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SPANISH FOR ORIGINAL VERSION

THE IMPACT OF PUBLIC-PRIVATE PARTNERSHIP TENDERED UNDER PERFORMANCE STANDARDS

Ángel Trinidad Martínez Arboleya, Ariadna Moncada Palafox, Franco
Gómez Rojas VISE S.A. de C.V. Concessions Management,
Guanajuato, Mexico amartinez@vise.com.mx

1. Background

The particularities of highway PPP projects under performance standards are: i) the infrastructure already exists, ii) the Developer rehabilitates and maintains it, iii) it is a contract in which the Developer provides a service, iv) the right of way is available and the environmental impact assessment is exempted, and v) in the case of projects under the NMO, "operation" services were included since they are implemented on toll roads.

Table 1 - PPP vs. Traditional Scheme for Infrastructure Development

Concept/Scheme	Conservation PPP Scheme	Traditional Scheme
Scope	Design, financing, construction, equipment, maintenance and operation of the asset.	Infrastructure Development
Payments	Payment for Performance Standards subject to deductions	Unit Price or Lump Sum Payments
Term of contracts	Long-term contracts	Short or medium-term contracts
Parameters	Performance Indicators	Specifications and Standards
Risks	Substantial risk transfer to the private sector	Substantial risk retention
Financial effort of the Unit	In the medium and long term	In the short term
Public sector purchases	Services	Assets

Source: 1st International Seminar on Road Maintenance by Salvador Pou Boix.

2. Description of contracts

Table 2 - Main characteristics of the contracts analyzed

Contract	Location	Length (km)	Type of road	Contract start - end year
M&R	Jalisco and Colima	148	A2 and A4	2012-2025
APPQRO	Querétaro, Guanajuato and San Luis Potosi	167.42	A4	2016-2027
MRO	State of Mexico and Michoacán	64	A4	2019-2026

Source: Own elaboration with information from contracts.

3. Control and verification methodologies

3.1 Division of sections and segments

The subdivision of the roads has a direct impact on the achievement of the objectives established in the PPP contracts since it influences the time of the initial rehabilitation, the establishment of performance standards for each of the segments according to the conditions of the road, the payment mechanism, and the application of deductions for non-compliance.

3.2 Performance standards

3.2.1 Selection of performance standards and their grouping

Table 4 - Performance standards for each contract

	M&R	APPQRO	MRO
Standard	Indicator	Performance standard	Performance standard
Crown	Surface deterioration	Surface deterioration	Surface deterioration
	Pavement (fatigue cracking)	Not Applicable	Rigid pavements
	IRI	IRI	IRI
	Depth of rutting	Depth of rutting	Depth of rutting
	Coefficient of friction	Coefficient of friction	Coefficient of friction
	Not measured	Deflections	Not measured
	Not measured	Macrotexture	Not measured
Cleaning of roadways and shoulders	Roadway Cleaning and Sidewalks	Cleaning of roadways and shoulders	
Cuts and embankments	Slopes	Slopes	Slopes
	Landslide removal		
Structures	Structures	Structures	Structures
Drainage, cleaning and repair	Drainage, roads drainage works, cleaning and repair works	Drainage Works	Drainage and roads drainage works
Special pavements and Trustee facilities	Special paving and maintenance of the Trustee's facilities	Not applicable	Not applicable
Signaling and safety devices	Road lines	Road lines	Road lines
	Road signs	Road signs	Road signs
	Defenses and barriers	Defenses and Barriers	Defenses and barriers
Right-of-way functionality	Vegetation control	Right-of-way functionality	Vegetation control
	Cleaning Right of Way		Cleaning Right of Way
	Fence right of way		Fence right of way
Road Safety. Danger Index	Danger Index Improvement (% improvement >25%)	Not Applicable	Emergency Coordination (% improvement >10%) (standard of operation)
Not Applicable	Not Applicable	Road Services	SOS poles (roadside assistance towers and emergency telephones (standard of operation)

Source: Own elaboration with information from PPP contracts.

