

# Road Asset Management (RAM) Training

10-13 August 2020

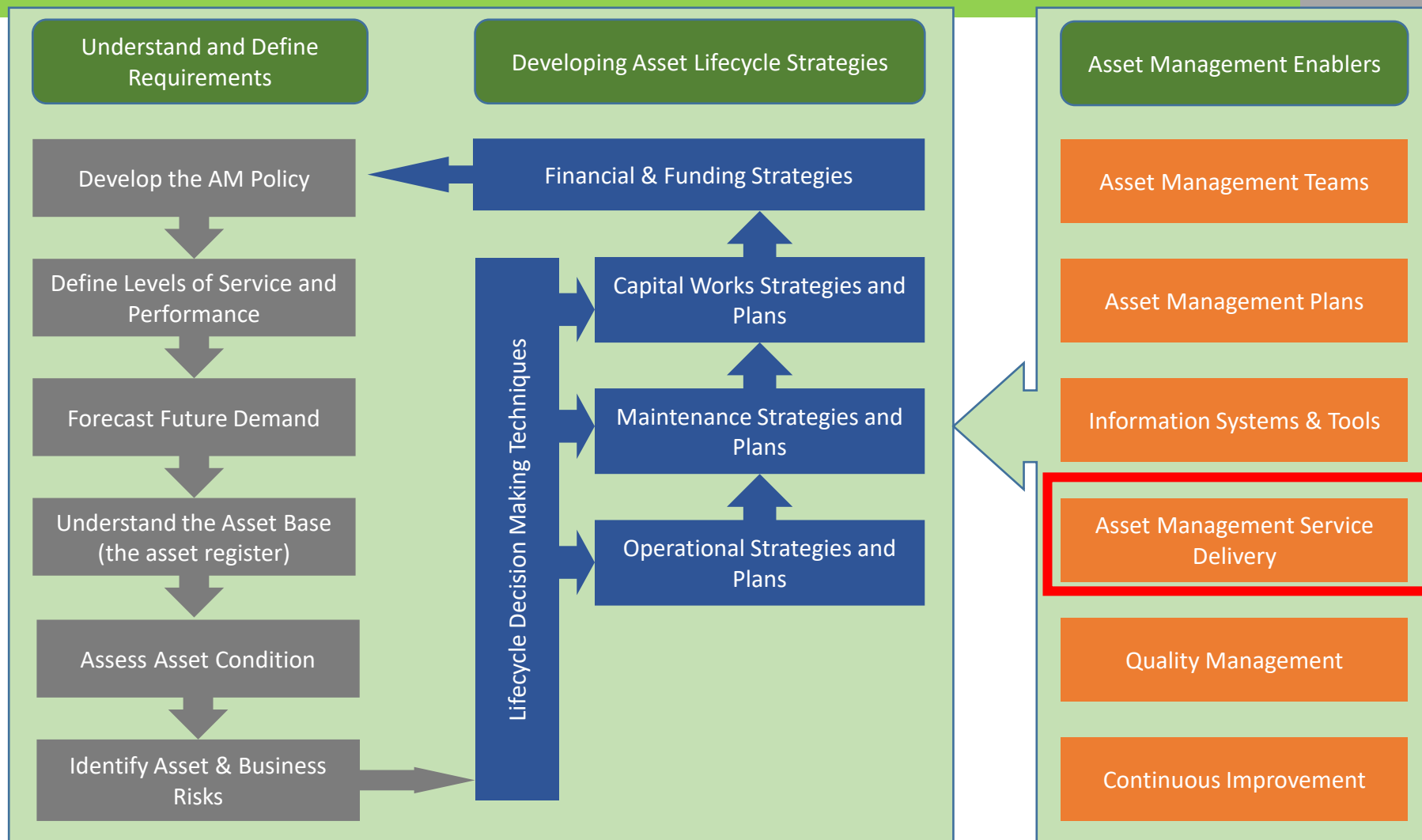
## Session 4-2: Contracting Models

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# Training Sessions

1. Introduction to Road Asset Management
2. Overview of the Components of RAM
3. Levels of Service and Performance Measures
4. Inventory and Condition Data
5. Lifecycle Decisions Making and Funding
6. Asset Valuation
7. Asset Management Plans, Teams and Tools
- 8. Contracting Models and Impact on RAM**

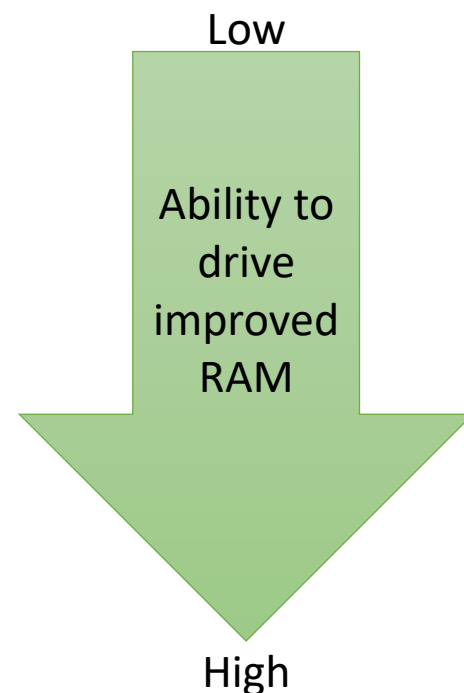
# International Infrastructure Management Manual (IIMM) AM Process



# Contract Model Types

# Different Contract Types

- In-House / Force Account
- External
  - Input based
    - \$/hr of labour
    - \$/m<sup>3</sup> of materials
  - Output based
    - \$/pothole
    - \$/m<sup>2</sup> of reseal
  - Outcome (or performance) based
    - \$/km/month that meets standard



# Traditional (Input based) Road Contracts

- **“Ok, tell me what to do and how to do it”**
  - Risk on the owner to design, specify, and control the work
  - Price driven approach- Lowest price
- Use Recipe or M&M specifications
  - **M**aterial to be used (e.g. Polymer modified bitumen)
  - **M**ethod (required processes)



# So what is a Full PBC?

❑ “Tell me what you want, but not how to do it”

“the Contract.... to perform the services

to be provided by the contractor and

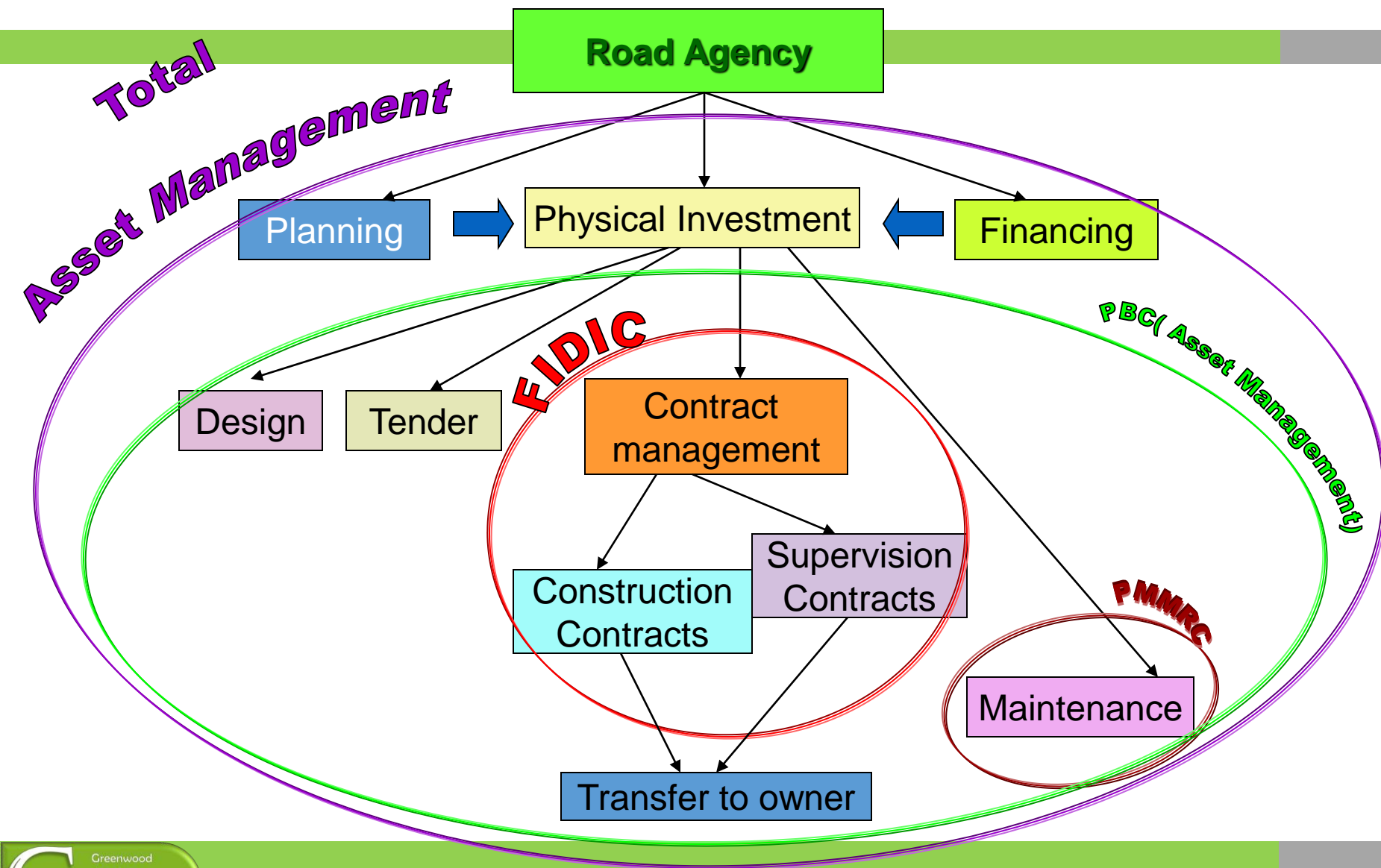
to execute, complete, and maintain the Works” —*WB PBC document*

