CAREC
Central Asia Regional Economic Cooperation Program

Highways Workshop

22–23 May 2023 • Tbilisi, Georgia

Семинар по автомобильным дорогам

22–23 мая 2023 года • Тбилиси, Грузия

Performance-Based Road Maintenance Contracts in the CAREC Region

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Types of payments for road maintenance

1. **Input-based**
   - Payment based on persondays, fuel, volume of materials used
   - Difficult to supervise – constant presence to monitor usage and productivity
   - Applied in force account implementation

2. **Volume-based (output-based)**
   - Based on volume of completed works, paid against unit rates (BOQ) or lumpsum
   - Suitable for larger works – requires frequent measurement of volumes
   - Applied in traditional construction and repair contracts

3. **Performance-based (outcome-based)**
   - Based on performance of contractor – compliance with required standards
   - Simple checking of resulting road condition against standards
   - Most suitable for maintenance and current repair

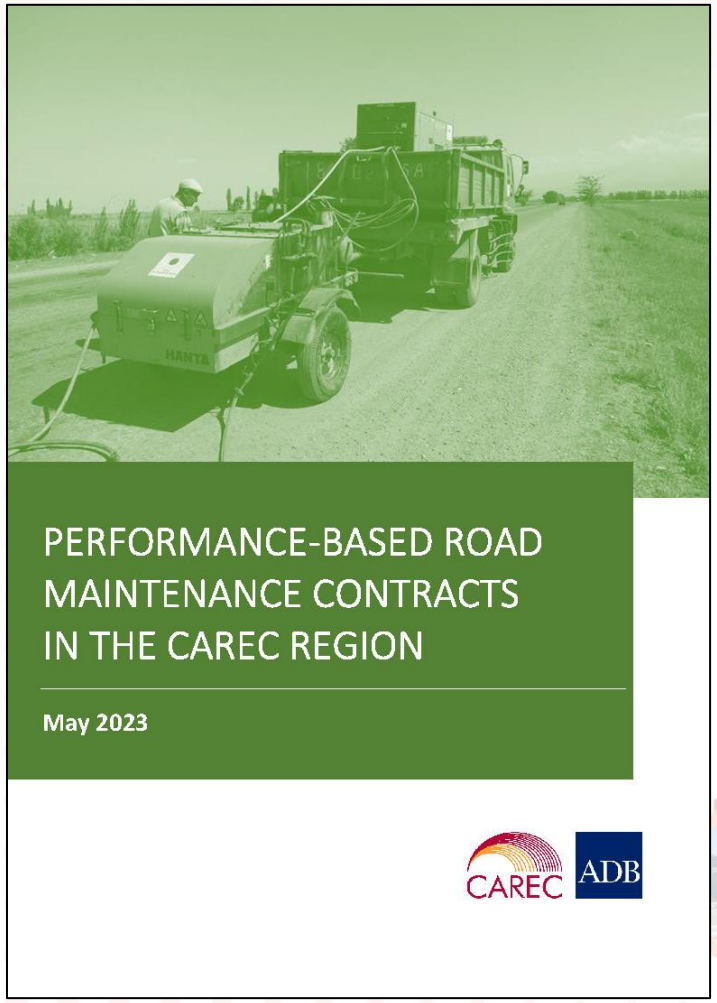
Performance-based road maintenance

- Payments are made on the basis of performance
  - Payment is not dependent on inputs or volumes of work completed
  - Performance standards (e.g. maximum number of potholes per kilometre)
  - Fixed (monthly) payments against compliance with the performance standards
  - Deductions if the performance standards are not fully complied with
  - Generally applied to routine maintenance (current repair) and winter maintenance

- Often combined with volume-based payments (hybrid contract)
  - For initial repairs required to bring the road up to standard
  - For emergency repairs during the course of the contract (provisional sum)
  - For other maintenance and repair activities that are difficult to predict

Study carried out by ADB

- Performance-based road maintenance contracts in the CAREC region
- 6 countries
  - Azerbaijan
  - People's Republic of China
  - Georgia
  - Kyrgyz Republic
  - Mongolia
  - Tajikistan
- 13 projects
- 24 contracts
- 2,900 km



Performance-Based Maintenance Contracts (PBMC)

- Performance-based maintenance services
  - Lumpsum payment (monthly)
  - Multiple years (generally 3-5 years)
- Volume-based provisional sum
  - Emergency maintenance, periodic maintenance, (winter maintenance)
  - Unit rates, with payment against work order
  - Main function is to reduce risk for contractor and thus reduce costs

