

ACBA5009 – WORK BASED PROJECT

LEARNING CONTRACT

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1. PROPOSED RESEARCH TITLE

Is plastic waste in road construction sustainable in the construction industry?

2. ABSTRACT

With the current issues on climate change and sustainability in the world today, mainly focusing on the construction industry, this research sets out to determine if using plastic in construction is sustainable and the way forward for the future of construction.



Image 1 Recycling waste plastic for use in infrastructure like roads. (Science Direct, 2021)

3. RESEARCH CONTEXT

The world produces 381 million tonnes of plastic waste yearly, this is also predicted to double by 2034 and half of this is single use plastic, only 9% of that has ever been recycled. (Condor Ferries, 2022)

With an ever changing and growing world, and a huge housing shortage along with population growth the need for housing arises with new and old infrastructure required as well as repairing old roads and paving. The norm is building, creating, and developing with natural resources and other materials that produce some sort of carbon footprint such as concrete, wood, and steel. The question arises as to why not reuse plastic waste that has already been produced? (TRVST, 2022)

When talking about sustainability and avoiding the depletion of our natural resources, it only makes sense to try and use a product in construction that will have a low carbon footprint and last for the entire life cycle of the product or building by recycling or reusing.

There has been many debates and research on the use of plastic waste in building materials from using a plastic bottle as a brick, adding plastic waste into concrete production as well as constructing infrastructure like roads from plastic waste.

A recent article in an online magazine that offers opinion, analysis, reporting and debate on global environmental issues, stated that, paving with plastic could make a dent in the global waste problems we face. (Parson, 2021)

The idea of using plastic in road construction is a fairly new research area and topic, there have however been various examples of plastic being used in road construction around the world, some countries that have already put this case study into practice are the UK, Netherlands, Ghana, Ethiopia and South Africa. (Government, United Kingdom, 2019)

4. *AIMs & OBJECTIVES*

- The purpose of this research is to discover and understand if plastic or plastic waste can be used in the construction of roads?

The research will answer the following questions by looking at cases and studies to determine whether using plastic waste in road construction is viable.

- Whether using plastic waste is sustainable and viable in the construction industry and different methods of adding plastic waste to roads?
- Would these roads performance levels stand up to traditional roads?
- Would using plastic in road construction reduce the plastic waste problems we currently face?

5. *LITERATURE REVIEW*

5.1 UK Government – Use of Waste Plastics in Road Construction, a helpdesk report conducted in 2019 for the United Kingdom government by the University of Birmingham, investigated the use of waste plastic in construction of roads what the latest innovations and the possible future of and maintenance. The idea is a new idea and there are still many tests and studies taking place, laboratory test however showed that 5 – 10% by weight of plastic used in bitumen asphalt mixes produced higher stability, strength, and durability. The limitations of the study are the fact the roads developed using these methods are approximately 10 years old, long-term results cannot be determined. (Sasidharan, et al., 2019)

5.2 BBC – Could Plastic Roads Make for a Smoother ride? India has been a leader in the world constructing roads out of plastic-tar since the early 2000's.

Using plastic in road construction, helps prevent the plastic waste landing up in the oceans, and landfills, early data has shown that using plastic in road construction also increases the life expectancy of the average road. Plastic roads seem to deteriorate slower and have less potholes.

The process is not complicated and doesn't require the use of high-tech equipment. Using plastic in roads also saves tonnes of carbon dioxide by incineration. (Lee, 2021)

5.3 TRVST – Plastic Waste in Road Construction for Sustainable Plastic Paving,

some advantages of using plastic waste in road construction would be the reduction in plastic waste. Plastic is extremely durable; it takes hundreds of years for plastic to break down. Using plastic waste would in turn lead to a reduction on our natural resources, the main advantage with plastic is once we have made it, it can be reused there is no need to use the resources again. Plastic in roads and paving can assist in the prevention of flooding, plastic paving and roads can remove rainwater, by using hidden channels and direct it to run off areas. (TRVST, 2022)

5.4 ScienceDirect – Recycling Waste Plastics in Roads: A life-cycle assessment study using primary data

There are currently two processes of using waste plastic in road construction, either the plastic has been recycled and pellets formed, and it is then added as an additive this is called the wet method, or the dry method of plastic recycling for roads is where it is used as a replacement for natural aggregate.

