



INTERNATIONAL ROAD FEDERATION  
FEDERATION ROUTIERE INTERNATIONALE

Better roads, better world.



# Measuring the carbon footprint of road construction using CHANGER

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**[www.irfnet.ch](http://www.irfnet.ch)**

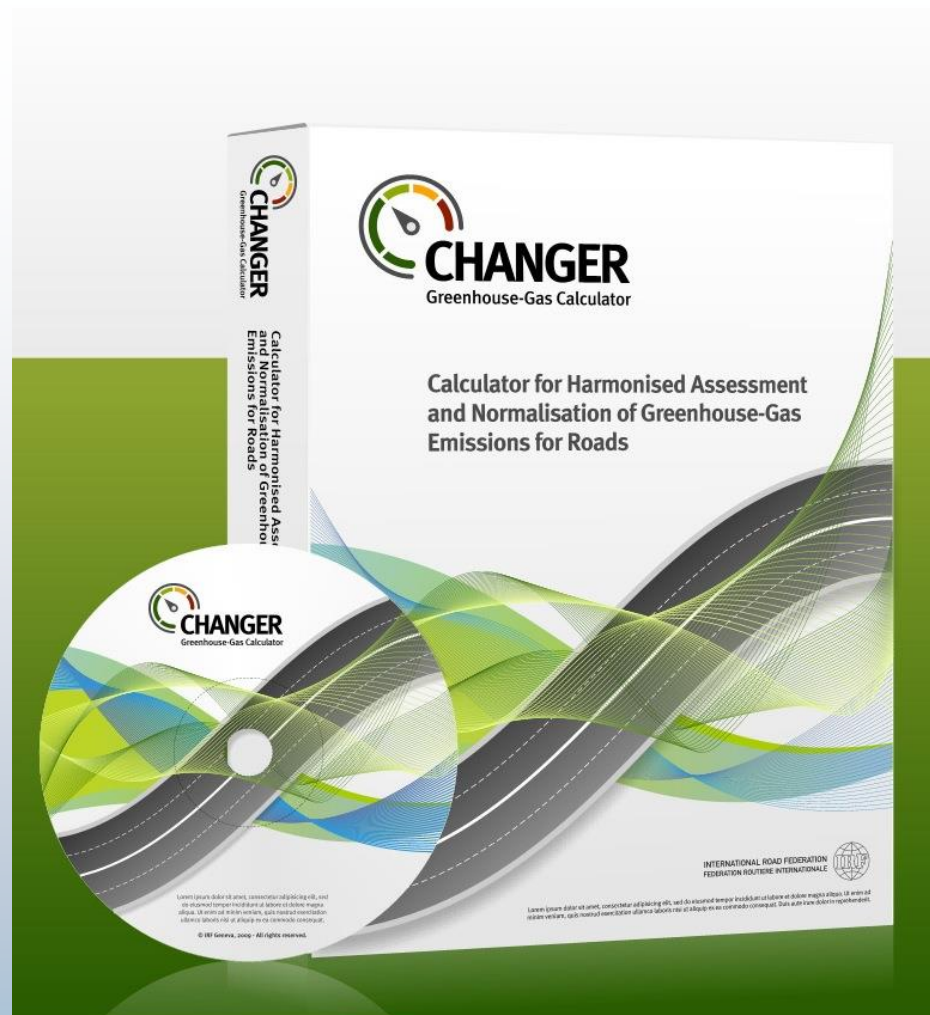


## The Facts

- Climate change is one of the most urgent environmental issues facing the global community.
- No sector can afford to close its eyes.
- The transport sector has the scope and means to make a significant contribution.

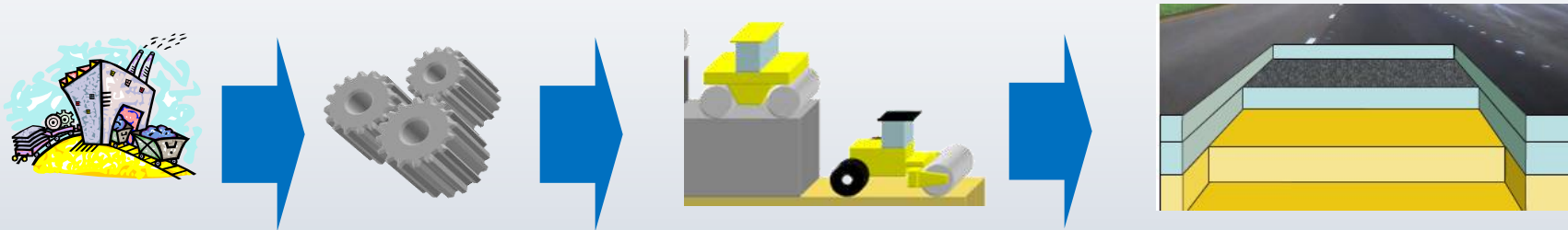


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Building road infrastructure is a complex process  
involving many operations



How to assess GHG emissions?

Where can you make energy and resources savings?

