

Road Asset Management Systems + Performance-Based Contracting

Session 1.2: Functions of a RAMS

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Agenda

Day 1 Road Asset Management System (RAMS)	Day 2 Road Asset Management System (RAMS)	Day 3 Performance Based Contracting (PBC)
Session 1.1 Introduction to RAMS	Session 2.1 Data processing and management	Session 3.1 Introduction to PBCs
Coffee break	Coffee break	Coffee break
Session 1.2 Functions of a RAMS	Session 2.2 Data analysis and planning	Session 3.2 Performance standards
Lunch	Lunch	Lunch
Session 1.3 Data to be collected	Session 2.3 Road asset management	Session 3.3 Inspections and Payments
Coffee break	Coffee break	Coffee break
Session 1.4 Method of data collection	Session 2.4 Conclusions and way forward	Session 3.4 Conclusions and way forward

Functions of a RAMS

Optimizing the level and the allocation of road funding in relation to medium- and long-term results regarding road conditions and road user costs

- Define the network maintenance, rehabilitation and upgrading needs
- Define the required budget to address those needs
- Determine how the available budget is best allocated
 - To different roads and networks (class, traffic, etc.)
 - To different treatment types (routine, periodic, rehabilitation, upgrading)
- Based on agreed prioritization criteria
 - Economic (e.g. transport costs, traffic levels)
 - Social (e.g. population, minimum access)
- Predict the result of that budget allocation
 - Future road network conditions
 - Future maintenance and rehabilitation costs
- Monitor the road network over time



Network vs Project Planning

- RAMS is a network planning tool
 - Planning for an entire (sub-)network
 - Determine budget allocations
 - Identify best treatment approaches
 - Based on data collected for entire (sub-)network
 - Limited data collection to reduce costs

- Different from project level planning
 - For specific road (section)
 - Much higher data requirement
 - Identify specific designs
 - Determine volumes of works



Road Asset Management System

- Data collection
 - Road data (inventory, condition, traffic, etc.)
 - Treatment data (costs, performance, etc.)
 - RAMS without / with outdated data is useless
- Data management (database)
 - Store data and make it easily accessible
 - Combine different data sets
 - Prepare simple reports - provide statistics for the network
- Data analysis (planning tool)
 - Criteria for prioritization
 - Formulas for predicting deterioration and costs
 - Recommend prioritization for specific budget
- Other modules
 - Bridge management system
 - Contract management system

Data collection

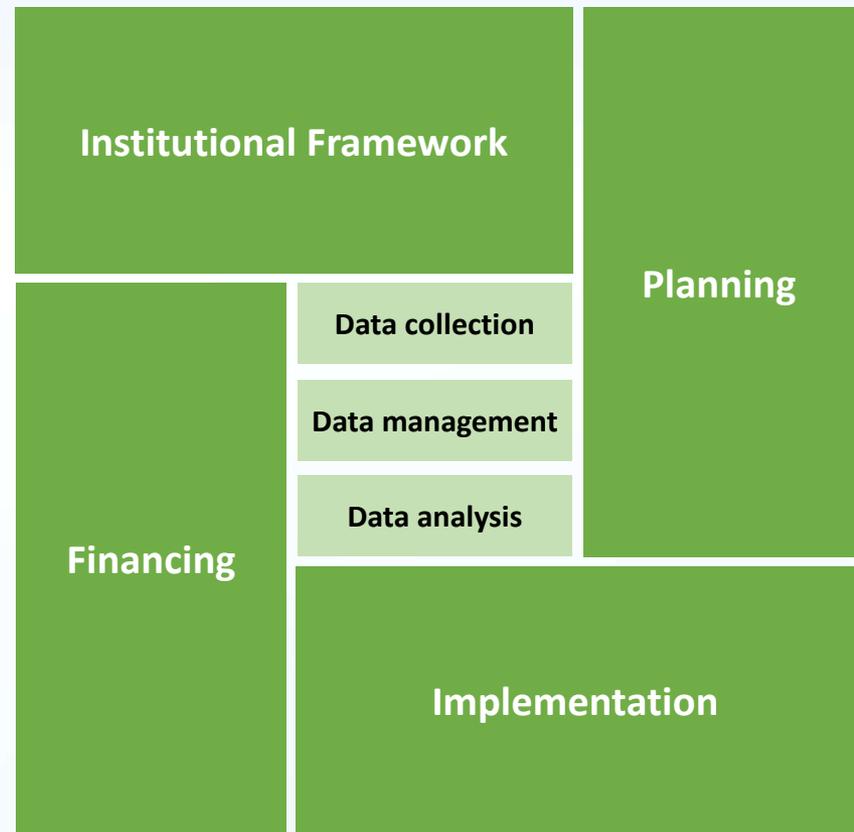
Data management

Data analysis



Road Asset Management System

- The RAMS needs to be integrated into existing systems
- Institutional framework
 - Resources for RAMS operation
 - Especially data collection
- Planning and budgeting procedures
 - In time for budget preparation
 - Used as basis for budget preparation
- Financing procedures
 - Influence budget levels by predicting results
 - Identify alternative funding options
- Implementation modalities
 - Capacity to implement plans
 - Shift to (periodic) maintenance
 - Suitable contracting modalities



RAMS in the CAREC Region

- Compendium of Best Practice in 2018
- What is road asset management?
- Set of 11 best practices
 - i. Limit the data to be collected
 - ii. Make the database easy to use
 - iii. Start with simple software
 - iv. Institutionalize from the start
 - v. Publish annual performance statistics
 - vi. Integrate into decision-making processes
 - vii. Provide sufficient and predictable funding
 - viii. Separate management from implementation
 - ix. Ensure high-level support
 - x. Continue development support
 - xi. Develop the works implementation capacity
- Road asset management in the CAREC region





RAMS Complexity

- A RAMS can be technologically simple or complex
 - Simple database (MS Excel, MS Access, etc.)
 - Off-the-shelf road database (ArcGIS, ROMDAS HIMS, etc.)
 - Custom-made road database
 - Standalone database or with remote access
- A RAMS can be just a database or also include other functions
 - Data storage and management (database)
 - Data analysis and planning
 - GIS mapping
 - Contract management
 - Bridge management



Start simple

- Three of the best practices
 - i. Limit the data to be collected
 - ii. Make the database easy to use
 - iii. Start with simple software
- Start with the minimum and gradually expand
 - Data types to be collected
 - Complexity of the database and related functions
 - Complexity of the software



Example: Nepal

- Context
 - Rural road network managed at district level – low capacity, strong political influence
 - No network data or database available, no evidence-based planning criteria in use
- Functions
 - Basic inventory, road classification, objective prioritization criteria, visual needs assessment, budget proposal, basic mapping, easy-to-use software
- Simple Excel-based RAMS + Word-based maps (later GIS)
 - Simple inventory (length, surface type, bridges, traffic categories)
 - Prioritization based on multicriteria analysis (population, traffic, connectivity, class)
 - Needs assessment based on visual data
 - Budget allocation module based on prioritization criteria
- Suitability for functions
 - Restructuring in Nepal – many roads managed at Provincial level
 - Larger network of higher level roads
 - Need to move to a more advanced database with more data

