TLC Sustainability in Concrete and Construction
A Building Technologists Business Case for Reducing Embodied Carbon

1. Why Sustainability?

Sustainability is a term that has many associations, from sandal wearing hippies blocking motorways, Greta Thunberg rallying against airplanes, Prince Charles planting trees, to world leaders signing pledges.

TLC Sustainability is very simple.
It is simply Better Business!

TLC Sustainability in building and construction is identifying:
The Best Materials and Resources; Used in the Most Effective and Cost-Efficient Way.

The TLC business case for sustainability is clear, using our international building and infrastructure specialists, in your choice of materials and within your construction project, means you can:

- **Save up to 20% in concrete costs and other materials**
- **Enhance your reputation to clients, customers, peers, and competitors**
- **Charge up to 25% more for service and operations within the new building**

The evidence base is persuasive, and the benefits and return on investment obvious:

"66% of respondents said they are willing to pay more for sustainable products and services "

(Nielson Global Survey of Corporate Social Responsibility and Sustainability 2015) [1]

[1] https://ashtonmanufacturing.com.au/66-of-consumers-willing-to-pay-more-for-sustainable-goods-nielsen-report-reveals/ 2015, 30,000 respondents across 60 countries
[1] https://dspace.mit.edu/handle/1721.1/33030

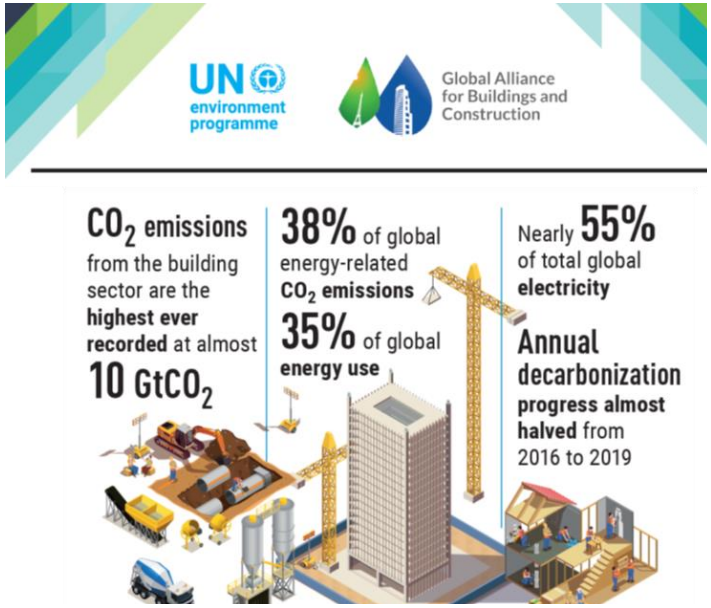
2. Why Focus on Concrete and Construction for Sustainability?

Concrete is the Second Most Consumed Material in the World After Water
(Massachusetts Institute of Technology)[2]

If the Cement Industry were a Country, it would be the Third Largest Carbon Emitter in the World with 2.8 billion tons.

The construction industry is responsible for 38% of global greenhouse gas emissions. (United Nations Environment Programme)

The Construction and Building (embodied carbon) can represent up to 70% of a building's carbon emissions over its lifetime. And the concrete and steel can be 90% of that build.



3. Why TLC Sustainability in Concrete and Construction?

TLC's position, is that sustainability provides a powerful lever to disrupt approaches and methods, drive efficient use of resources and improve business prosperity.

It is an approach that asks. Can we reduce the amount of planet harming materials, but also, can we reformulate or revise how those materials are made to make them less harmful?

More effective use and formulation of concrete/ cement is a classic example of how sustainability can transform the industry.

Our TLC sustainability in construction, can reduce the build cost for a hotel or resort, but because of that sustainability, and premium position. The operational partner can charge more for guests to stay in it.

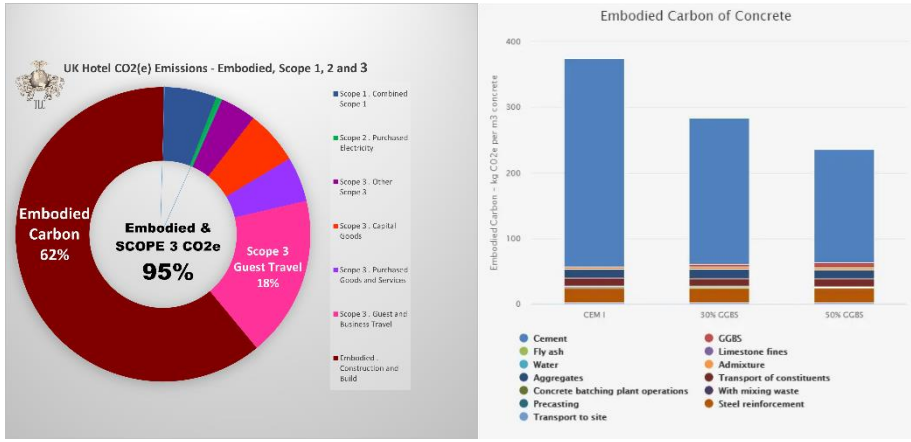
TLC

Sustainability in Materials & Construction

The Majority of Greenhouse Gases in Construction (Embodied Carbon) comes from the Cement used in Concrete

Concrete is very versatile, inexpensive, literally hard, and can be cast into almost any shape. It consists of sand, gravel, water, and a binder.

