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ICMPA9 • International Conference on Managing Pavement Assets

Taking the Namibian Road Management System to the next level

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AASHTO THE VOICE OF TRANSPORTATION

VirginiaTech Transportation Institute

TRB

U.S. Department of Transportation Federal Highway Administration

WORLD ROAD ASSOCIATION MONDIALE DE LA ROUTE 1909-2009

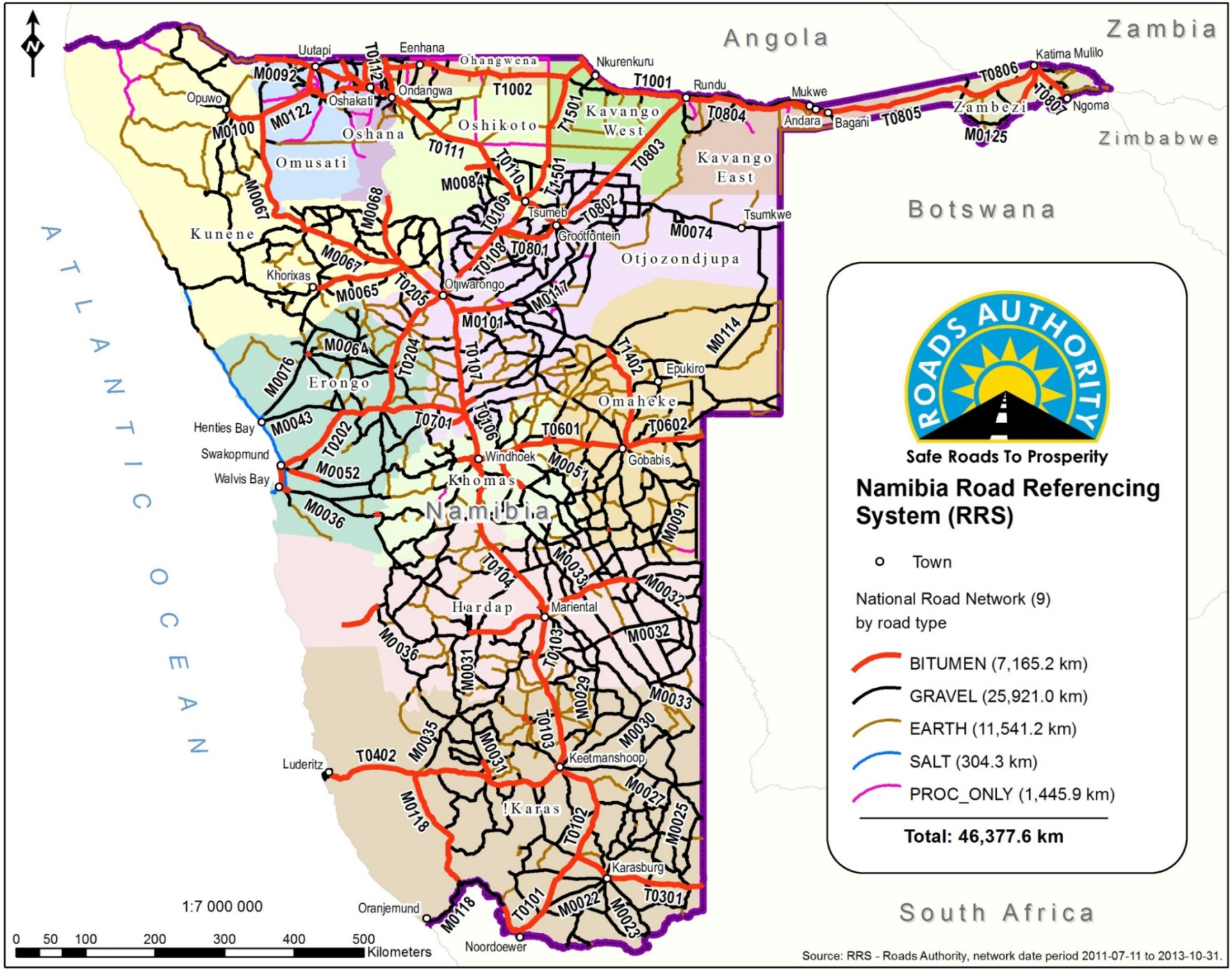
VDOT Virginia Department of Transportation

SCOPE OF PRESENTATION

1. **INTRODUCTION NAMIBIA**
2. **BACKGROUND TO THE ROAD SECTOR REFORM AND INTRODUCTION TO THE RMS**
3. **DATA COLLECTION, ANALYSIS AND EXAMPLES OF OUTPUT**
4. **NETWORK INTEGRATION MODULE (NIM)**
5. **TAKING THE NAMIBIAN RMS TO THE NEXT LEVEL**
6. **FUTURE DEVELOPMENT**
7. **CONCLUSION**

1. INTRODUCTION - NAMIBIA

- Area of 825,418 Km^2
- 34^{th} biggest country
- Least densely populated country in the world (2.5 persons per km^2).
- Average ann. rain fall 500mm; population 2mill
- The GDP ~ US$ 12 billion, with inflation rate of 5% per annum.
- 1US$=11.0 N$=South African Rand
- Independence from South Africa in 1990.
- 1^{st} Country in Africa to use electronic voting system for elections– Nov 2014


Angola
Zambia
Zimbabwe
Botswana
South Africa
ATLANTIC OCEAN
Namibia
Uutapi
Eenhana
Ohangwena
Nkurenkuru
Katima Mulilo
Rundu
Mukwe
Andara
Bagani
Zambezi
Ngoma
Opuwo
Oshakati
Ondangwa
Oshana
Oshikoto
Kavango West
Kavango East
Omusati
Kunene
Tsumeb
Grootfontein
Tsumkwe
Otjozondjupa
Khorixas
Otjiwarongo
Erongo
Epukiro
Omaheke
Henties Bay
Swakopmund
Walvis Bay
Windhoek
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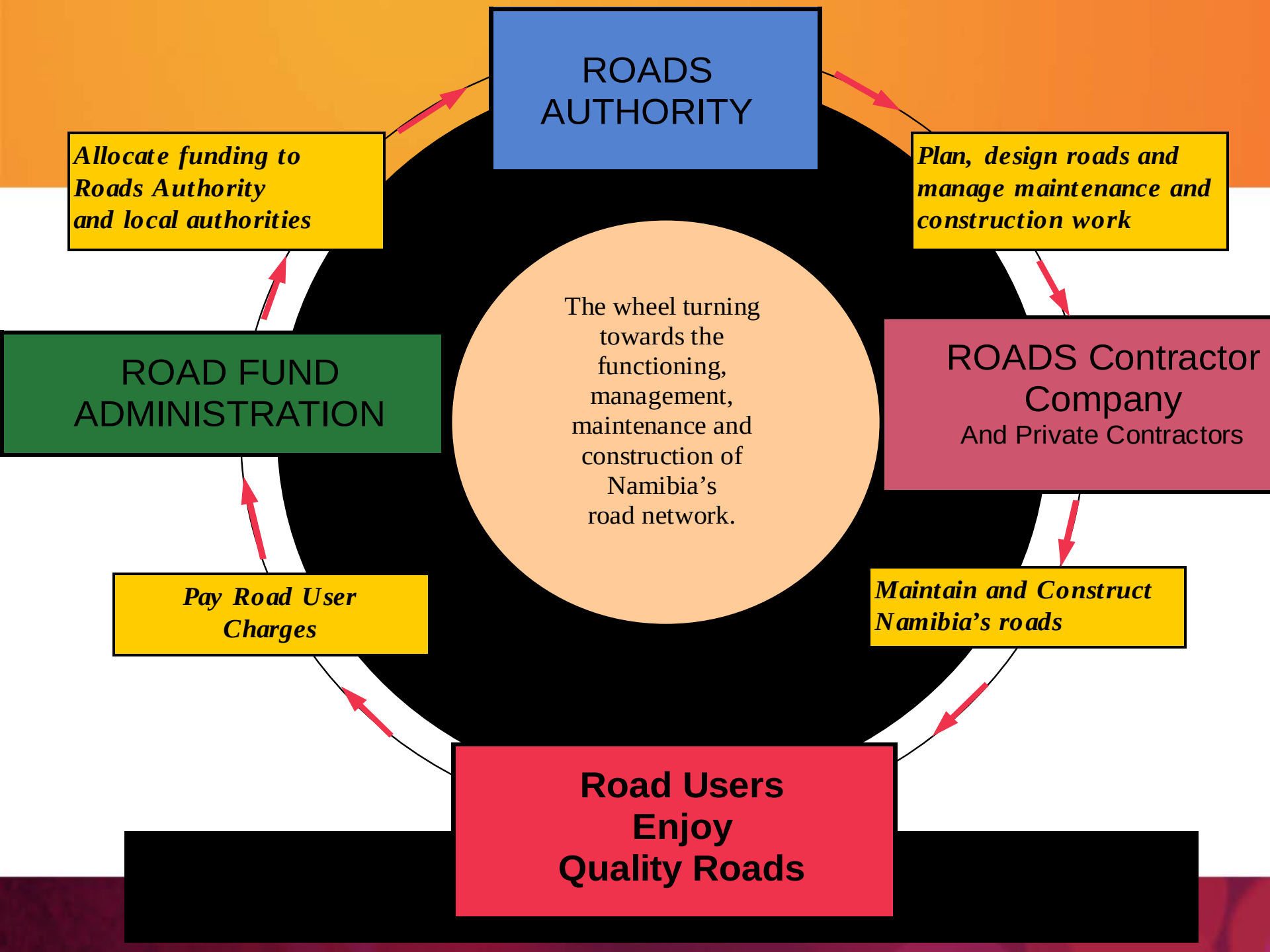
1:7 000 000
0 50 100 200 300 400 500
Kilometers
ROADS AUTHORITY
Safe Roads To Prosperity
Namibia Road Referencing System (RRS)
Town
National Road Network (9)
by road type
BITUMEN (7,165.2 km)
GRAVEL (25,921.0 km)
EARTH (11,541.2 km)
SALT (304.3 km)
PROC_ONLY (1,445.9 km)
Total: 46,377.6 km
Source: RRS - Roads Authority, network date period 2011-07-11 to 2013-10-31.

