The Home of Geosynthetics

IGS Sustainability Initiatives

The International
Geosynthetics Society

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Acknowledgment: limited natural resources

- The most common materials used in civil engineering are:
  - Concrete
  - Aggregate
  - Sand
  - Steel
  - Asphalt
  - Selected or treated soils – clays, lime stabilised
  - Timber

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Civil engineering and natural resources

Essential for infrastructure construction BUT a limited and dwindling resource and come at a growing cost to the environment via 3 principal activities:

- Sourcing
- Transport
- Construction

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Construction materials - The Environmental Cost

Sourcing

- extraction
- processing
- unsuitable waste materials (disposal?)
- landform change and restoration: aesthetics, flora and fauna, water tables

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Construction materials - The Environmental Cost

Transport

- multiple heavy delivery vehicles
- often large distances (depending on material) with associated energy and emissions
- damage to existing infrastructure with associated maintenance
- disruption and threat to the public

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Construction materials - The Environmental Cost

Construction
- excavation
- placement
- disposal of unsuitable
- maintenance

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Construction materials - The Environmental Cost

Sand

- majority used in construction to make concrete and asphalt
- also used in glass (windows, windshields, smart phone screens, silicon chips)
- suitable sand typically comes from seabeds, riverbeds, beaches and under forests
- sand is so valuable that ‘Sand Smuggling’ is a reality and there are many recorded cases

Reference to the New York Times article

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Construction materials - The Environmental Cost

Structural Aggregate

- Used in concrete and asphalt and beneath roads, and railways and a range of other applications
- Good quality hard rock is required to make effective structural aggregate
- Sources of this material are limited by geology and planning restrictions
- Quarries are often many km from construction sites
- Extraction requires large and environmentally expensive plant and processes
  Quarries often in rural locations so natural habitats are destroyed

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Construction materials - The Environmental Cost

Drainage Aggregate

- Used for ground drainage in highways, around buried structure and landfills
- Generally sourced via sea or river gravel extraction which can
- Special single size or course graded environmentally costly to excavate and screen
- Very localised sources – long environmentally costly haulage distances

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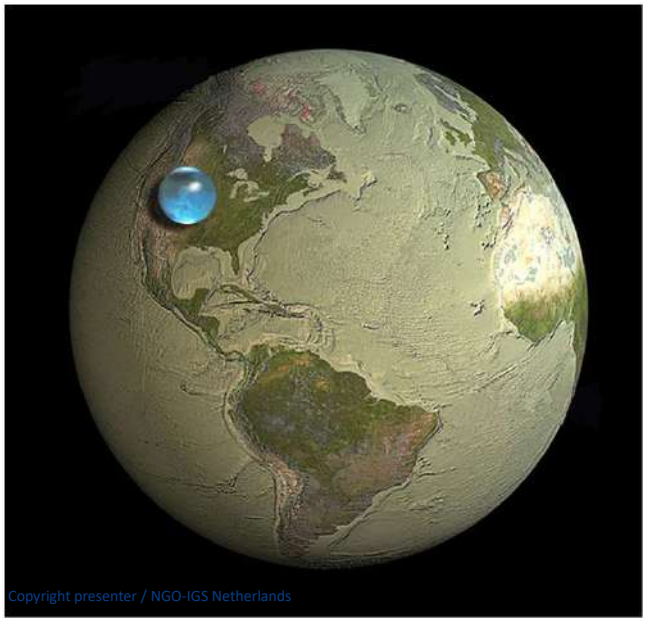
Construction materials - The Environmental Cost

Water

Scarcity of resource

1384 km diameter
Approx. 1.39M km3

862 miles diameter
332,500,000 (mi3)



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So what can geosynthetics do to reduce this environmental damage?

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Geosynthetics have a wide range of applications

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The Engineering Requirements in an Infrastructure Project

- Students of engineering are formally trained to design infrastructure to optimize performance
- Professional engineers soon learn that infrastructure design, particularly the selection of alternatives, is driven by cost
- We are starting to figure out how to incorporate, in the selection of alternative designs for engineering infrastructure, a third important requirement: sustainability

From Zornberg

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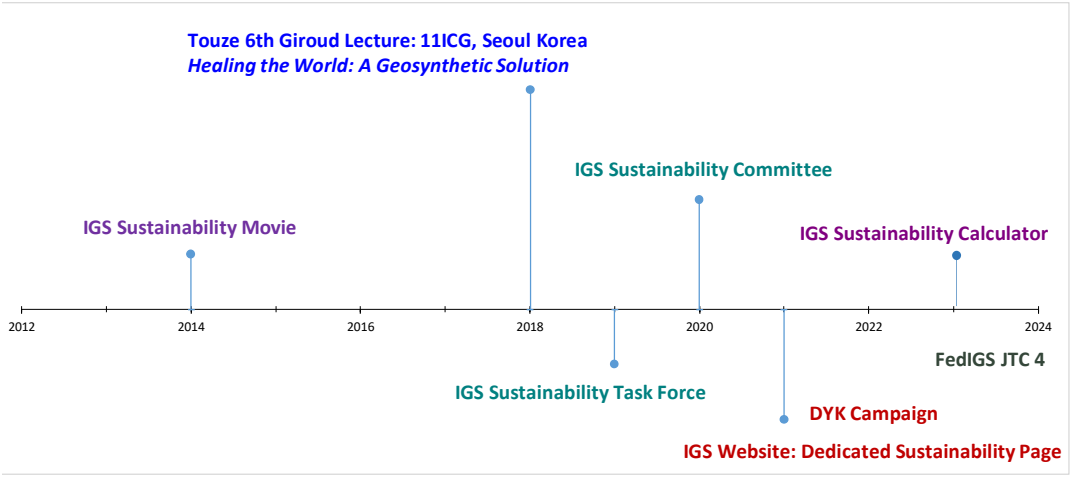
IGS Events & Initiatives – Meeting the Mission