Example: Nepal

- Inventory and traffic data

Karnali Pradesh - 2. PROVINCIAL ROAD NETWORK (PRN)															
#	Road code	Road section	Class	District	Road name	Width m	BT km 82.47	GR km 151.27	ER km 913.84	Existing km 1147.58	UC km -	PL km 669.06	Total km 1816.64	Provincial priority	Traffic category
1	P60001	A	PH	Surkhet / सुर्खेत	NH58 (H12,Dhuliyabit)-Kalyan	4.50		16.00		16.00			16.00		T2
2	P60001	B	PH	Surkhet / सुर्खेत	Kalyan-Shivanagar P60002A(F183)	4.50		14.21		14.21			14.21		T2
3	P60001	C	PH	Surkhet / सुर्खेत	Shivanagar P60002A(F183)-Subhaghat	4.50		3.60		3.60			3.60		T2
4	P60001	D	PH	Surkhet / सुर्खेत	Subhaghat-Bheri Bridge-NH57(F047)	5.00		0.51		0.51			0.51		T2
5	P60002	A	PH	Surkhet / सुर्खेत	NH57 (F047,Shahare)-Dailekh Border (Simta, F183)	4.50			2.35	2.35			2.35		T1
6	P60002	B	PH	Surkhet / सुर्खेत	NH57 (F047,Shahare)-Dailekh Border (Simta, F183)	4.50			26.88	26.88			26.88		T1
7	P60002	C	PH	Surkhet / सुर्खेत	NH57 (F047,Shahare)-Dailekh Border (Simta, F183)	4.50			22.31	22.31			22.31		T1
8	P60003	A	PH	Surkhet / सुर्खेत	NH57(F047),Tulasipur - Purandhara - Botechaur	5.50		2.04	12.37	14.41			14.41		T2
9	P60003	B	PH	Salyan / सल्यान	NH57(F047),Tulasipur - Purandhara - Botechaur	5.50			18.94	18.94			18.94		T2
10	P60003	C	PH	Salyan / सल्यान	NH57(F047),Tulasipur - Purandhara - Botechaur	5.50			1.76	1.76			1.76		T2
11	P60003	D	PH	Salyan / सल्यान	NH57(F047),Tulasipur - Purandhara - Botechaur	5.50			1.54	1.54			1.54		T2
12	P60003	E	PH	Salyan / सल्यान	NH57(F047),Tulasipur - Purandhara - Botechaur	5.50			3.55	3.55			3.55		T2
13	P60004	A	PH	Surkhet / सुर्खेत	NH58(H12) Ratna Rajmarg-Phalate-Bhurigaun	4.00	8.73			8.73			8.73		T1
14	P60005	A	PH	Surkhet / सुर्खेत	NH59(F048) Chheda-Ghodaankhe NH58(H13)	4.00		16.33		16.33			16.33		T1

Karnali Pradesh - 3. TRAFFIC														
#	Road code	Road section	Class	District	Road name	Traffic							Traffic category	
						Bicycle, motorcycle	Car, SUV, light van, pick-up	Light (mini) truck, tractor	Truck, minibus, bus, tractor-trailer	Total traffic count	Total traffic estimation	Total traffic		
						VPD	VPD	VPD	VPD	VPD	VPD	PCU		
1	P60001	A	PH	Surkhet	NH58 (H12,Dhuliyabit)-Kalyan	88	143	25	39	295			342	T2
2	P60001	B	PH	Surkhet	Kalyan-Shivanagar P60002A(F183)	105	145	23	35	308			337	T2
3	P60001	C	PH	Surkhet	Shivanagar P60002A(F183)-	145	25	55	22	247			246	T2
4	P60001	D	PH	Surkhet	Subhaghat-Bheri Bridge-NH57(F047)	157	31	40	17	245			221	T2
5	P60002	A	PH	Surkhet	NH57 (F047,Shahare)-Dailekh	85	24	18	8	135			118	T1
6	P60002	B	PH	Surkhet	NH57 (F047,Shahare)-Dailekh	80	21	16	6	123			103	T1
7	P60002	C	PH	Surkhet	NH57 (F047,Shahare)-Dailekh	70	16	12	4	102			81	T1
8	P60003	A	PH	Surkhet	NH57(F047),Tulasipur - Purandhara	92	147	29	41	309			360	T2
9	P60003	B	PH	Salyan	NH57(F047),Tulasipur - Purandhara	95	149	31	42	317			369	T2
10	P60003	C	PH	Salyan	NH57(F047),Tulasipur - Purandhara	95	149	31	42	317			369	T2
11	P60003	D	PH	Salyan	NH57(F047),Tulasipur - Purandhara	101	151	32	44	328			382	T2
12	P60003	E	PH	Salyan	NH57(F047),Tulasipur - Purandhara	101	151	32	44	328			382	T2
13	P60004	A	PH	Surkhet	NH58(H12) Ratna Rajmarg-Phalate-	65	22	18	12	117			118	T1
14	P60005	A	PH	Surkhet	NH59(F048) Chheda-Ghodaankhe	15	4	5	2	26			25	T1
15	P60006	A	PH	Surkhet	NH58(H13) Badichaur-Babiyachaur	125	51	39	36	251			280	T2
16	P60006	B	PH	Surkhet	Babiyachaur- Gutu (Part of F170)	130	50	42	30	252			268	T2
17	P60006	C	PH	Surkhet	Gutu-Baijura-Benighat Doti District	85	25	18	8	136			119	T1
18	P60007	A	PH	Surkhet	NH59(F048) Ratanangla-Awalching	128	61	15	15	219			193	T2
19	P60007	B	PH	Surkhet	NH59(F048) Ratanangla-Awalching	130	55	12	12	209			174	T2
20	P60007	C	PH	Surkhet	NH59(F048) Ratanangla-Awalching	117	52	11	10	190			157	T2



Example: Nepal

- Prioritization and ranking

Karnali Pradesh - 5. RANKING																	
#	Section code	District	Road name	Palika centres connected		Population served		Population unconnected		Traffic category		Road class		Provincial priority		Total 100	Rank
				15		30		20		20		5		10			
				#	Score	#	Score	#	Score	#	Score	#	Score	#	Score		
14	P60005A	Surkhet	NH59(F048) Chheda-Ghodaankhe NH	2	15.0	57,471	30.0	-	-	T1	-	PH	5.0	-	-	50.0	1
79	P60503A	Kalikot	NH58(H13)-Kumalgaun	1	7.5	21,366	11.2	21,366	20.0	T1	-	PR	-	-	-	38.7	2
15	P60006A	Surkhet	NH58(H13) Badichaur-Babiyachaur	1	7.5	30,295	15.8	-	-	T2	6.7	PH	5.0	-	-	35.0	3
80	P60504A	Kalikot	NH58(F172) Sannighat-Phukot-Syuna	2	15.0	29,118	15.2	-	-	T1	-	PR	-	-	-	30.2	4
25	P60011A	Dailekh	NH58(H13) Sangetada-Chamunda NH	1	7.5	33,730	17.6	-	-	T1	-	PH	5.0	-	-	30.1	5
83	P60505B	Kalikot	Ramnakt-Thirpu	1	7.5	15,303	8.0	15,303	14.3	T1	-	PR	-	-	-	29.8	6
82	P60505A	Kalikot	F172-Jarkot-Ramnakt	2	15.0	27,646	14.4	-	-	T1	-	PR	-	-	-	29.4	7
18	P60007A	Surkhet	NH59(F048) Ratanangla-Awalching	1	7.5	17,275	9.0	-	-	T2	6.7	PH	5.0	-	-	28.2	8
77	P60501A	Kalikot	NH61(H13)-Sukatiya	1	7.5	14,080	7.3	14,080	13.2	T1	-	PR	-	-	-	28.0	9
38	P60017A	Rukum West	H18-Chaurjhari (Bijeshwori)	1	7.5	27,438	14.3	-	-	T1	-	PH	5.0	-	-	26.8	10
93	P60704A	Jajarkot	NH03(H18) Thala- Managhat	1	7.5	35,295	18.4	-	-	T1	-	PR	-	-	-	25.9	11
42	P60020A	Jajarkot	NH57(F047) - Dalli (Nalgad M)	1	7.5	25,597	13.4	-	-	T1	-	PH	5.0	-	-	25.9	12
24	P60010A	Dailekh	NH58(H13,Tallo Dungeshwor) - Dullu	1	7.5	24,972	13.0	-	-	T1	-	PH	5.0	-	-	25.5	13
67	P60202A	Mugu	Tarapani-Jima/Sorukot	1	7.5	12,238	6.4	12,238	11.5	T1	-	PR	-	-	-	25.3	14
48	P60021E	Dolpa	Triveni-Narku NH57(F047)	2	15.0	7,402	3.9	-	-	T1	-	PH	5.0	-	-	23.9	15
29	P60014A	Dailekh	NH60 Dailekh (Khursanibari)-Naumu	1	7.5	20,802	10.9	-	-	T1	-	PH	5.0	-	-	23.4	16
27	P60013A	Dailekh	NH03 (H18,Bhirkhet) -Kharigaira-Gai	1	7.5	19,277	10.1	-	-	T1	-	PH	5.0	-	-	22.6	17
70	P60303A	Humla	NH58(F172) - Sarkegad	1	7.5	9,868	5.2	9,868	9.2	T1	-	PR	-	-	-	21.9	18
55	P60025A	Humla	NH58(F172) Kawadi-Maila	1	7.5	5,964	3.1	5,964	5.6	T1	-	PH	5.0	-	-	21.2	19
101	P60902A	Salyan	NH55(H11)-Dhorchaur	1	7.5	24,972	13.0	-	-	T1	-	PR	-	-	-	20.5	20