2. BACKGROUND TO THE ROAD SECTOR REFORM AND INTRODUCTION TO RMS

1. Road Sector Reform 1995-2000
2. All work of the RA to be outsourced
3. To manage the RA on commercial principles
4. Decentralisation principle versus centralisation
5. RCC to break up in to many SMEs
6. Road User Pay Principle - economically warranted roads
7. New construction – non economical/social roads government


ROADS AUTHORITY
Plan, design roads and manage maintenance and construction work
ROADS Contractor Company
And Private Contractors
Maintain and Construct Namibia's roads
Road Users Enjoy Quality Roads
Pay Road User Charges
ROAD FUND ADMINISTRATION
Allocate funding to Roads Authority and local authorities
The wheel turning towards the functioning, management, maintenance and construction of Namibia's road network.

Challenges

1. **Management of the Road Network**
   - **Lack of sufficient funding**
   - **Large network versus revenue**
2. **Balanced Distribution of Available Funding**

- **The Balance between preservation and development**
- **60% of rural Namibians do not have access to a road (2km)**

3. **Institutional Challenges**
4. **Environmental challenges – climate change; flood - draught**

Introduction

- PURPOSE OF THE RMS
  - Record and update road infrastructure asset information
  - Assist the RA in strategic and tactical planning
    - Identification
    - Quantification
    - Prioritisation of projects
    - Budgeting

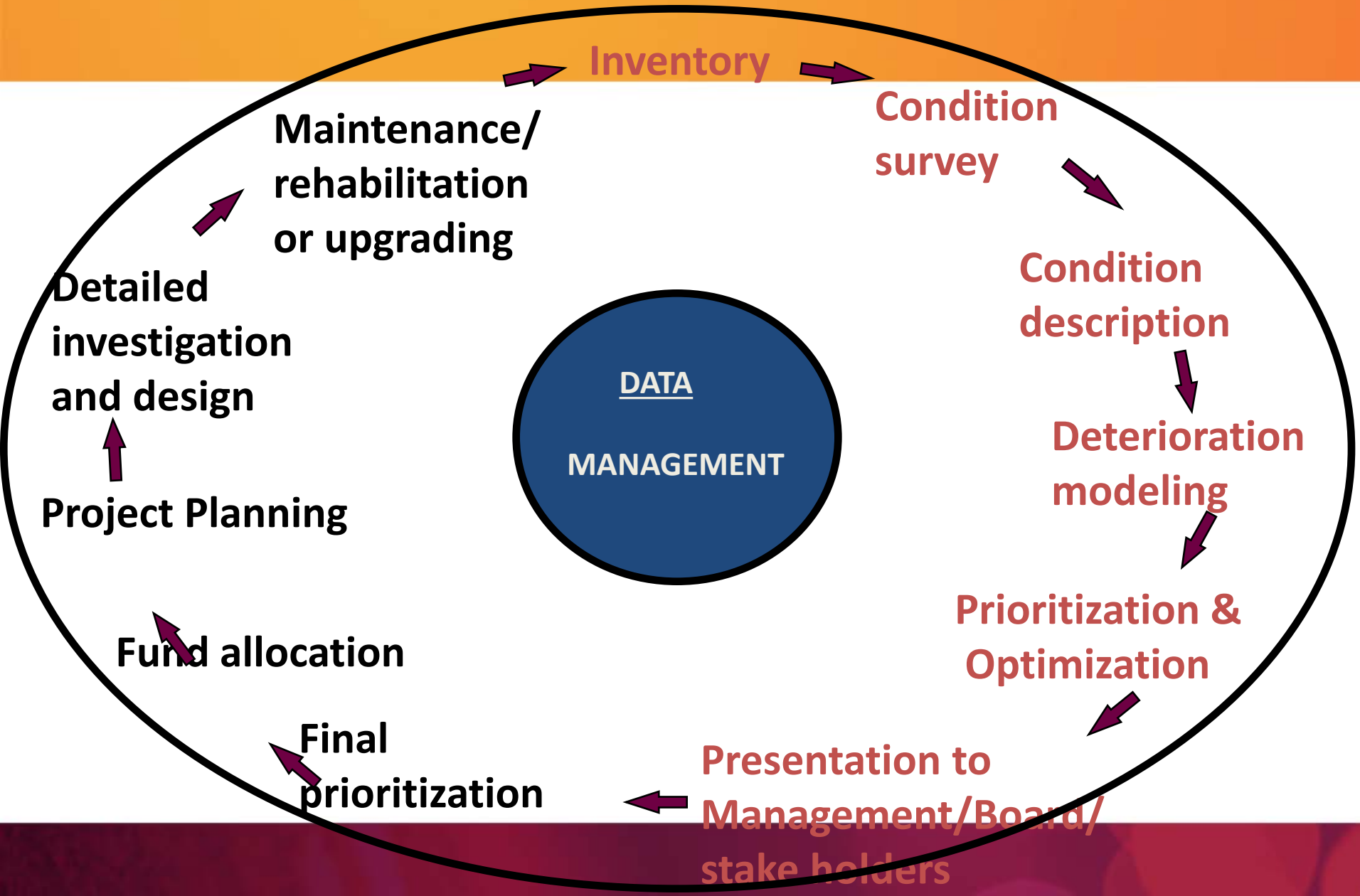
What is an IRMS

- An Integrated Road Management System (RMS) is an all encompassing framework,
- including both information processing and human resources,
- for the integrated management of the road network,
- including the determination and optimization of economically warranted projects, programmes, strategies and budgets,
- for both development and maintenance.

