PPIAF
PUBLIC-PRIVATE INFRASTRUCTURE ADVISORY FACILITY

Moving Forward: Developing Highway PPPs in Lao PDR

2013

Supported by: Anita Mauchan Consultants Limited & Lao-Asie Consultants Group

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Annexes

About PPIAF

The Public-Private Infrastructure Advisory Facility (PPIAF) was created in 1999 to act as a catalyst to increase private sector participation in emerging markets. It provides technical assistance to governments to support the creation of a sound enabling environment for the provision of basic infrastructure services by the private sector.

A sound business enabling environment consists of strong institutions, legal systems and rule of law, high standards of public and corporate governance, transparency, competition, protection of investments, enforcement of laws, and dispute resolution mechanisms.

- Governments are the main generators of private sector projects, but there are obstacles that impede private sector participation. PPIAF can assist to remove some of these obstacles by supporting:
- Policy formulation, as public authorities decide between public and private provision of infrastructure services
- The selection of the best mode of delivery of infrastructure services and the risk allocation between the public and the private sectors
- Building capacity in public authorities to design public-private partnership projects, manage the award process and the service delivery, and partner with private investors
- Adequate consultation with beneficiaries to share project objectives
- Legislation and institutional reforms to ensure the sustainability of the investments and the protection of property and contractual rights
- Support for the negotiations of contracts to ensure adequate risk allocation between public and private parties

PPIAF is a multi-donor technical assistance facility, financed by 17 multilateral and bilateral donors: Asian Development Bank, Australia, Austria, Canada, European Bank for Reconstruction and Development, France, Germany, International Finance Corporation, Italy, Japan, Millennium Challenge Corporation, Netherlands, Sweden, Switzerland, United Kingdom, United States, and the World Bank. PPIAF funds are untied and grants are provided on a demand-driven basis.

Acronyms

13N	*National Route 13, north section*
13S	*National Route 13, south section*
AADT	*Annual Average Daily Traffic*
ADB	*Asian Development Bank*
ADSCR	*Average Debt Service Cover Ratio*
DAC	*Development Assistance Committee*
GMS	*Greater Mekong Subregion*
IDA	*International Development Association*
IFI	*International Financial Institutions*
JICA	*Japan International Cooperation Agency*
MoPWT	*Ministry of Public Works and Transport*
MoPI	*Ministry of Public Investment*
NR13	*National Route 13*
ODA	*Official Development Assistance*
RMF	*Road Maintenance Fund*

Executive Summary

Since independence in 1975, Lao PDR, a landlocked country in the heart of the Greater Mekong Subregion (GMS), has achieved significant and rapid economic development. In recent years, the country's GDP has grown by an annual average of 7%. Internal policy reforms, natural resource endowments and close proximity to some of the world's fastest growing economies like China and Vietnam have propelled this advancement.

As the country strives to further integrate with its region and benefit from increased trade, it has settled on its Seventh Five-Year National Socio-Economic Development Plan (2011-2015). Achieving growth rates above 8% per annum and graduating to middle-income status by 2020 mark the plan's key aims, and increasing the provision of infrastructure services is offered as a driver to meet these aims.

In light of the country's land-locked location and emphasizing the importance of regional integration to economic development, the Laotian government aims to transition from a "land-locked" to a "land-linked" country. An improved highway network would move the country one step closer to achieving its land-linked vision. However, scarce public funds and competing needs in the social sectors challenge the Government of Lao to prioritize transport needs and mobilize resources from other sources of funds including the private sector, effectively and efficiently.

The following report aims to inform the Government of Lao on the necessary considerations and steps to take into account as it progresses in evaluating options for private sector investment and participation in its highway sector. Part one of the report provides a general overview of the economic, political and historical background that will influence the government's decision-making process and affect the private sector's willingness to ultimately participate in the highway sector. Part two identifies, evaluates and recommends steps to engage the private sector in the proposed pilot project to upgrade the main highway corridor in Lao PDR, National Route 13 (NR13). Finally, part three provides a roadmap to how the country could implement a PPP on NR13.

The key findings and recommendations from the report are summarized below.

Part I: Economic, Political and Historical Context

In recent years, Lao PDR has made impressive strides towards reducing poverty and developing its economy. It successfully weathered the global financial crisis, moving from low-income to lower middle income status in 2011. The government aims to continue this trend and achieve growth rates above 8% per annum and graduate from least-developed country status by 2020.

Lao PDR needs an improved road network to achieve its land-linked vision, and although investments in its road network over the past decade have increased, they have not kept pace with the demand. The road network's total length has more than tripled from 1975 to 2005, but travel demand is increasing rapidly, for example, the 3 provinces of Vientiane Capital, Vientiane and Borikhamxai have witnessed a growth in total vehicle registrations of over 500% since 2000. [1] Moreover, the existing network faces significant challenges from natural disasters such as landslides and flooding, with over 40% of villages lacking access to all-weather roads. [2]

In such a high traffic growth environment, regular road maintenance is critical to sustaining road assets over the long-term and the Laotian government has recognized the importance of routine maintenance for existing road assets by establishing the Road Maintenance Fund (RMF) in 2001.

Lao PDR needs significant investments across infrastructure sectors to achieve development goals, and will need to look to the private sector and arrangements like public private partnerships (PPPs) to fund its infrastructure needs. Lao PDR has some experience implementing PPPs, with 16 projects reaching financial close between 1993 and 2011. The energy sector reaped the benefits of the majority of these investments with the development of a large number of hydropower plants that provide or will provide power for export to neighboring countries. PPPs conducted in other sectors saw mixed results.

The availability of private finance to infrastructure projects is a key factor in assessing what kind of PPPs could work in the Laotian context. The Laotian banking sector is therefore

[1] Data provided by MoPWT
[2] The World Bank. Country Partnership Strategy: Lao People's Democratic Republic for the Period FY 12 – FY 16. January 25, 2012

important. It has developed significantly since its reform in the late 1980s, which introduced competition, and therefore commercial banks, paving the way for a greater offering of financial products. However, the sector continues to face profitability, liquidity and efficiency challenges. It is characterized by a high degree of public ownership and limited market depth and breadth, and faces constraints in terms of availability and cost of private finance. This is particularly the case for infrastructure debt products (e.g., project finance), which are neither readily available from the Laotian banking sector nor are likely to be easily sourced from international or regional lenders due to reduced liquidity, currency and country risk perceptions.

Multilateral and bilateral donors will also be important in that they could provide finance to both governments and to the private sector in PPP projects. A number of donors are active in the Laotian transport sector; Asian Development Bank and JICA recently prioritized transport as a fundamental component of their assistance strategy for Lao PDR. The World Bank also has very active assistance program to the road sector funded through IDA grants.

