

Road Asset Management Systems

Session 3: Data Processing and Management

Serge Cartier van Dissel
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Agenda

Day 1	Day 2
<p>Session 1</p> <p>Introduction to RAMS</p>	<p>Session 5</p> <p>RAMS Action Plan</p>
Coffee break	Coffee break
<p>Session 2</p> <p>RAMS Data Collection</p>	<p>Session 6</p> <p>RAMS Action Plan</p>
Lunch	Lunch
<p>Session 3</p> <p>RAMS Data Management</p>	<p>Session 7</p> <p>RAMS Institutionalization</p>
Coffee break	Coffee break
<p>Session 4</p> <p>RAMS Data Analysis and Planning</p>	<p>Session 8</p> <p>Conclusions and next steps</p>

Data processing and management

- Data is only useful if we can access it and analyse it
 - Data needs to be reliable
 - Data needs to be accessible
 - Combining of different data needs to be possible
- Data therefore needs to be:
 - Validated (checked for errors or issues)
 - Processed (right format, combining different data sources)
 - Managed (in a database)

Data validation

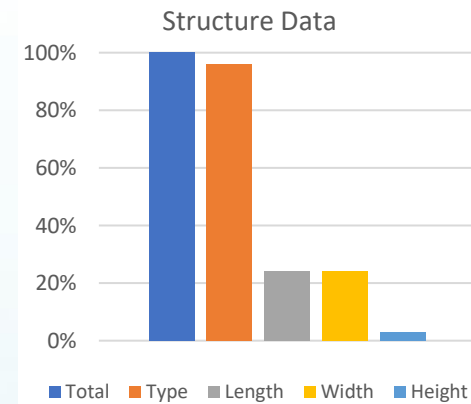
- Checking data for errors/inconsistencies
 - IRI value of 98.5 – this is not possible and should be marked as an error
 - RoadLab roughness app records IRI=1 if speed is too low – this should be recorded as no data rather than a very low roughness of IRI=1
- Validation to be carried out before data is uploaded into database
 - Based on raw data (or processed data)
 - May include auditing of sample of data
 - Complemented by automatic checks in database – e.g. values within thresholds
- This is an important activity that is often given insufficient attention
 - Errors or problems in data can make the RAMS useless

Data processing

- Transforming data into the required format
 - Transforming data into a format that can be imported into the database
 - Transforming the units of the data
 - Transforming from m² to a percentage of the pavement surface
 - Sometimes automated in the database
- Importing data into a database
 - Making data ready for import
 - Preparing as a single CSV sheet with fixed columns
 - Some equipment can export data into a specific format
 - ROMDAS uses MS Access database
- All raw data should be kept and properly stored
 - If issues are found with processed data, raw data can be checked
 - Proper folder structure + backup system are needed

Example: Cambodia

- Rural Roads Information Management System (RRIMS)
 - Data collection by provincial departments – 45,000 km
 - Data entry by different staff (working group of 25 people)
 - Limited time and responsibility
- Insufficient data validation and processing
 - Provinces used Excel sheets to send data – data errors and format inconsistencies
 - Data was not always validated and instead imported directly into the RRIMS
- Database contained many errors and corrupted data
 - Data entered in wrong location (road width instead of pavement type)
 - Data entered in wrong format (e.g. centimetres instead of metres)
 - Data not according to defined categories (e.g. wrong spelling)
 - Data was often incomplete
 - Database did not include automatic checks of imported data
- Analysis of the data proved impossible
 - Data cleaning required first – very costly (for out-of-date data)
 - Raw data not always recoverable
 - Data will need to be collected again – 45,000 km



Example: Myanmar

- Road Data Bank (RDB) for trunk roads
 - 27,000 km surveyed using RoadRoid app and visual assessments
- Road data was only validated towards end of data collection
 - For much data the travel speed was too low to allow accurate IRI measurement
 - A lot of data had unrealistic IRI values
 - Only 16,800 km was found to have reliable IRI data
 - Over 10,000 km of IRI data was found to be unusable
- Although data validation was carried out and identified unreliable data, it was done too late in the process

