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New Jersey Department of Transportation
Bureau of Research

Technical Brief

Carbon Footprint Estimator, Phase II
Volume I – GASCAP Model & Volume II – Technical Appendices

This study resulted in the development of the GASCAP model (the Greenhouse Gas Assessment Spreadsheet for Transportation Capital Projects). This spreadsheet model provides a user-friendly interface for determining the greenhouse gas (GHG) emissions of transportation construction and maintenance projects. The components of the model account for materials used, construction equipment, recycled materials, project staging and mobilization, traffic disruption due to project staging, life-cycle maintenance, induced travel of new lane miles, and a procedure for estimating GHG emissions from rail construction. The model is available for use at www.gascap.org. The project includes analysis of four case studies to demonstrate the capabilities of the GASCAP model.

Background

New Jersey's Global Warming Response Plan (GWRP) seeks to significantly reduce carbon emissions from the transportation sector by 2050. One of the specific action items listed within the draft implementation plan is to develop methods to analyze the lifecycle carbon footprint of transportation projects. This will allow an assessment of how the actual construction and maintenance of various facilities will affect carbon or more specifically greenhouse gas (GHG) emissions. In particular, the development of a methodology for assessment can provide a useful criterion for project selection and for providing incentives and guidance to contractors and NJDOT staff to take GHG emissions into account in how they design and build capital projects. The GASCAP project was developed to meet this goal.

Research Objectives and Approach

Our objective was to develop a detailed but user-friendly software product that would allow the many components of transportation construction projects to be analyzed for their GHG emissions. This phase of the project had specific goals to complete an induced travel module, develop a life-cycle maintenance module, simplify and automate the input of project related construction equipment, develop a traffic disruption and diversion module, and to develop systems to more

easily update the emissions factors embedded in the model. Four case studies were also completed to test the software and demonstrate its various capabilities.

Findings

- The case study analysis found that emissions associated with production of materials used in construction projects generally accounts for the majority of project related GHG emissions. This is due to the upstream production process of materials, primarily asphalt, concrete, and steel. This means that to reduce GHG emissions material inputs should be minimized to the largest extent possible, but also implies that other sectors of the economy are largely responsible for reducing the GHG emissions associated with these materials.

- Construction equipment emissions are generally a minor source of total project GHG emissions. More efficient equipment operation or the use of alternative fuels can reduce emissions, but for a large project, this will provide only minor reductions.

- Life-cycle maintenance largely involves the use of material inputs and thus also can be a large component of total project emissions. Further work should determine the optimal maintenance procedures to reduce GHG emissions with a focus on how sub-optimal maintenance and consequent road deterioration can affect the GHG emissions of users.

- Traffic disruption due to detours implemented during construction can account for a large fraction of GHG emissions. While lighting for construction activities at night can also account for a substantial level of GHG emissions, this is generally less than diversion and disruption caused by daytime rerouting of traffic.

- Working with staff at the South Jersey regional office we developed a special maintenance module tailored to their maintenance activities. Data was input by NJDOT staff for maintenance projects focused on crack sealing, manual patching, and the use of the Pothole Killer.

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A final report is available online at: http://www.state.nj.us/transportation/refdata/research/. If you would like a copy of the full report, send an e-mail to: Research.Bureau@dot.state.nj.us.

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