Part II: Piloting a PPP project on the 13N and 13S

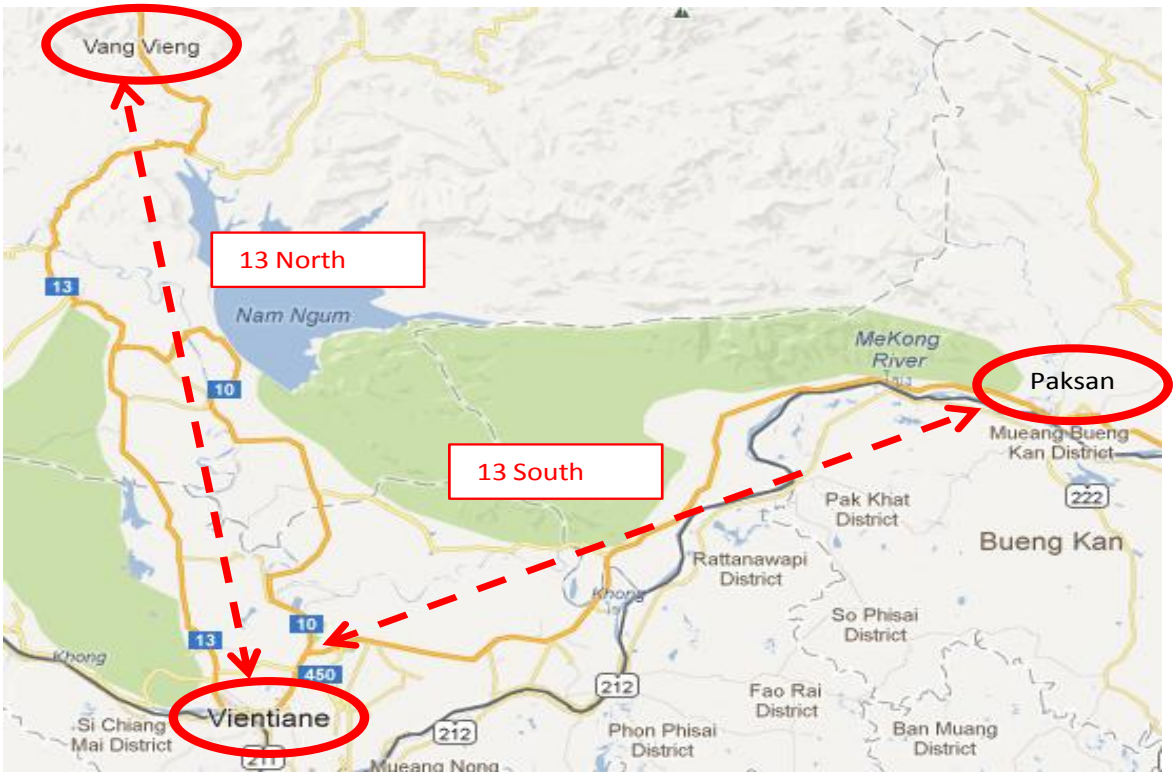
Given limited resources for the roads sector, the government must prioritize which projects receive public investment and encourage greater private investment in the road network.

Lao PDR's road and bridge network requires an estimated 1.13 USD billion investment in the next decade.[3] In the five years from fiscal 2005-2010, however, the government's total expenditure in the transport sector only reached 130.5 USD million.[4] During this period international donors contributed an additional 312.2 USD million in investments to the sector.[5]

Providing updates to and expanding NR13 would be a good pilot project for Lao PDR. As the backbone of the country's road network, NR13 is a priority corridor critical to achieving the government's land-linked vision. Stretching from the Chinese border in the north to the Cambodian border in the south, the road runs through the capital city of Vientiane and is the most heavily traveled route in the country. The highway connects Lao PDR to major trading partners within the GMS region and the majority of goods traffic travels across this route. This report uses the following sections of NR13 as the basis for analyzing whether a PPP approach to upgrading and rehabilitating this key highway could be piloted:

[3] Queiroz, Ceasar. Project Pipeline Screening and Initial Feasibility Assessment of Potential Road Infrastructure PPPs in Lao PDR. Prepared for PPIAF. p. 1
[4] Data provided by the MWPT, includes investments in water way and erosion prevention projects
[5] ibid

- 13N (section between Vientiane and Vang Vieng)
- 13S (section between Vientiane and Paksan)



The analysis incorporated a traffic and revenue study, cost analysis and financial analysis of different PPP options.

With the continuation of strong economic growth in Lao, traffic on NR13 is predicted to increase significantly. Over the next 37 years until 2050, traffic levels on the 13N and 13S are predicted to increase by 250-440% due to increasing economic wealth and car ownership. Traffic on the busiest sections of the 13S closest to Vientiane is predicted to increase from 20,400 to 53,100 vehicles average annual daily traffic (AADT) at Don Noun and from 14,300 to 41,900 vehicles at km19 by 2030. On the rural sections of NR13 traffic is predicted to increase 8,000 – 18,000 AADT depending on location.

A traffic and revenue study was completed as a part of this report. Traffic forecasts have been prepared for two different scenarios, namely:

- Do-Minimum Scenario – NR13 is not improved from its current configuration and remains un-tolled
- Do-Something Scenario – NR13 will be rehabilitated and widened and tolls will be charged to the road user

An illustrative toll strategy has been designed to indicate the potential toll revenue that could be collected from the proposed rehabilitation and widening of NR13. Three potential toll plaza locations have been identified on 13N and 13S. Illustrative toll tariffs have been based on an average toll of 300 Kip/km for Class 2 vehicles (cars, jeeps, taxis and pick-ups).The resulting revenue forecasts for the Do-Something Scenario are outlined below:

Forecast Year	Kip billion			USD million		
	NR13 North	NR13 South	Total	NR13 North	NR13 South	Total
2015	65.53	88.74	154.28	8.74	11.83	20.57
2020	107.95	145.73	253.68	14.39	19.43	33.82
2030	179.05	245.41	424.46	23.87	32.72	56.59
2040	237.65	328.72	566.37	31.69	43.83	75.52
2050	291.43	405.23	696.66	38.86	54.03	92.89

Based on forecast traffic levels and typical design parameters – it is estimated that the roads will predominately require widening to 4 lanes (i.e. 2 lanes in each direction). The major exception is the section between Phônhông and Vang Vieng, which is lightly trafficked and would be extremely costly and difficult to widen from its current configuration. We have therefore assumed only minor safety improvements would be made to this section.

	Existing Lane Configuration	Forecast Vehicle: Capacity Ratio[6]	Proposed Lane Configuration	Forecast Vehicle: Capacity Ratio [7]
13N				
Section 1 - Road 450 to Phônmouang	2 lanes (1x1)	217%	4 lanes (2x2)	95%
Section 2 - Phônmouang to Phônhông	2 lanes (1x1)	76%	4 lanes (2x2)	38%
Section 3 - Phônhông to Vang Vieng	2 lanes (1x1)	62%	2 lanes (1x1)	62%
13 S				
Section 1 - Vientiane to km21	4 lanes (2x2)	131%	6 lanes (3x3)	87%
Section 2 – km21 to Naxay	2 lanes (1x1)	137%	4 lanes (2x2)	69%
Section 3 - Naxay to Paksan	2 lanes (1x1)	53%	4 lanes (2x2)	26%

The construction costs were estimated based on the above widening proposals. Estimated costs to upgrade 13N totaled roughly 884 billion Kip and to upgrade 13S totaled roughly 2,337 billion Kip (2013 prices). Operating and maintenance costs were also estimated for both the 13N and 13S sections and these were estimated to be around 50 billion Kip per year (2013 prices). These cost estimates are only indicative and require significant revision during a full feasibility study that includes a more detailed assessment.

