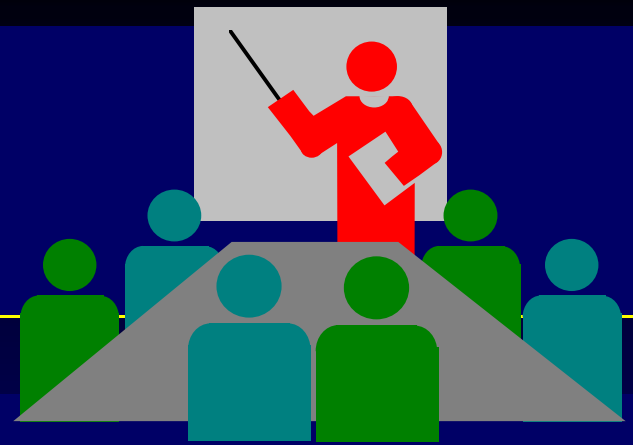


Performance-Based Contracts for Management and Maintenance of Roads (PMMR)

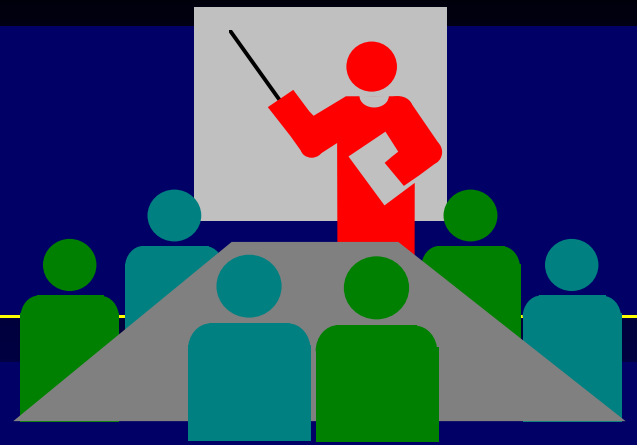
Module 1 Introduction and Overview of PMMR

Overview of Presentation (1)

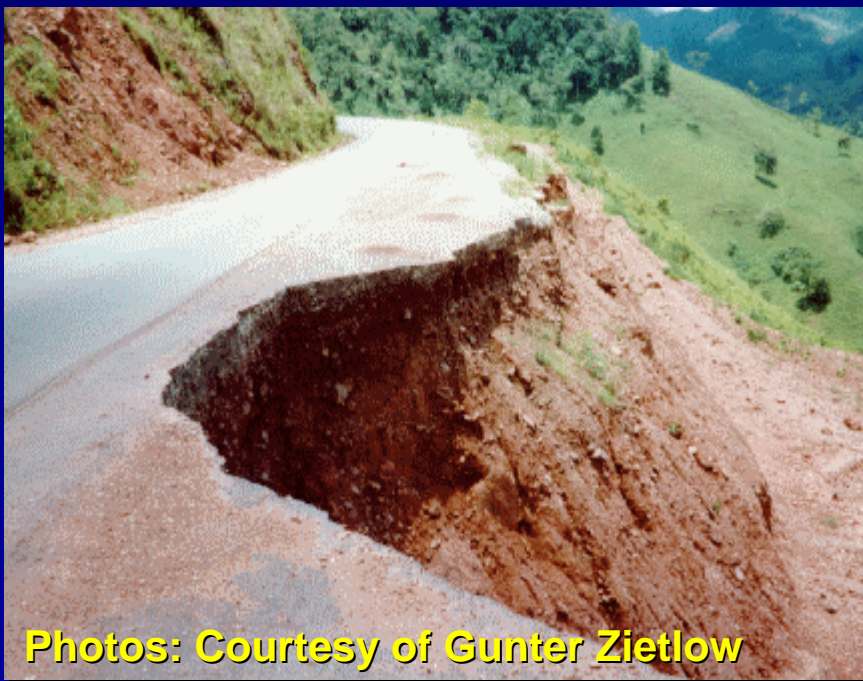


- Introduction
- Benefits and disadvantages of PMMR
- Performance standards and response times
- Long-term asset modeling
- Risk management strategies and Processes
- Performance monitoring
- Payments and incentive systems

Overview of Presentation (2)



- Data management and ownership
- Customer perception and community involvement
- Tender design and evaluation
- Changes required by the client and consulting and contracting industry
- Implementation experiences and strategy
- Lessons learned





Importance of Timely Maintenance



- When roads are in **poor** condition every \$ “saved” in road conservation will cost:
 - \$ 3 to road users in additional vehicle operating costs and
 - \$ 2 to the road administration (or the tax payer) in reconstruction and rehabilitation costs.

Contracting out Road Maintenance Can Save a Lot of Money

- **Routine and periodic road maintenance done by in-house labor is being replaced more and more by contracts with the private sector worldwide.**
- **Studies made by the World Bank in the 1980's revealed that contracting out road maintenance to the private sector can reduce maintenance cost by between 30% and 50%.**
- **Latin American countries were among the first to replace in-house labor by contracts with the private sector.**
- **Asian countries in general are still lagging behind.**

Savings due to the privatization of road maintenance

- **Better utilization of equipment**
- **Less staff with higher productivity**
- **Post being filled according to qualification and less according to seniority or political connections**
- **Maintenance being done when necessary and not when money is available**
- **No governmental rules and regulations**
- **Modern work methods and procedures**

Type of Contracts

- Unit price contract (admeasured)
 - Unit rates for work items
 - Payments are based on quantity of completed work
- Lump sum contract
 - Definition of total work
 - Payment based on single price for total work
- Performance based contract
 - Performance Standards or Service Quality Criteria
 - Fixed monthly payments if performance standards are complied with
- Hybrid contract
 - Mixture of performance contract and unit price contract

Performance-Based Management and Maintenance of Roads (PMMR)

- **Performance Standards** define the minimum conditions of road, bridge and traffic assets as well as the management and operation of the assets during the entire contract period, leaving it to the contractor as to how to achieve them.
- **The contractor is free to decide**
 - What to do
 - When to do
 - How to do
 - Where to do
 - To do the physical works himself or subcontract (with certain restrictions)

as long as he meets the performance standards during the contract period

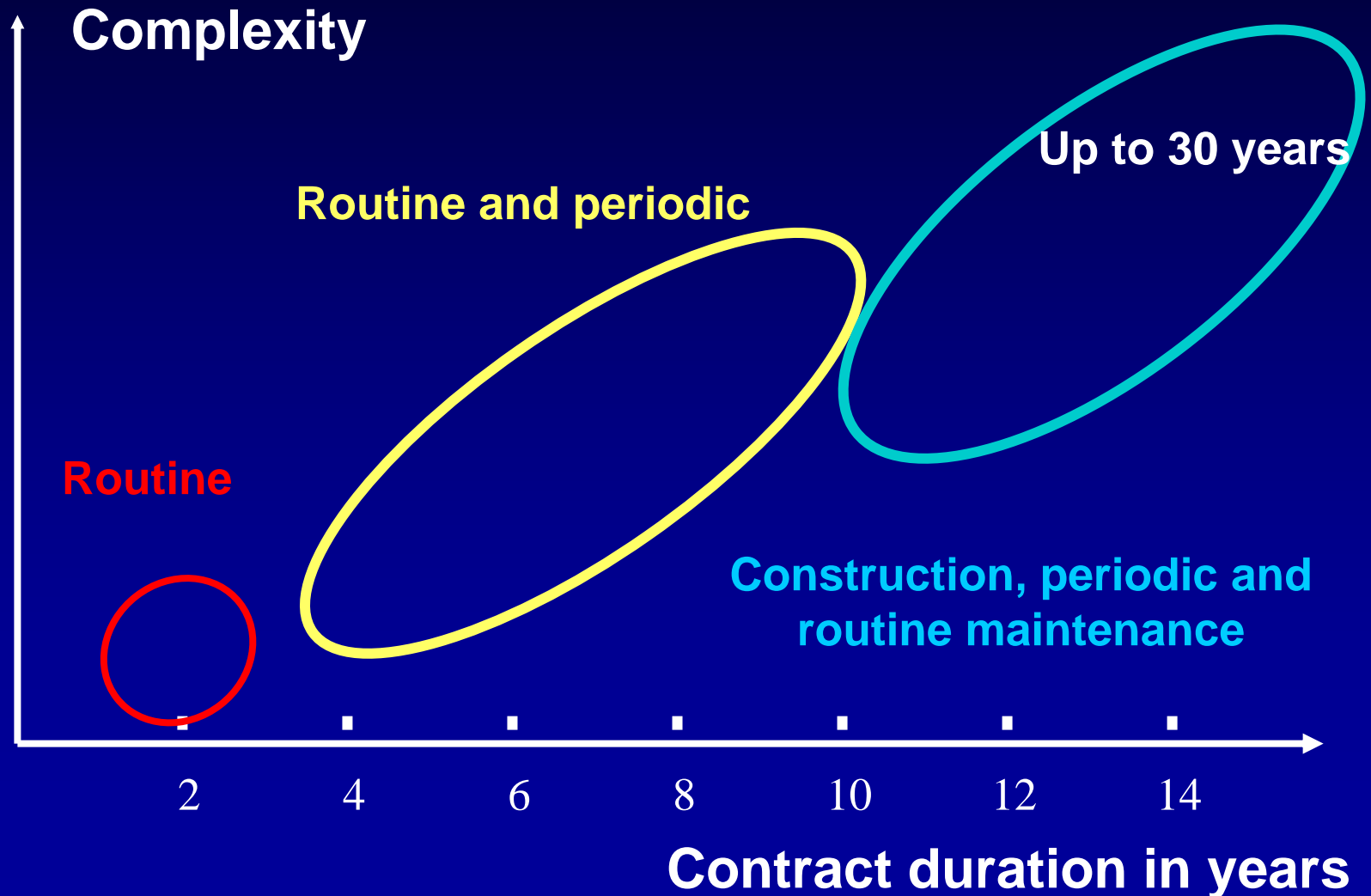
Performance-Based Management and Maintenance of Roads (PMMR) cont.

- **Lump sum payments** are made periodically and might be adjusted in accordance with the change of certain factors, like inflation or traffic volume.
- **Major emergency, rehabilitation and improvement works** might be paid based on unit prices for works agreed case by case.

Performance-Based Management and Maintenance of Roads (PMMR) cont.

- **Deductions or penalties** are being made for non-compliance with terms and conditions of contract, especially with respect to the service level criteria.
- **Duration** of contracts should at least include one periodic maintenance cycle (4-5 years for gravel roads and 8-10 years for bituminous roads). Pure routine maintenance contracts can be 1-2 years.