	Year 1	Year 2	Year 3
Maintenance Services			
Provisional Sum			

Output- and Performance-based Road Contract (OPRC)

- Volume-based initial repairs
  - Rehabilitation or periodic maintenance of (part of) the road
  - Unit rates or lumpsum
- Performance-based maintenance services
  - Lumpsum payment (monthly)
  - Multiple years, often longer than PBMC (5-10 years)
- Volume-based provisional sum
  - Emergency maintenance, periodic maintenance, (winter maintenance)
  - Unit rates, with payment against work order

Service Level Agreement (SLA)

- Performance-based contract with state-owned maintenance enterprise
  - Generally PBMC because enterprises lack capacity for large initial repairs
  - Summer/winter maintenance + current repairs
  - Directly awarded without competition
  - Possibly separate allocations for salaries, equipment, materials

	Year 1	Year 2	Year 3
Maintenance Services			
Provisional Sum			

Contract Scope

- Initial repairs: volume-based – unit rates/lumpsum (known volume)
- Maintenance Services: performance-based (unknown volume)
- Provisional sum: volume-based – unit rates (unknown volume)

	Initial Repairs	Maintenance Services	Provisional sum
Rehabilitation (capital repairs)	At start		
Periodic maintenance (mid-term repairs)	At start	During contract	During contract
Management activities		During contract	
Routine maintenance		During contract	
Current repairs		During contract	During contract
Winter maintenance		Up to threshold	Above threshold
Emergency repairs		Up to threshold	Above threshold
	Volume-based (unit rates or lumpsum)	Performance-based (lumpsum)	Volume-based (unit rates)

Contract duration

- PBMC
  - 3-5 years for maintenance services + possibility of extension
  - Beyond that, the risk becomes too high since no initial repairs are included
  - Depends on starting condition of the road
- OPRC
  - 1-2 years for initial repairs and 5-10 years for maintenance services
  - Depends on scope of initial repairs
  - Avoid very short duration for maintenance services (little need in first years)
  - Contractor can reduce maintenance needs by improving initial repairs
- SLA
  - Often 1-3 years, even though the scope is the same as PBMC

Country	Pilot section	Length	Years	# years	Type	RH	PM	RM	WM	EM	Status
KGZ	Osh-Batken-Isfana	407 km	2014-2015	1	SLA	-	-	MS	MS	PS	Completed
AZE	M2 Baku-Yevlach	264 km	2019-2021	2	SLA	-	-	MS	MS	PS	Completed
AZE	M2 Yevlach-Georgia	229 km	2019-2021	2	SLA	-	-	MS	MS	PS	Completed
AZE	M4 Baku-Yevlach	253 km	2019-2021	2	SLA	-	-	MS	MS	PS	Completed
PRC	Yunnan G320, S324	107 km	2016-2020	3	SLA	-	-	MS	-	PS	Completed
TAJ	Sayron - Karamyk	89 km	2018-2021	4	PBMC	-	-	MS	PS	PS	Completed
TAJ	Vose - Khovaling	87 km	2018-2021	4	PBMC	-	-	MS	PS	PS	Completed
TAJ	Khovaling-Kangurt	43 km	2020-2023	3	PBMC	-	-	MS	PS	PS	Ongoing
TAJ	Vahdat - Obigarm	76 km	2013-2016	3	OPRC	IR	IR	MS	PS	PS	Completed
TAJ	Nurobod - Nimich	73 km	2013-2016	3	OPRC	IR	IR	MS	PS	PS	Completed
KGZ	Karabalta-Sussamyr	69 km	2018-2020	3	OPRC	IR	IR	MS/PS	MS/PS	PS	Completed
MON	Ulaanbaatar-Arvaikheer	58 km	2021-2026	2+3	OPRC	IR	-	MS	MS	PS	Completed
PRC	Yunnan G323	57 km	2015-2020	5	OPRC	IR	IR	MS	-	PS	Completed
PRC	Anhui G205	89 km	2020-2025	5	OPRC	IR	-	MS	PS	PS	Ongoing
PRC	Anhui S215, G233	65 km	2021-2026	5	OPRC	IR	-	MS	PS	PS	Ongoing
PRC	Anhui S303, S229	81 km	2021-2026	5	OPRC	IR	-	MS	PS	PS	Ongoing
PRC	Anhui G206, S233, S246	63 km	2021-2026	5	OPRC	IR	-	MS	PS	PS	Ongoing
PRC	Anhui G312, S210, S213	65 km	2021-2026	5	OPRC	IR	-	MS	PS	PS	Ongoing
PRC	Anhui S601	125 km	2021-2026	5	OPRC	IR	-	MS	PS	PS	Ongoing
GEO	Kakheti	117 km	2016-2021	5	OPRC	IR	(MS)	MS	MS	PS	Completed
GEO	Guria	240 km	2020-2026	5	OPRC	IR	IR	MS	MS	PS	Cancelled
GEO	Mtskheta–Mtianeti	142 km	2020-2026	5	OPRC	IR	-	MS	MS	PS	Cancelled
KGZ	Balykchy-Kochkor	43 km	2020-2027	2+5	OPRC	IR	MS	MS	PS	PS	Ongoing
KGZ	Kochkor-Epkin	27 km	2020-2027	2+5	OPRC	IR	MS	MS	PS	PS	Ongoing