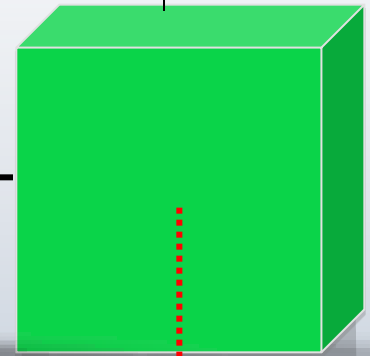
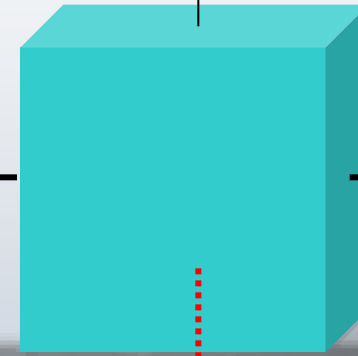
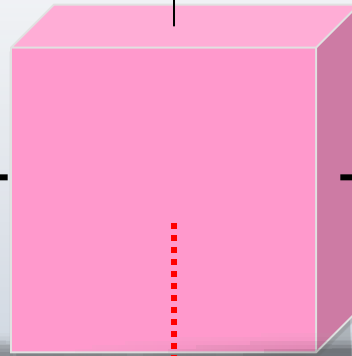
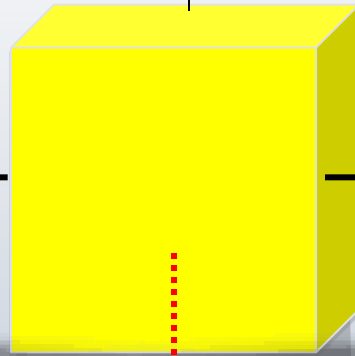
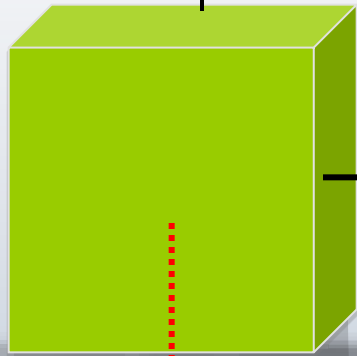


## The Objectives

- Detailed environmental analysis of road projects
- Comparing alternative techniques and materials
- Optimising supply schemes at road construction sites
- Estimating the carbon footprint of road construction

*Quantifying the carbon footprint of an activity or product  
allows the **sources of the impacts** to be understood,  
investigated and managed*