Most Important Sub-Systems

- Road Referencing System (RRS)
- Traffic surveillance System (TSS)
- Pavement Management System (PMS)
- Unsealed Road Management System (URMS)

ACTIVITY FLOW IN ROAD MANAGEMENT



3. DATA COLLECTION, ANALYSIS AND EXAMPLES OF OUTPUT

Regular Condition Assessment

- Condition assessment

Profile

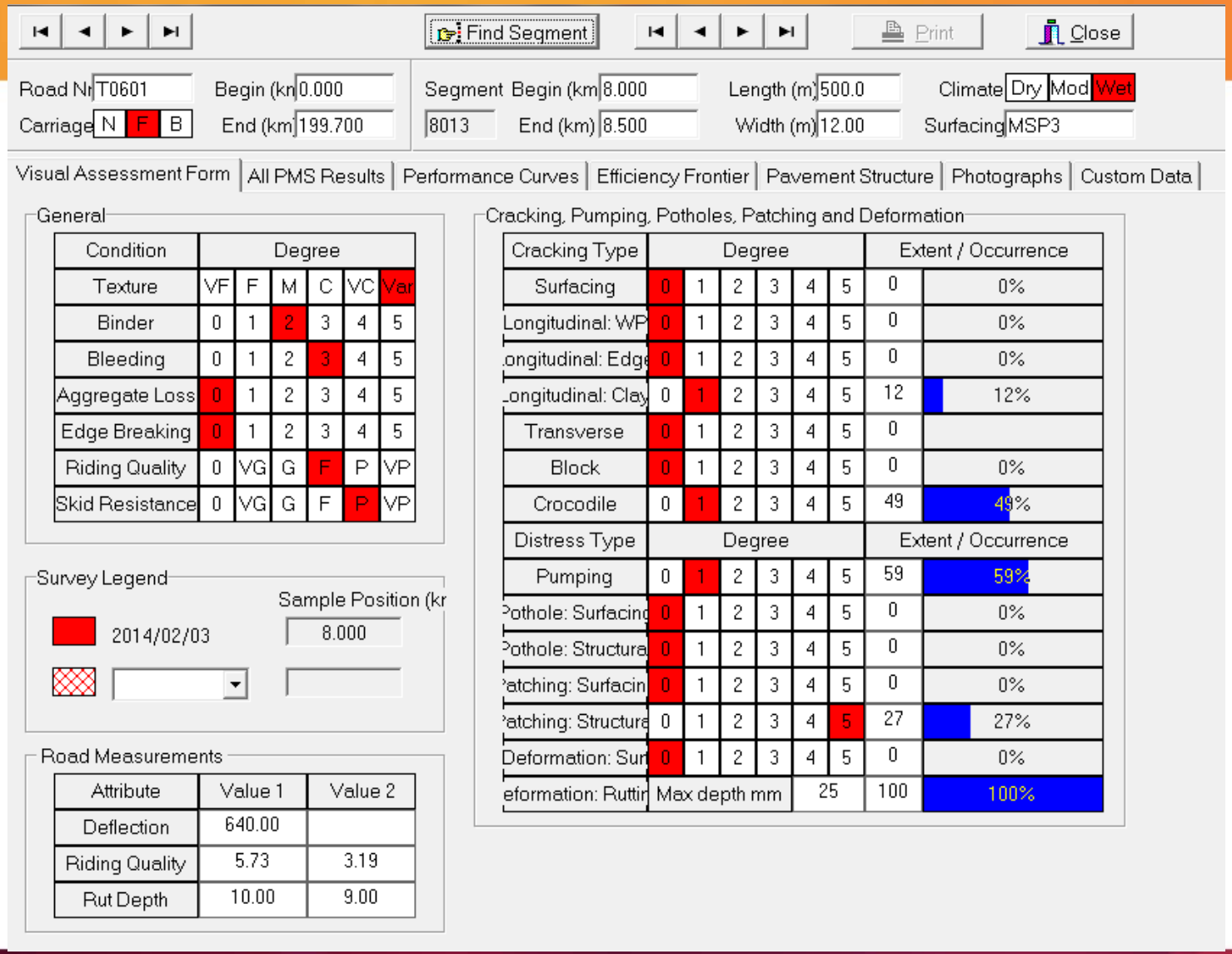
Visuals

Deflection

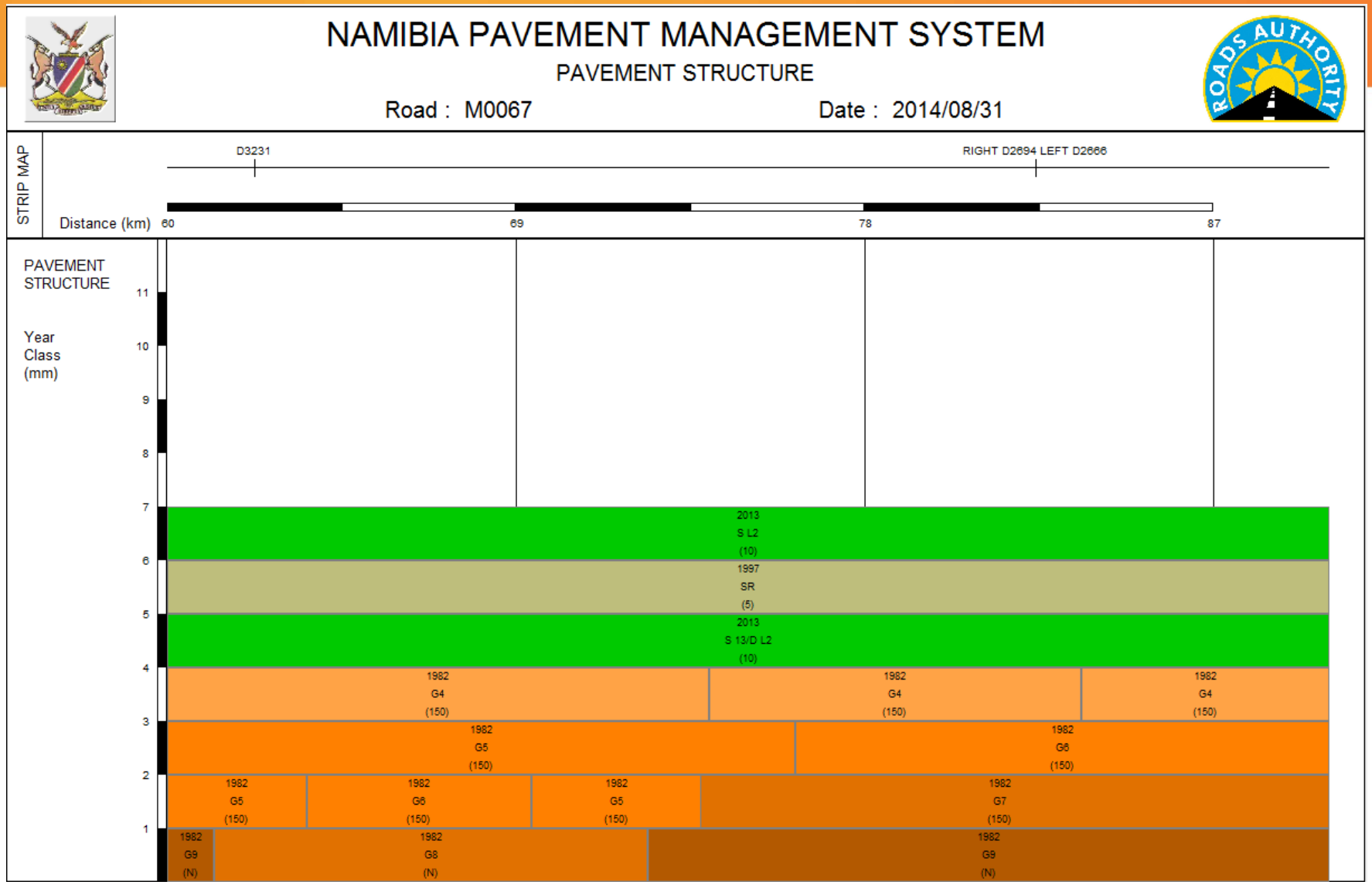
ROADS AUTHORITY : NAMIBIA									
Visual Assessment : Surfaced Roads									
Road Number	D0212			Date		Date			
Carriageway	0	F	B	Assessor					
Position (km)	0.150			Climate		Dry	Mod	Wet	
CONDITION	**Degree**								
Texture	VF	F	M	C	VC	Var			
Binder	0	1	2	3	4	5			
Bleeding	0	1	2	3	4	5			
Aggregate Loss	0	1	2	3	4	5			
Edge Breaking	0	1	2	3	4	5			
Riding Quality	0	1	2	3	4	5			
Skid Resistance	0	1	2	3	4	5			
CRACKING	**Degree**						**Extent**		
Surfacing / Hardening	0	1	2	3	4	5		m	
Longitudin: Wheelpath	0	1	2	3	4	5		m	
Longitudinal: Edge	0	1	2	3	4	5		m	
Longitudinal: Random	0	1	2	3	4	5		m	
Transverse Cracking	0	1	2	3	4	5		Nr	
Block Cracking	0	1	2	3	4	5		m	
Crocodile Cracking	0	1	2	3	4	5		m	
DISTRESS	**Degree**						**Extent**		
Pumping	0	1	2	3	4	5		m	
Failures: Surfacing	0	1	2	3	4	5		m	
Potholes: Structural	0	1	2	3	4	5		m	
Patching: Surfacing	0	1	2	3	4	5		m	
Patching: Structural	0	1	2	3	4	5		m	
Deformation: Surfacing	0	1	2	3	4	5		m	
Deformation: Rutting	Max depth (mm)							m	
GENERAL	Condition of the Sample								
Surfacing	V Good	Good	Fair	Poor	V Poor				
Structure	V Good	Good	Fair	Poor	V Poor				
ACTION	Assessor's rating of Maintenance requirement								
Action Required	None	Routine	Resurf	Rehab					
Urgency Rating	None	Low	Medium	High					
COMPARE	Condition of the section compared to the sample								
Surfacing	Much B	Better	Similar	Worse	Much W				
Structure	Much B	Better	Similar	Worse	Much W				

