

**Regional Workshop on Public-Private  
Partnership in Transport**

**Modern Tools for Economic  
and Financial Assessment  
of PPP Projects**

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# Presentation Outline

- **Highway Development and Management (HDM-4) model**
- **Total Society Costs of Road Transport**
- **Road Deterioration Models**
- **Road User Cost Models**
- **PPIAF - WB Toolkit for PPP in Highways**
- **PPP financial simulation model**

# The HDM-4 Model

- **Analytical tool for engineering and economic assessment of**
  - **road investments and maintenance**
  - **transport pricing and regulation**
- **Uses reliable relationships on road deterioration, the effects of maintenance activities, and vehicle operation and user costs**

# **Total Society Costs of Road Transport**

**= ROAD AGENCY COSTS**

**Construction**

**Maintenance**

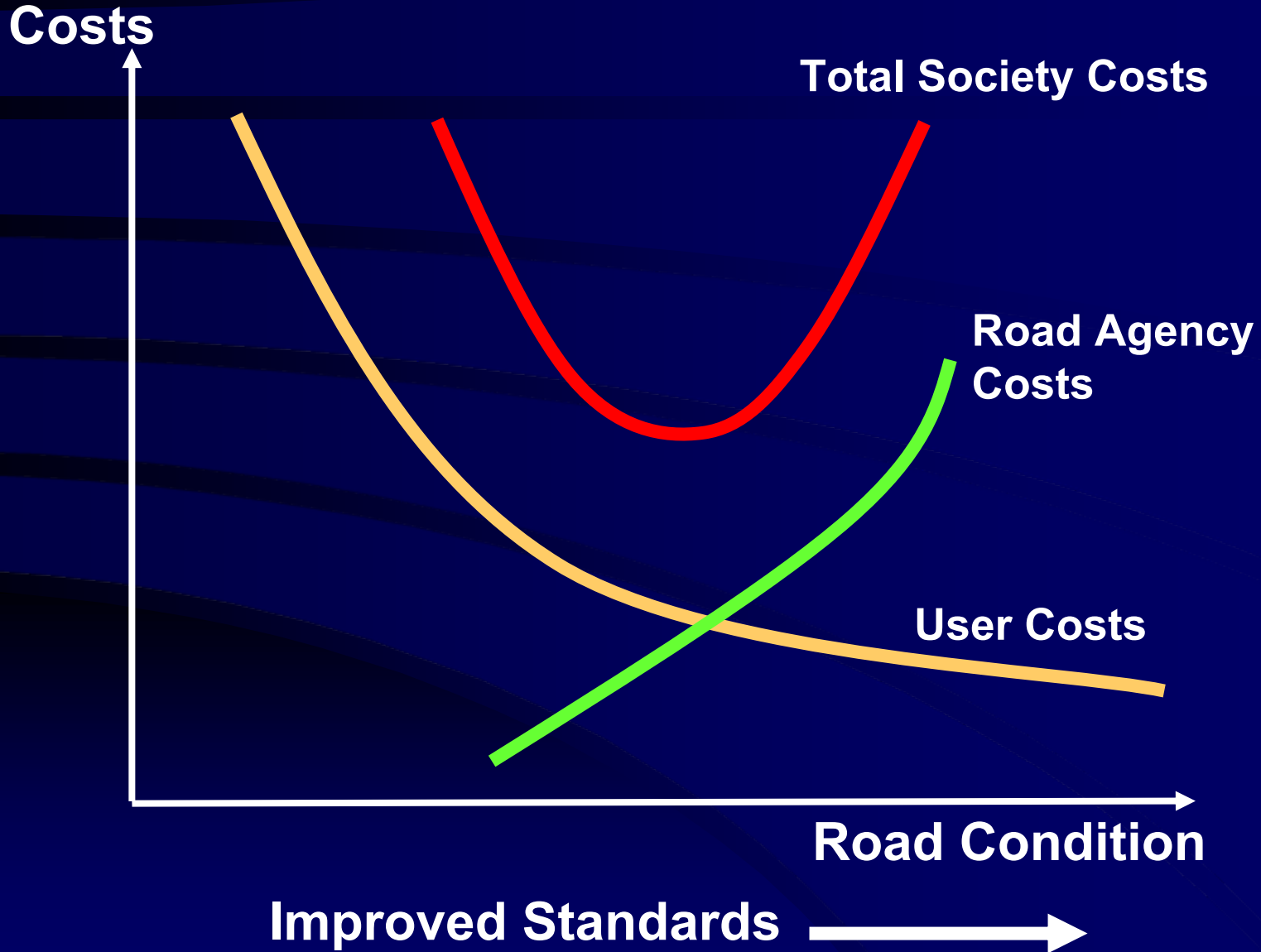
**+ ROAD USER COSTS**

**Vehicle operation**

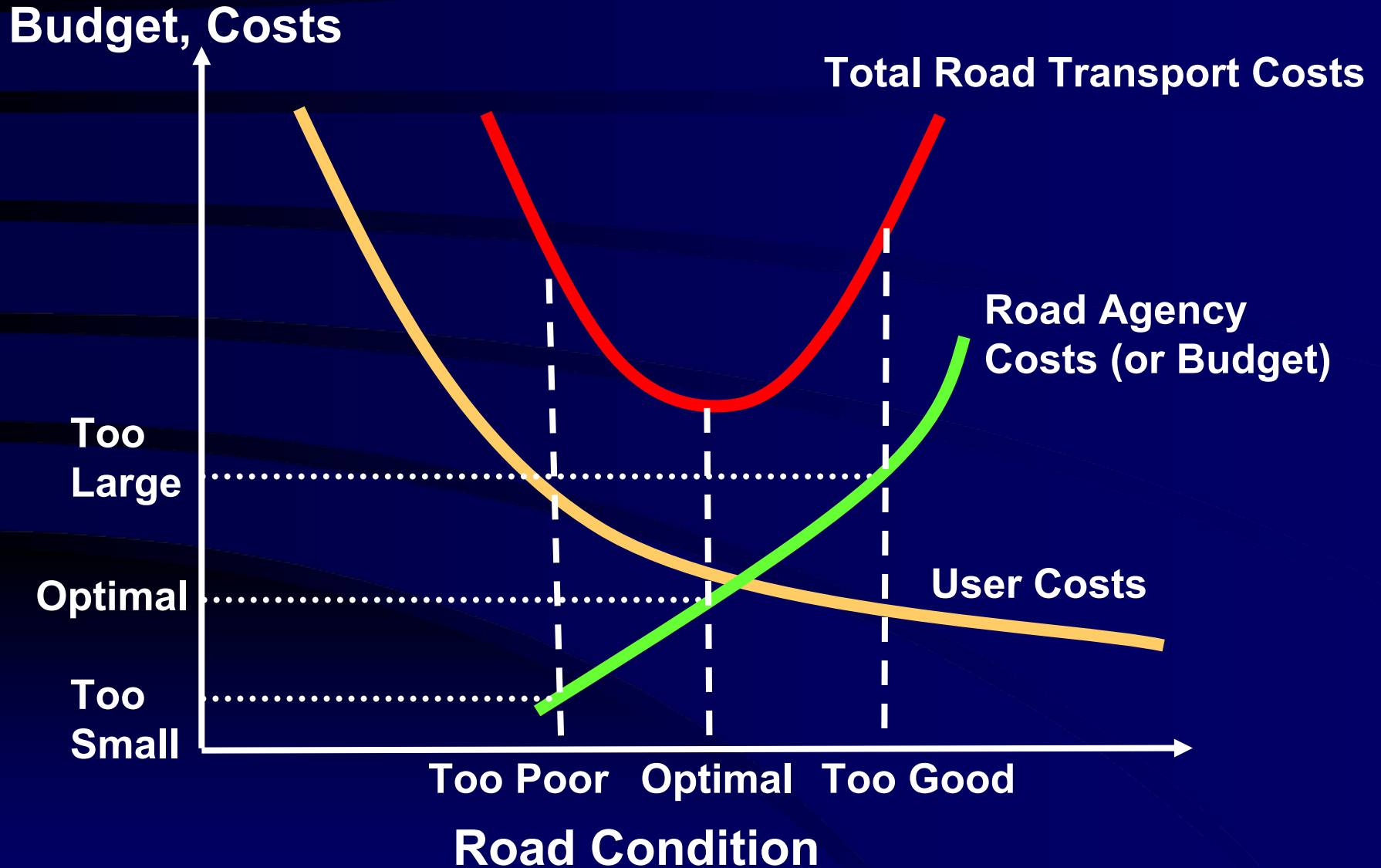