IR: Initial Repairs (volume-based), MS: Maintenance Services (performance-based), PS: Provisional Sum (volume-based)

Contract Scope - Findings

- Very few PBMCs – only Tajikistan
  - Possibly due to difficulties using development partner funding for maintenance
  - Need for more PBMC pilots, as these are most needed
- SLAs applied in three countries, but not replicated
  - Experiences are not well documented
  - Important in CAREC where most countries have state-owned maintenance enterprises
- OPRCs most common, but contract durations too short
  - After pavement renewal, maintenance needs will be limited during initial years
  - Duration of performance-based maintenance services should be at least 5 years

Contract Scope - Findings

- Periodic maintenance
  - Inclusion in performance-based maintenance services increases risk
  - Risk (and costs) reduced if included in provisional sum
- Winter maintenance
  - High risk if contract duration is short and historical data is limited
  - Risk (and costs) reduced if extreme events are included in provisional sum
- Current repair
  - Inclusion in provisional sum only acceptable for first piloting
  - Allows contractors to get used to approach with minimal risk

Performance standards

- Performance standard = indicator + threshold
  - Generally maximum allowable defect
  - Sometimes reaction time to correct the defect

Road element	Indicator	Threshold
Pavement – potholes	Maximum diameter of any pothole	20 cm
Pavement – potholes	Maximum number of potholes per 1 km of road	5 potholes
Right-of-way – Vegetation	Maximum height of vegetation within 3 metres of pavement edge	30 cm
Right-of-way – Landslide	Maximum reaction time to remove landslide <200 m^3	2 days
Pavement – Snow	Maximum reaction time to remove snow >2 cm	4 hours

- Service level = set of performance standards
- SMART – Specific, Measurable, Achievable, Relevant, Time-bound

Performance Standards - Findings

- Wide variety of performance standards used
  - Almost each project uses different performance standards
  - Standards appear to depend on experience of consultants
  - Only Tajikistan used the same standards in all 5 contracts and 2 projects
  - More consistent use of standards in each country required
- Several cases of inappropriate standards
  - Maximum pothole size of 0.5 m^2, equivalent to 80 cm diameter
  - Performance standards for winter maintenance where this is volume-based
  - Zero tolerance standards widely used, increasing risk – e.g. shoulder free of trash
  - Some standards not clearly defined – e.g. 20% obstruction of culverts
- Need to include performance standards for management activities
  - Management activities required, but not linked to payment or deduction

Inspections

- Formal inspections
  - Monthly (possibly complemented by yearly inspections)
  - Verify compliance with performance standards
  - Drive-over survey - Entire road or a random sample
  - Basis for applying deductions to fixed payment
- Informal inspections
  - Non-compliances reported to contractor
  - Deductions only applied if reaction times are exceeded
  - Otherwise checked in next formal inspection
- Compliance assessed per 1-km segment
  - Independent of contracted road length

Inspections - Findings

- Formal inspections form the basis for deductions in all contracts
- Informal inspections sometimes result in deductions
  - Not always clear in contract
  - Generally for performance standards involving reaction times
- Only some contracts include hotlines to report defects
  - Allows early identification of defects
  - Important for performance standards involving reaction times