**MODULES**



**PRE CONSTRUCTION**

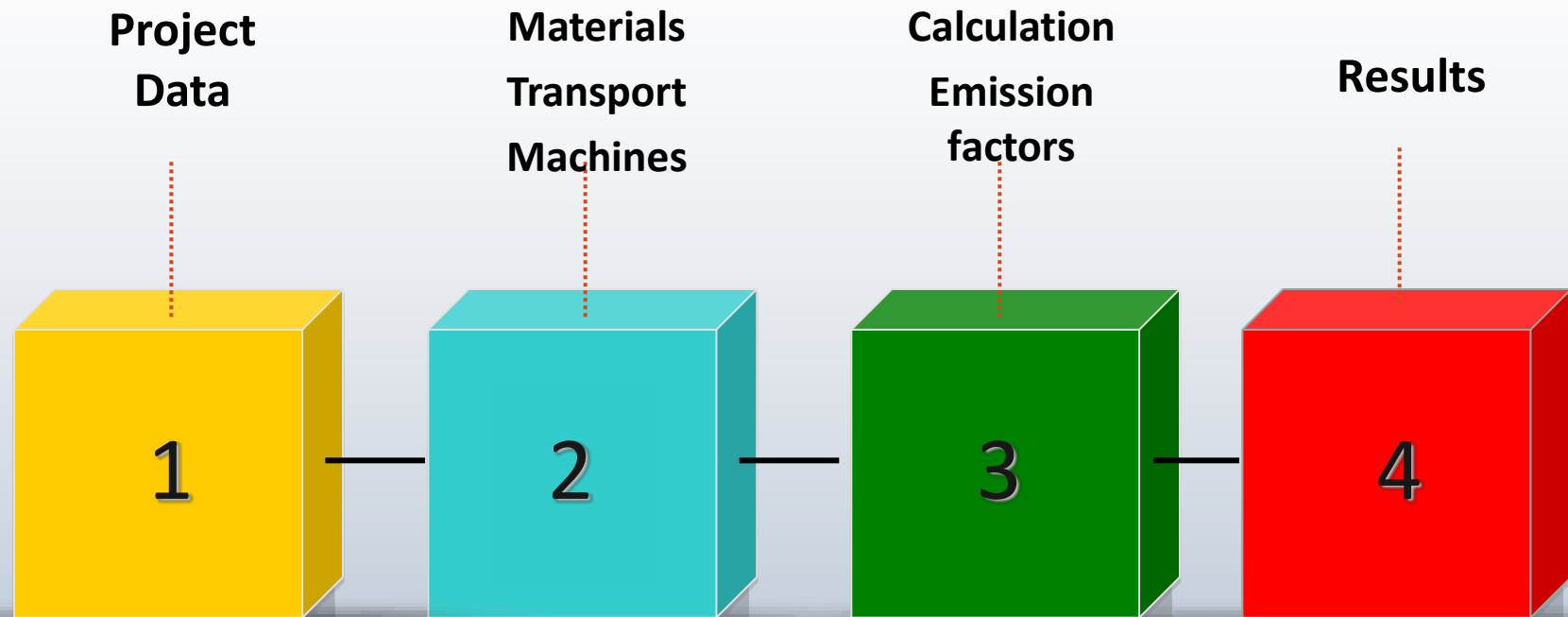
**PAVEMENT**

**MAINTENANCE**

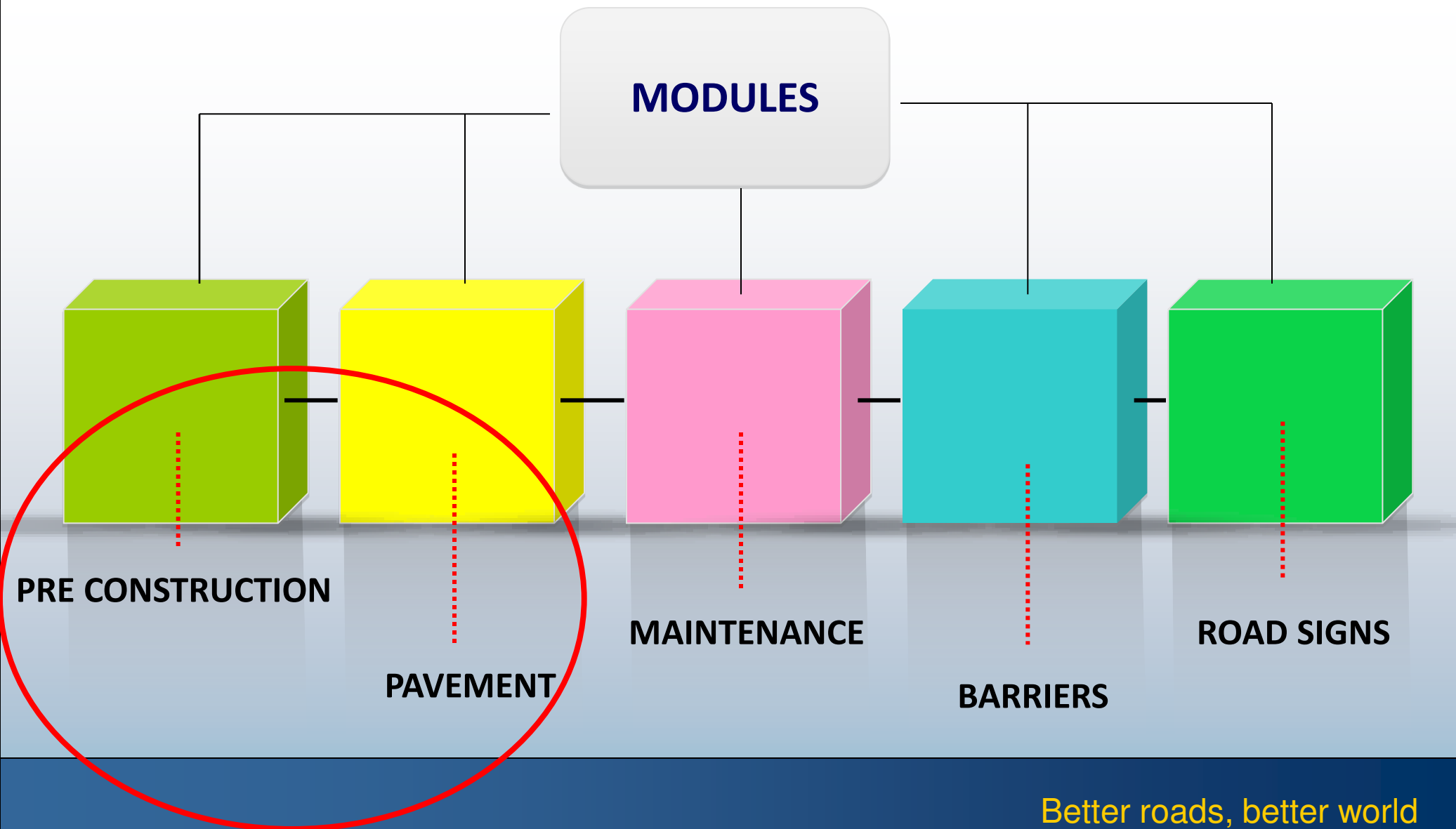
**BARRIERS**

**ROAD SIGNS**

## Structure of Modules







## PRE-CONSTRUCTION MODULE



File Edit Results Help

CHANGER  
Greenhouse gas Calculator

- Data Collection
  - Basic Data
  - Pre-Construction
    - Clearing and Piling
    - Cut Transport**
    - Fill Transport
  - On-Site Impacts
- Materials
  - Construction Material Quantity