In order to make these upgrades to NR13, the Government of Lao should consider the various PPP structures appropriate to the Lao PDR context. There are a number of key constraints present in the existing PPP market both in Lao and globally that will dictate what kind of model is likely to be appropriate. Under each of these models, it is apparent that whilst the asset is valuable in the long-term, the government will be required to either provide significant upfront investment and/or ongoing financial support (i.e. availability payments).

This report carried out financial analysis for four types of PPP that could be appropriate for the Lao PDR case. They are as follows:

[6] Based on maximum peak-hour Do-Minimum traffic flows for 2040
[7] Based on maximum peak-hour Do-Minimum traffic flows for 2040

Design Build Contract and Operating and Maintenance Contract (DB +O&M) - Under this structure one contract would govern a private contractor as it designs and builds the highway asset while a separate contract would govern the operations and maintenance of that asset over a multi-year contract whereby payment for services would be contingent on meeting contractually agreed service standards.

Design Build Operate Maintain (DBOM) - Under this structure, the private contractor designs and constructs the infrastructure asset and operates and maintains it for a specified period of time after construction. Payment for services would be contingent on meeting contractually agreed service standards.

Design Build Finance Operate and Maintain – Availability (DBFOM - Availability) - Under this contract structure, the private sector assumes responsibility for executing the entire project – completing the design and construction, raising funds to finance construction, and operating and maintaining the asset throughout the project term (typically between 20 – 40 years) and receives a fixed availability payment from the government for the asset. The availability payment would be contingent on meeting contractually agreed service standards.

Design Build Finance Operate and Maintain – Toll (DBFOM – Toll) – This structure is similar to DBFOM - Availability but the private sector collects and retains tolls and receives no availability payment from the government but under the contract would still be required to meet agreed service standards.

The table below summarizes the required levels of government financial support to the project and the net government cashflows (in USDm) that result over the assumed 28 year contract period. It also shows the amount of private sector investment that could be attracted under each scenario:

	Amount of Private Investment Achieved (USDm)	Government Capital Contribution (USDm)	Government Operating Subsidy/Availability Payment (USDm)	Government Toll Revenues (USDm)	Government Tax Revenues (USDm)	Total Net Government Cashflow (USDm)
DB+O&M	-	(513)	(413)	2,878	15	1,967
DBOM	-	(489)	(413)	2,878	15	1,990
DBFOM (Availability)	249	(246)	(1,665)	2,878	268	1,234
DBFOM (Toll)	250	(244)	-	-	609	365

The key findings from the PPP options analysis for the 13N and 13S projects are summarized below:

- **Asset Value:** Rehabilitating and widening of the 13N and 13S highways and subsequent tolling would create two valuable cash assets regardless of whether the private or public sector procures the project. Compared to a greenfield project, the costs of widening an existing road are relatively low whilst strong forecasted traffic growth with minimal competition from other routes provides a strong future revenue base.

- **The need for government financial support and recourse to budgets:** Despite the underlying financials and strong project value, the government will still likely need to provide significant financial support to the project regardless of which model is adopted. The DB+O&M and DBOM models will require a significant upfront capital investment of around 3,500 billion Kip plus a significant on-going commitment to pay for operating and maintenance services (although toll revenues should more than cover this expenditure). Likewise, a DBFOM model, whilst reducing upfront government investment still requires a capital contribution from government as there is unlikely to be sufficient private capital available to meet all of the investment costs. A DBFOM with an availability payment structure would also create a long-term mortgage-type liability, albeit this should be fundable through toll revenues. A DBFOM option with toll revenue risk transferred will also require government upfront capital subsidy for the same reason of limited availability of private capital but also because the amount of commercial debt has to be reduced to levels whereby low initial traffic levels can provide enough revenue to make interest payments.

- **Deliverability:** Lao PDR undoubtedly has an infant and as yet untested PPP market. This has to be factored into the decision-making process for what kind of delivery model is appropriate. Ideally, the country would adopt a model that maximizes risk transfer and minimizes the recourse to government budgets; however such a model (e.g., the DBFOM-toll model) may not be deliverable in an infant market as the risks of such a model may be perceived to be too high by the private sector. Even a DBOM model where no private finance is envisaged could be difficult to deliver given that there is little contractor experience of bundling construction, maintenance and operations under a single contract.

- **Bankability:** The thin nature of the local finance market will likely mean that any model that requires private finance (i.e., DBFOM models) will need to seek it from either international/regional commercial lenders, multi-lateral lenders (e.g. ADB or IFC) or bi-lateral enterprises (e.g. state development banks). This will require *inter alia* a very carefully structured risk allocation.

- **Scale:** In an infant PPP market, the scale of a pilot project is vitally important. On the one hand, the project should not be too large and complex so as to raise questions of affordability or deliverability. On the other hand, it should not be too small so as to reduce the appetite of potential bidders or lead to an inefficient maintenance operation that unnecessarily duplicates existing plant, machinery and labor. A project that combined the full 13N and 13S widening/upgrades into a single project would create a funding requirement in excess of 500 USD million. This may be perceived as too large a project by the private sector and it might not be an optimal size for piloting a PPP approach to road construction and maintenance.

Based on the findings of the technical, traffic and options analysis contained in this study, we believe that all the models that were analyzed could be applied in the context of Lao PDR but those incorporating private finance would need to be very carefully structured. We would therefore make the following recommendations with regard to the government's approach to procuring the 13N and 13S projects as a PPP project:

- **Recommendation 1:** We would recommend that the government proceeds with a smaller scale pilot project than the upgrading of 13N and 13S all the way to Vang Vieng and Paksan. Instead, we propose that a smaller pilot project that upgrades 13N to

Phonghong and 13S to the 13S/NH10 interchange (near Km 64), ***would be the most appropriate pilot project***.

- **Recommendation 2a:** If the government is able to and can afford to finance the pilot project from its budget or donor funds then we believe that a ***DB+O&M contract represents the most efficient model for a country that has only limited experience in PPPs and multi-year contracts***. The long-term operating contract could be structured to transfer or retain traffic risk but would transfer key operations and maintenance risks so that better quality standards are met.

- **Recommendation 2b:** ***If the government cannot afford to finance the pilot project in its entirety and needs to attract private capital then we would propose that a DBFOM model is adopted with an availability payment (or shadow toll) structure.*** We do not recommend a full transfer of revenue risk as it would likely reduce private sector financier's appetite for the project. Likewise, government would surrender significant upside in revenues, but would still likely be required to make a significant capital contribution upfront given the likely low level of private capital available in the financing markets.