Traffic Counters

Visual Assessment Data

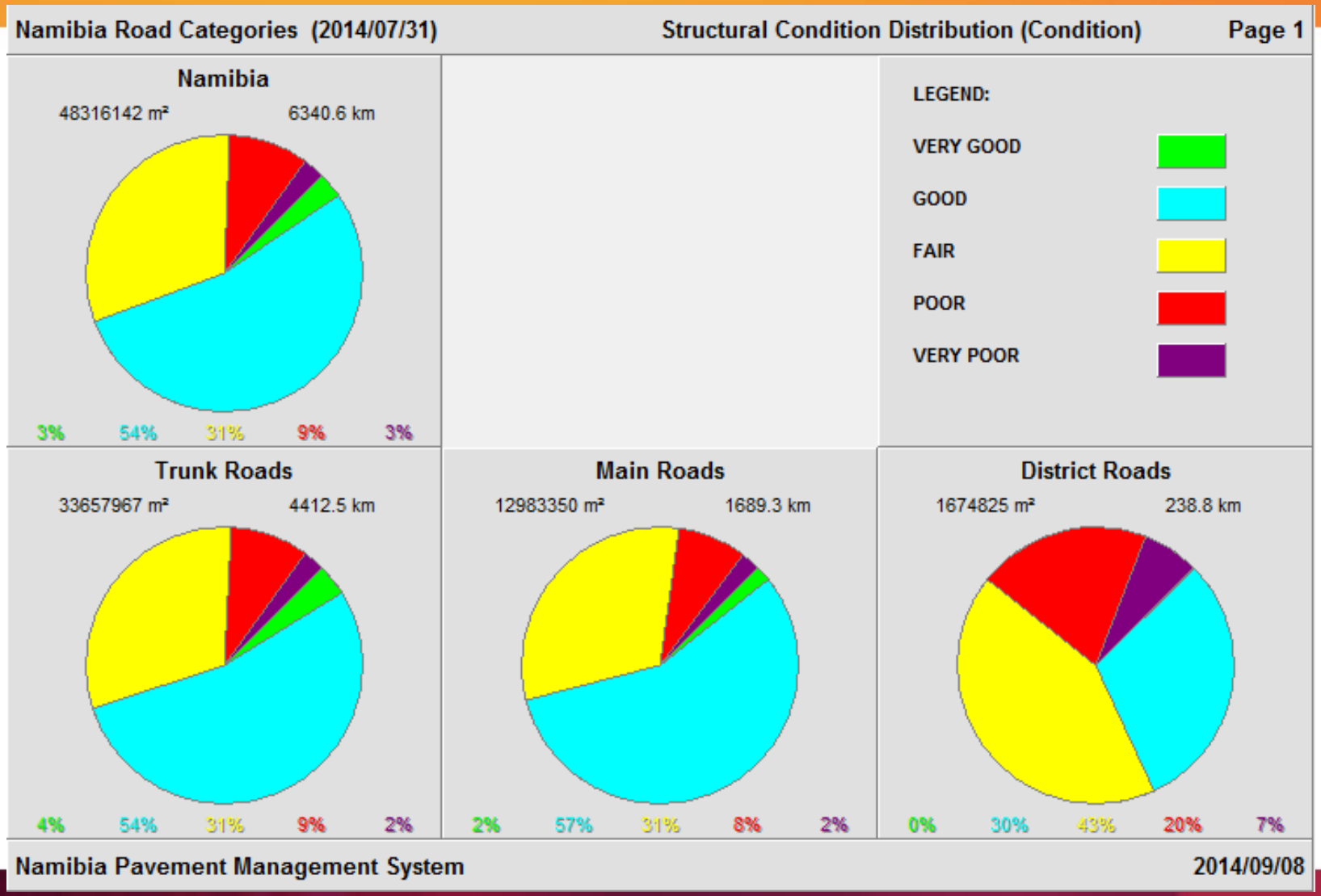


Pavement History



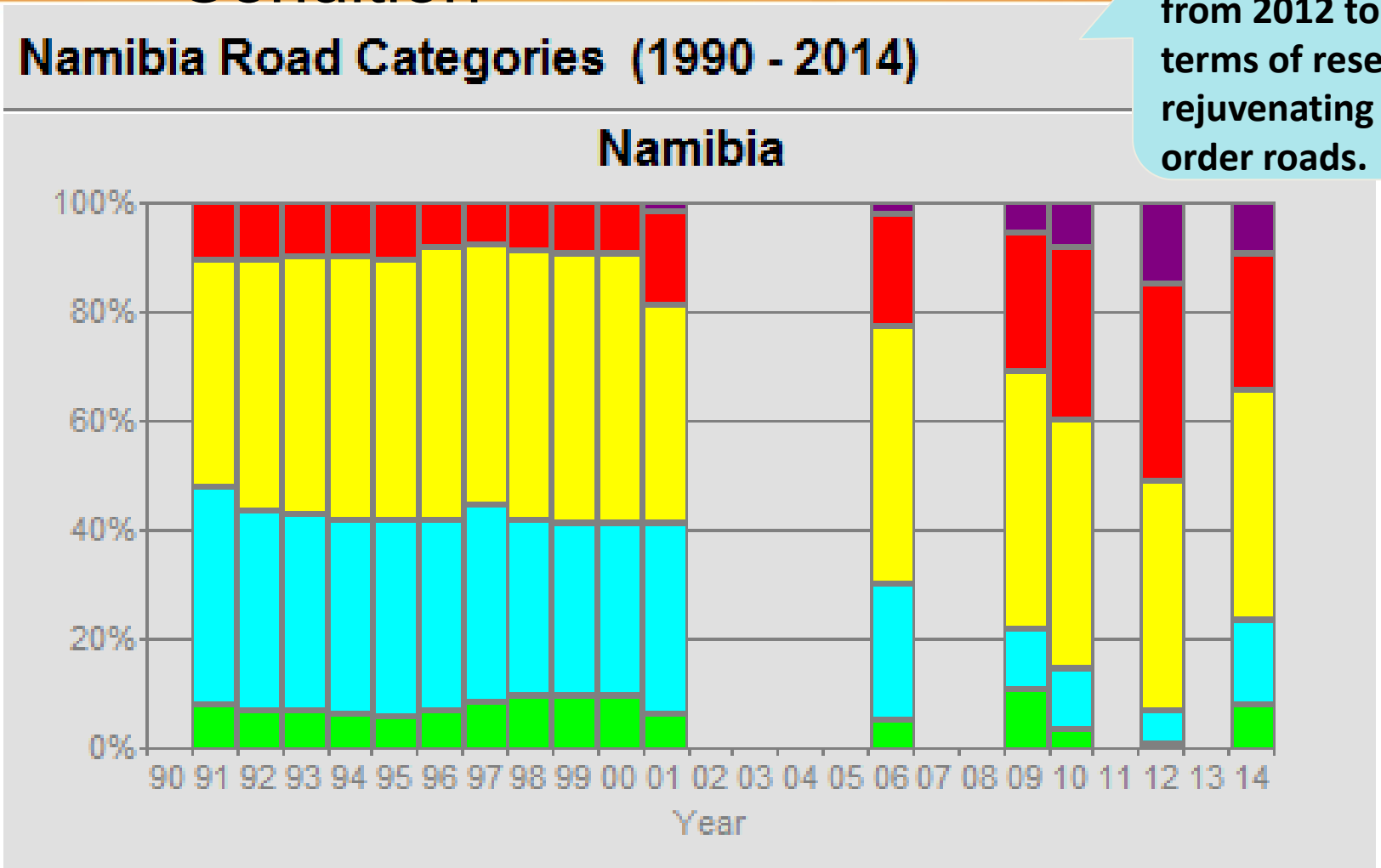
Results

- Current Condition - Pavement structural condition



Results

- Condition



A huge effort was made from 2012 to 2014 in terms of resealing and rejuvenating the higher order roads.

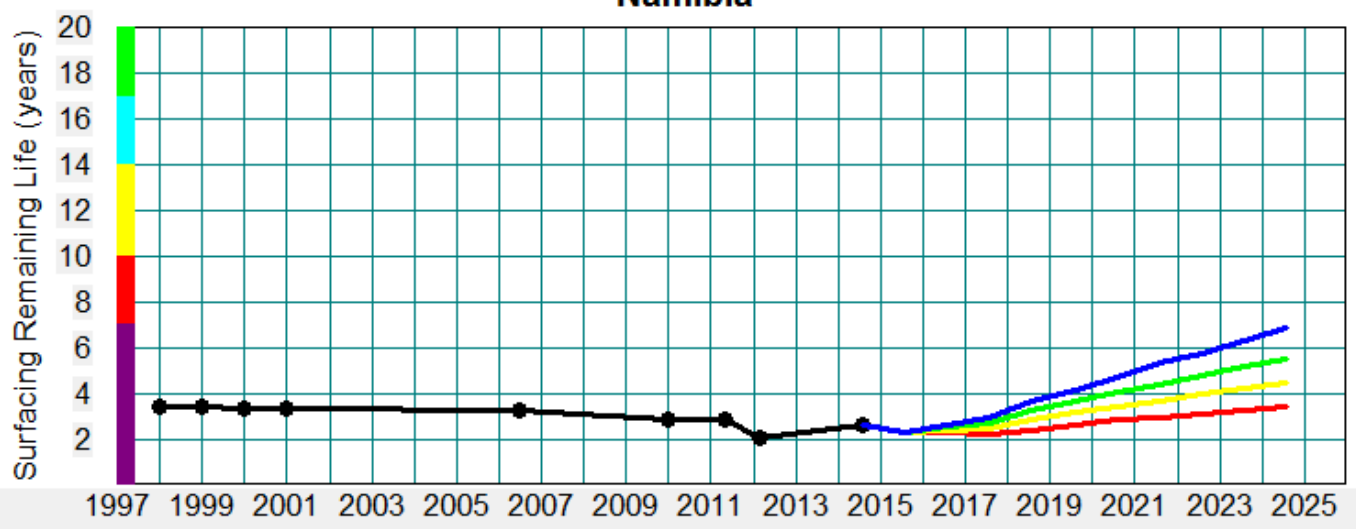
Long Term Impact Analysis

- Remove backlog over 10-year period
- Remaining life of pavements to > 10 years
- Remaining life of surfacings > 5 years

