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Achieving Sustainable Roads Through Asset Management and Pavement Design

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Life Cycle Carbon Emissions

The Whole Life Carbon of 1 km of road, is determined to be

- 2,659 tCO_2e for dual-3 lane;
- 2,014 tCO_2e for dual-2 lane; and
- 880 tCO_2e for single-2 lane carriageway.

The 'Material production' phase is determined to be the dominant carbon contributor across the whole life of a road.

- Followed by material transport
- Followed by road-lighting operation

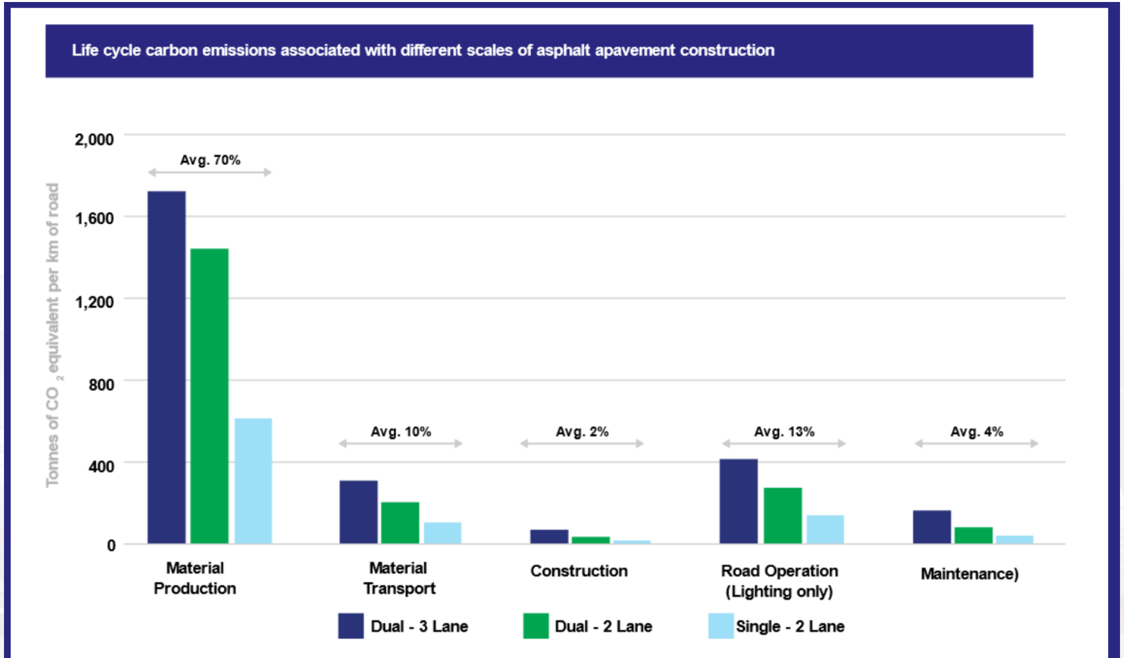

Figure 12 Life cycle carbon emissions

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Achieving Sustainable Roads Through Asset Management and Pavement Design

1. Background To TII Sustainability Policy
2. TII Pavement Asset Management
3. Pavement Engineering IAPDM
4. Materials
5. Lifecycle Analysis
6. Education

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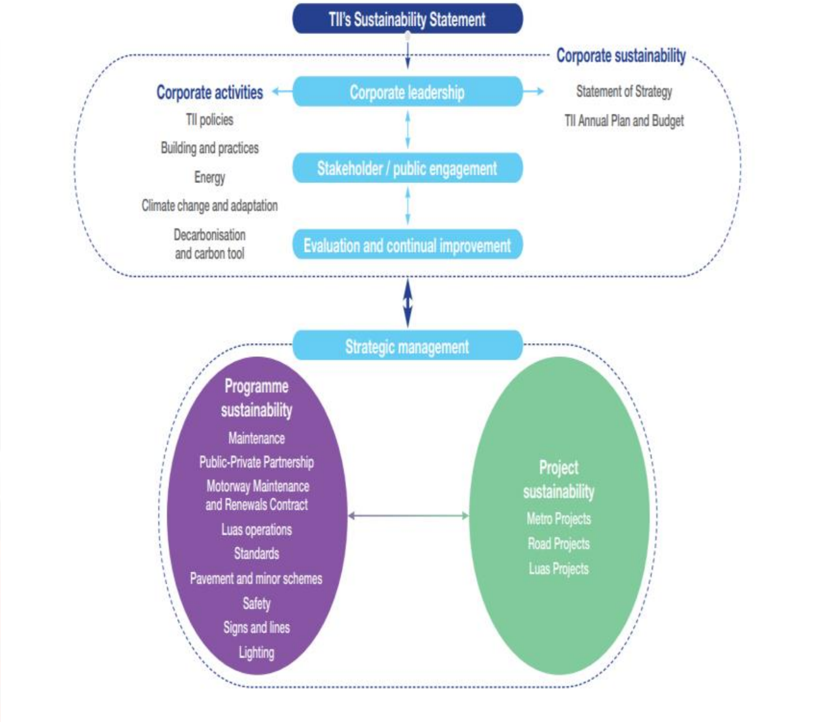


