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A Study about Advanced Waste Management

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Abstract

More production equals more waste, more waste creates environmental concerns of toxic threat. An economical viable solution to this problem should include utilization of waste materials for new products which in turn minimize the heavy burden on the nation's landfills. Recycling of waste construction materials saves natural resources, saves energy, reduces solid waste, reduces air and water pollutants and reduces greenhouse gases. The construction industry can start being aware of and take advantage of the benefits of using waste and recycled materials. Studies have investigated the use of acceptable waste, recycled and reusable materials and methods. The use of swine manure, animal fat, silica fume, roofing shingles, empty palm fruit bunch, citrus peels, cement kiln dust, fly ash, foundry sand, slag, glass, plastic, carpet, tire scraps, asphalt pavement and concrete aggregate in construction is becoming increasingly popular due to the shortage and increasing cost of raw materials. In this study a questionnaire survey targeting experts from construction industry was conducted in order to investigate the current practices of the uses of waste and recycled materials in the construction industry.

Key Words: shortage, recycle, materials

Introduction

Several issues exist regarding reducing waste. A key environmental issue is waste incinerators, furnaces for burning trash, garbage and ashes. These incinerators produce 210 different dioxin compounds plus mercury, cadmium, nitrous oxide, hydrogen chloride, sulfuric acid and fluorides. Produced also in incinerators is particulate matter that is small enough to remain permanently in the lungs. Additionally, waste.

Incinerators generate more CO2 emissions than coal, oil, or natural gas-fueled power plants. For years, scientists and researchers have been searching for possible solutions to environmental concerns of waste production and pollution. Many have found that replacing raw materials with recycled materials reduces our dependency on raw materials in the construction industry.

Objectives

- Economic - Improving economic efficiency through the means of resource use, treatment and disposal and creating markets for recycles can lead to efficient practices in the production and consumption of products and materials resulting in valuable materials being recovered for reuse and the potential for new jobs and new business opportunities.
- Social - By reducing adverse impacts on health by proper waste management practices, the resulting consequences are more appealing settlements. Better social advantages can lead to new sources of employment and potentially lifting communities out of poverty especially in some of the developing poorer countries and cities.
- Environmental - Reducing or eliminating adverse impacts on the environmental through reducing, reusing and recycling, and minimizing resource extraction can provide improved air and water quality and help in the reduction of greenhouse gas emissions.
- Inter-generational Equity - Following effective waste management practices can provide subsequent.

Materials and Methods

1 Tire Rubber

An estimated number of one billion scrap tires have been disposed of in huge piles across the United States. An additional 250 million tires unaccounted for are discarded yearly (RMA, 2011). Whole tires have been used in artificial reefs, break waters, dock bumpers, soil erosion control mats and play ground equipment. Several studies have shown that tire waste can

be successfully used in concrete, grass turf, asphalt mix, embankments, stone cladding, flowable fill and clay composite.

2 Reclaimed Asphalt Pavement

The transportation sector has used Reclaimed Asphalt Pavement (RAP) for many years. In 2009, the amount of RAP used in asphalt pavements was 56.0 million tons and in 2010, 62.1 million tons. RAP is America's most recycled and reused material; currently, RAP is being recycled and reused at a rate over 99%. RAP is used to backfill pavement edges, rework base and base course. According to the World Business Council for Sustainable Development, manufactures around the world produce more than 25 billion tons of concrete yearly.

3 Recycled Concrete Aggregate

The Federal Highway Administration (FHWA) projected an increase in aggregates to over 2.5 billion tons per year. Crushed aggregate has been used as base course or granular base in highway construction. Its primary function is to increase the load capacity of then pavement and to distribute the applied load to avoid damage to the sub grade.

4 Roofing Shingles

Each year, the U.S. generates approximately 11 million tons of asphalt roofing shingle scrap (Cal Recycle, 2006). Use of recycled asphalt shingles (both manufacturer's waste and tear-offs) increased from 702,000 tons to 1.10 million tons from 2009 to 2010, which represents a 57% increase. Assuming conservative asphalt content of 20% for shingles, this represents 234,000 tons (1.5 million barrels) of asphalt binder conserved. Roofing shingles are made from a fiberglass or organic backing, asphalt cement, sand-like aggregate and mineral fillers such as limestone dolomite and silica. Beneficial applications include, but not limited, to Hot Mix Asphalt (HMA), cold patch mix asphalt, aggregate substitute, base course, mineral filler and granular base stabilizer. Benefits of using roofing shingles include Lower disposal costs for shingle scrap manufactures, reduced cost in the production of HMA, improved the rutting

resistance of the mixtures considerably, due to a combination of the fibers and harder asphalt and improved resistance to pavement cracking.

5 Glass

Americans generated 11.5 million tons of glass in the Municipal Solid Waste (MSW) stream in 2010. Glass is composed of silica or sand and contains some amounts of limestone and soda ash used to produce uniform quality and color. According to the Association of Cities and Regions for Recycling (ACRR), people around the world send 1.5 million tons of glass to landfills each year. Glass that ends up in the landfill won't break down for over a million years. Glass cullet creates workability problems in concrete mix and the likely hood of alkali-silica reaction. Beneficial uses are in the secondary applications, such as in the manufacture of fiberglass insulation, roadbed aggregate, driving safety reflective beads and decorative tile.

6 Plastic

In 2010, plastic waste generated approximately 31 million tons, representing 12.4% of total Municipal Solid Waste. Uses of recycled plastic in the construction industry include plastic strips to add to soil embankments, which has positive results of increasing the measured strength in reinforcement of soils. HMA mixture has a higher stability, reduced pavement deformation; increase fatigue resistance and provide better adhesion between the asphalt and the aggregate (Awwad and Shbeeb, 2007). Grinded polyethylene to provide better coating or attached easily to the aggregate as the surface area of the polymer increases.

Results

The survey was compiled of 65 participants from 50 companies. The companies surveyed consisted of contractors, engineers, architects and suppliers of concrete, asphalt, landfills, scrap yards, steel manufactures, drilling, demolition and recycling companies. From this sample of companies, the most common recycled material was Recycled Concrete at 15%; followed by Recycled Asphalt and Wood, with 12 and 8% respectively. Seven percent of the companies did not use recycled material at all. There were a few companies that were not included in the graph.

These companies used less than 2% of any given recycled material including tire rubber, silica fume, glass, cement kiln dust, carpet, foundry sand, swine manure, animal fat, soy bean, citrus peels, sewage sludge and date and oil palm tree, which were listed in the survey as usable

Conclusion

` Review of several studies suggested that the use of recycled materials has positive impact through different aspects. This include the benefits in enhancing sustainability of the construction industry while reducing cost, providing solutions to environmental pollution and reducing the need for natural resources. In this study, a questionnaire survey was conducted to find out the current practices in using waste and recycled materials in the construction industry. Results indicated that some companies were not aware of the availability, quality of the materials' performance, cost savings, or any other benefits including environmental benefits. It is, thus recommended to create better documentation for green infrastructure, connecting researches and industry with an overview of what recycled materials are available for different construction applications. Companies need to be innovative in their use of recycled materials and reduce their dependency on raw materials. Also, more data and better documentations are needed to encourage the use of waste and recycled materials in the construction industry.

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