Welcome

Presented by:
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Monitoring and Evaluation Section

MSc in Urban and Regional Development

- Financed by:

"***LGED's Human Resources Development and Capacity Building Project***"

- Course duration: 23.09.2019 – 21.09.2020

Course overview:

- To develop knowledge and understanding about the nature and source of economic change and recognise its uneven impact on different social groups, communities and countries.
- Provide key skills required to shape local and regional development through policy and practice innovation.
- Provide critical skills to address the practical challenge of designing strategies to make cities and regions more innovative and resilient places for living and working.

Course structure:

This is a full-time MSc programme over one year (3 semesters) and comprised of modules totalling 180 credits.

It is divided into two parts:

- **Part one:** a teaching programme over two semesters.

  - Three modules (60 credits) per semester

- **Part two:** Dissertation (60 credits).

Programme details:

- Urban and Regional Dynamics
- Governing Urban and Regional Economies
- Planning City Futures
- Urban and Regional Development in Practice
- Housing in a Globalising World
- Research Methods
- Dissertation

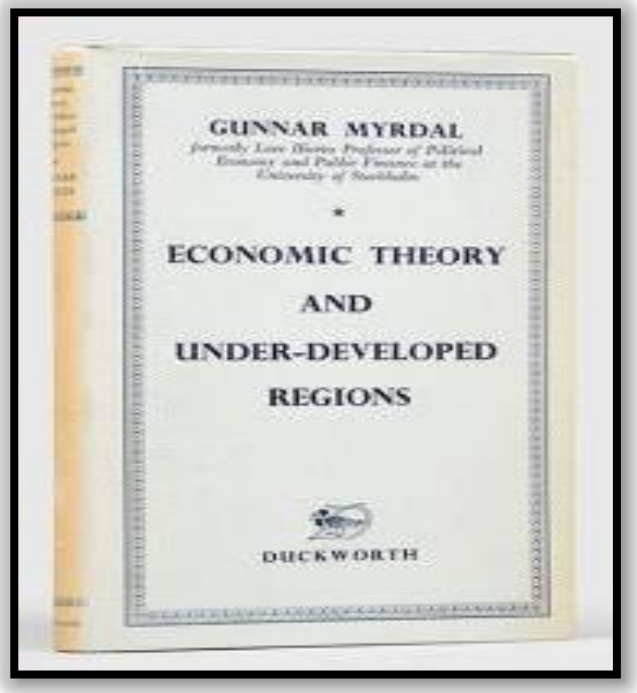
Dr. Crispian Fuller

Dr. Kevin Morgan

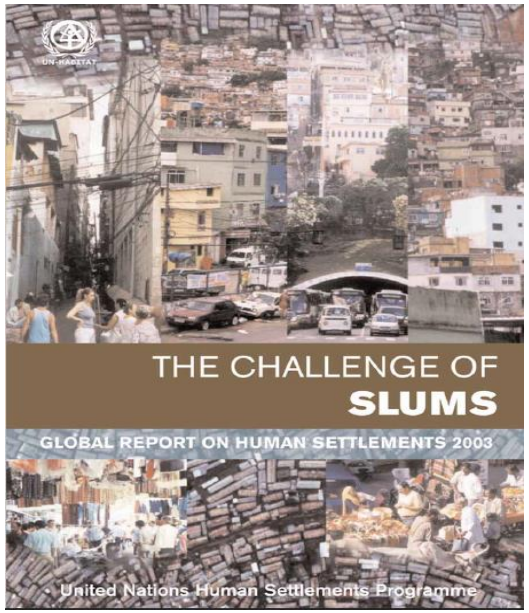
CPT888 : Urban and Regional Dynamics

Module outlines:

- Explore the key concepts, thinkers and theories of uneven spatial development.
- Examine why cities and regions grow and decline and what can be done to reverse economic decline
- Examine the strategies to assess why some places are more dynamic and more innovative than others.