Principle 4 – Deliver End to End Improvements

Deliver enhanced whole lifecycle value through impact and influence on stakeholders, partners and suppliers.

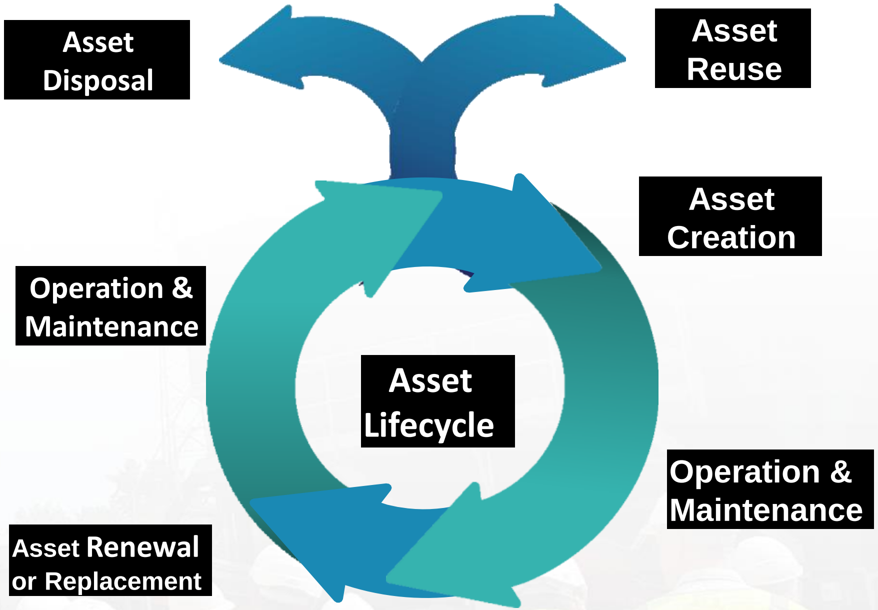
- Using fewer resources
- Using procurement to build total value
- Provide guidance to suppliers via Standards
- Work with suppliers and Stakeholders to find solutions
- Influence the use of sustainable materials and better design
- Taking a lifecycle view in procurement decisions

Principle 5 – Transition to Net Zero

- By decarbonizing our own activities.
- Reduce material use in construction, maintenance and operation
- Re-engineer our systems to optimize material use
- Better maintenance to repair, repair and refurbishment to increase the lifetime of our assets
- Pave the way to a circular economy.