The binding agent for most concrete used worldwide is cement. Cement production is the largest industrial emitter of CO2 emissions worldwide, accounting for about 8 percent or 2.7 billion tons of CO2 per year. This is due to the combustion of fossil fuels—mostly coal—at temperatures of around 1,000 degrees Celsius and sintering at around 1,450 degrees Celsius. A cubic meter of concrete made with traditional cement can have embodied emissions of around 310 kg of CO_2 .



Source - University of Bath)

Using less cement, alternatives to cement and clever concrete design can have a big impact in Embodied Carbon, the largest component of a hotel, resort or tourism Carbon Life Cycle.

Different cement additive and substitutes can be used alter the carbon emissions of concrete. The Graphic above demonstrates the variance in concrete carbon emissions against cement alone and percentage blends of Ground Granulated Blast Furnace Slag, a cement alternative.

"A cubic meter of concrete made with traditional cement has Embodied Carbon Emissions of around a 310 kgs"

(That's the equivalent carbon of a first-class flight from London to Casablanca)

4. Reducing Construction Costs by 'Greening' Concrete.

With the cost of building materials reaching a 40-year high, it is more important than ever to use these materials more effectively and efficiently. A Sustainable and 'Green Concrete' can not only save money in the build but also provide a sustainability premium that people are more willing to pay for.

‘Greening’ Concrete can be achieved by:

- Alternatives to, and Blends of Cement
- Reducing the amount of binder

5. The Economics of Greening Concrete

Sustainability has several key principles:

- **REDUCE**
- **REUSE**
- **REPLACE**

Reviewing the concrete and construction industries within these parameters provides a useful way to identify material cost savings:

REDUCE the amount of binder. Most concrete provided to the construction industry is constituted from an excess of cement. Greening concrete can just mean reducing the amount of cement used in the concrete while providing the required statutory strength and structural integrity of the final concrete.

REDUCE the amount of concrete used. More effective design in the use of concrete in structures can reduce the volume of concrete required. Foundations, pillars, and overhangs can be better designed to provide safe and effective infrastructure and buildings.

REDUCE the amount of water used. Concrete uses a tremendous amount of water using almost a 10th of the world’s industrial water use. This often strains supplies for drinking and irrigation[3]

REUSE industrial waste. Greener concretes use cement replacements to lower their carbon footprint. The 3 main cement replacements used in concrete are man-made.

- GGBS = Ground Granulated Blast Furnace Slag - byproduct from steel manufacture
- Silica Fume = A byproduct of the manufacture of silicon for industries such as computing
- PFA = Pulverized Fuel Ash byproduct from coal power stations

GGBS, Silica Fume and PFA have been around for decades and used by concrete companies, they were cheaper than cement although as they become popular and coal power declines, they are getting more expensive.

REUSE old concrete. Some ‘greener’ concretes use ground concrete from demolished buildings and sites to add to their concrete mixture

REPLACE cement. The oldest and most NATURAL green cement replacement has been in use over 2000 years is **Natural Pozzolans** that come from volcanoes, they meet American (ASTM) and European/ British Building Standards (BS EN 197-1:2011, 5.2.3.3), and are an effective cement replacement.

It is what the ancient Romans used for their buildings which still stand today.

[3] https://www.nature.com/articles/s41893-017-0009-5

6. The TLC Sustainable Offer & Services - Materials and Construction

The TLC Sustainable Materials and Construction team is led by **Alex Page**, a geologist and materials executive within the concrete, construction, and geological industry for over 30 years.
Currently Director of TLC UK and GCC destination projects, and international hotels, resorts, and infrastructure construction and development.