Performance-Based Management and Maintenance of Roads

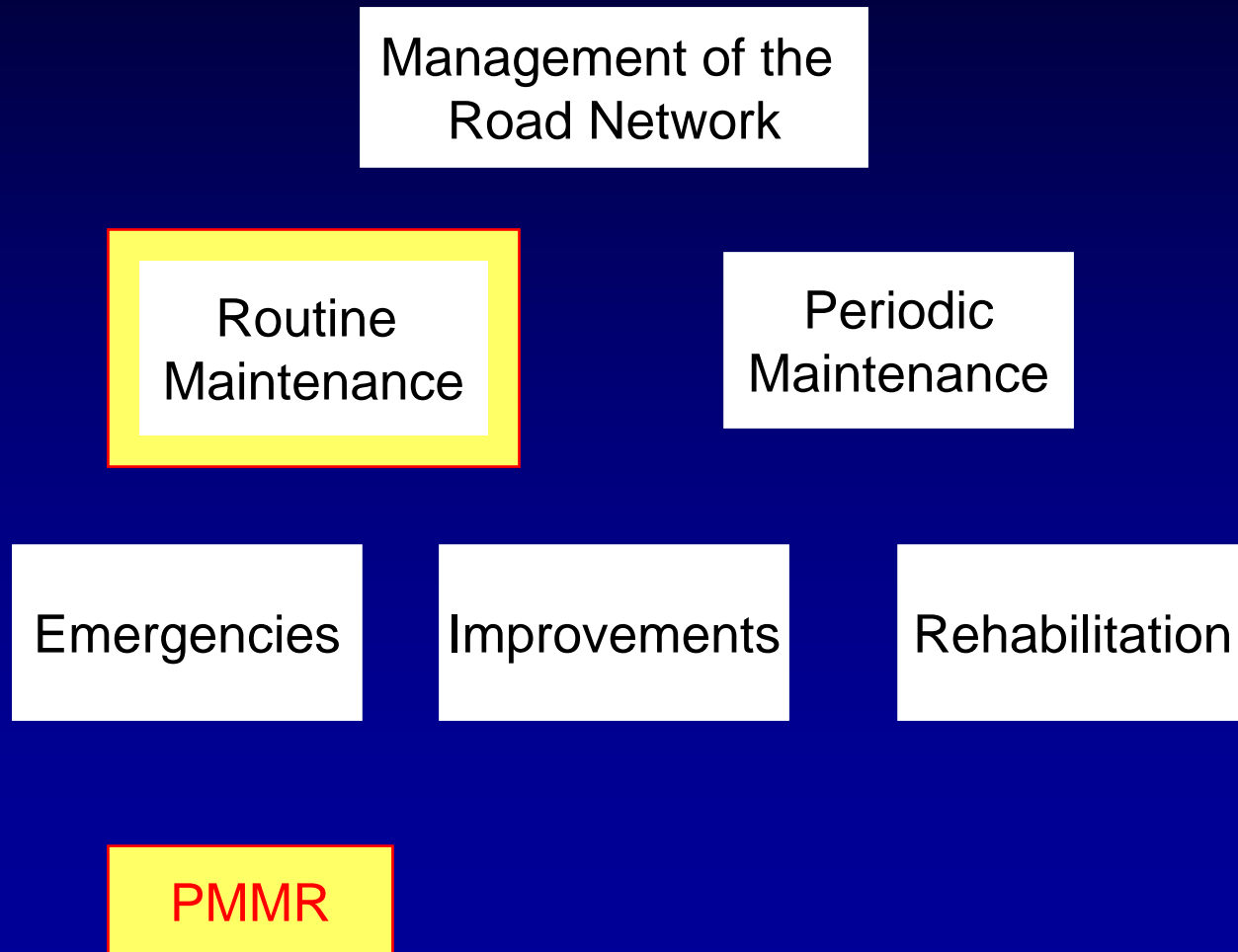


Performance-Based Management and Maintenance of Roads (PMMR)

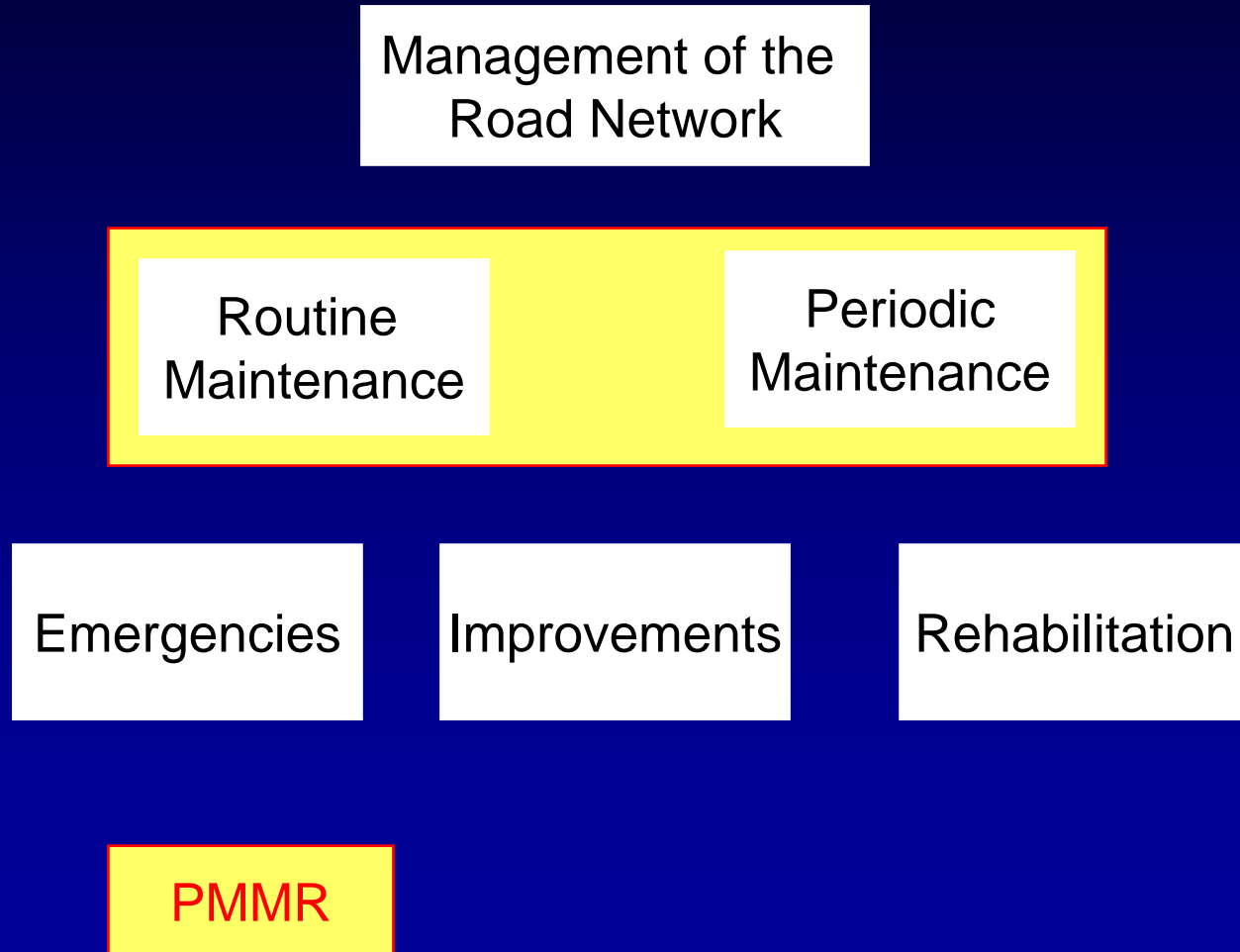
is also referred to as

- Performance Specified Road Maintenance Contract, PSMC (Australia and New Zealand)**
- Highway Asset Management Contract (USA)**
- Maintenance Service Level Contract (Latin America)**

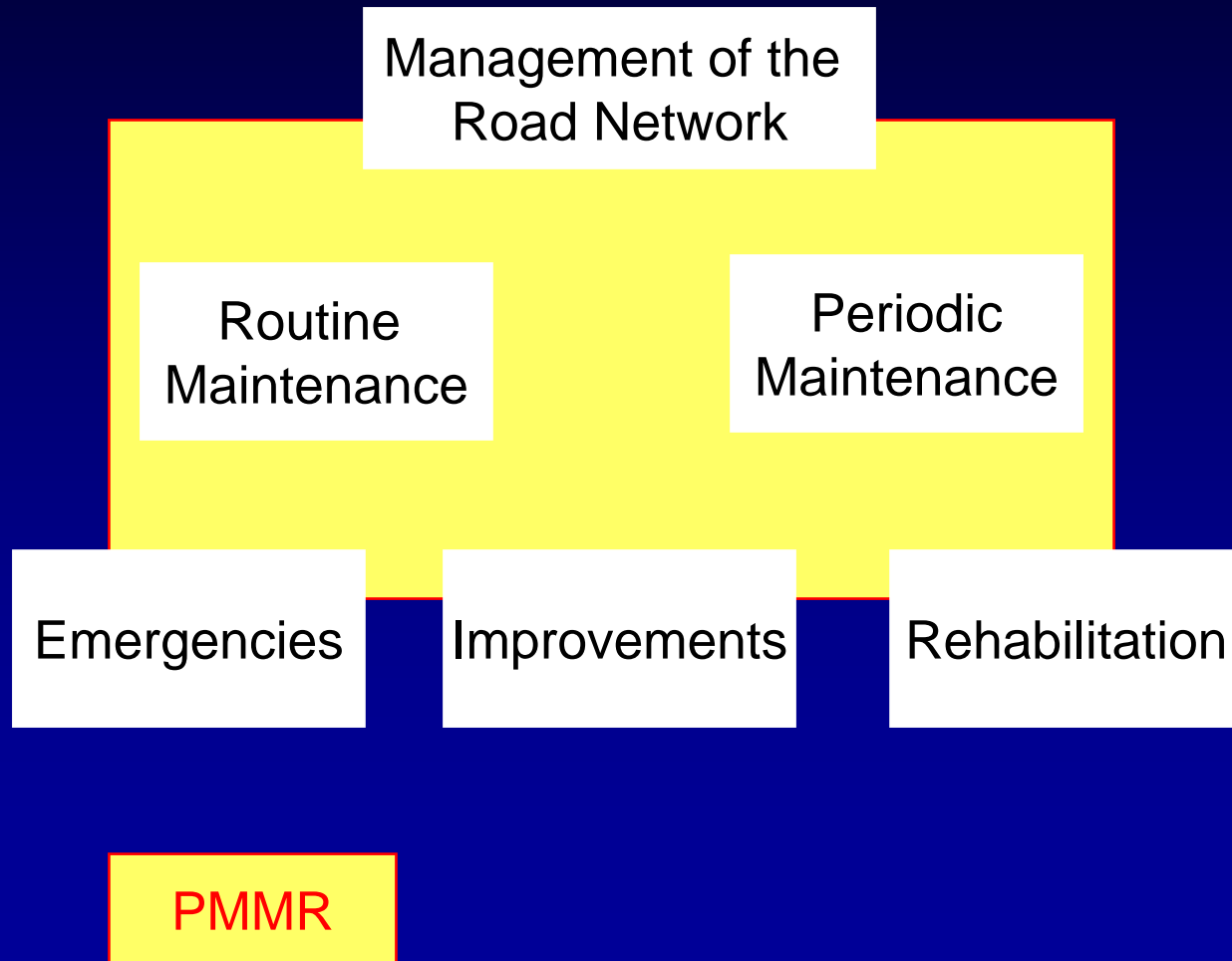
Scope of Services of PMMR (1)