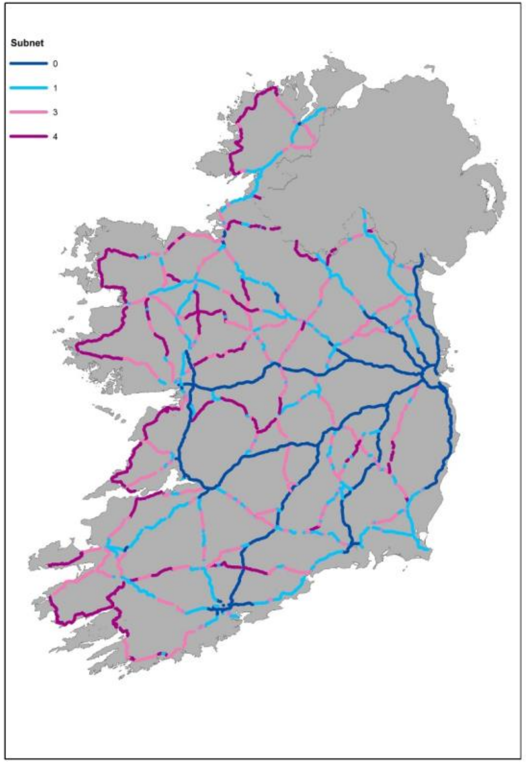
Asset Management Policy

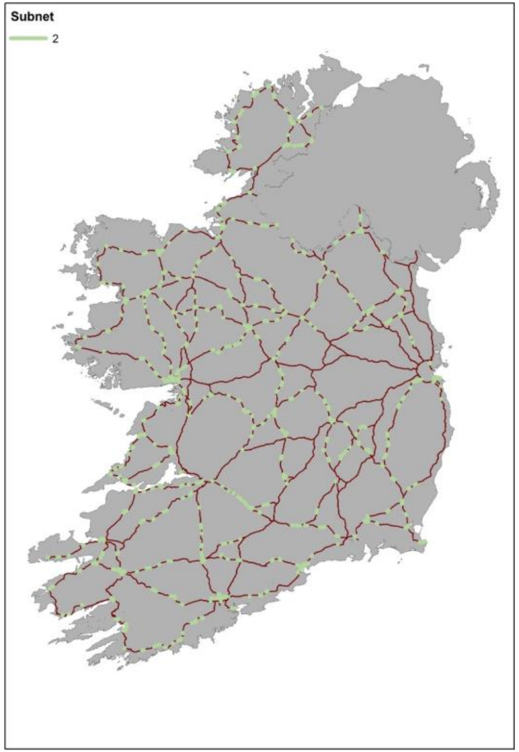
Assets will be managed in a sustainable manner through the development, implementation, and maintenance of an asset management approach ***that is risk-based and data-driven, enabling us to make informed decisions throughout the life of our assets."***



Good asset management requires coordinated and optimised planning throughout its lifecycle from development, creation, maintenance and ultimately disposal or renewal

Network Definition - Subnetworks





	Subnetwork	Length (km)	Classification
0	Motorways and Dual Carriageway s	1194	High speed, high volumes pavement made up of Motorway and Dual Carriageway sections of the network. Much of this subnetwork is less than 10 years old.
1	Engineered Pavement	1194	Significant geometric and pavement design has taken place in the construction and/or rehabilitation of the pavement sections. Typically carry reasonably large volumes of traffic and are identified by presence of hard shoulders adjacent to the carriageway.
2	Urban Pavement	688	Pavements running through urban areas, as defined by CSO polygons and/or speed limits
3	Legacy Pavement - high traffic	1258	Legacy subnetwork typically constructed without formal geometric or pavement design. Typically carries traffic volumes less than 5000 AADT.
4	Legacy Pavement - low traffic	984	Legacy subnetwork typically constructed without formal geometric or pavement design. Typically carries traffic volumes less than 2000 AADT.

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Network Definition

IRI

Category	Subnet 0	Subnet 1	Subnet 2	Subnet 3	Subnet 4
V. Good	<1.5	<2	<2.7	<2.7	<3
Good	1.5 to 2	2 to 2.5	2.7 to 3.2	2.7 to 3.2	3 to 4
Fair	2 to 2.5	2.5 to 3	3.2 to 4	3.2 to 4	4 to 5
Poor	2.5 to 3	3 to 3.5	4 to 5	4 to 5	5 to 7
V Poor	>3	>3.5	> 5	> 5	>7

Rut

Category	Subnet 0	Subnet 1	Subnet 2	Subnet 3	Subnet 4
V. Good	<3	<3	< 4	< 4	< 6
Good	3 to 5	3 to 5	4 to 6	4 to 6	6 to 9
Fair	5 to 6	5 to 6	6 to 9	6 to 9	9 to 15
Poor	6 to 9	6 to 9	9 to 15	9 to 15	15 to 20
V Poor	>9	>9	> 15	> 15	>20

LPV3

Category	Subnet 0	Subnet 1	Subnet 2	Subnet 3	Subnet 4
V. Good	< 1	< 1	< 2	< 2	< 2
Good	1 to 2	1 to 2	2 to 3	2 to 3.5	2 to 4
Fair	2 to 3	2 to 3	3 to 4	3.5 to 5	4 to 7
Poor	3 to 4	3 to 4	4 to 6	5 to 7	7 to 10
V Poor	> 4	> 4	> 6	> 7	> 10