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The International Geosynthetics Society believes that geosynthetics and associated technologies make a significant contribution to the achievement of sustainable development.

The IGS is committed to complying with applicable legislation and maximizing the positive sustainability contribution of geosynthetics, while minimizing the environmental impacts of our operations, including events organized or endorsed by the Society.

From IGS Sustainability Statement

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Geosynthetics for Sustainable Development Video

developed for regulators and policy makers

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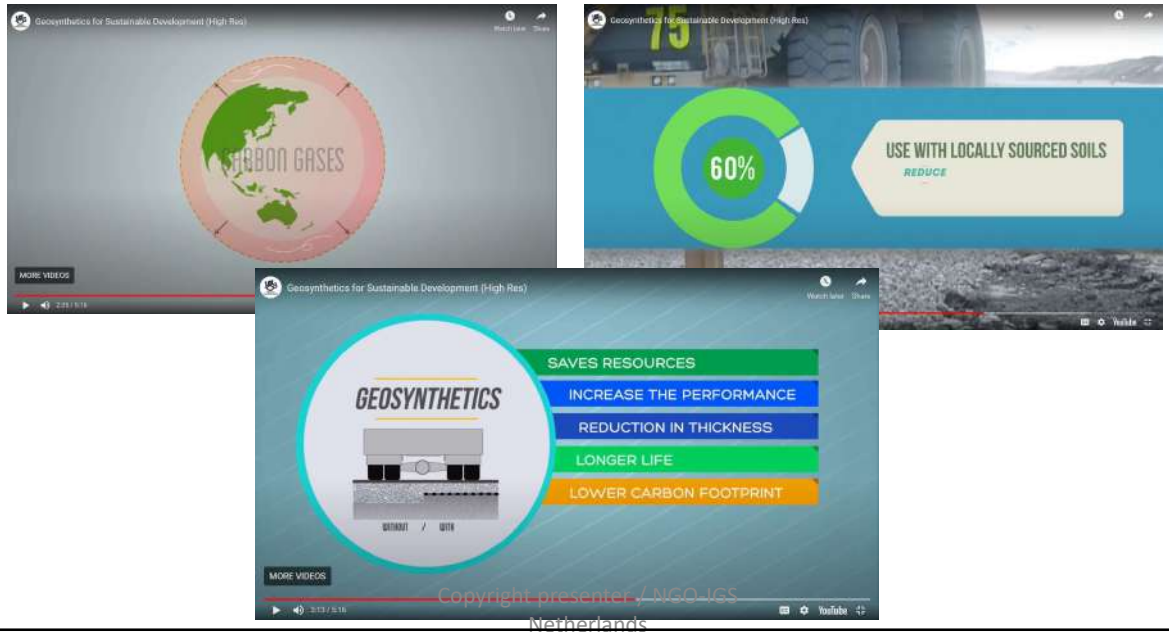
Geosynthetics for Sustainable Development Video



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Geosynthetics for Sustainable Development Video

- Initiated from Communications Committee
- Sam Allen / Neil Dixon script and story board - EuroGeo5, Valencia, Spain
- Animator and Producer from Mexico
- Premiered at 10th ICG, Berlin Germany
- Translated into 9 languages

Geosynthetics for Sustainable Development Video

developed for regulators and policy makers

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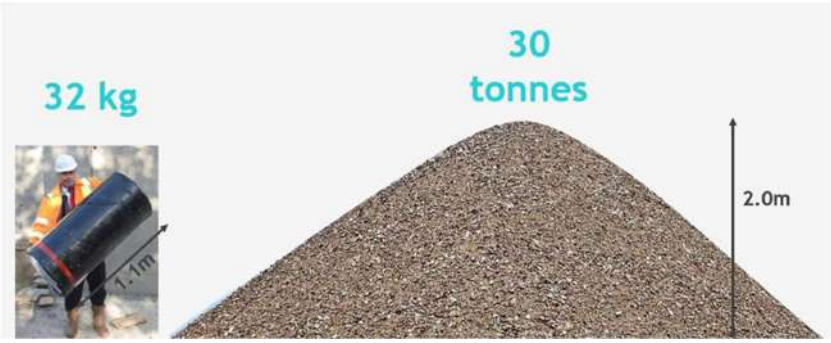
Geosynthetics can reduce the use of aggregate in infrastructure construction by over 50% and up to 90% in some cases