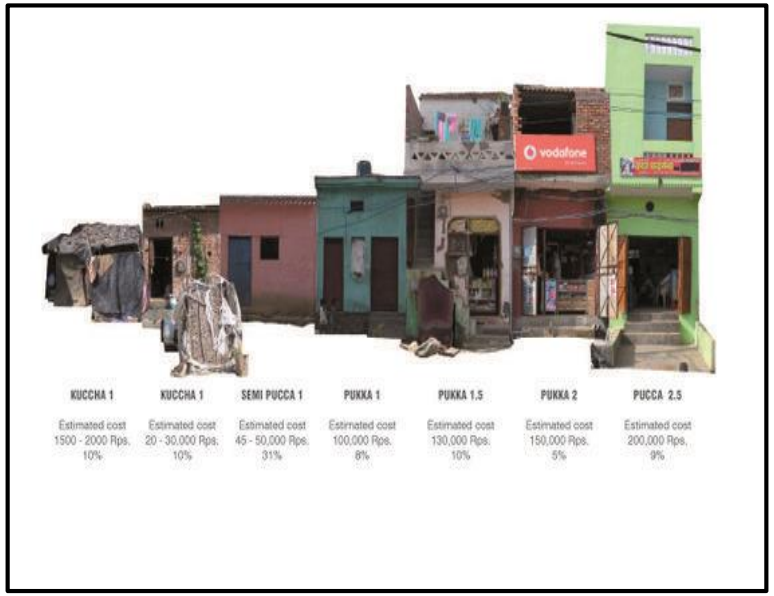
Dr. Alison Brown

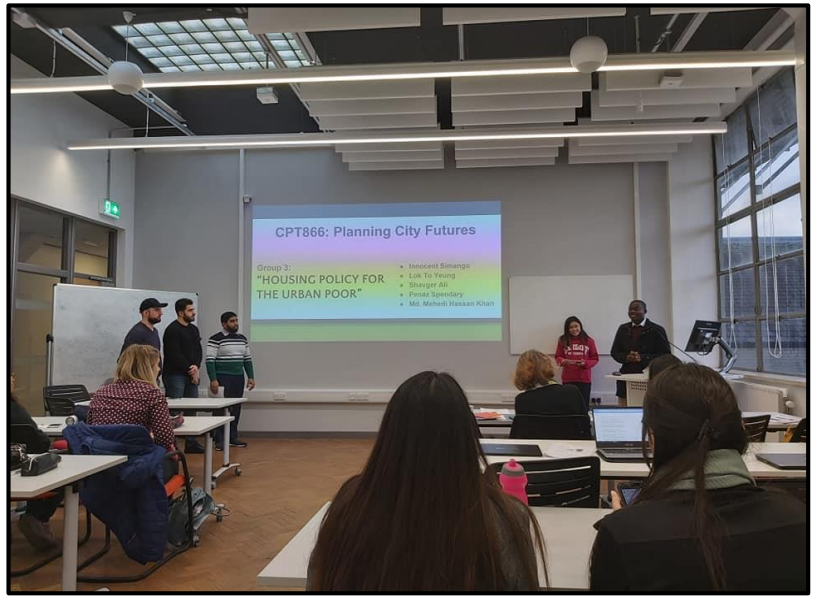


CPT866 : Planning City Futures

Module outlines:

- This module introduces the theoretical debates surrounding issues of globalization, governance and environment in different political, cultural and socio-economic urban contexts.
- The module includes conference-style teaching on low-income housing policy.
- Explore the ways in managing change in the future cities





Dr. Peter Mackie

CANADA

CPT871 : Housing in a Globalising World

Module outlines:

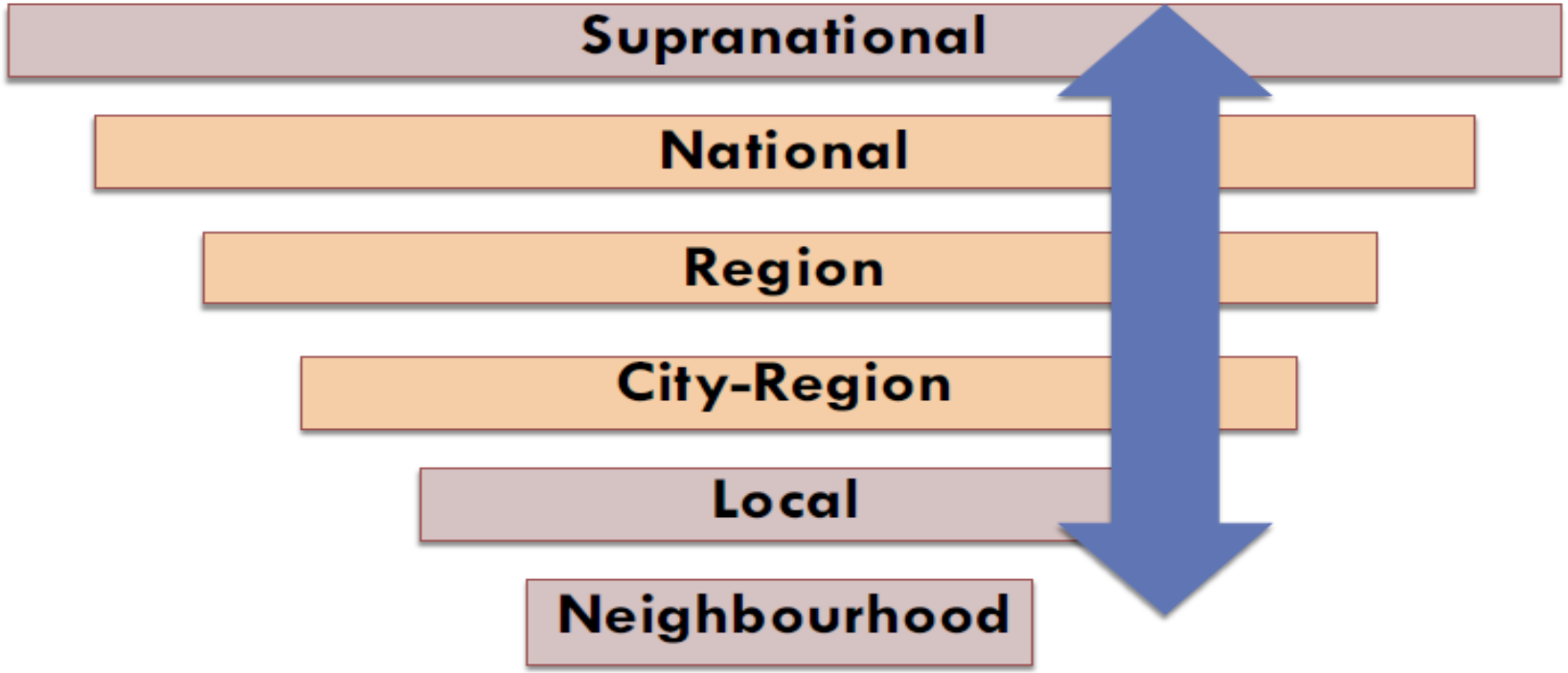
- This module critically examines housing systems, challenges and policies across the globe.
- The module challenges students to think critically about housing policies and to draw upon experiences across the globe to develop a better and more socially just solutions.

