

Highways Workshop

22-23 May 2023 • Tbilisi, Georgia

Семинар по автомобильным дорогам

22-23 мая 2023 года • Тбилиси, Грузия



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Design-Build & Output and Performance Based Road Contracts (OPRC) Experience in Georgia

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Introduction: Context



Introduction: Context

- The Construction/Rehabilitation Contracts:
 - Detailed Design Provided by the Employer
 - The Contractor`s responsibility to execute the Works as per Detailed Design
 - Employer`s responsibility for the Detailed Design
 - Remuneration based on the schedule of rates per item and quantities
- Routine and Periodic Maintenance: Routine 25 and Periodic 8 regional networks
 - Remuneration based on the schedule of rates per item and quantities
 - Routine and Periodic Maintenance Contracts separated
 - Monthly measurements and payments is verified by the Supervisor and approved by RD

Inception: Design-Build OPRC in Georgia

- The World Bank Group funded Projects
 - Secondary Road Asset Management Project & Secondary and Local Roads Projects II
- 2013 Feasibility of the OPRC
- 2015 First Bid Kakheti Region OPRC (totally Outcome based Design Build Rehabilitation and Maintenance)
- 2016 Commencement of the OPRC in Kakheti Region
- 2017 Commencement of the Design-Build Rehabilitation Contracts:
 - 7 different sections throughout the country with total length of 95 km
 - Length of each varies from 10 to 30 km

Design-build: General concept

The Contractor's *substantially* increased Risks and *Sole* Responsibility:

- Preparation of the Design, the carrying out of all Works and the performance of all Services required for keeping the Road in *accordance with the Service Levels* defined in the Specifications.
- Programming of the Works and Services, and for the accuracy and completeness of the information used for that design and programming in accordance with the requirements established in the Specifications
- Project Manager's approval shall not relieve the Contractor of any responsibility or liability imposed upon it by any provisions of the Contract

Design-build: General concept

The Contractor's *substantially* increased Risks and *Sole* Responsibility:

- The Contractor is responsible for properly estimating the difficulty or cost of successfully performing the Works and Services
- The Contractor warrants that the Works and Services or any part thereof shall be free from defects in the design, engineering, materials and workmanship of the Works and Services executed – <u>Design Responsibility</u> <u>covering the Defects Notification Period</u>
- The Employer's *minimized* Risks and Responsibility:
 - Ensure the accuracy of all information and/or data to be supplied to the Contractor

Design-build: General concept

Payment:

- a firm lump sum to be paid according to work progress- achievement predefined Service Levels/Completion of the Project Road particular Section (for example – every continuous 2km length section)
- For Emergency Works, the Provisional Sum to be paid based on the schedule of rates per item and quantities

Design-build: General Concept

Service Levels:

- Defined through output and performance measures and used to define and measure the desired performance of the Contractor *from the Road Users Perspective – <u>Safety, Comfort, Durability</u>*
 - Road Roughness
 - Road and lane width
 - Longitudinal and cross profiles
 - Pavement strength
 - Rutting
 - Skid resistance
 - Vegetation control
 - Visibility of road signs and markings
 - Availability of each lane-km for use by traffic
 - Drainage system



Design-build: general concept

Service Levels to be *clearly defined and objectively measurable*

- Road and lane width Number of lanes: 2 Lane width: 3.00 m Carriageway width:
 6.00 m Width of shoulder: 0.50 m
- Rutting There shall not be ruts deeper than 5 mm. Rutting of more than five (5) mm shall not be present in more than 5 percent of any of the road sections defined in the contract.
- Road Roughness Average value for entire road or road section and for any 1 km continuous section must not exceed 2.2 IRI. Average value for any continuous 100m section must not exceed 2.5 IRI
- Pavement strength Average deflection of section must be below the threshold values indicated for each road section: 0.7 mm

The Service Levels shall be met during acceptance of any respective section for payment and for Final Handling-Over of the whole project road for issuance of Certificate of Completion.

