Road Asset Management Systems

Session 5: RAMS Institutionalization

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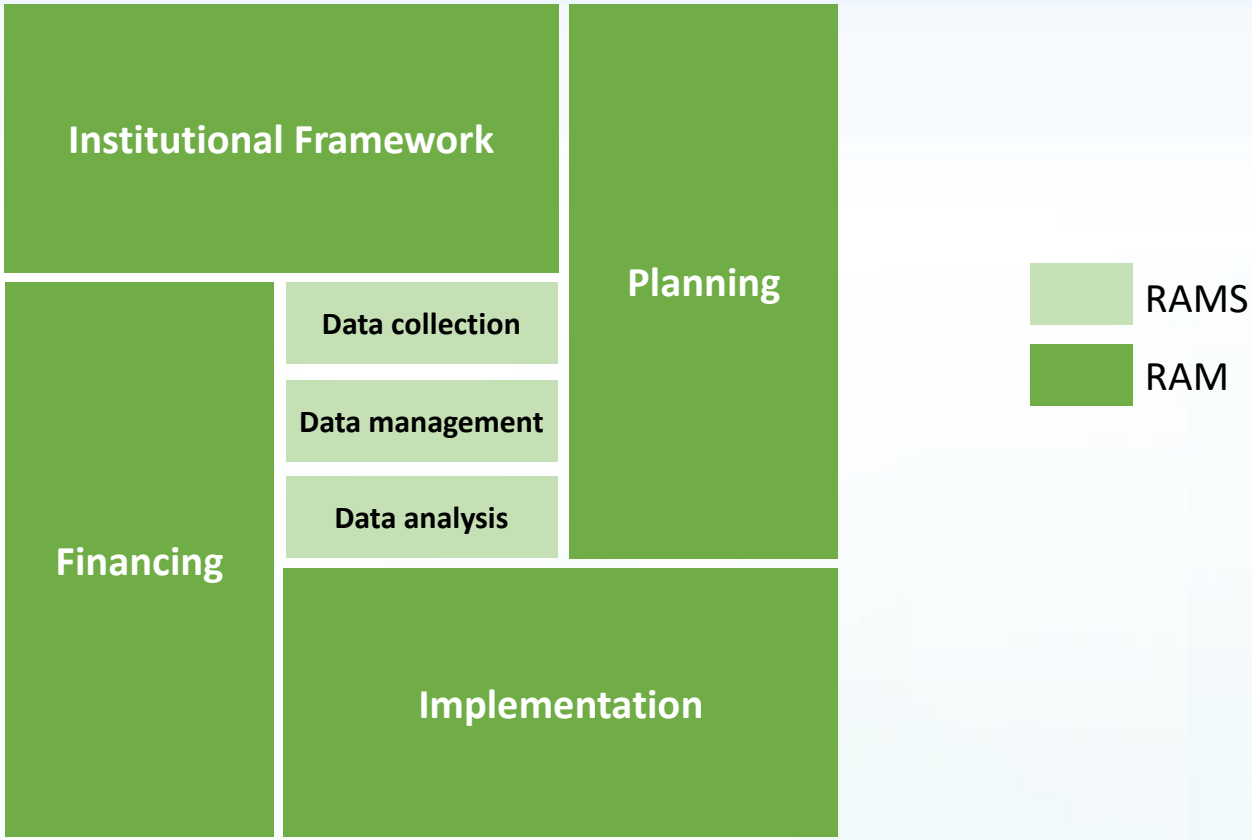
November 2022

Agenda

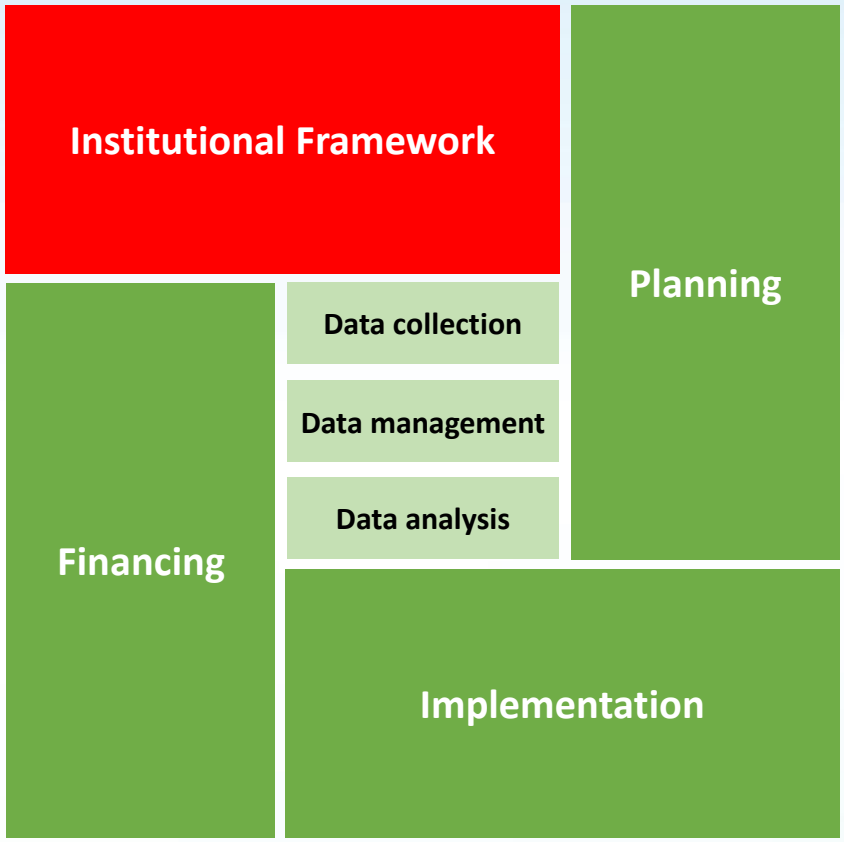
Day 1	Day 2
Session 1 **Introduction to RAMS**	Session 5 **RAMS Institutionalization**
Coffee break	Coffee break
Session 2 **RAMS Data Collection**	Session 6 **RAMS Action Plan**
Lunch	Lunch
Session 3 **RAMS Data Management**	Session 7 **RAMS Action Plan**
Coffee break	Coffee break
Session 4 **RAMS Data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

