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# Appendix A

## A1. Calculation of hot-mixed asphalt production

Kristjansdottir et al (2007) and Olard, Héritier and Beduneau (2008) took as their standard aggregate mix 54% of coarse aggregate (defined as retained on a 2 mm sieve) with 1% water content and fine aggregate with 4% water. The higher water content of the fine aggregate was necessary to achieve bitumen foaming for the LEA method, but in any case the higher surface to volume ratio of fine material will encourage greater absorption of water. For the purposes of comparison these water contents will be assumed for all mixes to be discussed.

Ambient temperature is taken as 25 °C and the mixing temperature as 160 °C.

Initially, 1000kg of coarse dry aggregate accompanies 1000/99kg of water (ie supplied moist aggregate has 1% water by weight of water plus aggregate).

1000kg of fine dry aggregate accompanies 1000/24kg of water (moist fine aggregate initially has 4% water by weight of water plus aggregate).

Thus, a 1000 kg mix of 650kg coarse and 350 kg fine aggregate contains

$$(0.54\times1000/99 + 0.46\times1000/24) = 24.621 \text{ kg water.}$$

Heating the 1000kg of aggregate from 25°C to 160°C requires:

$$1000\times C_{agg}\times135 = 114{,}750\text{kJ}=114.75\text{MJ.}$$

Heating the 24.621kg of water from 25°C to 160°C requires:

$$24.621\times[C_{H2O}\times75 + L_{vap} + C_{vap}\times60] = 24.621\times2695.325 = 66{,}362 \text{ kJ}=66.362\text{MJ.}$$

Note that the vaporization of the water at 100°C requires 100×2270/2695.325 = 84.2% of the total energy involved in heating the water. Thus, if a methodology of asphalt manufacture can be devised that means the water need not be heated above 100°C there is potential for significant energy saving.

The total heat required for the 1000kg of aggregate plus the water is thus

$$114.75 + 66.362 = 177.808\text{MJ.}$$

If we standardize on a mix containing 4.3% by weight of bitumen, in a ton (1000kg) of mix we have 957kg of aggregate and 43kg of bitumen. If we take the bitumen as having been heated from 25°C to 155°C, according to equation the heat required to raise the bitumen to

$$155^{\circ}\text{C is } 43\times Q_{bit}(25,155) = 43\times247.89 = 10{,}142\text{kJ} = 10.142\text{MJ.}$$

The heat input for one ton of hot mix is therefore $0.957\times177.808 + 10.142 \approx 187.95$MJ.

## A2. Calculation of warm-mixed asphalt production

Kristjansdottir et al (2007) and Olard, Héritier and Beduneau (2008) took as their standard aggregate mix 54% of coarse aggregate (defined as retained on a 2mm sieve) with 1% water content and fine aggregate with 4% water. The higher water content of the fine aggregate was necessary to achieve bitumen foaming for the LEA method, but in any case the higher surface to volume ratio of fine material will encourage greater absorption of water. For the purposes of comparison these water contents will be assumed for all mixes to be discussed.

Ambient temperature is taken as 25°C and the mixing temperature as 140°C.

Initially, 1000kg of coarse dry aggregate accompanies 1000/99kg of water (ie supplied moist aggregate has 1% water by weight of water plus aggregate).

1000kg of fine dry aggregate accompanies 1000/24kg of water (moist fine aggregate initially has 4% water by weight of water plus aggregate).

Thus, a 1000kg mix of 650kg coarse and 350kg fine aggregate contains

$$(0.54\times1000/99 + 0.46\times1000/24) = 24.621\text{kg water.}$$

Heating the 1000kg of aggregate from 25°C to 140°C requires:

$$1000\times C_{agg}\times115 = 97{,}750\text{kJ}=97.75\text{MJ.}$$

Heating the 21.150kg of water from 25°C to 140°C requires:

$$24.621\times[C_{H2O}\times75 + L_{vap} + C_{vap}\times40] = 24.621\times2658.325 = 65{,}451\text{ kJ}=65.451\text{MJ.}$$

Note that the vaporization of the water at 100°C requires 100×2270/2658.325 = 85.39% of the total energy involved in heating the water. Thus, if a methodology of asphalt manufacture can be devised that means the water need not be heated above 100°C there is potential for significant energy saving.

The total heat required for the 1000kg of aggregate plus the water is thus

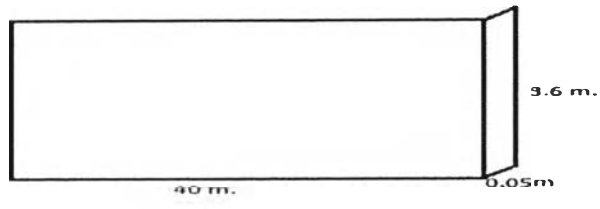
$$97.75 + 65.451 = 160.88\text{MJ.}$$

The 43kg of binder consists of 3% Sasobit (1.29kg) and 41.71kg of bitumen. Specific heat and heat of fusion values for Sasobit wax are not available, and so are assumed to be the same as for ordinary paraffin waxes, ie 2.9kJ kg-1 °C-1 and 220kJ kg-respectively). Heating the binder to 140°C requires

$$41.71\times217.59+1.29\times([2.9\times140]+220) = 9075.68+807.54 = 9835.22\text{ kJ}\approx9.835\text{ MJ.}$$

The total heat input for a tonne of mix is therefore 0.957×160.88+9.835 = 170.712MJ as against 187.95MJ for hot mix.

## A3. Calculation of asphalt pavement




| Volume($m^3$) | ton/$m^3$ | Asphalt usage (ton) |
|---|---|---|
| 7.2 | 2.428 | 17.4816 |

- **Paver (Titan 325 EPM) :** From real measurement, paver and asphalt concrete truck moves with a speed of 7.28 m/s (A distance of about 15 meter and a timer for 2.06 minutes) and fuel rate of paver is 0.7020 MJ/$m^2$. So fuel rate is 0.7020 MJ/$m^2$x 40 m x 3.6 m = 101.088 MJ and energy per ton asphalt is 5.78
- **Steel Roller (Dynamac CS142) :** Fuel rate from literature is 148.48 m/min. Time of real measurement is 1.0776 min and fuel rate of steel roller is 6.7 L/hour. So 0.12 liters calculate to energy which is 4.58 MJ or 0.262 MJ/Ton asphalt.
- **Tire Roller (Sakai TS200) :** Fuel rate from literature is 30.435 m/min. Time of real measurement is 36.8 min and fuel rate of steel roller is 9.1 L/hour. So 5.58 liters calculate to energy which is 212.64 MJ or 12.164 MJ/Ton asphalt.
- **Water :** Data from foreman said that rate of water usage is 100 l/500 m but distance of rolling is 40 meter. So total rate of water usage is 4.576 L/ton asphalt

## A4. Calculation of Grease

Based on the data received from Thaiwat Engineering at Bangbuatong, amount used is 1 kg/day. The calculation in this part is based on the production data in July and June only since the asphalt production in August is unusually low and much lower than the production in July and August.

| | July | June |
|---|---|---|
| Number of days (days/month) | 31 | 30 |
| Amount of grease(kg/month) | 31 | 30 |
| Amount of hot-mixed asphalt production (Ton/month) | 21,982 | 13,859 |
| Amount of grease per amount of hot-mixed asphalt production (kg/ton) | 0.00141 | 0.00216 |
| Average amount of grease per amount of hot-mixed asphalt production (kg/ton) | 0.00179 | |
| Average amount of grease per amount of hot-mixed asphalt production (g/ton) | **1.79** | |

## A5. Calculation of Hot-Oil Usage

Based on the data received from Thaiwat Engineering at Bangbuatong, amount used is 200 L/year

| | August | July | June |
|---|---|---|---|
| Amount of hot-mixed asphalt production (Ton) | 4,723 | 21,982 | 13,859 |
| Average amount of hot-mixed asphalt production(Ton/month) | | | 13,521 |
| Average amount of hot-mixed asphalt production(Ton/year) | | | **162,256** |

Thus, hot oil usage = (200 L)/year x (1 year)/(162,256 ton) = 0.00123 L/ton asphalt

## A6. Calculation of Fuel Oil

Based on the data received from Thaiwat Engineering at Bangbuatong, amount used is = 12 L/batch where 1 batch = 1.567 ton hot-mixed asphalt production

Thus, amount of fuel oil used is (12 L)/batch x (1 batch)/(1.567 ton) = 7.66 L/ton HMA.

## A7. Calculation of Electricity

Calculation is based on the data received from Thaiwat Engineering at Bangbuatong

Data recorded from small meter of workers habitation at production site

On September 20th (10.00 am) = 32874 kWh

On November 2nd (10.10 am) = 45282 kWh

Thus, electricity for habitation = 288.59 kWh/day

| | August | July | June |
|---|---|---|---|
| Amount of hot-mixed asphalt production (Ton) | 4,723 | 21,982 | 13,859 |
| Electricity used total (unit) | 63,000 | 167,000 | 133,000 |
| Electricity for habitation within the plant (unit) | 8,946.29 | 8,946.29 | 8,657.70 |
| Electricity for office within the plant (unit) | 3,132.30 | 3,132.30 | 3,031.26 |
| Electricity for hot-mixed asphalt production (unit) | 50,921.41 | 154,921.41 | 121,311.04 |
| Electricity for hot-mixed asphalt production (unit/Ton) | 10.78 | 7.05 | 8.75 |
| Average electricity for hot-mixed asphalt production (unit/Ton) | | **8.86** | |

| | Electric equipment | no. | Using rate (hour/day) | Power (Watt) | Unit |
|---|---|---|---|---|---|
| Meeting Room | | | | | |
| 1 | Bulb | 6 | 3 | 15 | 0.27 |
| 2 | Fluorescent | 4 | 3 | 36 | 0.432 |
| 3 | Air Conditioner | 1 | 3 | 1200 | 3.6 |
| Office | | | | | |
| 1 | PHILIPS 107 S1 Computer | 1 | 15 | 500 | 7.5 |
| 2 | Weighter | 1 | 15 | 20 | 0.3 |
| 3 | EPSON LQ-300-II Printer | 1 | 15 | 60 | 0.9 |
| 4 | Fluorescent | 7 | 15 | 36 | 3.78 |
| 5 | Screen Computer | 2 | 15 | 330 | 9.9 |
| 6 | CPU | 2 | 15 | 150 | 4.5 |
| 7 | loudspeaker | 2 | 15 | 10 | 0.3 |
| 8 | UPS | 1 | 15 | 1200 | 18 |
| 9 | EPSON Stylus Printer | 1 | 15 | 60 | 0.9 |
| 10 | Small Printer | 1 | 15 | 4.5 | 0.0675 |
| 11 | Photocopier | 1 | 15 | 200 | 3 |
| 12 | Fax | 1 | 15 | 60 | 0.9 |
| 13 | TP-LINK TD854W | 1 | 15 | 1500 | 22.5 |
| Toilet | | | | | |
| 1 | Long light bulb | 2 | 2 | 36 | 0.144 |
| Building | | | | | |
| 1 | Bulb | 6 | 8 | 18 | 0.864 |
| 2 | Freezer | 1 | 8 | 150 | 1.2 |
| 3 | Fan | 2 | 8 | 60 | 0.96 |
| 4 | Television | 1 | 8 | 60 | 0.48 |
| 5 | Refrigerator | 1 | 8 | 120 | 0.96 |
| 6 | Short light bulb | | 8 | 18 | 0 |
| 6 houses | | | | | |
| 1 | Short light bulb | 36 | 8 | 18 | 5.184 |
| 2 | Television | 6 | 8 | 60 | 2.88 |
| 3 | Refrigerator | 6 | 8 | 120 | 5.76 |
| 4 | Fan | 12 | 8 | 60 | 5.76 |
| | | | | Total | 101.0415 |
| | | | | **30 days** | **3,031.25** |
| | | | | **31 days** | **3,132.29** |