3.2.2 Performance standards specifications

Table 5 - Performance standard specifications by PPP contract

Indicator	M&R	APPQRO	MRO
Surface deterioration	No potholes Crack-Not specified Cracking <=5% a. lane Detachment <5% No. of cracks <1 per 100m	No potholes Crack <3mm wide Cracking <5% a. rail Detachment <5% No. of cracks -Not specified	No potholes Crack -Not specified Cracking <10% w/ 100m Spalling<10% No. of cracks -Not specified
Structural fatigue	>1% per segment per year	Not measured	
IRI	<=2.5		
Rut depth	<10mm	<=12mm	<=8mm
Coefficient of friction	>=0.45	0.4<U<=0.9	
Deflections	Not measured	<=500	Not measured
Macrotexture	Not measured	>0.75MM	Not measured
Obstacles	Clean and free of obstacles		
Slopes	Slopes in cuts and embankments: no cracking and in good condition		
	Not measured		+ Hydroseeding (80%)
Landslide removal	No obstructions in crown and drainage works due to landslides		
Structures	Bridge Administration System (SIAP) [3,4 or 5]	Mexico Bridge System (SIPUMEX) [0,1 o 2].	Bridge Administration System (SIAP) [3,4 or 5]
Drainage works	Clean, unclogged and unobstructed culverts, ditches, washes, curbs and waterways		
Special pavements	Cracks < 3mm Detachments <75mm	Not applicable	Cracking < 3mm
Road lines	100% present, visible and adhered		
	Retroflexion paint: White > 200 mcd/lx/m ² Yellow> 150 mcd/lx/m ² Vibroline 4-lane stretches	Retroflexion paint: White > 200 mcd/lx/m ² Yellow> 150 mcd/lx/m ² Vibroline 4-lane stretches	Retroflexion paint: White > 150 mcd/lx/m ² Yellow> 150 mcd/lx/m ² - Red> 24 mcd/lx/m ²
Road signs	100% present, clean, well positioned, structurally sound		
	Retroflexion: 580>White>342 435>Yellow>257 Orange>104 Green>38 Blue>17	Retroflexion: 580>White>342 435>Yellow>257 Orange>104 Green>38 Blue>17	Retroflexion: White>342 Yellow>257 Orange>123 Green>34 Blue>15/ Red>68
Defenses and barriers	100% present, well positioned, and undamaged (SCT regulations). Incl. anti-glare screens		
Vegetation control	10m from curb edge to right-of-way fence Height <20cm	From edge of curb to right-of-way fence Height <20 cm	From edge of curb to right-of-way fence Height <20 cm Reused waste
Cleaning	Clean and unobstructed		
Fencing	Concrete posts and cattle netting 100% present and undamaged.		
Improved Danger Index	YES	Not measured	Standard operation
Road services	Not measured	2 Daily tours Attention to incidents and emergencies (max. 45 minutes)	Standard operation

Source: Own elaboration with information from PPP contracts.

3.3 External oversight and reporting activities

A control measure established in the 3 PPP contracts is the definition of the figure of the "Supervising Manager" (SM) in the case of APPQRO, and the "Supervising Administrative Agent" (SAA) in the M&R and MRO contracts, which are figures that represent the Contracting Party and are in charge of requesting and validating the reports supporting the activities carried out and to be carried out by the Developer. and are in charge of requesting and validating the reports that support the activities performed and to be performed by the Developer, and validating that the contract specifications are being fully complied with, or if applicable, applying the corresponding deductions to the payment received by the Developer.

3.4 Self-monitoring unit

In the 3 PPP contracts it was defined that the Developer is obliged to establish within its own organizational structure, a self-monitoring unit with qualified personnel, whose task is to verify, on an ongoing basis, the degree of compliance with the required performance standard indicators.

The Self-control Unit, in conjunction with the AAS or GS, performs inspection functions, control tests, corrective actions, validates follow-up plans, budgets, reports, supervises routine and periodic maintenance work, and validates and approves the monthly payments of the consideration for each performance standard.

3.5 Road management system

The system aims to ensure the optimal use of the resources available for the administration of the highways so that the infrastructure is in adequate condition, and to carry out timely actions in the stretches that require intervention.