Road Asset Management (System)

- **Road Asset Management System**: Any system that is used to collect, manage and analyze road data for road planning and programming purposes
- **Road Asset Management**: Integration of the RAMS into the institutional framework, planning procedures, financing systems and implementation modalities



RAMS – Institutional Framework



Institutional Framework

- RAMS Unit
  - Small dedicated group of fixed full-time staff working on the RAMS
  - Not part-time, not large working group
  - Generally under Planning Department or Section
  - As a separate unit or team

- Minimum 3-4 people
  - Data collection and validation expert
  - Database and pavement management system expert
  - GIS expert

- Size depends on functions
  - Size of network and types of data to be collected
  - Whether some functions are outsourced or not

Data collection

- Outsourcing of data collection
  - Some data collection outsourced (contractors, consultants)
  - May include post-processing (e.g. of video data)
  - Depends on quantity of data and collection methods
  - More common with data collected every few years (inventory, traffic data)

- In-house data collection
  - Some data collected in-house (RAMS Unit)
  - Data that is collected every year (condition data)
  - Data that is available in-house or from other units (e.g. from toll stations)

- RAMS Unit to coordinate data collection
  - Prepare contracts for data collection
  - Check that all required data is collected
  - Check that collected data is in order

Data management

- Data validation and processing
  - May be outsourced together with data collection
  - Will need to be verified by in-house RAMS unit

- Data management (database)
  - RAMS maintenance and support may be outsourced (especially IT side)
    - Cloud-based, remotely accessible, part-time support service
  - RAMS operation generally in-house (data side)

Data analysis

- Generally done in-house (RAMS unit)
  - Allows for back-and-forth, adjusting runs to incorporate other criteria
  - Should have strong linkage with planning unit

- May be supported by consultants
  - e.g. HDM4 strategy analysis every 5 years as basis for decision matrix

Example: Georgia

- RAMS Unit
  - 3 fixed staff (supported by consultant for RAMS development)
  - Part of Planning & Operations Unit (formerly separate RAMS Unit)

- Data Collection
  - Road condition every year by RAMS Unit – ROMDAS vehicle surveys
  - ROMDAS vehicle also used for construction quality control
  - Traffic counts outsourced to routine maintenance contractors (24 zones)
  - Inventory data and bridge data to be collected – beyond scope of RAMS staff

- Data management
  - RAMS staff (ArcGIS)

- Data analysis
  - RAMS staff (ArcGIS + HDM4)
  - In coordination with Planning and Operations Unit and management staff

Example: China (Yunnan)

- Yunnan Province Highway Research Institute
  - Own a highly-automated survey vehicle
  - Second vehicle rented and later purchased

- Data collection
  - Outsourced to Research Institute
  - 46,000 km in 2009 (multiple lanes)
  - Many organizations now have such vehicles, allowing for competitive bidding
- Data management
  - Outsourced to Research Institute
  - Using China Pavement Management System (CPMS)
- Data analysis
  - CPMS analysis module not purchased
  - HDM4 used with ADB support – through Research Institute