Karnali Pradesh - 4. CONNECTIVITY											
District	Palika code	Palika name	Palika type	Palika centre	Population (2011)	District Centre	1st connecting road	2nd connecting road	3rd connecting road	4th connecting road	
Dolpa	60101	Dolpo Buddha	Gaunpalika	Dho	2,126		CRN				
Dolpa	60102	She Phoksundo	Gaunpalika	Saldang	3,099		P60101B	P60101A			
Dolpa	60103	Jagadulla	Gaunpalika	Majhgaun	2,273		P60105B	P60105A	P60021E		
Dolpa	60104	Mudkechula	Gaunpalika	Narku	5,129		P60021D	P60021E			
Dolpa	60105	Tripura Sundari	Nagapalika	Tripurakot	10,104		CRN				
Dolpa	60106	Thuli Bheri	Nagapalika	Juphal	8,370		P60104A				
Dolpa	60107	Kaika	Gaunpalika	Sahartara Bagar	3,576		CRN				
Dolpa	60108	Chharka Tangsong	Gaunpalika	Chharka-3	1,451		P60103A				
Mugu	60201	Mugum karmarong	Gaunpalika	Pulu	5,396		CRN				
Mugu	60202	Chhayanath Rara	Nagapalika	Gangadhi Bazar	20,078	x	CRN				
Mugu	60203	Soru	Gaunpalika	Jima/Sorukot	12,238		P60202A	P60023A			
Mugu	60204	Khatyad	Gaunpalika	Majhachaur/Rataudi	17,116		P60201A	P60404A			
Humla	60301	Chankheli	Gaunpalika	Piplang	5,517		P60024C				
Humla	60302	Kharpunath	Gaunpalika	Yanchubagar	6,011		P60302A				
Humla	60303	Simkot	Gaunpalika	Simkot	11,557	x	CRN				
Humla	60304	Namkha	Gaunpalika	Yalwang	3,900		CRN				
Humla	60305	Sarkegad	Gaunpalika	Sarkegad	9,868		P60303A				
Humla	60306	Adanchuli	Gaunpalika	Shreengar	7,116		P60305A				
Humla	60307	Tanjakot	Gaunpalika	Maila	5,964		P60025A				
Jumla	60401	Patarasi	Gaunpalika	Dilichaur	14,571		P60402A				
Jumla	60402	Kanaka Sundari	Gaunpalika	Birat	12,977		CRN				



Example: Nepal

- Needs assessment and budgeting

Karnali Pradesh - 6. INVESTMENT NEEDS																				
#	Rank	Section code	District	Road name	BT km	GR km	ER km	UC/PL km	Width m	Traffic	Construction km	Rehabilitation km	Gravelling km	Black-topping km	Widening km	Bridge m	Causeway m	Box culvert #	Pipe culvert #	Retaining wall m3
14	1	P60005A	Surkhet	NH59(F048) Chheda-Ghodaank	-	-	16.33	-	4.00	T1	617.88	-	835.27	109.51	-	1,881	30	36	436	-
79	2	P60503A	Kalikot	NH58(H13)-Kumalgaun	-	-	8.64	15.59	4.00	T1	5.38	-	5.83	-	-	80	-	-	19	-
15	3	P60006A	Surkhet	NH58(H13) Badichaur-Babiyac	22.11	-	-	-	6.00	T2	-	-	1.01	-	-	-	-	-	-	-
80	4	P60504A	Kalikot	NH58(F172) Sannighat-Phukot-	-	-	11.22	-	4.50	T1	-	-	8.97	-	-	-	6	-	6	-
25	5	P60011A	Dailekh	NH58(H13) Sangetada-Chamun	-	-	9.50	-	7.00	T1	29.19	-	-	-	-	-	-	-	-	-
83	6	P60505B	Kalikot	Ramnakt-Thirpu	-	-	5.10	8.35	4.50	T1	10.79	-	25.27	-	-	-	-	-	-	-
82	7	P60505A	Kalikot	F172-Jarkot-Ramnakt	-	-	1.02	-	4.50	T1	-	-	0.51	-	-	-	-	-	-	-
18	8	P60007A	Surkhet	NH59(F048) Ratanangla-Awalc	12.90	-	-	-	4.50	T2	-	-	-	35.53	-	-	-	-	-	-
77	9	P60501A	Kalikot	NH61(H13)-Sukatiya	-	-	3.56	7.75	3.50	T1	-	-	6.06	-	-	50	-	-	18	-
38	10	P60017A	Rukum West	H18-Chaurjhari (Bijeshwori)	-	-	1.01	-	4.00	T1	84.12	-	-	-	-	-	-	-	-	-
93	11	P60704A	Jajarkot	NH03(H18) Thala- Managhat	-	-	1.62	-	3.50	T1	-	-	-	-	-	-	-	-	-	-
42	12	P60020A	Jajarkot	NH57(F047) - Dalli (Nalgad M)	-	-	2.78	-	4.50	T1	10.01	-	-	-	-	-	-	-	-	-
24	13	P60010A	Dailekh	NH58(H13,Tallo Dungeshwor J)	16.76	-	-	-	5.50	T1	-	-	35.76	-	-	61	-	-	16	-
67	14	P60202A	Mugu	Tarapani-Jima/Sorukot	-	-	-	10.01	3.75	T1	-	-	15.49	-	-	-	-	-	-	-
48	15	P60021E	Dolpa	Triveni-Narku NH57(F047)	-	-	9.05	-	3.50	T1	-	-	30.80	-	-	-	-	-	-	-
29	16	P60014A	Dailekh	NH60 Dailekh (Khursanibari)-N	-	-	16.36	-	4.50	T1	19.19	-	28.67	-	-	-	-	-	-	-
27	17	P60013A	Dailekh	NH03 (H18,Bhirkhet) -Kharigair	-	-	13.18	-	4.00	T1	13.18	-	15.43	-	-	75	-	-	26	-
70	18	P60303A	Humla	NH58(F172) - Sarkegad	-	-	2.58	-	3.75	T1	-	-	-	-	-	-	-	-	-	-
55	19	P60025A	Humla	NH58(F172) Kawadi-Maila	-	-	4.67	-	3.75	T1	-	-	-	-	-	-	-	-	-	-
101	20	P60902A	Salyan	NH55(H11)-Dhorchaur	-	-	0.51	-	4.00	T1	-	-	-	-	-	-	-	-	-	-