**Passenger and cargo time**

**Accidents**

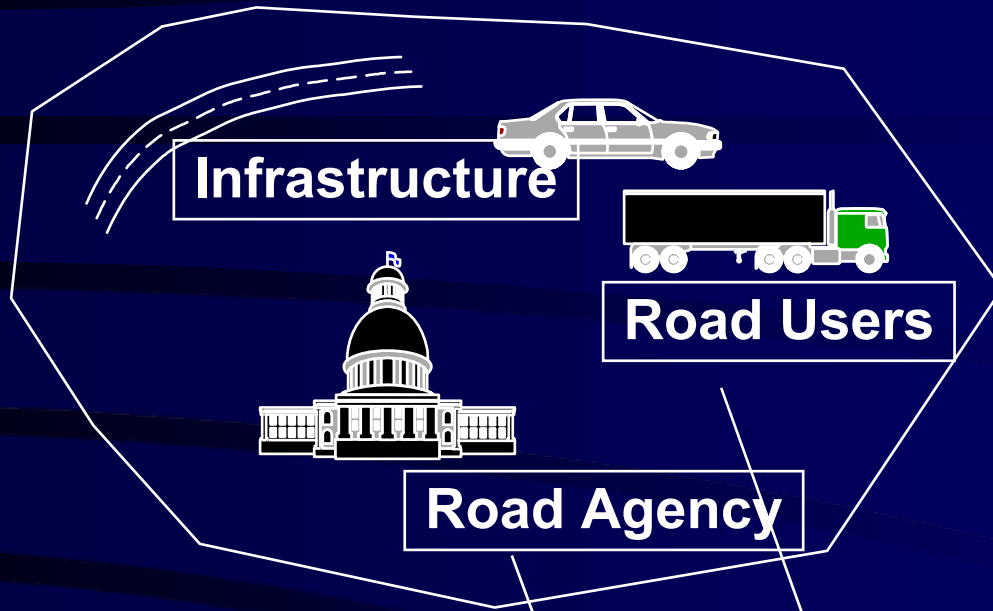
# Total Society Costs of Road Transport



# Optimization of Road Condition and Budget



# Minimizing Consumption of Resources



m<sup>3</sup>

liters, hours

**Consumption**

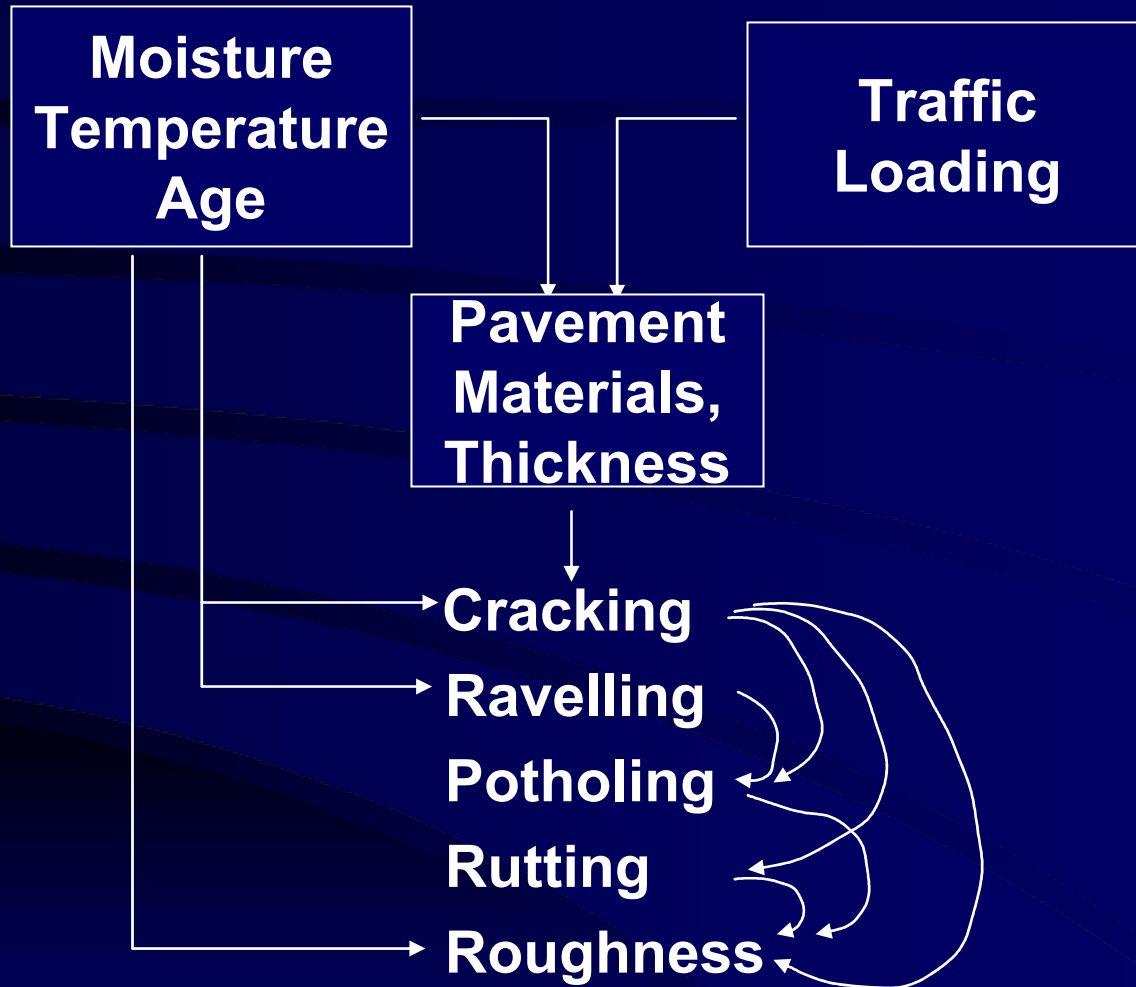
**x**

**Unit Costs**

**=**

**Total Society Costs**

# Paved Road Deterioration Model



# Road User Costs Model

Road  
Geometry,  
Condition

Driver,  
Traffic  
Flow