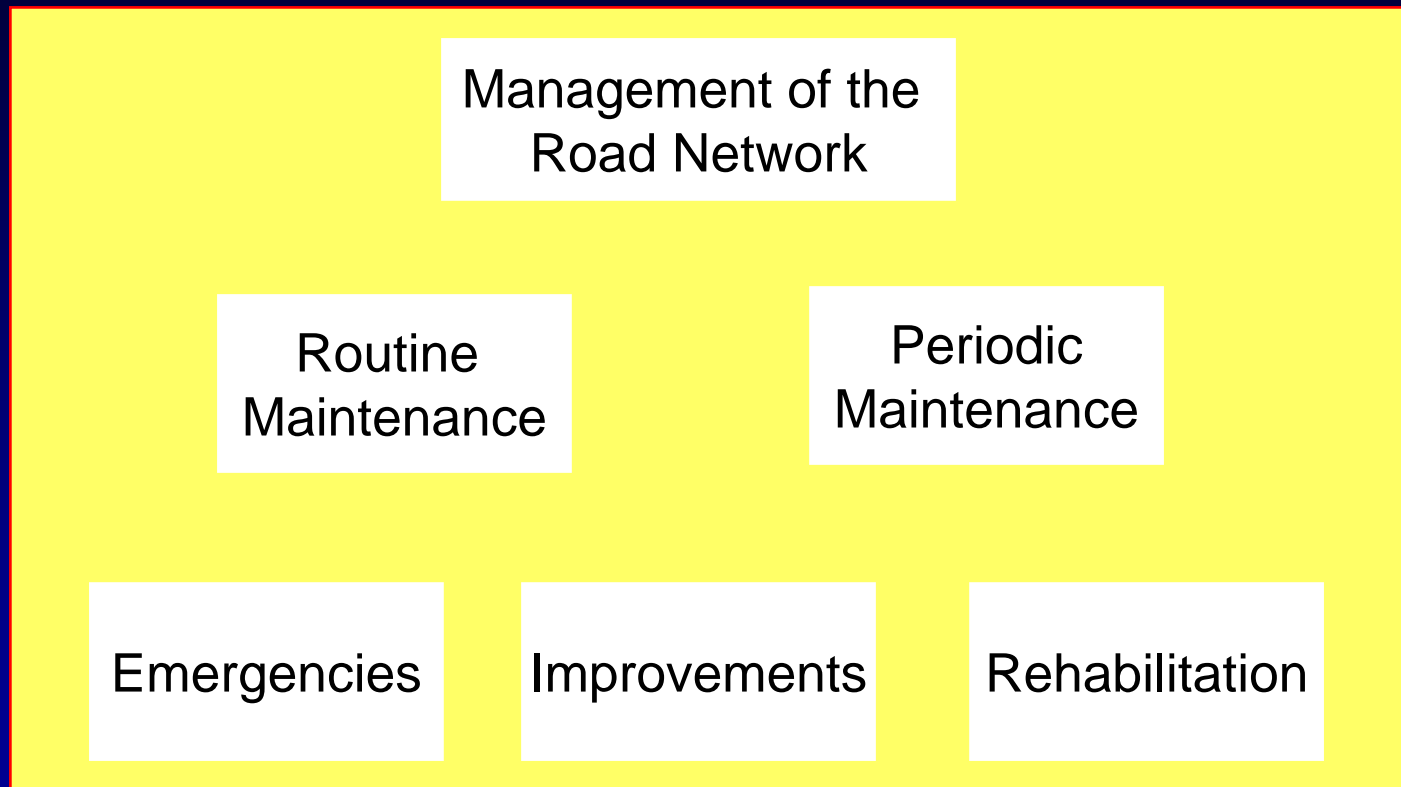
Scope of Services of PMMR (2)



Scope of Services of PMMR (3)

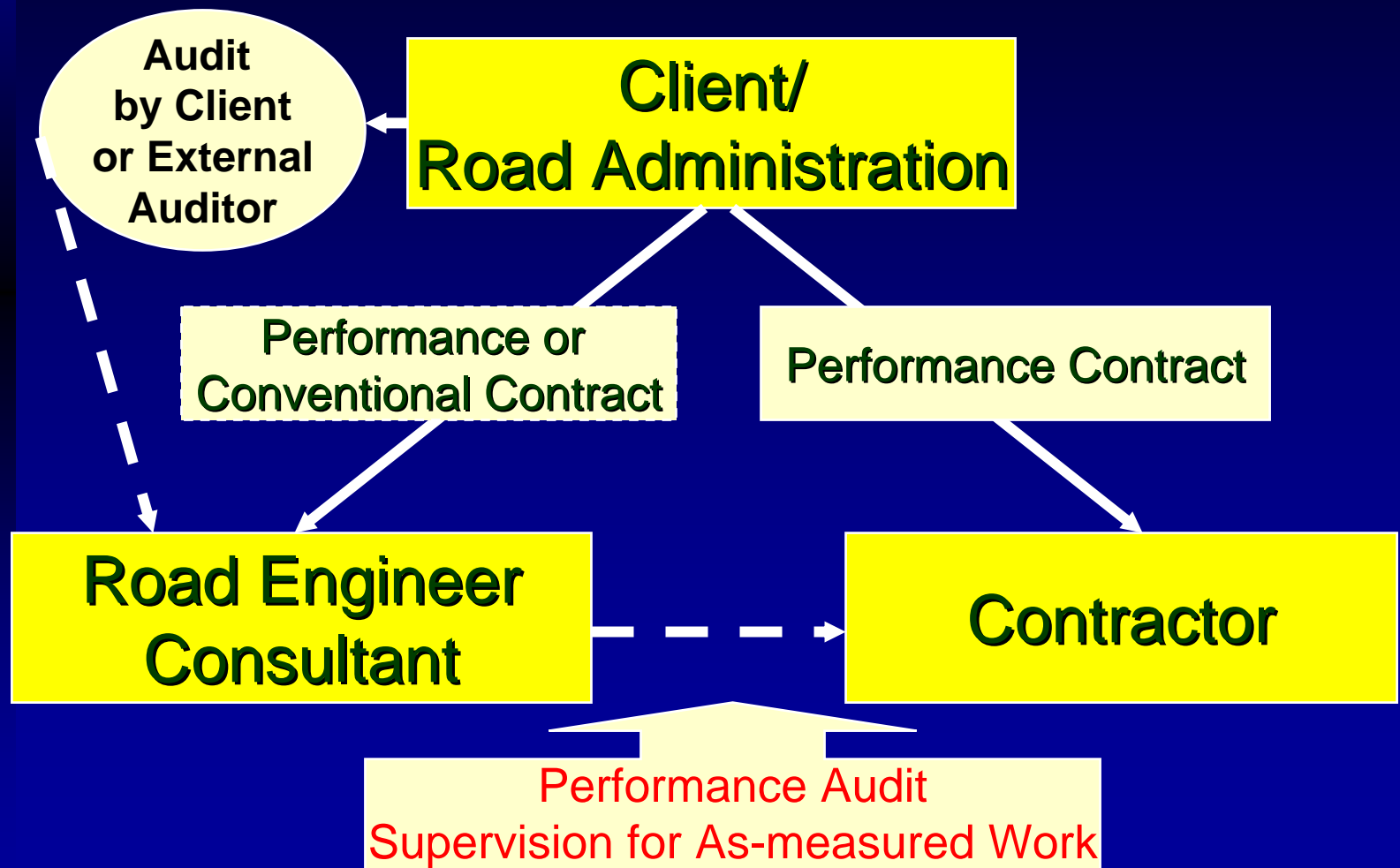


Scope of Services of PMMR (3)

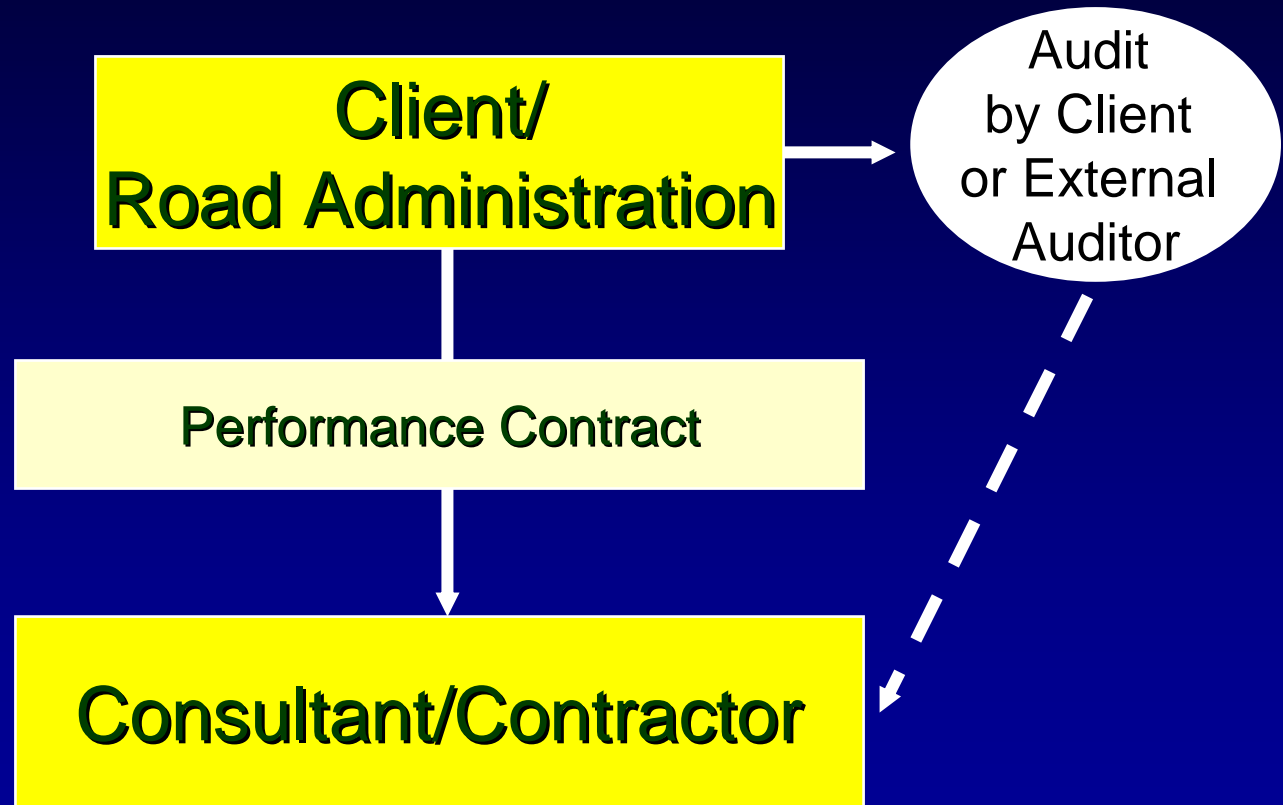


PMMR

Contractual Relationship of PMMR (1)

