

# HDM 4.2 Upgrade: Ensuring the centrality of resilience and climate change in Road Management : The road to HrDM 5.0

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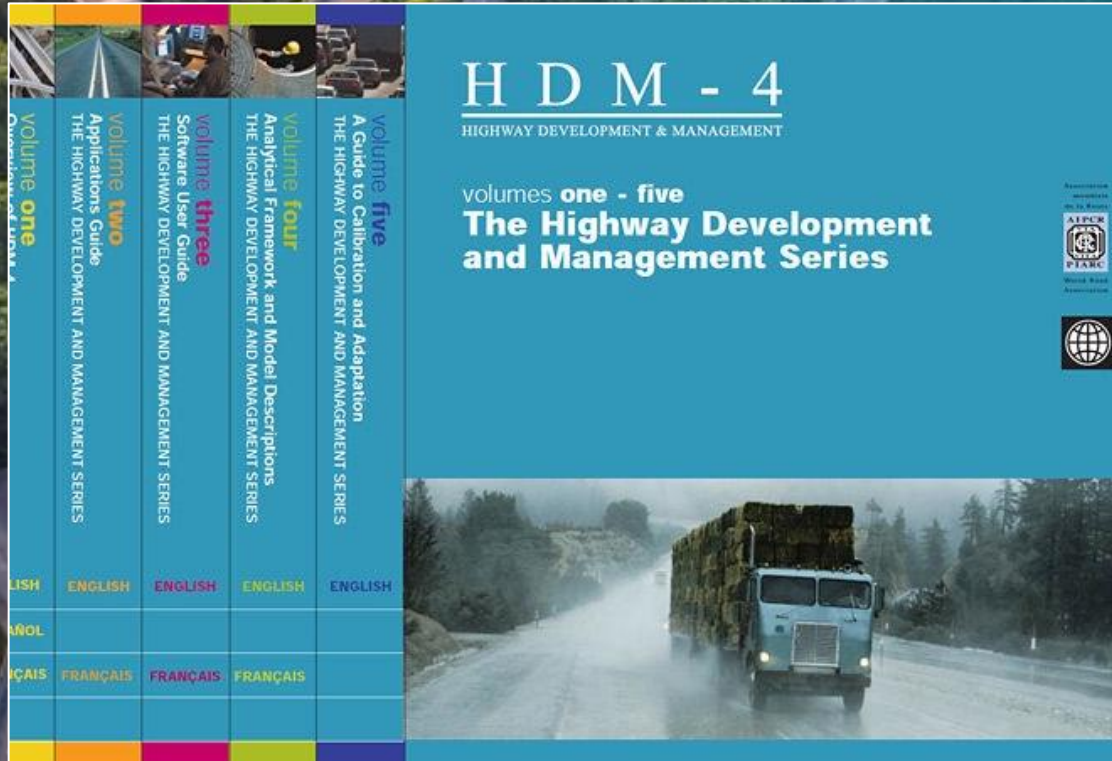
TRANSPORT GLOBAL PRACTICE

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Global Expertise and Knowledge Unit



**WORLD BANK GROUP**  
Transport

# AGENDA



- 1 What is the HDMM
- 2 Need for Change
- 3 Implementing change
- 4 Current Status
- 5 Next Steps

# 1 What is the HDMM



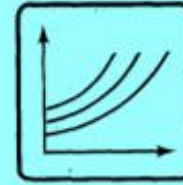
## 2. A Short History of the HDMM

- The first move towards producing a road project appraisal model was made in 1968 by the World Bank, in conjunction with the Transport and Road Research Laboratory (TRRL);
- The resulting Highway Cost Model (HCM) in 1971 was a considerable advance over other models used for examining the interactions between road work costs and vehicle operation costs;
- A major field study was undertaken in Kenya (1971-75) by the same partners led to the Road Transport Investment Model (RTIM) for developing countries in 1977, and the HCM model to become Highway Design and Maintenance Standards model in 1979 (HDM-I) – Both based on a mainframe;
- Further work in a number of countries (Caribbean, India, Brazil) to extend the geographic scope of the models, led to the RTIM2 model and HDM-III in 1987 – both PC based;
- Further development led to HDM-PC (1989), HDM-Q (1993) and HDM-Manager (1994).