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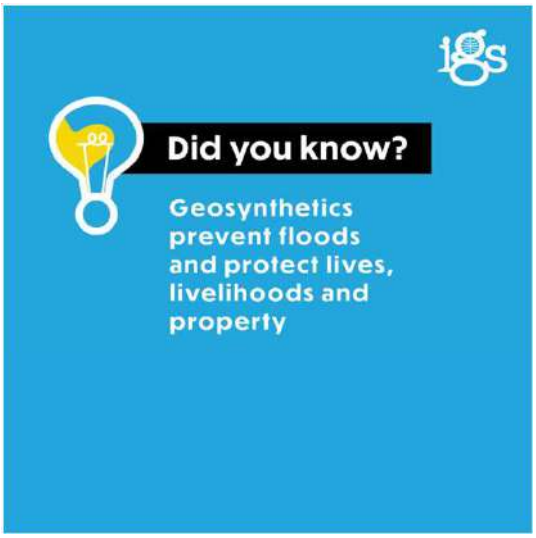

International Geosynthetics Society

Did you know?

Did You Know?... geosynthetics prevent floods and protect lives, livelihoods, and property.

Changes in weather patterns are one of the principal effects of climate change. We now see more extreme weather conditions. This has a huge impact on communities in low-lying areas, who suffer change to land use on a massive scale when exposed to environmental risks such as flooding.

In these cases, water needs to be kept within certain bounds. Sea defense dykes, flood alleviation emergency dykes, canal dykes, and all manner of streams and channels are an important element of land protection to allow for irrigation or navigation. Indeed, longitudinal dykes are one of the most often used structures designed and constructed to keep river water contained in the event of a flood.

In recent decades, several major flood events have shown the vulnerability of flood protection structures around the world. Frequently, the overtopping of flood protection dykes has led to the total failure of the structure. Plus, river dykes affected by previous incidents were often too low, or in too poor of a condition to resist water height and erosion during a flood. The aftermath of disastrous flood events has shown that dykes are an important part of a society's infrastructure. They must be designed with maximum safety in mind.

Geosynthetics, when designed into dykes, strengthen flood defenses.

www.geosyntheticssociety.org

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- Education campaign
- Leverage social media accounts
- Application oriented
- Backed up with Technical Notes housed on IGS website
- Promotion of GS benefits to sustainable infrastructure development

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Spotlight on Sustainable Solutions

Saving Energy and Resources with Geosynthetics

Recycling, Smart Energy Use and Circular Economy

igs INTERNATIONAL GEOSYNTHETICS SOCIETY

This project supports these UN Sustainability Goals

Cutting CO_2 in Belgium by Improving Structural Integrity and Safety with Geotextiles

Ostend-Bruges International Airport, known as Ostend Airport, is a partnership between the French Egis airports' network group and Flemish government. The popular interchange reportedly welcomed 386,000 passengers in 2023, a rise of 4.6% on 2022. Travellers can fly to 14 destinations with routes set to expand.

Company: Beaulieu International Group
Client: Ostend-Bruges International Airport
Location: Ostend, Belgium
Application: Reducing CO2, noise pollution and microplastics release by replacing gravel with geotextiles
Benefits: Carbon savings, cost savings, time savings, conserves natural resources

Increasing demand takes its toll on the infrastructure and runway areas needed an upgrade. This was not only to improve flight and passenger safety, but to directly impact sustainability outcomes by lowering CO2 and other emissions, as well as noise pollution.

As part of this, construction of a new aircraft parking apron (paved areas where planes refuel, load/unload, and board/disembark passengers) took place. Gravel was substituted with a woven geotextile to stabilize the ground and separate two reusable layers from each other. This approach was chosen because of the important economic and ecological advantages of material savings, installation time and the overall construction costs.

INTERNATIONAL GEOSYNTHETICS SOCIETY

The International Geosynthetics Society (IGS) is a learned society dedicated to the scientific and engineering development of geosynthetics, geosynthetics-related products, and associated technologies. We are registered as a not-for-profit corporation.

The ongoing positive impact had been considerable with CO2 emissions reduced by more than 77% compared with using gravel, as well as a dramatic saving of more than 97% in microplastics (MP) emissions. This is because the geosynthetic materials require less construction traffic compared to transporting gravel. Truck tires are therefore less vulnerable to constant wear and related MP release.

The use of geosynthetics has boosted the positive environmental impact of Ostend Airport, drastically reducing the impact of CO2 and microplastics emissions.

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IGS Response to European Commission Microplastics Consultation

The IGS has called on the European Commission to fully understand the enormous sustainability benefits of geosynthetics when considering how to reduce microplastics in the environment. This important issue must be addressed using the best available scientific data and case studies. The Commission should recognise that geosynthetics are part of the solution. Read our press release and our response to the Commission's consultation.