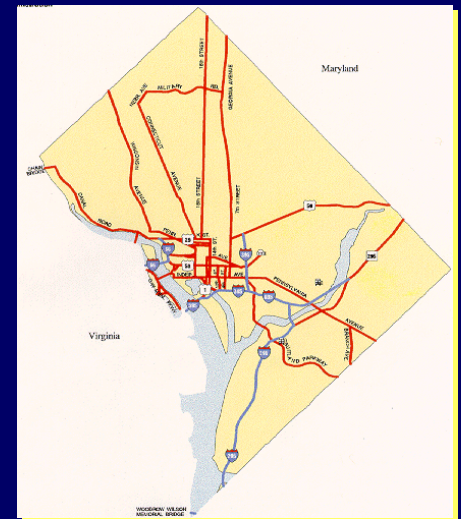


Contractual Relationship of PMMR (2)

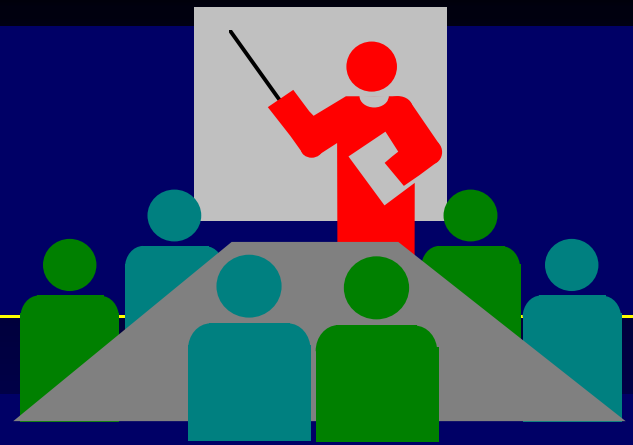


Brief History of PMMR

- 1988 British Columbia, Canada
- 1990 Argentina
- 1996/7/8 Uruguay, Chile, Colombia, Brazil
- 1995 Sydney, Australia
- 1996 Virginia, USA
- 1998 New Zealand
- 2000 Chad
- 2001 India (Karnataka)
- 2001 Spain (Alava)
-



Overview of Presentation (1)



- Introduction
- **Benefits and disadvantages of PMMR**

Benefits of PMMR (1)

➤ Road Agency

- Reduces workload
- Helps to assure long-term maintenance funding
- Provides better transparency and accountability
- Reduces maintenance cost
- Improves customer focus
- Improves control and enforcement of quality standards
- Avoids frequent claims and contract amendments to increase quantities of work by the contractor
- Reduces road rehabilitation
- Reduces risks

Benefits of PMMR (2)

➤ Road Users

- Provides better and safer roads with consistent conditions
- Reduces road user cost

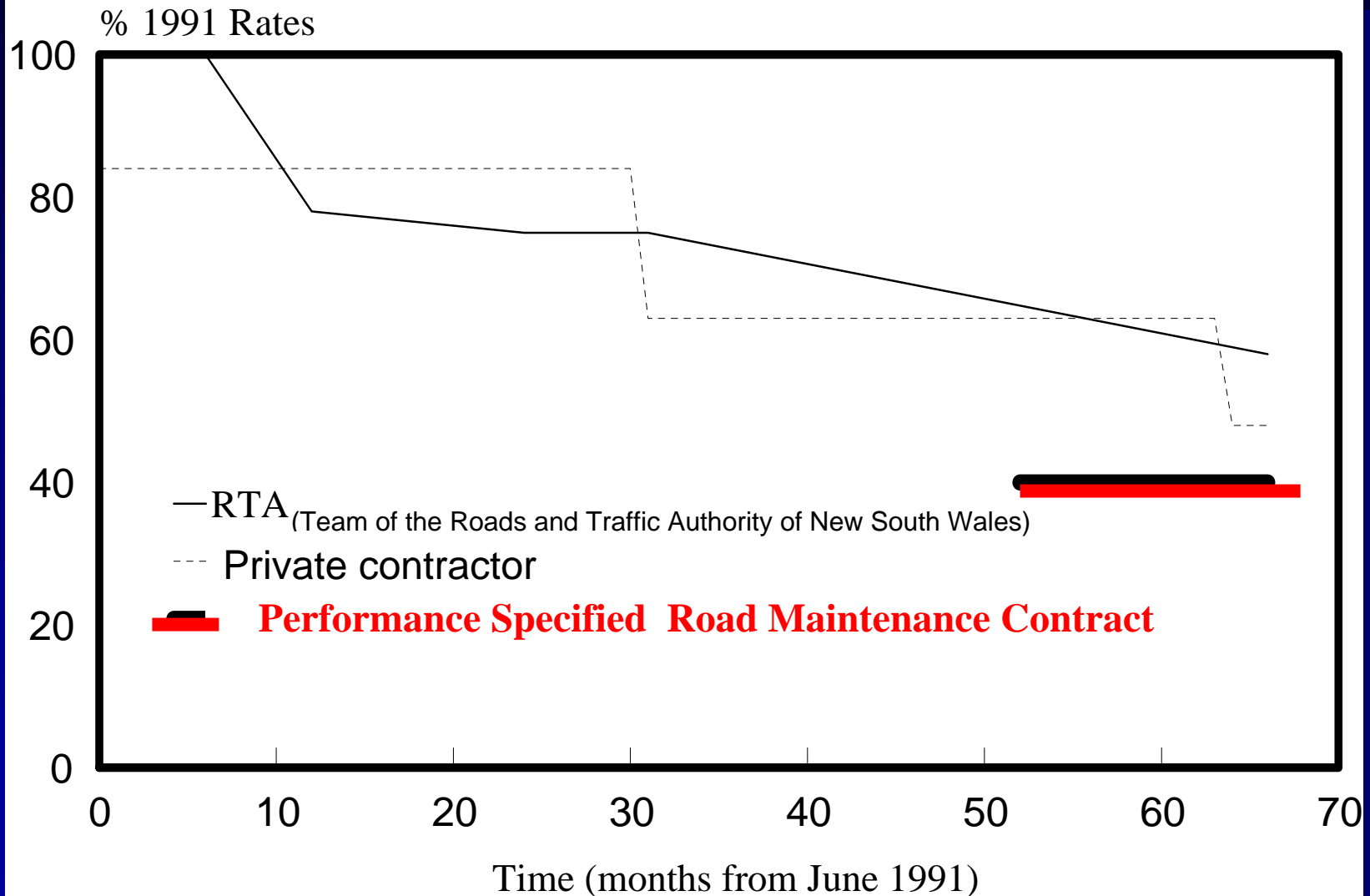
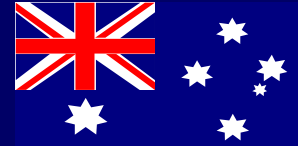
➤ Consultants and Contractors

- Guarantees workload over longer period
- Provides potential for increased margins
- Opens excellent opportunities for business growth

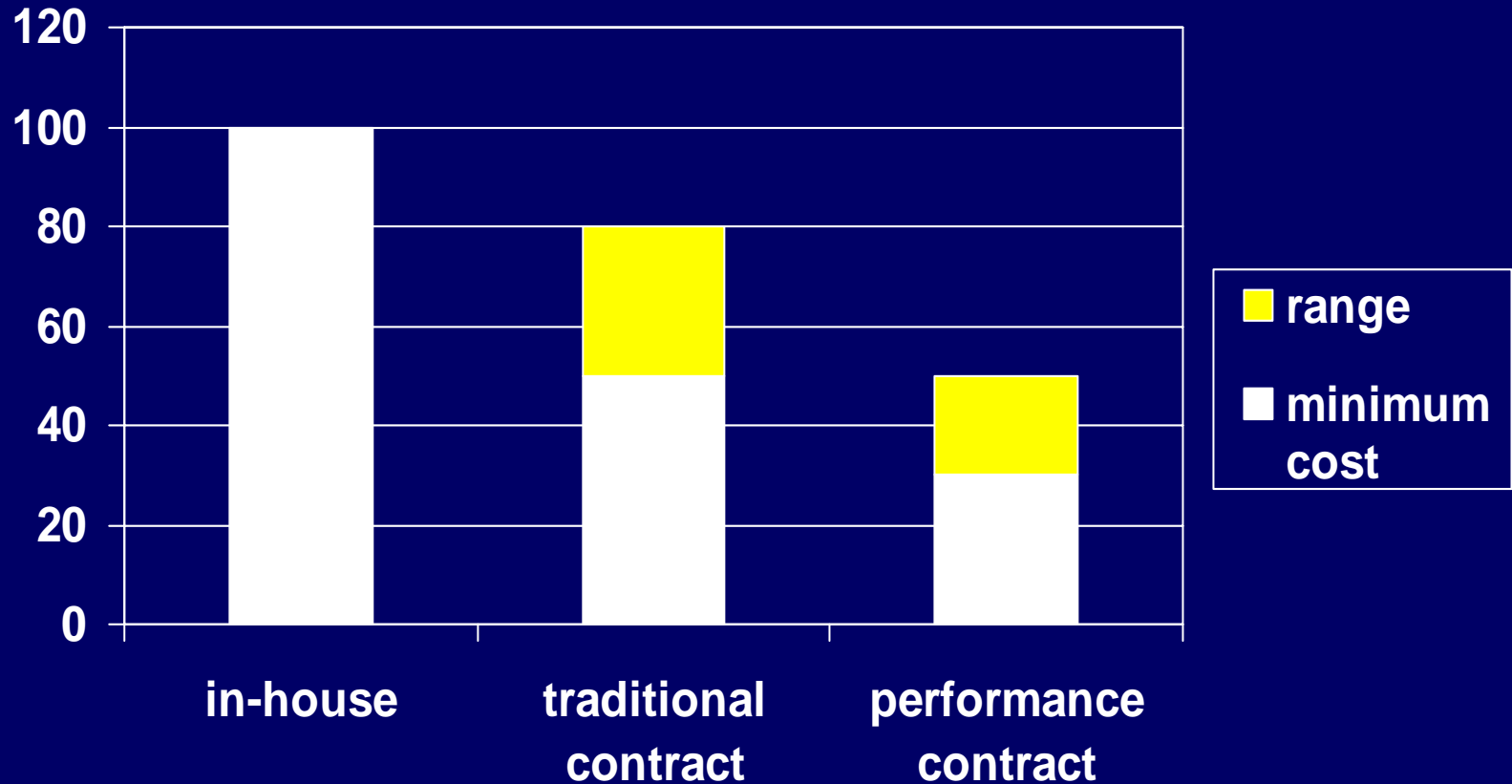
Examples of reported savings by introducing PMMR

➤ Australia	<u>Savings in %</u>
➤ Sydney	35
➤ Tasmania	20
➤ Western Australia	15-35
➤ New South Wales	37
➤ New Zealand	15-40
➤ Virginia (USA)	15

Development of Road Maintenance Cost in Sydney



Cutting Cost by Contracting out Road Maintenance



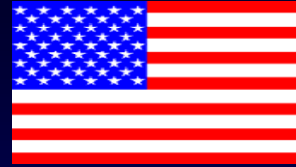
Cost comparison between road maintenance by force account (in-house) and contracting out

Reasons for reduction in road maintenance cost

Drivers of savings: Incentives / competition / long-term management

- Modern management and work procedures
- Increased productivity
- Total life cycle costing
- Just-in-time maintenance
- Work package optimization
- Use of latest technologies