“an approach to contracting that provides disincentives, incentives, or both to the contractor to achieve performance standards or targets for measurable outcomes and sometimes outputs”

—*NCHRP (US)*



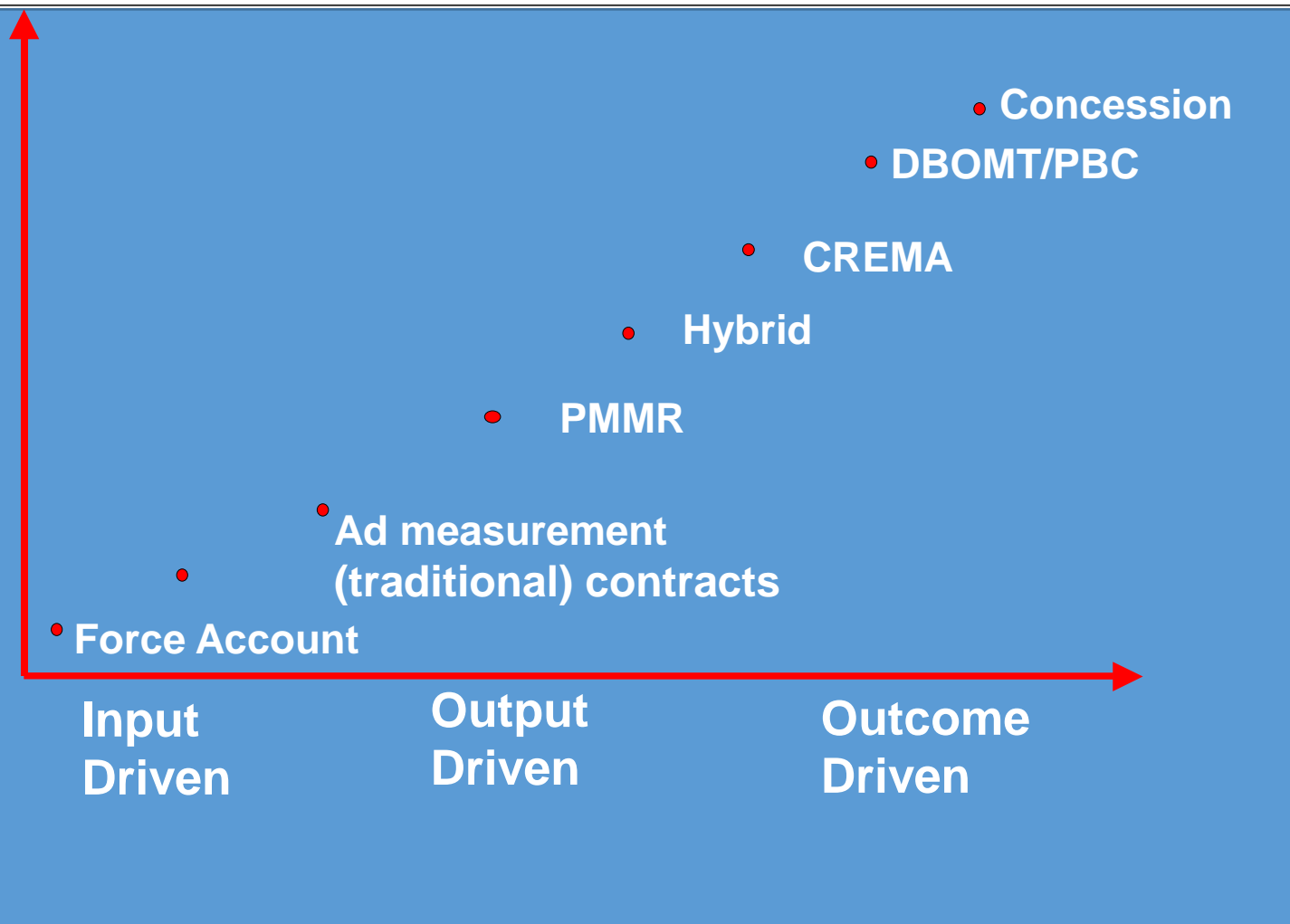
# Contractual Models Available





# Types of Contracts

- Contract Duration
- Innovation
- Flexibility
- Contractor's Risks
- Cost Savings



# Traditional vs. Outcome Based Contracts

## *Traditional support contract*

Command and control

Inputs and processes

Price



## *Outcome based contract*

Collaboration

Outputs and results

Value

*Source:* J.North and B. Keane; Corrs Chambers Westgarth, Australia, 2014

# Types of PBCs...

## Many names for PBCs

- Output and Performance Based Road Contract (**OPBRC**- World Bank)
- Performance based Maintenance Management Contract (**PMMR**-World Bank)
- Performance Specified Maintenance Contracts (**PSMC**- NZ, Australia)
- Asset Management Contract (**USA**)
- Contract for Rehabilitation and Maintenance (**CREMA**-Argentina)
- Managing Agent Contract (MAC), Asset Support Contract (ASC) - (UK)
- Area Maintenance Contract (Finland, Ontario, Canada)
- Engineering, Procurement and Construction Contract (**EPC**)
- “Turnkey” Contract

# Hybrid Approach is Common

- Input based items
  - Emergency works
  - Day works
- Output based items
  - Improvement works on \$/km of completed road
- Outcome based items
  - Routine maintenance

# Performance Based Contracts

# What is performance-based contracting?

- It is an outcome or performance –based approach to contracting, where a client pays for results delivered by a service provider (contractor), rather than for defined activities, tasks or assets.
- The contract focuses on the desired outcome of the work to be performed (the “what”), rather than the manner in which it is to be performed (the “how”).
- The service provider decides how it will deliver on the client requirements – and thus a degree of both control and risk shift to the service provider.

# Users of Performance Based Contracting

- Performance or output –based contracts are used in a wide range of public sector programs and services, including defense and aerospace contracting; health services; social welfare, employment and skills programs: logistics; and operation and maintenance of infrastructure , including roads.
- Historical records suggest that outcome –based procurement was used by US Corp of Engineers as early as the 1870s.
- The use of performance–based contracting model worldwide is increasing. Government agencies (e.g. in New Zealand, Canada, Australia) now formally endorse or even mandate this form of contracting.
- The World Bank has highlighted outcome–based contracting as a key area of focus to enhance procurement efficiency. Other IFIs are also piloting PBCs.

# Benefits of Performance Based Contracting

- Greater efficiency in service delivery, by allowing the service provider flexibility in its method of delivery
- Increased motivation for the service provider to achieve the best outcome to maximize financial gain
- Closer alignment of objectives between the customer and the service provider
- Cost savings
- Supporting innovation on the part of the service provider; ability to adapt to technological advancements
- Higher responsiveness to customer requirements
- Better outcomes for customers

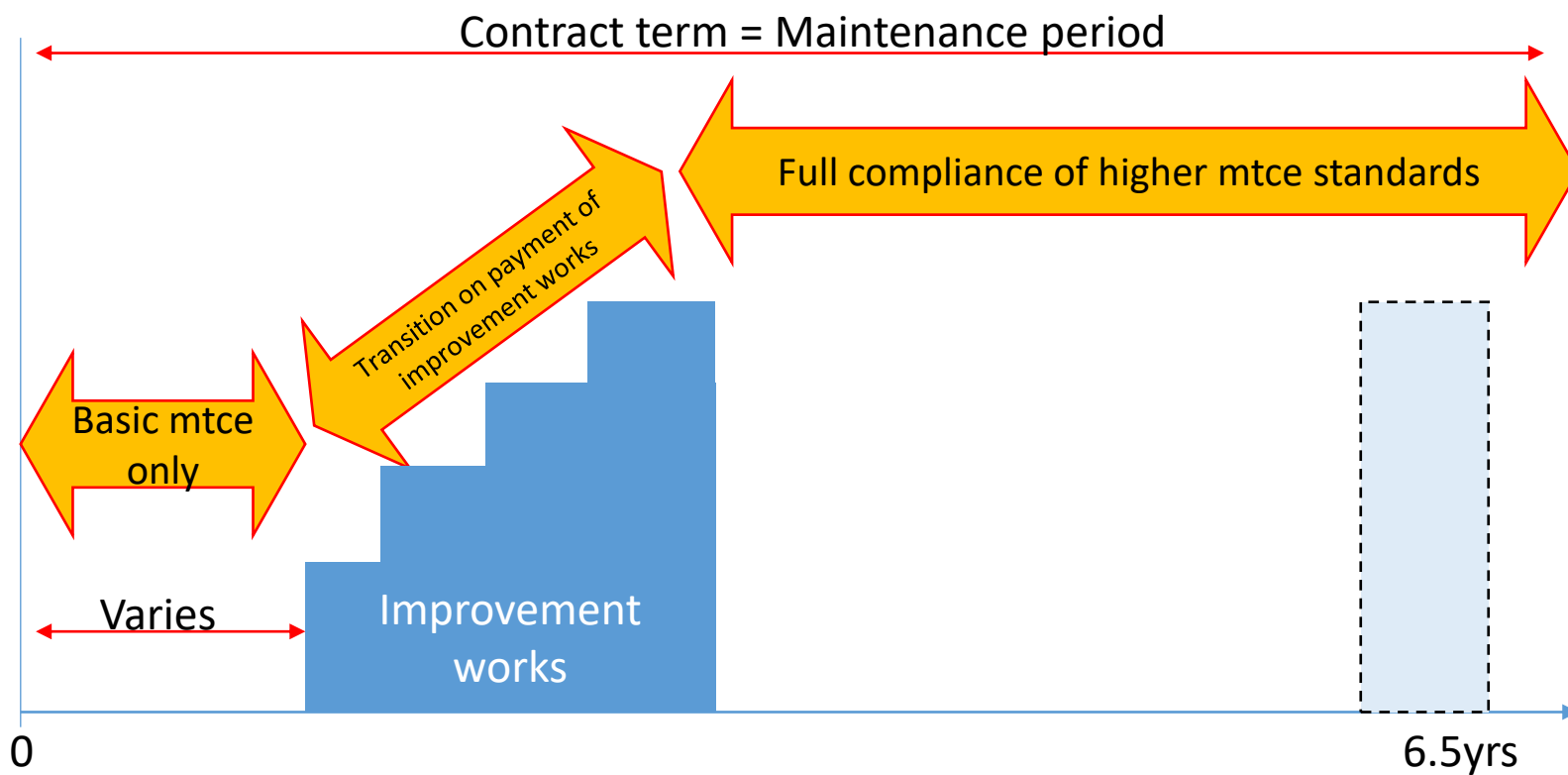
Source: J. North and B. Keane; Corrs Chambers Westgarth, Australia, 2014