Vehicle  
Characteristics

SPEED

COMSUMPTION

Fuel & Lubricants

Tire

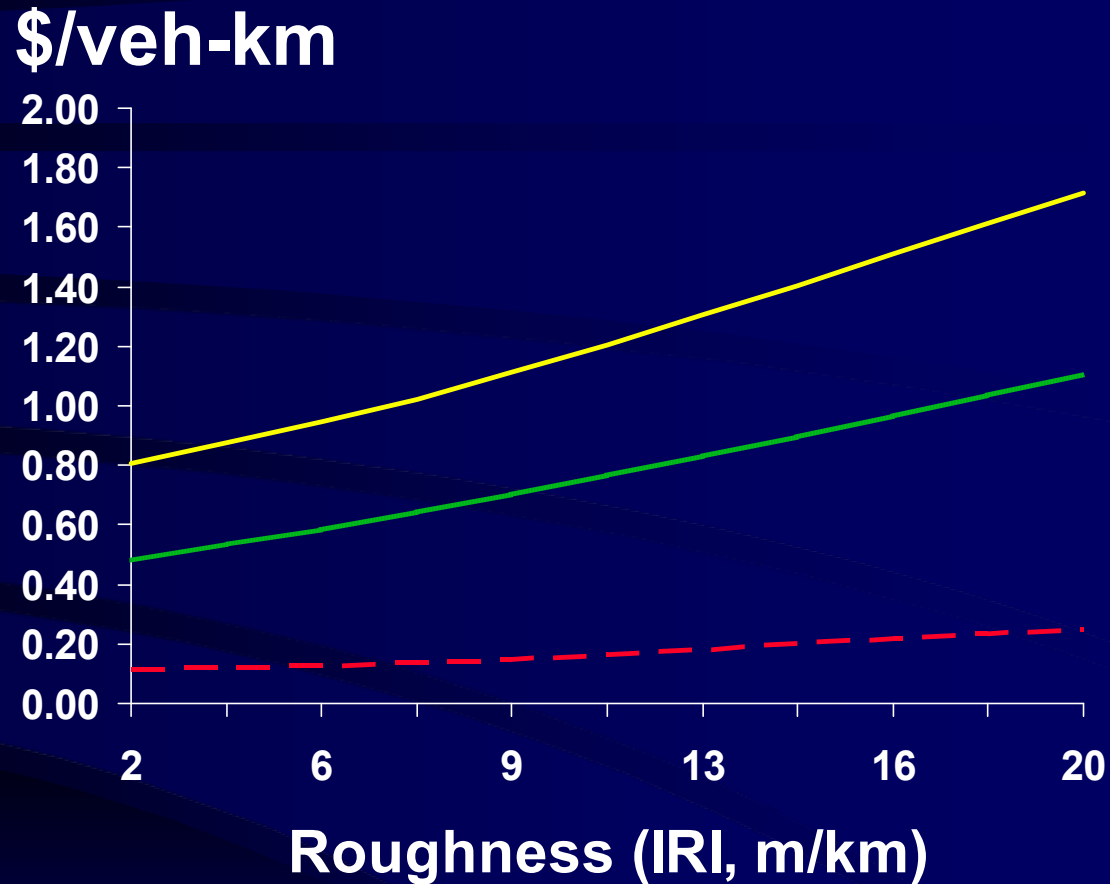
Maintenance Parts & Labor

Crew Time

Depreciation & Interest

Passenger & Cargo Time

# Vehicle Operating Costs



--- Car    — Truck    — Articulated Truck

# **PPIAF-World Bank Toolkit for PPP in Highways**

**Provides policy makers from  
developing and transition  
economies with some guidance  
in the design and  
implementation of a PPP  
project in the highway sector**