Different levels of expectation for each subnetwork leading to:

- Different thresholds for condition class definitions
- Different intervention levels for maintenance treatments
- Different expected outcomes of maintenance treatments
- Different treatment costs and benefits

Pavement Engineering

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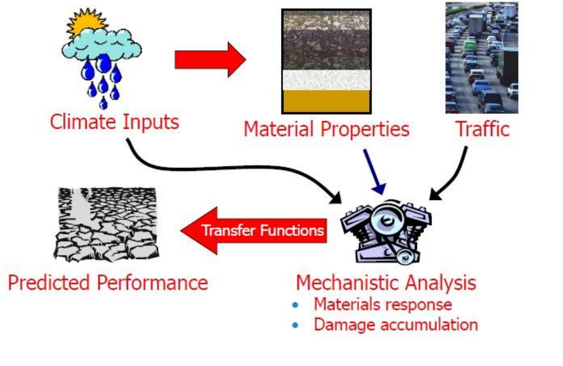
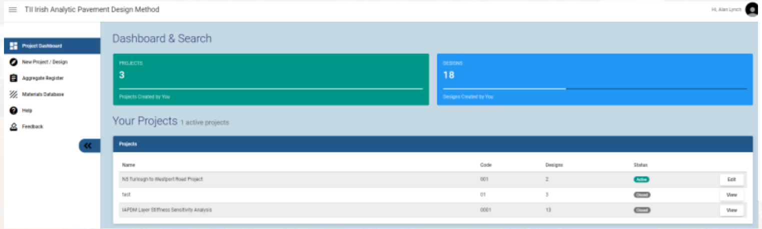
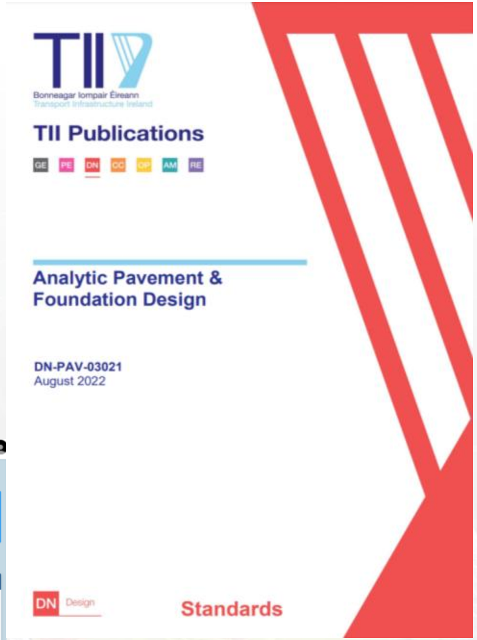
The IAPDM

- Mechanistic-Empirical Pavement Design
- Material performance characteristics
- Irish environmental and loading conditions
- Long term performance e.g. cracking, deformation
- Design models within a web-based user interface







Access – email address and mobile phone number to iapdm@tii.ie

Materials

Performance Related based Specification

- Laboratory Design criteria
- Works performance criteria
- Warm Mixes
- Cold Mixes
- In Situ Recycling
- Surface Dressing