  - Materials Transport
  - Road Construction Machinery
- Results
  - Pre-Construction
  - On-Site Impacts
  - Construction Materials
  - Materials Transport
  - Construction Machines
  - Consolidated Results

### Data Collection - Cut Transport

**Location 1**  
Distance :  km  
Weight :  t  
Transportation mode :

**Location 2**  
Distance :  km  
Weight :  t  
Transportation mode :

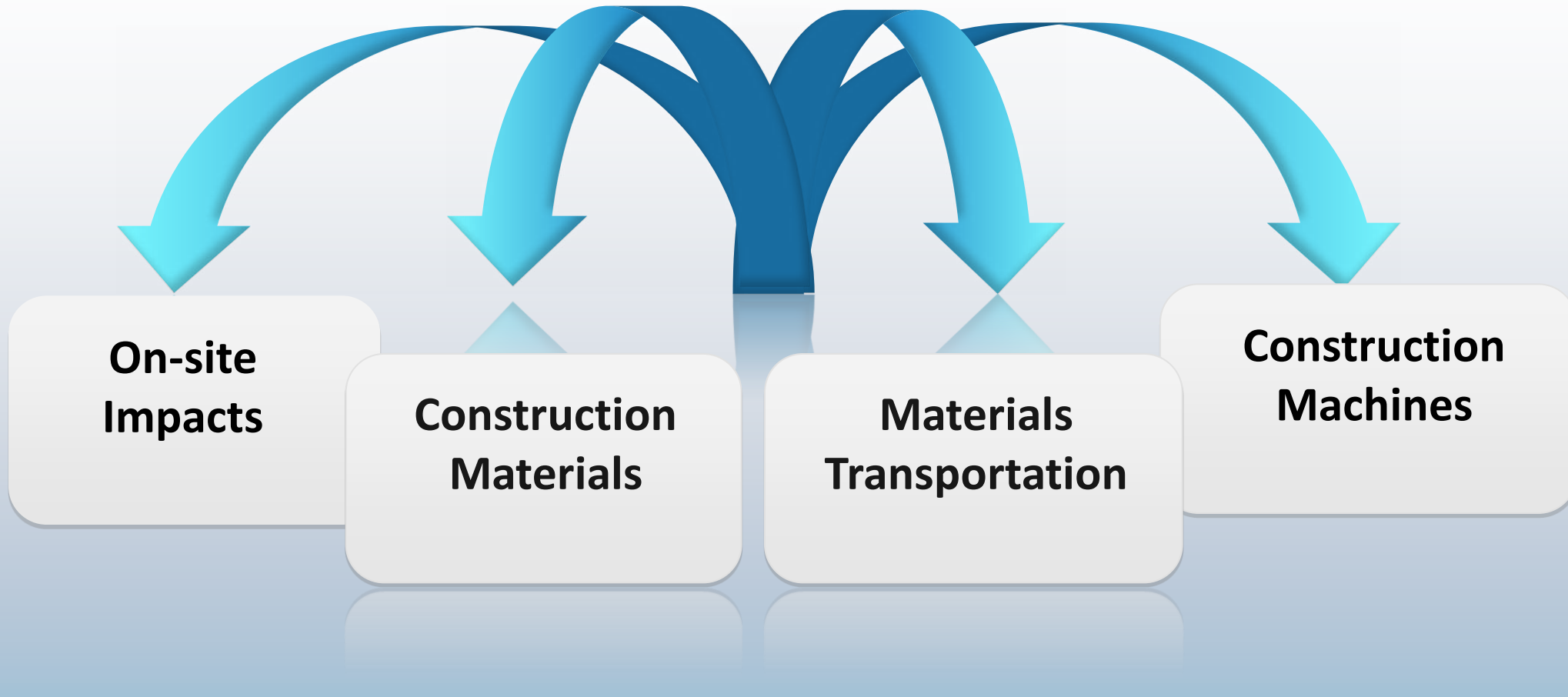
**Location 3**  
Distance :  km  
Weight :  t  
Transportation mode :