# Availability of the Toolkit

- Free of charge
- A multimedia product available on a CD ROM
- Also available at the World Bank's website:  
*[www.worldbank.org/transport](http://www.worldbank.org/transport)*  
*<http://rru.worldbank.org/Toolkits/PartnershipsHighways/>*

# Toolkit CD ROM

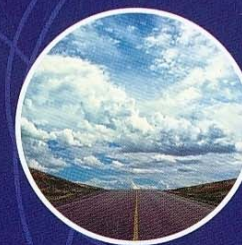
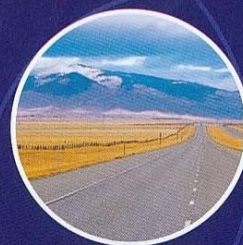


PUBLIC-PRIVATE  
INFRASTRUCTURE  
ADVISORY FACILITY



THE WORLD BANK

## Toolkit for **PUBLIC-PRIVATE PARTNERSHIP** in Highways



Funded by the Public-Private Infrastructure Advisory  
Facility (PPIAF), a multi-donor technical assistance facility.

# Debt Service Cover Ratio (DSCR)

$$DSCR_n = \frac{(CAFDS)_n}{\sum_{i=1}^3 (\text{Debt Service})_{i,n}}$$

where

$i$  = number of tranches,  $1 \leq i \leq 3$

$n$  = current year

$(\text{Debt Service})_{i,n} = (\text{Principal})_{i,n} + (\text{Interest})_{i,n}$

CAFDS = Cash Available for Debt Service

# Return on Equity (ROE)

$$\sum_{i=1}^{\text{end of the concession}} \frac{(\text{Equity injected} - \text{dividends})}{(1 + ROE)^i} = 0$$

where:

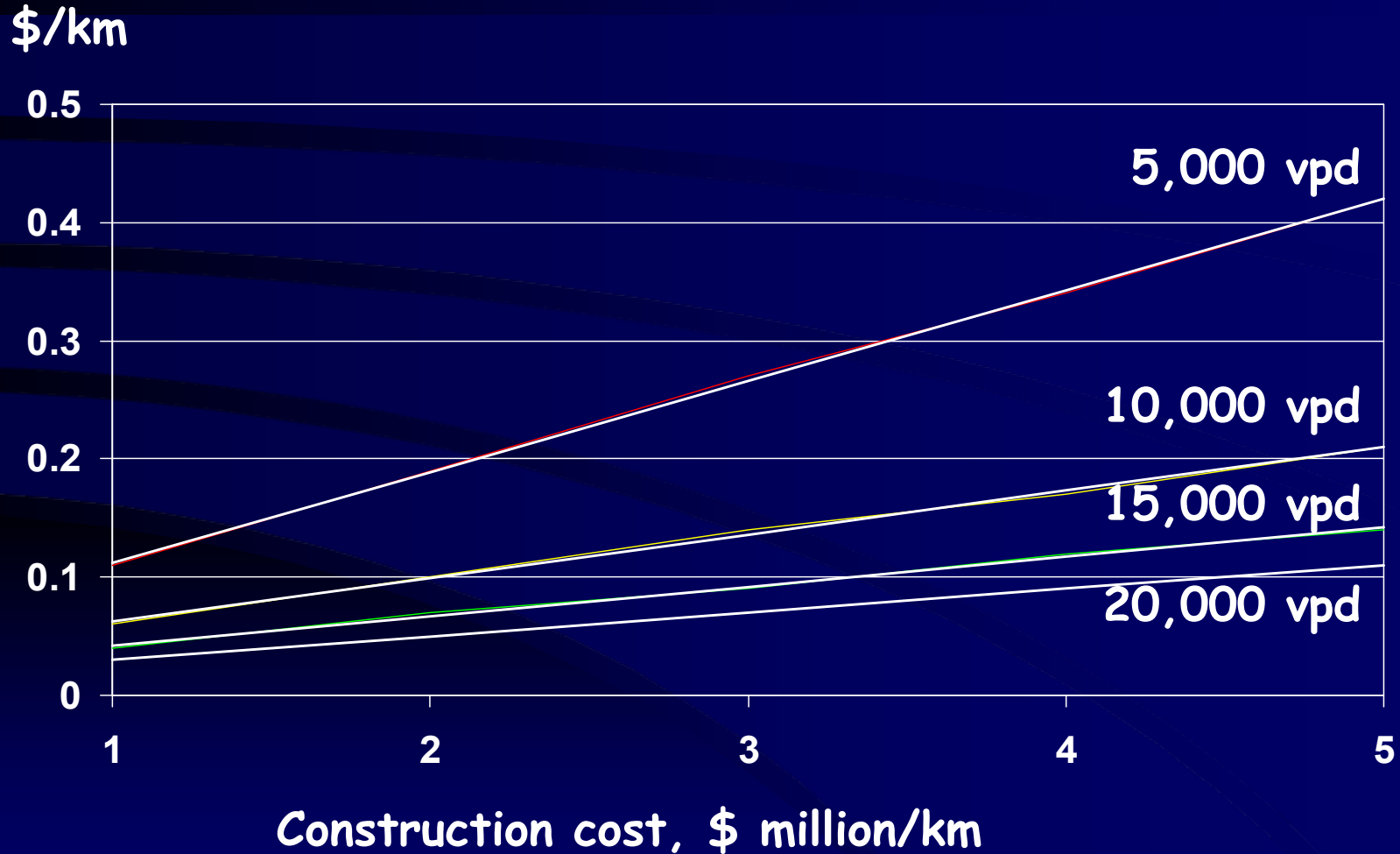
Equity injected<sub>i</sub> is the equity provided by the sponsors in year i