Dr. Brian Webb

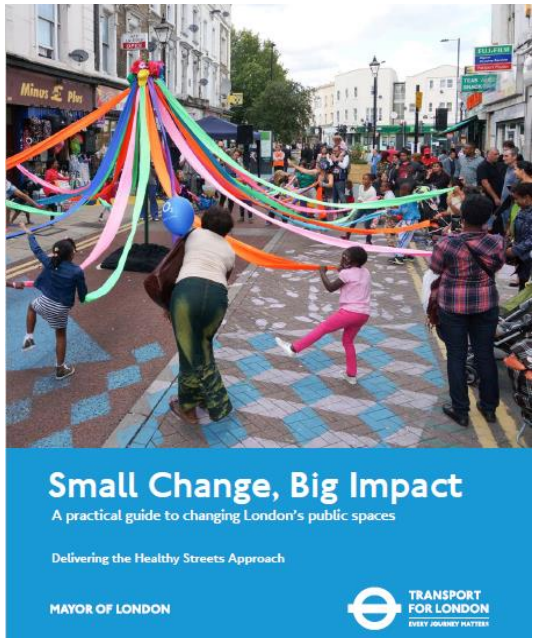
CPT922 : Governing Urban and Regional Economies

Module outlines:

- This module addresses the complexities of policy-making processes in the context of multi-level, co-governance arrangements.
- Running through the module is the systemic tension between a number of competing, equally important public policy goals, namely subsidiarity (devolved democracy) and solidarity (social equality); competition and collaboration.



Dr. Maxwell Hartt



CPT892 : Urban and Regional Development in Practice

Module outlines:

- The module focused on understanding the nature, role and merits of different policy and practice interventions around the built environment and local economic development.
- It combined insights from academic theory and practice-based perspectives on contemporary regeneration strategies, projects and economic development policies and initiatives drawn from both the UK and international experience.

Dr. Adrian Gonzalez

CPT926 : Research Methods

Module outlines:

The module is organised in two parts:

- **Part A** provides a generic introduction to, and an overview of, social science research methods with an emphasis on planning, geography and urban studies.
- **Part B** provides skills and contexts in subject-specific epistemological paradigms, methodologies and methods. The module is specifically designed to assist students in designing an effective MSc-level dissertation.

Dr. Kevin Morgan

CPT508 : Dissertation

Module outlines:

The dissertation provides a student with the opportunity to independently pursue in greater depth of a chosen subject or topic in the field. It provides the means for developing and expressing students' research and analytical abilities.

A circular economy experiment in Bangladesh: how can the circular use of waste PET bottles benefit a developing country

Circular economy:

The circular economy (CE) is- a new way to design, make, and use things within planetary boundaries. It is defined as,

“an economic system based on business models which replace the ‘end-of-life’ concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes … with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations” (Kirchherr et. al. 2017, p. 225).

Research question:

"How can the circular use of waste PET bottles benefit a developing country like Bangladesh?"

Research objectives:

- To check the influence of PET bottle granules on the properties of concrete.
- To examine the benefits of reusing PET bottles in waste reduction and pollution control.
- To determine the position of reused PET bottles in ensuring sustainability.
- To evaluate the contribution of waste PET bottles on the economic development.
- To determine the role of public and private sectors to implement circular economy of plastic.

Research plan:

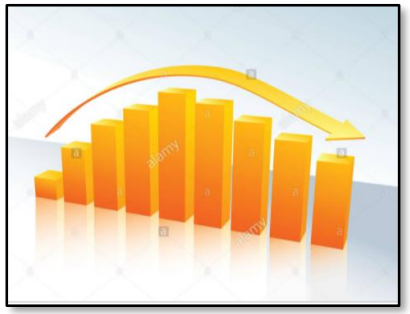
In this research, an attempt was taken to develop the circular use of waste PET bottles as construction materials, where the natural fine aggregates was partially replaced by the plastic aggregates.

- First, the properties of the modified concrete was checked through a physical experiment in the laboratory. Two types of plastic aggregate (FM 2.18 & 2.80) were used for this experiment.

- Then, a series of structured interviews were taken with participants from the government officials, academician, and entrepreneurs to further demonstrate the potential of the CE concept in the context of a developing country like Bangladesh.

Now, the research question will be discussed by summarising the key findings-

How can the circular use of waste PET bottles benefit a developing country like Bangladesh?