**Location 4**  
Distance :  km  
Weight :  t  
Transportation mode :

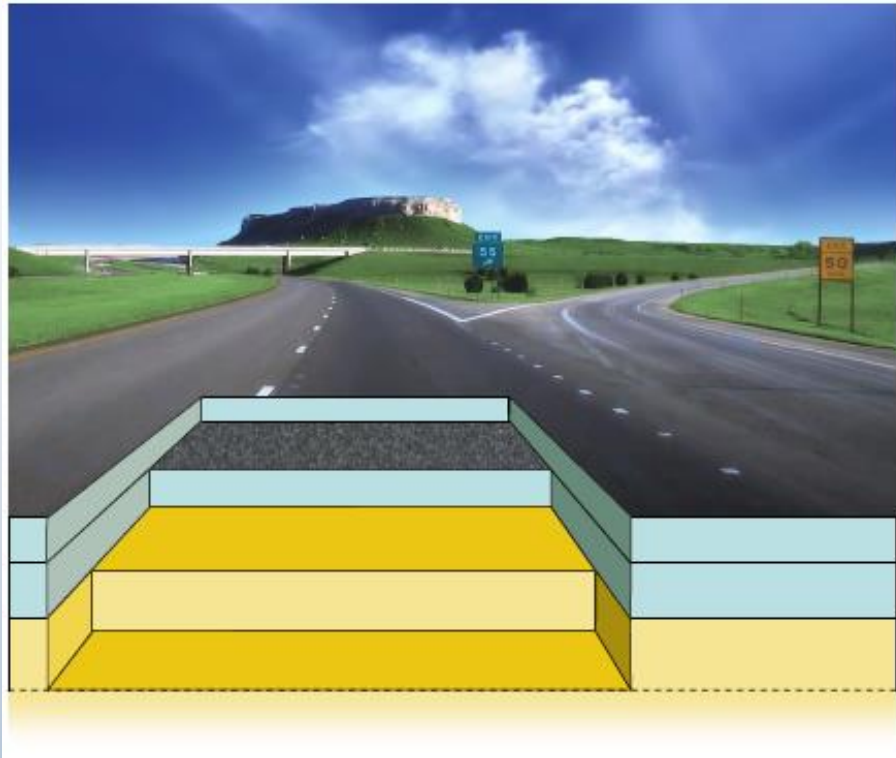
From Road Site To

- Light vehicles (1.5-3.5T)
- Truck (3.6-6T)
- Truck (6.1-10.9T)
- Truck (11-21T)
- Truck (21.1-32.6T)
- Rail - Diesel
- Rail - Electric
- Inland waterways

## PAVEMENT



## CONSTRUCTION MATERIALS



What type of  
materials?

What quantities?