TLC Sustainable Materials and Construction services are available for clients requiring cost reductions and consultancy to:

- **Analyse, Review and Save** by deploying adaptive use of Concrete, Cement and Alternative Binding Agents.
- **Acquire Sustainable Building Development** including the measure and financial modeling of a Building Life-Cycle Impacts towards climate
- **Green Material** evaluation of specified building and construction materials and suitability against building standards

7. Previous Construction Projects have Included:

Hong Kong
Mass Transit Railway Corporation Projects
KCRC (Kowloon Canton Railway)-West Island Line
Chek Lap Kok- New Hong Kong Airport
Stone Cutters Island Bridge
Tsing Kau Bridge
Langham Place Office & Towers - HK Sky Scraper -255 MT Height
Nina Tower- Sky Scraper – 319 MT Height
IFC Tower –C100 Pump Trial 410 MT vertical using 1 concrete pump

Macau
Macau Tower- 338 MT Height
New Lisboa Casino
Venetian Casino
Wynn Casino
City Of Dreams Casino
Galaxy Casino
Sands Casino

Shanghai
Shanghai Financial Centre (Morri Tower 490 meters)

Thailand
Maka Nakhon Tower Bangkok 77 stories – Bouygues

Myanmar
Star City, Yangon

India
Jamnagar Petrochemical Refinery –Gujarat- Reliance
Mumbai Metro

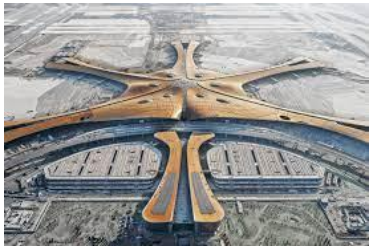
China
New International Airport Beijing
Xialandi- Hydro Power Project
Morri Tower Shanghai – 490m
Israeli Embassy Beijing
Urrtan Hydro Power Project- Sichuan province
Beijing TV Tower

USA
7 World Trade Centre
Reconstruction at Ground Zero New York City

Langham Place; Nina Tower; Tsing Kau Bridge - Hong Kong

Venetian Casino- Macau

Shanghai Financial Centre Tower



Beijing Airport

World Trade Centre Redevelopment – NYC

8. Real World Projects - Concrete Examples (Financial Savings & CO2 Reductions Acquired)

TLC REVISED CEMENT in CONCRETE AMOUNTS

PROJECT EXAMPLE	INITIAL CONTRACTOR CONCRETE PROPOSAL	TLC REVISED CONCRETE PROPOSAL	TOTAL FINANCIAL & CO2 SAVINGS ACQUIRED
Hong Kong **500,000m3** G =45 mpa $100/ton	Contractors design mix: =235,000 tons cement Contractors cement spend = $23.5 million (USD)	TLC revised cement requirement =205,000 tons TLC revised cement spend = $20.5 million (USD) TLC revised cement saving =30,000 tons	**Total Saving = $3 million (USD)** % Cement saving =13 % % USD saving = 13 % (reduced CO2 = 20,580 tons[4])
Myanmar **200,000 m3** G60 mpa $150/ton	Contractors design mix: = 110,000 tons cement Contractors cement spend = 16.5 million (USD)	TLC revised cement requirement = 94,000 tons TLC revised cement spend = £14.1 million (USD) TLC revised cement saving = 16,000 Tons	**Total Saving = $2.4 million (USD)** % Cement saving = 12% %USD saving = 15% (reduced CO2 = 10,976 tons)
Philippines **200,000m3** G=50 mpa $120/ton	Contractors design mix = 96,000 tons of cement Contractors cement spend = $11.52 million (USD)	TLC revised cement requirement = 88,000 tons TLC revised cement spend =$10.56 million (USD) TLC revised cement savings = 8,000 tons	**Total saving = $960,000 (USD)** % Cement saving = 8.4% % USD saving = 8.4% (reduced CO2 = 5,488 tons)

For any project it is the main contractor appointed by the client who is responsible for the concrete mix design used. They will base it all on the concrete specification written by the Engineer /Architect. The main contractor will either produce the concrete themselves by constructing their own batch plants on the site; or they will go to an outside commercial concrete company and appoint them to design and supply the concrete.

Additional Savings by Optimization Using Natural Pollozan Blend - eg1 Hong Kong:

		TLC Optimization Level		
	Non-Optimized	(1st) TLC Cement Revision	(2nd) TLC 30% Pollozans	(3rd) TLC 50% Pollozans
Materials Cost	$23.5 million	$20.5 million	$13.67 million	$10.25 million
Savings (USD)	**$0**	**$3 million (USD)**	**$9.83 million**	**$13.25 million**

[4] Imperial University: 1 ton of cement produces 0.686 tons of CO2 emissions

10. Embodied Carbon Reduction is Fundamentally Good for your Project, your Business and the Planet

RESET Concrete and Construction

RATES:

TLC works with our Owners and Development companies for mutual benefit. Our job is to analyze and save money on the concrete and construction solutions provided.

Adding in sustainable development strategy which not only saves during construction but allows the final project to attract higher spending guests once staying in the property.

We are confident of our approach and will negotiate a percentage of savings made through the Owner for our input with project management.
Our consulting fees are based on global benchmarks for specialists.

TLC

TLCHarmony.com

Email: n.page@tlchealthtravel.co.uk