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A Study and assessment of Carbon Footprint of Construction Industry and Current Methods of Estimation for Carbon Emission

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Abstract - We know that Climate change is a global concern now among all the countries. The effect can be seen all over the globe through rise in the earth temperature year by year and man's anthropogenic activities is a major contributor. Most of countries has agreed on target for Net Zero Emission by 2050. The Construction field is one of the areas that contribute most to the emission of Green House Gases (GHGs). Consequently, it is almost a protagonist in our heavy carbon footprints. This issue is related to the emission of polluting gases that accelerate global warming through burning of fossil fuel for generation of energy for various human activities. This means that Construction has a potential to contribute minimizing this damage. In this report we will explore the concept of Carbon footprint, what it is, why several countries are committed to reduce it, how to calculate it, what are the ways construction can collaborate with it.

The Carbon assessment is done to find an empirical method to estimate the Carbon Dioxide (CO2) emission based on four selected projects of highway construction. By dividing the construction period into three stages: material production stage, material transportation and onsite construction. The results show that the major Carbon emission was generated from the material production, secondly from onsite construction, and transportation stage accounted for the least. Also, finding the ways to minimize carbon impact through selection of alternate material types and general awareness in the industry.

We will be discussing on the methods, tools and techniques currently available in the industry and future scope of improvements.

Key Words: Footprint, Net Zero, global warming, GHGs

1.INTRODUCTION

The increasing concentration of greenhouse gases is a serious threat to the earth. The emission of greenhouse gases can be made directly resulting from burning fossil fuels or indirectly from activities associated with an organization, product or person. The impacts on the environment can be measured by calculating the carbon footprint. Climate change policies are focused on reducing direct emissions, but there is a large untapped potential to reduce indirect emissions. The Transportation and Infrastructure, as a sector in energy and sustainability, had not even an accounting of carbon footprint. The objective of this study is to quantify the Highways carbon footprint using a hybrid model of process analysis and input-output. In the last part of the thesis carbon footprint reductions are suggested.

2. Body of Paper

In most cases carbon footprint is used as a generic substitute for emissions of carbon dioxide or greenhouse gases expressed in tons of CO2 equivalents instead of CO2 in particular and is evaluated for the time period of a year. The exact origin of the expression is unknown, but it is reasonable to assume that it was derived from the Ecological Footprint concept formulated in the 1990s. Carbon footprint 'has become a synonym for the impact of climate change in individuals, communities, nations, companies, or products. Carbon footprints have been calculated for countries and sub-national regions, institutions such as schools, products, businesses and investment funds. Examples of possible emission sources are transport, electricity, paper, manufactured products, food, drink, health and hygiene products. For the context of this thesis carbon footprint is defined as a measure of the exclusive total amount of greenhouse gas emissions that is directly and indirectly caused by an activity or is accrued over the life stages of a product.

Usually, carbon emissions are calculated at a national level, often using methodologies and default values suggested by the Intergovernmental Panel on Climate Change (IPCC). These national estimates comprise sectoral estimations, which are based on detailed sectoral analysis. A few nations have carried out carbon inventories for the road sector to evaluate its contribution to total transport sector generated GHG emissions. New Zealand's Ministry of Transport has commenced modeling to understand the factors that control road transport's contribution to CO2 emissions and the potential impacts of proposed mitigation actions at the national, sector level. New Zealand developed a Vehicle Fleet Fuel Model to measure likely increases in CO2 emissions in the absence of policy interventions and with possible policy interventions compared with requirements under the Kyoto Protocol. To envisage CO2 emissions, the model uses variables such as expected population growth, future levels of economic development, and the changing composition of the vehicle fleet.

Many carbon footprint calculations are based on household or individual consumption behavior with a view to influencing changes in comportment toward a more energy-efficient lifestyle. Typically, these footprint calculators merely require the user to input the make and model of

their car and an estimate of the kilometers traveled over a month or year. More detailed estimates are based on fuel efficiency of the vehicle and differences based on driving behavior (DEFRA 2007). Other factors recognized, but normally not included in the calculators, are vehicle payload,

travel racks or other accessories that increase aerodynamic drag, poor maintenance, incorrect tire pressure, terrain factors, weather, or aggressive driving styles and heavy braking. The state of the roads is not a factor in any of the calculators studied.