# Contract Duration

- Internationally was common to be 10 years
- Now 5-7years is considered more workable
- If completing improvement works in 1<sup>st</sup> couple of years, in what condition do you want to receive those back?
  - Could include a second treatment near the end of the contract period.

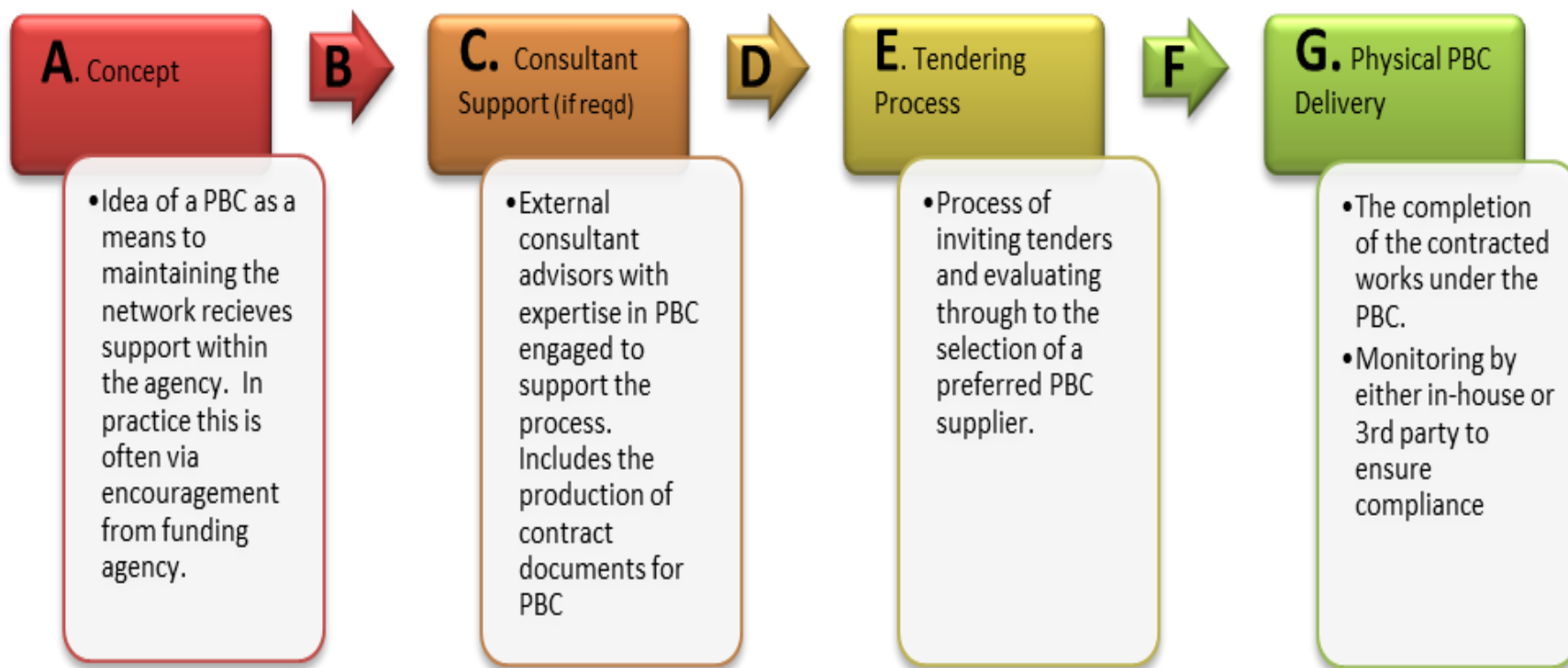
# Example of Contract Term



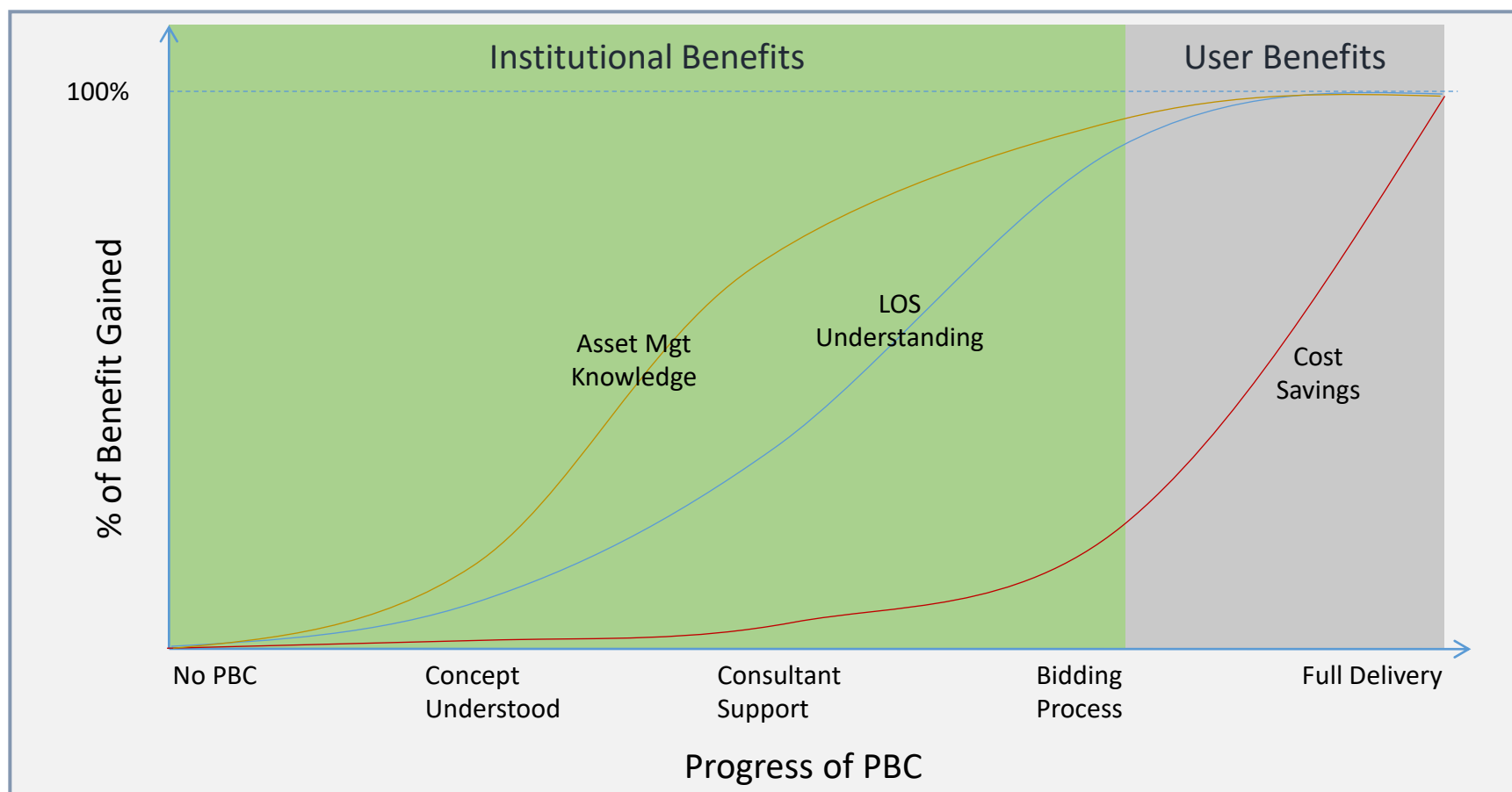
# Scope of Works

- Emergency response
- Basic routine maintenance under direction
  - just some defects = outsourced force account approach
- Full routine maintenance
- Periodic resurfacing
- Rehabilitation
- Reconstruction
- Improvement works