THE HIGHWAY DESIGN AND MAINTENANCE STANDARDS SERIES

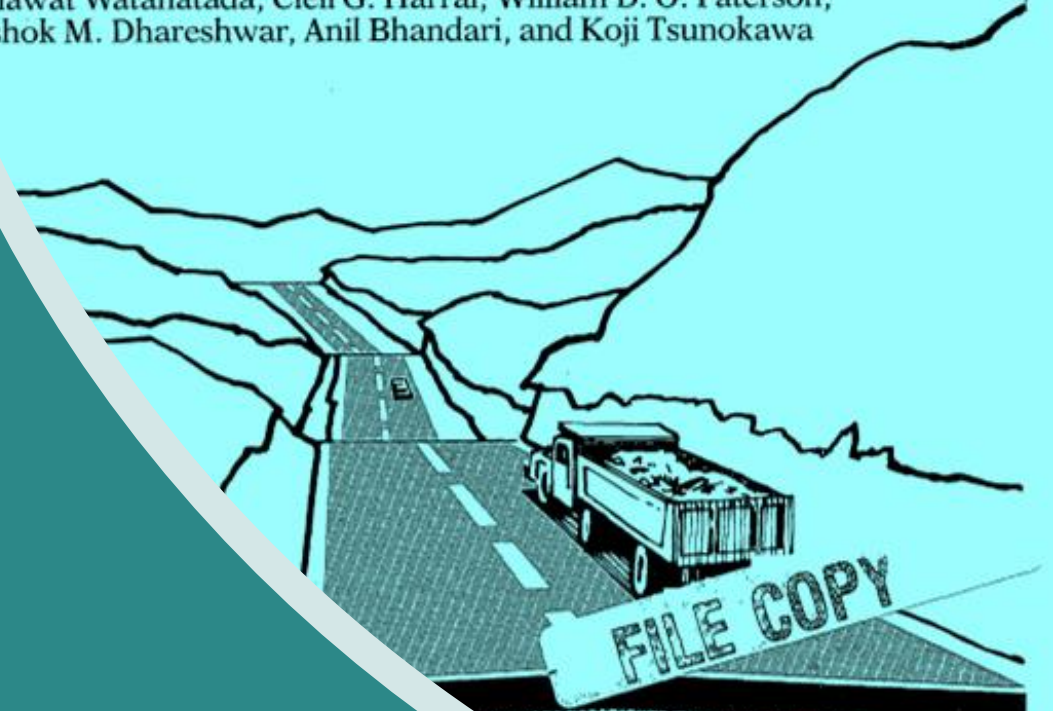
9951  
VOL. 1

### The Highway Design and Maintenance Standards Model



*Volume 1  
Description of the HDM-III Model*

Thawat Watanatada, Clell G. Harral, William D. O. Paterson,  
Ashok M. Dhareshwar, Anil Bhandari, and Koji Tsunokawa



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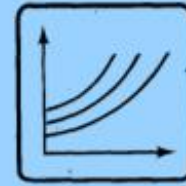
## 2. A Short History of the HDMM

- By 1993, the models had been extensively used, but there was a need to incorporate the extensive research that had been undertaken over the previous ten years.
- Moreover, whilst the models had been mostly used in developing countries, industrialized countries also started to make use of the models. This resulted in the need for additional capabilities to be introduced.
- The International Study of Highway Development and Management Tools (ISOHDM) was set up in 1993 to extend the scope of HDM-III.
- This led to the development of HDM-4 version 1 in 1999, and HDM-4 Version 2 in 2005.

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### The Highway Design and Maintenance Standards