- Lack of full acknowledgement of the Contractor's responsibilities under Design-Build Contracts by the local contractors, as a result of vast dominance of the traditional approaches (conventional construction/ rehabilitation contracts)
- Case 1:
 - The Contractor refused to execute the Works for relocation of the power cable, located along the newly
 constructed road section, resulting in non-achievement the Service Level Availability of each lane-km for
 use by traffic, as the height distance between the newly constructed pavement and the existing cable
 challenged the safety of the road users, contradicting the relevant standards.
 - The Contractor grounded it's refusal on the following circumstances:
 - The Feasibility Study did not consider the existence of the cable
 - During the bidding stage, the Employer did not take into account the relocation of the cable
 - Therefore, the Contractor did not include these works in the detailed design, as the scope did not mention them at all
 - The detailed design, not containing power cable relocation works, was approved by the Project Manager
 - proposed to consider these works as Additional Works related with unforeseen conditions and execute them for additional cost (like Variation procedure in traditional construction contracts)

- Case 1 Solution:
 - The Contractor ignored the main principles of the Design-Build Contact:
 - the fact that the relocation of the cable was not envisaged in the documents provided by the Employer, does
 not relieve the Contractor from the obligation to execute them
 - The Contractor shall execute the basic and detailed design and the engineering work in compliance with the provisions of the Contract and the Specifications, or where not so specified, in accordance with good engineering practice.
 - Preparation of the Design, the carrying out of all Works and the performance of all Services required for keeping the Road in accordance with the Service Levels defined
 - Project Manager's approval, with or without modification of the document furnished by the Contractor, shall
 not relieve the Contractor of any responsibility or liability imposed upon it by any provisions of the Contract
- Thus, the existence of the power cable along the project road and it's relocation in order the Service Levels achieved, could not be considered respectively as unforeseen conditions and additional works, and the Contractor's was hold accountable for that.

• Case 2:

- In this particular case, the Design-Build Road Rehabilitation Works were fully completed, the Project Manager issued a Taking-Over Certificate, and only after the completion, during the Defects Liability Period, the particular 100 m length section of the newly rehabilitated road was affected by the landslide processes.
- The Contractor refused to rectify the damages, with following argumentation:
 - The Detailed Design, approved by the Project Manager, did not include the landslide treatment measure, as during the preparation, it could not be foreseen by the Contractor (not active by that time)
 - The damages occurred, were not attributable to the detailed design prepared and the Works executed (traditional approach)

Case 2 Solution:

- The Contractor warrants that the Works and Services or any part thereof shall be free from defects in the design, engineering, materials and workmanship of the Works and Services executed – Design Responsibility covering the Defects Notification Period
- Project Manager's approval, with or without modification of the document furnished by the Contractor, shall not relieve the Contractor of any responsibility or liability imposed upon it by any provisions of the Contract
- Contractor responsible for programming of the Works and Services, and for the accuracy and completeness of the information used for that design and programming in accordance with the ,....At two location signs of potential landslides have been recorded...", ,,Landslide formed and created by Jurassic and Oligocene lean clays are mostly represented in Racha-Lechkhumi (Project Region) cavity."
- Thus, the occurrence of the landslide along the project road even during Defects Notification Period and it's treatment in order the Service Levels achieved, could not be considered respectively as unforeseen conditions and the obligation not attributable to Contractor, and the Contractor's was hold accountable for that.

OPRC: rehabilitation & maintenance

- Ensures that the physical condition of the roads adequate for the needs of road users
- Similar to the Design, Build, Maintain, Operate and Transfer (DBMOT) Contracts
- Fixed lump-sum prices for bringing the road to a certain service level and then maintaining it at that level for a relatively long period
- Lump-sum periodic remuneration paid to the Contractor will cover all physical and non-physical services provided by the Contractor
- Relatively long period Contracts (5,7,10 years)
- The Contractor has a strong financial incentive to be both efficient and effective whenever he undertakes work: early and Service Level fit intervention