Impact of Funding Scenarios on Pavement Condition **Page 1**

Replacement Value (RV) N$ 38 503 891 000

Scenario	Funding Value (FV)	(% RV	Resurfacing (N$)	(% FV	Rehabilitation (N$)	(% FV)
	770 077 820	2.000	423 543 000	55	346 535 000	45
	962 597 275	2.500	529 429 000	55	433 168 000	45
	1 155 116 730	3.000	635 314 000	55	519 803 000	45
	1 347 636 185	3.500	741 200 000	55	606 436 000	45



Namibia Pavement Management System **2014/09/11**

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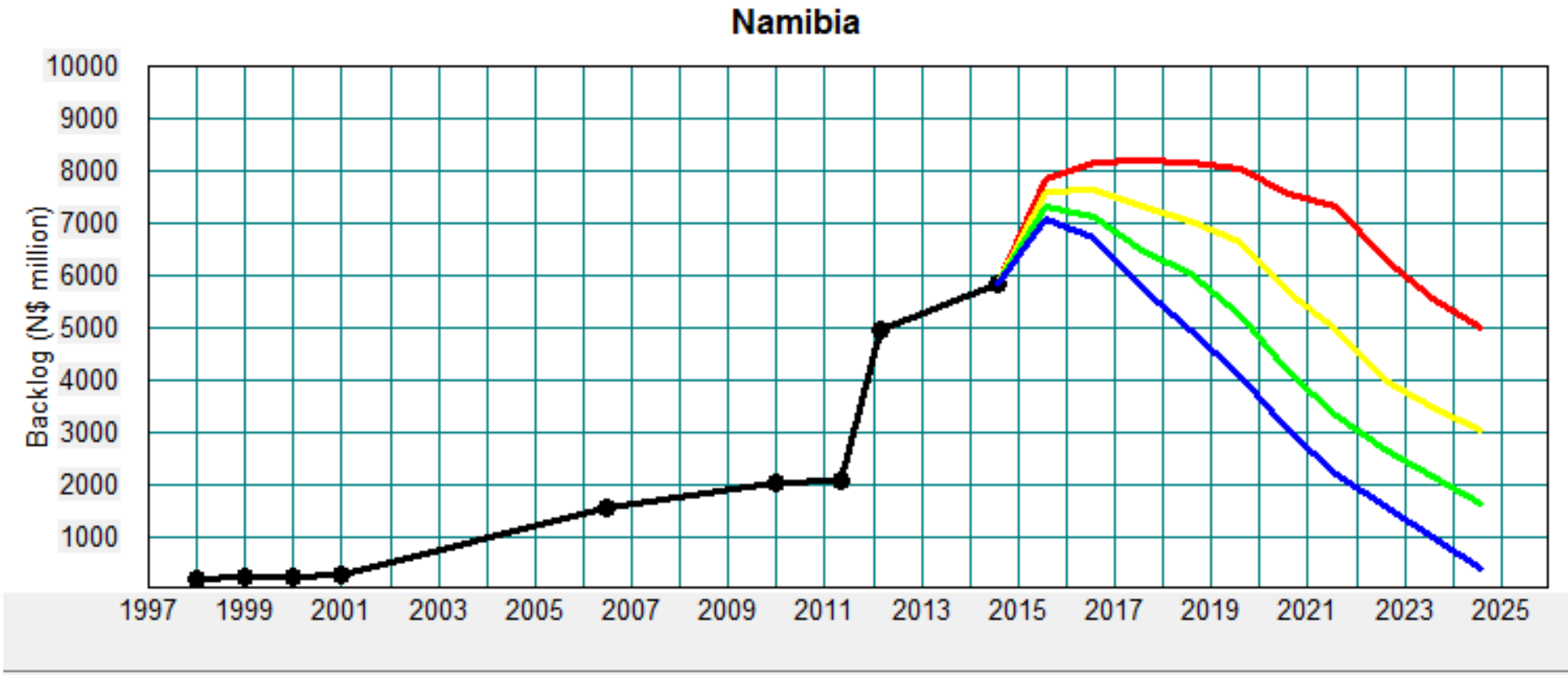