Data management

- Data is entered into a database to facilitate access and combination of datasets
- Standard spreadsheet/database software (e.g. Microsoft Excel, Microsoft Access)
 - Good as starting software, but quickly becomes insufficient for full-fledged RAMS
- Off-the-shelf road database software (e.g. HIMS, ArcGIS)
 - Often lacks certain functionalities, difficult to make changes
 - Often includes functionalities that are not used, but are paid for
 - Requires (annual) licenses
- Custom-made road database software (often web-based)
 - Gradually becoming less expensive to develop
 - Allows great flexibility in design and scope
 - Possible to expand in future, but can be dependent on original developer
 - Requires good ideas of database needs – involvement of experienced road management specialist

Database software

Software type	Advantages	Disadvantages	Examples
Standard spreadsheet (MS Excel or similar)	<ul style="list-style-type: none"> • Inexpensive • Easy to operate • Software often available • Support widely available • Simple interface possible 	<ul style="list-style-type: none"> • Limited functionality • Need to develop structure 	<ul style="list-style-type: none"> • Nepal (PTMP) • Kyrgyz (СУДА)
Standard database (MS Access or similar)	<ul style="list-style-type: none"> • Inexpensive • Support widely available • Simple interface possible 	<ul style="list-style-type: none"> • Limited capacity • Need to develop structure 	<ul style="list-style-type: none"> • Bangladesh (RSDMS) • Solomon Islands (SITAMS) • Tajikistan (HMS)
Off-the-shelf road database software	<ul style="list-style-type: none"> • Can be less expensive • Support widely available 	<ul style="list-style-type: none"> • Not always suitable • Limited functionality • Language issues 	<ul style="list-style-type: none"> • Georgia (ArcGIS) • Cambodia trunk (HIMS) • Zambia (HIMS)
Custom-made database software	<ul style="list-style-type: none"> • Adjusted to needs • In own language 	<ul style="list-style-type: none"> • Expensive • Limited support 	<ul style="list-style-type: none"> • Myanmar (RDB) • Timor-Leste (ESTRADA) • Azerbaijan (RDBAze) • Pakistan (RMS) • Cambodia rural (RRIMS) • Kyrgyz (СУДА) • Kazakhstan

Database use

- Skill requirement
 - Is the software easy to use or only useable by trained staff
 - How feasible is it to train staff and retain them?
- Language
 - Is the database software available in a local/regional language?
 - Is it possible to have a local language interface?

Database access

- Remote access – central server
 - Does the database only work as a standalone desktop software?
 - Requires sharing and merging of database copies
 - Can it be accessed remotely by multiple users?
 - Central server within local area network (LAN)/wide area network (WAN)
 - Online access through internet
- Does the software allow for differentiated user rights?
 - Technical operators – data entry and editing
 - Road entity users – data viewing and exporting
 - Public users – limited data viewing

Data identifier

- Databases need unique identifiers for data sets
 - For roads use is made of road codes
 - Road names not unique + problems with spelling
- Road code needs to reflect
 - Administrative class
 - Road number
 - Link number (for link code)
- Codes for bridges and other structures
 - To include road code (important to know what road a structure is in)
 - Letter to indicate the type of structure (e.g. "B" for bridge)
 - Numbering preferably in sequence of chainage
- Exact format of code can be varied, but has to be used consistently
 - In database
 - In contracts

Database functions

- Related to functionality of the RAMS
- Database functions
 - Search/select data (multiple filters)
 - Show selected data (tables, graphs and maps)
 - Export data (generally as tables to PDF or CSV format, also as maps)
 - Standard reports (sets of agglomerated data for certain road types)
 - Calculate statistics and key performance indicators