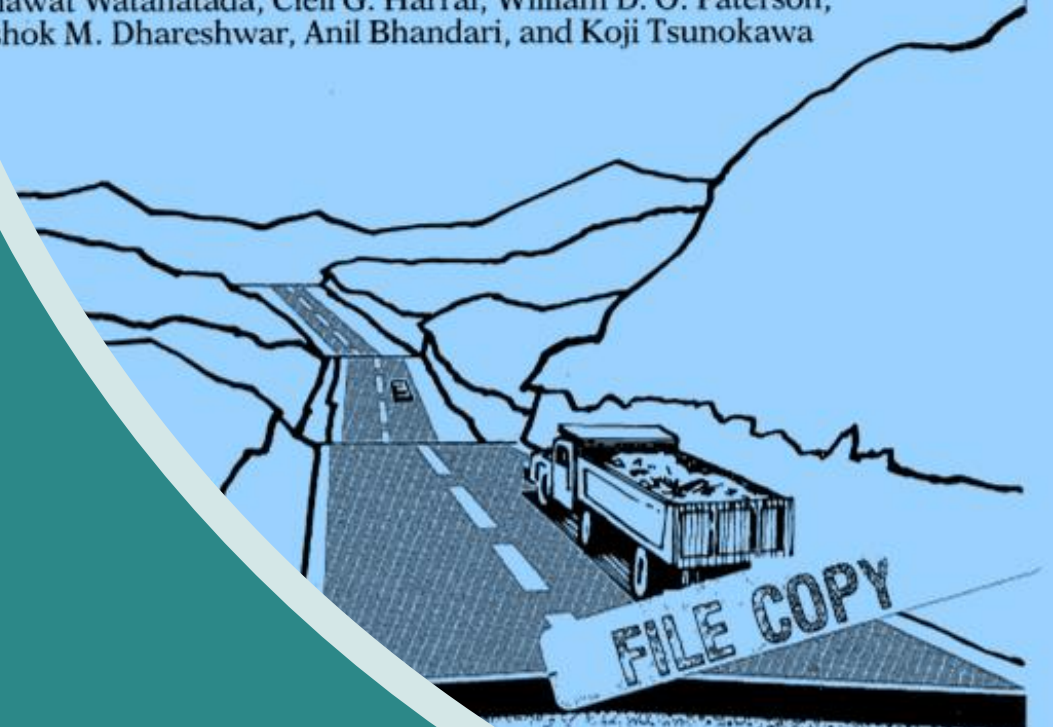


Model

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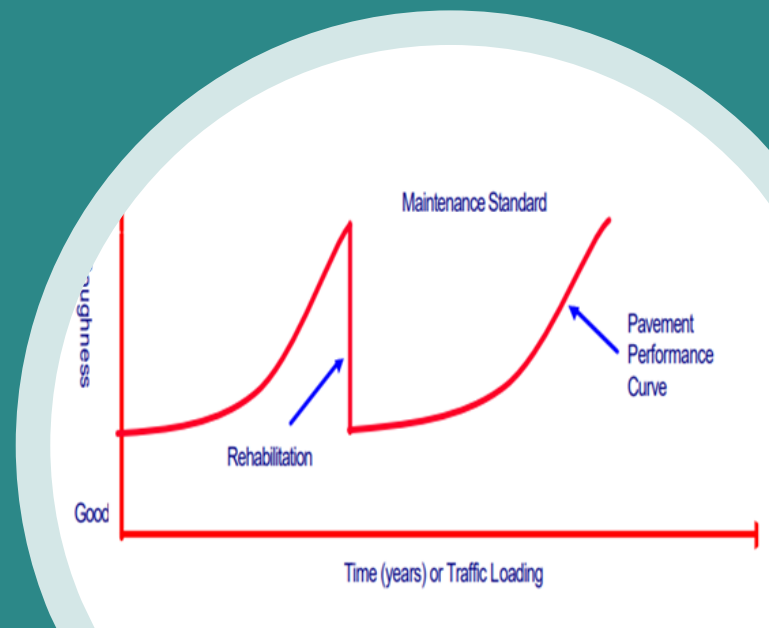
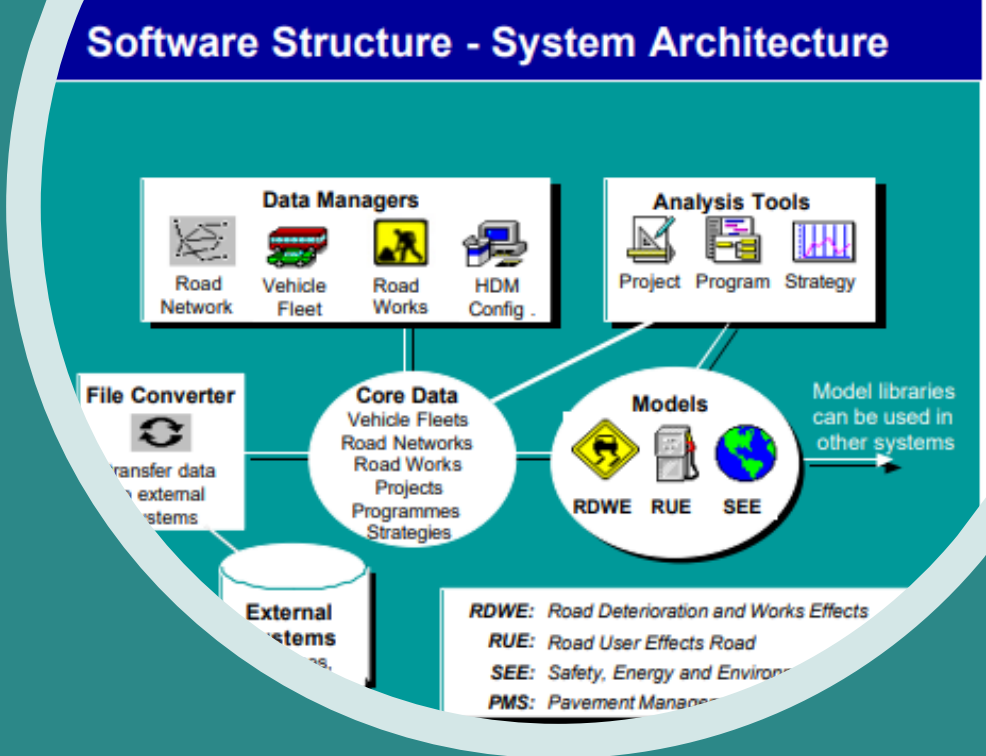
# 1. What is the HDMM?