Response times vs Reaction times

- Response times applied in most contracts
  - Time given to contractor to correct defects identified during inspection
  - However, most defects occur gradually and can be corrected before the inspection
    - Example: maximum number of potholes per km
  - Response times require (several) follow-up inspections
  - Undermines the principle of performance-based contracts
  - Deductions should be applied directly after inspection

- Reaction times need to be applied for certain defects
  - For defects that occur suddenly or that cannot be predicted
  - The reaction time is the actual performance standard
    - Example: landslide to be removed within 2 days, snowfall to be removed within 4 hours
  - Requires informal inspections (possibly in response to hotline identification of defect)

Response times vs Reaction times - Findings

- Almost all contracts involve response times
  - Confused with reaction times
  - Varying response times require multiple follow-up inspections
  - Only one contract without response times, but was not awarded
- Response times also applied to defects that occur suddenly
  - Only some contracts include reaction times as part of performance standard
  - More often defined as response times, requiring a formal inspection
  - Sometimes reaction times combined with response times
    - E.g. removal of snow within 1 day, response time of 2 days
- Need to distinguish between reaction times and response times
  - Remove response times and keep reaction times

Payments and deductions

- Fixed monthly payments
  - Bid prices based on estimated volumes of work and costing of those volumes
  - Data on volumes of work from previous years can be very important
  - Deductions applied in case of non-compliance with one or more performance standards
- Deductions expressed as percentage of monthly payment
  - Generally applied per 1-km segment of road (monthly payment per km)
  - Makes deductions independent of total road length
  - Higher percentages if more serious defects or costlier to correct
  - Total of the deduction percentages should be much higher than 100%, but total deduction cannot exceed 100%
  - Simple system with clear relationship between defects and deductions
  - Reduced deductions during initial months of the contract

Payments and deductions - Findings

- Most contracts apply basic system for deductions
  - Fixed deduction percentages applied to 1-km segments
  - Some contracts apply more complicated systems that are harder to understand
- Deduction percentages often very low
  - Deduction percentages often add up to 100% in total
  - Resulting deduction only $10-$20 for non-compliant 1-km segment
  - Even if contractor does nothing, he would still be eligible to partial payment
  - Each deduction percentage should each be in order of 10%-50% or even higher
- Not all performance standards are applicable to 1-km segments
  - Some deductions applied to full contracted road length
  - Small percentages applied to full road length can result in large deductions
- We should consider using monetary deductions involving fixed amounts
  - Easier to understand and apply, both for 1-km segment and for total length

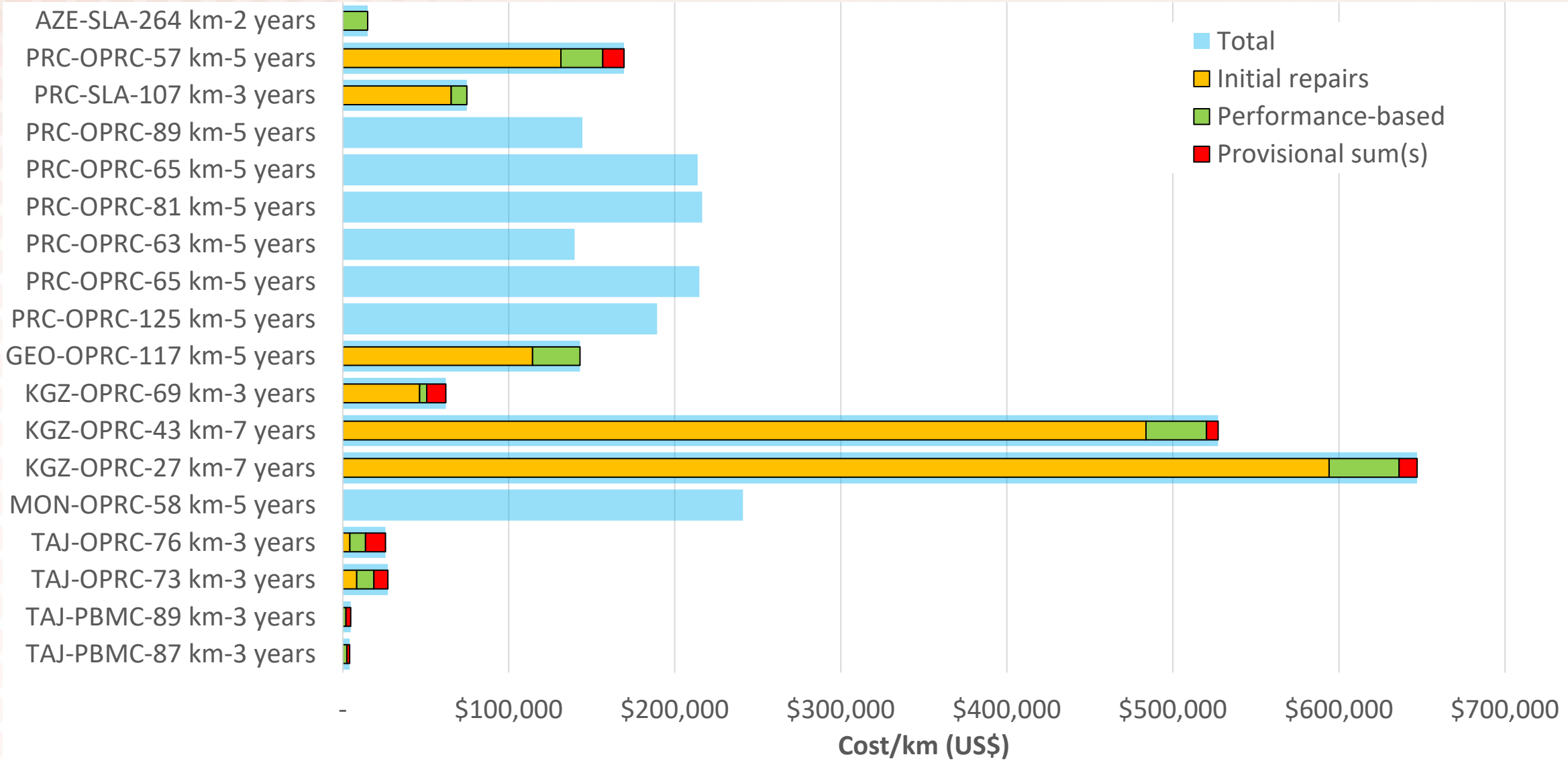
Procurement and contract costs - Findings