# PBC Implementation Chain



# Many Benefits from the Process

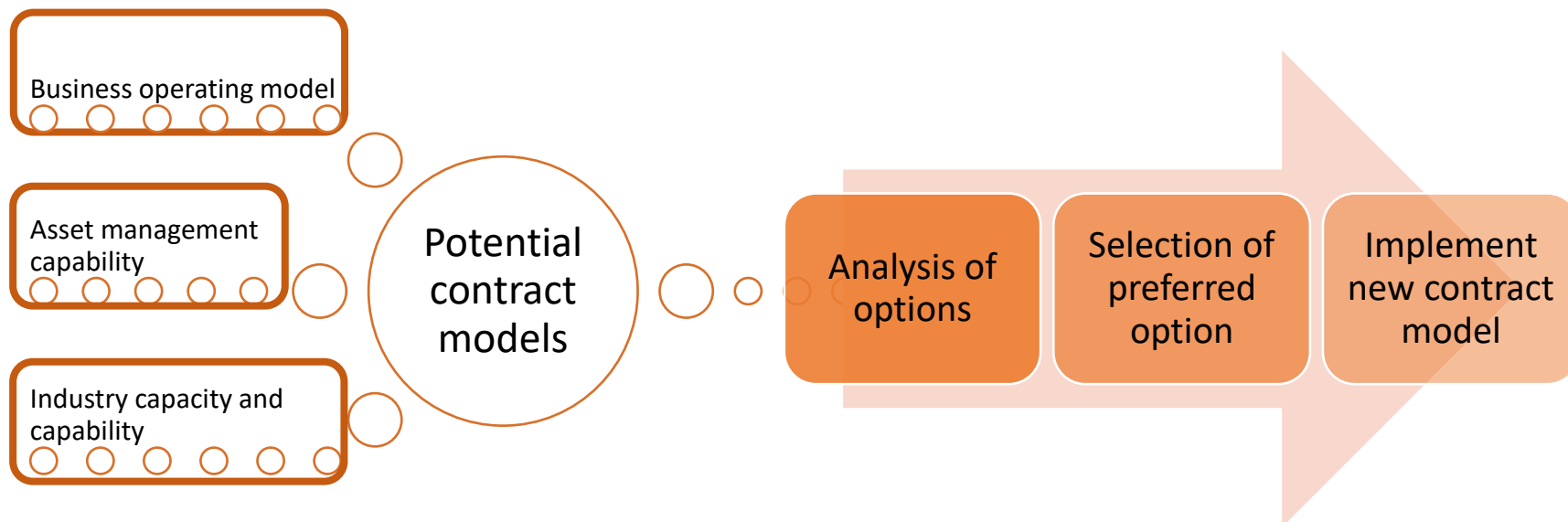


# Designing a PBC

# Strengths and Weaknesses

- Road authorities perception of the strength and weaknesses of PBC models often depends on their position (implicit or explicit):
  - Appetite for risk
  - Approach to asset management
  - Funding regime
  - Political influence
  - Culture [governance or management]
  - Approach to performance management

# Process to Pick the Model





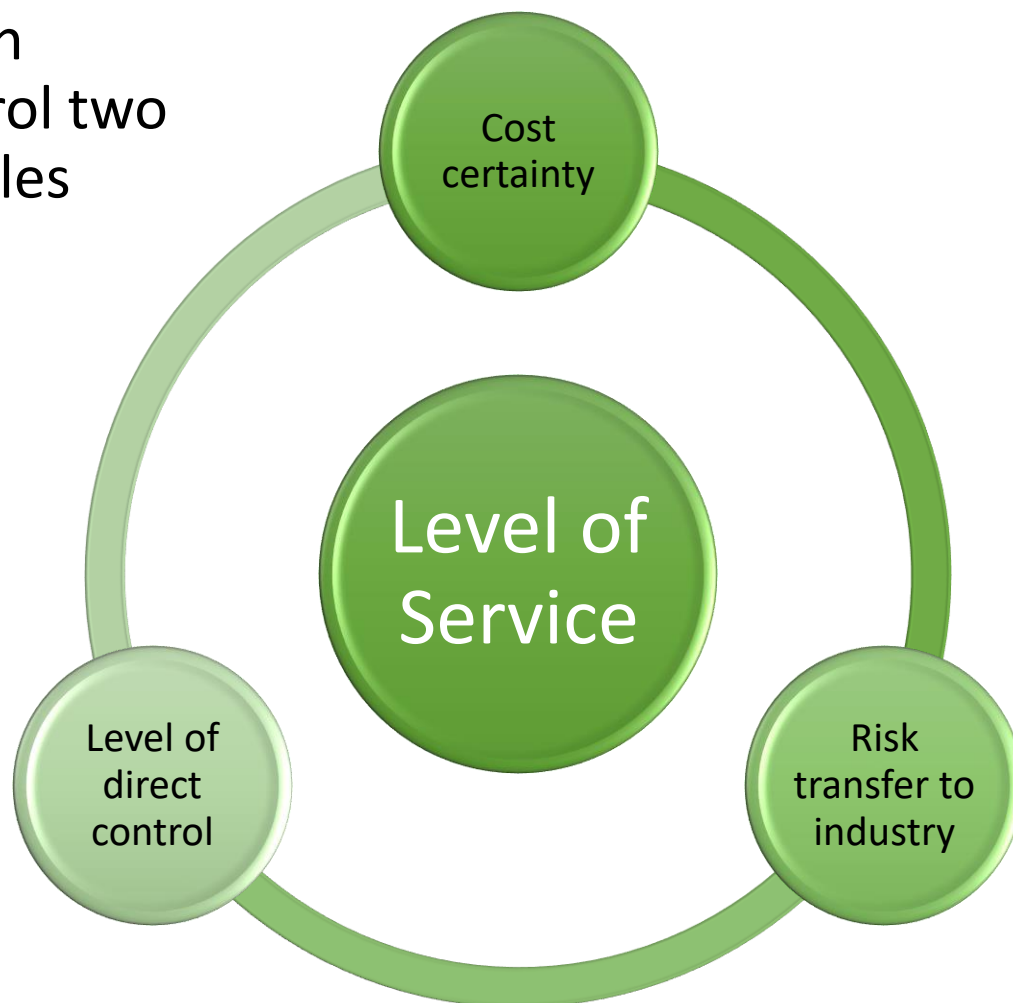
# What is the Problem You Are Seeking to Fix with a PBC?

- Cost savings?
- Certainty/securing of funding needs?
- Risk transfer?
- Improved construction quality?
- More consistent delivery of service levels?
- Reducing public sector / increasing private sector participation?
- Skill shortage in the public sector?
- Improving a road network in poor condition / protecting a network in good condition?
- Addressing climate change?
- Accessing development partner funds (ADB, World Bank etc.)?

...and as a result every PBC is subtly different.

# What Sort of an Organisation Are You?

- For a given LoS, can typically only control two of the three variables



# Issues to be considered

- Expenditure predictability vs Budget flexibility
- Length of Contract term
  - Shorter vs Longer
- Establishment of LOS
  - Costing
  - Overall linkage to Network LOS
- Incentives and Disincentives
  - Usually focus is only on disincentives (penalties)
- Contractor Selection Criteria
  - Low Bid vs Best Value

# Issues to be considered

- Internal Agency Support
  - Inertia because of long history of Input contracting
  - Threat to jobs, wages or benefits
- Training
  - Change in culture
  - Agency staff and contractor
- Multi Year Funding Commitment

# Contract Document

- Likely options
  - Start afresh with World Bank Sample Output and Performance-based Road Contract (PBC) or similar; or
  - Work with the existing contract document and enhance to capture key PBC concepts
- Also need to review technical specifications, and ideally replace method based specifications with outcome based specifications.

# Payment – Routine Maintenance

- Routine maintenance on monthly lump sum with reductions for non-performance for key assets (pavement and drainage)
  - Payment starts from when initial works completed on length of road
  - Deductions start from first month if not performing
  - Contractor has to prove compliance with standards
  - Client will engage a Monitoring Consultant (not supervising routine maintenance)
- May revert to payment on an output basis for less critical (or hard to measure) assets
  - Vegetation
  - Line marking

# Payment – Initial Works

- Payment can only be claimed when a length (minimum 1km) is fully completed
  - Drainage, pavement, lines, signs, site cleared of debris
- Once payment claimed then higher standards of routine maintenance apply to that length of road
- Drives two key outcomes
  - Contractor finishes discrete lengths rather than opening up large areas to get high profit establishment payments
  - Provides a clear transition to high maintenance standards
  - Avoids scenario where contractor has made 100% profit, completed 90% of work, and road user has 0% of benefits!

# Tender Schedules

- Main items
  - \$/km for each cross-section type or
  - Standard BoQ, but with caveat of only payment upon completion of a section of road
  - \$/km/month for routine maintenance
- Then standard schedule to enable pricing and payment for variations
  - Emergency works
  - Risk based variations
- Likely a constraint on routine maintenance to avoid low pricing
  - Either minimum rate, or minimum % of total tender price



# What Is Needed To Implement Concept?

- New technical specification that separates the specification of material quality, from the payment for the output
- Outcome based maintenance specification
- Risk allocation table
- Asset management information system
  - More data available to the contractor the less risk there is

# For Improvement Works

- Prefer to avoid payment on inputs (or sub-components subgrade, pavement, surfacing etc)
  - Pay on \$/km of completed road if at all possible
  - If there is uncertainty in the subgrade works, pay that on inputs for the 'risky' items and then move to \$/km for the remainder of the works; or
  - If all on inputs, then put a criteria that no payment is due until a section of road is complete.
- History of contractor having 90% of the payment, but the road user has 0% of the benefits
  - Especially if they have freedom to bid high rates for establishment and site clearance, and low rates for signs, line marking etc.
- Paying on completed sections of road encourages the contractor to finish a section, rather than encouraging to start many sections.
- The claiming and payment for the completion of a section of the works, is also the triggering for the application of the full maintenance specifications to that section of road.