Database development

- Database development has to go hand-in-hand with data collection
- Do not develop the database before collecting any data
 - Problems in Timor Leste
- Do not collect all the data before developing the database
 - Problems in Myanmar
- Apply a stepwise approach
 - Collect data for a portion of the road network(s) to be included in the database
 - Check and validate the data collection
 - Develop and test the database
 - Collect the data for the rest of the network(s)
 - Complete database development and testing

Data management costs

- Equipment and software

- Excel/Access: \$10,000+ (including costs for developing structure)
- Off-the-shelf: ROMDAS HIMs
 - Desktop \$80,000-\$250,000
 - Enterprise: \$200,000-\$750,000
 - Web version: \$500,000-\$1,250,000
 - Cloud version: \$2,500-\$7,500 per month
- Custom-made: >\$250,000
- Server, computers, network equipment, printers, plotters

- Operation

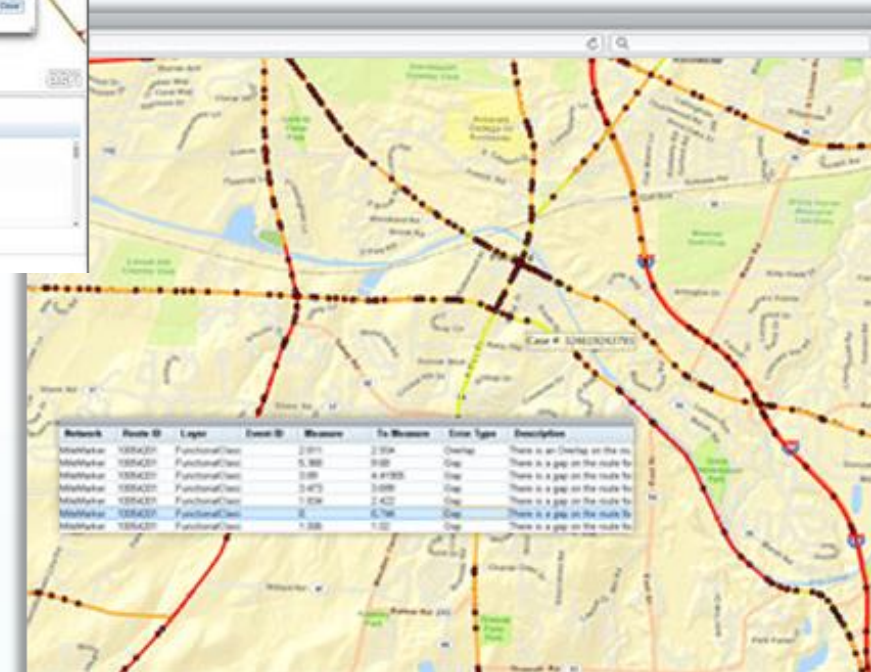
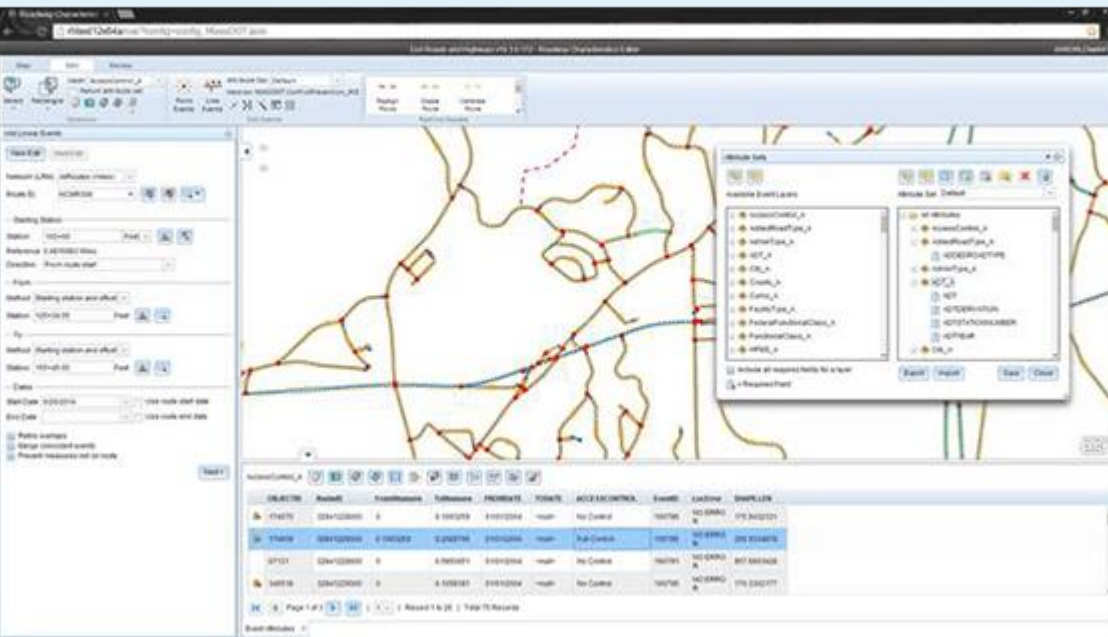
- Staff + training
- Operational expenses (paper, ink, internet, etc.)