Mobile Pothole Patching



CONVENTIONAL METHOD

Average Unit Cost:
\$120 per patch
\$900 per lane mile
\$5,900 per ton

** Production =
20-30 patches per day*

MOBILE PATCHER

Average Unit Cost:
\$22 per patch
\$38 per lane mile
\$880 per ton

**Production =
120 patches per day*





Innovative RoadFlex™ Pothole Patching Material



- **Multiple Benefits:**
- **Permanent patch material**
- **No failures in 3 years**
- **No rework required**
- **Reduced labor and lane closures**
- **Less disruption to motorists**

Disadvantages of PMMR

➤ Road Agency

- Tends to prolong tender period
- Requires new procedures, mentality change of staff, and training
- Might lead to loss of information if contractor is not obliged to supply detailed information on condition, interventions and inventory of the road
- Loss of flexibility
- Loss of expertise
- Might reduce competition

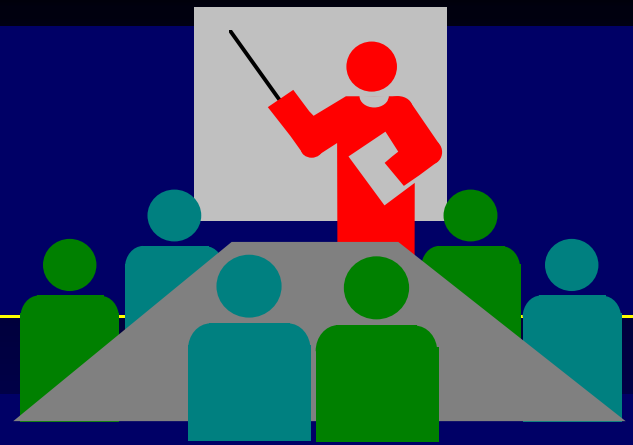
➤ Road Users

- None

➤ Consultants and Contractors

- Increases risks
- Requires mentality change of staff, new procedures, and training

Overview of Presentation



- Introduction
- Benefits and disadvantages of PMMR
- **Performance standards and response times**

Definitions

- **Performance Indicator** (or Service Quality Indicator) is a characteristic of an output that can be measured such as an aspect of quality, quantity or timeliness, which enables a comparison of performance against a desired standard, norm, goal or target value.
- **Performance (or Service Level) Standard, Criteria, Target Value, Intervention Level or Benchmark** is the desired level of performance.
- **Performance Index** relates the value of a performance indicator to a desired Standard, Criteria, Target Value, Intervention Level or Benchmark.



Performance Standards

➤ Objectives

- To satisfy the road user
 - accessibility
 - comfort
 - travel speed
 - safety
- To minimize total system cost (cost to road users and agency – *life-cycle cost of assets*)
- To minimize environmental impacts

Examples of Performance Indicators/Standards

- **Absence of potholes and control of cracks and rutting, which affects safety and pavement performance;**
- **Roughness of the road surface, which affects vehicle operating cost;**
- **Amount of obstruction of the drainage system to avoid destruction of the road structure;**
- **Friction between tires and road surface for safety reasons;**
- **Retro reflexivity of road signs and markings for safety reasons**
- **.....**

Scope of Contract (Assets and Services)

Example Washington DC, USA

- **Drainage System**
- **Pavement, incl. markings**
- **Traffic assets (safety, signs, markings, signals, etc.)**
- **Roadside Assets**
- **Bridges**
- **Tunnels**
- **Traffic Services**
- **Emergency Response**
- **Snow & Ice Control**

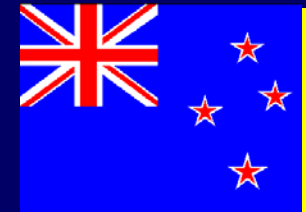
Examples of Performance Standards 12/2000 (1)

Asset Class	Component	Performance Standards
Pavement	Potholes	No potholes
	Roughness (a)	IRI < 2.0 (A), < 2.8 (U)
	Roughness (b)	IRI < 2.9 (A), < 3.4 (U)
	Rutting	< 12mm (A), < 10mm (U)
	Cracks > 3mm	Sealed
Gravel surfaces	Potholes	No potholes
	Roughness	IRI < 6 (U), < 10 (C)
	Thickness of gravel layer	> 10cm (C,U)
Paved Shoulders	Potholes	No potholes
	Cracks > 3mm	Sealed
	Joints with pavement	Vertical alignment < 1cm (C,U)

Examples of Performance Standards 12/2000 (2)

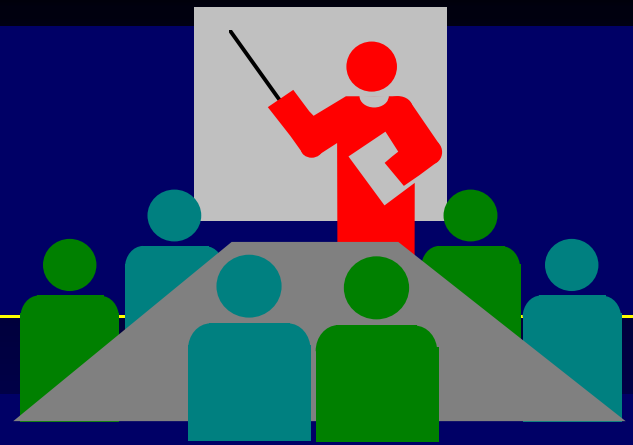
Asset Class	Component	Performance Standards
Drainage system	Obstructions	No obstructions. Should allow for unhindered flow of water
	Structures	Structurally sound with no damages
Road signs and markings	Road signs	Complete, visible, and clean
	Reflectivity of Road markings	> 160 mcd/lx/sqm (Argentina), > 70 mcd/lx/sqm (Chile)
Right of way	Vegetation	< 15 cm height of grass (Argentina) 5 –15 cm height of grass (Uruguay)
	Foreign objects	No foreign objects allowed

Performance Specified Maintenance Contract, New Zealand



Feature	Performance Standard	Response time
Potholes on highways > 10000 vpd	Not more than 3 potholes with a diameter greater than 70 mm on any 10 km section	48 hrs
Potholes on all highways	No potholes greater than 150 mm in diameter	48 hrs
Depression and Rutting	No ponding greater than 30 mm in depth at any location	6 months
Lined Channels	No lined channels with more than 10% of the cross-sectional area obstructed and free of vegetation	1 week
Edge Break	No more than 2 m of edge break within any continuous kilometer greater than 0.5 m	1 month

Overview of Presentation



- Introduction
- Benefits and disadvantages of PMMR
- Performance standards and response times
- **Long-term asset modeling**

Long-Term Asset Modeling (1)

Asset modeling is part of the asset management that helps to optimize the benefits and cost of maintaining an asset in the long-term, taking into account road user cost. The development of adequate performance standards is part of this equation.

Long-Term Asset Modeling (2)

Main assets

- Pavement
- Bridges
- Tunnels

Critical items

- Data history
- Actual condition
- Remaining life time
- Alternatives of intervention

Long-Term Asset Modeling (3)

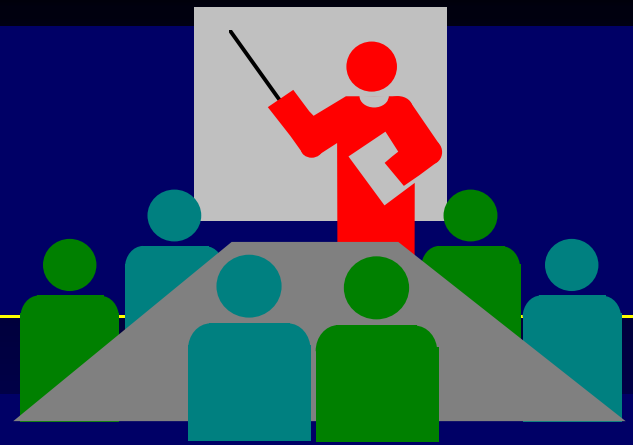
Models

- **Pavement Management Systems**
- **Bridge Management System**
- **Tunnel Management System**
- **HDM 4**

Critical issues

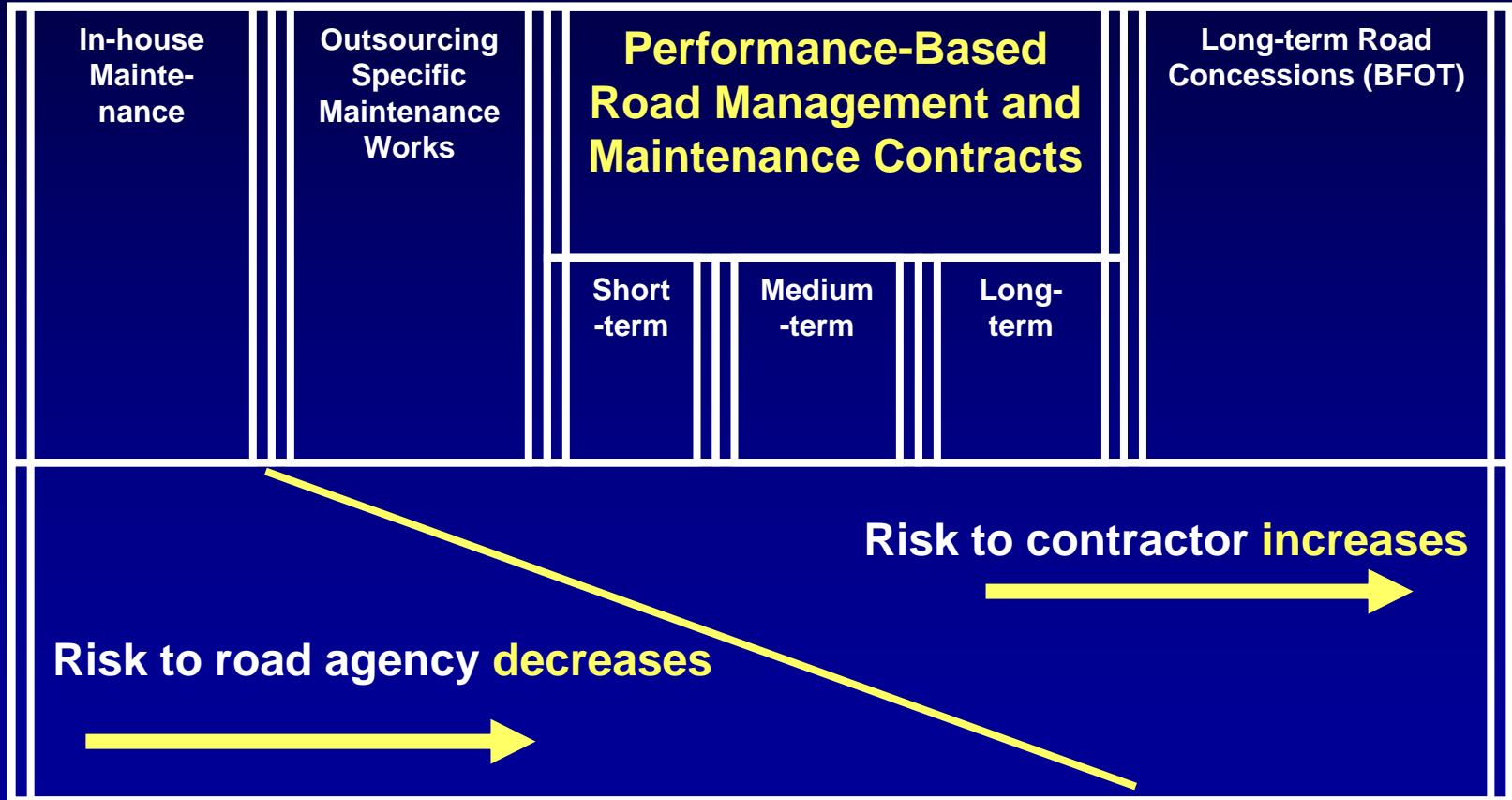
- **Availability and reliability of data**
- **Interpretation of results**