## A8. Calculation of sasobit

In cases where paraffin wax is present and heated above its fusion range, we need to account for the heat of fusion:

$$L_{fus} = 220 \text{ kJ/kg}$$

But, sasobit in Bungbuatong use 1.33 kg = 220*1.29 = 283.8 kJ

sasobit in Average use 1.29 kg = 220*1.33 = 292.78 kJ

# Appendix B

**Table B1** Results of the impact assessment 1 kg hot-mixed asphalt production by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total |
|---|---|---|
| abiotic depletion | kg Sb eq | 1.2840819 |
| global warming (GWP100) | kg CO2 eq | 43.659266 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 3.70E-05 |
| human toxicity | kg 1,4-DB eq | 18.215193 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 1.7648351 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 7602.3209 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 0.1133853 |
| photochemical oxidation | kg C2H4 | 0.0410696 |
| acidification | kg SO2 eq | 0.3814992 |
| eutrophication | kg PO4--- eq | 0.0609151 |

**Table B2** Results of the impact assessment 1 kg hot-mixed asphalt production by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total |
|---|---|---|
| greenhouse | kg CO2 | 25.09101822 |
| ozone layer | kg CFC11 | -1.21E-04 |
| acidification | kg SO2 | 0.370522409 |
| eutrophication | kg PO4 | 0.053428289 |
| heavy metals | kg Pb | -2.1061E-05 |
| carcinogens | kg B(a)P | 2.55E-06 |
| winter smog | kg SPM | 7.842502154 |
| summer smog | kg C2H4 | -0.06238035 |
| Pesticides | kg act.subst | 0 |
| energy resources | MJ LHV | 881.6105102 |
| solid waste | kg | 0.007277287 |

**Table B3** Results of the impact assessment 1 kg warm-mixed production by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total |
|---|---|---|
| abiotic depletion | kg Sb eq | 1.2762551 |
| global warming (GWP100) | kg CO2 eq | 4.36E+01 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 3.59E-05 |
| human toxicity | kg 1,4-DB eq | 18.368256 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 1.801274 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 7730.0873 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 0.11689866 |
| photochemical oxidation | kg C2H4 | 0.039929392 |
| acidification | kg SO2 eq | 0.35022333 |
| eutrophication | kg PO4--- eq | 0.053891372 |

**Table B4** Results of the impact assessment 1 kg warm-mixed asphalt production by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total |
|---|---|---|
| greenhouse | kg CO2 | 2.56E+01 |
| ozone layer | kg CFC11 | -1.17E-04 |
| acidification | kg SO2 | 0.3313949 |
| eutrophication | kg PO4 | 0.046626193 |
| heavy metals | kg Pb | -2.61E-06 |
| carcinogens | kg B(a)P | 2.63E-06 |
| winter smog | kg SPM | 7.840324916 |
| summer smog | kg C2H4 | -0.06003205 |
| pesticides | kg act.subst | 0 |
| energy resources | MJ LHV | 924.6112294 |
| solid waste | kg | 0.007106675 |

**Table B5** Results of the impact assessment 43 kg asphalt binder transportation in full load of hot-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | Transport_rawmat_Asphalt bineder | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 1.63E-03 | 0 | 1.63E-03 |
| global warming (GWP100) | kg CO2 eq | 0.2973039 | 0.27642058 | 0.020883281 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 0.0151576 | 0.014767527 | 3.90E-04 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 3.48E-05 | 3.18E-05 | 2.92E-06 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 0.1604652 | 0.14738942 | 0.013075828 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 6.01E-06 | 2.41E-06 | 3.60E-06 |
| photochemical oxidation | kg C2H4 | 4.42E-05 | 3.77E-05 | 6.51E-06 |
| acidification | kg SO2 eq | 1.96E-03 | 1.69E-03 | 2.65E-04 |
| eutrophication | kg PO4--- eq | 4.53E-04 | 4.25E-04 | 2.78E-05 |

**Table B6** Results of the impact assessment 968 kg aggregate transportation in full load of hot-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | Transport_rawmat_Aggregate | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 0.0275883 | 0 | 0.027588346 |
| global warming (GWP100) | kg CO2 eq | 5.030529 | 4.6771754 | 0.35335365 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 0.2564808 | 0.2498808 | 0.00659996 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 0.0005885 | 0.000539051 | 4.94E-05 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 2.715349 | 2.4941006 | 0.22124836 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 0.0001017 | 4.08E-05 | 6.09E-05 |
| photochemical oxidation | kg C2H4 | 0.0007472 | 0.000637107 | 0.000110139 |
| acidification | kg SO2 eq | 0.0331679 | 0.028678258 | 0.004489638 |
| eutrophication | kg PO4--- eq | 0.007662 | 0.007192385 | 0.000469658 |

**Table B7** Results of the impact assessment 7.12 kg fuel-oil transportation in full load of hot-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | Transport_rawmat_Fuel oil | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 0.0003106 | 0 | 0.000310563 |
| global warming (GWP100) | kg CO2 eq | 0.0482082 | 0.044230507 | 0.003977714 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 0.0021975 | 0.002123195 | 7.43E-05 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 6.61E-06 | 6.05E-06 | 5.56E-07 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 0.0305111 | 0.028020457 | 0.0024906 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 1.14E-06 | 4.58E-07 | 6.85E-07 |
| photochemical oxidation | kg C2H4 | 6.13E-06 | 4.89E-06 | 1.24E-06 |
| acidification | kg SO2 eq | 0.0002883 | 0.000237796 | 5.05E-05 |
| eutrophication | kg PO4--- eq | 6.42E-05 | 5.89E-05 | 5.29E-06 |

**Table B8** Results of the impact assessment 0.00106 kg hot-oil transportation in full load of hot-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | Transport_rawmat_Hot oil | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 1.53E-07 | 0 | 1.53E-07 |
| global warming (GWP100) | kg CO2 eq | 2.27E-05 | 2.07E-05 | 1.96E-06 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 1.88E-06 | 1.85E-06 | 3.66E-08 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 3.25E-09 | 2.97E-09 | 2.74E-10 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 1.50E-05 | 1.38E-05 | 1.23E-06 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 5.62E-10 | 2.25E-10 | 3.37E-10 |
| photochemical oxidation | kg C2H4 | 8.05E-09 | 7.44E-09 | 6.10E-10 |
| acidification | kg SO2 eq | 5.76E-08 | 3.27E-08 | 2.49E-08 |
| eutrophication | kg PO4--- eq | 9.66E-09 | 7.06E-09 | 2.60E-09 |

**Table B9** Results of the impact assessment 0.00179 kg grease transportation in full load of hot-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | Transport_rawmat_grease | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 2.57E-07 | 0 | 2.57E-07 |
| global warming (GWP100) | kg CO2 eq | 3.81E-05 | 3.48E-05 | 3.30E-06 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 3.17E-06 | 3.10E-06 | 6.16E-08 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 5.45E-09 | 4.99E-09 | 4.61E-10 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 2.52E-05 | 2.31E-05 | 2.06E-06 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 9.46E-10 | 3.78E-10 | 5.68E-10 |
| photochemical oxidation | kg C2H4 | 1.36E-08 | 1.25E-08 | 1.03E-09 |
| acidification | kg SO2 eq | 9.69E-08 | 5.50E-08 | 4.19E-08 |
| eutrophication | kg PO4--- eq | 1.62E-08 | 1.19E-08 | 4.38E-09 |

**Table B10** Results of the impact assessment 1000 kg Asphalt concrete transportation in full load of hot-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | Transport_product_Asphalt concrete | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 0.0113759 | 0 | 0.011375919 |
| global warming (GWP100) | kg CO2 eq | 1.7625488 | 1.6168451 | 0.14570365 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 0.0803395 | 0.077618012 | 0.002721461 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 0.0002416 | 0.00022122 | 2.04E-05 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 1.1154974 | 1.0242667 | 0.091230678 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 4.19E-05 | 1.68E-05 | 2.51E-05 |
| photochemical oxidation | kg C2H4 | 0.0002243 | 0.000178928 | 4.54E-05 |
| acidification | kg SO2 eq | 0.0105474 | 0.00869611 | 0.00185128 |
| eutrophication | kg PO4--- eq | 0.0023461 | 0.002152475 | 0.000193661 |

**Table B11** Results of the impact assessment 3.7 kg water transportation in full load of hot-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | Transport_rawmat_water | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 3.90E-05 | 0 | 3.90E-05 |
| global warming (GWP100) | kg CO2 eq | 0.0060585 | 0.005558455 | 0.000500055 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 0.0002762 | 0.000266887 | 9.34E-06 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 8.30E-07 | 7.61E-07 | 6.99E-08 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 0.0038329 | 0.003519837 | 0.000313104 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 1.44E-07 | 5.76E-08 | 8.61E-08 |
| photochemical oxidation | kg C2H4 | 7.71E-07 | 6.15E-07 | 1.56E-07 |
| acidification | kg SO2 eq | 3.62E-05 | 2.99E-05 | 6.35E-06 |
| eutrophication | kg PO4--- eq | 8.06E-06 | 7.40E-06 | 6.65E-07 |