Example: Pakistan

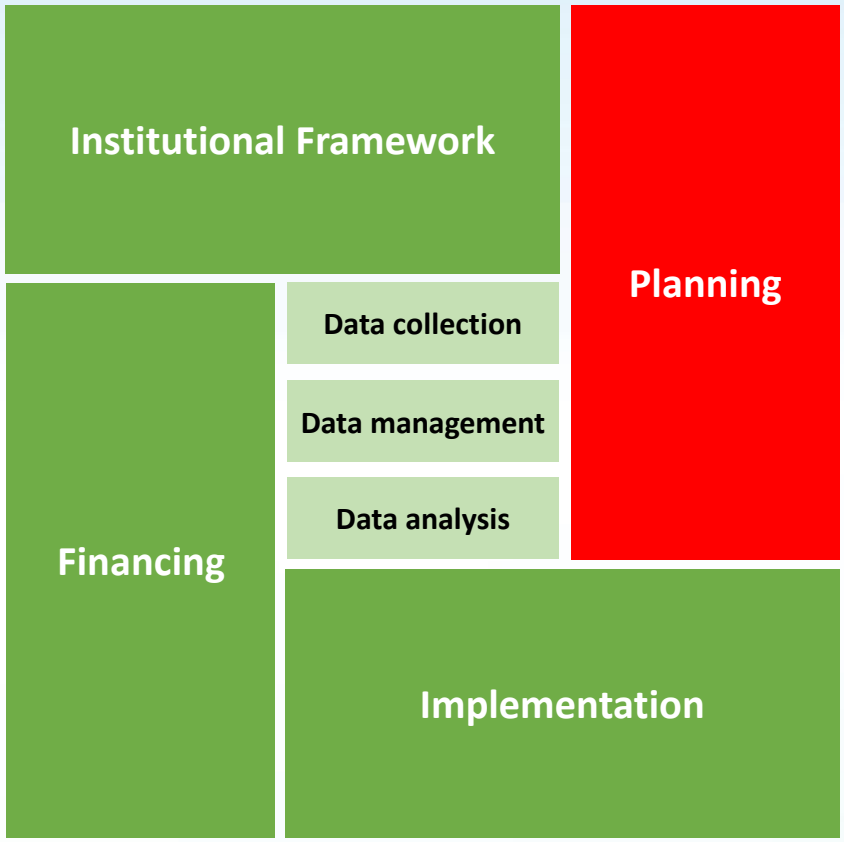
- Road Asset Management Directorate
  - Under National Highway Authority

- Data collection
  - In-house by RAMD
  - ROMDAS survey vehicle (bump integrator, laser profiler, GPS, odometer)
  - Dynatest trailer (Falling Weight Deflectometer)
  - Currently more detailed data collection outsourced

- Data management
  - In-house by RAMD
  - Currently data entry outsourced

- Data analysis
  - In-house by RAMD using HDM4
  - Currently outsourced (resulting plans as deliverable)

RAMS - Planning



Planning Procedures

- RAMS analysis has to fit into existing planning procedures

- Timing of data collection, processing and analysis important
  - Results need to be ready in time for budgeting
  - Not always appropriate timing with regard to seasons

- Results of the data analysis need to form basis of planning
  - Data analysis is not the same as planning
  - It is the basis for the subsequent planning process
  - Planning takes into account other criteria and priorities
  - Resulting plan should not deviate too much from the data analysis
  - e.g. Georgia plans include approximately 80% of HDM4 prioritized roads

Planning Procedures

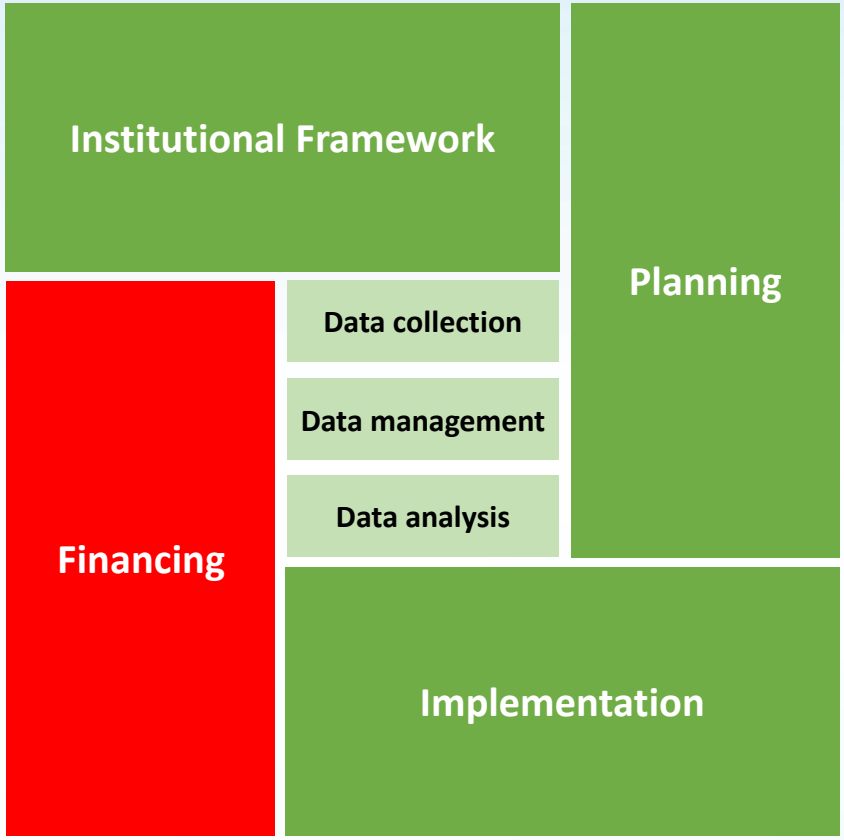
- Data analysis goes further than just planning and budgeting