Overview of Presentation



- Introduction
- Benefits and disadvantages of PMMR
- Performance standards and response times
- Long-term asset modeling
- **Risk management strategies and processes**

Distribution of Risk



Risk Identification

There are three fundamental risks:

- **a background risk**
 - Political, legal and regulatory risks
 - Monetary and macro-economic risks
 - Force majeure,
- **a cost risk**, a risk of exceeding initial cost estimates for the construction or operation of the project, and
- **a revenue risk** if the client does not pay on time

Risk Sharing (1)

- **PMMR requires the principle acceptance of sharing risk between the client and the contractor.**
- **Private actors are willing to take some of the project risks, provided that the nature of the risks relates to their expertise so that they will be able to properly assess the consequences. The expected remuneration is proportionate to the level of risk they will bear.**
- **Asking the private sector to bear risks that could best be handled by the public sector will usually result in either withdrawal of the private partners who refuse to take the risk, or premature termination by the contractor, with the possibility of him going bankrupt.**

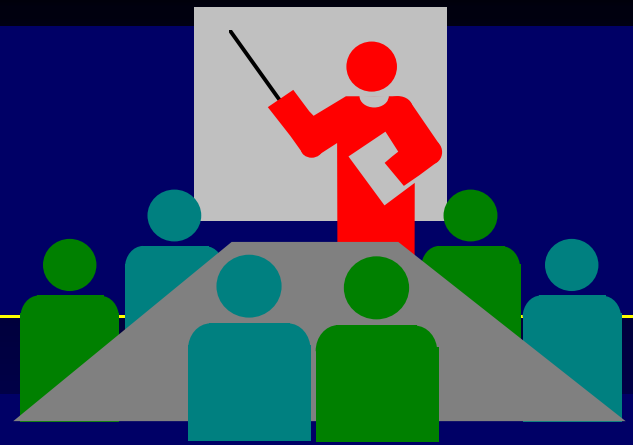
Risk Sharing (2)

- Risks are allocated between the public and private sectors but also between private partners among themselves through the contractual framework.
- All project risks should be assessed to the finest possible degree prior to initiating the project.
- Each risk must be assessed under the responsibility of the entity which will incur the risk.

Risk Mitigation

- **Background risks**
 - Born by client
- **Technical risks**
 - Pavement history and condition
 - Geological conditions
 - Drainage and flooding
- **Revenue risks**
 - Payment adjustment formula
 - Road maintenance fund
- **Social acceptability**
 - Involvement of the road agency's staff
 - Involvement of the public

Overview of Presentation (1)



- Introduction
- Benefits and disadvantages of PMMR
- Performance standards and response times
- Long-term asset modeling
- Risk management strategies and processes
- **Performance monitoring**

Performance Monitoring

- **Contractor's self-control system**
 - Contractor's Quality Assurance Plan
 - Self-Control Unit of Contractor
- **Formal monthly inspections**
- **Informal inspections**
- **Road user complaints**

Contractor's Quality Assurance Plan

Describes the methods and procedures to:

- identify the quality requirements specific to the contract
- plan and execute the work to satisfy those requirements
- inspect and/or test the work to ensure compliance with the quality requirements
- record and monitor the results as evidence of compliance, and
- ensure that prompt action is taken to correct non-compliance.

Self-Control Unit of Contractor

- Own organizational structure with qualified personnel
- Verifying continuously the compliance with the service level criteria
- Monthly reporting of compliance to client using standard formats
- Participating in monthly formal inspections

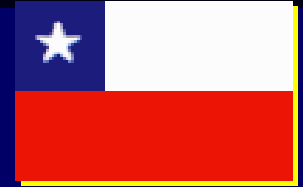
Quality Management System

ISO 9001:2000 “Quality Management System – Requirements” requires contractor to establish, document, implement, and maintain a QMS that:

- Identifies processes
- Illustrates sequences and interactions
- Identifies criteria and methods to ensure effectiveness
- Documents resources and information necessary to operate, monitor, measure and analyze the processes
- Defines action required to achieve the planned results and continually improve the process

Performance Monitoring

Inspection System in Chile



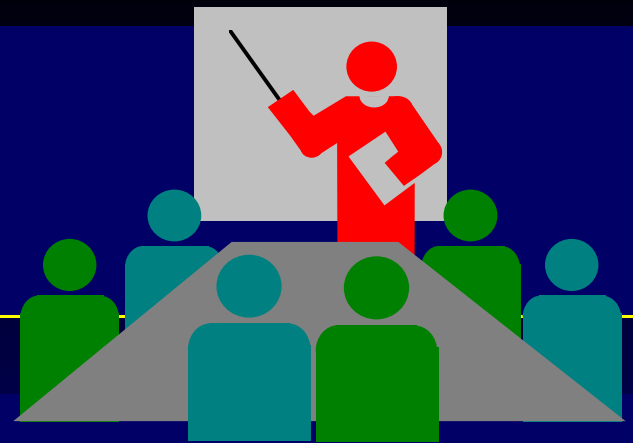
- **Inspections for purposes of payment** done once a month taking 10% of the road network selected at random different stretches of 1 km length;
- **Informal inspections** done once a week selecting 5% of the network at random;
- **Inspections due to complaint by the public;** and
- **Follow-up inspections** to verify if contractor rectified deficiencies detected by one of the inspections mentioned above.

Performance Monitoring by Contractor

Example Virginia, USA

- Asset inventory and condition assessment (updated annually)
- Pavement management program
- Bridge management program
- Safety management and traffic control plan
- Emergency response plan
- Hazardous materials communications plan
- Customer response plan
- Public information plan
- Annual work plan updated every 3 months

Overview of Presentation



- Introduction
- Benefits and disadvantages of PMMR
- Performance standards and response times
- Long-term asset modeling
- Risk management strategies and Processes
- Performance monitoring
- **Payments and incentive systems**

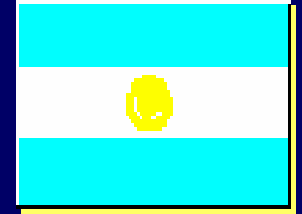
Payments

- Fixed monthly payments for scope of work and services contracted under service level or performance standards
- Rehabilitation works may be paid as fixed monthly payments as well or based on unit prices and quantities of work performed
- Emergency and improvement works to be paid based on unit prices and quantities of work performed
- PMMR should include schedules of rates as well

Bonuses and Penalties

- Monthly fixed payments might be reduced if contractor does not comply with the service level or performance standards
- Contractor might have to pay penalties for not rectifying deficiencies within the response times given
- Contractor might get bonus payments if he exceeds the performance standards

Example of Penalties for not Rectifying Deficiencies within Specified Response Times (CREMA, Argentina)

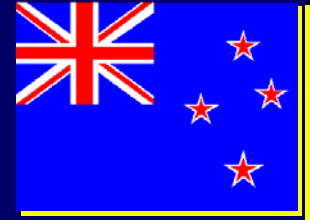


Performance Standards	Penalty in US\$
No pothole > 2cm deep on paved roads	110/day/pothole
No edge failure on paved roads	110/day/failure
No rutting > 20cm long and 12mm deep on paved roads	66/day/rut
No cracking or raveling on paved roads	88/week/km
Travel speed of at least 50km/hr on earth and 70km/hr on gravel roads	176/day/km
No potholes > 2cm on paved shoulders	44/day/pothole
Drains, ditches, culverts and other drainage structures to be clean	44/day/structure

Bonus System

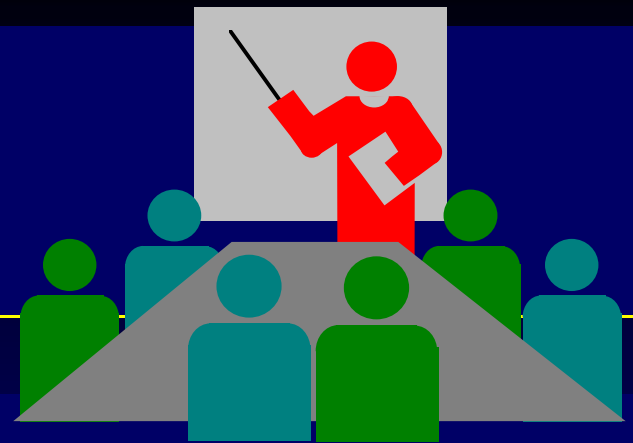
- **Bonus payment if contractor exceeds service level criteria**
- **Amounts**
- **Limitations**

Adjustment for rise and fall in costs: Example New Zealand



- All prices in the price schedules and the lump sum payment are subject to adjustment for rise and fall in costs.
- The adjustment will be made once only in each calendar year.
- The adjustments are on formulas covering labor cost index, various producer price indices, and farm expenses price index.