Measurement selection

- Using incremental benefit cost analysis

Funding Requirement

- Realistic funding requirement over the next three to five years

FUNDING REQUIRED FOR	Average annual funding	Road length per annum
REHABILITATION	N$ 800 million/annum	200 km
RESEAL	N$ 500 million /annum	770 km (3 years)
ROUTINE MAINTENANCE (Estimated)	N$ 234 million /annum	
TOTAL NEED (Surfaced Roads)	N$ 1534 million	

PMS Recommendations

- Visible improvement in the surfacing condition and stabilisation of the structural condition from 2012 to January 2014 – due to effective reseal program
- Still a huge backlog in rehabilitation and reseal
- Recommend
  - Sufficient funding
  - Focus on reseal (periodic maintenance) to extend pavement structural life (Verification of identified projects)
  - Appointments for identified rehabilitation projects

KPI

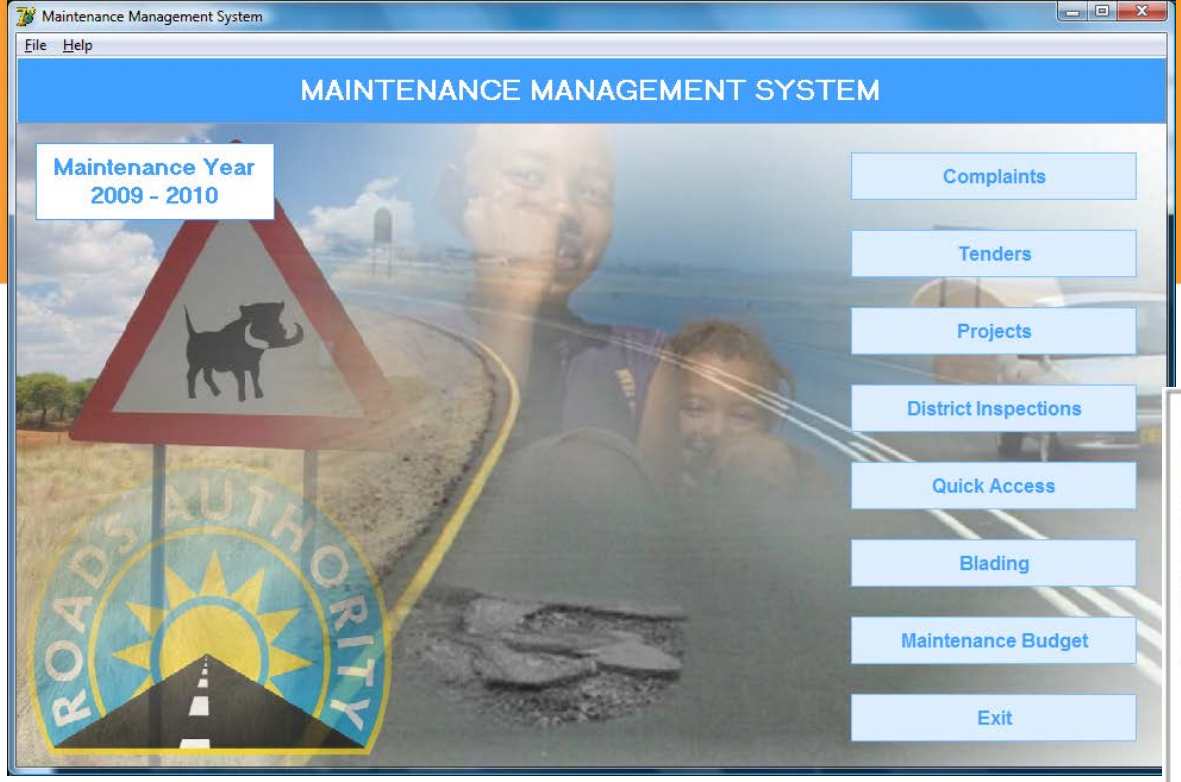
Financial year	% of bitumen roads in unacceptable condition: Bitumen (Surfacing Condition/ Structural Condition)	% of unsurfaced roads in unacceptable conditions
2007/2008	8/6	29
2008/2009		
2009/2010	11/9	
2010/2011	13/9	38
2011/2012	**17/10**	
2012/2013	-	58
Target for NDP III period	10/10	
2013/2014	**12/11**	

Process: Comfortable Speed versus IRI

- **Condition assessment**
  - ❑ Visual assessment

    per 5km segment
    - Accessibility
    - Safety
    - Maintainability
  - ❑ Road roughness (estimate)

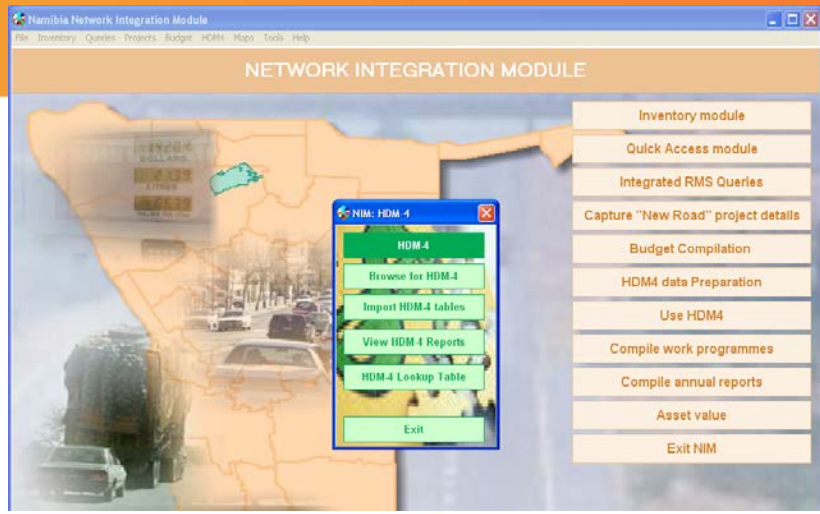
Comfortable Speed	IRI (photo)	Typical Condition
100 km/h	< 5 (3)	
80 – 100 km/h	7.5 – 5 (5.7)	
60 - 80 km/h	10 - 7.5 (8)	
45 – 60 km/h	12.5 – 10 (11)	
< 35 km/h	15 (15)	