- The HDMM (HDM4 version 2 in its latest iteration) is a pc based software package and associated documentation for road authorities around the world;
- It is intended to serve as **the primary tool** for the strategic analysis, planning, and appraisal of investment decisions on the road network at three levels:
  - **Strategic Level Analysis** of the whole network for longer term budget planning under different budget scenarios, different maintenance strategies, to optimize expenditures.
  - **Program Level Analysis** in the form of the definition of a single or multi-year rolling work maintenance program under a defined budget constraints.
  - **Project Level Analysis** to assess the financial and economic feasibility of specified project alternatives against a base case (do nothing).



# 1. What is the HDMM?

- How does it do this:
  - Calculates the structural performance of pavement;
  - Includes a life cycle prediction of deterioration, given maintenance, weather, fleet composition and traffic levels;
  - The CBA assesses road user costs and benefits and agency costs and benefits over the project life.



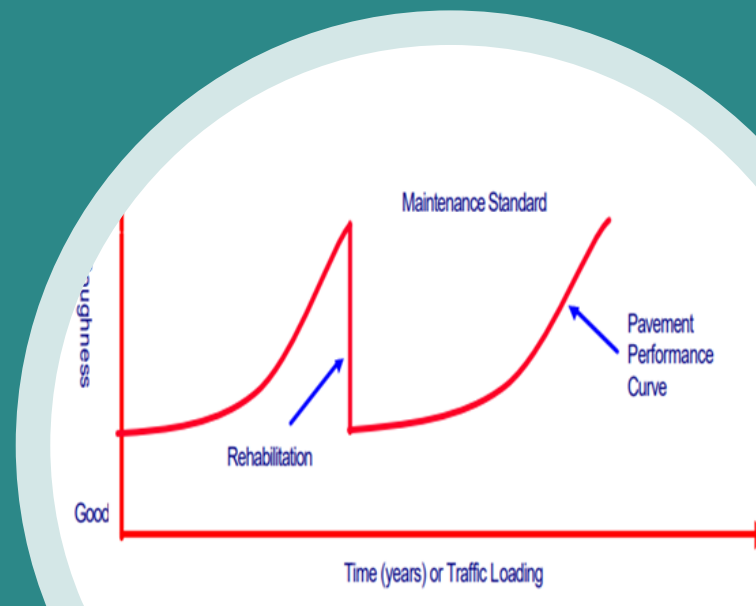
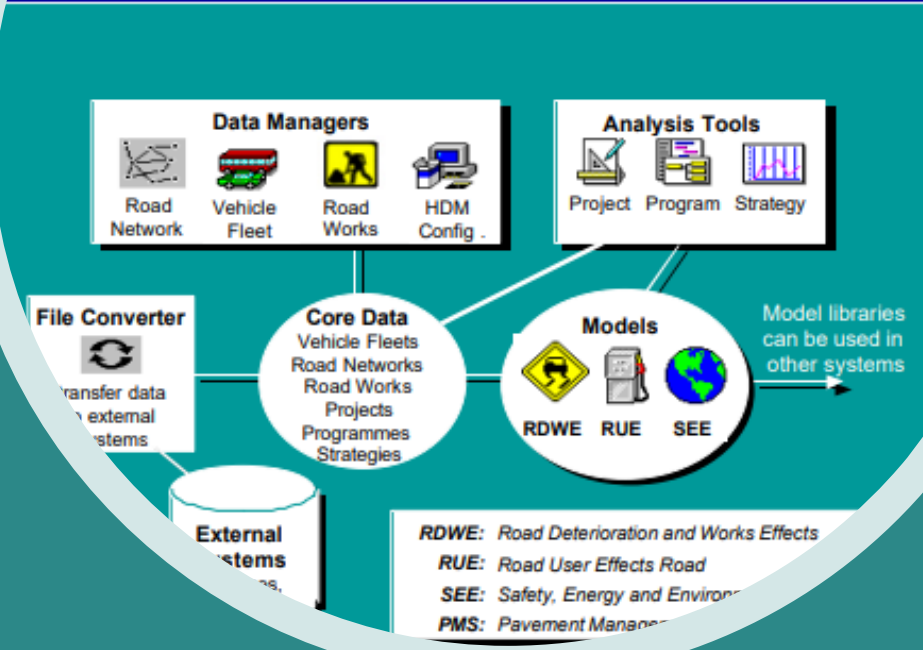
# 2 The need for change





# 2. The Need for Change

- 67 countries around the world currently hold the license for the existing software;
- Seen as commercially independent, cheaper than proprietary alternatives;
- Pre-requisite to the provision of finance to client countries by a number of MDBs, including the World Bank, ADB, EIB, AfDB, JICA.
- WB currently has 162 active transport projects in its portfolio amounting to US\$31 billion, of which approx. US\$ 20 billion are for connectivity (inter-urban and rural).
- Pipeline of connectivity projects is US\$18 billion over the next 3 years



## 2. The Need for Change

Since 2005, the demand for change was increasing due to the following *inter alia*:

- Declining trend in sales over the last 10 years indicated a need for action
- The current license period was coming to an end;
- There was little institutional incentive to update;
- Written for a PC based platform – Windows XP – losing a lot of research opportunities from a different modality; and
- Computing power has advanced so much.