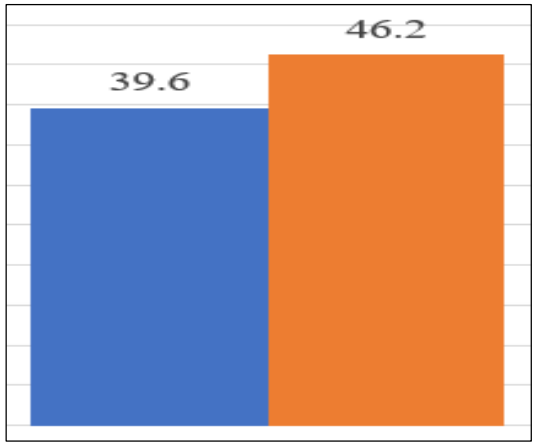
The circular use of PET bottles in concrete increased the strength (compressive strength) of the modified concrete.

- The strength reached at maximum value with 3% replacement of natural fine aggregates with the plastic aggregates and then started decreasing with further addition.

The workability of the modified concrete was increased.

The density was decreased with the addition of plastic aggregates.

How can the circular use of waste PET bottles benefit a developing country like Bangladesh?



Strength of the modified concrete was highest at 3% replacement, and at this replacement **the strength of the modified concrete was 16.6% higher than the control mix.**

The increase of strength will ensure economy and resilience in construction (Chavan and Rao, 2016), at the same time reduced density will help to design earthquake resistant structures (Abdel-Azim, 1996).

How can the circular use of waste PET bottles benefit a developing country like Bangladesh?

The use of plastic aggregates in concrete production will reduce the amount of waste and it will save the environment by reducing pollution from plastic.

Let's see a simple calculation:

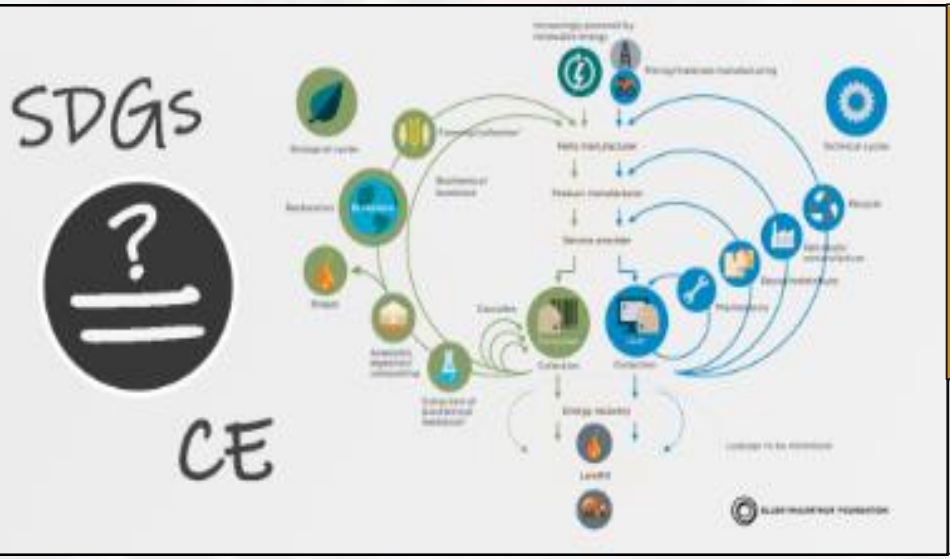
- Annual consumption of cement in BD (in 2017): 27.10 million ton (MT);
- Expected growth rate: 8 to 10% per year (The Daily Star, 27 May 2018).
- Present consumption (in 2020) of cement: 36.07 MT.
- Consumption of fine aggregates per year: 72.14 MT.
- Present demand of plastic aggregates: 2.16 MT.
- But, generation of plastic wastes in BD: 0.8 MT per year (Rahman, 2020).