CEN TC 189, WG8
ASTM International Committee D35.40: Sustainability
EAGM, GMA

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IGS E-Book

geosyntheticssociety.org

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IGS E-Book

- Based on Touze's Giroud Lecture
- Responds to UN Sustainability Goals
- Offered in 9 different languages
- Downloadable pdf "published books"
- Available on IGS Sustainability Web Page

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IGS Sustainability Calculator

- Selection of OneClick LCA as initial platform
- Purchase of a multi-user license
- Engagement of teams from George Mason University (Washington D.C.) and Universitat Politècnica de Catalunya·BarcelonaTech (UPC) to prepare example templates
- Launch of a calculator at Rome 12 ICG for any IGS member

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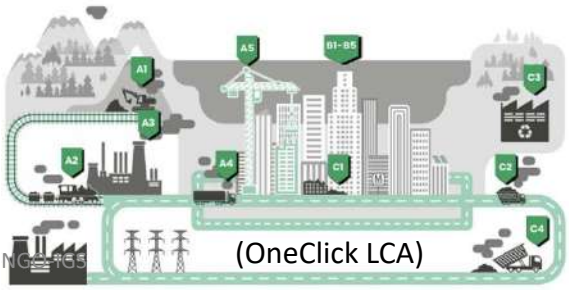
OneClick LCA

- Analysis stages
  - A1: Raw material extraction
  - A2: Transport to manufacturing site
  - A3: Manufacturing

  } Basic EDP information
  - A4: Transport to construction site
  - A5: Installation / Assembly

  } Based on design requirements
  - B1-B5: Use stages ➡ Not relevant for geotechnical structures, only repair stage (B3) could apply
  - C1-C4: End of life stages ➡ Includes various types of reuse, recycle, and disposal



(OneClick LCA)

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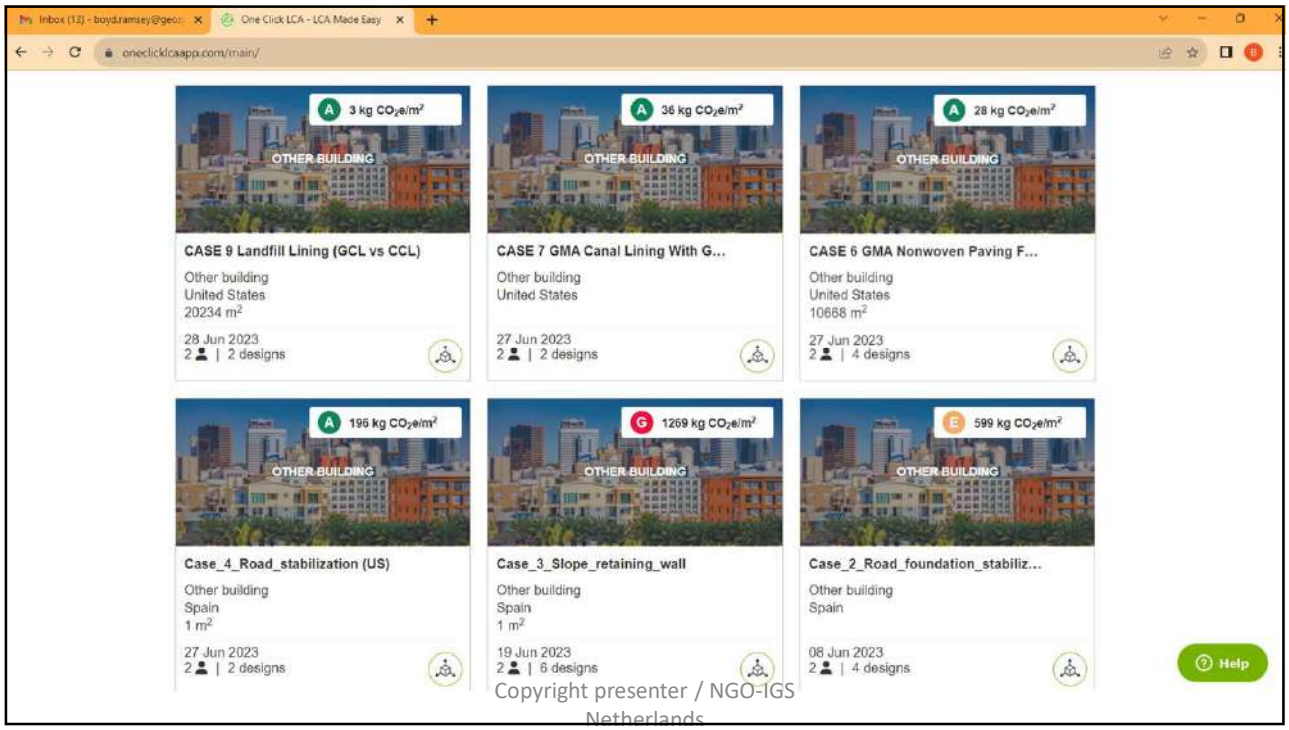
OneClick LCA

- Focused on building and infrastructure
- Assessments according to EN 15978
- Can use CML and/or TRACI
- Kg CO_2e ➡ Analyses carried out using the "Life Cycle Carbon – Global" tool
- Compensation to local conditions ➡ Can recalculate impacts to a specific location using local energy matrix
- Wide array of EPDs (average, generic, and manufacturer specific)
- Intuitive interface

Calculation variables (partial!)