## 2. The Need for Change

Since 2005, the functional needs of the HDMM have also grown including *inter alia*:

- PDWE Models were deterministic (not probabilistic);
- change in climate;
- need for greater resilience;
- Need to consider Stage 1 and Stage GHG emissions;
- road safety benefits;
- tertiary roads;
- vehicle Fleet;
- wider economic benefits; and
- indexing of the real value of time and life.





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# Implementing change



### 3. The Governance Structure



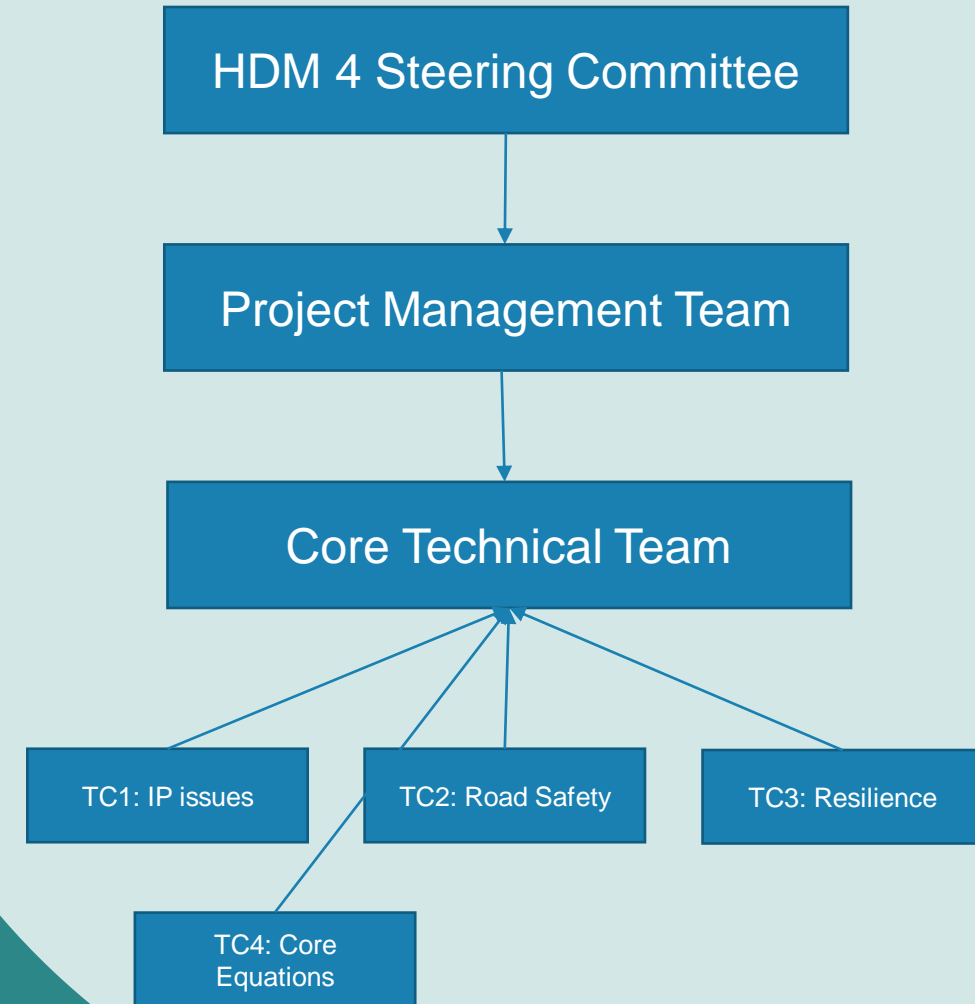
An agile Steering Committee (SC) oversees the upgrade and provide strategic direction to the work program;



Membership of the SC is restricted to partners who have provided support directly or in kind – Chaired by WB, UK FCDO, ADB, PIARC, EIB, AfDB (tbc);



A number of Technical Committees have met/are meeting – the process involves the TCs making recommendations to the CTT who will consider how best to reflect the recommendation in the core equations;



### 3. Tasks 5 -7 . Technical Committees established and Scoping Papers produced



Chairs/Co-Chairs of TCs identified as needed to prepare Scoping papers in the key topic areas.