Karnali Pradesh - 10. BUDGET ALLOCATION							
Financial year		2076/77	2077/78	2078/79	2079/80	2080/81	Estimated annual maintenance cost
Expected PTMP budget		2,828,970,000	2,828,970,000	2,828,970,000	2,828,970,000	2,828,970,000	
Maintenance allocation		226,516,850	226,516,850	226,516,850	226,516,850	226,516,850	226,516,850
Investment allocation		2,602,453,150	2,602,453,150	2,602,453,150	2,602,453,150	2,602,453,150	
Rank	Section code	Investment allocation					Main funding source
		Cost NPR	NPR	NPR	NPR	NPR	
		16,871,624,293	2,602,453,150	2,602,453,150	2,602,453,150	2,602,453,150	
1	P60005A	44,272,000	44,272,000	-	-	-	
2	P60503A	233,139,600	233,139,600	-	-	-	
3	P60006A	2,424,000	2,424,000	-	-	-	
4	P60504A	22,015,200	22,015,200	-	-	-	
5	P60011A	926,296,000	926,296,000	-	-	-	
6	P60505B	287,647,200	287,647,200	-	-	-	
7	P60505A	1,101,600	1,101,600	-	-	-	
8	P60007A	179,071,200	179,071,200	-	-	-	
9	P60501A	86,480,800	86,480,800	-	-	-	
10	P60017A	1,525,376,000	820,005,550	705,370,450	-	-	
11	P60704A	-	-	-	-	-	
12	P60020A	204,204,000	-	204,204,000	-	-	
13	P60010A	167,481,600	-	167,481,600	-	-	
14	P60202A	30,980,000	-	30,980,000	-	-	
15	P60021E	57,493,333	-	57,493,333	-	-	
16	P60014A	449,962,800	-	449,962,800	-	-	
17	P60013A	365,297,067	-	365,297,067	-	-	
18	P60303A	-	-	-	-	-	
19	P60025A	22,000,000	-	22,000,000	-	-	
20	P60902A	-	-	-	-	-	

Karnali Pradesh - 11. OUTPUT				
Investment needs				
ER km	GR km	BT km	Widen km	Bridge m
617.88	835.27	109.51	-	1,881
Investment output				
ER	GR	BT	Widen	Bridge
456.58	650.05	109.51	-	1,725
-	27.67	-	-	-
5.38	5.83	-	-	80
-	1.01	-	-	-
-	8.97	-	-	-
29.19	-	-	-	-
10.79	25.27	-	-	-
-	0.51	-	-	-
-	-	35.53	-	-
-	6.06	-	-	50
84.12	-	-	-	-
-	-	-	-	-
-	35.76	-	-	61
-	15.49	-	-	-
-	30.80	-	-	-
19.19	28.67	-	-	-
13.18	15.43	-	-	75
-	-	-	-	-
-	11.00	-	-	-
-	-	-	-	-



Example: Kyrgyz

- Context

- Network managed at central level through local units (PLUADS/UADs)
- Little network data available (currently inventory data being collected)
- No evidence-based planning criteria in use (currently being introduced)

- Functions

- Network inventory, prioritization criteria, introduce RAMS, visual + equipment condition assessment, budgeting, linked to mapping, easy-to-use software

- Detailed Excel-based RAMS

- Detailed road and structure inventory, traffic data
- Condition categories based on measured data or visual assessments
- Prioritization and needs assessment based on decision matrix
- Budget allocation based on ranking
- Export of data to Google Earth for mapping or RONET for analysis

- Suitability for functions

- Simple database, but extensive data needs – complicated to use
- Currently being integrated into web-based RAMS

Example: Kyrgyz

Decision matrix and work programming

Решения о работах в зависимости от состояния

Инт-ть дв. (СГД)	Трещины	Колея										
		Ямы	0-1			2			3			
		IRI: 0-1	IRI: 2	IRI: 3-4	IRI: 0-1	IRI: 2	IRI: 3-4	IRI: 0-1	IRI: 2	IRI: 3-4		
< 1000	0-1	0 - 1	СОД	СОД	МР	СОД	СОД	МР	МР	РЕК1	РЕК1	
		2	ЯР	ЯР	МР	ЯР	МР	ЯР	ПИ	РЕК1	РЕК1	
		3	ЯР	ЯР	МР	ЯР	МР	МР	ПИ	РЕК1	РЕК1	
	2 - 3	0 - 1	ЗТ	ШПО	Ф308	ШПО	ШПО	Ф308	РЕК1	РЕК1	РЕК1	
		2	ШПО	ШПО	Ф308	ШПО	Ф304	Ф308	РЕК1	РЕК1	РЕК1	
		3	ШПО	ШПО	Ф308	Ф304	Ф306	Ф308	РЕК1	РЕК1	РЕК1	
	4	0 - 1	ШПО	ШПО	ПИ	ШПО	Ф304	ПИ	РЕК1	РЕК1	РЕК1	
		2	ШПО	Ф304	ПИ	Ф304	Ф306	ПИ	РЕК1	РЕК1	РЕК1	
		3	РЕК1	РЕК1	РЕК1	РЕК1	РЕК1	РЕК1	РЕК1	РЕК1	РЕК1	
	1000-3000	0-1	0 - 1	СОД	СОД	МР	СОД	ШПО	АБ08	МР	РЕК2	РЕК2
			2	ЯР	ЯР	АБ08	МР	МР	АБ08	ПИ	РЕК2	РЕК2
			3	ЯР	ЯР	АБ08	МР	АБ08	АБ08	ПИ	РЕК2	РЕК2
2 - 3		0 - 1	ЗТ	ДШПО	АБ08	ШПО	АБ08	АБ08	РЕК2	РЕК2	РЕК2	
		2	ШПО	Ф304	АБ11	Ф304	АБ08	АБ11	РЕК2	РЕК2	РЕК2	
		3	Ф304	АБ08	АБ11	АБ08	АБ11	АБ11	РЕК2	РЕК2	РЕК2	
4		0 - 1	ШПО	Ф304	АБ11	Ф304	АБ08	АБ11	РЕК2	РЕК2	РЕК2	
		2	Ф304	АБ08	РЕК2	АБ08	АБ11	РЕК2	РЕК2	РЕК2	РЕК2	
		3	РЕК2	РЕК2	РЕК2	РЕК2	РЕК2	РЕК2	РЕК2	РЕК2	РЕК2	
>3000		0-1	0 - 1	СОД	СОД	МР	СОД	ШПО	АБ11	МР	РЕК3	РЕК3
			2	ЯР	ЯР	АБ11	МР	МР	АБ11	ПИ	РЕК3	РЕК3
			3	ЯР	ЯР	АБ11	МР	АБ11	АБ11	ПИ	РЕК3	РЕК3
	2 - 3	0 - 1	ЗТ	АБ04	АБ11	ШПО	АБ04	АБ11	АБ11	РЕК3	РЕК3	
		2	ШПО	Ф304	АБ13	Ф304	АБ11	АБ11	АБ11	РЕК3	РЕК3	
		3	Ф304	АБ11	АБ13	АБ11	АБ13	АБ11	АБ11	РЕК3	РЕК3	