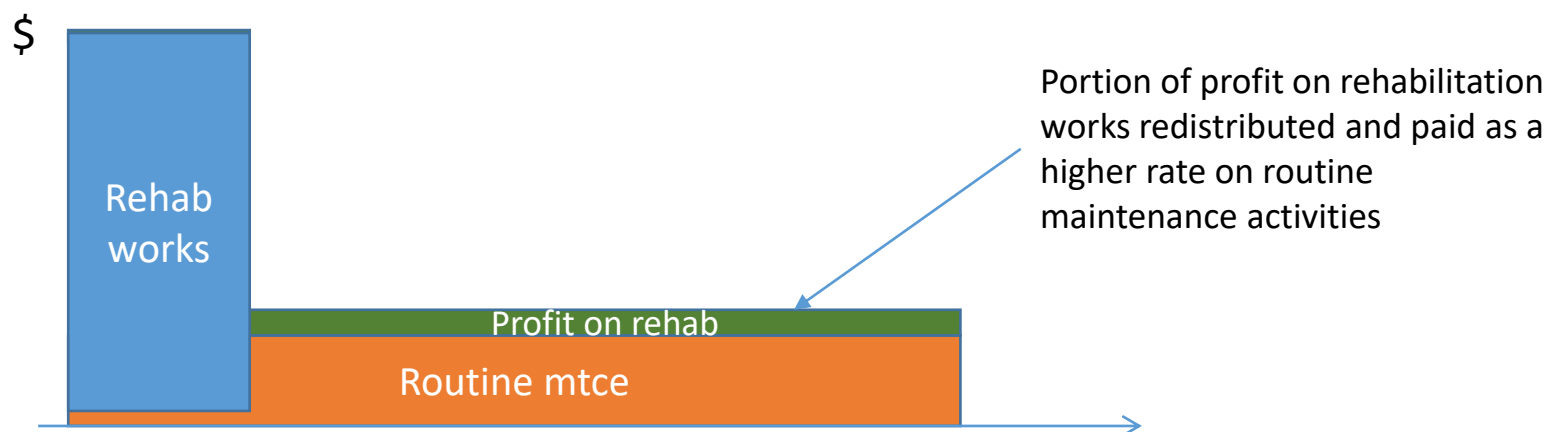
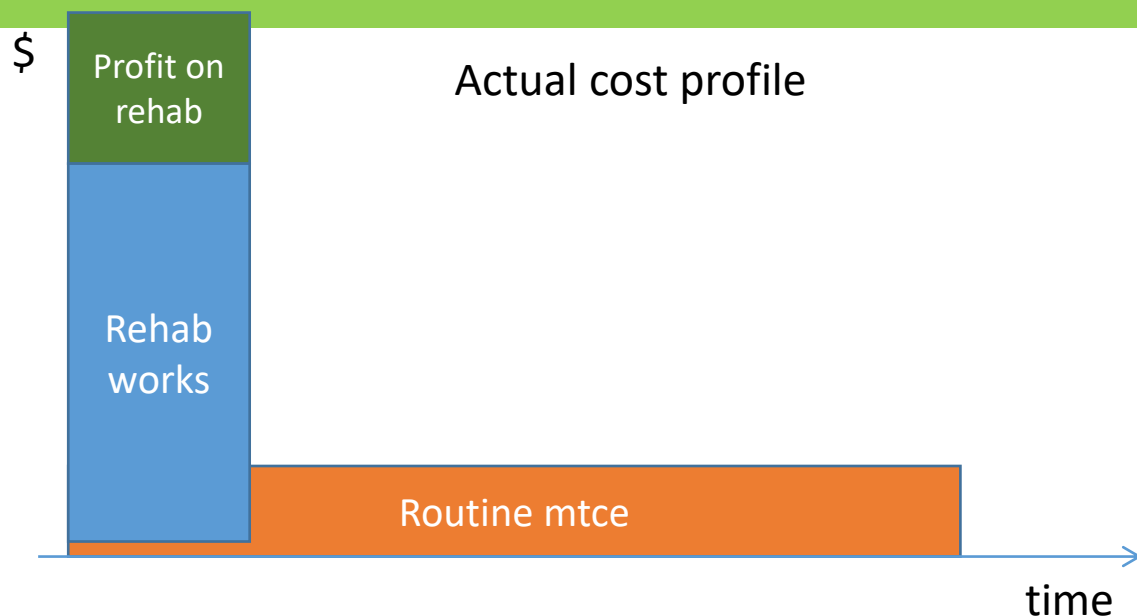
# For Maintenance Works

- Base maintenance (ahead of improvement works)
  - Often not paid at all, unless there is several years before improvement works occur
  - Can still make deductions from monthly claim if not compliant though
- Full performance based maintenance
  - Paid on a \$/km/month basis at tendered rate
  - Deductions for non-compliance
    - Penalties are to drive full compliance
    - Termination is to avoid bad performance
    - Typically cap at 30% for really bad performance
    - If worse than say 20% for 3 months out of a 6 month period, then contractor in default and can be terminated
  - Contractor is rewarded for completing improvement works early through either
    - Additional months of payment of the tendered \$/km/month rate or
    - Total routine maintenance payment is spread out over more months or
    - Routine maintenance is specified to only start being paid at a fixed time at the earliest

# Avoiding Underbidding of Maintenance

- Place a limit on the minimum percentage of the total tender value that the contractor can assign to routine maintenance
- Idea is to make routine maintenance highly profitable and improvement works marginally profitable
  - This way the contractor retains focus on maintenance
- Example
  - Assume that 85% of the value is in the improvement works and 15% is in the routine maintenance & 10% profit margin on all works
  - Then
    - improvement works is 76.5% cost and 8.5 % profit
    - maintenance works are 13.5% cost and 1.5% profit
  - Set the minimum tender percent for routine maintenance at 20% of total tender value
    - Improvement works is now 76.5% cost and 3.5% profit = 4% effective profit rate
    - Maintenance work is now 13.5% cost and 6.5% profit = 32% effective profit rate

# Payment Model Concept



# Key Steps To Tender Process

- Client to determine works to be undertaken
- Client completes concept designs and estimates cost of works in normal way
- Designs (typical cross sections) are included into contract document as 'contractual minimums'
- Contractor bids to deliver at least the minimums
- Contract awarded
- Contractor finalises site testing and designs
- Contractor undertakes works, including maintenance activities across entire length of road

# Key principles for successful PBC implementation

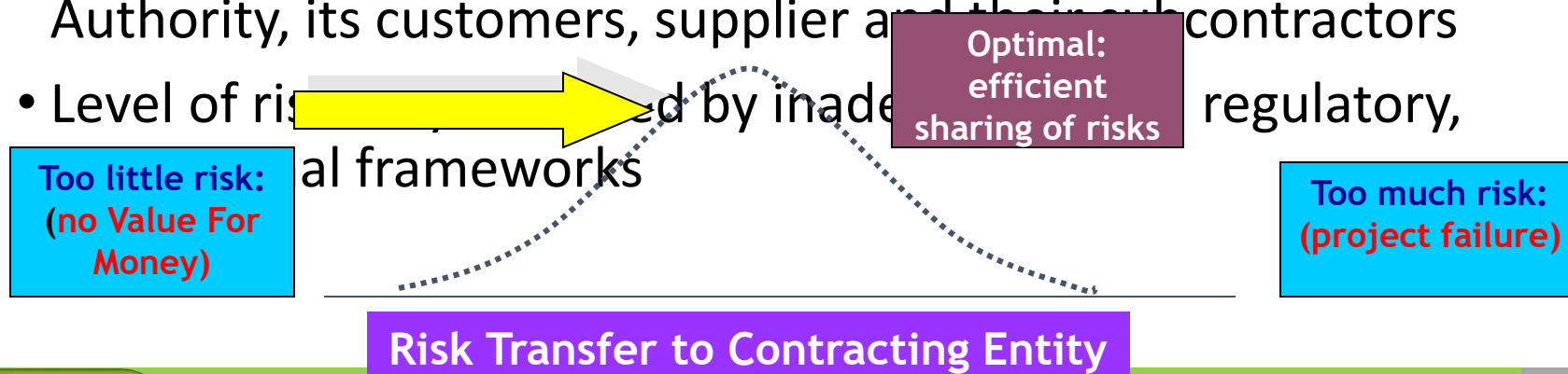
- Selection of a network of roads, rather than isolated road links
- A contract period of at least 5 years and ideally 7-10 years to ensure that the contractor is incentivized to think long term
- Client specifies the minimum designs to be built, but the contracting entity (contractor plus their sub-contracted consulting firm) must take ultimate responsibility for what is built
- A single contract covers all works within the contract period.