Road Safety – Draft Scoping Paper available – TC meeting held in April 2023– paper now with Core Technical Committee;

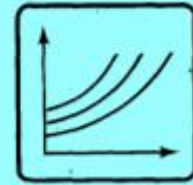


Resilience – module for HrDM-5 is being prepared by the University of Oxford, with the support of the FCDP CCG program; and



Meeting of the Resilience TC to be arranged in May 2024.

## The Highway Design and Maintenance Standards

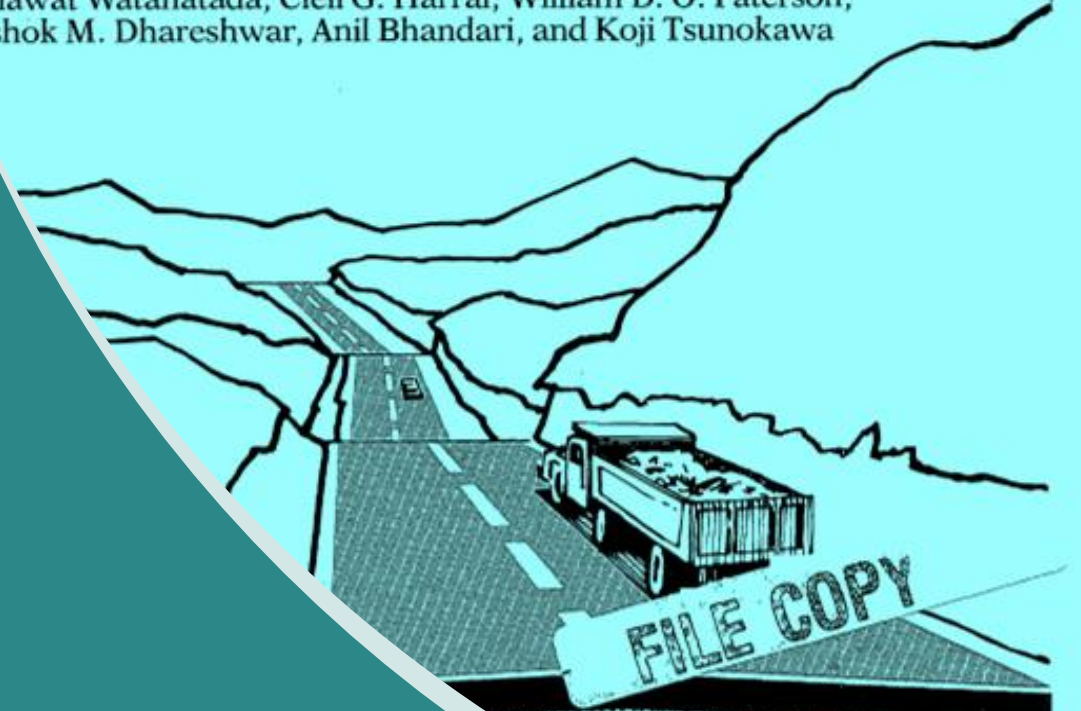


### Model

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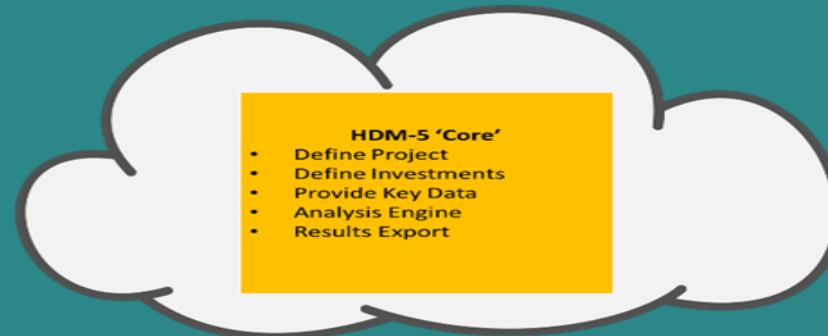