А Программа работ

№	участок	значени	ПЛУАД	ДЕП	От Км	До Км	Протяж. км	Индекс серьезности	Функциональный индекс	Индекс приоритетности	Предлагаемые работы	Затраты
ЭМ-02	Ош-Исфана 179-280 км	ЭМ	УАД ОБИ	ДЭП-02	218	219	1	18	15	270	РЕК2	560
ЭМ-02	Ош-Исфана 75-179 км	ЭМ	УАД ОБИ	ДЭП-46	101	102	1	17	15	255	РЕК2	640
ЭМ-02	Ош-Исфана 75-179 км	ЭМ	УАД ОБИ	ДЭП-46	100	101	1	16	15	240	РЕК2	640
ЭМ-02	Ош-Исфана 75-179 км	ЭМ	УАД ОБИ	ДЭП-46	102	103	1	16	15	240	РЕК2	640
ЭМ-02	Ош-Исфана 30-75 км	ЭМ	УАД ОСИ	ДЭП-37	48	49	1	15	16	240	РЕК3	612
ЭМ-02	Ош-Исфана 30-75 км	ЭМ	УАД ОСИ	ДЭП-37	49	50	1	15	16	240	РЕК3	612
ЭМ-02	Ош-Исфана 30-75 км	ЭМ	УАД ОСИ	ДЭП-37	50	51	1	15	16	240	РЕК3	612
ЭМ-02	Ош-Исфана 179-280 км	ЭМ	УАД ОБИ	ДЭП-02	229	230	1	16	15	240	РЕК2	440
ЭМ-02	Ош-Исфана 75-179 км	ЭМ	УАД ОБИ	ДЭП-46	97	98	1	16	15	240	АБ11	196
ЭМ-02	Ош-Исфана 280-403 км	ЭМ	УАД ОБИ	ДЭП-13	356	357	1	15	15	225	РЕК3	714
ЭМ-02	Ош-Исфана 75-179 км	ЭМ	УАД ОБИ	ДЭП-46	96	97	1	15	15	225	АБ11	196
ЭМ-02	Ош-Исфана 75-179 км	ЭМ	УАД ОБИ	ДЭП-46	98	99	1	15	15	225	АБ11	196
ЭМ-02	Ош-Исфана 179-280 км	ЭМ	УАД ОБИ	ДЭП-02	228	229	1	15	15	225	АБ11	147
ЭМ-02	Ош-Исфана 179-280 км	ЭМ	УАД ОБИ	ДЭП-02	230	231	1	15	15	225	АБ11	147
ЭМ-02	Ош-Исфана 30-75 км	ЭМ	УАД ОСИ	ДЭП-37	51	52	1	14	16	224	РЕК3	816
ЭМ-02	Ош-Исфана 30-75 км	ЭМ	УАД ОСИ	ДЭП-37	46	47	1	14	16	224	РЕК3	612
ЭМ-02	Ош-Исфана 30-75 км	ЭМ	УАД ОСИ	ДЭП-37	47	48	1	14	16	224	РЕК3	612
ЭМ-02	Ош-Исфана 30-75 км	ЭМ	УАД ОСИ	ДЭП-37	62	63	1	14	15	210	РЕК3	816
ЭМ-02	Ош-Исфана 30-75 км	ЭМ	УАД ОСИ	ДЭП-37	63	64	1	14	15	210	РЕК3	816
ЭМ-02	Ош-Исфана 30-75 км	ЭМ	УАД ОСИ	ДЭП-37	64	65	1	14	15	210	РЕК3	816
ЭМ-02	Ош-Исфана 30-75 км	ЭМ	УАД ОСИ	ДЭП-37	66	67	1	14	15	210	РЕК3	816
ЭМ-02	Ош-Исфана 30-75 км	ЭМ	УАД ОСИ	ДЭП-37	72	73	1	14	15	210	РЕК3	816
ЭМ-02	Балыкчы - Боконбаево - Каракол 0-60 км	ЭМ	ПЛУАД-4	ДЭП-10	41	42	1	15	14	210	РЕК3	714
ЭМ-02	Балыкчы - Боконбаево - Каракол 0-60 км	ЭМ	ПЛУАД-4	ДЭП-10	42	43	1	15	14	210	РЕК3	714
ЭМ-02	Ош-Исфана 75-179 км	ЭМ	УАД ОБИ	ДЭП-46	103	104	1	14	15	210	РЕК2	640
ЭМ-02	Ош-Исфана 30-75 км	ЭМ	УАД ОСИ	ДЭП-37	73	74	1	14	15	210	АБ11	196
ЭМ-02	Ош-Исфана 30-75 км	ЭМ	УАД ОСИ	ДЭП-37	44	45	1	13	16	208	РЕК3	816
ЭМ-02	Ош-Исфана 30-75 км	ЭМ	УАД ОСИ	ДЭП-37	54	55	1	13	16	208	РЕК3	816

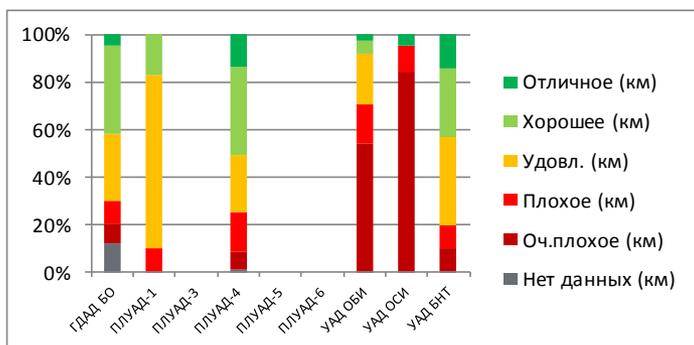
Example: Kyrgyz

- Standard reports for monitoring

Результаты состояния сети с твердым покрытием в плане визуально заметного разрушения



По ПЛУАдам



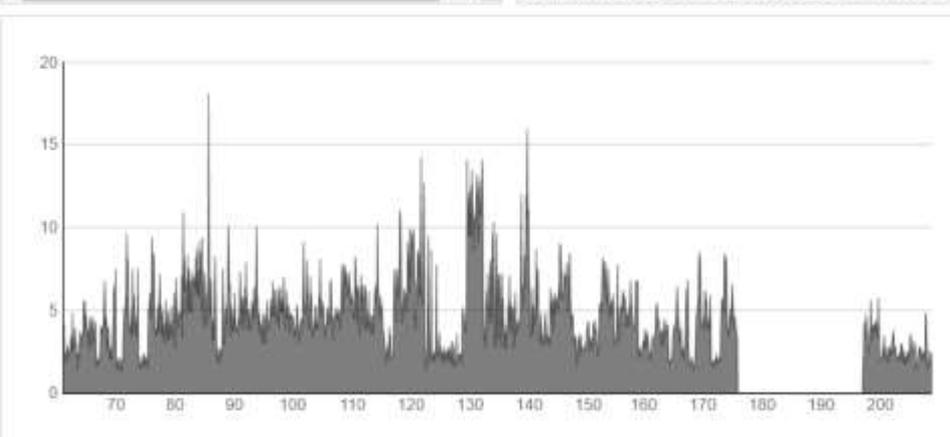
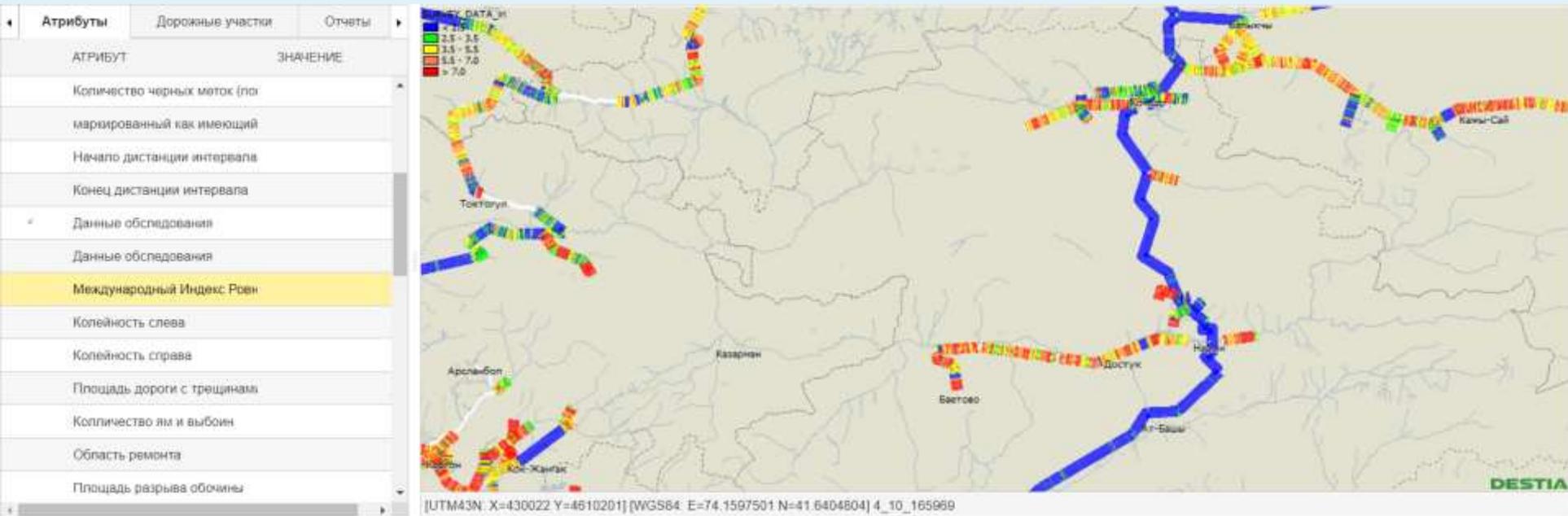
	Отличное (км)	Хорошее (км)	Удовл. (км)	Плохое (км)	Оч.плохое (км)	Нет данных (км)
ГДАД БО	20.0	153.0	119.0	39.0	34.0	52.0
ПЛУАД-1	0.0	13.0	55.2	7.8	0.0	0.0
ПЛУАД-3	0.0	0.0	0.0	0.0	0.0	0.0
ПЛУАД-4	60.5	159.0	105.2	71.4	34.4	4.0
ПЛУАД-5	0.0	0.0	0.0	0.0	0.0	0.0
ПЛУАД-6	0.0	0.0	0.0	0.0	0.0	0.0
УАД ОБИ	5.0	9.0	36.0	29.0	92.0	0.0
УАД ОСИ	2.0	0.0	0.0	5.0	38.0	0.0
УАД БНТ	17.0	34.5	44.0	12.0	12.0	0.0