- **Recommendation 3:** The government must undertake a full feasibility study to validate these findings and this must include a significant market sounding to fully assess appetite for the pilot project

Part III: Roadmap to Implementation

As discussed, the construction of 13N and 13S all the way to Vang Vieng and Paksan may be too large for a single project, particularly as Lao has a limited track record of PPP projects. A project that upgrades only as far as Phonhong (13N) and the 13S/NH10 Interchange (13S) would represent a more deliverable and manageable pilot project. The size, complexity, and cost of a single project may be too large for contractor capacity and financier appetite. Affordability for the public sector is also a concern, as the government will need to provide significant support to the project under all of the PPP models discussed above. This smaller scale project would represent a more deliverable pilot project for the following reasons:

- These sections of 13N and 13S are more heavily trafficked and therefore need investment sooner
- Rehabilitating these sections of the 13N and 13S will deliver greater benefits due to its higher traffic volume
- Construction and land acquisition for this project appear to be less complex and carry more manageable risks
- The funding requirement for this project is more manageable. It is also sized at a level whereby there is potential for the private sector to meet a significant proportion of the funding requirement
- The project is of sufficient length of highway (111km) to justify a separate operating and maintenance operation, as would be required under a PPP
- This project could act as a demonstration project to be followed by the 13N project

The next steps to move the project forward include undertaking a more detailed project feasibility study, which is envisaged under a proposed IDA operation. The feasibility stage should continue to study the themes outlined in this viability assessment and should include:

- The development of a reference design for the project
- Robust cost estimates
- Further traffic data collection and development of the traffic model. This should include willingness to pay surveys
- Market sounding of potential contractors, lenders, equity providers and bilateral/multilateral agencies to understand their appetite for the pilot project

The government should also consider the engagement of a transaction advisor shortly after the commencement of the feasibility study if it wishes to pursue a PPP option.

In addition to undertaking a detailed feasibility study, the government should also work with PPIAF and other IFIs to identify any gaps within the existing legal, regulatory and institutional frameworks. Areas that are likely to require technical assistance include:

- Identification and analysis of required changes to the legal framework

- Establishing a tolling policy that will govern the introduction of tolling on national highways
- Institutional strengthening through the development of policy guidance for PPPs and tolling
- Building the MoPWT and MoPI's capacity to implement and oversee PPP contracts
- Assessment and management of contingent liabilities under PPPs

The government should also consider how the project would affect its broader transportation sector development plans and related policies. These policies and the enabling environment will be critical to delivering a successful project, particularly as this will be Lao PDR's first PPP in the highway sector. Developing a well-structured, bankable pilot project for the 13S will demonstrate the government's commitment to private sector participation in infrastructure and assist the country to develop additional PPP projects in the future.

Part 1: Context

Part I: Context

The following report aims to inform the Government of Lao on the necessary considerations and steps to take into account as it moves forward in evaluating options for private sector investment and participation in its highway sector. Part one provides a general overview of the economic and political background that will influence the government's decision-making process and affect the private sector's willingness to ultimately participate in the highway sector.

This section begins with a discussion of the current macroeconomic context in Lao PDR, followed by an overview of the country's banking sector and donor activity, which are the two main groups of financiers who could provide funding to PPP projects in Lao. It then looks at Lao PDR's history with private sector involvement in infrastructure, using public private partnerships and ends with a closer look at infrastructure development in the transport sector.

1.1 The Macroeconomic Context

Situated in the heart of the Greater Mekong Subregion (GMS), the Lao People's Democratic Republic (Lao PDR) borders Cambodia, Myanmar, Thailand, Vietnam and the People's Republic of China, some of the worlds' most rapidly developing economies. While smaller and poorer than its neighbors, the country's favorable geographic location, which has strategic importance in terms of potential for increased cross border investment and exports, and abundance of natural resources have and continue to spur rapid socioeconomic development.[8]

Since independence in 1975, Lao PDR has moved steadily from a centralized to a more market economy. Following market oriented reforms in 1986 Lao PDR liberalized prices, unified the exchange rate and removed the Government's trade monopoly, opening foreign and inter-provincial trade. These reforms put the country on a path to favorable economic growth. During the Asian Financial Crisis in the late nineties, however, the country experienced a period of economic instability, due in part to poor monetary and fiscal management. Committed to growth, the government responded to the crisis by tightening monetary and fiscal policies to stabilize inflation.[9]

As a result of these policy reforms, in the last decade, Lao PDR has made impressive strides towards reducing poverty and developing its economy. Growing at an annual average of 7% the

[8] http://www.worldbank.org/en/country/lao/overview
[9] http://www.unlao.org/Country_Information/countryinfo.asp

country boasted one of the highest growth rates in the region in recent years.[10] Natural resource development has driven much of this GDP growth, with the hydropower and mining sectors accounting for about one third of the country's economic growth between 2005 and 2010.[11] The non-tradable sectors (construction and services) also played a significant role in the country's growth, accounting for 3.6% of the growth from 2003-2008.[12] Continued growth in these sectors is anticipated over the medium- and long-term.

Lao PDR's macroeconomic policies are generally sound, and inflation is at a manageable level. Furthermore the country's fiscal deficit has returned to near pre-global financial crisis levels, and the exchange rate remains stable. However low reserve coverage and rapid credit growth amid high lending rates have the potential to create vulnerability for the country.[13]

Rapid credit growth, while possibly a welcome development as it signals financial deepening, has raised concerns about the health of Lao PDR's banking system. Improvements in banking sector regulation and supervision capacity must keep pace with credit growth. Likewise, the country's low current reserve levels put it on shaky ground in the face of external shocks. If rapid credit expansion and large capital inflows fund imports of consumption goods rather than productive investments, which would lead to increased exports, Lao PDR risks vulnerability in terms of trade shocks.[14]

Lao PDR successfully weathered the global financial crisis and in 2011 moved from low-income to lower middle-income status. As part of the Seventh Five-Year National Socio-Economic Development Plan (2011-2015), the government aims to achieve growth rates above 8% per annum with a goal of graduating from least-developed country status by 2020. The plan identifies increasing the provision of infrastructure services as one of the key tasks to achieving these goals and reducing poverty rates, particularly in rural areas.

1.2 Availability and Cost of Private Finance

The availability and cost of private finance mark two key factors that will determine whether Lao can develop the infrastructure it needs to reach its goal of graduating from least developed

[10] International Monetary Fund. *Lao People's Democratic Republic: Staff Report for the 2012 Article IV Consultation*. August 16, 2012.
[11] http://www.worldbank.org/en/country/lao/overview
[12] World Bank. Lao PDR Development Report 2012: National Resource Management for Sustainable Development. Background Paper: Lao PDR: Growth Analysis for a Small Resource-Rich Transition Economy. 2010.
[13] Ibid
[14] Ibid

status. The Laotian banking sector has developed significantly since its reform in the late 1980s, which introduced competition and thus, commercial banks. This resulted in a greater offering and range of financial services and products; however, the sector continues to face profitability, liquidity and efficiency challenges. Characterized by a high degree of public ownership and limited market depth and breadth, the banking sector faces constraints in terms of availability and cost of private finance. This is particularly the case for infrastructure debt products (e.g. project finance) which are neither readily available from the Laotian banking sector nor are likely to be easily sourced from international or regional lenders due to reduced liquidity, currency and country risk perceptions.