Table 6 - Scope of the PPP Contract Road Management System

Scope of the QMS Module Contract	M&R	APPQRO	MRO
GIS interface (Georeferenced Information System)	X		
Inventory of road assets	X	X	X
Inventory Condition Management and Inspection	X	X	X
Auscultation Charts (Pavement Evaluation)	X	X	
Pavement Management and Preservation (Evolution, Behavior and Pavement Interventions Models)	X	X	
Conservation Management	X	X	X
Queries of the information contained in the Database	X		X
Electronic logbook			X
Operation Management			X
Reports	X		X
Mobile application to review incidents and update inventories.	X		X
Quality and continuous improvement			X
ITS and Communications System			X
Deductions for noncompliance			0.12 % (each day in arrears)

Source: Own elaboration with information from PPP contracts.

3.6 Other controls

Table 7 - Other controls established in PPP contracts

Controls established in the contract	M&R	APPQRO	MRO
Camp	X	X	X
Quality control of materials	X	X	X
Equipment calibration	X	X	X
Key personnel	-	X	-
Non-compliance with inspection frequency	X	X	X
Site protection signage	X	X	X
Annual measurement of the structural capacity of the pavement.	-	X	-
Environment	-	-	X
Annual maintenance program for services	X	X	X
Quality Management Plan	X	X	X
Remaining life (years)	2	3	5

Source: Own elaboration with information from PPP contracts.

4. Payment mechanisms

Table 8 - Payment mechanisms and deductions by PPP contract

Concepts	M&R	APPQRO	MRO
Payments	<p>Pay Per Availability (PPD): Initial Rehabilitation Payment.</p> <p>Monthly Unit Prices (MUP): payment for compliance with performance standards, applying deductions in case of non-compliance.</p> <p>Unit Prices for Completed Work (PUOT): additional work not considered in the contract</p>	<p>Fixed Monthly Unit Price for Rehabilitation (PUMr): Payment for Initial Rehabilitation and is comprised of financing plus riskcapital.</p> <p>Fixed Monthly Unit Price Maintenance(PUMm): Reimbursement of the IRR of the risk capital plus the standard maintenance amounts.</p>	<p>Monthly Unit Price (MUP): payment for services meeting performance standards. Divided into 2: - Maintenance and Rehabilitation (MR): For periodic, routine maintenance and reconstruction.</p> <p>- Operation (O): Operation services.</p> <p>Unit Price Service Provided (PUSP): initial improvement works that are paid upon completion of the work.</p>
Formula for deductions in payment	$\%Cumpl = \left[1 - \left(\frac{\sum(\beta_{i \cdot a_i})}{Stot} \right) \right] * 100$	$PM_i = \sum PM_i S_j E_e R \sum PM_i S_j E_{em} * FC_{ij}$	$ITPUM \text{ "MR" } c/d = ITPUM \text{ MR} - \sum DTVC_x$

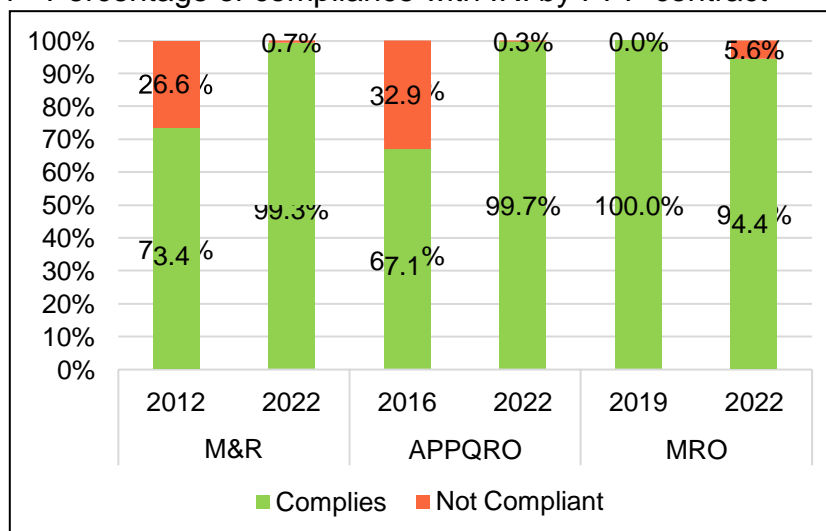
Special features	Deduction for: degree of affectation (defined), days, and segment weighting.	Deduction for 3 scenarios (2%-5%): threshold allowed, not solved in time, and for additional corrective time, and if applicable, area or length affected.	Deduction for 3 scenarios (0.25%-10%): initial, corrective and reiterative deduction, and by length and/or times of occurrence.
	Segment weighting and defined degree of impairment	Includes Compliance Factor (1.05)	Method for calculating the impact.
Advantages	Segment payment allowed early termination of IR	Compliance factor as an incentive or excessive punishment	Deduction established for each standard, and allocation methods.
	Segmentation allows the establishment of standards according to the characteristics of the section.	Deduction focused on correction times.	Inclusion of "Reiterative" deduction percentage.
Cons	Predefined weightings that may be subjective	Segmentation decreases the amount to be deducted.	Does not include compliance factor incentive
	Segmentation of standards decreases the amount to be deducted.	There is no deduction for repeat offenses.	Does not include penalty for elapsed days.
Historical % Deductions with respect to Payment	0.23%	0.20%	0.13%