**Table B12** Results of the impact assessment asphalt binder transportation in no load of hot-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | Transport_rawmat_Asphalt binder no load | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 9.32E-07 | 0 | 9.32E-07 |
| global warming (GWP100) | kg CO2 eq | 0.000136079 | 0.000124146 | 1.19E-05 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 7.03E-06 | 6.80E-06 | 2.23E-07 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 1.99E-08 | 1.83E-08 | 1.67E-09 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 9.20E-05 | 8.45E-05 | 7.47E-06 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 3.44E-09 | 1.39E-09 | 2.06E-09 |
| photochemical oxidation | kg C2H4 | 2.10E-08 | 1.73E-08 | 3.72E-09 |
| acidification | kg SO2 eq | 9.19E-07 | 7.68E-07 | 1.52E-07 |
| eutrophication | kg PO4--- eq | 2.07E-07 | 1.91E-07 | 1.59E-08 |

**Table B13** Results of the impact assessment aggregate transportation in no load of hot-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | Transport_rawmat_Aggregate no load | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 7.05E-07 | 0 | 7.05E-07 |
| global warming (GWP100) | kg CO2 eq | 0.000102348 | 9.33E-05 | 9.04E-06 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 5.30E-06 | 5.13E-06 | 1.69E-07 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 1.50E-08 | 1.37E-08 | 1.26E-09 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 6.92E-05 | 6.35E-05 | 5.66E-06 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 2.60E-09 | 1.04E-09 | 1.56E-09 |
| photochemical oxidation | kg C2H4 | 1.58E-08 | 1.30E-08 | 2.82E-09 |
| acidification | kg SO2 eq | 6.92E-07 | 5.77E-07 | 1.15E-07 |
| eutrophication | kg PO4--- eq | 1.55E-07 | 1.43E-07 | 1.20E-08 |

**Table B14** Results of the impact assessment fuel-oil transportation in no load of hot-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | Transport_rawmat_Fuel oil no load | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 5.92E-07 | 0 | 5.92E-07 |
| global warming (GWP100) | kg CO2 eq | 8.55E-05 | 7.79E-05 | 7.59E-06 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 3.91E-06 | 3.77E-06 | 1.42E-07 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 1.26E-08 | 1.15E-08 | 1.06E-09 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 5.81E-05 | 5.34E-05 | 4.75E-06 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 2.18E-09 | 8.74E-10 | 1.31E-09 |
| photochemical oxidation | kg C2H4 | 1.11E-08 | 8.70E-09 | 2.36E-09 |
| acidification | kg SO2 eq | 5.17E-07 | 4.21E-07 | 9.64E-08 |
| eutrophication | kg PO4--- eq | 1.14E-07 | 1.04E-07 | 1.01E-08 |

**Table B15** Results of the impact assessment hot-oil transportation in no load of hot-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | Transport_rawmat_Hot oil no load | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 3.26E-09 | 0 | 3.26E-09 |
| global warming (GWP100) | kg CO2 eq | 4.71E-07 | 4.30E-07 | 4.18E-08 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 3.90E-08 | 3.82E-08 | 7.80E-10 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 6.95E-11 | 6.37E-11 | 5.84E-12 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 3.21E-07 | 2.95E-07 | 2.62E-08 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 1.20E-11 | 4.82E-12 | 7.19E-12 |
| photochemical oxidation | kg C2H4 | 1.68E-10 | 1.55E-10 | 1.30E-11 |
| acidification | kg SO2 eq | 1.21E-09 | 6.84E-10 | 5.31E-10 |
| eutrophication | kg PO4--- eq | 2.02E-10 | 1.47E-10 | 5.55E-11 |

**Table B16** Results of the impact assessment grease transportation in no load of hot-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | Transport_rawmat_grease no load | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 3.26E-08 | 0 | 3.26E-08 |
| global warming (GWP100) | kg CO2 eq | 4.71E-06 | 4.30E-06 | 4.18E-07 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 3.90E-07 | 3.82E-07 | 7.80E-09 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 6.95E-10 | 6.37E-10 | 5.84E-11 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 3.21E-06 | 2.95E-06 | 2.62E-07 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 1.20E-10 | 4.82E-11 | 7.19E-11 |
| photochemical oxidation | kg C2H4 | 1.68E-09 | 1.55E-09 | 1.30E-10 |
| acidification | kg SO2 eq | 1.21E-08 | 6.84E-09 | 5.31E-09 |
| eutrophication | kg PO4--- eq | 2.02E-09 | 1.47E-09 | 5.55E-10 |

**Table B17** Results of the impact assessment Asphalt concrete transportation in no load of hot-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | Transport_product_Asphalt concrete no load | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 1.51E-07 | 0 | 1.51E-07 |
| global warming (GWP100) | kg CO2 eq | 2.18E-05 | 1.99E-05 | 1.93E-06 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 9.96E-07 | 9.60E-07 | 3.61E-08 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 3.19E-09 | 2.92E-09 | 2.70E-10 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 1.48E-05 | 1.35E-05 | 1.21E-06 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 5.55E-10 | 2.22E-10 | 3.33E-10 |
| photochemical oxidation | kg C2H4 | 2.81E-09 | 2.21E-09 | 6.02E-10 |
| acidification | kg SO2 eq | 1.32E-07 | 1.07E-07 | 2.45E-08 |
| eutrophication | kg PO4--- eq | 2.90E-08 | 2.64E-08 | 2.57E-09 |

**Table B18** Results of the impact assessment water transportation in no load of hot-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | Transport_rawmat_water no load | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 1.42E-07 | 0 | 1.42E-07 |
| global warming (GWP100) | kg CO2 eq | 2.07E-05 | 1.88E-05 | 1.82E-06 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 9.46E-07 | 9.12E-07 | 3.40E-08 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 3.05E-09 | 2.79E-09 | 2.54E-10 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 1.41E-05 | 1.29E-05 | 1.14E-06 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 5.25E-10 | 2.11E-10 | 3.13E-10 |
| photochemical oxidation | kg C2H4 | 2.67E-09 | 2.10E-09 | 5.67E-10 |
| acidification | kg SO2 eq | 1.25E-07 | 1.02E-07 | 2.31E-08 |
| eutrophication | kg PO4--- eq | 2.75E-08 | 2.51E-08 | 2.42E-09 |

**Table B19** Results of the impact assessment 43 kg asphalt binder transportation in full load of hot-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | Transport_rawmat_Asphalt bineder | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 0.29535675 | 0.27448247 | 0.020874284 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 0.002620666 | 0.002338834 | 0.000281832 |
| eutrophication | kg PO4 | 0.000452826 | 0.000425069 | 2.78E-05 |
| heavy metals | kg Pb | 3.92E-08 | 3.56E-08 | 3.66E-09 |
| carcinogens | kg B(a)P | 2.67E-10 | 2.53E-10 | 1.31E-11 |
| winter smog | kg SPM | 0.000207292 | 5.00E-05 | 0.000157292 |
| summer smog | kg C2H4 | 0.000225045 | 0.00014021 | 8.48E-05 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| **energy resources** | **MJ LHV** | 3.3845141 | 0 | 3.3845141 |
| solid waste | kg | 0.000345455 | 0 | 0.000345455 |

**Table B20** Results of the impact assessment 968 kg aggregate transportation in full load of hot-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | Transport_rawmat_Aggregate | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 4.9975829 | 4.6443815 | 0.35320143 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 0.044342977 | 0.03957426 | 0.004768717 |
| eutrophication | kg PO4 | 0.007662044 | 0.007192385 | 0.000469658 |
| heavy metals | kg Pb | 6.62E-07 | 6.00E-07 | 6.19E-08 |
| carcinogens | kg B(a)P | 4.51E-09 | 4.29E-09 | 2.22E-10 |
| winter smog | kg SPM | 0.003507479 | 0.000846032 | 0.002661447 |
| summer smog | kg C2H4 | 0.003807859 | 0.002372418 | 0.001435441 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 57.267364 | 0 | 57.267364 |
| solid waste | kg | 0.005845235 | 0 | 0.005845235 |

**Table B21** Results of the impact assessment 7.12 kg fuel-oil transportation in full load of hot-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | Transport_rawmat_Fuel oil | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 0.04796424 | 0.04398824 | 0.003976 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 0.000380152 | 0.00032647 | 5.37E-05 |
| eutrophication | kg PO4 | 6.42E-05 | 5.89E-05 | 5.29E-06 |
| heavy metals | kg Pb | 7.45E-09 | 6.75E-09 | 6.97E-10 |
| carcinogens | kg B(a)P | 3.95E-11 | 3.70E-11 | 2.50E-12 |
| winter smog | kg SPM | 3.94E-05 | 9.48E-06 | 3.00E-05 |
| summer smog | kg C2H4 | 6.34E-05 | 4.72E-05 | 1.62E-05 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.64466059 | 0 | 0.64466059 |
| solid waste | kg | 6.58E-05 | 0 | 6.58E-05 |

**Table B22** Results of the impact assessment 0.00106 kg hot-oil transportation in full load of hot-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | Transport_rawmat_Hot oil | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 2.23E-05 | 2.03E-05 | 1.96E-06 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 6.91E-08 | 4.27E-08 | 2.64E-08 |
| eutrophication | kg PO4 | 9.66E-09 | 7.06E-09 | 2.60E-09 |
| heavy metals | kg Pb | 3.66E-12 | 3.32E-12 | 3.43E-13 |
| carcinogens | kg B(a)P | 4.27E-14 | 4.15E-14 | 1.23E-15 |
| winter smog | kg SPM | 1.94E-08 | 4.64E-09 | 1.47E-08 |
| summer smog | kg C2H4 | 3.72E-08 | 2.92E-08 | 7.95E-09 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.000317265 | 0 | 0.000317265 |
| solid waste | kg | 3.24E-08 | 0 | 3.24E-08 |

**Table B23** Results of the impact assessment 1000 kg Asphalt concrete transportation in full load of hot-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | Transport_product_Asphalt concrete | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 1.7536572 | 1.6080163 | 0.14564088 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 0.013904407 | 0.01193805 | 0.001966357 |
| eutrophication | kg PO4 | 0.002346136 | 0.002152475 | 0.000193661 |
| heavy metals | kg Pb | 2.74E-07 | 2.48E-07 | 2.55E-08 |
| carcinogens | kg B(a)P | 1.45E-09 | 1.35E-09 | 9.16E-11 |
| winter smog | kg SPM | 0.001445235 | 0.0003478 | 0.001097435 |
| summer smog | kg C2H4 | 0.002318697 | 0.0017268 | 0.000591897 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 23.613917 | 0 | 23.613917 |
| solid waste | kg | 0.002410254 | 0 | 0.002410254 |