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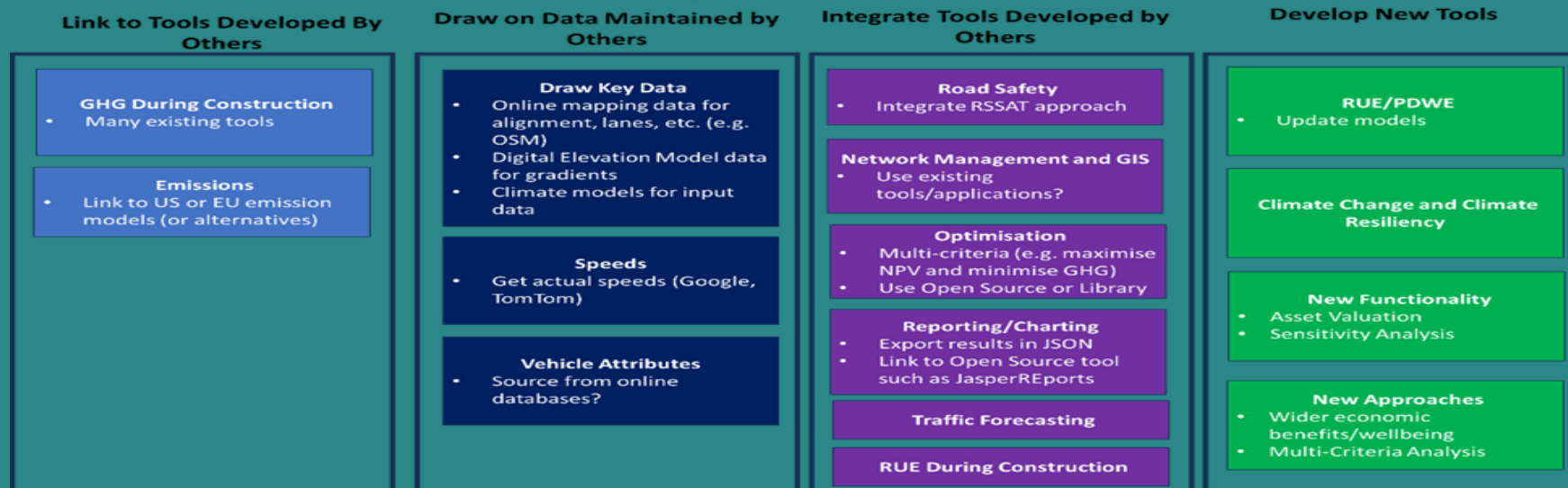
# Current Status



# 2. Current Progress – DRAFT Conceptual Approach for developing the HrDM-5.0 Software – Project Analysis



Browser based interface. Applications and tools are seamlessly integrated so users only have a single interface to work through. Cloud operations optional?





## 2. Implementing change : The Legal Review

Search for a soft copy of the memorandum of agreement (MoA) regarding Intellectual Property of HDM-4 from 1998 to 2000. No body could not find a copy, we proceed without it. To handle Intellectual Property (IP) rights in future, the WB Lead Counsel suggested the following approach:

1. Draft a new MoU to be signed by all financial contributors that nullifies the previous one and agrees the following step; and

2. We would establish a new robust technology transfer agreement, that would transfer the IP rights as part of the license to the consortium/firm/entity procured to undertake the construction of the IT architecture.



## 2. Implementing Change: Tasks 2-3



Task 2: Survey of Users –complete (funding – HVT – UK FCDO)



Task 3: Detailed Business Plan – complete (funding HVT – UK FCDO)

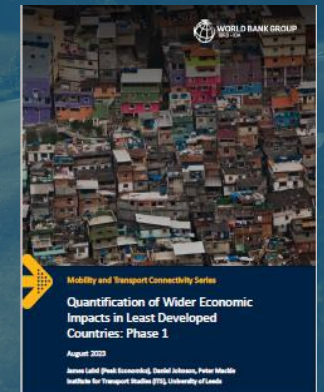
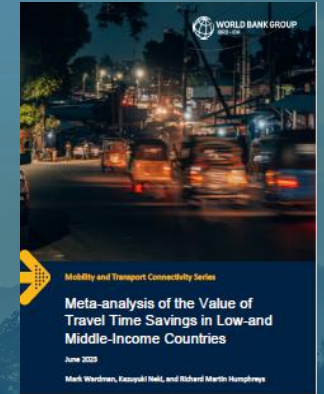


Task 4: Core Technical Team Established – Meeting held in August 2023 and December 2023. Next meeting as needed



## 2. Current Progress - Complementary Work

- 1. A meta-analysis of the Value of Time (VoT) studies** for passengers for all modes globally, with the emphasis on MDB client countries as an extension to a similar European wide study undertaken earlier, has been undertaken. This builds on and extends earlier work funded by the EIB. Complete;
- 2. A similar meta-analysis of all work on Freight VoT** (road, rail and IWT) will be commissioned, again with the emphasis on MDB client countries, but not ignoring the evidence from Part 1 countries. A similar study in June 2021 did this exercise for 23 countries, but only 4 of our countries (China, India, Brazil and Indonesia), so hardly representative. Additional primary research was needed here. Delayed. Funded in kind by the ADB;
- 3. A similar meta-analysis of all work on Value of Statistical Life (VoSL)** is being undertaken in house (road, rail, public transport etc.), again with the emphasis on MDB client countries, but not ignoring the evidence from Part 1 countries. The statistical modelling has been completed, now needs to be written up. This work has been supported by a WB Trust Fund, and is now complete (Said?); and
- 4. A Scoping Paper on the inclusion of wider economic benefits** involving a literature review, assessment of applicability to Less Developed Countries (LDCs), transferability to specific types of projects, and initial guidance in terms of parameters for HDM-4 and for more general guidance, together with research needs is available in draft, excepting a case study. Phase 1 Complete, Phase 2 underway.