Recent case studies in Australia have been carried out with the results showing that using recycled plastics as a polymer for bitumen as a synthetic aggregate in asphalt can be very advantageous to the environment compared to natural aggregates used. (Science Direct, 2021)

5.4 ScienceDirect – Pyrolysis of Polyolefin plastic waste and potential applications in asphalt road construction: A Technical Review

Plastic is petroleum-based material, that is non-biodegradable and is in high demand, this has led to a depletion of non-renewable fossil fuels, therefore plastic is not sustainable, and the recycling of plastic is still at a very low rate.

Pyrolysis could become the strategy used for recycling plastics to products that can be matched with other applications throughout different industries.

However, there are limitations in using these plastic waste materials from an environmental and technical perspective.

Design from Recycling, exams the concept of different application routes for plastic waste. (Science Direct, 2022)

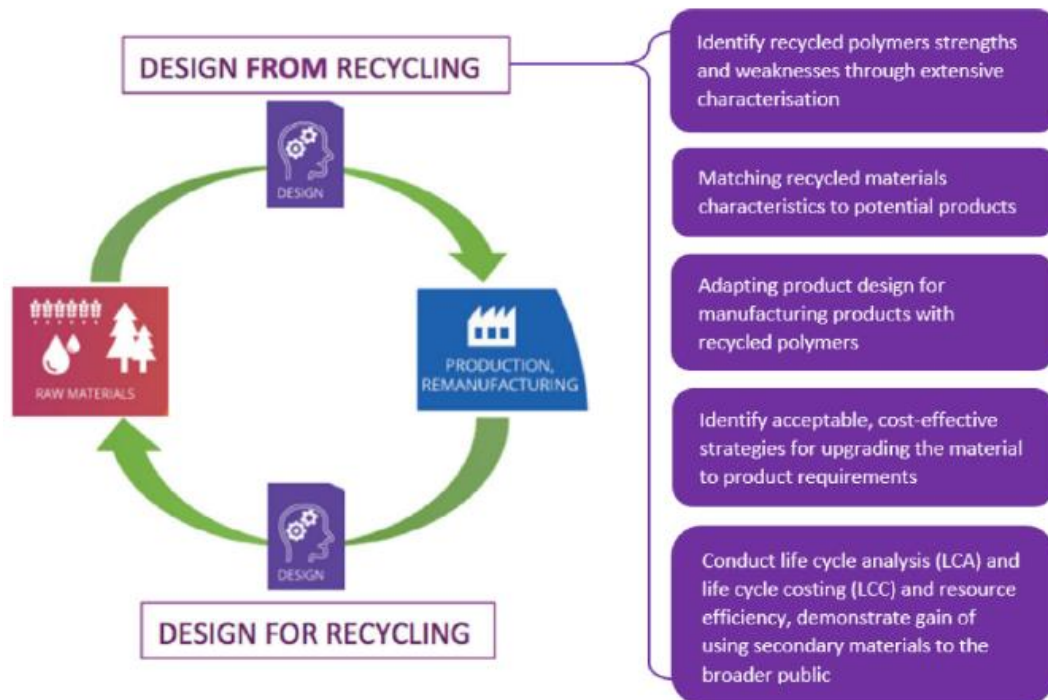


Fig. 1. Design from recycling concept key aspects, adapted from (Ragaert et al., 2017).

6. RESEARCH METHODS

Most of the research will be done online, with various scientific journals and studies conducted within the UK as well as other countries, who have done research and have constructed roads using recycled plastic methods.

7. SIGNIFICANCE

The significance of this research is the fact, we need to ensure in a constantly growing world, construction and other industries become more sustainable for the future, it makes sense to use a product that is not biodegradable and is landing up in landfills and oceans while very little is being recycled would be the way forward. We need to look after our natural resources, and fossil fuels.

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