Lao's financial industry includes the central bank (Bank of the Lao PDR), state-owned commercial banks, private banks, joint stock banks and branches of foreign banks and non-bank financial institutions. Commercial banks refer to legal entities established to provide financial services such as accepting deposits, issuing loans, arranging settlements of accounts, and engaging in other businesses in accordance with the 'Law on Commercial Banks'. They include state-owned commercial banks, private commercial banks, joint venture banks and foreign commercial banks' branches.[15] As of June 2012, 29 commercial banks operated in Lao with their head offices based in the capital city of Vientiane (see Table 1.1 below). The 29 commercial banks include: four state-owned commercial banks, two joint venture banks, ten private banks, twelve branches of foreign banks and one representative office.

[15] An Analysis of the Recent Financial Performance of the Laotian Banking Sector during 2005-2010

Table 1.1: List of Commercial Banks

Name of Banks	Established	Branches
State-owned commercial banks+ Specialized banks		
1. Banque pour le Commerce Extérieur Lao	1989	18
2. Lao Development Bank	2002	18
3. Agricultural Promotion	1993	17
4. Nayoby Bank	2006	7
Joint venture Banks		
1. Lao - Viet Bank	2000	5
2. Banque Franco	2010	0
Private Banks		
1. Joint Development Bank	1989	0
2. Phongsavanh Bank	2007	4
3. ST Bank	2009	3
4. Indochina Bank	2008	1
5. Booyong Lao Bank	2009	0
6. ANZV Bank	2007	0
7. ACleda Bank	2008	4
8. International Commercial Bank	2008	2
9. Industrial and Commercial Bank of China	2011	0
10. Sacom Bank	2008	0
Foreign Bank Branches		
1. Siam Commercial Bank	1993	0
2. Thai Military Bank	1992	0
3. Bangkok Bank	1993	0
4. Krung Thai Bank	1993	0
5. Ayudhya Bank	1994	0
6. Ayudhya Bank Savannakhet Branch	2009	0
7. Public Bank	1995	0
8. Public Bank Sikhai Branch	2008	0
9. Public Bank Savannakhet Branch	2008	0
10. Military Commercial Joint Stock Bank	2010	0
11. Lao Construction Bank	2012	0
12. Vietin Bank Lao Branch	2012	0

Representative Office		
1. Standard chartered bank	1997	0

Source: Monetary Statistics of Bank of Lao PDR, 2012

The public sector owns the majority of assets, deposits and loans in the banking sector. Total assets of the sector amounted to 45,169.51 billion Kip (5,640 million USD) or around 68 percent of GDP in 2011. Total bank deposits and loans amounted 23,430.54 billion Kip (2,925 million USD) and 20.727,47 billion Kip (2,588 million USD) and represented 35.3 percent of GDP and 31.2 percent of GDP in 2011. State-owned commercial banks account for 52.1 percent of the total assets, 64.4 percent of deposits, 62.6 percent of loans in the banking sector in 2012 (see Table 1.2 below).

Table 1.2: Financial Statistics for commercial banks in Lao (as of June, 2012)

Types of Banks	Total Assets (Kip billion)	Total Assets (USD million)	Market share (%)	Total deposits (Kip billion)	Total deposits (USD million)	Market share (%)	Total loans (Kip billion)	Total loans (USD million)	Market share (%)
SOCBs (4)	23,525.55	2,937.81	52.1%	15,089.24	1,884.30	64.4%	12,967.36	1,619.33	62.6%
Private Banks (10)	7,363.88	919.58	16.3%	5,284.79	659.95	22.6%	4,225.50	527.67	20.4%
Joint Venture Banks (2)	4,130.63	515.82	9.1%	1,295.00	161.72	5.5%	1,437.94	179.57	6.9%
Branches of Foreign Banks (12)	10,149.44	1,267.43	22.5%	1,761.51	219.97	7.5%	2,096.67	261.83	10.1%
Total	45,169.50	5,640.65	100.0%	23,430.54	2,925.94	100.0%	20,727.47	2,588.39	100.0%

Source: Monetary Statistics of Bank of Lao PDR, 2012

The three largest state-owned commercial banks, namely Banque pour le Commerce Extérieur Lao (BCEL), Lao Development Bank and Agricultural Promotion Bank are almost exclusively owned by the government. Among these banks, BCEL maintains a leading position, accounting for around half of total deposits and almost 40 percent of total loans in the banking system, at the end of 2010. As of June 2012, BCEL's total loans amounted to 6,304 billion Kip (around 788 million USD) and accounted for 30 percent of total commercial bank loans. This number indicates that the size of local commercial finance is relatively limited.

Commercial banks also have limitations on their loan conditions, especially tenor and interest rates. The average interest rates for loans have decreased over the last decade from 18.8 percent in 2003 to 13 percent in 2012. However, they are still costly compared with other

currencies such as Thai Baht and US Dollars. BCEL and other commercial banks generally provide loans with the following conditions:

- Tenor of long-term loans: 3 to 5 years
- Three types of currencies: Lao Kip, Thai Baht and US Dollar
- Interest rates for loans: 11-13 percent

Table 1.3: commercial loans interest rates (effective: November 2011)

Types	Kip	Baht	USD
Short-term (1 year)	8.00-10.0%	6.75-8.50%	6.75-8.50%
Medium-term (1-5 years)	10.0-12.0%	7.75-8.75%	7.75-8.75%
Long-term (over 5 years)	11.0-13.0%	8.25-9.25%	8.25-9.25%
Interest rates for deposit			
Saving deposit	3.0%	1.0%	1.20%
Fixed deposit (5 years)	13.0%	6.50%	7.00%

Source: Banque pour le Commerce Extérieur

- Size of the loan: up to 25 percent of its capital, in accordance with the Bank of Lao regulation for commercial banks
- Security: mortgage (land and/or building), corporate finance
- Focus sector: commercial services and real estate

The Laotian banking sector has scant experience with infrastructure financing. Historically, foreign investors financed large infrastructure projects with their own sources or from overseas capital markets. Lao PDR's commercial banks have little experience in financing infrastructure projects with local investors. Such projects like roads and bridges were small in nature. The loans given in these circumstances usually offered on a corporate finance basis were around 10 million USD and had high interest rates. In addition, local commercial banks have limits on their ability to finance because of the above-mentioned regulation on loan limit. Even the biggest commercial bank, BCEL can only provide up to 30 million USD for a project, which fails to meet infrastructure financing needs. .

1.3 Donor Appetite

In general, official development assistance (ODA) to Lao has come from DAC countries and multilateral organizations. Net ODA to Lao in 2011 totaled USD 396.14 million. Net bilateral aid flows from DAC donors totaled USD 287.1 million.[16] Traditional multilateral donors have primarily been the World Bank through IDA, and the Asian Development Bank (ADB). Currently, the main bilateral donor is Japan, providing an average of USD $100 million annually, almost 50% of total bilateral assistance, mostly in grants to finance energy and transport infrastructure. China is also involved in similar major infrastructure projects, accounting for some 15% of total ODA[17]. Among the DAC donors, Australia, Korea, Germany, Switzerland and France are also major donors (see Table below).