- Show total needs
  - RAMS can be used to determine the complete needs for the network
  - Not just the current year budget usage
  - Decision support system for longer-term budget allocation priorities

- Predicting road network conditions
  - RAMS can help predict the road conditions to be achieved with the expected budgets
  - Can go up to 20 years, but generally 5-10 years

- Assessing different budget scenarios
  - RAMS can show the impact of higher/lower budgets on road conditions
  - Important tool in budget negotiations with Ministry of Finance

RAMS - Financing



Financing Systems

- Implementing the proposed plan depends on financing
- RAMS analysis can be used to justify (higher) budget allocations
  - Show linkage between budget and achievable road network conditions
- RAMS data can also be used to evaluate other funding mechanisms
  - Concessions
  - Road User Charges (RUC)
- For maintenance road user charges are often used

Road User Charges

- Fuel tax or levy
- Vehicle importation fees or taxes
- Annual vehicle registration fees / Road tax
- Transit fees
- Tolls
- Heavy vehicle surcharges / Weighbridge fees and fines

- Access-based or usage-based

- RUC revenue well-suited to maintenance
  - User-pays principle
  - Predictable funding
  - Revenue increases with road usage and vehicle ownership

Road Fund

- Revenue from RUCs often earmarked to Road Fund
  - Road Fund receives revenue from RUCs and other sources
  - Road Fund allocates funding to road authorities
    - National road authority
    - Local road authorities
    - Often according to fixed criteria (percentage, network length, etc.)
- Some countries apply same concept without Road Fund
- Simple bank account managed by road authority
  - Receives RUC revenue based on parliamentary approval of the budget
- RUC revenue as part of general budget
  - (Partly) allocated to road maintenance and improvement as part of general budget

Example: Zambia

- National Road Fund Agency
  - Receives RUC revenue ($200 million in 2018)
    - Fuel levy, toll revenue, transit fees, weigh bridge fees and fines, road taxes and licences
  - Receives general budget allocations and domestic loans ($160 million in 2018)
  - Receives funding from donors ($320 million in 2018)

- Funds managed by National Road Fund Agency
  - Road Development Agency 60%
  - Local road authorities (rural roads) 25%
  - City councils (urban roads) 15%

- Funds mainly used for upgrading and rehabilitation, insufficient funding for maintenance
  - Currently push to use RUC revenue only for maintenance

Example: Pakistan

- Road Maintenance Account (RMA)
  - Simple bank account created by Ministerial Notification
  - Budget allocations from general budget - mainly financed from RUCs
  - Budget allocations largely follow needs as defined by RAMS
- Only used to fund national highways
  - States are pushing to have some roads reclassified as national highways
- National Highway Agency
  - RMA managed directly by NHA
- Used specifically for maintenance (mainly periodic maintenance)

Example: China

- Fuel tax introduced in 2009
  - Replaced existing RUCs
    - Class II highway tolls
    - Vehicle maintenance fee
    - Farm vehicle and motorcycle maintenance fee
  - Collection costs greatly reduced

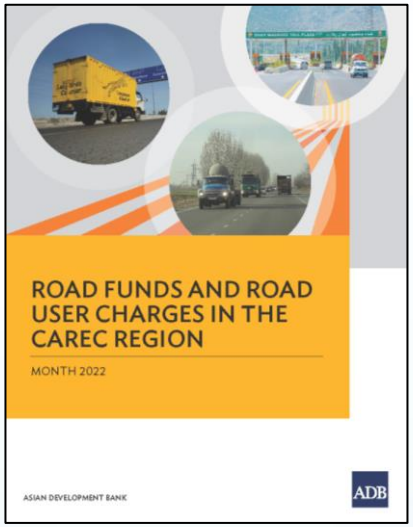
- Revenue increased significantly with fuel consumption
  - Flows into state budget, allocations as part of annual budget

- Revenue used for maintenance, rehabilitation and development
  - 20% for highway maintenance (by provinces)
  - Fixed allocations to local authorities for local roads (based on 2007 revenue)
    - Cofinancing from local authority revenues
  - Large portion used for development

Road Funds in the CAREC region

- Road funds currently exist in 5 countries in the CAREC region
  - Azerbaijan — Road Budget Trust Fund (2006)
  - Kyrgyz Republic — Road Fund (1998-2018), new Road Fund (2021)
  - Mongolia — State Road Fund (1998), new law (2017)
  - Pakistan — Road Maintenance Account (2003)
  - Uzbekistan — Republican Road Fund (2003-2019), Republican Trust Fund (2019)

- Review carried out by ADB in 2021-2022
  - Eligible expenditures and allocation of funding
  - Sources of funding and revenue levels
  - Management structure of the road funds
  - Reporting and accounting requirements