Source: Own elaboration with information from PPP contracts.

5. Economic and social impacts

5.1 International roughness index (IRI)

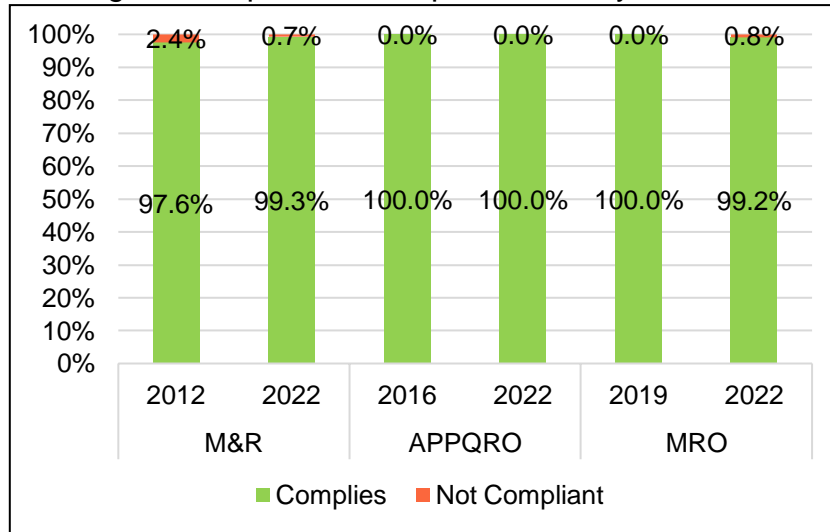
Graph 1 - Percentage of compliance with IRI by PPP contract



Source: Own elaboration with information from PPP contracts.

5.2 Depth of rutting

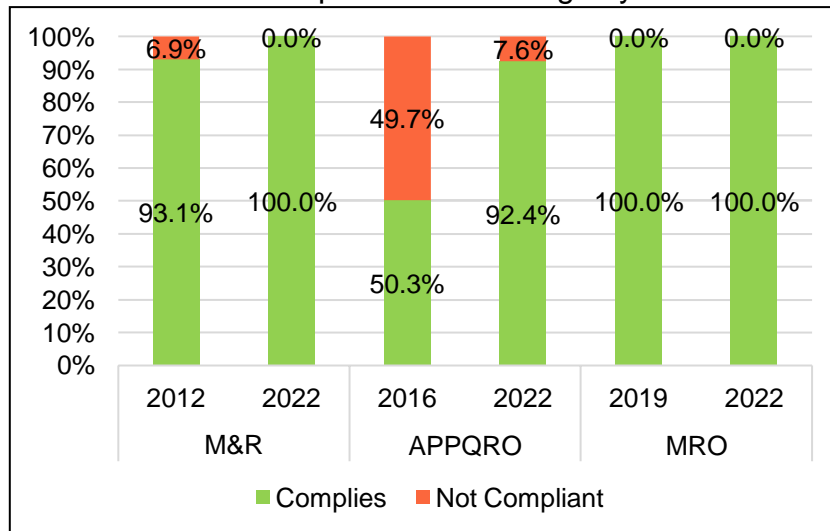
Graph 2 - Percentage of compliance in Depth of Bolls by PPP Contract



Source: Own elaboration with information from PPP contracts.

5.3 Coefficient of friction

Graph 3 - Friction Coefficient Compliance Percentage by PPP Contract



Source: Own elaboration with information from PPP contracts.