- Maintenance

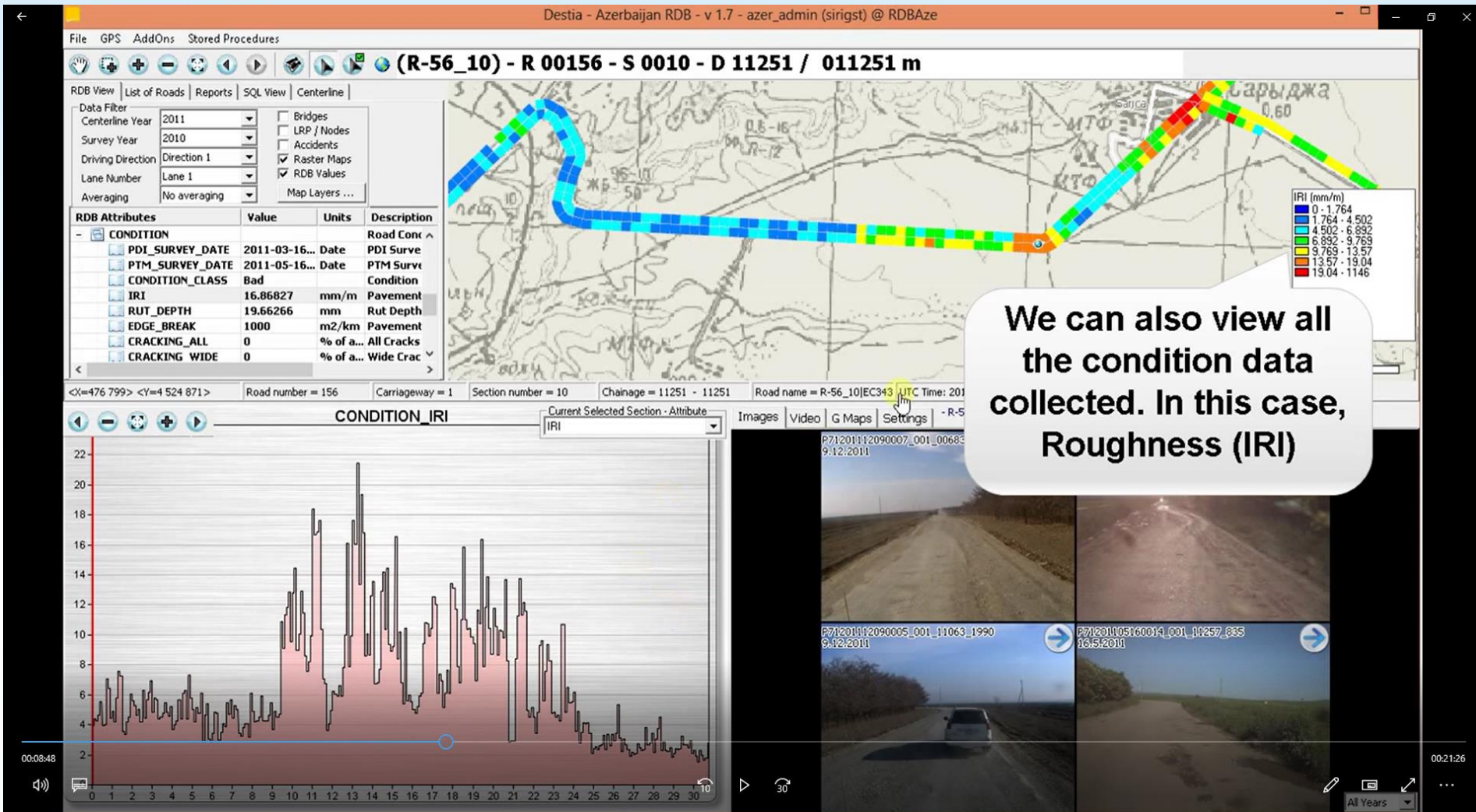
- Servicing and adjustments to software (service license)
- IT staff