Eligible expenditures and allocation of funding

Activity	AZE	KGZ	MON	PAK	UZB*
Winter + summer maintenance	++	+	++	++	+
Routine maintenance / current repair	++	+	++	++	+
Emergency maintenance / emergency repair	++	+	++	++	+
Periodic maintenance / midterm repair	++	+	+	++	+
Rehabilitation / capital repair	++	+	+	+	+
Inspections and asset management	+	+	+	+	+
Operation of road fund secretariat	-	+	-	-	+
Operation of road agency	-	+	-	-	+
Toll plazas	-	+	+	+ (<2.5%)	-
Equipment procurement	-	+	+ (<10%)	-	+
Safety improvements	-	+	+	+ (<5%)	+
Geometric improvements	-	+	-	+ (<6%)	+
Roadside facilities and services	-	+	-	+ (<1.5%)	+
Design	-	+	-	-	+
(Re)construction	-	+	-	-	+
Loan repayments	-	+	-	-	-

** This refers to the Republican Road Fund that existed previously in Uzbekistan*

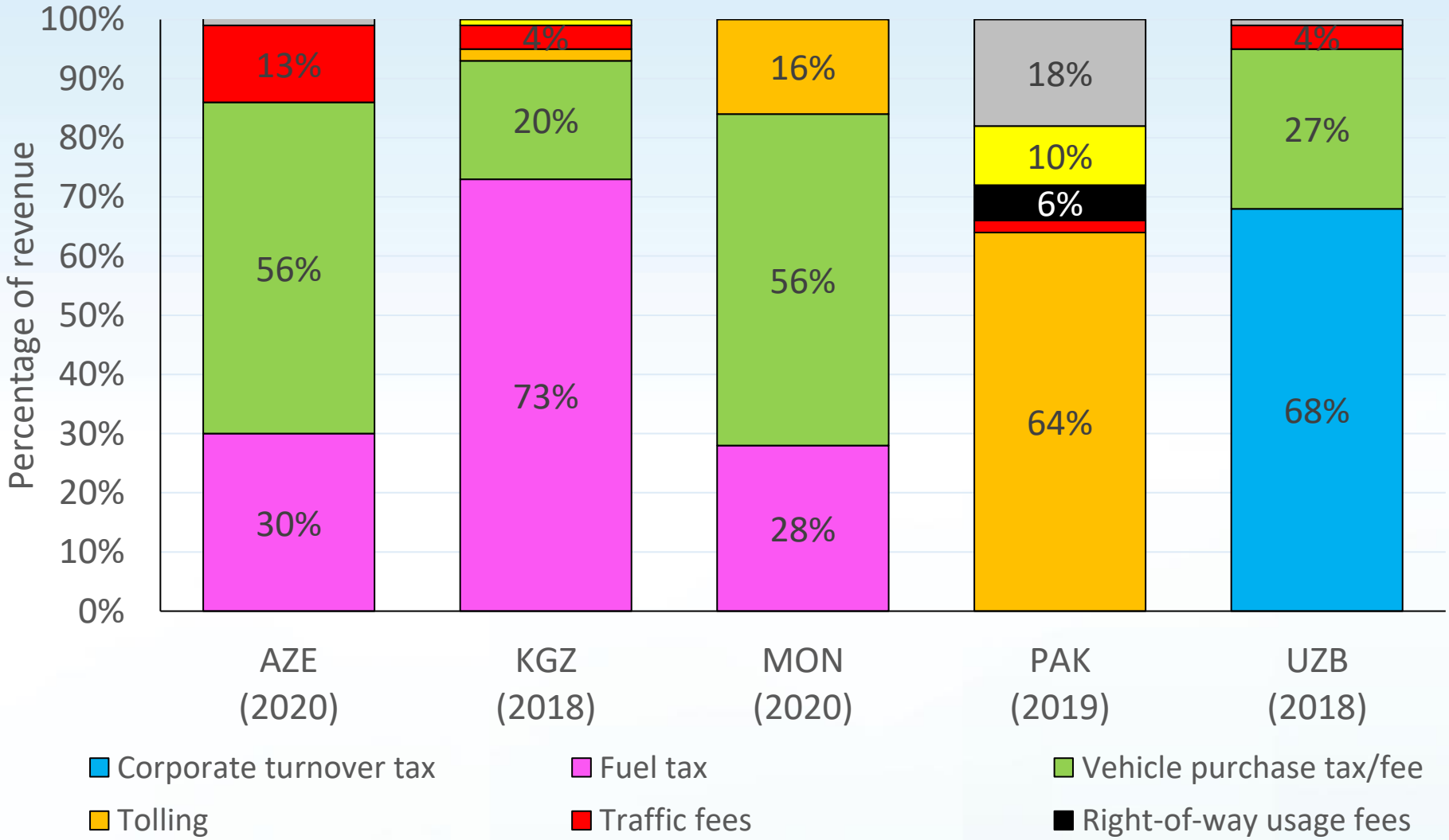
Sources of funding

3 main sources: ❶ Fuel tax, ❷ Vehicle import tax/duty/registration fee, ❸ Tolling