- Most contracts awarded to domestic contractors
  - Domestic contractors generally capable of carrying out maintenance services
  - Exceptions involved large contracts with significant initial repairs
- Wide range in contract costs
  - Only partially explained by type of road and contract scope
  - Appears to be determined to large extent by applied systems and perceived risks
- Initial repairs form very large part of contract amount (>75%)
- Longer contracts have higher annual costs for maintenance services
  - Risks perceived to be greater further into the future
  - Benefits of shorter contracts with possibility of extension
- Performance-based maintenance least expensive in PBMC contracts
  - Second batch of contracts with similar approach

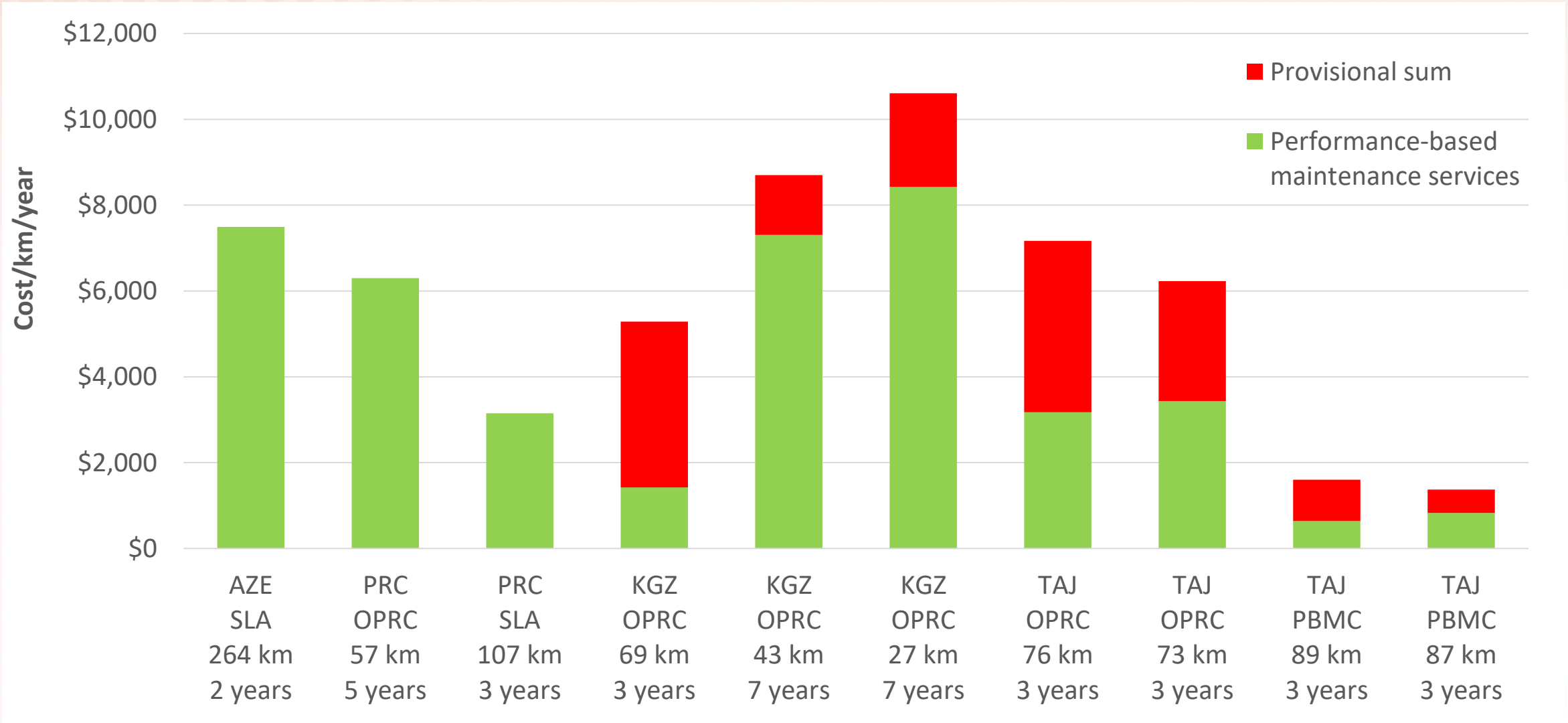
Procurement and contract costs - Findings