Table 1.4: Net bilateral aid flows from DAC donors, 2009-2011(USD)

Country	2009	2010	2011	total	share
Japan	92,360,000	121,450,000	48,510,000	262,320,000	30.0%
Australia	29,610,000	32,680,000	53,930,000	116,220,000	13.3%
Korea	25,140,000	27,750,000	33,480,000	86,370,000	9.9%
Germany	27,360,000	24,800,000	24,320,000	76,480,000	8.7%
European Union institutions	25,900,000	15,950,000	22,890,000	64,740,000	7.4%
Switzerland	11,290,000	16,370,000	24,580,000	52,240,000	6.0%
France	19,090,000	14,980,000	16,840,000	50,910,000	5.8%
Other countries	55,130,000	47,890,000	62,600,000	165,620,000	18.9%
Total	285,880,000	301,870,000	287,150,000	874,900,000	100.0%

Source: World Development Indicators, World Bank

In terms of assistance to transport infrastructure, Japan, the World Bank and ADB have been the main players in the last decade. However, the assistance has been provided through grants or concessional finance. During the period of 2007-2012, these three organizations provided a total of USD 183.2 million to transport infrastructure in grants and concessional loans (see Table below). JICA provided grants for the Hinheup Bridge construction (USD 9.13 million) in 2007, the improvement of National Road No.9 (USD 32.3 million) and the expansion of the Vientiane International Airport (USD 19 million) in 2011. ADB provided loans and grants for the northern Greater Mekong Subregion (GMS) Transport Network Improvement Project (USD 54 million) in

[16] http://databank.worldbank.org/data/views/variableSelection/selectvariables.aspx?source=world-development-indicators

[17] Organization for Economic Cooperation and Development. The Thematic Study, The Developmental Effectiveness of United Aid: Evaluation of the Implementation of the Paris Declaration and the 2001 DAC Recommendation on Untying ODA to the LDCs, Lao PDR Country Study, 2009. http://www.oecd.org/development/evaluation/dcdndep/44539854.pdf

2007 and the Second Northern GMS Transport Network Improvement Project (USD 20 million) in 2010. The World Bank provided loans to a road sector project (USD 27.8 million) in 2010 and then provided additional financing to the road sector project (USD 21 million) in 2012.

Table 1.5: Grants and loans to transport infrastructure by JICA, WB and ADB, 2007-2012 (USD million)

	2007	2008	2009	2010	2011	2012	Total
JICA	9.1	0	0	0	51.3	0	60.4
World Bank	0	0	0	27.8	0	21	48.8
ADB	54	0	0	20	0	0	74.0
Total	63.1	0	0	47.8	51.3	21.0	183.2

Source: JICA, World Bank, ADB

A review of donor assistance as shown above reveals that the transport sector has not been the top priority for the donors. However, ADB and JICA have recently prioritized their assistance strategy for transport in Lao because of Lao's geographic characteristic as a land locked country in a high growth region. Improved transport networks would contribute to strengthening regional integration with its neighboring countries. Other emerging donors such as Korea and China have also provided assistance to the transport sector, however detailed information is not available.

1.4 Public-Private Partnerships (PPPs) in Lao PDR

To meet its development goals and sustain economic growth, Lao PDR needs significant investments across infrastructure sectors. Although Lao PDR has reduced its risk of debt distress, the demand for new infrastructure exceeds the government's ability to fund such projects. Mega-projects such as the planned Lao-China high-speed railway have raised concerns about the sustainability of government debt. The railway, projected to cost 7 USD billion, will be fully funded by public resources.[18] The rail project, valued at over 80% of Lao PDR's GDP in 2011, will severely limit the fiscal space available to support other transportation and infrastructure projects. Therefore, the government will have to look to private sector and arrangements like public private partnerships (PPPs) to fund the transport infrastructure necessary to achieve its "land-linked" goal. Lao PDR has some experience implementing public-private partnerships (PPPs), with 16 projects reaching financial close between 1993 and 2011. The energy sector reaped the benefits of the majority of these investments. Specifically, the country saw the development of a large number of hydropower plants that provide or will

[18] http://jclao.com/laos-china-rail-project-goes-full-steam-ahead/

provide power for export to neighboring countries. These export deals generate a stable revenue source, which along with support from development agencies and international finance institutions, enabled mega-projects such as the 1,070MW Nam Theun 2 (NT2) to reach financial close. NT2 follows Nam Ngum 1 (150 MW), commissioned between 1971 and 1984, and Theun Hinboun (210 MW), commissioned in 1998 as the third dam primarily built to serve the Thai market. [19]