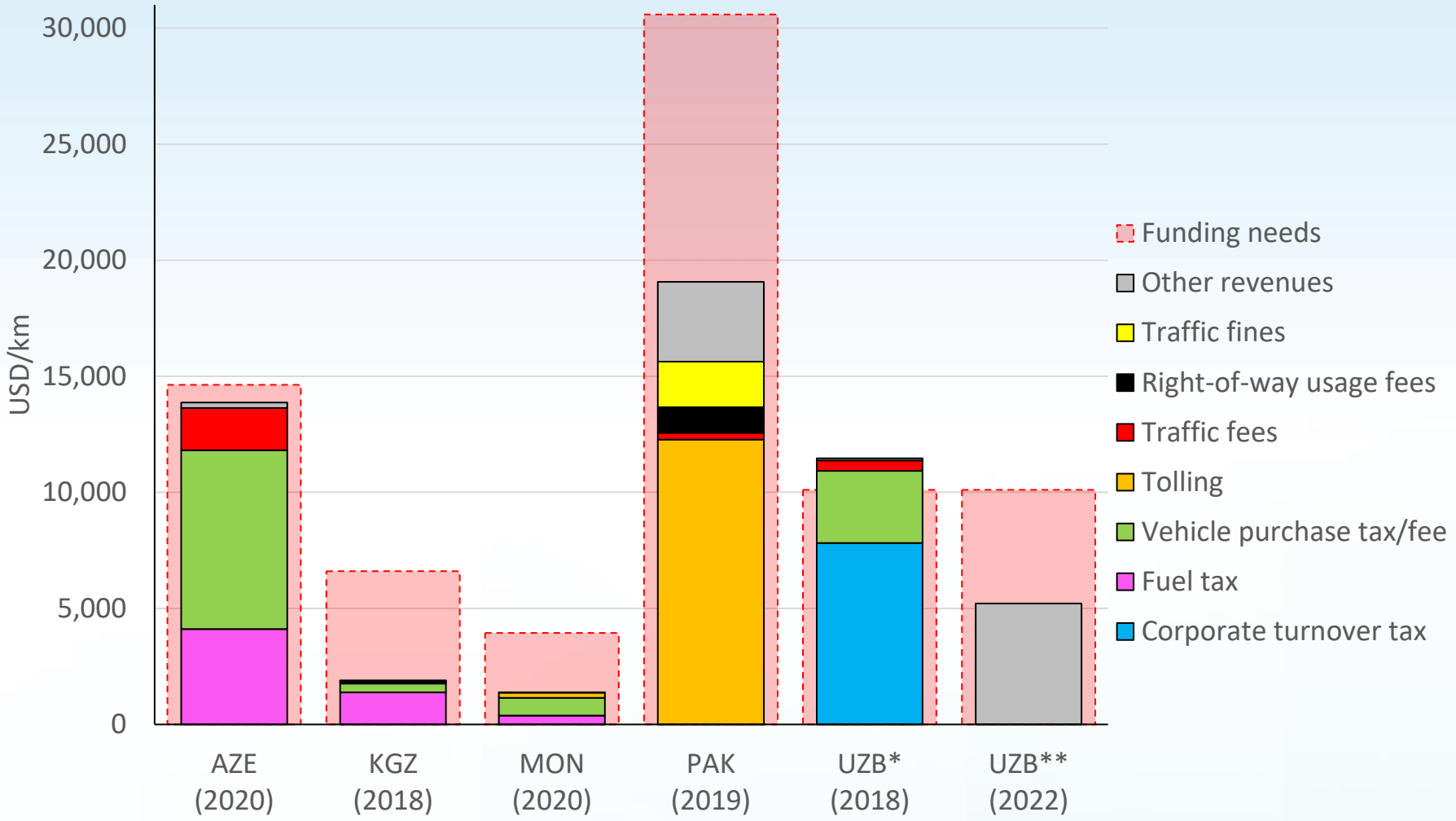
Road User Charge	AZE (2020)	KGZ (2018)	MON (2020)	PAK (2019)	UZB* (2018)
Fuel tax	**30%****	**73%**	**28%****	-	-
Vehicle purchase tax/fee/registration fee	**56%**	**20%**	**56%****	-	**27%**
Tolling	-	2%	**16%**	**64%**	-
Corporate turnover tax	-	-	-	-	**68%**
Foreign vehicle entry fee	3%**	-	-	-	4%
International transport permit fee	4%	-	-	-	-
Vehicle technical inspection fee	6%	-	-	-	-
Load and dimension control fee	-	3%	-	2%	-
Indivisible load fee	-	1%	-	-	-
Right-of-way usage fees	-	-	-	6%	-
Compensation for damages fine	-	1%	-	-	-
Traffic fines	-	-	-	10%	-
Simplified tax for transporters	2%	-	-	-	-
Other revenues	-	-	-	18%	1%