OneClickLCA
Materials
Shipment modes distance segment
Waste percentage
Service life
Repair and maintenance activity
End of use disposal
Multiple cases for comparison

EPD
Material used by type and emission classification data
Packaging used, data for unit shipments – truck, container etc.
Utilities used to make – electric, gas, etc, – plant operations
Maintenance requirements, waste disposal data, fate of waste and end-of-life



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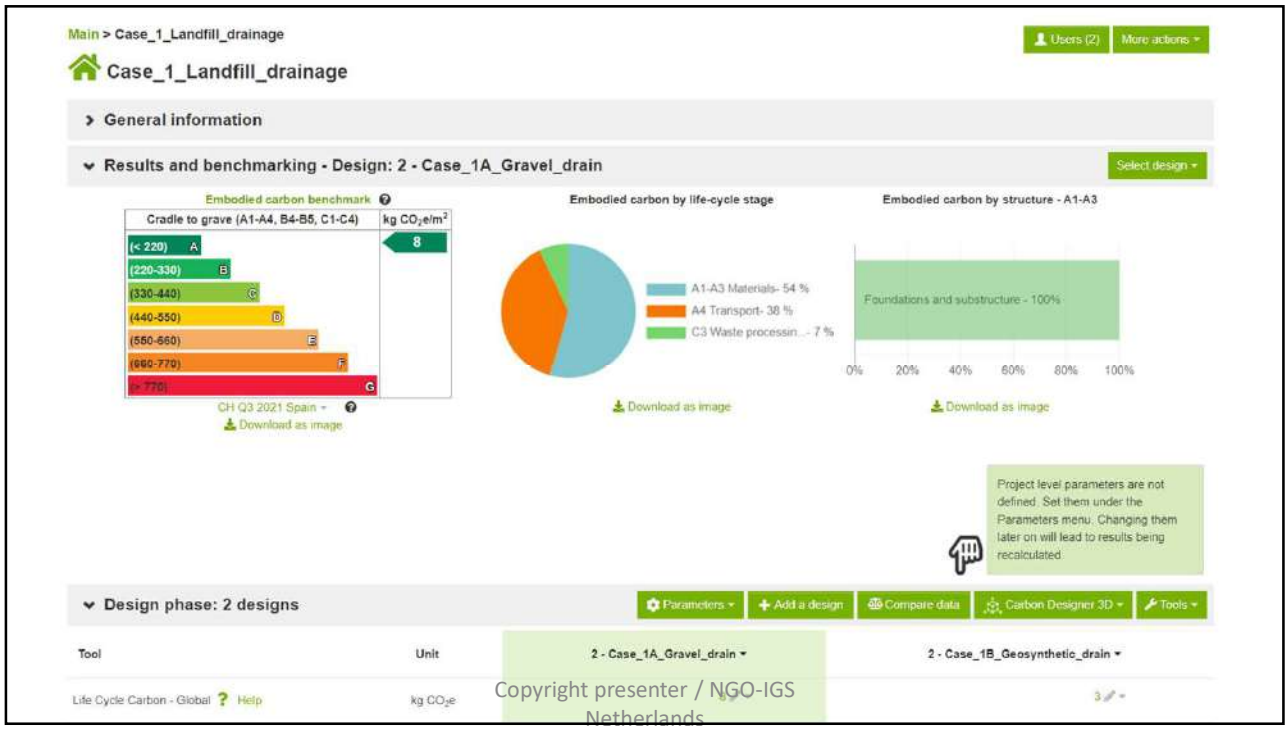

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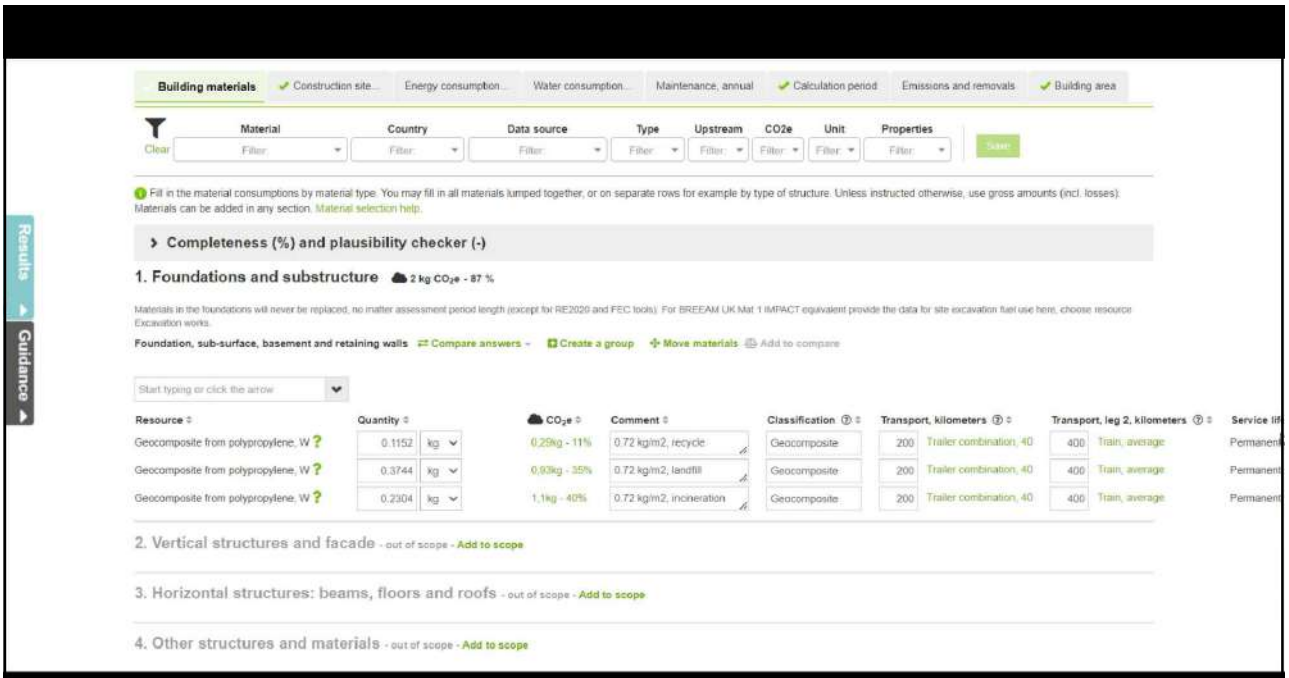