По участкам

ПЛУАД	ДЭП	Участок	Отличное (км)	Хорошее (км)	Удовл. (км)	Плохое (км)	Оч.плохое (км)	Нет данных (км)	Среднее разрушение	Среднее IRI	Максимальное IRI
ГДАД БО	ДЭП-09	Бишкек-Ош 9-209 км	8.0	53.0	33.0	19.0	34.0	52.0	31.80	2.74	5.60
ГДАД БО	ДЭП-23	Бишкек-Ош 209-318 км	6.0	87.0	12.0	1.0	0.0	0.0	6.75		
ГДАД БО	ДЭП-30	Бишкек-Ош 318-427 км	6.0	13.0	74.0	19.0	0.0	0.0	20.58		
ПЛУАД-1	ДЭП-954	Бишкек - Торугарт 32-82 км	0.0	0.0	43.8	5.8	0.0	0.0	26.75	3.48	4.91
ПЛУАД-1	ДЭП-958	Бишкек - Торугарт 0-32 км	0.0	13.0	11.4	2.0	0.0	0.0	18.75	4.10	7.13
ПЛУАД-4	ДЭП-03	Балыкчы - Боконбаево - Каракол 124-150 км	8.0	15.0	3.0	1.0	0.0	0.0	7.96	3.88	5.56
ПЛУАД-4	ДЭП-04	Балыкчы - Ананьево - Каракол 156-207 км	13.7	11.0	8.9	17.4	0.0	0.0	20.19	4.15	5.61
ПЛУАД-4	ДЭП-07	Балыкчы - Ананьево - Каракол 40-156 км	16.8	99.1	0.6	0.0	0.0	0.0	5.15	4.24	6.50
ПЛУАД-4	ДЭП-10	Балыкчы - Ананьево - Каракол 0-40 км	0.0	0.0	28.0	2.0	5.0	0.0	33.14	4.88	6.32
ПЛУАД-4	ДЭП-10	Балыкчы - Боконбаево - Каракол 0-60 км	8.0	1.0	28.0	7.0	16.0	0.0	32.33	4.56	7.20
ПЛУАД-4	ДЭП-33	Балыкчы - Боконбаево - Каракол 60-124 км	14.0	2.0	17.0	21.0	6.0	4.0	28.00	3.99	9.28
ПЛУАД-4	ДЭП-35	Балыкчы - Ананьево - Каракол 207-218 км	0.0	5.9	1.7	1.0	2.4	0.0	25.50	4.65	6.28
ПЛУАД-4	ДЭП-35	Балыкчы - Боконбаева - Каракол 150-220 км	0.0	25.0	18.0	22.0	5.0	0.0	28.00	4.16	7.18

Example: Kyrgyzz

- Currently web-based RAMS being developed





Example: Georgia

- Context

- Network managed at central level through Roads Department
- Large move towards evidence-based planning

- Functions

- Network inventory, prioritization criteria, introduce RAMS, equipment condition assessment, budgeting, linked to mapping, off-the-shelf software (support)

- ArcGIS-based RAMS

- Basic road and structure inventory, traffic data
- Condition categories based on measured data
- Prioritization of treatments using HDM4
- Budget allocation based on HDM4 results and other criteria
- Status and plans presented on maps

- Suitability for functions

- Five-year maintenance and rehabilitation plans updated annually
- Basic data collection using ROMDAS – plans to expand (safety, passportization)
- Data only accessible to trained users, not remotely accessible

Example: Georgia

Acquisition of Data collection system IRI + GPS

Acquisition of GIS system

Automatic Traffic counters

Acquisition of HDM-4 2.0 and development of planning guideline

Development of network modelling tool

Created RAMS unit within Agency

Development of 5 year program and respective guidelines/manuals

Attempt to procure All in one software (data processing, analysis, planning)