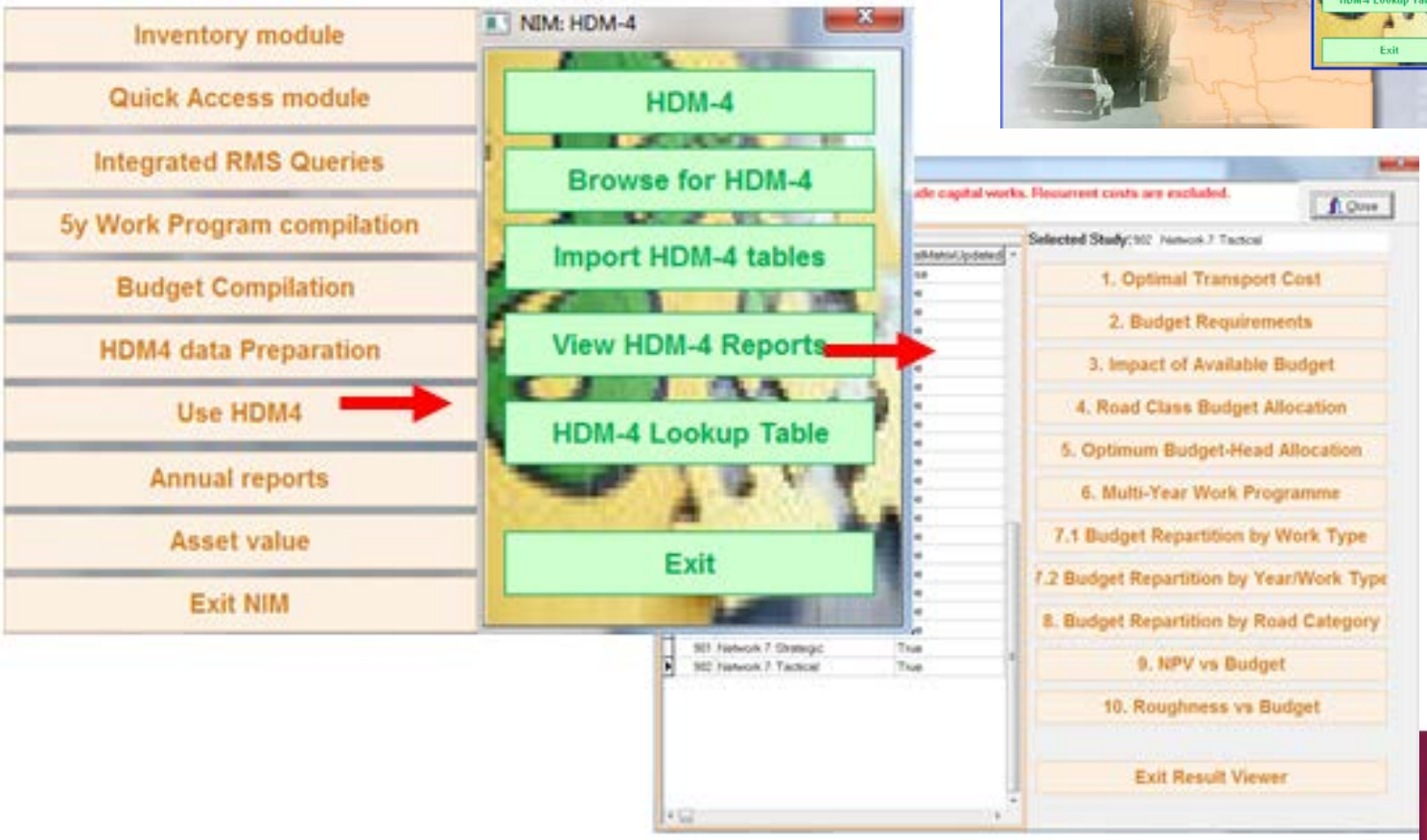

Maintenance Management System
File Help
MAINTENANCE MANAGEMENT SYSTEM
Maintenance Year
2009 - 2010
Complaints
Tenders
Projects
District Inspections
Quick Access
Blading
Maintenance Budget
Exit


Namibia Roads Authority
MMS PROJECTS
Physical Progress Report
Month Ending December 2009
Project Number :
Project Name :
Expected Project Duration :
Start Date :
End Date :
Elapsed :
Remaining :
Report Compiler :
Project Co-ordinator :
Main Contractor :
Consultant :
Report - Physical Progress
Behind Program
On Program
Ahead Of Program
Project Time Line
Planned vs Physical Progress
Site Picture
Actual vs forecast physical progress
Physical Progress Report
Page 1
Printed on 2010/01/18
MMS