** Based on the former RRF, ** These revenues are reported together, and the division is based on estimations.*

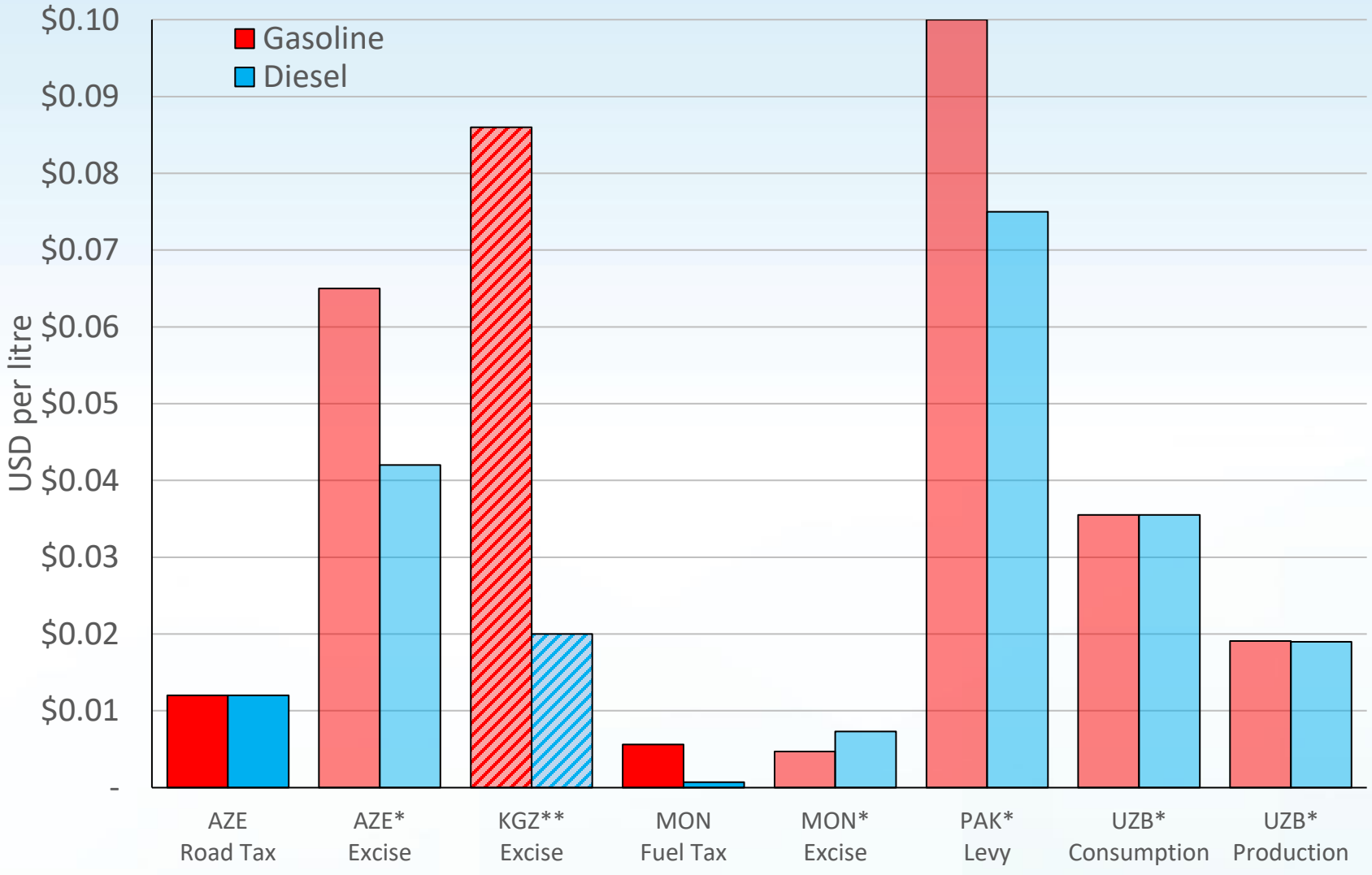
Sources of funding



Coverage of funding needs

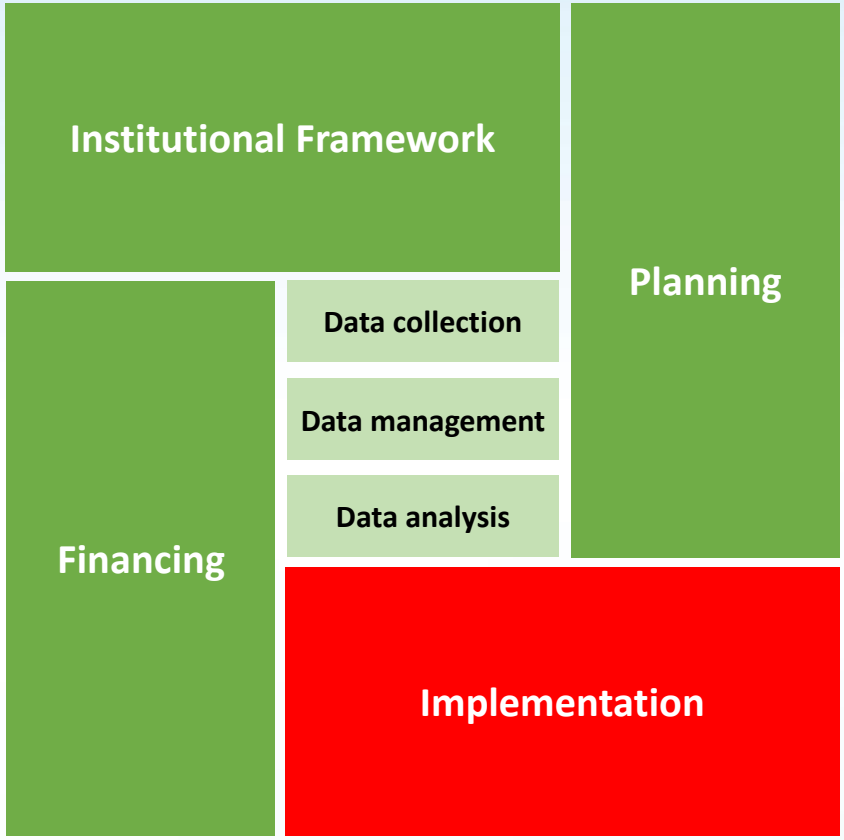


Fuel tax or levy



** Not earmarked to the road funds, ** Only 50% earmarked to the road fund*

RAMS - Implementation



Implementation modalities

- RAMS economic analysis introduces shift in type of works
  - Prioritizes maintenance of good/fair roads over rehabilitation of poor roads
  - Limits upgrading to roads where this is economically justified

- Much more emphasis on maintenance works
  - Increased attention to routine maintenance
  - Significant increase in length of periodic maintenance
    - In Pakistan 59% of the maintenance budget was spent on periodic maintenance in 2015
  - Complementary need for emergency maintenance

- This requires
  - Contracting (or in-house) capacity to implement the maintenance works
  - Contracting modalities suitable for maintenance contracting

Contracting capacity

- Many countries lack maintenance experience
  - Especially periodic maintenance

- This capacity needs to be developed
  - Training of contractors/in-house units
  - Gradual increase in size and complexity of contracts

Contracting modalities

- Three main contracting modalities

- Input-based
  - Payment according to inputs (time, materials, etc.)
  - In-house force account units

- Output-based (volume-based)
  - Payment according to volume of work completed
  - Traditional Bill of Quantities contracts

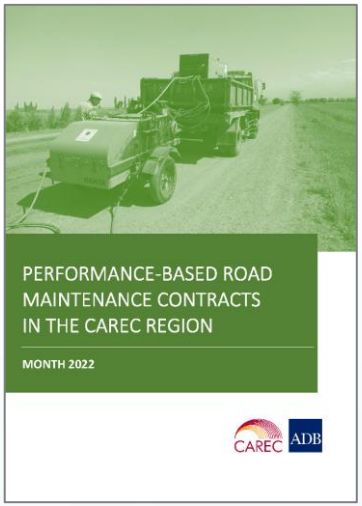
- Outcome-based (performance-based)
  - Payment according to resulting condition/standard
  - Lumpsum payments with deductions in case of poor performance

Contracting modalities

- Volume-based contracts not suitable for routine maintenance
  - Incentive to let damages increase in size – greater work volume and payment
  - High management burden to approve and measure completed works
  - Risk of insufficient volume and additional costs beyond contract price

- Performance-based contracts more suitable
  - Incentive to repair damages when they are still small
  - Management burden reduced to performance inspections (sampling)
  - Fixed payments that can only go down