OPRC: rehabilitation & maintenance

- The Contract envisages two main phases: Rehabilitation and Maintenance
- Covers relatively long sections Road Networks (120 250 km)
- Defects Liability Period do not apply to the executed Rehabilitation works
- For the sections considered only for the Maintenance works, the grace period (1 to 3 months from the Commencement) may be applied:
 - The penalties monthly deductions from the per 1 km maintenance lump sum not applied
 - Giving the Contractor the opportunity to improve the network to Maintainable condition
 - BoQ based Initial Repairs/Improvement Works is an alternative
- Emergency Works BoQ based

- Outcome Based Rehabilitation 80% of the Contract Price
 - 37.5 km in 24 moths period
 - Detailed Design prepared by Contractor (without particular payment), approved by RD
 - Take-over and payment for minimum every continuous 2 km length rehabilitated section
- Outcome Based Maintenance (Routine + Winter + Periodic) 20% of the Contract Price
 - 117 km in 60 moths period
 - Achievement of Service Levels defined on per-km via preset Performance Indicators
 - Monthly Lump Sum Payments
- Emergency and Contingency
 - BoQs





• Levels of Service / Maintenance Performance Indicators - Example

Noncompliance	Performance Indicator	Unit of Measurement	Size	Penalty, %	
Non-compliance with	Potholes, diameter	cm	>20	100 %	
100% penalty (4 PIs)	Potholes, Edge breaks amount unit		>5	100 %	
	Potholes, diameter	cm	≤20		
Potholes, Edge Break	Potholes, Edge breaks amount	unit	≤5		
	Edge Break, maximum width allowed	mm	>75mm	10 %	
	Response time, potholes and edge break	days	10 (30 in winter)		



- Example of Non-Compliance
- Non-compliance on km 5-6 of road SH-1:
 - drainage and culverts 6%,
 - cleanliness of road carriageway and shoulders when safety hazard 8%,
 - rutting 6%
 - cracks 6%
 - potholes 10%
- Reduction of lump-sum payment for 1km by 36%
- If not rectified during the first 30 days, liquidated damages start to increase afterwards



- In 2019, the survey, supported by the WB, was conducted to identify the road users' perception of comfort, safety and reliability of roads covered by the pilot Kakheti OPRC in relation to the condition of road network in 2015 before the start of OPRC and in 2018 the third year of OPRC implementation. Both qualitative and quantitative methods were used during the study.
- Findings of the study indicate that satisfaction of respondents with the roads covered by the OPRC project has significantly increased:
 - While 25% of respondents mentioned satisfaction with the road considering all parameters in 2015, the satisfaction has increased three times in 2018 and reached 75%;
 - The number of respondents dissatisfied with the road has been minimized. Only 4% of respondents expressed dissatisfaction in 2018 compared to 31% in 2015.

Guria OPRC: 2019-2024



Guria OPRC: 2019-2024

• Levels of Service / Maintenance Performance Indicators – Example

Manageme M	ent Performance easure	Non-	Sub-weighting criteria (Unit)		Road Users	Service and Comfort Performance Measure	Non-	Sub-weighting
Performance Measure	Description	Compliance Weighting			Performance Measure	Description	Compliance Weighting	criteria (Unit)
MPM	Road Safety & Traffic Management	2	Each week of non-receipt of RSTMP after deadline and each day delay of non-compliance of RSTMP at worksite		RUS & CPM - Pavement Maintenance	Edge Break within any continuous 1km centre line length, the aggregated longitudinal edge line length of deficient sealed width must be less than 5m in length and 75mm in width	2	Each 10 days of non-response
MPM	Inventory Database Management	2	Each week f non-receipt after deadline		RUS & CPM - Drainage Maintenance	Culvert Cleaning	2	Each week f non- receipt after deadline

Road Durability	Weightings to be Applied to the Recorded Non- Compliance				
Measure	Weighting	Sub Weighting			
Pavement Roughness	5	No. of Months			
oadway Cut and Embankment Slopes	5	No. Weeks			