Data collection equipment upgrade

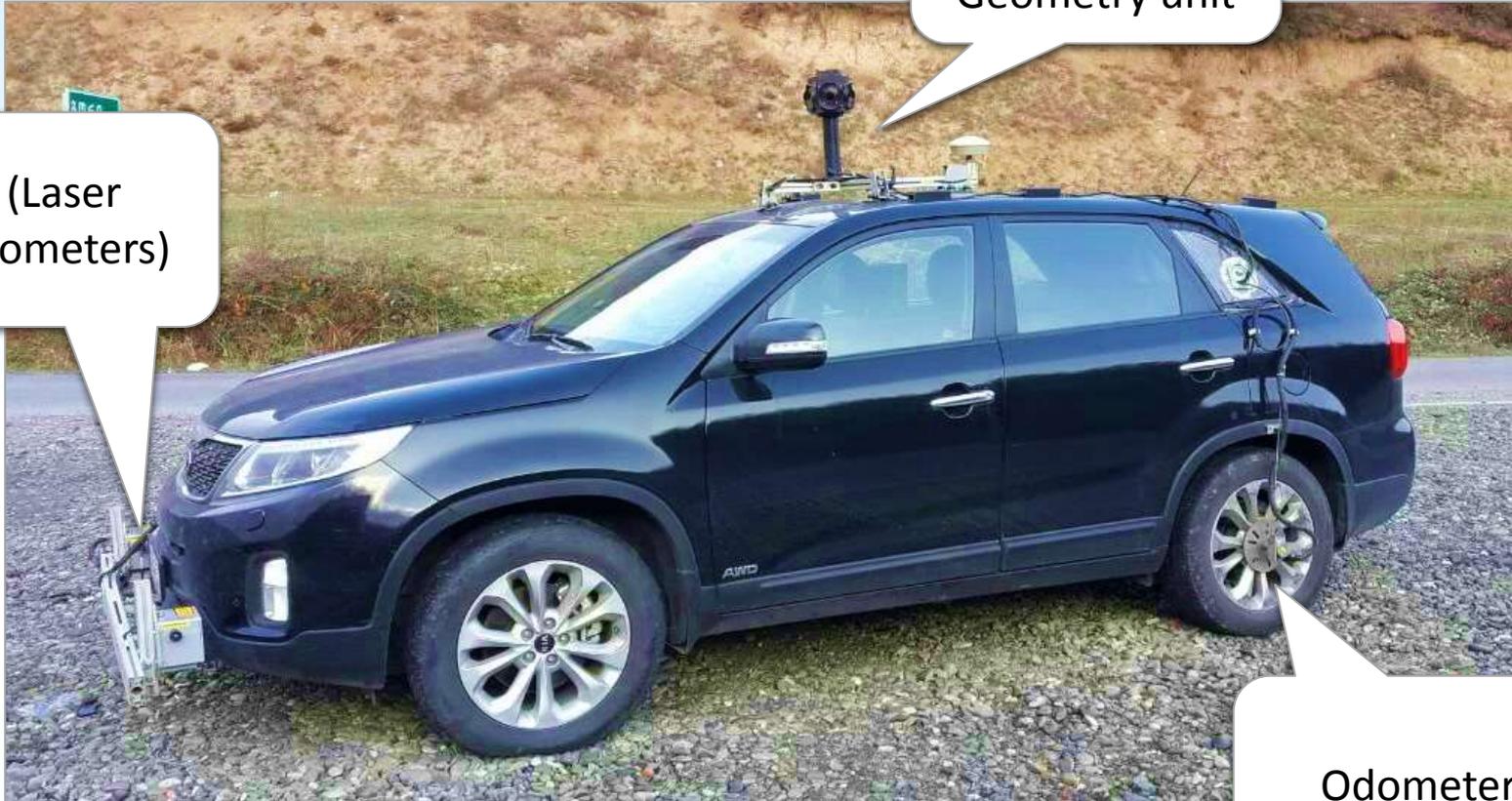
Introduction of social indicators in 5 year plan

Development of TOR for implementing commercial GIS based advanced linear referencing system

2008

2018

Example: Georgia



IRI (Laser
Profilometers)

360 Degree
camera, GPS,
Geometry unit

Odometer

Example: Georgia

MainWindow

HDM-4 Road Network Modeling Tool 0.7b

Main Road Network Traffic Data Surface Distresses Default Values Export Weight

Roughness: New +3.2 81% Rutting: + 0 mm 92% Deflection: + 0.2 SMP 98% Friction: + 0.1 SN 25%

Good + 4 10% 20 mm 70% 4.2 SMP 40% 4.2 SN 25%

Fair 0 0% 30 mm 60% 4.1 SMP 35%

Poor - 2 10% 40 mm 50% + 1.3 SMP 40%

Bad - 3 40% + 20 mm 40%

Apply

Terminal IRI: 1.7 Enable Force Combine

Min Section Length: 1 Max Section Length: 7

Road ID	Road Name	Count	ID	Row
sh01	Batumi-Akhalsikhe	1598	1	sh01
sh02	Sajavakso-Coxatauri-Ozurgeti-Kobuleti	726	2	sh02
sh03	Abasha-Gagma Kodori-Guleiskin-Japani	325	3	sh03
sh04	Abasha-Martvis	346	4	sh02
sh05	Senaki-Nokakavni-Sandza-Khoni	370	5	sh02
sh06	Zugdidi-Tsalenyikha-Chkhorotsku-Senak	852	6	sh02
sh07	Zugdidi-Jvari-Mestia-Laidli	1923	7	sh03
sh08	Zugdidi-Anaklia	318	8	sh03
sh101	Zestafoni-Kitskhi-Kharagauli	208	9	sh03
sh102	Tufoti-Alisubani-Sazano-Tuzi	281	10	sh03
sh103	Ianeti-Didi Jkhaishi-Khoni	171	11	sh02
sh104	Kutaisi-Gegubi-Sakulisi-Bashi	336	12	sh03
sh105	Vani-Sulon	114	13	sh02
sh106	SuanTa-Chvishi (G. Tabidze Muzeum)	46		

Programme: 5 Year Program International

Perform Run Unconstrained Programme

Budget Scenario: Unconstrained Programme

Life Cycle Analysis - performed at 05-02-2015 (costs in Works Currency (millions of Lari))

Road Section	Road class	Length	MT AADT	Pavement	Road Works	Year	Cost (m#)	Recurrent Cum. Cost	Capital Cum. Cost (m#)	NPV/CAP
Ponichola-Mameuli-Guguli 67	International	3.30	6550	Bituminous	C.Rehab(S)@IRI>11	2015	2.43	-	2.43	21.18
Ponichola-Mameuli-Guguli 70	International	2.30	6550	Bituminous	C.Rehab(S)@IRI>11	2015	1.69	-	4.12	21.09
Tbilisi by Pass 48.6 - 48.9	International	0.10	7459	Bituminous	C.Rehab(S)@IRI>10	2015	0.08	-	4.20	21.04
Tbilisi by Pass 15 - 17.9	International	2.90	7459	Bituminous	C.Rehab(S)@IRI>10	2015	2.33	-	6.53	20.57
Tbilisi by Pass 42.1 - 44.4	International	2.30	7459	Bituminous	C.Rehab(S)@IRI>10	2015	1.85	-	8.38	20.14
Tbilisi by Pass 38.9 - 42.1	International	2.20	7459	Bituminous	C.Rehab(S)@IRI>10	2015	1.77	-	10.15	20.13
Tbilisi-Senaki-Laselidze 339	International	0.10	5239	Bituminous	C.Rehab(S)@IRI>11	2015	0.07	-	10.22	17.96
Tbilisi-Bakurtsikhe-Legodekh International	International	1.00	2424	Bituminous	C.Rehab(S)@IRI>10	2015	0.58	-	10.80	16.30
Tbilisi by Pass 44.4 - 47.2	International	2.80	7459	Bituminous	B.Rehabilitation@>I	2015	0.73	-	11.53	15.00
Tbilisi by Pass 34.3 - 36.3	International	2.00	7459	Bituminous	B.Rehabilitation@>I	2015	0.52	-	12.05	13.38
Tbilisi by Pass 47.2 - 48.8	International	1.60	7459	Bituminous	B.Rehabilitation@>I	2015	0.41	-	12.46	13.03
Mtskheta-Stepantsminda-Lari International	International	1.30	2708	Bituminous	C.Rehab(S)@IRI>10	2015	0.76	-	13.22	13.03
Tbilisi by Pass 17.9 - 20.4	International	2.50	7459	Bituminous	B.Rehabilitation@>I	2015	0.65	-	13.87	12.94
Ponichola-Mameuli-Guguli 63	International	4.30	6550	Bituminous	B.Rehabilitation@>I	2015	1.11	-	14.98	7.07
Ponichola-Mameuli-Guguli 75	International	1.20	6550	Bituminous	B.Rehabilitation@>I	2015	0.31	-	15.29	7.07
Ponichola-Mameuli-Guguli 73	International	2.80	6550	Bituminous	B.Rehabilitation@>I	2015	0.73	-	16.02	7.02
Ponichola-Mameuli-Guguli 59	International	3.20	6550	Bituminous	B.Rehabilitation@>I	2015	0.83	-	16.85	6.99
Senaki-Pob-Serpi 1.1 - 1.9	International	2.80	6513	Bituminous	C.Rehabilitation@>I	2015	0.73	-	17.58	6.69
Tbilisi by Pass 13.4 - 15	International	1.60	2488	Bituminous	B.Rehabilitation@>I	2015	0.41	-	17.99	5.11
Tbilisi-Bakurtsikhe-Legodekh International	International	3.00	2424	Bituminous	B.Rehabilitation@>I	2015	0.78	-	18.77	3.09
Tbilisi-Bakurtsikhe-Legodekh International	International	3.00	2424	Bituminous	B.Rehabilitation@>I	2015	0.78	-	19.55	2.86
Tbilisi-Bakurtsikhe-Legodekh International	International	3.80	2424	Bituminous	B.Rehabilitation@>I	2015	0.98	-	20.53	2.86
Tbilisi-Bakurtsikhe-Legodekh International	International	2.90	2424	Bituminous	B.Rehabilitation@>I	2015	0.75	-	21.28	2.84
Tbilisi-Bakurtsikhe-Legodekh International	International	2.80	2424	Bituminous	B.Rehabilitation@>I	2015	0.73	-	22.01	2.84