**Table B24** Results of the impact assessment 0.00179 kg grease transportation in full load of hot-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | Transport_rawmat_grease | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 3.74E-05 | 3.41E-05 | 3.29E-06 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 1.16E-07 | 7.17E-08 | 4.45E-08 |
| eutrophication | kg PO4 | 1.62E-08 | 1.19E-08 | 4.38E-09 |
| heavy metals | kg Pb | 6.15E-12 | 5.57E-12 | 5.78E-13 |
| carcinogens | kg B(a)P | 7.18E-14 | 6.97E-14 | 2.07E-15 |
| winter smog | kg SPM | 3.26E-08 | 7.81E-09 | 2.48E-08 |
| summer smog | kg C2H4 | 6.25E-08 | 4.91E-08 | 1.34E-08 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.000534147 | 0 | 0.000534147 |
| solid waste | kg | 5.45E-08 | 0 | 5.45E-08 |

**Table B25** Results of the impact assessment 3.7 kg water transportation in full load of hot-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | Transport_rawmat_water | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 0.006027848 | 0.005528008 | 0.00049984 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 4.78E-05 | 4.10E-05 | 6.75E-06 |
| eutrophication | kg PO4 | 8.06E-06 | 7.40E-06 | 6.65E-07 |
| heavy metals | kg Pb | 9.37E-10 | 8.49E-10 | 8.76E-11 |
| carcinogens | kg B(a)P | 4.97E-12 | 4.66E-12 | 3.14E-13 |
| winter smog | kg SPM | 4.96E-06 | 1.19E-06 | 3.77E-06 |
| summer smog | kg C2H4 | 7.96E-06 | 5.93E-06 | 2.03E-06 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.081043046 | 0 | 0.081043046 |
| solid waste | kg | 8.27E-06 | 0 | 8.27E-06 |

**Table B26** Results of the impact assessment asphalt binder transportation in no load of hot-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | Transport_rawmat_Asphalt binder no load | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 0.000135203 | 0.000123275 | 1.19E-05 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 1.22E-06 | 1.06E-06 | 1.61E-07 |
| eutrophication | kg PO4 | 2.07E-07 | 1.91E-07 | 1.59E-08 |
| heavy metals | kg Pb | 2.25E-11 | 2.05E-11 | 2.09E-12 |
| carcinogens | kg B(a)P | 1.26E-13 | 1.18E-13 | 7.50E-15 |
| winter smog | kg SPM | 1.18E-07 | 2.86E-08 | 8.99E-08 |
| summer smog | kg C2H4 | 1.15E-07 | 6.64E-08 | 4.85E-08 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.001933982 | 0 | 0.001933982 |
| solid waste | kg | 1.97E-07 | 0 | 1.97E-07 |

**Table B27** Results of the impact assessment aggregate transportation in no load of hot-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | Transport_rawmat_Aggregate no load | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 0.000101689 | 9.27E-05 | 9.03E-06 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 9.16E-07 | 7.94E-07 | 1.22E-07 |
| eutrophication | kg PO4 | 1.55E-07 | 1.43E-07 | 1.20E-08 |
| heavy metals | kg Pb | 1.69E-11 | 1.54E-11 | 1.58E-12 |
| carcinogens | kg B(a)P | 9.48E-14 | 8.91E-14 | 5.68E-15 |
| winter smog | kg SPM | 8.96E-08 | 2.15E-08 | 6.81E-08 |
| summer smog | kg C2H4 | 8.66E-08 | 4.99E-08 | 3.67E-08 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.001464301 | 0 | 0.001464301 |
| solid waste | kg | 1.49E-07 | 0 | 1.49E-07 |

**Table B28** Results of the impact assessment fuel-oil transportation in no load of hot-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | Transport_rawmat_Fuel oil no load | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 8.51E-05 | 7.75E-05 | 7.58E-06 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 6.79E-07 | 5.77E-07 | 1.02E-07 |
| eutrophication | kg PO4 | 1.14E-07 | 1.04E-07 | 1.01E-08 |
| heavy metals | kg Pb | 1.42E-11 | 1.29E-11 | 1.33E-12 |
| carcinogens | kg B(a)P | 7.08E-14 | 6.60E-14 | 4.77E-15 |
| winter smog | kg SPM | 7.51E-08 | 1.80E-08 | 5.71E-08 |
| summer smog | kg C2H4 | 1.18E-07 | 8.75E-08 | 3.08E-08 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.00122946 | 0 | 0.00122946 |
| solid waste | kg | 1.25E-07 | 0 | 1.25E-07 |

**Table B29** Results of the impact assessment hot-oil transportation in no load of hot-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | Transport_rawmat_Hot oil no load | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 4.63E-07 | 4.21E-07 | 4.17E-08 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 1.45E-09 | 8.90E-10 | 5.64E-10 |
| eutrophication | kg PO4 | 2.02E-10 | 1.47E-10 | 5.55E-11 |
| heavy metals | kg Pb | 7.83E-14 | 7.10E-14 | 7.32E-15 |
| carcinogens | kg B(a)P | 8.84E-16 | 8.58E-16 | 2.63E-17 |
| winter smog | kg SPM | 4.14E-10 | 9.93E-11 | 3.15E-10 |
| summer smog | kg C2H4 | 7.83E-10 | 6.14E-10 | 1.70E-10 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 6.77E-06 | 0 | 6.77E-06 |
| solid waste | kg | 6.91E-10 | 0 | 6.91E-10 |

**Table B30** Results of the impact assessment grease transportation in no load of hot-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | Transport_rawmat_grease no load | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 4.63E-06 | 4.21E-06 | 4.17E-07 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 1.45E-08 | 8.90E-09 | 5.64E-09 |
| eutrophication | kg PO4 | 2.02E-09 | 1.47E-09 | 5.55E-10 |
| heavy metals | kg Pb | 7.83E-13 | 7.10E-13 | 7.32E-14 |
| carcinogens | kg B(a)P | 8.84E-15 | 8.58E-15 | 2.63E-16 |
| winter smog | kg SPM | 4.14E-09 | 9.93E-10 | 3.15E-09 |
| summer smog | kg C2H4 | 7.83E-09 | 6.14E-09 | 1.70E-09 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 6.77E-05 | 0 | 6.77E-05 |
| solid waste | kg | 6.91E-09 | 0 | 6.91E-09 |

**Table B31** Results of the impact assessment Asphalt concrete transportation in no load of hot-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | Transport_product_Asphalt concrete no load | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 2.17E-05 | 1.97E-05 | 1.93E-06 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 1.73E-07 | 1.47E-07 | 2.61E-08 |
| eutrophication | kg PO4 | 2.90E-08 | 2.64E-08 | 2.57E-09 |
| heavy metals | kg Pb | 3.61E-12 | 3.28E-12 | 3.39E-13 |
| carcinogens | kg B(a)P | 1.80E-14 | 1.68E-14 | 1.21E-15 |
| winter smog | kg SPM | 1.91E-08 | 4.59E-09 | 1.46E-08 |
| summer smog | kg C2H4 | 3.02E-08 | 2.23E-08 | 7.85E-09 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.000313121 | 0 | 0.000313121 |
| solid waste | kg | 3.20E-08 | 0 | 3.20E-08 |

**Table B32** Results of the impact assessment water transportation in no load of hot-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | Transport_rawmat_water no load | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 2.06E-05 | 1.87E-05 | 1.82E-06 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 1.64E-07 | 1.39E-07 | 2.45E-08 |
| eutrophication | kg PO4 | 2.75E-08 | 2.51E-08 | 2.42E-09 |
| heavy metals | kg Pb | 3.43E-12 | 3.11E-12 | 3.19E-13 |
| carcinogens | kg B(a)P | 1.71E-14 | 1.60E-14 | 1.14E-15 |
| winter smog | kg SPM | 1.81E-08 | 4.36E-09 | 1.37E-08 |
| summer smog | kg C2H4 | 2.86E-08 | 2.12E-08 | 7.39E-09 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.000294702 | 0 | 0.000294702 |
| solid waste | kg | 3.01E-08 | 0 | 3.01E-08 |

**Table B33** Results of the impact assessment 41.7 kg asphalt binder transportation in full load of warn-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | WMA-Transport_rawmat_Asphalt binder | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 0.001581564 | 0 | 0.001581564 |
| global warming (GWP100) | kg CO2 eq | 0.28838477 | 0.26812798 | 0.020256791 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 0.014700891 | 0.014322534 | 0.000378358 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 3.36E-05 | 3.08E-05 | 2.83E-06 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 0.15529804 | 0.14261449 | 0.012683558 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 5.82E-06 | 2.34E-06 | 3.49E-06 |
| photochemical oxidation | kg C2H4 | 4.28E-05 | 3.65E-05 | 6.31E-06 |
| acidification | kg SO2 eq | 0.001901414 | 0.001644035 | 0.000257379 |
| eutrophication | kg PO4--- eq | 0.000439241 | 0.000412317 | 2.69E-05 |

**Table B34** Results of the impact assessment 968 kg aggregate transportation in full load of warn-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | WMA-Transport_rawmat_Aggregate | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 0.027588346 | 0 | 0.027588346 |
| global warming (GWP100) | kg CO2 eq | 5.030529 | 4.6771754 | 0.35335365 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 0.25648076 | 0.2498808 | 0.00659996 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 0.000588456 | 0.000539051 | 4.94E-05 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 2.715349 | 2.4941006 | 0.22124836 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 0.000101659 | 4.08E-05 | 6.09E-05 |
| photochemical oxidation | kg C2H4 | 0.000747246 | 0.000637107 | 0.000110139 |
| acidification | kg SO2 eq | 0.033167896 | 0.028678258 | 0.004489638 |
| eutrophication | kg PO4--- eq | 0.007662044 | 0.007192385 | 0.000469658 |

**Table B35** Results of the impact assessment 6.77 kg fuel-oil transportation in full load of warn-mixed asphalt asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | WMA-Transport_rawmat_Fuel oil | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 0.000295301 | 0 | 0.000295301 |
| global warming (GWP100) | kg CO2 eq | 0.0458385 | 0.042056263 | 0.003782237 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 0.00209088 | 0.002020235 | 7.06E-05 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 6.29E-06 | 5.76E-06 | 5.29E-07 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 0.029026345 | 0.026658141 | 0.002368205 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 1.09E-06 | 4.36E-07 | 6.51E-07 |
| photochemical oxidation | kg C2H4 | 5.83E-06 | 4.65E-06 | 1.18E-06 |
| acidification | kg SO2 eq | 0.000274164 | 0.000226107 | 4.81E-05 |
| eutrophication | kg PO4--- eq | 6.10E-05 | 5.60E-05 | 5.03E-06 |