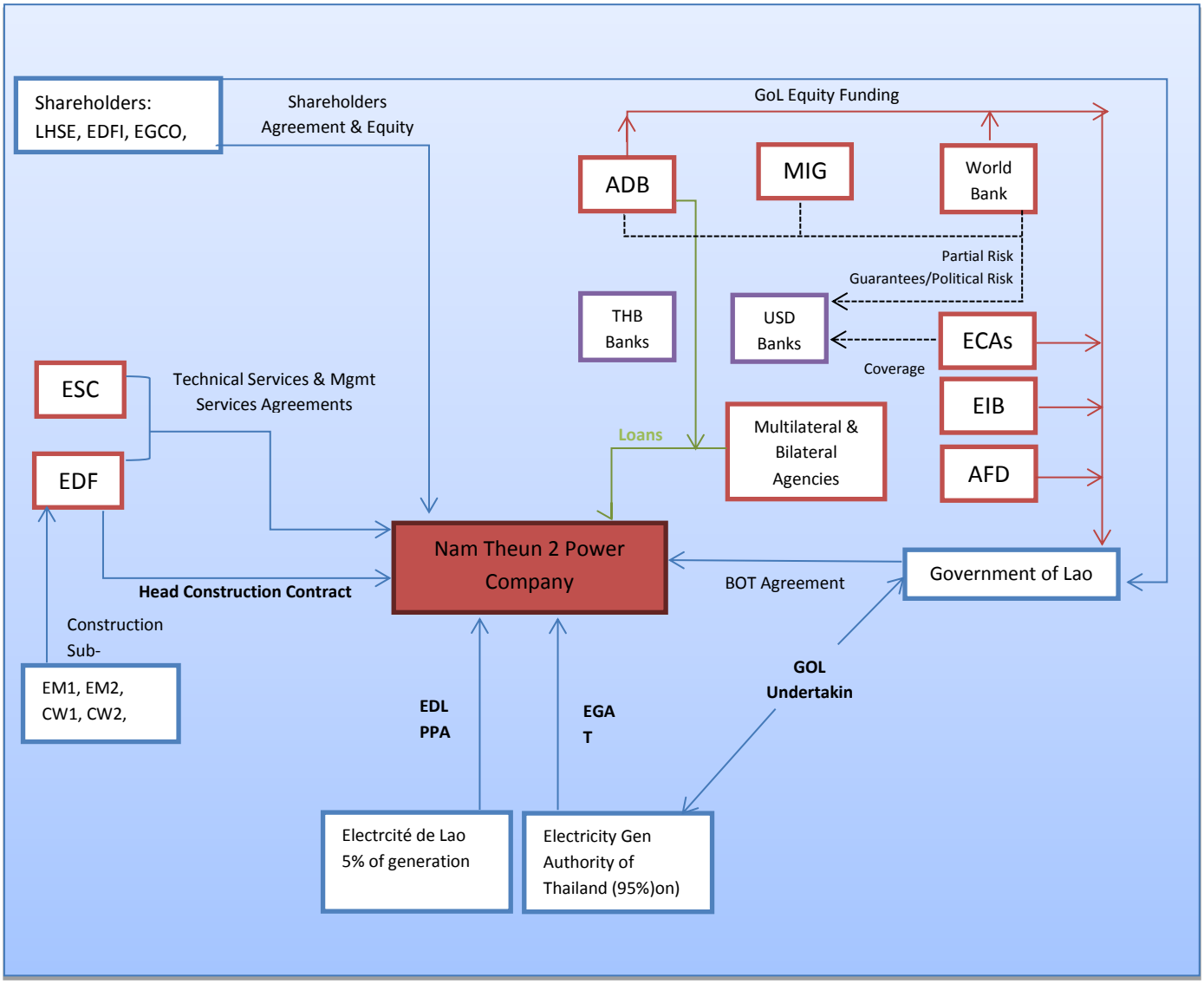
Preparation of the 1.45 USD billion NT2 project in Lao PDR represented an important milestone for the government, the developers, international partners, and other stakeholders. In the early stages of project planning, developers sought financing from commercial banks. Yet due to risks associated with dam construction and uncertainties about the political commitment and governance capacity in Lao PDR, few banks would consider financing requests without some sort of guarantee from an international finance institution.[20] Almost a decade later in 2005, with a view that NT2 as a large infrastructure project could create growth and reduce poverty in Lao PDR, the World Bank alongside the Asian Development Bank (ADB), Agence Francaise de Developpement (AFD), the European Investment Bank (EIB), the Nordic Investment Bank and other private financiers reached an agreement to finance NT2.[21] To date, NT2 represents the largest foreign investment in Lao PDR. It is also the world's largest cross border power project financing, the largest private sector hydroelectric project financing, and one of the largest internationally financed IPPs (Independent Power Producer) in Asia since the 1997 financial crisis.[22]

It was built and operated by the Nam Theun 2 Power Company (NTPC), a special purpose company. NTPC is 35% owned by the Electricité de France (EDF), 25% by the Electricity Generating Public of Thailand (EGCO), 25% by the Government of Lao and 15% by the Italian Thai Development Public Company Ltd.

[19] Porter, Ian C. and Shivakumar, Jayasankar. *Doing a Dam Better: The Lao People's Democratic Republic and the Story of Nam Theun 2*. 2011 International Bank for Reconstruction and Development.
[20] Porter, Ian C. and Shivakumar, Jayasankar. *Doing a Dam Better: The Lao People's Democratic Republic and the Story of Nam Theun 2*. 2011 International Bank for Reconstruction and Development.
[21] Ibid
[22] Project Finance and Guarantees Group. "IDA Guarantee Paves Renewed Interest in Private Hydropower – the Nam Theun 2 Project. June 2005. The World Bank

Commercial operation for NT2 started in March of 2010. With a generation capacity of 1,070 MW, contract arrangements stipulate that NT2 export about 995 MW to Thailand and retain 75 MW for Electricité du Lao (EDL) for domestic consumption.[23]

Figure 1.1: Nam Theun 2 Contractual Structure



While private investment in hydropower and other energy projects has grown, only two transportation projects have reached financial close: the Tha Ngone Bridge project and a management contract for the Vientiane Airport.

[23] Porter, Ian C. and Shivakumar, Jayasankar. *Doing a Dam Better: The Lao People's Democratic Republic and the Story of Nam Theun 2*. 2011 International Bank for Reconstruction and Development.

Tha Ngone Bridge opened to traffic in 1995. Originally conceived as a 50/50 4.2 USD million joint venture between the Government of Lao PDR and Transfield, an Australian company, it held a concession period of 15 years. Australia's Export Finance and Insurance Corporation provided debt finance.[24] Soon after the Tha Ngone Bridge opening, Lao's economy began to feel the tremors of the Asian Financial Crisis. As a result, currency exchange fluctuation started to deteriorate the Tha Ngone joint venture. Tolls collected in the deeply depreciated Lao Kip fell short of the anticipated USD revenue forecasts and failed to provide sufficient revenue to service the debt and generate the projected Investment Rate of Return (IRR). Transfield asked the Laotian government to increase the toll price to meet revenue expectations, though political realities prevented them from complying.

A year later, with the threat of negative private sector sentiments growing and spilling into the hydro sector, the two parties achieved a settlement. In a contract buyout the Lao government agreed to compensate Transfield for its equity in the project and the full projected IRR over the contracted ten-year concession period. The concession was taken over by Banque pour le Commerce Extérieur Lao (BCEL).[25]

In 2008, the Bank of Lao PDR bought the debt from BCEL and has since operated the toll bridge, under a concession expected to expire in 2017. Currently toll revenue is about 4.5 billion Kip (or about USD 562,000) per year. The original bridge construction cost was about 4.1 USD million, with a design life of 100 years. It is therefore highly likely that Bank of Lao will (or has) recovered its investment cost from the buy-out of Transfield; however, the early years of this concession did not go as smoothly as perhaps originally envisioned.

The Laotian government likely did not expect to buy out Transfield – the private sector operator in this joint venture. It seems that when negotiating the original joint venture, the Laotian government failed to adequately account for demand risk, perhaps overstating demand, something not uncommon in transport projects.[26] Likewise the government seemed unprepared to deal with the extreme currency fluctuation that occurred during the Asian Financial Crisis. It seems likely that no hedging type arrangements were used to shield the Laotian government

[24] Wyatt, Andrew B. Privatization of Public Infrastructure in Transitional Southeast Asian Economies: The Case of Build Own Operate Transfer projects in Vietnam and Laos.
[25] Ibid
[26] World Economic Forum. Strategic Infrastructure Steps to Prepare and Accelerate Public-Private Partnerships: 2.1 Demand Forecasting. May 2013

from the currency risk inherent in a toll road operation that collected payments in Lao Kip and paid the private sector operator in USD. Whatever the particulars of the joint venture contract, once the collected tolls failed to meet the projected revenues, the Laotian government, in relatively short order, was forced to shoulder the entire burden of the Tha Ngone Bridge. This was not the original plan.