Country	Type	Length	Years	Total	Performance-based		Provisional sum	
				Cost/km	Activity	Cost/ km/year	Activity	Cost/ km/year
AZE	SLA	264 km	2	$14,988	RM+WM	$7,494	EM	n/a
PRC	OPRC	57 km	5	$169,457	RM	$6,300	EM	n/a
PRC	SLA	107 km	3	$74,766	RM	$3,150	EM	n/a
PRC	OPRC	89 km	5	$144,349	RM	n/a	WM+EM	n/a
PRC	OPRC	65 km	5	$213,847	RM	n/a	WM+EM	n/a
PRC	OPRC	81 km	5	$216,543	RM	n/a	WM+EM	n/a
PRC	OPRC	63 km	5	$139,683	RM	n/a	WM+EM	n/a
PRC	OPRC	65 km	5	$214,810	RM	n/a	WM+EM	n/a
PRC	OPRC	125 km	5	$189,318	RM	n/a	WM+EM	n/a
GEO	OPRC	117 km	5	$142,870	RM+WM	$5,145	EM	$770
KGZ	OPRC	69 km	33	$62,157	RM+WM	$1,424	RM+WM+EM	$3,861
KGZ	OPRC	43 km	2+5	$527,253	PM+RM	$7,310	WM+EM	$1,390
KGZ	OPRC	27 km	2+5	$647,157	PM+RM	$8,428	WM+EM	$2,181
MON	OPRC	58 km	5	$241,017	RM+WM	n/a	EM	n/a
TAJ	OPRC	76 km	3	$25,741	RM	$3,176	WM+EM	$3,991
TAJ	OPRC	73 km	3	$27,118	RM	$3,436	WM+EM	$2,797
TAJ	PBMC	89 km	4	$4,816	RM	$641	WM+EM	$964
TAJ	PBMC	87 km	4	$4,124	RM	$829	WM+EM	$546

Procurement and contract costs - Findings



Procurement and contract costs - Findings



Replication under government systems

- No country in the CAREC region has moved beyond pilot stage
  - All experiences so far have been carried out under development partner projects
  - Despite some pilots having been fully funded by governments
- Legislation often forms an obstacle
  - Legislation regarding procurement and multiannual contracting
  - Also norms and standards regarding maintenance implementation
- Need for legal assessments on a country-by-country basis
  - Identify legal amendments required or desired
- Prepare a Performance-Based Road Maintenance Action Program
  - Initial introduction, piloting, training, etc.
  - Replication, legislative amendments, contracting procedures, evaluations, etc.

Thank You