Dividends<sub>i</sub> are the dividends distributed to shareholders in year i

ROE is calculated in real terms through deflated flow (equity - dividends)

$$ADSCR_n = \frac{(CAFDS)_n}{\sum_{i=1}^3 DebtService_n}$$

# Estimated Minimum Toll Rate to Attract Private Investment for a PPP Project



**Thank you!**

# Basic Assumptions to Estimate the Minimum Toll Rate to Attract Private Investors for a PPP Project

- Concession term: 20 yrs
- Construction Cost: \$1M/km to \$5M/km
- Operation cost: \$500,000/km/yr
- Equity: 14%
- Subsidies: 0
- Interest rate: 5%/yr
- Grace period: 4 yrs
- Repayment period: 14 years
- Discount rate: 10%
- Initial traffic: 5,000 vpd to 20,000 vpd
- Traffic growth: 3%
- Inflation: 6%
- Tax: 18%
- IRR  $\geq$  12%
- ROE  $\geq$  16%
- LLCR  $\geq$  1.0
- DSCR  $\geq$  1.0

# Some Basic References

World Bank (2001). "World Bank-Financed Procurement Manual [Draft]." Washington, D.C.  
<http://siteresources.worldbank.org/PROCUREMENT/Resources/pm7-3-01.pdf>

Guasch, J. Luis (2004). *Granting and Renegotiating Infrastructure Concessions Doing It Right*. Washington, D.C.: World Bank.  
[http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2004/05/06/000090341\\_20040506150118/Rendered/PDF/288160PAPER0Granting010renegotiating.pdf](http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2004/05/06/000090341_20040506150118/Rendered/PDF/288160PAPER0Granting010renegotiating.pdf)

World Bank (2004). "Guidelines: Procurement Under IBRD Loans and IDA Credits." (May). Washington, D.C.  
<http://siteresources.worldbank.org/INTPROCUREMENT/Resources/Procurement-May-2004.pdf>

Queiroz, Cesar (2005). "Launching Public Private Partnerships for Highways in Transition Economies." Transport Paper TP-9. (September). Washington, D.C.: World Bank.

Kerf and et al. (1998). "Concessions for Infrastructure: A Guide to Their Design and Award." Technical Paper no. 389.

World Bank (1998). "Bidding for Private Concessions. The Use of World Bank Guarantees." RMC Discussion Paper Series, no 120. Washington, D.C.

# Toolkit for PPP in Highways

The toolkit provides a detailed guide to introducing private participation in highways, with practical tools for structuring the main contractual and financial terms:

<http://rru.worldbank.org/Toolkits/PartnershipsHighways/>

<http://rru.worldbank.org/Documents/Toolkits/Highways/start.HTM>

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