Recycling

- AC up to 30% currently
- UGM up to 30% “A” No limit “B

Miscellaneous Products / Processes

- Surface Course Rejuvenators
- Crack Sealing and Joint Repairs

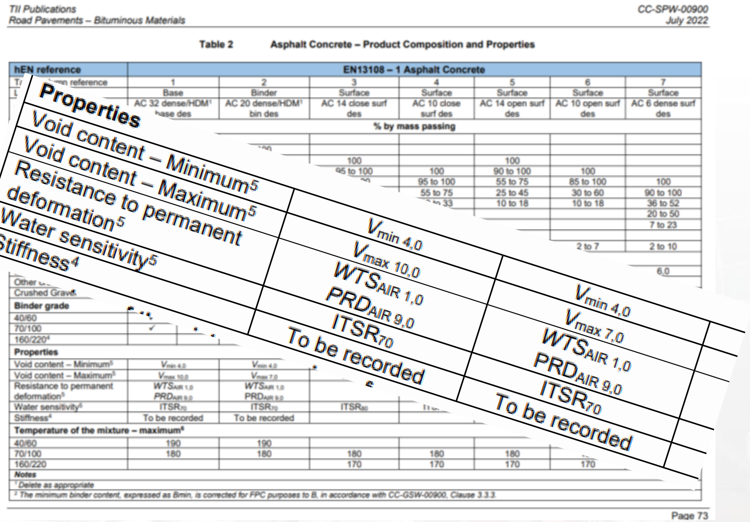

TII Publications
Road Pavements – Bituminous Materials
CC-SPW-00900
July 2022

Table 2 Asphalt Concrete – Product Composition and Properties

Properties		
Void content – Minimum[5]	$V_{min\ 4,0}$	$V_{min\ 4,0}$
Void content – Maximum[5]	$V_{max\ 10,0}$	$V_{max\ 7,0}$
Resistance to permanent deformation[5]	$WTS_{AIR\ 1,0}$ $PRD_{AIR\ 9,0}$	$WTS_{AIR\ 1,0}$ $PRD_{AIR\ 9,0}$
Water sensitivity[5]	$ITSR_{70}$	$ITSR_{70}$
Stiffness[4]	To be recorded	To be recorded

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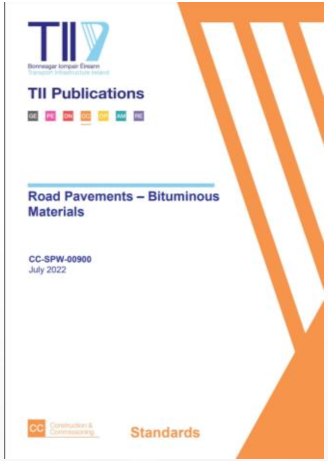
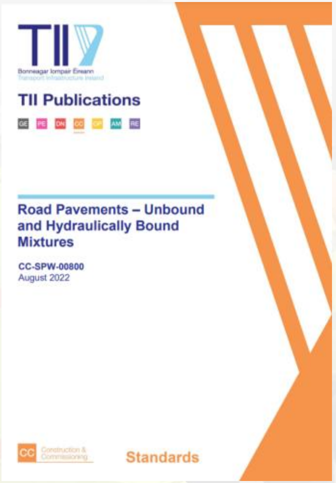
Table 2.7 UGM Works Requirements per Design Level

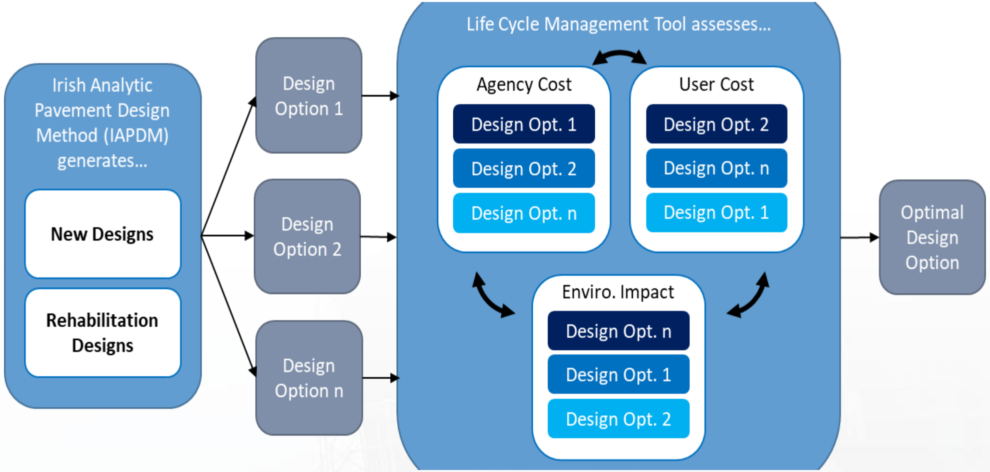
IAPDM Material Design Level	Works Requirement	
	Compaction	Design Performance
1	Yes	No
2	Yes	Yes