**Table B36** Results of the impact assessment 0.00106 kg hot-oil transportation in full load of warn-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | WMA-Transport_rawmat_Hot oil | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 1.53E-07 | 0 | 1.53E-07 |
| global warming (GWP100) | kg CO2 eq | 2.27E-05 | 2.07E-05 | 1.96E-06 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 1.88E-06 | 1.85E-06 | 3.66E-08 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 3.25E-09 | 2.97E-09 | 2.74E-10 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 1.50E-05 | 1.38E-05 | 1.23E-06 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 5.62E-10 | 2.25E-10 | 3.37E-10 |
| photochemical oxidation | kg C2H4 | 8.05E-09 | 7.44E-09 | 6.10E-10 |
| acidification | kg SO2 eq | 5.76E-08 | 3.27E-08 | 2.49E-08 |
| eutrophication | kg PO4--- eq | 9.66E-09 | 7.06E-09 | 2.60E-09 |

**Table B37** Results of the impact assessment 0.00179 kg grease transportation in full load of warn-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | WMA-Transport_rawmat_grease | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 2.57E-07 | 0 | 2.57E-07 |
| global warming (GWP100) | kg CO2 eq | 3.81E-05 | 3.48E-05 | 3.30E-06 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 3.17E-06 | 3.10E-06 | 6.16E-08 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 5.45E-09 | 4.99E-09 | 4.61E-10 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 2.52E-05 | 2.31E-05 | 2.06E-06 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 9.46E-10 | 3.78E-10 | 5.68E-10 |
| photochemical oxidation | kg C2H4 | 1.36E-08 | 1.25E-08 | 1.03E-09 |
| acidification | kg SO2 eq | 9.69E-08 | 5.50E-08 | 4.19E-08 |
| eutrophication | kg PO4--- eq | 1.62E-08 | 1.19E-08 | 4.38E-09 |

**Table B38** Results of the impact assessment 1000 kg Asphalt concrete transportation in full load of warn-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | WMA-Transport_product_Asphalt concrete | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 0.011375919 | 0 | 0.011375919 |
| global warming (GWP100) | kg CO2 eq | 1.7625488 | 1.6168451 | 0.14570365 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 0.080339474 | 0.077618012 | 0.002721461 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 0.000241592 | 0.00022122 | 2.04E-05 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 1.1154974 | 1.0242667 | 0.091230678 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 4.19E-05 | 1.68E-05 | 2.51E-05 |
| photochemical oxidation | kg C2H4 | 0.000224343 | 0.000178928 | 4.54E-05 |
| acidification | kg SO2 eq | 0.01054739 | 0.00869611 | 0.00185128 |
| eutrophication | kg PO4--- eq | 0.002346136 | 0.002152475 | 0.000193661 |

**Table B39** Results of the impact assessment 3.7 kg water transportation in full load of warn-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | WMA-Transport_rawmat_water | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 3.90E-05 | 0 | 3.90E-05 |
| global warming (GWP100) | kg CO2 eq | 0.00605851 | 0.005558455 | 0.000500055 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 0.000276227 | 0.000266887 | 9.34E-06 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 8.30E-07 | 7.61E-07 | 6.99E-08 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 0.003832941 | 0.003519837 | 0.000313104 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 1.44E-07 | 5.76E-08 | 8.61E-08 |
| photochemical oxidation | kg C2H4 | 7.71E-07 | 6.15E-07 | 1.56E-07 |
| acidification | kg SO2 eq | 3.62E-05 | 2.99E-05 | 6.35E-06 |
| eutrophication | kg PO4--- eq | 8.06E-06 | 7.40E-06 | 6.65E-07 |

**Table B40** Results of the impact assessment 1.9 kg sasobit transportation in full load of warn-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | WMA-Transport_rawmat_Sasobit | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 0.000184985 | 0 | 0.000184985 |
| global warming (GWP100) | kg CO2 eq | 0.027431302 | 0.025062005 | 0.002369297 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 0.00228216 | 0.002237907 | 4.43E-05 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 3.94E-06 | 3.61E-06 | 3.31E-07 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 0.018166603 | 0.016683095 | 0.001483508 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 6.81E-07 | 2.73E-07 | 4.08E-07 |
| photochemical oxidation | kg C2H4 | 9.77E-06 | 9.03E-06 | 7.39E-07 |
| acidification | kg SO2 eq | 6.97E-05 | 3.96E-05 | 3.01E-05 |
| eutrophication | kg PO4--- eq | 1.17E-05 | 8.55E-06 | 3.15E-06 |

**Table B41** Results of the impact assessment asphalt binder transportation in no load of warn-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | WMA-Transport_rawmat_Asphalt binder no load | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 9.32E-07 | 0 | 9.32E-07 |
| global warming (GWP100) | kg CO2 eq | 0.0001360 | 0.000124146 | 1.19E-05 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 7.03E-06 | 6.80E-06 | 2.23E-07 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 1.99E-08 | 1.83E-08 | 1.67E-09 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 9.20E-05 | 8.45E-05 | 7.47E-06 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 3.44E-09 | 1.39E-09 | 2.06E-09 |
| photochemical oxidation | kg C2H4 | 2.10E-08 | 1.73E-08 | 3.72E-09 |
| acidification | kg SO2 eq | 9.19E-07 | 7.68E-07 | 1.52E-07 |
| eutrophication | kg PO4--- eq | 2.07E-07 | 1.91E-07 | 1.59E-08 |

**Table B42** Results of the impact assessment aggregate transportation in no load of warn-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | WMA-Transport_rawmat_Aggregate no load | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 7.05E-07 | 0 | 7.05E-07 |
| global warming (GWP100) | kg CO2 eq | 0.000102348 | 9.33E-05 | 9.04E-06 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 5.30E-06 | 5.13E-06 | 1.69E-07 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 1.50E-08 | 1.37E-08 | 1.26E-09 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 6.92E-05 | 6.35E-05 | 5.66E-06 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 2.60E-09 | 1.04E-09 | 1.56E-09 |
| photochemical oxidation | kg C2H4 | 1.58E-08 | 1.30E-08 | 2.82E-09 |
| acidification | kg SO2 eq | 6.92E-07 | 5.77E-07 | 1.15E-07 |
| eutrophication | kg PO4--- eq | 1.55E-07 | 1.43E-07 | 1.20E-08 |

**Table B43** Results of the impact assessment fuel-oil transportation in no load of warn-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | WMA-Transport_rawmat_Fuel oil no load | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 5.92E-07 | 0 | 5.92E-07 |
| global warming (GWP100) | kg CO2 eq | 8.55E-05 | 7.79E-05 | 7.59E-06 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 3.91E-06 | 3.77E-06 | 1.42E-07 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 1.26E-08 | 1.15E-08 | 1.06E-09 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 5.81E-05 | 5.34E-05 | 4.75E-06 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 2.18E-09 | 8.74E-10 | 1.31E-09 |
| photochemical oxidation | kg C2H4 | 1.11E-08 | 8.70E-09 | 2.36E-09 |
| acidification | kg SO2 eq | 5.17E-07 | 4.21E-07 | 9.64E-08 |
| eutrophication | kg PO4--- eq | 1.14E-07 | 1.04E-07 | 1.01E-08 |

**Table B44** Results of the impact assessment hot-oil transportation in no load of warn-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | WMA-Transport_rawmat_Hot oil no load | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 3.26E-09 | 0 | 3.26E-09 |
| global warming (GWP100) | kg CO2 eq | 4.71E-07 | 4.30E-07 | 4.18E-08 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 3.90E-08 | 3.82E-08 | 7.80E-10 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 6.95E-11 | 6.37E-11 | 5.84E-12 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 3.21E-07 | 2.95E-07 | 2.62E-08 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 1.20E-11 | 4.82E-12 | 7.19E-12 |
| photochemical oxidation | kg C2H4 | 1.68E-10 | 1.55E-10 | 1.30E-11 |
| acidification | kg SO2 eq | 1.21E-09 | 6.84E-10 | 5.31E-10 |
| eutrophication | kg PO4--- eq | 2.02E-10 | 1.47E-10 | 5.55E-11 |

**Table B45** Results of the impact assessment grease transportation in no load of warn-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | WMA-Transport_rawmat_grease no load | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 3.26E-08 | 0 | 3.26E-08 |
| global warming (GWP100) | kg CO2 eq | 4.71E-06 | 4.30E-06 | 4.18E-07 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 3.90E-07 | 3.82E-07 | 7.80E-09 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 6.95E-10 | 6.37E-10 | 5.84E-11 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 3.21E-06 | 2.95E-06 | 2.62E-07 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 1.20E-10 | 4.82E-11 | 7.19E-11 |
| photochemical oxidation | kg C2H4 | 1.68E-09 | 1.55E-09 | 1.30E-10 |
| acidification | kg SO2 eq | 1.21E-08 | 6.84E-09 | 5.31E-09 |
| eutrophication | kg PO4--- eq | 2.02E-09 | 1.47E-09 | 5.55E-10 |

**Table B46** Results of the impact assessment Asphalt concrete transportation in no load of warn-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | WMA-Transport_prod_Asphalt concrete no load | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 1.51E-07 | 0 | 1.51E-07 |
| global warming (GWP100) | kg CO2 eq | 2.18E-05 | 1.99E-05 | 1.93E-06 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 9.96E-07 | 9.60E-07 | 3.61E-08 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 3.19E-09 | 2.92E-09 | 2.70E-10 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 1.48E-05 | 1.35E-05 | 1.21E-06 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 5.55E-10 | 2.22E-10 | 3.33E-10 |
| photochemical oxidation | kg C2H4 | 2.81E-09 | 2.21E-09 | 6.02E-10 |
| acidification | kg SO2 eq | 1.32E-07 | 1.07E-07 | 2.45E-08 |
| eutrophication | kg PO4--- eq | 2.90E-08 | 2.64E-08 | 2.57E-09 |

**Table B47** Results of the impact assessment water transportation in no load of warn-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | WMA-Transport_rawmat_water no load | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 1.42E-07 | 0 | 1.42E-07 |
| global warming (GWP100) | kg CO2 eq | 2.07E-05 | 1.88E-05 | 1.82E-06 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 9.46E-07 | 9.12E-07 | 3.40E-08 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 3.05E-09 | 2.79E-09 | 2.54E-10 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 1.41E-05 | 1.29E-05 | 1.14E-06 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 5.25E-10 | 2.11E-10 | 3.13E-10 |
| photochemical oxidation | kg C2H4 | 2.67E-09 | 2.10E-09 | 5.67E-10 |
| acidification | kg SO2 eq | 1.25E-07 | 1.02E-07 | 2.31E-08 |
| eutrophication | kg PO4--- eq | 2.75E-08 | 2.51E-08 | 2.42E-09 |