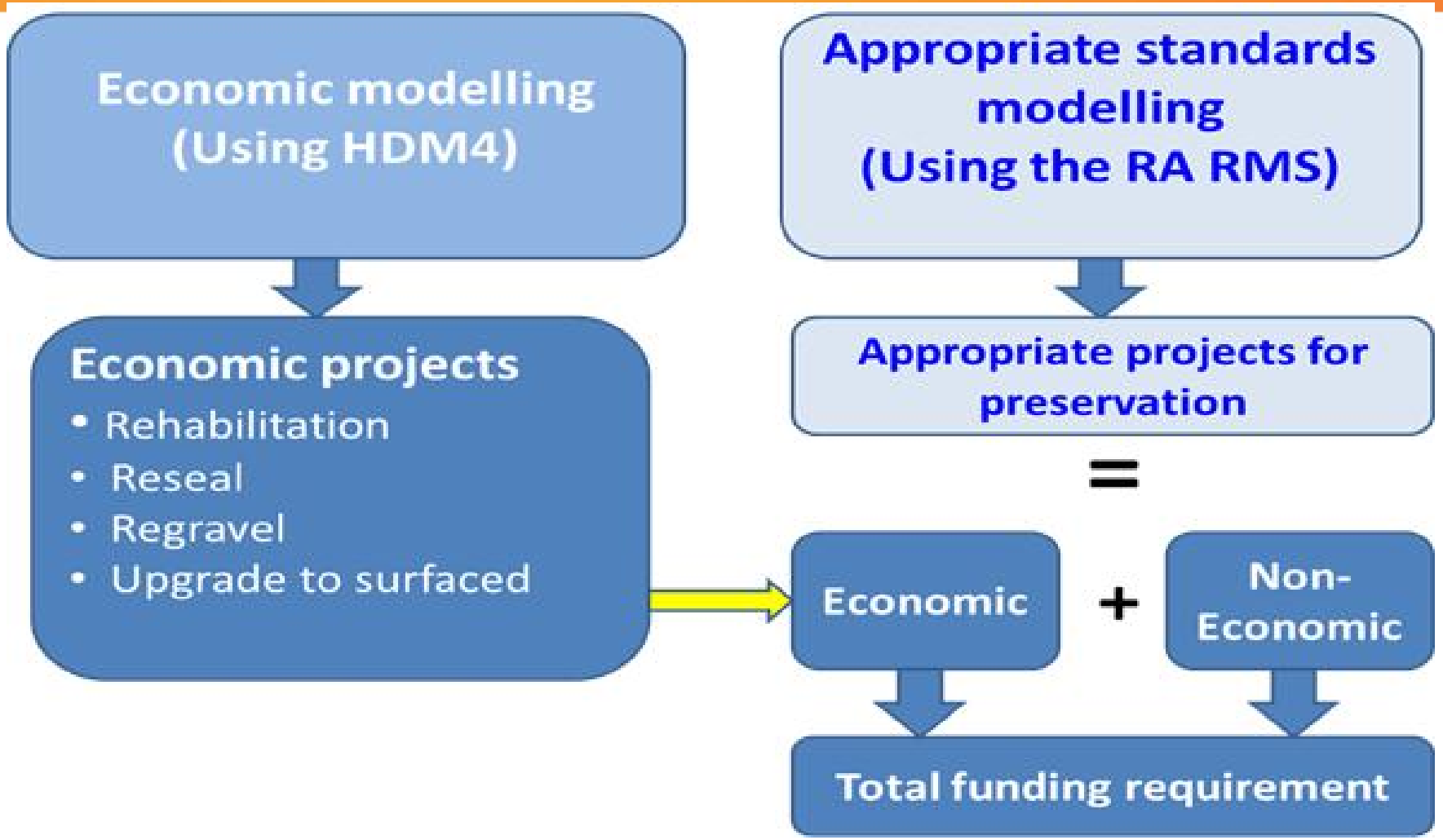
HDM Results

- Economic projects
- Optimisation based on minimisation TTC





Modelling Strategy



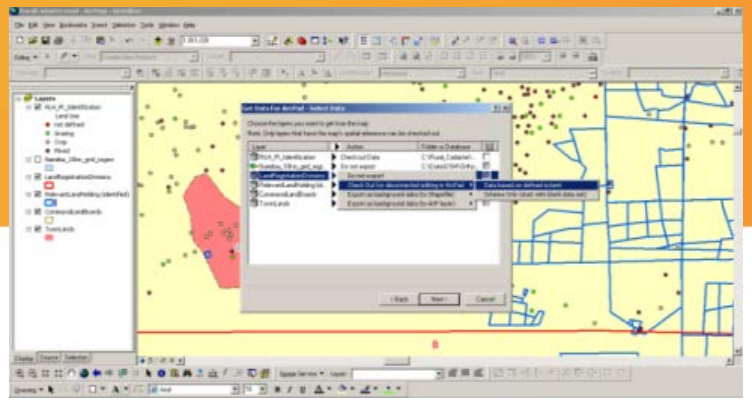
5. TAKING THE NAMIBIAN RMS TO THE NEXT LEVEL

1. Managing skill shortages:
   - only 458 registered Professional Engineers in Namibia
   - less 5% professional registered engineers are women
2. Top management support
3. Continuous training required
4. Models should be continuously improved to pass the test of reasonableness
5. Keep it simple at network level
6. Managing Institutional Challenges
7. Organisational Structure

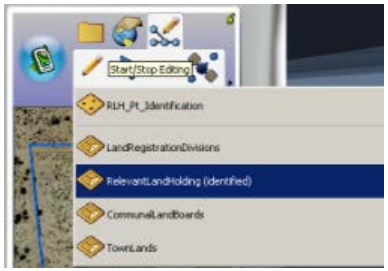
5. TAKING THE NAMIBIAN RMS TO THE NEXT LEVEL (2)

1. Easy access to all stakeholders
2. Automation of Performance indicators
3. Improved tactical level planning
4. Incorporating “Risk” in prioritisation
5. Incorporating “New Roads” in the prioritisation process; addition of Social Roads
6. Vehicle operating cost models
7. Integrating other relevant systems with the RMS
8. Import of and Quality assurance on as-built information
9. Utilising hand-held devices for visual assessments
10. Asset Valuation and Registry

4. Check the edits back into ArcGIS



1. Take data into the field



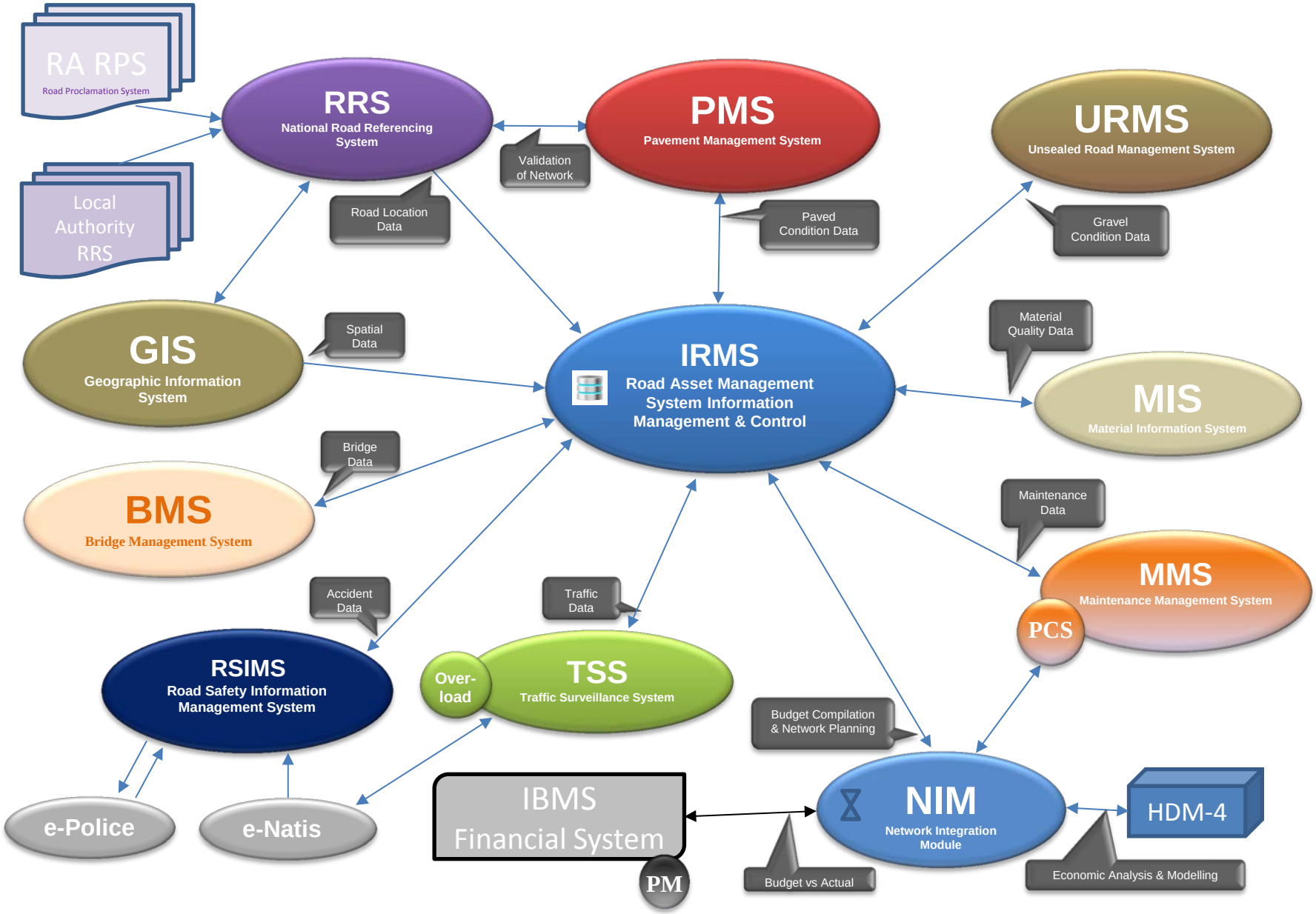
3. Edit and create data

2. Display and Query your data

6. FUTURE DEVELOPMENTS

1. Further Systems to be developed
   - Project Control System (PCS)
   - Network Integration Module of IMCS (Phase III)
   - Geometric Management System
2. Refinement to suit changing environment – technology & innovation
3. Data collection continuous exercise
4. Permanent km markers on whole network
5. New challenges such as Climate Change – draught
6. To make RMS information available on web.
7. To integrate other systems such as OMS, AMS - Local Authority PMS

Road Systems Interdependency



6. CONCLUSION

1. Institutional and legal frameworks in place – make them work.
2. **Sharing and networking important not to re-invent the wheel**
3. **Decision makers to use RMS for sound decisions**
4. **System developed in a developing country following "Best Practice Criteria",**
   - **compatible with international standard**
5. **RMS important for "Managing Pavements"**
6. **Improvement of RMS needed.**

Thank you!