### Materials - Construction Material Quantity



#### Step 1: Select category of material

Metals

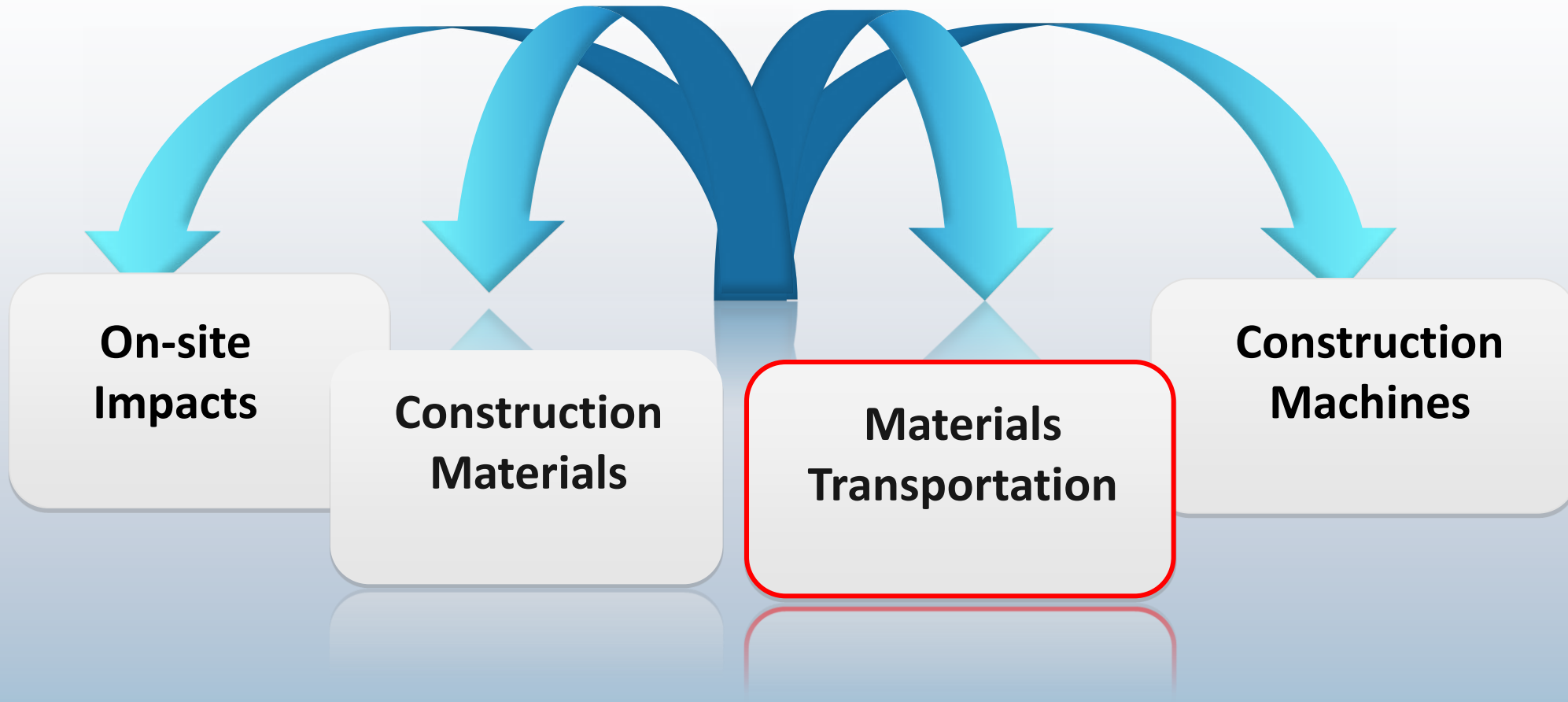
#### Step 2: Select material

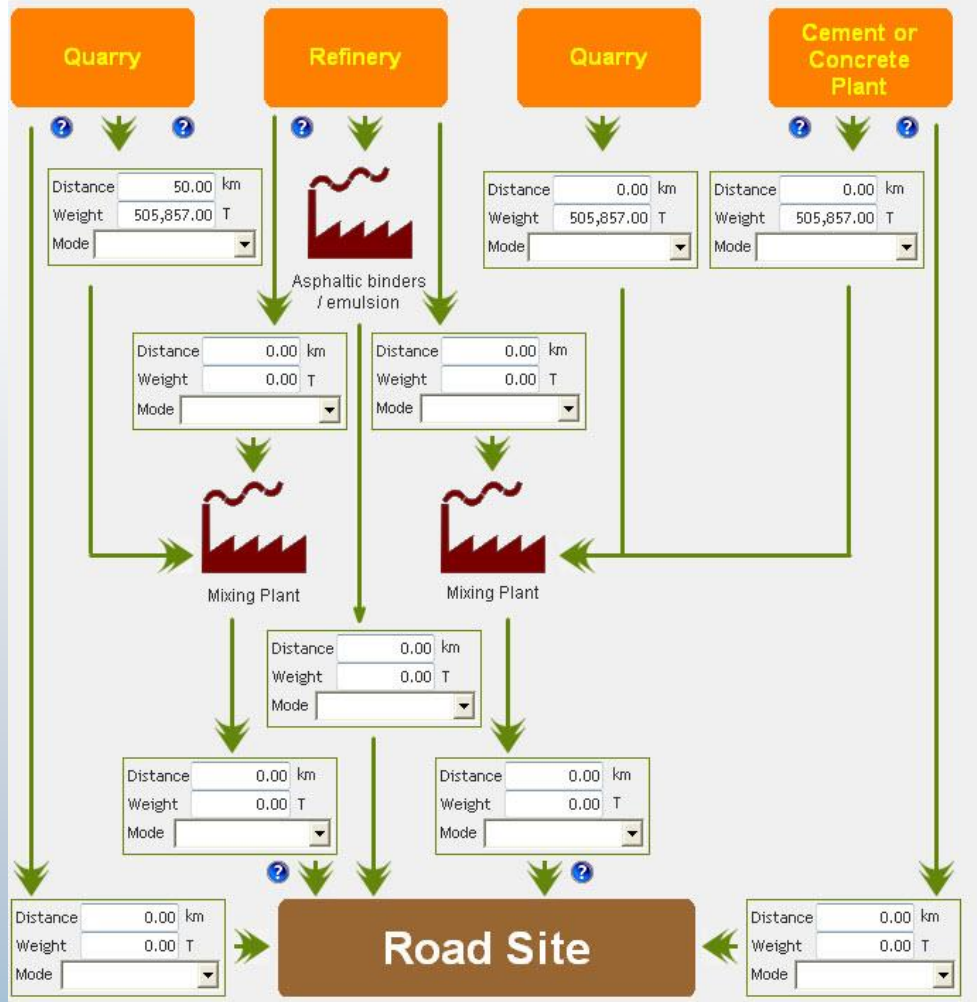
 Copper: General	 Copper: Recycled from Low-Grade Scrap
 Copper: Recycled from High-Grade Scrap	 Copper: Virgin
 Steel: General	 Steel: Predominantly Recycled

#### Step 3: Enter quantity of material

Materials	Categories	Quantity
 Polymer-modified bitumen (SBS, EVA, etc)	Bituminous Bound Mat	50 tonnes
 Recycled Aggregate	Unbound	10 tonnes
 Natural Latex Rubber	Rubber	5 tonnes
 Emulsion 60	Bituminous Bound Mat	15 tonnes
 Bitumen (Refinery)	Bituminous Bound Mat	300 tonnes