**Table B48** Results of the impact assessment sasobit transportation in no load of warn-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | WMA-Transport_rawmat_Sasobit no load | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 3.26E-07 | 0 | 3.26E-07 |
| global warming (GWP100) | kg CO2 eq | 4.71E-05 | 4.30E-05 | 4.18E-06 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 3.90E-06 | 3.82E-06 | 7.80E-08 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 6.95E-09 | 6.37E-09 | 5.84E-10 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 3.21E-05 | 2.95E-05 | 2.62E-06 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 1.20E-09 | 4.82E-10 | 7.19E-10 |
| photochemical oxidation | kg C2H4 | 1.68E-08 | 1.55E-08 | 1.30E-09 |
| acidification | kg SO2 eq | 1.21E-07 | 6.84E-08 | 5.31E-08 |
| eutrophication | kg PO4--- eq | 2.02E-08 | 1.47E-08 | 5.55E-09 |

**Table B49** Results of the impact assessment 41.7 kg asphalt binder transportation in full load of warn-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | WMA-Transport_rawmat_Asphalt binder | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 0.28649607 | 0.266248 | 0.020248064 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 0.002542046 | 0.002268669 | 0.000273377 |
| eutrophication | kg PO4 | 0.000439241 | 0.000412317 | 2.69E-05 |
| heavy metals | kg Pb | 3.80E-08 | 3.45E-08 | 3.55E-09 |
| carcinogens | kg B(a)P | 2.59E-10 | 2.46E-10 | 1.27E-11 |
| winter smog | kg SPM | 0.000201073 | 4.85E-05 | 0.000152573 |
| summer smog | kg C2H4 | 0.000218293 | 0.000136003 | 8.23E-05 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 3.2829801 | 0 | 3.2829801 |
| solid waste | kg | 0.000335091 | 0 | 0.000335091 |

**Table B50** Results of the impact assessment 968 kg aggregate transportation in full load of warn-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | WMA-Transport_rawmat_Aggregate | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 4.9975829 | 4.6443815 | 0.35320143 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 0.044342977 | 0.03957426 | 0.004768717 |
| eutrophication | kg PO4 | 0.007662044 | 0.007192385 | 0.000469658 |
| heavy metals | kg Pb | 6.62E-07 | 6.00E-07 | 6.19E-08 |
| carcinogens | kg B(a)P | 4.51E-09 | 4.29E-09 | 2.22E-10 |
| winter smog | kg SPM | 0.003507479 | 0.000846032 | 0.002661447 |
| summer smog | kg C2H4 | 0.003807859 | 0.002372418 | 0.001435441 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 57.267364 | 0 | 57.267364 |
| solid waste | kg | 0.005845235 | 0 | 0.005845235 |

**Table B51** Results of the impact assessment 6.77 kg fuel-oil transportation in full load of warn-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | WMA-Transport_rawmat_Fuel oil | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 0.04560651 | 0.041825902 | 0.003780608 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 0.000361466 | 0.000310422 | 5.10E-05 |
| eutrophication | kg PO4 | 6.10E-05 | 5.60E-05 | 5.03E-06 |
| heavy metals | kg Pb | 7.06E-09 | 6.40E-09 | 6.63E-10 |
| carcinogens | kg B(a)P | 3.76E-11 | 3.52E-11 | 2.38E-12 |
| winter smog | kg SPM | 3.75E-05 | 9.01E-06 | 2.85E-05 |
| summer smog | kg C2H4 | 6.02E-05 | 4.49E-05 | 1.54E-05 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.61298013 | 0 | 0.61298013 |
| solid waste | kg | 6.26E-05 | 0 | 6.26E-05 |

**Table B52** Results of the impact assessment 0.00106 kg hot-oil transportation in full load of warn-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | WMA-Transport_rawmat_Hot oil | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 2.23E-05 | 2.03E-05 | 1.96E-06 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 6.91E-08 | 4.27E-08 | 2.64E-08 |
| eutrophication | kg PO4 | 9.66E-09 | 7.06E-09 | 2.60E-09 |
| heavy metals | kg Pb | 3.66E-12 | 3.32E-12 | 3.43E-13 |
| carcinogens | kg B(a)P | 4.27E-14 | 4.15E-14 | 1.23E-15 |
| winter smog | kg SPM | 1.94E-08 | 4.64E-09 | 1.47E-08 |
| summer smog | kg C2H4 | 3.72E-08 | 2.92E-08 | 7.95E-09 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.000317265 | 0 | 0.000317265 |
| solid waste | kg | 3.24E-08 | 0 | 3.24E-08 |

**Table B53** Results of the impact assessment 0.00179 kg grease transportation in full load of warn-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | WMA-Transport_rawmat_grease | Diesel 1 |
|---|---|---|---|---|
| greenhouse | kg CO2 | 3.74E-05 | 3.41E-05 | 3.29E-06 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 1.16E-07 | 7.17E-08 | 4.45E-08 |
| eutrophication | kg PO4 | 1.62E-08 | 1.19E-08 | 4.38E-09 |
| heavy metals | kg Pb | 6.15E-12 | 5.57E-12 | 5.78E-13 |
| carcinogens | kg B(a)P | 7.18E-14 | 6.97E-14 | 2.07E-15 |
| winter smog | kg SPM | 3.26E-08 | 7.81E-09 | 2.48E-08 |
| summer smog | kg C2H4 | 6.25E-08 | 4.91E-08 | 1.34E-08 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.000534147 | 0 | 0.000534147 |
| solid waste | kg | 5.45E-08 | 0 | 5.45E-08 |

**Table B54** Results of the impact assessment 1000 kg Asphalt concrete transportation in full load of warn-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | WMA-Transport_product_Asphalt concrete | Diesel 1 |
|---|---|---|---|---|
| greenhouse | kg CO2 | 1.7536572 | 1.6080163 | 0.14564088 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 0.013904407 | 0.01193805 | 0.001966357 |
| eutrophication | kg PO4 | 0.002346136 | 0.002152475 | 0.000193661 |
| heavy metals | kg Pb | 2.74E-07 | 2.48E-07 | 2.55E-08 |
| carcinogens | kg B(a)P | 1.45E-09 | 1.35E-09 | 9.16E-11 |
| winter smog | kg SPM | 0.001445235 | 0.0003478 | 0.001097435 |
| summer smog | kg C2H4 | 0.002318697 | 0.0017268 | 0.000591897 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 23.613917 | 0 | 23.613917 |
| solid waste | kg | 0.002410254 | 0 | 0.002410254 |

**Table B55** Results of the impact assessment 3.7 kg water transportation in full load of warn-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | WMA-Transport_rawmat_water | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 0.006027848 | 0.005528008 | 0.00049984 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 4.78E-05 | 4.10E-05 | 6.75E-06 |
| eutrophication | kg PO4 | 8.06E-06 | 7.40E-06 | 6.65E-07 |
| heavy metals | kg Pb | 9.37E-10 | 8.49E-10 | 8.76E-11 |
| carcinogens | kg B(a)P | 4.97E-12 | 4.66E-12 | 3.14E-13 |
| winter smog | kg SPM | 4.96E-06 | 1.19E-06 | 3.77E-06 |
| summer smog | kg C2H4 | 7.96E-06 | 5.93E-06 | 2.03E-06 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.081043046 | 0 | 0.081043046 |
| solid waste | kg | 8.27E-06 | 0 | 8.27E-06 |

**Table B56** Results of the impact assessment 1.9 kg sasobit transportation in full load of warn-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | WMA-Transport_rawmat_Sasobit | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 0.026947928 | 0.024579652 | 0.002368276 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 8.36E-05 | 5.16E-05 | 3.20E-05 |
| eutrophication | kg PO4 | 1.17E-05 | 8.55E-06 | 3.15E-06 |
| heavy metals | kg Pb | 4.43E-09 | 4.02E-09 | 4.15E-10 |
| carcinogens | kg B(a)P | 5.18E-11 | 5.03E-11 | 1.49E-12 |
| winter smog | kg SPM | 2.35E-05 | 5.63E-06 | 1.78E-05 |
| summer smog | kg C2H4 | 4.50E-05 | 3.54E-05 | 9.62E-06 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.38398748 | 0 | 0.38398748 |
| solid waste | kg | 3.92E-05 | 0 | 3.92E-05 |

**Table B57** Results of the impact assessment asphalt binder transportation in no load of warn-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | WMA-Transport_rawmat_Asphalt binder no load | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 0.000135203 | 0.000123275 | 1.19E-05 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 1.22E-06 | 1.06E-06 | 1.61E-07 |
| eutrophication | kg PO4 | 2.07E-07 | 1.91E-07 | 1.59E-08 |
| heavy metals | kg Pb | 2.25E-11 | 2.05E-11 | 2.09E-12 |
| carcinogens | kg B(a)P | 1.26E-13 | 1.18E-13 | 7.50E-15 |
| winter smog | kg SPM | 1.18E-07 | 2.86E-08 | 8.99E-08 |
| summer smog | kg C2H4 | 1.15E-07 | 6.64E-08 | 4.85E-08 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.001933982 | 0 | 0.001933982 |
| solid waste | kg | 1.97E-07 | 0 | 1.97E-07 |

**Table B58** Results of the impact assessment aggregate transportation in no load of warn-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | WMA-Transport_rawmat_Aggregate no load | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 0.000101689 | 9.27E-05 | 9.03E-06 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 9.16E-07 | 7.94E-07 | 1.22E-07 |
| eutrophication | kg PO4 | 1.55E-07 | 1.43E-07 | 1.20E-08 |
| heavy metals | kg Pb | 1.69E-11 | 1.54E-11 | 1.58E-12 |
| carcinogens | kg B(a)P | 9.48E-14 | 8.91E-14 | 5.68E-15 |
| winter smog | kg SPM | 8.96E-08 | 2.15E-08 | 6.81E-08 |
| summer smog | kg C2H4 | 8.66E-08 | 4.99E-08 | 3.67E-08 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.001464301 | 0 | 0.001464301 |
| solid waste | kg | 1.49E-07 | 0 | 1.49E-07 |

**Table B59** Results of the impact assessment fuel-oil transportation in no load of warn-mixed asphalt asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | WMA-Transport_rawmat_Fuel oil no load | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 8.51E-05 | 7.75E-05 | 7.58E-06 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 6.79E-07 | 5.77E-07 | 1.02E-07 |
| eutrophication | kg PO4 | 1.14E-07 | 1.04E-07 | 1.01E-08 |
| heavy metals | kg Pb | 1.42E-11 | 1.29E-11 | 1.33E-12 |
| carcinogens | kg B(a)P | 7.08E-14 | 6.60E-14 | 4.77E-15 |
| winter smog | kg SPM | 7.51E-08 | 1.80E-08 | 5.71E-08 |
| summer smog | kg C2H4 | 1.18E-07 | 8.75E-08 | 3.08E-08 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.00122946 | 0 | 0.00122946 |
| solid waste | kg | 1.25E-07 | 0 | 1.25E-07 |

