

Coursework 1

Research Proposal

Student Number: 1808474

Submitted in part fulfilment for the requirements of the module ‘Work Based Project’ (ACBA 5009) for the completion of a HND In Civil Engineering at UWTSD.

1. Provisional Title of Project:

“Evaluating the use and outlining the development of Stone Mastic Asphalts (SMA) in road construction and how problems with early-life skid resistance can be achieved”

2. Overview - What is the work going to be about?

This research project will investigate the usage and progression of SMA's in road construction since their inception, their development over time, associated advantages, disadvantages of SMAs and an in depth look at problems with early life skid resistance and how it can be achieved through modern techniques.

SMA's originated in Germany in the late 1960's (Hainin¹, Reshi and Niroumand, 2012) and have been adopted and developed in a variety of other major European countries including Wales, and has since become one, if not the most popular types of pavements materials to install. Michaut, (1995) describes SMA as “A gap graded asphalt concrete composed of a skeleton of crushed aggregates bound with a mastic mortar.” They are known for being very durable (deformation resistant), have excellent performance, however, there is a shortfall in early life skid resistance, typically in the first 2 years of installation. Designers throughout Europe, including the Welsh Government are looking at new ways of developing SMA's to help achieve skid-resistance in it's early to mid life cycle.

3. Aims and Objectives, Hypotheses to be tested, questions to answer, etc.:

The hypotheses for this research project are “Can early life skid resistance in SMA's be achieved in modern developments and techniques?” and “Are modern SMA's improving?”

The aim would be through secondary and primary research to prove whether skid resistance can be improved through modern techniques in Wales and to prove if modern SMA's are improving in development.

The objectives will be:

- To research from literature how SMA's have developed since their inception, associated advantages, disadvantages, and modern improvements in preventing early life skid resistance
- Demonstrate how modern technologies have reduced or eliminated early life skid resistance problems are being reduced in Europe and Wales.

4. Research Methodology(ies) and Justification:

This research project will explore industry standards, practices and theories regarding SMA's their development for use in Wales by critically analysing and interpreting data from a wide variety of information via journals, books, government documentation as secondary data. Through this we can directly target our research and tailor it towards what we are looking to achieve in our objectives.

Also, by using primary research from leaders in the industry in the form of contractors, WG designers and using my own personal experience will help provide a real representation of which stage SMA mixes are at and where they are headed.

All research will be represented accurately through graphs, tables both quantitatively and qualitatively to effectively develop and understanding of the topic. All data will help form an analysis for discussion in an un-biased manor for gaps in research, where clarity or more information might be required and where SMA's currently stand as a leading pavement material.

5. Chapters:

Chapter 1 Abstract

Chapter 2 Introduction

- Overview
- Aims
- Objectives
- Hypotheses

Chapter 3 Literature Review

3.1 - The inception and development of SMA's

Stone Mastic Asphalts (SMA) took popularity from Germany, as a durable and rut resistant product for surface courses and following a 'German Standard Specification' recognition of high performance led to variants and design mixes of SMA's being widely installed in a lot of European countries including Wales.

3.2 - Differences between SMA's and conventional surfacing mixes

A comparison between SMA's, Open Graded Asphalts (OGA), Dense Graded Asphalt (DGA), HRA's etc.

3.3 Road Surfacing Characteristics

Looking to achieve - Micro/Macro textures, Noise, wheel tracking, skid resistance, cracking resistance, ride quality, spray control.

SMA's provide - Stability at high temps, flexibility at lower temps, rut resistance, reduced water spray, low noise

3.4 - Current methodologies and composition of SMA's

Typical SMA compositions 70-80% coarse aggregate, 6-7% binder, 8-12% filler and 0.3% fibres, higher % of coarse aggregates provide more contact between stones allowing for better rut resistance and durability. Polymer modified binders & developments in SMA's

3.5 - Advantages of SMA's

Stability at high temps, flexibility at lower temps, rut resistance, reduced water spray, low noise, Life cycle pavement life 20-30% increase, dense aggregate, strength, and stiffness, wide usage, reduce lower layer issues reflecting through, recyclable

3.6 - Disadvantages of SMA's

Increased cost, potholing, mixing at high temps, premature rutting if laid incorrectly, striping below asphalt (Austroads, 1998), fines filling textures, logistic issues opening road due to temperatures, initial skid resistance.

3.7 - Skid Resistance

Factors affecting skid resistance, early life skid resistance in SMA's and associated issues,

3.8 - Welsh Gov SMA's (Application of SMA's in Wales)

PAG 112/20 (Welsh Government Procedure & Advice Guidance (PAG) 112/20), New surface specification for SMA's based on both German and Scottish practices, but treated with grit to increase overall skidding resistance

Chapter 4 Methodology

4.1 Mixes, manufacture, laying & compaction (TAIT trials for approval in Wales)

4.2 Lab and site measurements (Binder content etc.)

Chapter 5 Discussion

Chapter 6 Conclusion

- Critically evaluate and restate hypotheses, summarizing key ideas and the work that has been researched and how it formulates around the questions, aims and objectives.

6. Consent / Access / Ethics (Personal experience, industry representatives, contractors etc.)

The project will ensure a high level of data protection, for all data that is gathered from industry representatives and is to be secured in a protected document in line with the data protection act (Data Protection Act, 2018).

Any data that is gathered from external sources/people(s), no business names/companies or personal names shall be used thus to protect a particular organization and ensure privacy.

Prior to undertaking any research consent will be given from the representing authority who is being interviewed for research.

7. Timetable of Work

Work shall be submitted on time as part of a reflective journal, that will be due by 3 May 2022 and interim submissions to keep track of reflection and progress throughout the months prior to full submission these include 1st February 1st March, 29th March, 19th April.

References

Austroads (1993), APRG Technical Note 2, Australian Road Research Board, August 1993, Vermont South, Victoria, Australia

Data Protection Act 2018,. Available at:

<https://www.legislation.gov.uk/ukpga/2018/12/contents/enacted>

Hainin1, R., Reshi, W. and Niroumand, H., 2012. The Importance of Stone Mastic Asphalt in Construction. *EJGE*, 17.

Welsh Government Procedure & Advice Guidance (PAG) 112/20,. Available at:

<https://gov.wales/procedure-and-advice-guidance-pag-112-20-stone-mastic-asphalt-specification>