# Risk Management in a PBC

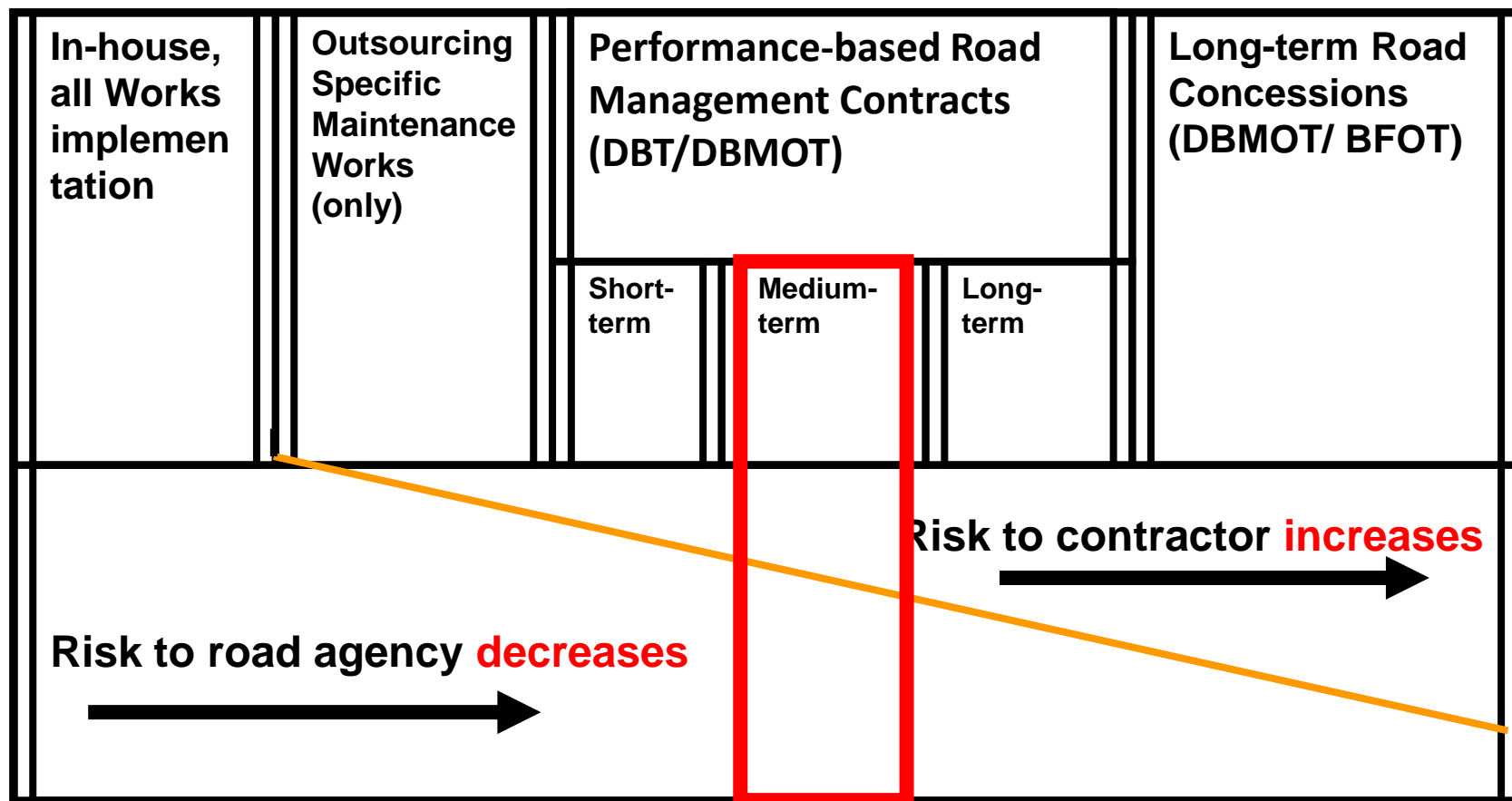


# Understanding Risks in PBC

- Risk is defined as uncertainty of outcome, whether positive – an opportunity, or negative – an impact
- It is important to quantify all risks involved
- Risk allocation is the process of apportioning individual risk related to project and service delivery to the party best placed to manage it (project-related risks to private sector; non-project-related risks to public sector)
- Risks are allocated across the supply process, from Road Authority, its customers, supplier and their subcontractors
- Level of risk is affected by inadequate regulatory,



# Distribution of Risks- Civil Works Projects



# Risk Allocation Table

- Important to ensure risks are appropriately allocated or shared
- For example with land slips it could be
  - If the volume is  $< 50\text{m}^3$  then the contractor is responsible
  - If the volume is  $> 50\text{m}^3$  then the client pays
    - This is assuming that the contractor can show they were in full compliance with all relevant performance measures (e.g. drainage) ahead of the event
- Trying to avoid the need for lots of variations

# Overloading Risk

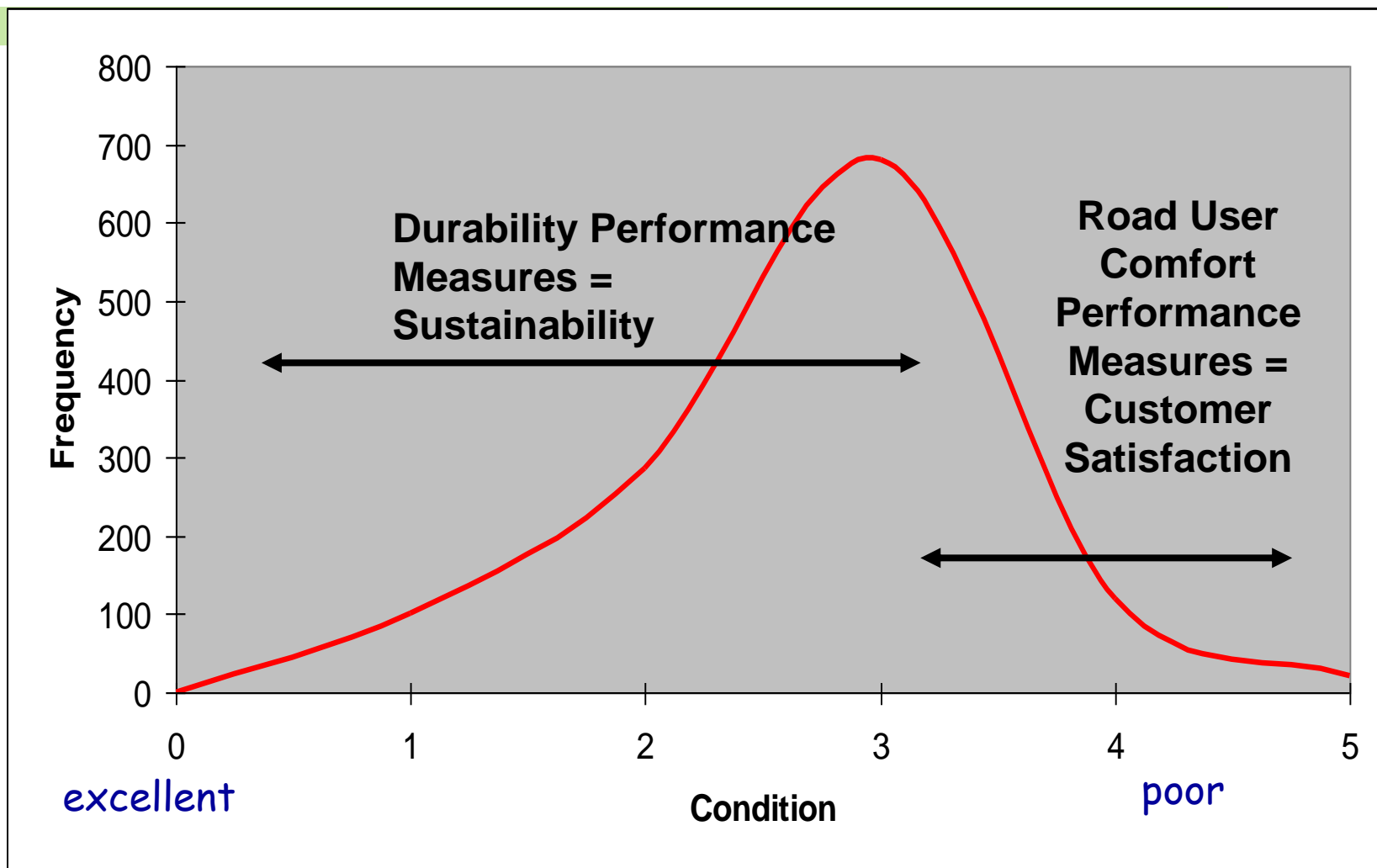
- Controlling (or eliminating) overloading is the clients problems and risk
- The Contractor just needs to be protected from an increase in overloading
- Therefore
  - Do not need to transfer control of overloading to the Contractor (e.g. weigh stations)
  - But do need to be able to determine if an increase in overloading has occurred (e.g. weigh in motion)
- If there is a current level of overloading present, then that is not a risk – that is a known.
  - Risk is that it gets worse
  - If currently overloading is at 10%, then can set risk threshold at 15% - beyond that a variation event is triggered.

# Variations

- If risk profile is exceeded then Contractor can claim a variation
- Contractor has to prove additional costs
- Client may
  - Make payment(s) to cover the additional routine maintenance costs to meet the performance specifications
  - Pay for specific corrective works to be undertaken
  - Lower the service levels required to cover the higher deterioration of the network
  - Exclude a certain road section from penalties for some defects
- Some risks that occur will have negligible (if any) impact on the contractor within the contract period

# Service Levels, Performance Measures and Penalties

# Definition of Terms



# Routine Maintenance Performance Measures

- Requirement to conduct daily patrols
  - Contractor will require system to store location of defects to manage the network
- Primarily focus on density based measures
  - E.g. Number of Potholes / 5 km
- Time based measures used only as a backstop for safety items or those that cannot be predicted
  - E.g. 4 hours to remove debris from carriageway surface
- If you can predict failure (such as a small pothole becoming larger), then why should there then be a tolerance to fix it.



