Comparison of Greenhouse Gas Emissions for Patching with Recycled and Traditional Asphalt

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1. Introduction

The purpose of this study was to predict the greenhouse gas emissions produced from asphalt patching jobs using recycled asphalt and traditional asphalt. Data from the Go Green Asphalt recycling system (Bagela Asphalt Recycler) was used for the recycled case and data from Huang, et al. was used for the traditional case. The methodology used is outlined below.

2. Computational Setup

The data used for the three cases, representing typical asphalt paving jobs, are presented in Table 1.

Table 1

Name	Case 1	Case 2	Case 3
Asphalt needed for job (tons)	2	5	13
Asphalt obtained from quarry (tons)	4	7	15
Distance driven from yard to job and back with recycler (miles)	40	40	40
Distance driven from yard to job to collect old asphalt, disposal of asphalt and back to yard (miles)	60	60	60
Distance driven from yard to asphalt quarry, to job and back to yard (miles)	60	60	60
Amount of diesel fuel required to run asphalt recycler (Gallons per ton of asphalt)	1.5	1.5	1.5
Mass of CO2 emitted from creation of recycler (lbs)	27,500	27,500	27,500
Expected life of recycler (tons of asphalt)	100,000	100,000	100,000
Fuel economy of all vehicles (mpg)	8	8	8

CO2 emissions from transportation and asphalt production were included for the traditional case. For the recycled case, CO2 emissions from transportation, operation of the recycler, fabrication of the recycler and production of the binder were included.

3. Results

Table 2 summarizes the results obtained from the three typical jobs cases. The recycled asphalt produced fewer CO2 emissions than the traditional method in every case, ranging from 32 to 61% savings. For smaller jobs, the energy savings from reduced transportation was most significant. Additional savings was predicted because it takes less energy to crush, heat and rejuvenate the recycled asphalt than it does to create new asphalt. Additionally, the extra "waste" asphalt that cools in transit to the job was eliminated by recycling.

Table 2

Emissions Source	Case 1	Case 2	Case 3
Total CO2 emissions from traditional method	485 lbs	598 lbs	902 lbs
Percentage of emissions from transportation	69%	56%	37%
Percentage of emissions from asphalt production	31%	44%	63%
Total CO2 emissions from recycled method	188 lbs	303 lbs	610 lbs
Percentage of emissions from transportation	58%	36%	18%
Percentage of emissions from running recycler	35%	55%	71%
Percentage of emissions from making recycler	2%	1%	1%
Percentage of emissions from making binder	5%	8%	10%
Percentage CO2 reduction by recycling	61%	49%	32%

4. Conclusions

Significant CO2 emission savings can be expected from using recycled asphalts for patching jobs due to reduced travel, reduced energy input recycling asphalt compared to creating new asphalt and reduced asphalt waste.

References

Huang, Y., Bird, R., and Heidrich, O., "Development of a life cycle assessment tool for construction and maintenance of asphalt pavements," Journal of Cleaner Production, 2009.

Chiu, C., Hsu, T.H., and Yang, W.F., "Life cycle assessment on using recycled materials for rehabilitating asphalt pavements," Resources, Conservation and Recycling, 2008.