- ADB review of PBC experiences in CAREC countries (including Mongolia)



Contracting modalities

- Periodic maintenance / rehabilitation
  - Large, pre-defined work volumes, implemented in short period
  - Generally paid on volume-basis
  - Increasingly paid as outcome-based lumpsum with predefined standards
  - At start of contract or when trigger is reached – agreed length of road

- Routine/winter maintenance
  - Small, roughly estimated work volumes, implemented over extended period
  - Generally paid on performance basis
  - Payment based on resulting condition (deductions in case of poor performance)
  - Activities that are difficult to predict are paid on volume basis or additional payments (e.g. snow removal)

- Emergency maintenance
  - Small-large, unpredictable work volumes, implemented in short period
  - Generally paid on volume basis
  - Often included as provisional sum
  - Avoids need for lengthy procurement – simple issuing of work order
  - Only damages of limited size

Example: Pakistan

- Capacity gradually developed
  - Introduction of HDM4 resulted in significant increase in periodic maintenance
  - Contractors lacked experience and suitable equipment for maintenance
  - Difficulties implementing the planned works

- Over time, contractors have gained experience
  - Currently many contractors with experience and equipment
  - Competitive bidding of maintenance works

Example: Kazakhstan

- Routine maintenance carried out by Kazakhavtodor
  - Including patching
  - Sole-sourced
  - Routine repair (repaving short sections) and periodic maintenance (repaving long sections) through competitive bidding

- Focus is on routine maintenance
  - 1 million square metres of patching in 2017
  - Many roads that require periodic maintenance are being patched
  - Inefficient use of funding

- Periodic maintenance very limited
  - 5% of road network length in 2014 – once every 20 years
  - Expected to increase significantly with introduction of RAMS

Example: Georgia

- Piloting of performance-based maintenance contracts
  - Difficulty replicating under government systems due to legislative obstacles
- Adjustment of routine maintenance and current repair contracts
  - Extended from 1 to 3 year contracts
  - Continue to be volume-based
  - Include annual collection of traffic data and some inventory and condition data