**Table B60** Results of the impact assessment hot-oil transportation in no load of warn-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | WMA-Transport_rawmat_Hot oil no load | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 4.63E-07 | 4.21E-07 | 4.17E-08 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 1.45E-09 | 8.90E-10 | 5.64E-10 |
| eutrophication | kg PO4 | 2.02E-10 | 1.47E-10 | 5.55E-11 |
| heavy metals | kg Pb | 7.83E-14 | 7.10E-14 | 7.32E-15 |
| carcinogens | kg B(a)P | 8.84E-16 | 8.58E-16 | 2.63E-17 |
| winter smog | kg SPM | 4.14E-10 | 9.93E-11 | 3.15E-10 |
| summer smog | kg C2H4 | 7.83E-10 | 6.14E-10 | 1.70E-10 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 6.77E-06 | 0 | 6.77E-06 |
| solid waste | kg | 6.91E-10 | 0 | 6.91E-10 |

**Table B61** Results of the impact assessment grease transportation in no load of warn-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | WMA-Transport_rawmat_grease no load | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 4.63E-06 | 4.21E-06 | 4.17E-07 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 1.45E-08 | 8.90E-09 | 5.64E-09 |
| eutrophication | kg PO4 | 2.02E-09 | 1.47E-09 | 5.55E-10 |
| heavy metals | kg Pb | 7.83E-13 | 7.10E-13 | 7.32E-14 |
| carcinogens | kg B(a)P | 8.84E-15 | 8.58E-15 | 2.63E-16 |
| winter smog | kg SPM | 4.14E-09 | 9.93E-10 | 3.15E-09 |
| summer smog | kg C2H4 | 7.83E-09 | 6.14E-09 | 1.70E-09 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 6.77E-05 | 0 | 6.77E-05 |
| solid waste | kg | 6.91E-09 | 0 | 6.91E-09 |

**Table B62** Results of the impact assessment Asphalt concrete transportation in no load of warn-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | WMA-Transport_product_Asphalt concrete no load | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 2.17E-05 | 1.97E-05 | 1.93E-06 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 1.73E-07 | 1.47E-07 | 2.61E-08 |
| eutrophication | kg PO4 | 2.90E-08 | 2.64E-08 | 2.57E-09 |
| heavy metals | kg Pb | 3.61E-12 | 3.28E-12 | 3.39E-13 |
| carcinogens | kg B(a)P | 1.80E-14 | 1.68E-14 | 1.21E-15 |
| winter smog | kg SPM | 1.91E-08 | 4.59E-09 | 1.46E-08 |
| summer smog | kg C2H4 | 3.02E-08 | 2.23E-08 | 7.85E-09 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.000313121 | 0 | 0.000313121 |
| solid waste | kg | 3.20E-08 | 0 | 3.20E-08 |

**Table B53** Results of the impact assessment water transportation in no load of warn-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | WMA-Transport_rawmat_water no load | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 2.06E-05 | 1.87E-05 | 1.82E-06 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 1.64E-07 | 1.39E-07 | 2.45E-08 |
| eutrophication | kg PO4 | 2.75E-08 | 2.51E-08 | 2.42E-09 |
| heavy metals | kg Pb | 3.43E-12 | 3.11E-12 | 3.19E-13 |
| carcinogens | kg B(a)P | 1.71E-14 | 1.60E-14 | 1.14E-15 |
| winter smog | kg SPM | 1.81E-08 | 4.36E-09 | 1.37E-08 |
| summer smog | kg C2H4 | 2.86E-08 | 2.12E-08 | 7.39E-09 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.000294702 | 0 | 0.000294702 |
| solid waste | kg | 3.01E-08 | 0 | 3.01E-08 |

**Table B64** Results of the impact assessment sasobit transportation in no load of warn-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | WMA-Transport_rawmat_Sasobit no load | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 4.63E-05 | 4.21E-05 | 4.17E-06 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 1.45E-07 | 8.90E-08 | 5.64E-08 |
| eutrophication | kg PO4 | 2.02E-08 | 1.47E-08 | 5.55E-09 |
| heavy metals | kg Pb | 7.83E-12 | 7.10E-12 | 7.32E-13 |
| carcinogens | kg B(a)P | 8.84E-14 | 8.58E-14 | 2.63E-15 |
| winter smog | kg SPM | 4.14E-08 | 9.93E-09 | 3.15E-08 |
| summer smog | kg C2H4 | 7.83E-08 | 6.14E-08 | 1.70E-08 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 0.000676894 | 0 | 0.000676894 |
| solid waste | kg | 6.91E-08 | 0 | 6.91E-08 |

**Table B65** Results of the impact assessment paver of hot-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | HMA-Pavement paver | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 0.006615 | 0 | 0.00661499 |
| global warming (GWP100) | kg CO2 eq | 0.5227139 | 0.43798861 | 0.0847253 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 0.006176 | 0.004593526 | 0.001582504 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 1.18E-05 | 0 | 1.18E-05 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 0.0530498 | 0 | 0.05304978 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 1.46E-05 | 0 | 1.46E-05 |
| photochemical oxidation | kg C2H4 | 5.82E-05 | 3.18E-05 | 2.64E-05 |
| acidification | kg SO2 eq | 0.0028945 | 0.00181797 | 0.001076502 |
| eutrophication | kg PO4--- eq | 0.0005717 | 0.000459069 | 0.000112612 |

**Table B66** Results of the impact assessment breakdown of hot-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | HMA-Pavement breakdown | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 0.0007831 | 0 | 0.000783062 |
| global warming (GWP100) | kg CO2 eq | 0.0609735 | 0.050943972 | 0.010029521 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 0.000733 | 0.000545672 | 0.000187332 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 1.40E-06 | 0 | 1.40E-06 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 0.0062799 | 0 | 0.00627987 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 1.73E-06 | 0 | 1.73E-06 |
| photochemical oxidation | kg C2H4 | 6.95E-06 | 3.82E-06 | 3.13E-06 |
| acidification | kg SO2 eq | 0.0003433 | 0.00021582 | 0.000127433 |
| eutrophication | kg PO4--- eq | 6.79E-05 | 5.45E-05 | 1.33E-05 |

**Table B67** Results of the impact assessment Finish rolling of hot-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | HMA-Pavement finish rolling | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 0.001067 | 0 | 0.001067005 |
| global warming (GWP100) | kg CO2 eq | 0.0951921 | 0.081525831 | 0.013666287 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 0.0012086 | 0.00095333 | 0.00025526 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 1.91E-06 | 0 | 1.91E-06 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 0.008557 | 0 | 0.00855699 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 2.35E-06 | 0 | 2.35E-06 |
| photochemical oxidation | kg C2H4 | 1.96E-05 | 1.53E-05 | 4.26E-06 |
| acidification | kg SO2 eq | 0.0005264 | 0.00035277 | 0.000173641 |
| eutrophication | kg PO4--- eq | 0.0001074 | 8.92E-05 | 1.82E-05 |

**Table B68** Results of the impact assessment paver of hot-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | HMA-Pavement_paver | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 0.5209941 | 0.4363053 | 0.0846888 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 0.003658928 | 0.00251551 | 0.001143418 |
| eutrophication | kg PO4 | 0.000571681 | 0.000459069 | 0.000112612 |
| heavy metals | kg Pb | 1.48E-08 | 0 | 1.48E-08 |
| carcinogens | kg B(a)P | 5.33E-11 | 0 | 5.33E-11 |
| winter smog | kg SPM | 0.001110748 | 0.0004726 | 0.000638148 |
| summer smog | kg C2H4 | 0.000450448 | 0.000106266 | 0.000344182 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 13.731271 | 0 | 13.731271 |
| solid waste | kg | 0.00140154 | 0 | 0.00140154 |

**Table B69** Results of the impact assessment breakdown of hot-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | HMA-Pavement_breakdown | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 0.0607666 | 0.0507414 | 0.0100252 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 0.000434034 | 0.00029868 | 0.000135354 |
| eutrophication | kg PO4 | 6.79E-05 | 5.45E-05 | 1.33E-05 |
| heavy metals | kg Pb | 1.76E-09 | 0 | 1.76E-09 |
| carcinogens | kg B(a)P | 6.30E-12 | 0 | 6.30E-12 |
| winter smog | kg SPM | 0.000131742 | 5.62E-05 | 7.55E-05 |
| summer smog | kg C2H4 | 5.34E-05 | 1.27E-05 | 4.07E-05 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 1.6254656 | 0 | 1.6254656 |
| solid waste | kg | 0.00016591 | 0 | 0.00016591 |

**Table B70** Results of the impact assessment Finish rolling of hot-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | HMA-Pavement_finish rolling | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 0.0943406 | 0.0806802 | 0.0136604 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 0.000672805 | 0.00048837 | 0.000184435 |
| eutrophication | kg PO4 | 0.000107357 | 8.92E-05 | 1.82E-05 |
| heavy metals | kg Pb | 2.39E-09 | 0 | 2.39E-09 |
| carcinogens | kg B(a)P | 8.59E-12 | 0 | 8.59E-12 |
| winter smog | kg SPM | 0.000268634 | 0.0001657 | 0.000102934 |
| summer smog | kg C2H4 | 8.56E-05 | 3.01E-05 | 5.55E-05 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 2.2148696 | 0 | 2.2148696 |
| solid waste | kg | 0.00022607 | 0 | 0.00022607 |

**Table B71** Results of the impact assessment paver of warm-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | WMA-Pavement paver | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 0.004631824 | 0 | 0.004631824 |
| global warming (GWP100) | kg CO2 eq | 0.36591686 | 0.3065921 | 0.059324757 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 0.004253747 | 0.003145676 | 0.001108071 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 8.29E-06 | 0 | 8.29E-06 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 0.03714552 | 0 | 0.03714552 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 1.02E-05 | 0 | 1.02E-05 |
| photochemical oxidation | kg C2H4 | 4.08E-05 | 2.23E-05 | 1.85E-05 |
| acidification | kg SO2 eq | 0.002026968 | 0.0012732 | 0.000753768 |
| eutrophication | kg PO4--- eq | 0.000400211 | 0.00032136 | 7.89E-05 |