A stack of papers with green and brown folders, partially obscured by a teal graphic overlay. The teal overlay features a white dotted pattern and a white silhouette of a person's head and shoulders. The number '5' is prominently displayed in a bright green color.

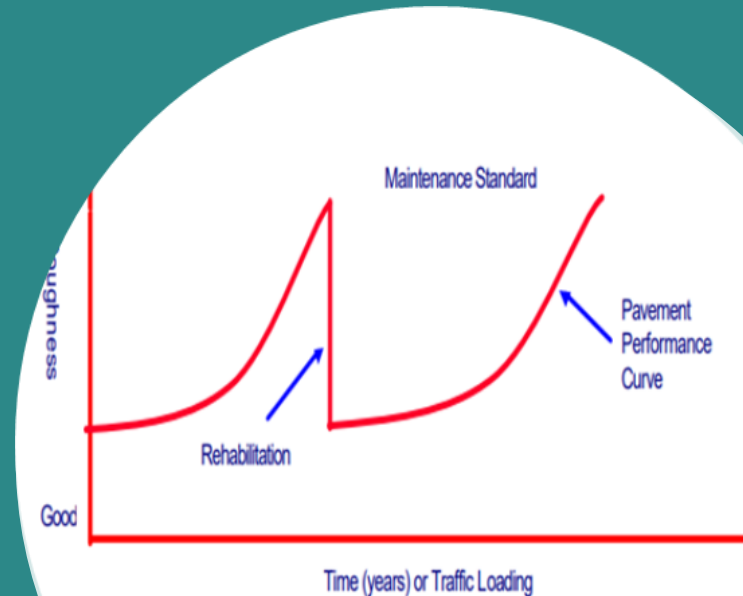
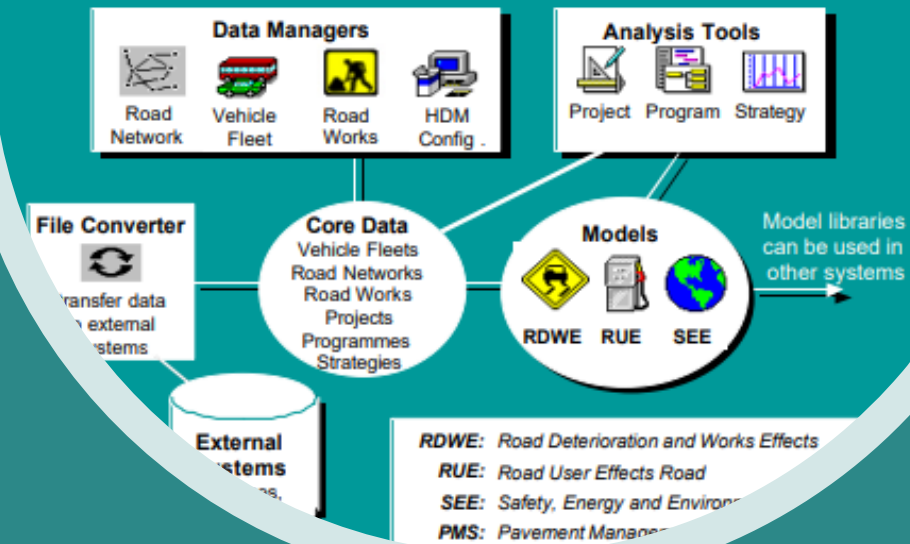
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# The Next Steps

# 5. The Next Steps: Procurement

Six complementary assignments are underway or under procurement:

- i. Gap Analysis - PDWE – Survey: 30 years of research, different pavement types, pavement technologies (polymer, recycling, waste streams) at RFP stage (WB funding).
- ii. Gap Analysis of Rd User & Env effects (RUE) – RFP stage (HVT funding);
- iii. Gap Analysis & Functional Review - system and software and propose improvements to MVP – RFP stage (HVT funding)
- iv. Gap Analysis & Functional Review – Fuel and Tyres– RFP stage (HVT funding)
- v. Gap Analysis & Functional Review – Capital– underway (WB funding)
- vi. ToR for the main licensee (Design, Build IT Architecture, Beta Testing, Rollout, Operate, Transfer) is at EOI stage (Bank executed with support of Japanese Government (and others).



# 5. The Next Steps

1. TC meeting on Resilience in May 2024
2. Contact management for the following TORs:
  - i. GA and updating PDWE
  - ii. GA and updating RUE – capital
  - iii. GA and updating RUE – Fuel and emissions
  - iv. GA and updating Functional Requirements
  - v. GA and updating Tyres and Emissions
  - vi. Main TOR – DBOT (5/7 years)
3. Next SC meeting to be scheduled Late May 2024