# Two Types of Measures

- Response time measures
  - E.g. Fix all potholes within 7 days
- Density measures
  - E.g. No more than 1 pothole in any 5kms of road
- Although it seems minor, the above difference can fundamentally change the performance of the contractor and the associated effort to manage a PBC

# Response Time Measures

- Common in road authorities
- Contractors like them as they don't have to take responsibility
  - Just wait till the consultant finds a fault and then they go and repair it
- But with many different response times for different defects, you end up with the consultant constantly on site
- Contractor becomes reactive and does not take control of the network as they are meant to
  - They don't go looking for the faults, as they know they will have time to repair them once the consultant finds them

# Density Based Measures

- Less common in road authorities
- Is actually how road users experience defects
- Contractors have to be in compliance whenever the consultant does an inspection
  - Consultant only needs to go on site once per month for maintenance inspections
- Contractor becomes proactive and takes control of the network
  - They go looking for faults and repair them before the consultant finds them
- Reduces contractors costs as don't have to respond immediately to a single small defect
- Far easier to enforce
  - Only a single inspection required to determine compliance

# Example for Measures

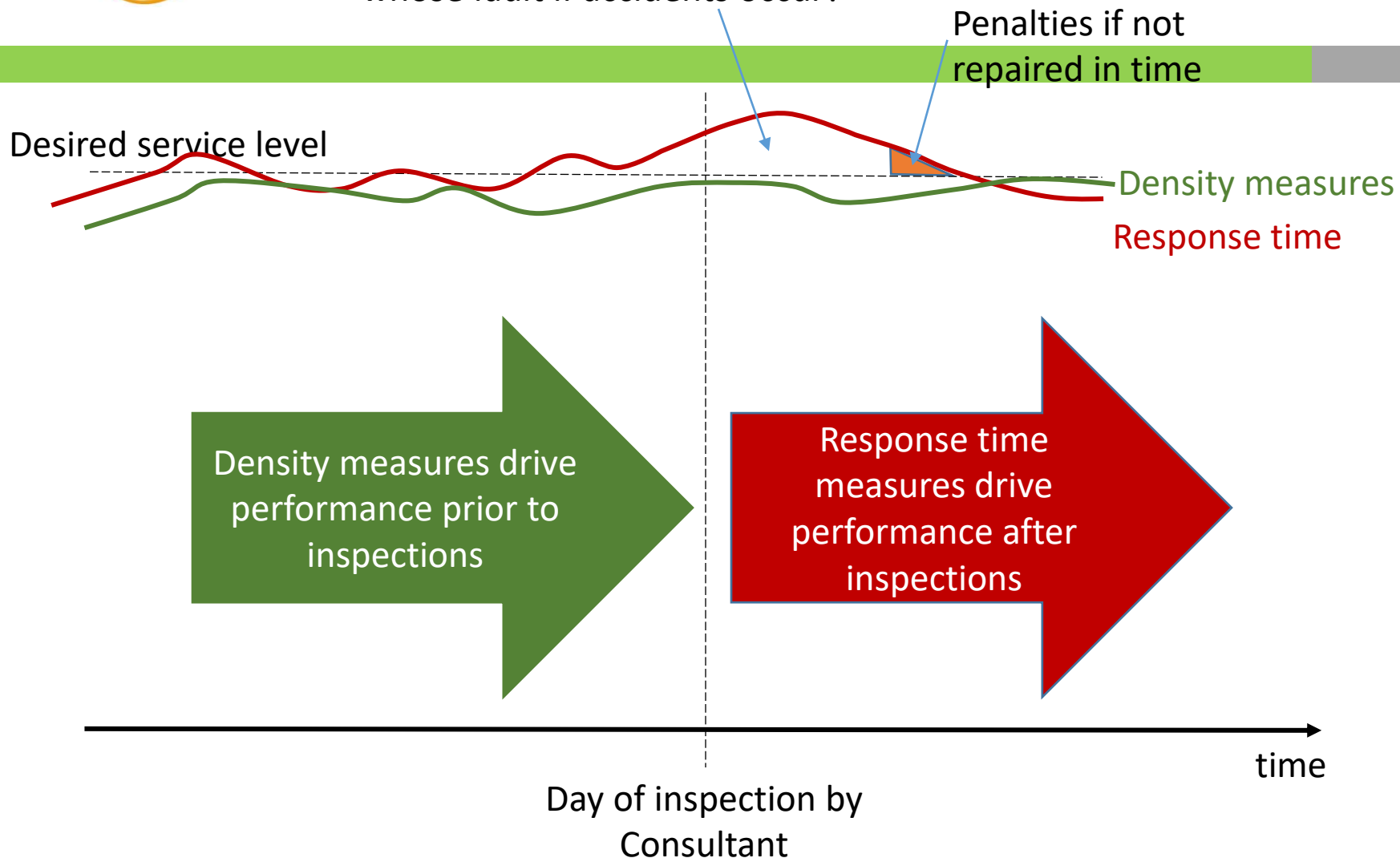
If current response time measure is:

All potholes > 300mm in diameter or > 100mm in depth to be repaired in 7 days

Converts in to...

Asset Class – Defect	Measure Definition	Target	Penalty Upon Initial Inspection	Period for Repeat Penalty if Not Compliant
<b>Pavement - Potholes</b>	<p>A Small Pothole is one that:</p> <ul style="list-style-type: none"> <li>Is less than 300mm in diameter, and which does not extend in depth to the wearing course</li> </ul> <p>A Medium Pothole is one that:</p> <ul style="list-style-type: none"> <li>is greater than 300mm in diameter, and with a depth of at least 50mm</li> </ul> <p>A Large Pothole is one that:</p> <ul style="list-style-type: none"> <li>is greater than 1000mm in diameter, and with a depth of at least 100mm. or</li> <li>is of any size and is in such a location so as to pose a significant safety hazard to road users (e.g. on a curve in the wheel path).</li> </ul>	<p>No Large Potholes.</p> <p>No more than 1 Medium Pothole within any 1km of travel (for roads less than 5km in length, the target shall apply to the whole road length)</p>	5% of monthly payment for each 1km not in compliance	7 days

Permitted non-compliance =>  
whose fault if accidents occur?



# Examples of Measures

- Potholes (Sealed Surface)

- There is no more than 1 pothole within any continuous 1km centre line length with a diameter greater than 150mm
- The maximum dimension of any single pothole shall be less than 300mm in diameter and less than 50mm in depth
- No pothole shall pose a significant safety risk to road users
- No pothole greater than 150mm in diameter may remain for more than 3 months.

- Incident and Emergency Works Response

- Maximum response time taken (from the time of notification):
  - To contact appropriate authorities: One (1) Hour
  - To secure the site: Four (4) Hours
  - Remove materials, abandoned vehicles, fallen trees and other obstructions etc. to the free traffic flow: Eight (8) Hours

# Performance Standards

- To work you need
  - A clearly measurable item
  - Some means of the contractor to estimate the quantity of works to be completed
- For some items (vegetation, linemarking, etc.) it is often easier to have these included on a scheduled basis, with the performance standard about the quality of works immediately after completion
  - Contractor takes risk on quality and efficiency of works
  - Client takes risk on quantity of works

# Penalties

- Best financial outcome for contractor must be to have the network in full compliance and be able to prove that compliance
- Next best outcome is to fail but tell the truth that they have failed
- Worst outcome is to fail performance standards and try to cover it up



# Penalties

- Focus the penalties on the key aspects of the network
  - Can include non-key aspects in a measurement assessment but not link to \$\$\$
- Penalty for having too many defects must be greater than the cost of fixing the defect
- If repeated failure of a measure, then increase penalty for that measure
- Really poor performance results in termination with associated loss of bonds.

# Penalties

- Change the performance standard as contract progresses, rather than changing the compliance with the performance standard
  - E.g. a pothole is a pothole, but can allow more prior to works being completed
- Is often reasonable to provide a period of 3-6 months to bring the network into compliance, during which scoring occurs, but penalties do not apply if the contractor is making progress towards full compliance
- Have a limited set of performance measures ahead of completion of improvement works to keep road safe and usable.

# Penalty and Bonuses

- Penalties are applied for non-compliance with:
  - Delivery of improvement works in time
  - Routine maintenance specifications (road user and comfort specifications RUSC)
    - E.g. potholes, bumps, line marking, vegetation.
  - Durability performance measures (DPMs) of improvement works
    - E.g. average roughness, residual life
  - Management performance measures (MPMs)
    - E.g. provision of data and reports, conducting routine inspections
- Do not advise on using bonus payments as can result in a distorted contract
  - Can have contract extension linked to performance
  - Why give a bonus for something you didn't want to start with?
  - Can end up with the contractor getting a bonus while not complying with the basic requirements.

# Impacts on Road Authority and Industry

- The move to performance based contracts requires a shift in the culture of all parties
  - Reversal of roles as contractor makes most money by doing as little as possible
- Industry is often more prepared for the cultural change than the road authority.