## PAVEMENT

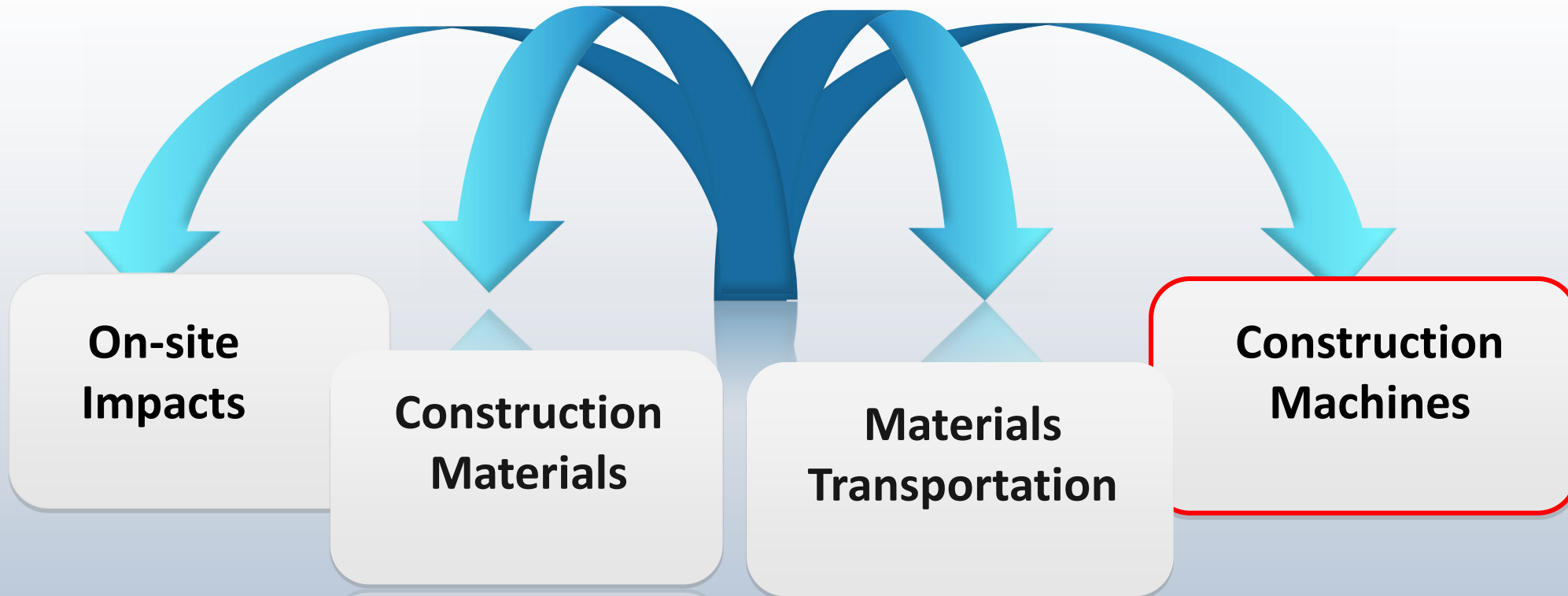




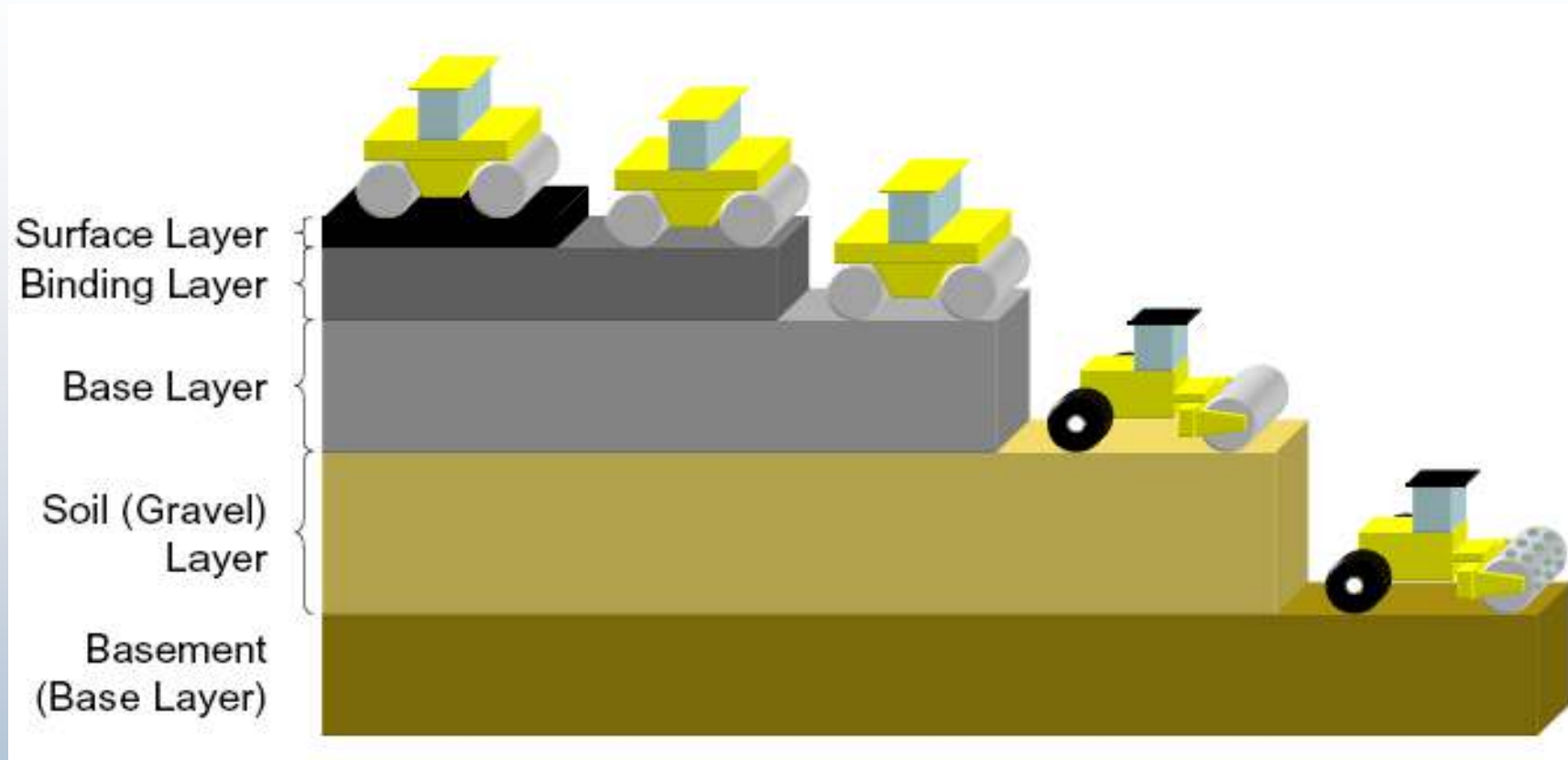
# Better roads, better world



## PAVEMENT



## CONSTRUCTION MACHINES



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- Data Collection
  - Basic Data
  - Pre-Construction
    - Clearing and Piling
    - Cut Transport
    - Fill Transportation
  - On-Site Impacts
- Materials
  - Construction Material Quantity
  - Materials Transportation
  - Road Construction Machinery
- **Results**

### Results



**Pre-Construction  
Emission**



**Onsite Electricity  
and Fuels**



**Construction  
Materials**



**Materials  
Transportation**



**Construction  
Machines**



**Consolidated  
Results**



### Results

Project name : Example  
Last update : 21/05/2010 14:31:52



#### Pre-Construction Emission

Total road area (paved) : 639580.00 m<sup>2</sup>  
Total road area (paved/unpaved) : 639580.00 m<sup>2</sup>  
Road length : 28.30 km

#### Clearing and Piling

Total fuel consumption (Diesel) : 613996.80 L 2414.26 t CO<sub>2</sub> - eq  
% Biofuel (0 - 100) : 0.00 % 0.00 t CO<sub>2</sub> - eq  
Vegetation : 31979.00 t.km 9.11 t CO<sub>2</sub> - eq

#### Cut Transport

T.km location 1 : 3760716.00 t.km 1071.69 t CO<sub>2</sub> - eq  
T.km location 2 : 0.00 t.km 0.00 t CO<sub>2</sub> - eq  
T.km location 3 : 0.00 t.km 0.00 t CO<sub>2</sub> - eq  
T.km location 4 : 0.00 t.km 0.00 t CO<sub>2</sub> - eq

#### Fill Transport

T.km location 1 : 3760716.00 t.km 1071.69 t CO<sub>2</sub> - eq  
T.km location 2 : 0.00 t.km 0.00 t CO<sub>2</sub> - eq  
T.km location 3 : 0.00 t.km 0.00 t CO<sub>2</sub> - eq  
T.km location 4 : 0.00 t.km 0.00 t CO<sub>2</sub> - eq

#### Onsite Electricity and Fuels

##### Electricity Usage

Total quantity of electricity purchased : 33168.00 kWh  
Country : United Kingdom  
Location :  
Emission Factor : 0.48 t CO<sub>2</sub> - eq / MWh  
Total emission t CO<sub>2</sub> - eq : 15.82 t CO<sub>2</sub> - eq

##### Transport Fuel Usage

Super Gasoline - Unleaded : 2194.65 L 6.51 t CO<sub>2</sub> - eq  
Diesel : 7084716.83 L 27857.41 t CO<sub>2</sub> - eq  
Liquefied Petroleum Gas (LPG) : 0.00 L 0.00 t CO<sub>2</sub> - eq



### Results

Project name : Example  
Last update : 21/05/2010 14:31:52



Wheel loaders : 0.00 L  
Staker / Telehandler : 0.00 L  
Forestry machines : 0.00 L  
Total road machines fuel consumption : 33128.50 L  
Biofuel (0 - 100) : 0.00 %  
Diesel : 33128.50 L  
Density : 830.00 t / m<sup>3</sup>  
Fuel weight : 27.50 t  
Emission Factor : 4.74 t CO<sub>2</sub> - eq / t material  
Diesel total emissions : 130.26 t CO<sub>2</sub> - eq  
Biofuel : 0.00 L  
Density : 830.00 t / m<sup>3</sup>  
Fuel weight : 0.00 t  
Emission Factor : 1.18 t CO<sub>2</sub> - eq / t material  
Biofuel total emissions : 0.00 t CO<sub>2</sub> - eq  
Total emissions : 130.26 t CO<sub>2</sub> - eq

#### Consolidated Results

##### Pre-Construction

A. Clearing and Piling  
Machines : 2414.26 t CO<sub>2</sub> - eq  
Vegetation : 9.11 t CO<sub>2</sub> - eq  
B. Cut transport : 1071.69 t CO<sub>2</sub> - eq  
C. Fill transport : 1071.69 t CO<sub>2</sub> - eq

##### Onsite Impacts

A. Electricity : 15.82 t CO<sub>2</sub> - eq  
B. Transport fuel usage : 27863.91 t CO<sub>2</sub> - eq

Construction materials : 21018.27 t CO<sub>2</sub> - eq  
Materials transport : 6669.44 t CO<sub>2</sub> - eq  
Construction machines : 130.26 t CO<sub>2</sub> - eq  
Total CO<sub>2</sub> equivalent emissions : 60264.47 t CO<sub>2</sub> - eq