Example: Georgia

- Off-the-shelf software (ArcGIS Roads and Highways)



Example: Azerbaijan



<https://www.youtube.com/watch?v=ncJ1lUZywRE>



- Asset Manager** | Reports | Planning

View: Fullscreen view

Map & Table | Map | Table

Filters | Clear all filters

LOCATION

Municipality +

ASSET

Road Class Clear -

☒ National
☐ Highway
☐ Municipal
☐ Urban
☐ Rural

Road Code +

Road Status Clear +

Surface Type Clear -

☐ Bitumen
☐ Asphalt Concrete
☒ Penetration Macadam
☐ Surface Treatment
☐ Cement Concrete
☐ Stone Macadam
☐ Gravel
☐ Earthen
☐ Under Construction

ASSET CONDITION

Surface Condition (SDI) +

Road Inventory									
Road Code	Link Code	Link Length (Km)	Link Start Chainage	Link End Chainage	Surface Type	Carriageway Width (m)	Roughness (IRI)	Surface Condition (SDI)	
A01	A01-01	62.41	0+000	63+260	View Surface Type	5.0		View Surface Condition (SDI)	
A01	A01-02	59.44	63+260	120+962	View Surface Type	5.0		View Surface Condition (SDI)	
A01	A01-03	59.58	120+962	182+040	View Surface Type	4.3		View Surface Condition (SDI)	
A03	A03-03	62.13	33+440	85+300	View Surface Type	4.3		View Surface Condition (SDI)	
A03	A03-04	2.99	85+300	114+214	View Surface Type	4.5		View Surface Condition (SDI)	
A03	A03-05	41.44	0+000	41+400	View Surface Type	4.4		View Surface Condition (SDI)	
A06	A06-01	27.19	0+000	27+120	View Surface Type	4.0		View Surface Condition (SDI)	
A06	A06-02	35.63	27+120	62+820	View Surface Type	4.0		View Surface Condition (SDI)	
A09	A09-01	22.22	0+000	0+000	View Surface Type	4.6		View Surface Condition (SDI)	