# Client Concerns

- Balance of work to ensure network does not deteriorate
  - Type
  - Location
- Residual life
- Loss of skills
- Funding
  - Under pricing
  - Lack of flexibility to respond to changes in available funds

# Client Concerns [continued]

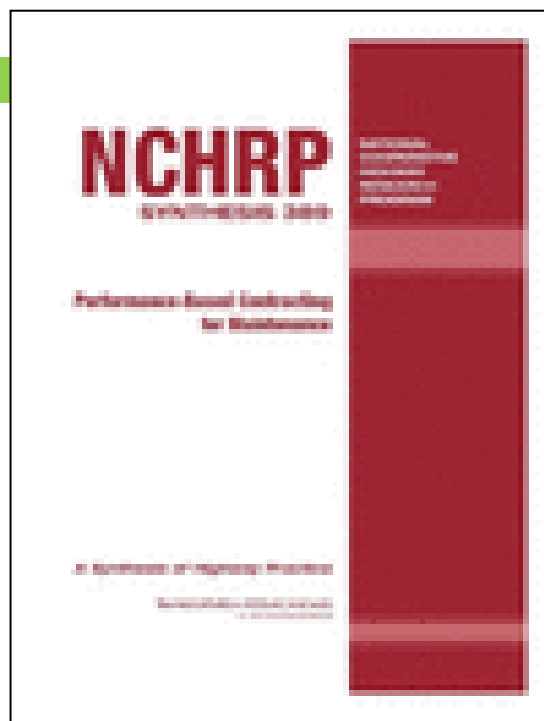
- Lack of control
- Service level manipulation
- Social impact
- Maintaining a competitive market
  - Information needs
  - Viable market

# Contractor Concerns

- Need for broader skill sets (or engaging consultants)
- Complexity of measures
- Scope creep
- Risk Transfer
  - Traffic
  - Historic work quality
- Insufficient funds
- Relationships
- Lack of commitment to success by RCA
  - Piecemeal outsourcing



# Reference Materials

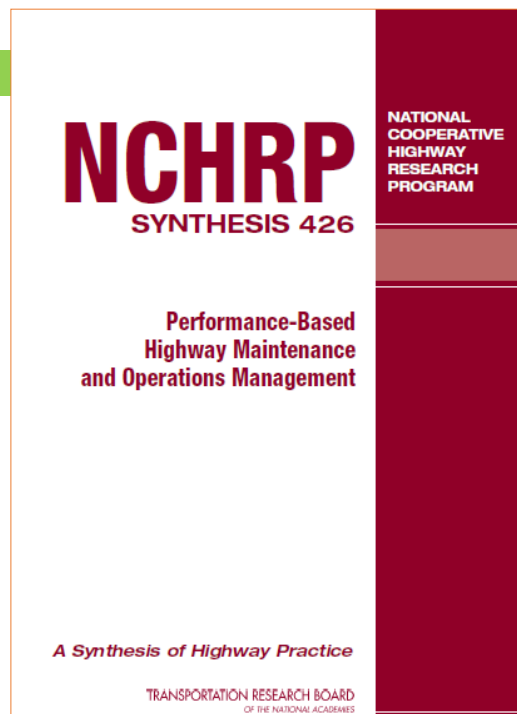


[http://www.nap.edu/catalog.php?record\\_id=14266](http://www.nap.edu/catalog.php?record_id=14266)

NCHRP Synthesis 389

Performance-Based Contracting for Maintenance

William A Hyman; Transportation Research Board, 2009



[http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp\\_syn\\_426.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_426.pdf)

## NCHRP Synthesis 426

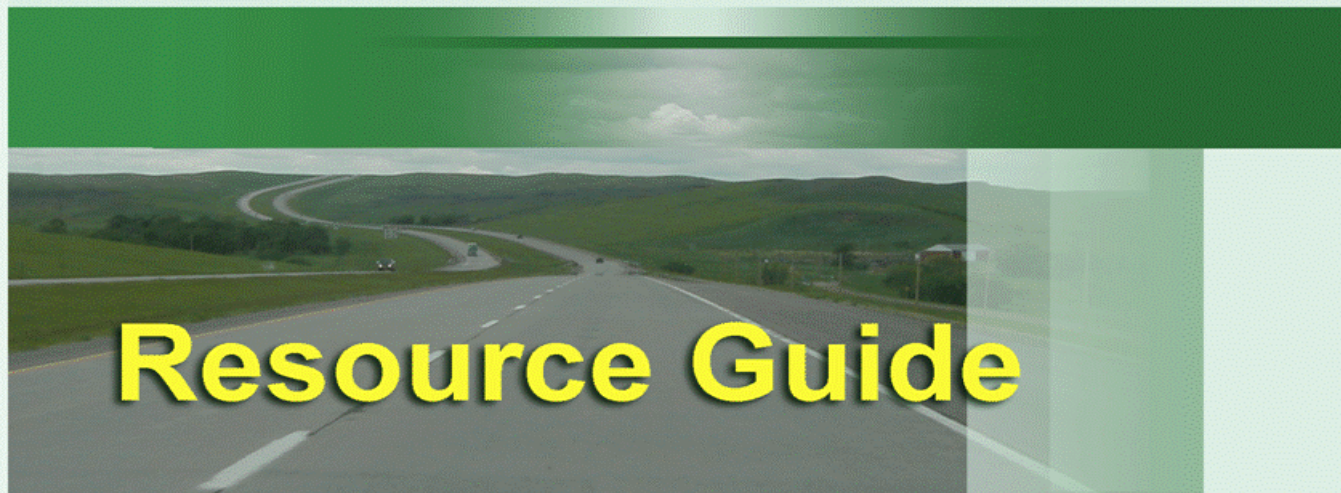
### Performance-Based Highway Maintenance and Operations Management

Michael Markow;; Transportation Research Board, 2012



THE WORLD BANK

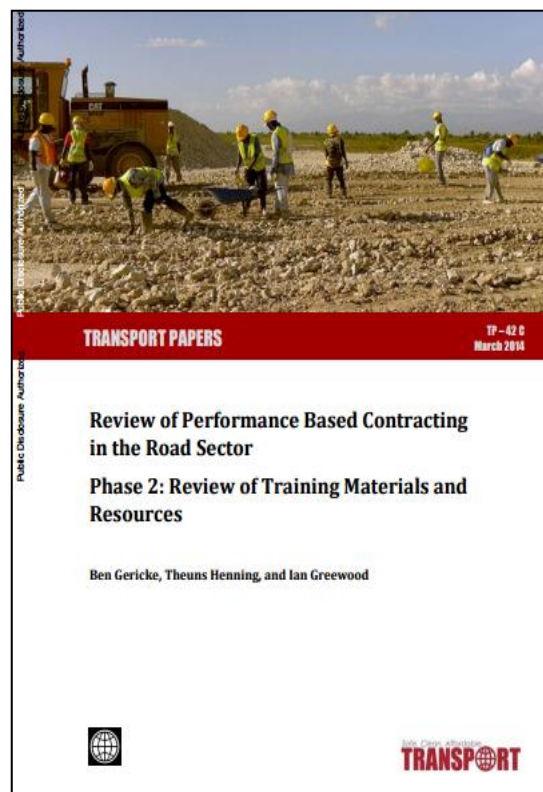
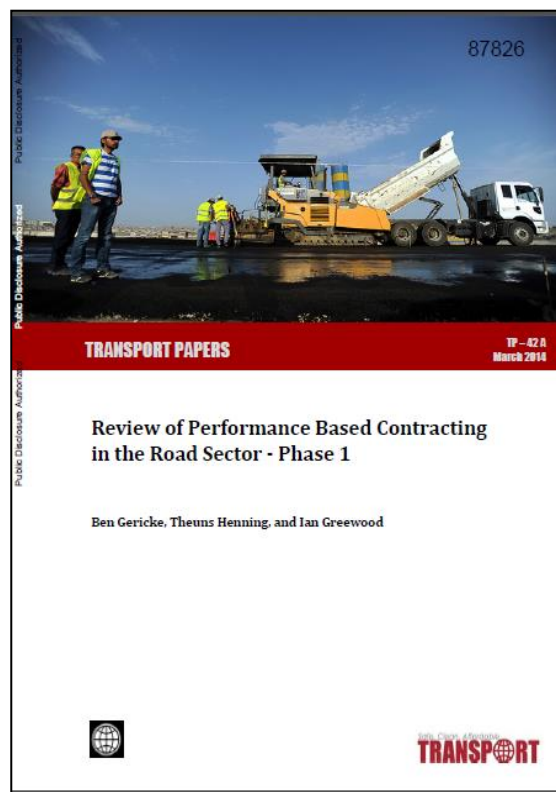
DFID  
Department for  
International  
Development



# Resource Guide

## Performance-based Contracting for Preservation and Improvement of Road Assets

Natalya Stankevich, Navaid Qureshi, Cesar Queiroz



#### [4-2: Contracting Models, Dr I.D. Greenwood](#)



# Policy Paper on Infrastructure

## Policy Challenges in the Implementation of Performance-based Contracting for Road Maintenance



European Bank  
for Reconstruction and Development

<http://dev.irf.global/extending-the-functional-life-of-road-assets-with-performance-based-contracts/>

# Summary

# RAM versus Contract Model

- **Good Asset Management should be the primary goal of any contract model**
- Lots of contract model types available to deliver works
- Performance based contracts that focus on outcomes tend to better align with RAM delivery
- But you can deliver good RAM with any contract model.



# Advantages of PBCs

- Potential reduction in costs
- Improved or more consistent level of service (could cost more)
- The transfer of risk to the contractor thereby providing surety of costs to the agency
- Securing of an appropriate level of multi-year financing
- More innovation as a result of the PBC contractor having a financial incentive
- Enhanced asset management on the part of both the PBC contractor and for the road agency
- Consciously focusing resource on the long term needs of the asset.

# Disadvantages of PBCs

- A more costly procurement process for the bidders
- The complexity of the bids also increases the evaluation time and skills required by the road agency
- Potentially a longer procurement process
- The increased cost of having good data
- A potential reduction in competition
- A potential loss of agency control and flexibility.

# To Implement a PBC Well Requires

- Knowledge of assets
- Defined LOS and Performance Measures
- Knowledge and allocation of risks
- Clear auditing guidelines
- Consequence of non-conformance related to the impact on the owner (not just the cost on the contractor)
- Cost of delivering the service

....Which has a lot of an AM sound to it!

# Key Points on PBC

- PBCs can drive the paradigm shift in all parties necessary to deliver good Asset Management outcomes
- Careful management of the full PBC implementation chain is necessary
- PBCs are not a panacea, but are a valuable instrument in a road agency's contracting toolkit
- There are advantages and disadvantages and PBC is not the solution for every scenario.
- Partnership and Trust are key to success!



# Questions?