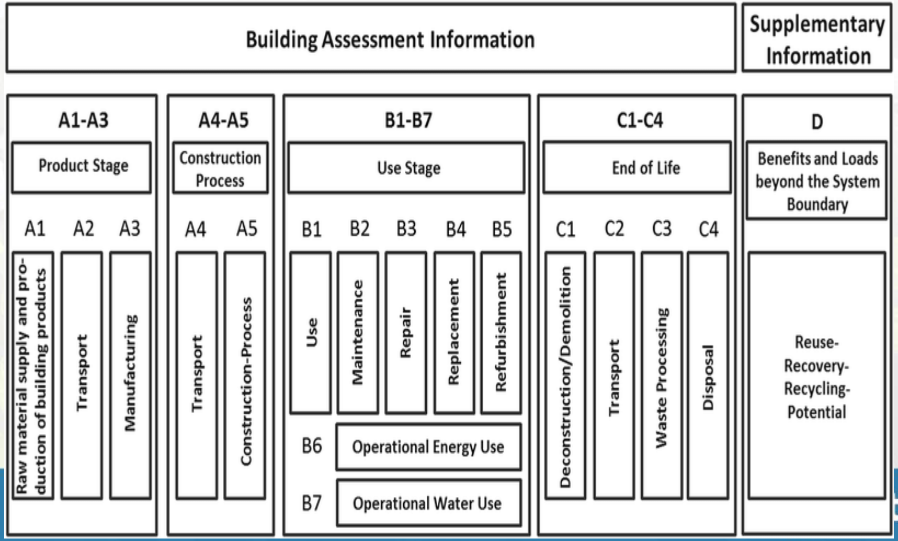




Lifecyle Management

- **Environmental Product Declarations**
  - Amount of energy used within the product lifecycle stages
  - **LCA Product**
    - A1 – A3 Manufacture
  - **LCA Project**
    - A4 – A5 Construction
    - B - Operational
    - C – Decommission
    - D - Reuse at end of life

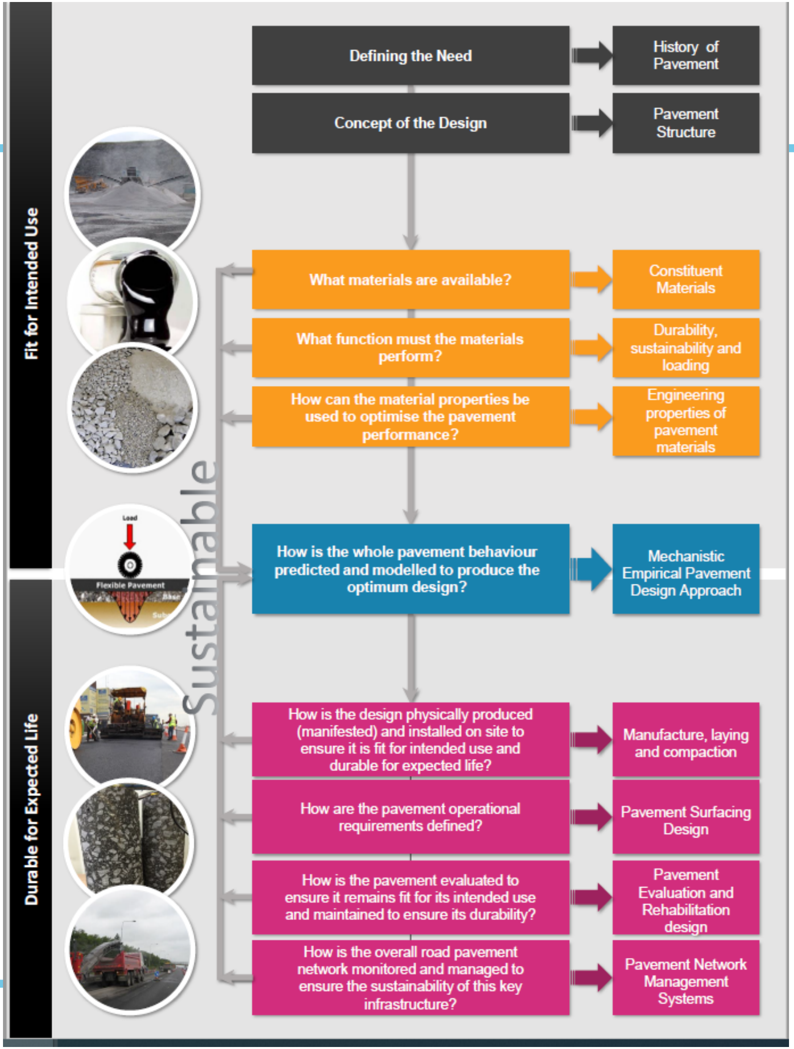




Education

"Fit for its Intended Use"

"Durable for its Expected Life"



IAPDM

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