Guria OPRC: 2019-2024

• Example of Non-Compliance

	Number of	Multiplicat			
Non-conformance	Non- Conformances	Weighting W	Sub Weighting	Score	
MPM- 4 Safety & Traffic Management	5	2	5	50	
MPM- 5 Inventory Data Base Management	1	2	1	2	
Repeat MPM non-conformance	0	4	1	0	
RUS&CPM - 4 Routine Maintenance of Bridges and Other Structures	3	2	1	6	
RUS&CPM-6 Vegetation Control	15	2	1	30	
RUS&CPM- 7 Road Sign Maintenance	20	2	1	40	
RUS&CPM 8 Pavement Marking	11	2	1	22	
Road Safety Hazard Repair	10	6	2	120	
RDPM non-conformance	0	5	0	0	
RUS&CPM Generated by the Employer	5	6	1	30	
Monthly Aggregated Contract Non-Conformance Score: 200					

Monthly aggregated non-conformance score applied in the particular formula towards the Contractor's Monthly Lump Sum payment for Routine Maintenance of the entire network

Calculation of Performance Achievement Payment deductions

> Identification of the final monthly Payment amount to the Contractor

- Importance of local contractors
 - Assessment or Update of the local construction industry prior to OPRC is a must
 - JV of international + local ones may be recommended but the lowest bidder is more often JV of local ones
 - Capacity building of local contractors prior to and during OPRC implementation shall be done & shall be continuous
 - Clear understanding/definition of incentives for international, local and JV of international + local and JV of local + local contractors

 Capacity and Relevant Experience of OPRC Monitoring/Supervising Consultant isn't less important than those of contractors and the Client in the first pilots

- Especially, if the winner is the local contractor

- Provision of capacity building both for the Contractor and the Client
- The OPRC Works supervision specifics shall be considered



- Grace Period should be realistic
 - Initial repairs based on BOQ is an alternative
- Periodic Maintenance should be included in the OPRC as a stand-alone service,
 - Not part of Maintenance
- Higher risk of PM not being done due to higher costs than those of RM
 - Risk of non-compliance with LoS and, eventually, revision of performance indicator targets for maintenance only sections, especially the ones rehabilitated 10 years ago

- 80% rehabilitation/20% maintenance in pure output- and performancebased contract shall be better planned/structured in longer-term OPRC, to avoid:
 - Contractor's increased attention to rehabilitation
 - Risk of non-compliance with maintenance LoS on the maintenance (only) sections, which were rehabilitated previously prior to OPRC
 - Risk of insufficient financial incentive to stay for maintenance till end of the contract
- If still considered:
 - Rehabilitation shall be spread over more than 2 years of 5-year contract period
 - Or payment with some % retention shall be considered
 - Or BOQ rehabilitation is more favoured by the Client to be more in control of the rehabilitation cost

- Performance Indicators shall be clear, realistic and rational
 - Don't overburden the Contractor/Consultant with too many indicators/different response times
 - Keep different response (shorter) time only for those which are safety-related indicators with 100% penalty (e.g., potholes if >5)
 - Special attention in setting IRI and Ravelling requirement for maintenance only sections which were rehabilitated more than 5 years ago
 - Clear to possible extent distinction between the OPRC
 Maintenance and BoQ based Emergency Works

Threshold values for Emergency works (per kilometer of the road)

Activity	Unit	Quantity per emergency single event
Removal of slides material from road and side drains	M ³	500 in any one occurrence
Replacement of damaged or washed out culvert	Number	More than 1 in any 1- kilometer section of road
Reinstatement of Road Pavement	M ²	200
Reinstatement of washed out erosion/scour measures	M ²	50
Reinstatement of washed out Embankment	M ³	200 in any one occurrence

The removal of the materials of less than 500m³ is treated as normal routine maintenance. In case the quantity exceeds the named threshold quantity and qualifies as an Emergency Works, the payment (by the BoQ) shall be applied only to the quantities that are above the threshold.

For example the materials to be removed amount to 1230m³. The payment for this Emergency works BOQ item shall be 730m³ (1230-500=730).



Questions

THANK YOU FOR YOUR ATTENTION!

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