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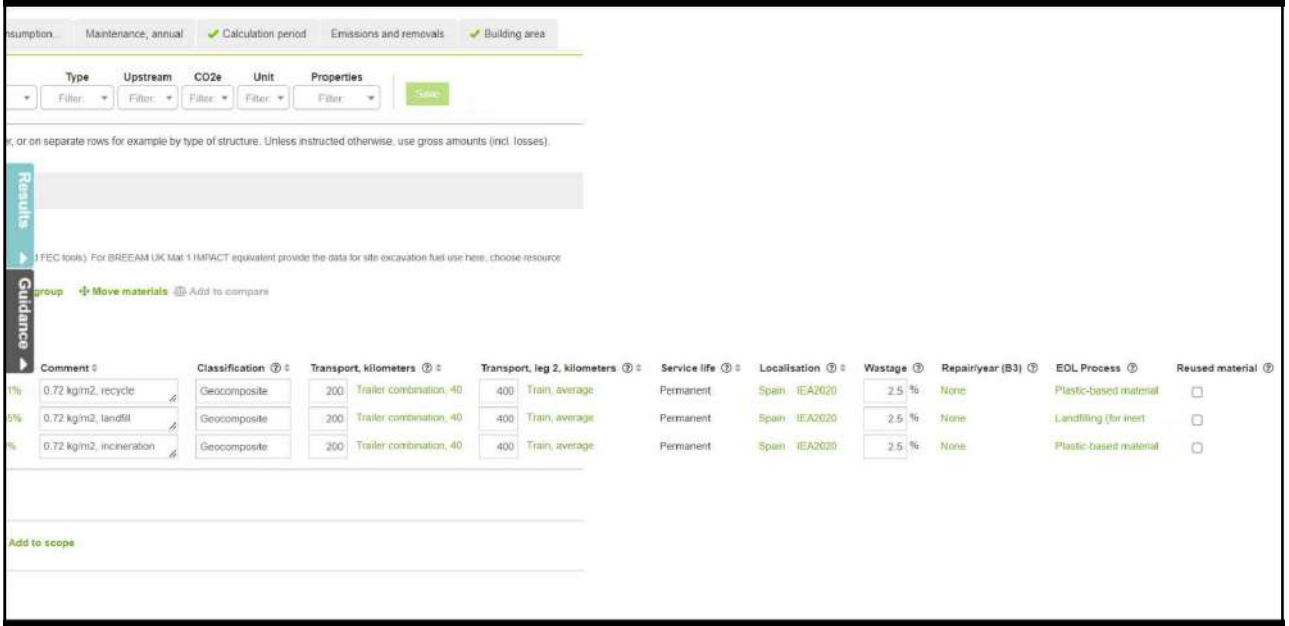

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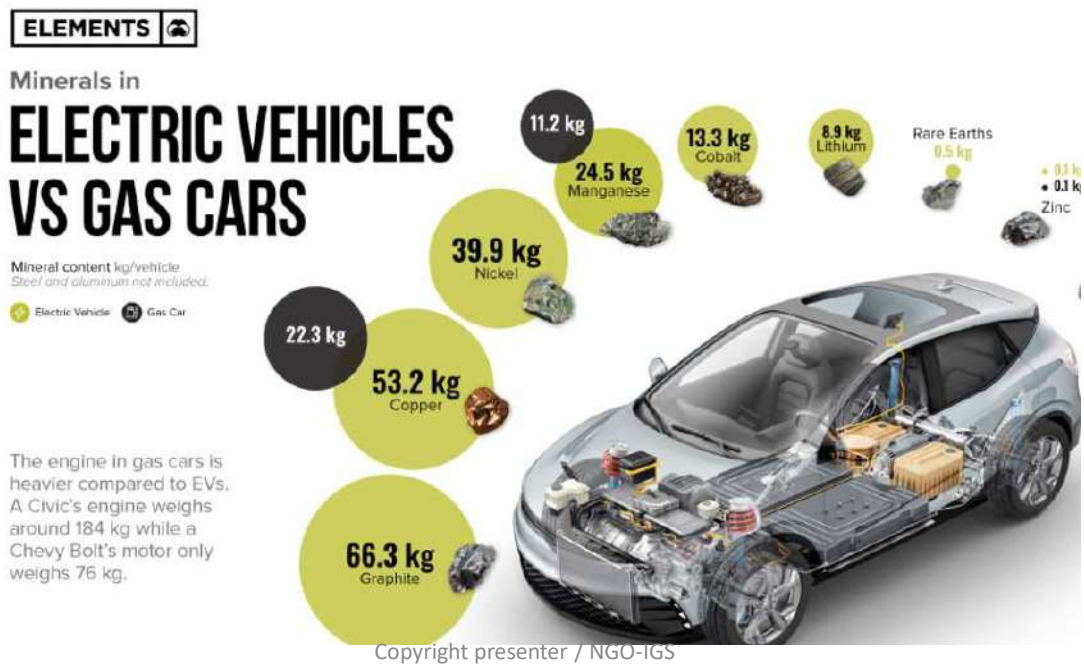
The IGS Sustainability Committee - A Look Ahead