**Table B72** Results of the impact assessment breakdown of warm-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | WMA-Pavement breakdown | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 0.000547922 | 0 | 0.000547922 |
| global warming (GWP100) | kg CO2 eq | 0.042679113 | 0.03566129 | 0.007017823 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 0.000505583 | 0.000374504 | 0.000131079 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 9.81E-07 | 0 | 9.81E-07 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 0.00439413 | 0 | 0.00439413 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 1.21E-06 | 0 | 1.21E-06 |
| photochemical oxidation | kg C2H4 | 4.89E-06 | 2.70E-06 | 2.19E-06 |
| acidification | kg SO2 eq | 0.000240967 | 0.0001518 | 8.92E-05 |
| eutrophication | kg PO4--- eq | 4.75E-05 | 3.82E-05 | 9.33E-06 |

**Table B73** Results of the impact assessment Finish rolling of warm-mixed asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total | WMA-Pavement finish rolling | Diesel I |
|---|---|---|---|---|
| abiotic depletion | kg Sb eq | 0.000745351 | 0 | 0.000745351 |
| global warming (GWP100) | kg CO2 eq | 0.066614623 | 0.05706811 | 0.009546513 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 | 0 | 0 |
| human toxicity | kg 1,4-DB eq | 0.000819666 | 0.000641356 | 0.00017831 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 1.33E-06 | 0 | 1.33E-06 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 0.00597744 | 0 | 0.00597744 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 1.64E-06 | 0 | 1.64E-06 |
| photochemical oxidation | kg C2H4 | 1.37E-05 | 1.07E-05 | 2.98E-06 |
| acidification | kg SO2 eq | 0.000368496 | 0.0002472 | 0.000121296 |
| eutrophication | kg PO4--- eq | 7.51E-05 | 6.24E-05 | 1.27E-05 |

**Table B74** Results of the impact assessment paver of warm-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | WMA-Pavement paver | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 0.3647132 | 0.305414 | 0.0592992 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 0.002562023 | 0.0017614 | 0.000800623 |
| eutrophication | kg PO4 | 0.000400211 | 0.00032136 | 7.89E-05 |
| heavy metals | kg Pb | 1.04E-08 | 0 | 1.04E-08 |
| carcinogens | kg B(a)P | 3.73E-11 | 0 | 3.73E-11 |
| winter smog | kg SPM | 0.000692832 | 0.000246 | 0.000446832 |
| summer smog | kg C2H4 | 0.000304677 | 6.37E-05 | 0.000240997 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 9.6146522 | 0 | 9.6146522 |
| solid waste | kg | 0.00098136 | 0 | 0.00098136 |

**Table B75** Results of the impact assessment breakdown of warm-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | WMA-Pavement_breakdown | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 0.0425338 | 0.035519 | 0.0070148 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 0.00030451 | 0.0002098 | 9.47E-05 |
| eutrophication | kg PO4 | 4.75E-05 | 3.82E-05 | 9.33E-06 |
| heavy metals | kg Pb | 1.23E-09 | 0 | 1.23E-09 |
| carcinogens | kg B(a)P | 4.41E-12 | 0 | 4.41E-12 |
| winter smog | kg SPM | 8.29E-05 | 3.00E-05 | 5.29E-05 |
| summer smog | kg C2H4 | 3.61E-05 | 7.56E-06 | 2.85E-05 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 1.1373655 | 0 | 1.1373655 |
| solid waste | kg | 0.00011609 | 0 | 0.00011609 |

**Table B76** Results of the impact assessment Finish rolling of warm-mixed asphalt by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total | WMA-Pavement_breakdown | Diesel I |
|---|---|---|---|---|
| greenhouse | kg CO2 | 0.0425338 | 0.035519 | 0.0070148 |
| ozone layer | kg CFC11 | 0 | 0 | 0 |
| acidification | kg SO2 | 0.00030451 | 0.0002098 | 9.47E-05 |
| eutrophication | kg PO4 | 4.75E-05 | 3.82E-05 | 9.33E-06 |
| heavy metals | kg Pb | 1.23E-09 | 0 | 1.23E-09 |
| carcinogens | kg B(a)P | 4.41E-12 | 0 | 4.41E-12 |
| winter smog | kg SPM | 8.29E-05 | 3.00E-05 | 5.29E-05 |
| summer smog | kg C2H4 | 3.61E-05 | 7.56E-06 | 2.85E-05 |
| pesticides | kg act.subst | 0 | 0 | 0 |
| energy resources | MJ LHV | 1.1373655 | 0 | 1.1373655 |
| solid waste | kg | 0.00011609 | 0 | 0.00011609 |

**Table B77** Results of the impact assessment transportation in full load of asphalt pavement by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total |
|---|---|---|
| abiotic depletion | kg Sb eq | 0.0112622 |
| global warming (GWP100) | kg CO2 eq | 1.7449238 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 |
| human toxicity | kg 1,4-DB eq | 0.0795394 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 0.0002393 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 1.104861 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 4.15E-05 |
| photochemical oxidation | kg C2H4 | 0.0002221 |
| acidification | kg SO2 eq | 0.0104419 |
| eutrophication | kg PO4--- eq | 0.0023227 |

**Table B78** Results of the impact assessment transportation in no load of asphalt pavement by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total |
|---|---|---|
| abiotic depletion | kg Sb eq | 1.51E-07 |
| global warming (GWP100) | kg CO2 eq | 2.18E-05 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 0 |
| human toxicity | kg 1,4-DB eq | 9.96E-07 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 3.19E-09 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 1.48E-05 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 5.55E-10 |
| photochemical oxidation | kg C2H4 | 2.81E-09 |
| acidification | kg SO2 eq | 1.32E-07 |
| eutrophication | kg PO4--- eq | 2.90E-08 |

**Table B79** Results of the impact assessment transportation in full load of asphalt pavement by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total |
|---|---|---|
| greenhouse | kg CO2 | 1.7361212 |
| ozone layer | kg CFC11 | 0 |
| acidification | kg SO2 | 0.0137654 |
| eutrophication | kg PO4 | 0.0023227 |
| heavy metals | kg Pb | 2.71E-07 |
| carcinogens | kg B(a)P | 1.43E-09 |
| winter smog | kg SPM | 0.0014308 |
| summer smog | kg C2H4 | 0.0022955 |
| pesticides | kg act.subst | 0 |
| energy resources | MJ LHV | 23.377787 |
| solid waste | kg | 0.0023862 |

**Table B80** Results of the impact assessment transportation in no load of asphalt pavement by using Eco-indicator 95 V2.03 / Europe e

| Impact category | Unit | Total |
|---|---|---|
| greenhouse | kg CO2 | 2.17E-05 |
| ozone layer | kg CFC11 | 0 |
| acidification | kg SO2 | 1.73E-07 |
| eutrophication | kg PO4 | 2.90E-08 |
| heavy metals | kg Pb | 3.61E-12 |
| carcinogens | kg B(a)P | 1.80E-14 |
| winter smog | kg SPM | 1.91E-08 |
| summer smog | kg C2H4 | 3.02E-08 |
| pesticides | kg act.subst | 0 |
| energy resources | MJ LHV | 0.0003131 |
| solid waste | kg | 3.20E-08 |

**Table B81** Results of the impact assessment recycling asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total |
|---|---|---|
| abiotic depletion | kg Sb eq | -0.976468 |
| global warming (GWP100) | kg CO2 eq | -24.8924 |
| ozone layer depletion (ODP) | kg CFC-11 eq | -3.12E-05 |
| human toxicity | kg 1,4-DB eq | -16.38605 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | -1.547806 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | -6806.238 |
| terrestrial ecotoxicity | kg 1,4-DB eq | -0.098348 |
| photochemical oxidation | kg C2H4 | -0.009426 |
| acidification | kg SO2 eq | -0.125598 |
| eutrophication | kg PO4--- eq | -0.022245 |

**Table B82** Results of the impact assessment recycling asphalt by using Eco-indicator 95 V2 03 / Europe e

| Impact category | Unit | Total |
|---|---|---|
| greenhouse | kg CO2 | -21.43815 |
| ozone layer | kg CFC11 | -4.15E-05 |
| acidification | kg SO2 | -0.146792 |
| eutrophication | kg PO4 | -0.022151 |
| heavy metals | kg Pb | -0.000165 |
| carcinogens | kg B(a)P | -2.56E-06 |
| winter smog | kg SPM | -7.63396 |
| summer smog | kg C2H4 | -0.064811 |
| pesticides | kg act.subst | 0 |
| energy resources | MJ LHV | -40.31012 |
| solid waste | kg | 0.0083136 |

**Table B83** Results of the impact assessment landfill asphalt by using CML 2 baseline 2000 V2.03 / World, 1995

| Impact category | Unit | Total |
|---|---|---|
| abiotic depletion | kg Sb eq | 0.0035931 |
| global warming (GWP100) | kg CO2 eq | 0.5538936 |
| ozone layer depletion (ODP) | kg CFC-11 eq | 7.30E-07 |
| human toxicity | kg 1,4-DB eq | 0.1359022 |
| fresh water aquatic ecotox. | kg 1,4-DB eq | 0.0294802 |
| marine aquatic ecotoxicity | kg 1,4-DB eq | 116.92078 |
| terrestrial ecotoxicity | kg 1,4-DB eq | 0.0005281 |
| photochemical oxidation | kg C2H4 | 0.0001347 |
| acidification | kg SO2 eq | 0.00413 |
| eutrophication | kg PO4--- eq | 0.0008371 |

**Table B84** Results of the impact assessment landfill asphalt by using Eco-indicator 95 V2.03 / Europe e

| **Impact category** | **Unit** | **Total** |
|---|---|---|
| greenhouse | kg CO2 | 0.5406285 |
| ozone layer | kg CFC11 | 9.72E-07 |
| acidification | kg SO2 | 0.0052358 |
| eutrophication | kg PO4 | 0.0008371 |
| heavy metals | kg Pb | 1.88E-06 |
| carcinogens | kg B(a)P | 5.45E-09 |
| winter smog | kg SPM | 0.0017239 |
| summer smog | kg C2H4 | 0.0009251 |
| pesticides | kg act.subst | 0 |
| energy resources | MJ LHV | 7.5900282 |
| solid waste | kg | 0 |

# CURRICULUM VITAE

**Name:** Ms. Suwimon Leedilok

**Date of Birth:** September 17, 1988

**Nationality:** Thai

**University Education:**

2007 – 2011 Bachelor Degree of Chemical Technology (Fuel Technology), Faculty of Science, Chulalongkorn University, Bangkok, Thailand

**Working Experience:**

| | | |
|---|---|---|
| April-May 2010 | Position: | Student Internship in process engineer, Engineering Section |
| | Company name: | Bangkok Synthetics Company Limited |

**Proceedings:**

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