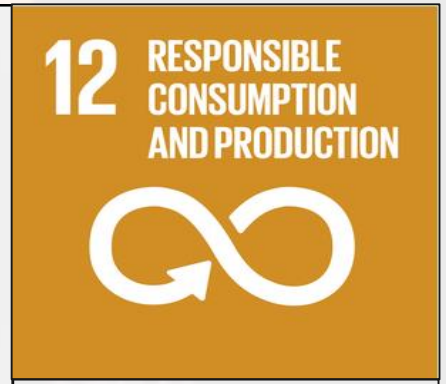
How can the circular use of waste PET bottles benefit a developing country like Bangladesh?

The circular use of plastic bottles (granules) ensure sustainability in construction and environment.

According to the World Commission on Environment and Development definition, sustainable development is the *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (WCED, 1987).*

This also helps to achieve sustainable development goals.





"To ensure sustainable consumption and production patterns"

"CE practices can be applied as a 'toolbox' and specific implementation approaches for achieving a sizeable number of SDG targets (21 out of 169 targets can be directly achieved from CE practices)" (Schroeder et. al. 2018, p. 77).

How can the circular use of waste PET bottles benefit a developing country like Bangladesh?

Circular use of PET bottles in concrete can contribute to the economic development of Bangladesh.

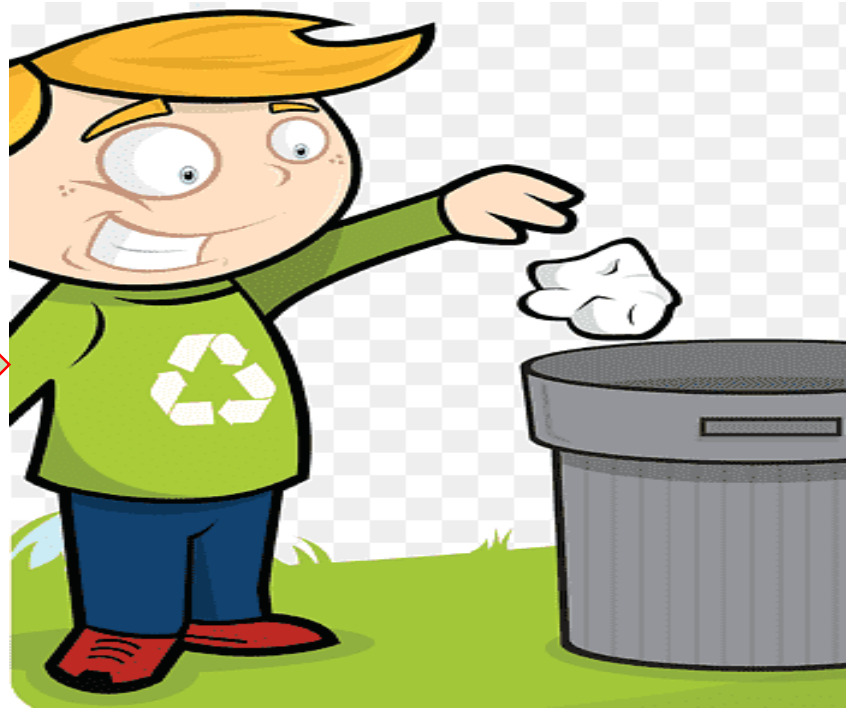
- Reduce construction cost.
- Create employment opportunity which will contribute to poverty reduction.
- Ensure savings from the waste management sector.

How can the circular use of waste PET bottles benefit a developing country like Bangladesh?

It will increase people's level of awareness regarding and creates a behavioural change in the society by changing people's throw away habit which can further spill over to other behaviours.

"It is now evidenced that one behaviour changes automatically lead to another (McLoughlin et al. 2019)."

Some money can be earned, if I store it!!