Overview of Presentation



- Introduction
- Benefits and disadvantages of PMMR
- Performance standards and standards and response times
- Long-term asset modeling
- Risk management strategies and Processes
- Performance monitoring
- Payments and incentive systems
- **Data management and ownership**

Data Management and Ownership

- **Collection and management of data is being shifted mainly to the contractor.**
- **Road agency needs to ensure that at least the data previously collected by the agency is being collected by contractor and transferred to the agency.**
- **Proper procedures have to be included in contract for collecting and managing data by contractor.**

Overview of Presentation

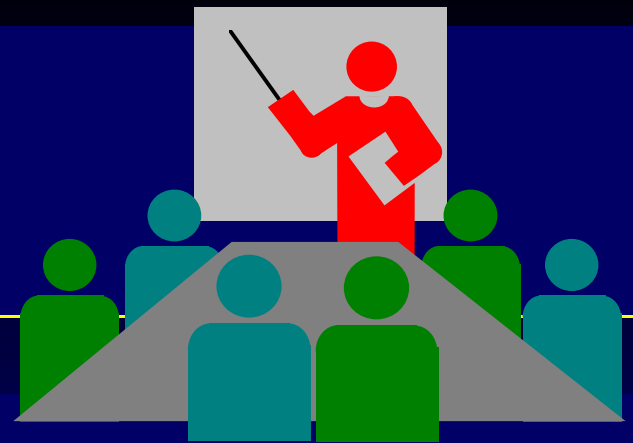


- Introduction
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- Payments and incentive systems
- Data management and ownership
- **Road user perception and involvement**

Road User Perception and Involvement

- **Involvement of road users in the planning stage**
 - Information disclosure
 - Consultation on service level indicators
- **and during operation**
 - Publication of basic contract information
 - Publication of relevant service level indicators
 - Consultation on relevant service level specifications and the compliance by the contractor

Overview of Presentation



- Introduction
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- Data management and ownership
- Customer perception and community involvement
- **Tender design and evaluation**

Tendering

- Legal and financial feasibility
- Preparation of bidding documents
 - Scope of Work
 - Time frame
 - Pure performance-based or hybrid
 - Role of contractor in preparing bidding documents
 - Risk allocation
- Pre-qualification
- Evaluation criteria



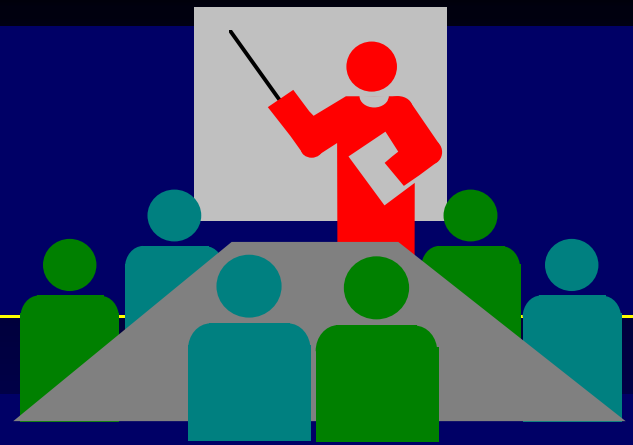
Tender Evaluation Criteria Used in First PMMR in Washington DC, USA

Technical	Experience, knowledge and understanding of issues relating to preservation and maintenance of the assets covered by this contract. Soundness of technical approach for meeting the performance measures for all of the assets referenced in this contract	20%
Staffing, Quality Control/Quality Assurance, Management	Staffing Plan	5%
	Management Plan	5%
	Quality Control/Quality Assurance Plan	5%
Past Performance	The extent to which the Prime Contractor's and subcontractors' past performance on similar asset preservation, maintenance, and management contracts demonstrates a likelihood of successfully performing all of the tasks set forth in this contract.	15%
Cost	The extent to which proposed costs are realistic and reflect the likely overall cost to the government over the term of the contract	50%

Examples of Bidding Documents

- **Sample Bidding Document for Performance-based Management and Maintenance of Roads prepared by the World Bank (World Bank 2002/2003)**
- **State Highway Maintenance Contract Proforma Manual SM032 (Transit New Zealand 2002)**

Overview of Presentation



- Introduction
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- Data management and ownership
- Customer perception and community involvement
- Tender design and evaluation
- **Changes required by the client and consulting and contracting industry**

Changes Required

➤ Road administration

- Structure
- Attitudes
- Procedures
- Training

➤ Consultants

- Procedures
- Training

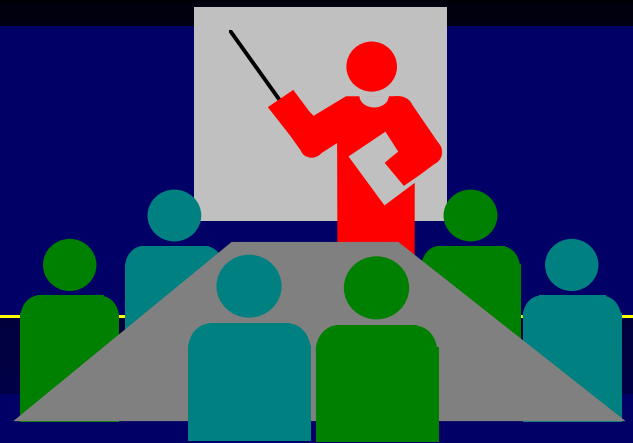
➤ Contractors

- Procedures
- Training

➤ Road users

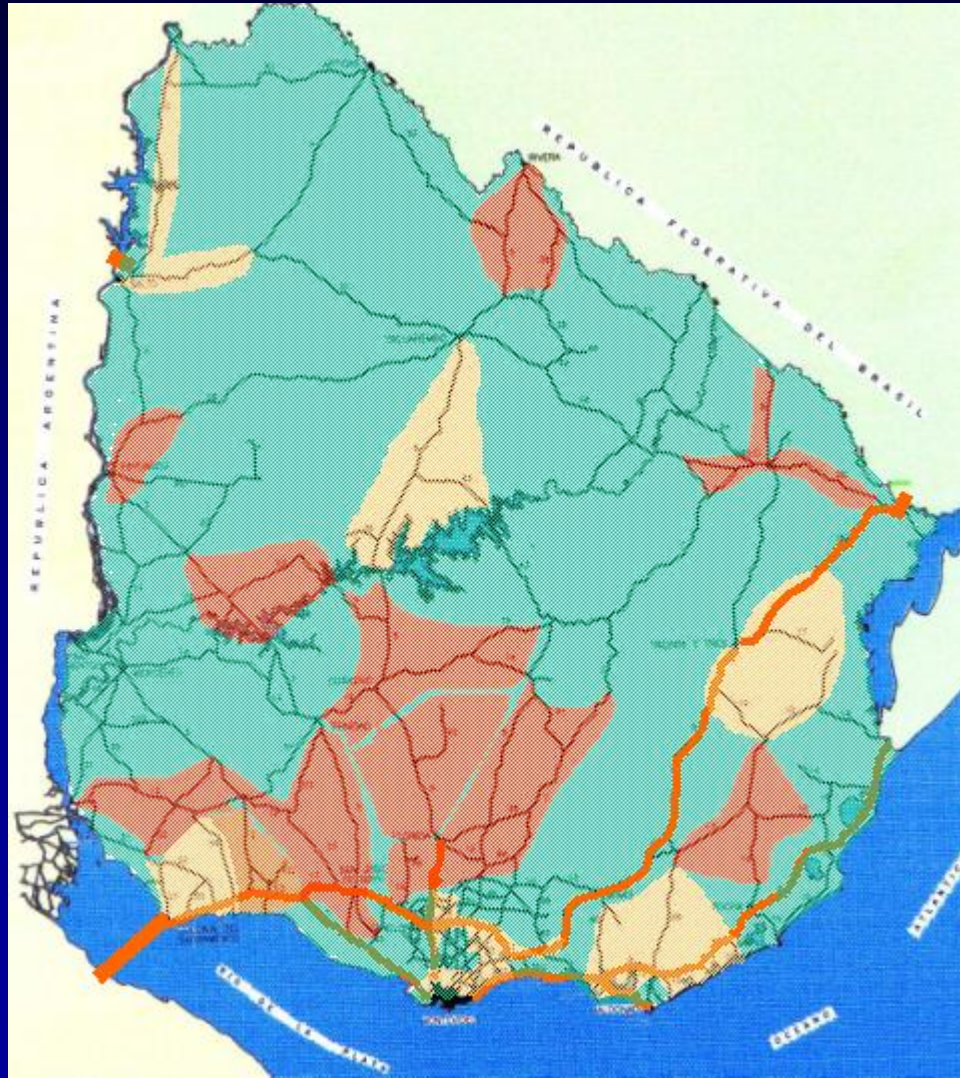
- Control of road conditions (claims)

Overview of Presentation



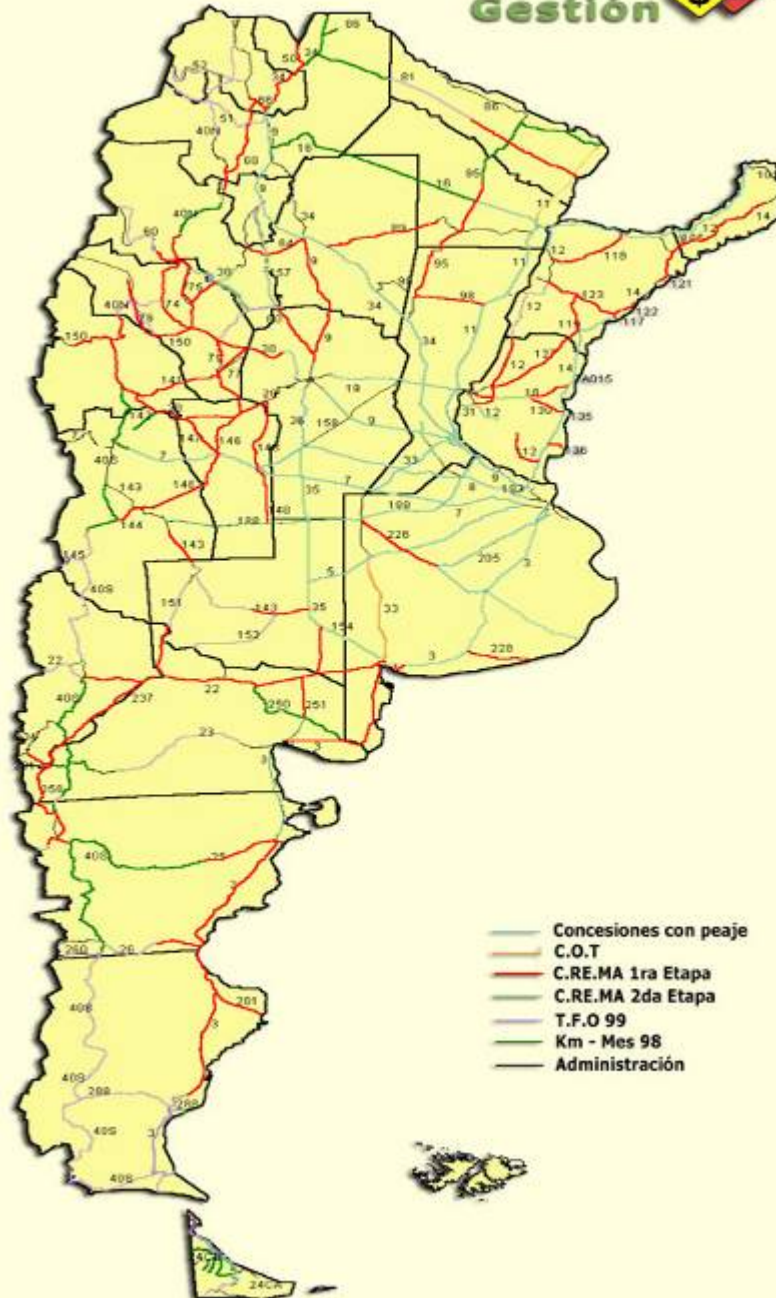
- Introduction
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- Tender design and evaluation
- Changes required by the client and consulting and contracting industry
- **Implementation experiences and strategy**

PMMR - Uruguay



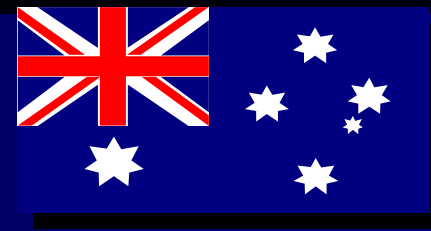


Argentina



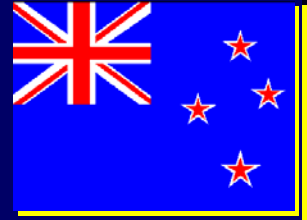
AUSTRALIA

PMMR



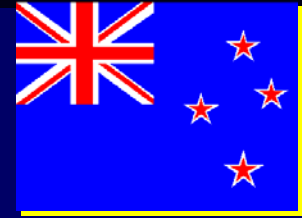
- **Actually, more than 20000 kilometers of road are being managed and maintained under PMMR in several provinces of Australia**
- **Some of the contracts are hybrid contracts (some works are being paid on a unit price basis)**
- **Reported savings are between 15% and 35%**