- 1st IGS Geosynthetics Handbook (highlighting sustainability benefits); IGS Professional Development Courses
- Animated DYKs – Recycling of existing / New DYK Offerings
- Carbon Calculator(s) / Inclusion in IGS Curriculum / Geosynthetic Lectures focused on sustainable benefits; new application modules
- IGS Case Histories highlighting IGS Corporate members' sustainability projects and citizenship
- FedIGS Position Papers (JTC 4 led effort; for policy makers)
- Differentiating plastic pollution from geosynthetic applications

Stay tuned to the IGS Sustainability Web Page



Future Use Cases: CAV/EV Impact on Pavement Structures

EVs are typically ~30% heavier than gas vehicles

EV semi-truck is about ~ 3630 kg. heavier than diesel semi-truck

From TX Department of Transportation: Mike Arellano

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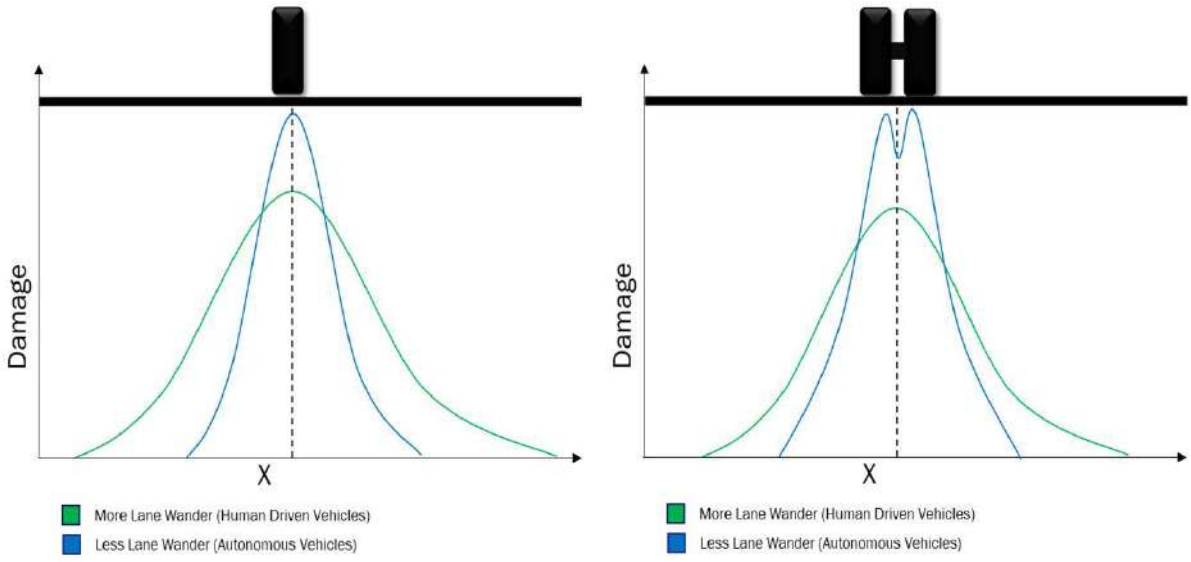
Advanced Driver Assistance Systems – Lane Keeping



From TX Department of Transportation: Mike Arellano

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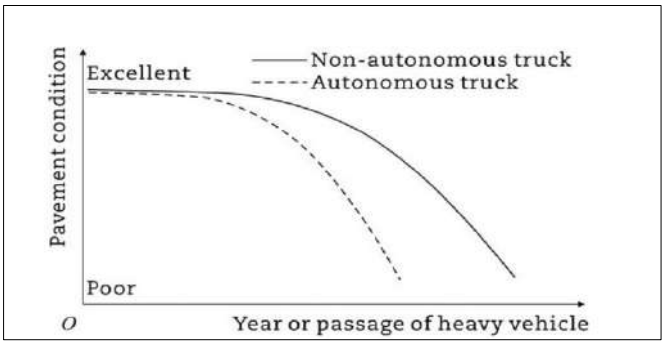
Advanced Driver Assistance Systems – Lane Keeping

- There 30% to 40% more rutting when there is no lane wandering.
- There is 2.7 times more fatigue damage when there is no lane wandering