The role of government to implement circular economy of plastic

- Mainstream the concept of circular economy into the overall strategy.
- Widely circulate the benefits of using plastic aggregates.
- Create enabling business environment.
- Patronize to the private sectors.
- Adopt a Material Recovery Framework (MRF).
- Demonstrate the concept through projects of relevant organizations.

The role of private sectors:

- Engaging themselves in the circular economy as their CSR.
- Establishing a collection cycle.
- Invest in the recycling industries
- Raise public awareness through campaigns.

Scope of using this knowledge in the LGED

- ✓ The knowledge of this course can be applied in the urban sector's projects of LGED.
- ✓ Create employment opportunity as well as reduce poverty.
- ✓ Save the environment by reducing the pollution.
- ✓ The findings are fully aligned with the SDG goals (21/169 targets), Delta plan and the 8^{th} five year plan.
- ✓ The experimental findings can be effectively used in engineering applications.

Thank you

Key References

Rahman, A. 2020. *Challenges and opportunities of plastic pollution management.* The Dily Star 12 February. Available at: https://www.thedailystar.net/supplements/29th-anniversary-supplements/governance-development-and-sustainable-bangladesh/news/challenges-and-opportunities-plastic-pollution [Accessed: 23 June 2020].

Abdel-Azim, A. A. 1996. Unsaturated polyester resins from poly (ethylene terephthalate) waste for polymer concrete. *Polymer Engineering and Science* 36(24), pp. 2973–2977.

Chavan, S. and Rao, P. 2016. Utilization of Waste PET Bottle Fibers in Concrete as an Innovation in Building Materials - [A Review Paper]. *International Journal of Engineering Research* 5(1), pp. 304-307

Kirchherr J, Reike D and Hekkert M. 2017. 'Conceptualizing the circular economy: an analysis of 114 definitions', *Resources, Conservation and Recycling* 127, pp. 221-232.

McLoughlin, N, Corner, A., Whitmarsh, L., Clarke, J., Capstick, S. and Nash, N. 2019. *Mainstreaming lowcarbon lifestyles*. Oxford: Climate Outreach

Key References

Schroeder, P., Anggraeni, K. and Weber, U. 2018. *The Relevance of Circular Economy Practices to the Sustainable Development Goals*. J. Ind. Ecol. 23(1), pp. 77–95.

The Daily Star reports. 2018. *Cement consumption to grow steadily*. The Daily Star 27 May. Available at: https://www.thedailystar.net/business/cement-consumption-grow-steadily-1581961#:~:text=Annual%20consumption%20of%20cement%20stood,officer%20of%20Crown%20Cement%20Group. [Accessed: 01 September 2020]

World Commission on Environment and Development (WCED). 1987. *Our Common Future*. New York: Oxford University Press.

Reasons behind these surprising results

The increase of strength is due to the presence of plastic particles at the starting points of failure that give higher strength to the concrete at low replacement levels. At this point, the replacement of hard sand with soft inclusions (plastics) led to the stress redistribution between soft and hard inclusions which delays failure (Aguayo et al. 2016). Again, because of their elongated sheet-shaped structure, plastic fragments tolerate part of the stress before their separation that delays failure and increase the concrete's strength (Azhdarpour et al. 2016).

The slump increased because, inclusion of recycled plastic aggregates in the concrete reduced the quantity of natural aggregates in the mix and the water absorbing capacity of plastic aggregates are less than the natural aggregates. So, as the quantity of plastics aggregates increased that made more water available to the mix to increase the slump (Osei, 2014; Babu and Babu, 2004).

Concrete's density depends on the compactness and specific gravity of the mix compositions (Babafemi et al. 2018). In this research, it was recorded that the density of concrete was decreased with the addition of plastic aggregates. This was exactly like the findings of some previous studies (Coppola et al. 2018; Sosoi et al. 2018 and Hannawi et al. 2010). This is because, the recycled plastics typically have lower density compared to natural aggregates that resulted decrease of concrete's density (Islam et al. 2016; Ferreira et. al. 2016 and Silva et. al. 2013).