5.4 Social benefits

Improved road conditions with respect to IRI, rut depth and coefficient of friction directly benefit all road users by increasing traffic speeds, reducing vehicle operating costs and increasing traffic safety.

Currently, the M&R contract has more than 5.7 million annual users; the APPQRO contract has more than 11.2 million users, of which almost 50% are freight vehicles; and the MRO contract has more than 4.6 million users.

Table 9 - Annual Average Daily Traffic (ADTD) by PPP Contract

	TDPA	M&R	APPQRO	MRO
A		9,438	14,175	8,325
B		729	1,225	472
C		5,563	15,216	3,971
Total		15,730	30,616	12,768
Annual		5,741,450	11,174,840	4,660,320

Source: Own elaboration with data from PPP contracts

Therefore, comparing the situation before the PPP contracts with the current situation, the improvements in road conditions, under certain assumptions *, generate annual social benefits of more than 321.2 million pesos in the M&R contract, and 848.6 million pesos in APPQRO. In the case of MRO, this calculation could not be made because they are currently performing Periodic Maintenance works, so the performance standards of the situation before the APP contract are better than the current situation.

If we compare the social benefits with the payments made by the Employer for services rendered, we find annual savings of 104.9 million pesos for the M&R contract and 161.7 million pesos for the APPQRO contract, as shown in Table 10.

Table 10 - Annual social benefits per PPP Contract¹

Concept	M&R	APPQRO
Annual social benefit	321.21	848.61
Annual payment to the Developer	216.36	686.91
Difference	104.85	161.70

Source: Own elaboration with data from PPP contracts.

¹ * The document published by the IMT "Base operating costs of representative vehicles for interurban transportation 2021" was used.

An average IRI before the PPP contract of 3 was considered for the entire road section and an average IRI of 2 for the entire road section at present.

For vehicle operating costs with an IRI of 3, speeds and costs were averaged between an IRI of 2 and an IRI of 4.

The social value of time of used the data published by the IMT in 2022 for the value of time per hour at the national level for work-related travel.

In the case of buses, a transport of 10 users per bus was considered.

5.5 Economic benefits

In a preliminary analysis, the costs per kilometer and per vehicle of the PPP contracts were calculated considering the annual payment made by the Contracting Party to the Developer as the cost, and compared against the cost obtained from 46 toll roads currently in charge of the public sector in the National Infrastructure Fund (FONADIN) using the annual income per toll as the cost.

Therefore, this indicator shows the amount spent per vehicle and per kilometer in PPP contracts, and it is assumed that the revenues collected by the public sector from toll collection would be spent on road maintenance and upkeep.

Table 11 - Costs per kilometer and per vehicle (pesos)

Concept	M&R	APPQRO	MRO	Average 46 roads	Lower cost highway
Cost per kilometer per vehicle	0.25	0.37	0.47	5.09	0.56

Source: Own elaboration with information from contracts and FONADIN.

6. Conclusions

The success in the implementation of PPP projects under performance standards will depend on a correct and deep analysis of the main variables that affect the scope, time and cost of the projects that affect the fulfillment of the objectives pursued with the contracts.

The segmentation of the tranches allows establishing performance standards according to the particular characteristics of each tranche, however, it may complicate the specifications of the standards, the payment mechanism, and the application of deductions.

The grouping of performance standards will depend on the objectives and resources available to the Employer.

The more demanding the specifications of the performance standards, the higher the cost of the PPP contract, so it is important to be clear on the scope, time and cost of each contract and to verify that the standards are affordable for the developer.

The Self-Monitoring Unit and the Supervising Administrative Agent or Supervising Manager are control strategies for the Employer and the Developer that allow them to supervise, generate reports, duly follow up on the specifications of the performance standards, validate, and authorize the corresponding payments and deductions.

The payment mechanism is an element in PPP contracts that either incentivizes or disincentivizes the Developer to fulfill the requirements of the contract efficiently and effectively.

The correct structuring of PPP contracts under performance standards has great social benefits by reducing vehicle-operating costs, reducing travel time, and increasing road safety for users.

The implementation of projects under performance standards can generate economic savings to the Employer, and maintain and preserve roads with high performance standards benefiting society.