PMMR, New Zealand (1)



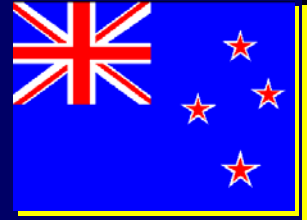
- **First contract covering 406 km of national roads was let for 10 years in 12/98**
- **Contract cost was 15% below comparable cost of traditional contracting**
- **Performance standards are very well elaborated**
- **System of quality control by the contractor (quality manual, quality plan, quality system procedures) in place**

PMMR, New Zealand (2)



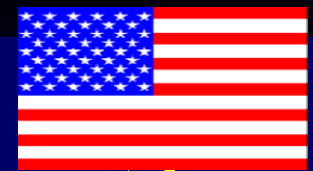
- **In 2000 a similar contract was concluded and**
- **Two years later a third PMMR covering 1040 km of local roads and 122 km of state highways**
- **While the first contract resulted in 15% savings the latest one came in 22% below the cost estimate for comparable conventional contracts**
- **New Zealand will continue to expand PMMR**

PMMR, New Zealand Services Covered



- **Management of the asset**
- **Routine, periodic maintenance and rehabilitation of assets incl. bridges**
- **Collection and management of asset inventory data**
- **Call-out and attendance to emergencies**
- **Response to public request, complaints and feedback**

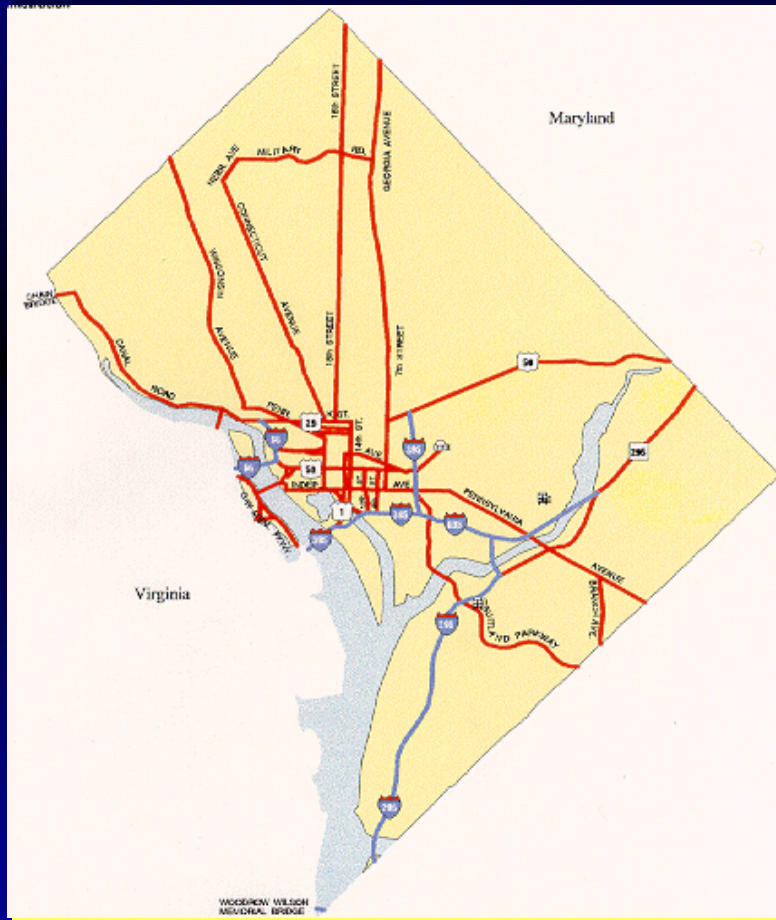
First Performance Based Road Management and Maintenance Contract in the State of Virginia (Comprehensive Agreement for Interstate Highway Asset Management Services)



- **Maintain and refurbish 1250 lane-miles on three Interstate Highways, 62 rest areas, and 7 visitor centers**
- **5+ year contract since early 1997**
- **131 million US\$ for 5 years with approximately 16% savings over VDOT cost**
- **Contractor is VMS**
- **15% of work is done by VMS staff**

Washington D.C.

Performance-Based Asset Preservation



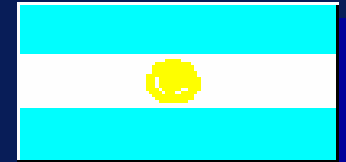
- pavement (344 lane-miles)
- drainage (2950 catch basins, 7 miles of ditches)
- roadside and landscape (450,000' of curb and gutter)
- bridges (109 structures)
- tunnels (4 major)
- snow and ice control
- traffic control and safety (108,270' guardrail, 51 crash attenuators)

Overloading



Weigh Station

Caminos del Río Uruguay



Implementation Strategy

“Ideal” Conditions for PMMR

- **Well developed contracting environment with local contractors experienced in road maintenance**
- **Road agency with good contract management experience, committed to the PMMR concept**
- **Good knowledge and data of network, maintenance needs and cost**
- **Network does not need major rehabilitation**
- **Financing secured for contract duration**

Performance-Based Management and Maintenance of Roads - Implementation Strategy -

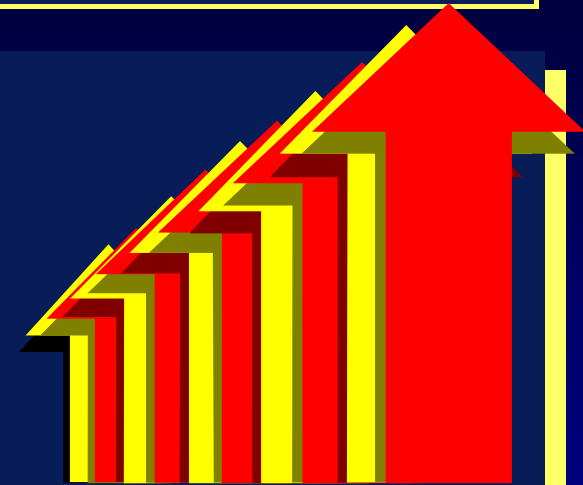
➤ Phased introduction of service level criteria.

- Routine maintenance
- Roughness and friction
- Deflection

➤ Increase time span of contracts.

- 1 to 2 years
- 4 to 5 years
- > 12 years

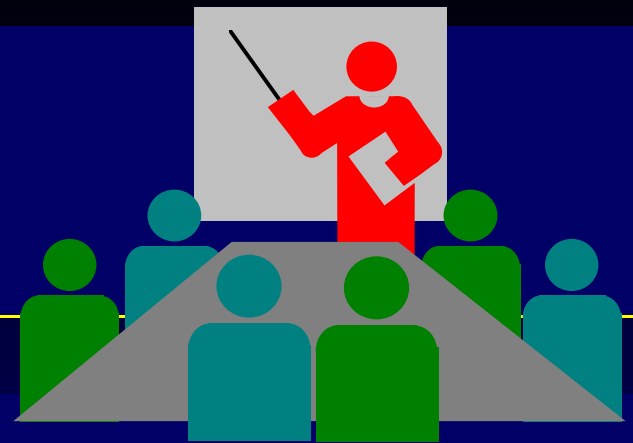
➤ Monitor implementation process.



Make Use of Available Knowledge and Experiences

- **Invite experts in PMMR**
- **Arrange visits to countries which have implemented PMMR**
- **Use recourses available on the internet**
 - **Sample Terms of Reference for consultancy services**
 - **Sample bidding documents**
 - **Case Studies**
 - **Relevant presentations and papers**

Overview of Presentation



- Introduction
- Benefits and disadvantages of PMMR
- Performance standards and response times
- Long-term asset modeling
- Risk management strategies and processes
- Performance monitoring
- Payments and incentive systems
- Data management and ownership
- Customer perception and community involvement
- Tender design and evaluation
- Changes required by the client and consulting and contracting industry
- Implementation experiences and strategy
- **Lessons learned**

Lessons learned (1)

- **Financing needs to be secured for the entire contract period.**
- **Performance Contracts have to be tailored to each specific situation**
- **Pilot schemes should be carefully planned and implemented**
- **Road have to be in “maintainable” conditions**

Lessons learned (2)

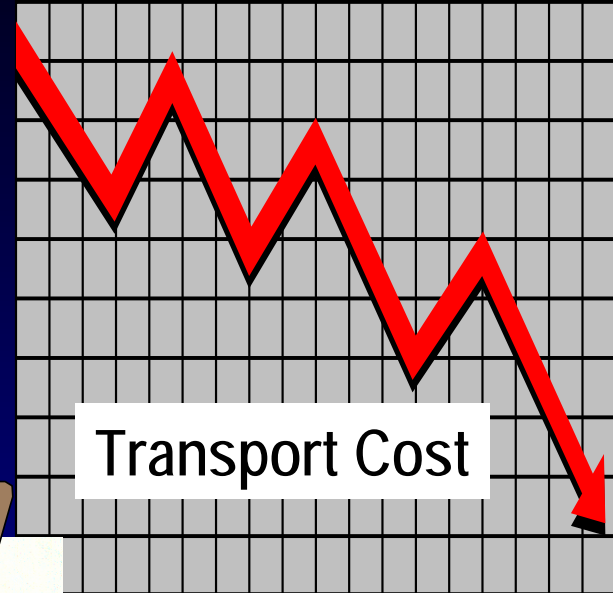
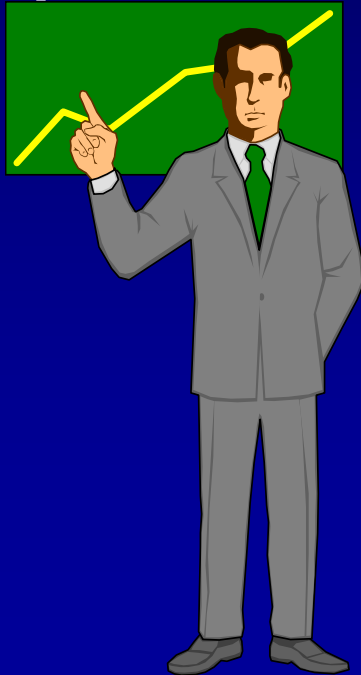
- **Full Performance Contracts should include at least one periodic maintenance cycle**
- **Risks shall be assigned to the party that can best bear and manage the risk**
- **Qualification of contractors and inspectors is key to success**
- **All contractors should use proper Quality Management Systems (QMS)**

Lessons learned (3)

- **Performance Contracts need strict performance monitoring and application of penalties for non-compliance**
- **Include Dispute Resolution Mechanism**
- **Performance standards need to be developed further**
- **Performance Contracts might not produce cost saving immediately**

VISION

Business Opportunities



Thank you for your attention