The International Road Federation (IRF) states that improving traffic fluidity, reducing congestion, and hence lowering fuel consumption is an effective way of reducing GHG emissions. Specific measures and their potential to reduce GHG emissions include (i) enlarging the road network (40%), (ii) replacing crossroads with bridges (30%), (iii) building bypasses (25%), (iv) eliminating level crossings (13.5%), (v) pre-selection at traffic lights (15%), flow management (30%), (vi) traffic (vii) synchronized traffic lights (40%), (viii) traffic jam reduction (22%), (ix) management of urban traffic (40%), (x) management of ex-urban traffic (30%), and (xi) management of traffic on motorways (20%) (IRF undated).he body of the paper consists of numbered sections that present the main findings. These sections should be organized to best present the material.

2.1 PURPOSE

Purpose of this study is to estimate the carbon footprint of Highways construction and improvement projects, operation and maintenance phases.

2.2 MOTIVATION

Global warming and climate change is a burning topic nowadays and construction industry is significantly responsible towards it. The reduction of carbon emission is based on the calculation of carbon footprints and this calculation is directly link to the project estimation process. Being a Quantity Surveyor, it has always been attracting me and motivating me to work into this area.

2.3 NECESSITY OF THE PROJECT

As Climate change is a very hot topic among countries and the awareness is very less among the people on this subject. It was a great opportunity to work in this area to explore how Construction industry is contributing and investing to minimize carbon footprint, what new tools and techniques are being adopted and how a Quantity Surveyor can add this area into their role to contribute into a greener planet and environment.

2.4 METHODOLOGY

Case studies were undertaken on some Highways construction and improvement Projects. Using various tools in the industry and with help of benchmarking using internal database the data was evaluated and it was found that though there were significant emissions from the highways construction projects. This study also assesses various estimating tool available in the Construction industry and the management techniques of carbon emissions in the highways construction industry by measuring the amount of carbon being emitted from Highways Projects. Also, the aim of this analysis is to demonstrate the research on Carbon Emission due to Construction, its types, Carbon Footprint calculations, Tools available and effective ways by using alternate material type to reduce or minimize the footprints. There are various phases in construction which are evaluated to assess carbon emission.

2.5 RESULT ANALYSIS

The results of the carbon footprint stimations for the sample projects indicated that the emissions from the construction and maintenance phases are relatively insignificant when compared with emissions from vehicular movement on roads for its total life. The future work on carbon footprint estimations for ADB road projects, therefore, may focus on documentation for the operation phase only and avoid the extensive data collection needed for construction and maintenance activities. An allowance of additional emissions of about 5% may be added to operation phase emissions to acknowledge the construction and maintenance phase contributions to the carbon footprint of the road project. This does not mean, however, that efforts to reduce GHG emissions from these phases should be ignored or abandoned.

3. CONCLUSIONS

The data and information required for the carbon footprint analysis were comprehensive, especially for the construction and maintenance stages of the road projects. Manual data collection from four project sites located in different parts of the country required a lot of efforts on the part of the team members and in this case a central database helps a lot.
Since Initial data collected from project sites are vital for the analysis, it was important that local authorities and contractors responsible for road construction projects understand the data needs as envisaged in the framework and assessment. Maintaining a database is very important.
The carbon footprint study is based on life cycle assessment of carbon impacts of road projects. Conversion factors for materials to estimate carbon emissions specifically embodied carbon values and emission factors are important for accurate calculations. These values and data are usually not readily available. Much research work needs to be done to select appropriate and context definite values.

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ABBREVIATION

LCA – Life Cycle Assessment

EPD – Environmental Product Declarations

GCB – Green Construction Board

GHG – Green House Gas