Save Close Manual assignment Display recurrent works

Select a Budget Scenario from the list to show its Work Programme

Example: Georgia

- HDM4 results for basis for planning
- Other criteria also applied
 - Difficulties getting objective data
- Final plan 80% in line with HDM4 results

Rehabilitation of: Sh37 Sadakhlo-Tsopi-Askhepi secondary road km3-km8 Section						
Project Description						
Following road section is part of rolling program for year 2018, section connects international road S07 Marneuli-Sadakhlo to Armenia border and provides access to social services to more than 1500 people. Road is considered important in terms of Agriculture as well as providing minimum standard of mobility and integration.						
Utilization		Class	Economic Indicators (mln. Gel) / Road Works			
Traffic (AADT)	250	1	Total Capital Cost	3.0	Pavement structure	n/a
Heavy Vehicles (%)	2.5		NPV	0.14	Bridge/Culvert/structure	n/a
¹ Condition	10.91	4	NPV/Cost Ratio	0.03	Traffic Safety	n/a
² Population Density	227	4	Cost/Pop. Ratio	0.002	Environment	n/a
Socio Economic Impact Assessment						
Objective	Indicator				Unit	
Enhanced National Connectivity	Part of Secondary Road connecting two international roads.				N	
Enhanced Regional Connectivity	Distance from the centre of section to closest city centre.				34km	
Enhanced economic activities	Number of registered businesses in the district where the section is located.				347	
Population	Number of people living within 2km buffer along the road section.				1520	
Education	Number of schools within 2 km buffer along the road section.				7	
Tourism	Number of attraction within 2 km buffer along the road section.				2	
Poverty	Percentage of people receiving government support within district where road section is located.				n/a	
Life Line Road	The road is the only possibility for connecting the village to outside world.				y	
Project Area Map						
						

¹Description of Condition Classes (Good, Fair; poor and Bad) is found in Chapter 4, section 1.1

²Number of persons/2km buffer from the homogenous section divided by section length



Example: Azerbaijan

- Context

- 17,473 km roads managed by Azeryolservis
- RAMS and data collection with WB support since 2010 - \$12 million
- 2003 attempt was not successful – system not used

- Functions

- Update and further develop existing database, collect data for 13,000 km, develop planning systems

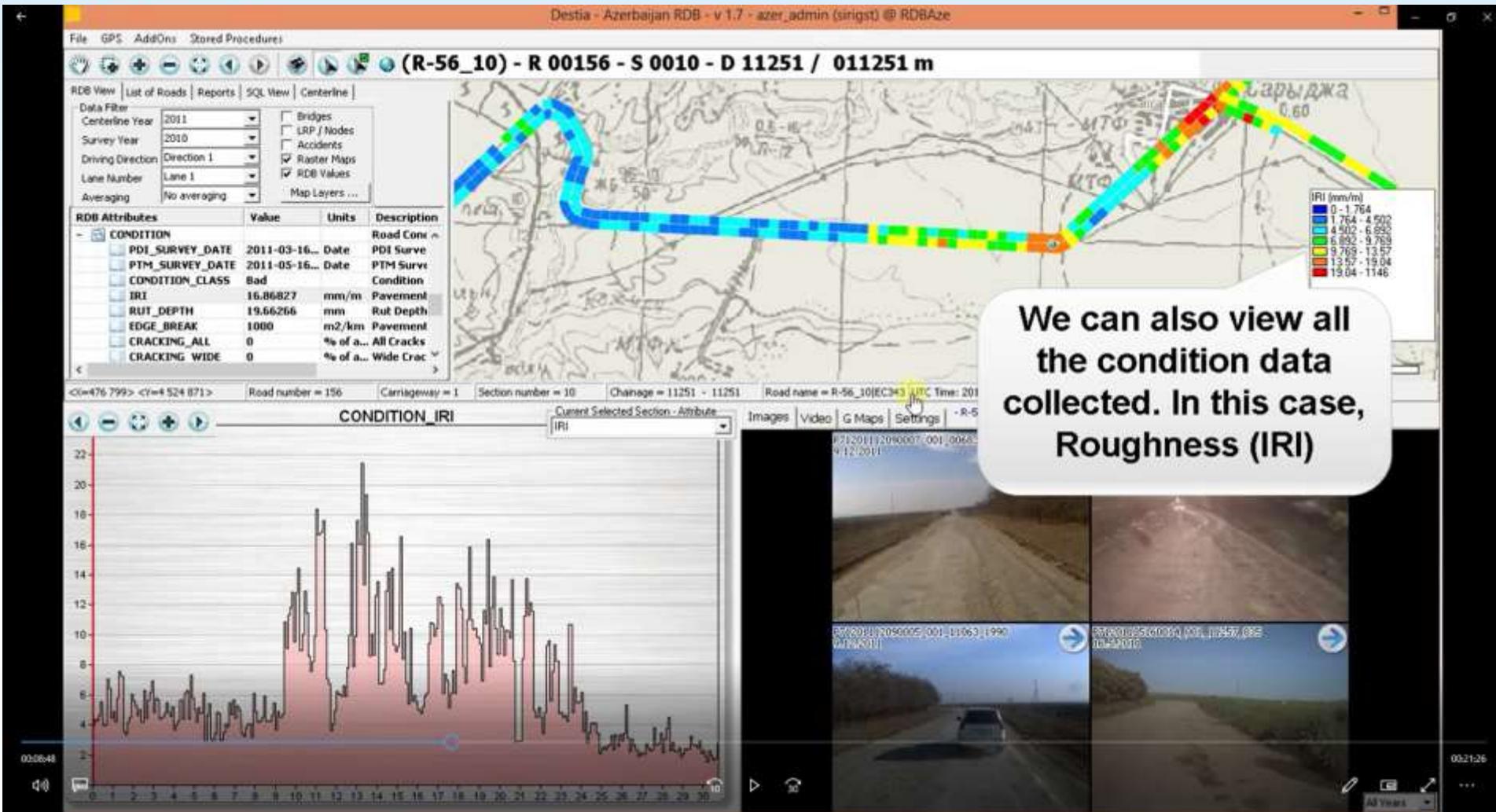
- Integrated RAMS

- Extensive data collection for 13,500 km as part of development
- Custom-made database (inventory, traffic, condition, video, photo, GIS, etc.)
- Export to HDM4 for further analysis

- Suitability for functions

- Very comprehensive system
- Very high data needs - \$10 million for data collection
- System reportedly no longer being used

Example: Azerbaijan



We can also view all the condition data collected. In this case, Roughness (IRI)

Functions of a RAMS

- The RAMS needs to be fit-for-purpose
 - What data needs to be collected and managed?
 - **How will we collect that data?**
 - How will we use that data?
 - Who will use and operate the RAMS (trained staff)?
 - Will we use off-the-shelf or custom-made software?
- Road management skills and needs will evolve over time
 - Start simple
 - Gradually increase functionality as skills/needs develop



Group Work

- Why do we want a RAMS? What will be the purpose?
- How do we want to use the RAMS?
- Who will use and operate the RAMS?
- What functions should the RAMS have?