From TX Department of Transportation: Mike Arellano

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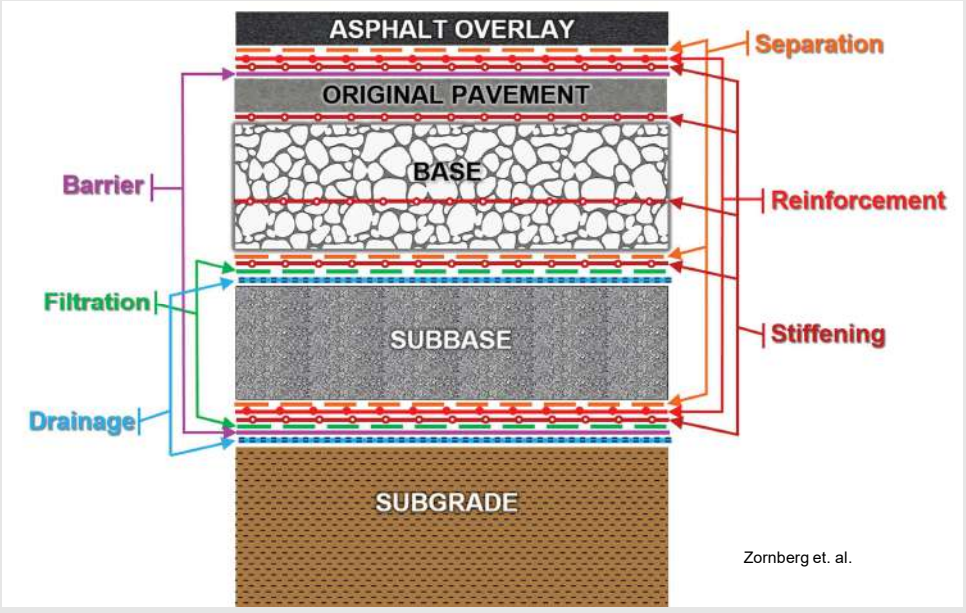

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The Home of Geosynthetics

Thank You

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The International
Geosynthetics Society

Sam Allen
President and Director The
TRI Environmental Group

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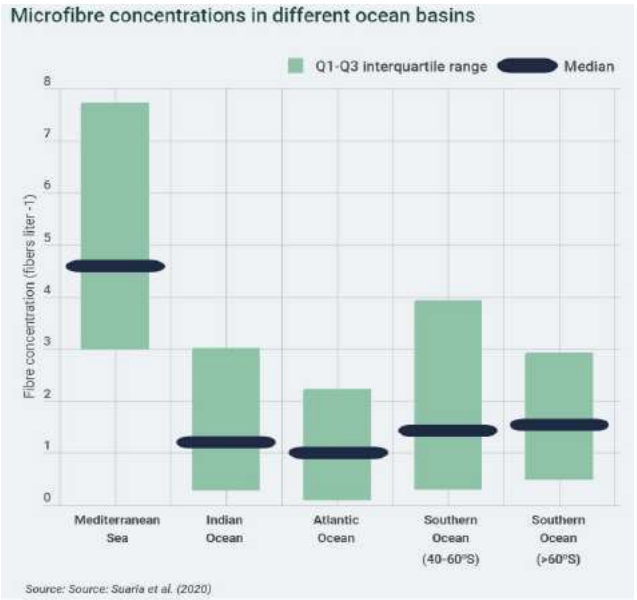
Synthetics fibers: 35%
Vehicle tires: 28%
City dust: 24%
Road markings: 7%
Marine coatings: 3.7%
Personal care products: 2%
Plastic pellets: 0.3%



International Union for Conservation of Nature (IUCN). *Primary Plastics in the Oceans, 2017*

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British firm Emissions Analytics, which has spent three years studying tire emissions, found that a car's four tires collectively emit 1 trillion ultrafine particles — of less than 100 nanometers — per kilometer driven.

Cars in the U.S. emit, on average, 5 pounds of tire particles a year, while cars in Europe, where fewer miles are driven, shed 2.5 pounds per year. Moreover, tire emissions from electric vehicles are 20 percent higher than those from fossil-fuel vehicles.

Emissions Analytics, 2023

The estimated per capita tire emissions average, globally, 0.81 kg/year.

Wear and Tear of Tyres: A Stealthy Source of Microplastics in the Environment
Pieter Jan Kole, Ansje J. Löhr, Frank G. A. J. Van Belleghem, and Ad M. J. Ragas

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Microplastics

- Eunomia and ICF (2018) found that 100% efficacy in source prevention for tire wear abrasion could result in a cumulative microplastics emissions reduction of 500,000 tonnes annually in the EU alone.

- In stormwater runoff in QLD during rain events, approximately 19 out of every 20 microplastics collected were tire wear particles with anywhere from 2 to 59 particles per litre of water.

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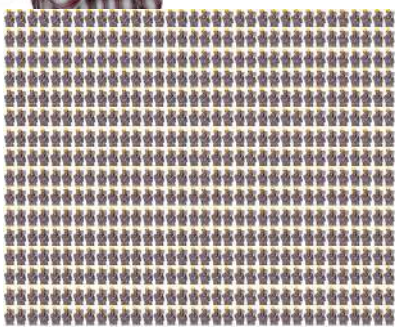
Installation speed and safe handling - Blocks

550 of these



= 1 of these

Here's a clue….

300 of these…..

= 1 of these

300 of these…..

= 1 of these

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Can geosynthetics produce microplastic /microfibers:
YES

If yes, do they contribute a critical portion of the world's plastic pollution?
NO!

INTERNATIONAL GEOSYNTHETICS SOCIETY

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