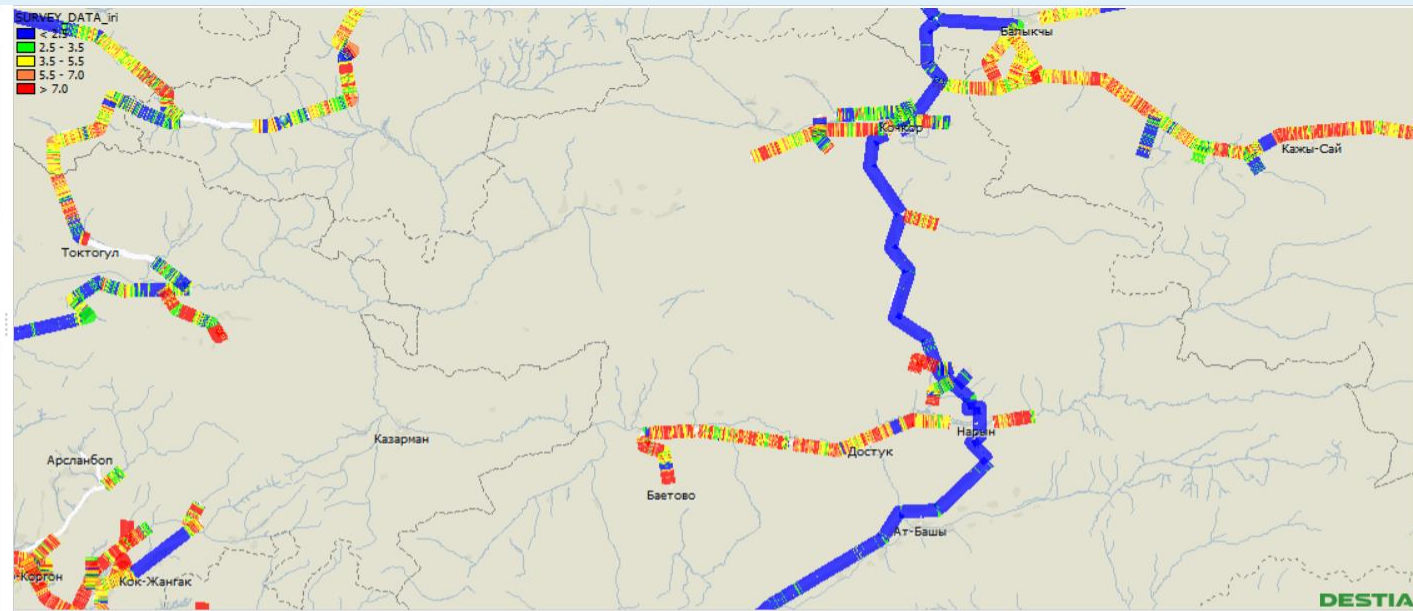
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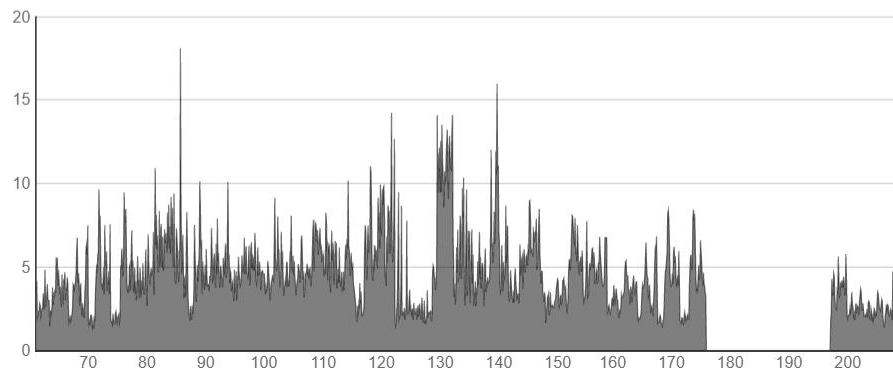
Example: Kyrgyz

- Custom-made database (under development)

Атрибуты	Дорожные участки	Отчеты
АТРИБУТ	ЗНАЧЕНИЕ	
Количество черных меток (пои		
маркированный как имеющий		
Начало дистанции интервала		
Конец дистанции интервала		
Данные обследования		
Данные обследования		
Международный Индекс Ровн		
Колейность слева		
Колейность справа		
Площадь дороги с трещинами		
Количество ям и выбоин		
Область ремонта		
Площадь разрыва обочины		



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Data management

- Who will validate and process data
- What type of database do we need (initially)
- What data should the database be able to manage
- What functionality should the database have
- Who will manage and operate the database
- Who can access data and how
- What in-house skills do we need