## OUR TECHNICAL PARTNERS

**URS**

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Wilson**

**COLAS**  
Suisse

**ict**  
India

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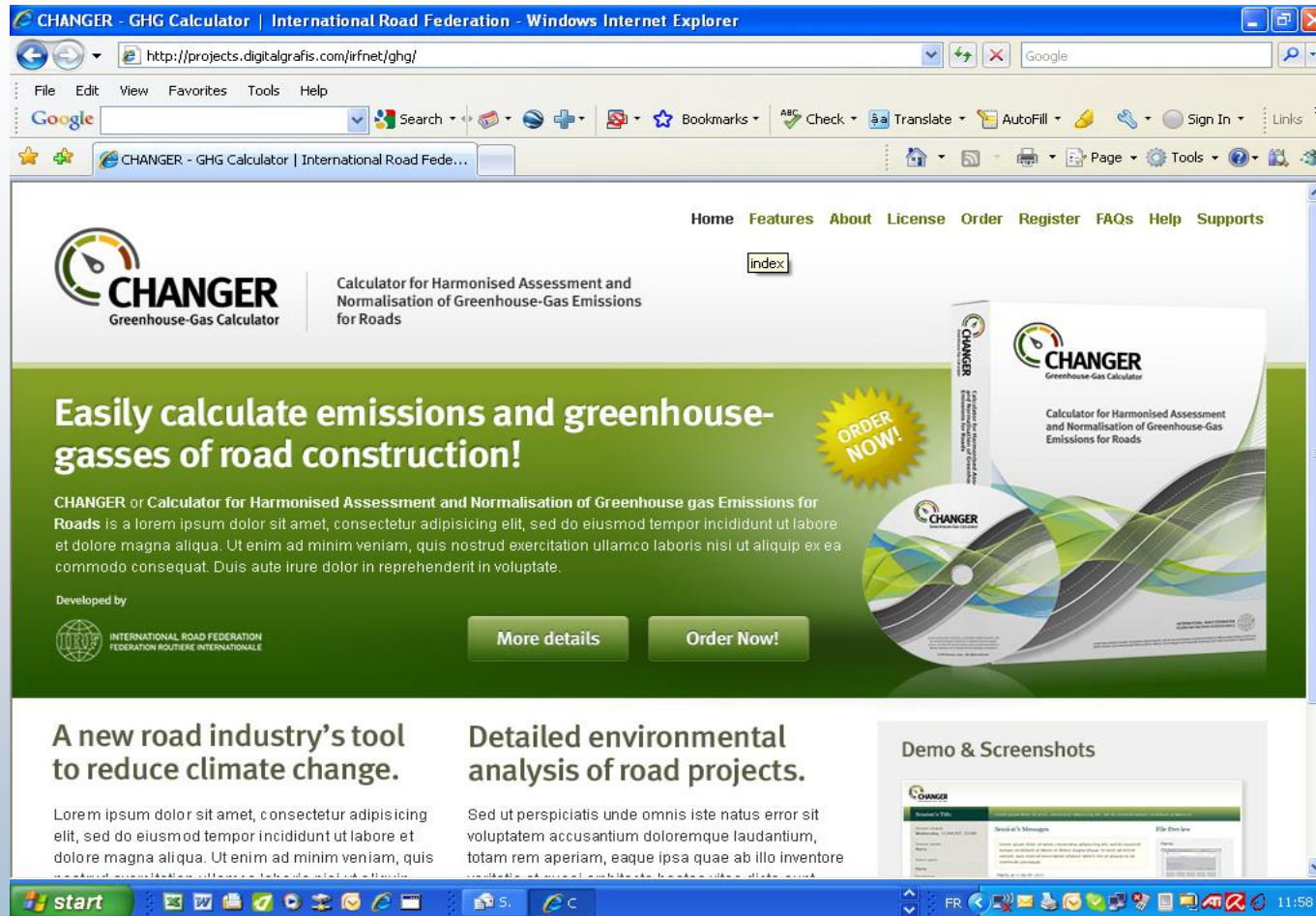
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**EPFL**  
ÉCOLE POLYTECHNIQUE  
FÉDÉRALE DE LAUSANNE



**VALIDATION**

## www.irfghg.org



CHANGER - GHG Calculator | International Road Federation - Windows Internet Explorer

http://projects.digitalgrafis.com/irfnet/ghg/

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CHANGER - GHG Calculator | International Road Federation

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**CHANGER**  
Greenhouse-Gas Calculator

Calculator for Harmonised Assessment and Normalisation of Greenhouse-Gas Emissions for Roads

**Easily calculate emissions and greenhouse-gasses of road construction!**

**ORDER NOW!**

CHANGER or Calculator for Harmonised Assessment and Normalisation of Greenhouse gas Emissions for Roads is a lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate.

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FEDERATION ROUTIERE INTERNATIONALE

**More details** **Order Now!**

**A new road industry's tool to reduce climate change.**

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**Detailed environmental analysis of road projects.**

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**Demo & Screenshots**

CHANGER

Windows Taskbar: start, S, C, FR, 11:58





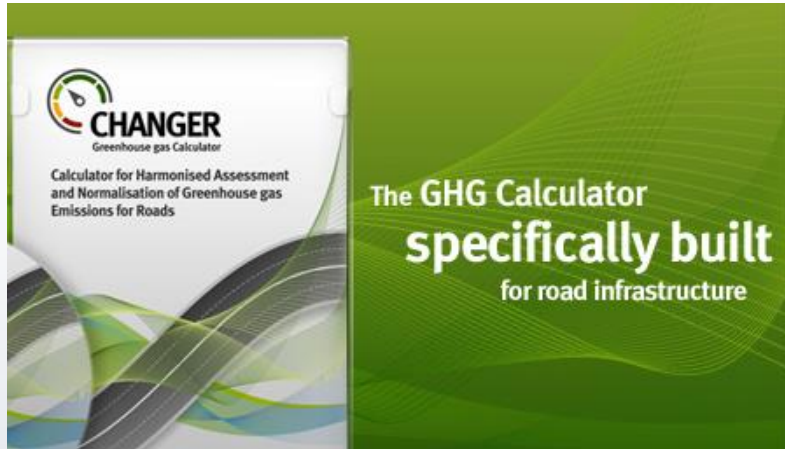
## **PART 2**

# **EXAMPLES OF CHANGER RESULTS**

## OVERVIEW

1. Widening of a trunk road in the UK
2. Public Private Partnership Highway construction in UAE
3. Highway upgrade schemes in India





## Some considerations

- Every sector is coming under pressure to evaluate current activities, practices and potential to **reduce emissions**.
- International financial institutions are looking at ways to include **compulsory GHG assessment** of projects in their tendering/lending procedures
- What has been lacking is a **common methodology** offering a credible and universally accepted system of measurement for defining strategy and monitoring progress.



**Thank you**  
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