The management contract for the international terminal at the Vientiane Airport achieved more success than the Tha Ngone Bridge project. JAL Trading and Tomen Corporation and the Laotian government formed a joint-venture company called Lao-Japan Airport Terminal Services, to undertake the management contract for a period of 10 years.[27]

The government holds a 51% stake in this company, while JAL Trading and Tomen Corp. equally share the remaining 49% stake. The new facility has 11,973 square meters with a capacity to serve 800 passengers per hour. Operation of the terminal began in 2000.[28]

The project initially required capital investment of 1.5 USD million, though required 3 USD million in 2009. Before the contract's expiry, it was extended, though it is unclear for how long. As of March 2011, the project remained operational. [29] Furthermore in 2011 the Japanese government committed an additional 23.5 USD million to expand the Vientiane International Airport to handle increasing passenger loads (expected to 1.5 million per day by 2016) and to come into compliance with international standards.[30]

Thus far, this arrangement whereby Lao-Japan Airport Terminal Services Co., Ltd (J-LATS) operates and manages the Vientiane International Passenger Terminal has worked well. This management contract however, is a very light form of PPP, as the private sector has taken on minimal risk. The government owns the airport and presumably dictates investment decisions. Furthermore, under this type of arrangement, the government bears little commercial risk. In this case though, less Laotian capital is on the line, as the money provided to build the terminal and expand it came via development aid from the Japanese government.

[27] PPI database
[28] Ibid
[29] Ibid
[30] http://www.jica.go.jp/laos/english/office/topics/111209.html

To date, Lao has had limited experience and mixed results with PPP arrangements in sectors other than hydropower. The two transport PPPs – the Tha Ngone Bridge and Vientiane Airport – were relatively small and uncomplicated. Even still, the Tha Ngone Bridge project, which could have classified as a Build Operate Transfer (BOT) project, where the private sector assumes more risks, did not meet original expectations. The private sector withdrew from the project all together. The management contract governing the Vientiane Airport International Terminal has performed well, yet the contract structure transfers little risk to the private sector and JICA provided grant financing for much of the capital costs. In the hydropower sector, Lao has used more complicated PPP structures that involved a fair degree of risk transfer to the private sector. However, these projects had certain revenue streams as well as in the case of Nam Theun 2, a lot of external help in terms of financing and guarantees from the donor agencies.

1.5 Transport Infrastructure in Lao PDR

Lao PDR will require improved infrastructure services to sustain its rapid GDP growth, diversify the economy, strengthen regional trade links, and reduce rural poverty. In particular, with one of the lowest population densities in East Asia, a large rural populace, and a mountainous topography, a strong transportation network is crucial to achieving these goals. [31]

1.5.1 Transport Infrastructure Needs

In light of the country's land-locked location and emphasizing the importance of regional integration as a key to economic development, the Laotian government has explicitly stated in its development strategy that it aims to transition from a "land-locked" to a "land-linked" country. Located at the heart of many GMS economic and transport corridors, the country faces both an opportunity and a challenge to benefit from the activities along the corridors, while managing the risks associated with cross border movement of people, goods and services.[32]

An improved road network would move the country one step closer to achieving its land-linked vision. Investments in Lao PDR's road network over the past decade have improved the transportation system but have not kept pace with the demand. While the road network's total length more than tripled from 1975 to 2005 and freight shipments by land increased by more

[31] The World Bank. Country Partnership Strategy: Lao People's Democratic Republic for the Period FY 12 – FY 16. January 25, 2012

[32] The World Bank. Country Partnership Strategy: Lao People's Democratic Republic for the Period FY 12 – FY 16. January 25, 2012

than 400% in the same period, [33] the existing network faces significant challenges from natural disasters such as landslides and flooding, with over 40% of villages lacking access to all-weather roads. [34] Approximately half of Lao PDR's roads are unpaved, which hinders the flow of trade and the ability to transport agricultural products to markets.

1.5.2 Highway Construction in Lao and Sector Governance

The implementation of road maintenance, upgrading, and construction contracts in Lao PDR is primarily the responsibility of the provincial Departments of Public Works and Transport (DPWT). At the national level, the Ministry of Public Works and Transport (MoPWT) is responsible for the overall planning of the road network and overseeing the provincial DPWTs. In addition to procuring and supervising the contracts for local and provincial roads, DPWTs oversee works on national roads in their jurisdictions for the MoPWT. Following the government's adoption of decentralization policies over the past decade, the direct implementation and supervision of contracts by the MoPWT has become an exception that applies only to large road projects for national highways that affect multiple provinces.

1.5.3 Procurement in the Lao PDR Transport Sector

There are noticeable differences in the procurement of construction services for road projects depending on the level of government responsible for the contract and how the project is financed. The MoPWT typically uses international competitive bidding processes for major national road projects and the majority of these contracts are won by firms from China, Thailand, and Vietnam. Donor-financed contracts managed by the provincial DPWTs are procured under the national competitive bidding process, while government-financed contracts are awarded to local firms through direct contracting. Projects procured by provincial governments under either of these methods are often found to be of low quality for the price paid, indicating that the processes may not be competitive in practice. Anecdotes from observers suggest that collusion between bidders and government officials commonly occurs and that many bids are submitted just below the projects' cost estimates, suggesting bidders have knowledge of these estimates during the bidding process.

[33] Oraboune, S. (2008), 'Infrastructure Development in Lao PDR', in Kumar, N. (ed.), International Infrastructure Development in East Asia – Towards Balanced Regional Development and Integration, ERIA Research Project Report 2007-2, Chiba: IDE-JETRO, p. 170

[34] The World Bank. Country Partnership Strategy: Lao People's Democratic Republic for the Period FY 12 – FY 16. January 25, 2012

Provincial DPWTs also directly contract firms for road projects financed by land-for-capital mechanisms and reimbursable contracts. Under these arrangements the contractor must secure the initial financing for the construction phase, either from private banks, state-owned enterprises, or the Central Bank, and is reimbursed by the provincial government upon completion of the project. In land-for-capital deals the provincial government purchases land adjacent to the planned road at below market prices and sells it once the road project is complete, using the subsequent increase in land value to repay the contractor. These arrangements allow the provincial governments to circumvent the budget priorities defined by the central government yet can create future liabilities for the government by promising to pay for services at a later date. Projects funded through land-for-capital mechanisms or on a reimbursable basis are more expensive than donor or government-financed roads, as contractors charge a premium for financing the project in advance of payment.

Tight budget constraints and low levels of funding for local roads appear to be the primary reason provincial governments engage in these procurement methods. Although the central government shifted a large portion of the implementation and oversight responsibilities to the DPWTs through decentralization, only one-third of current funding is allocated to the DPWTs, while the remaining two-thirds are controlled by the MoPWT. This allocation is not typically sufficient for the provincial governments to meet their responsibilities and often forces DPWTs to choose between several priority projects in a given year. Evidence suggests that the DPWTs frequently do not receive their full budget allocation, leading to cancelled or scaled back spending midway through the fiscal year.

1.5.4 Sector Capacity

Lao PDR's road construction industry is characterized by a large number of firms of varying size and capacity. A review of recently procured road projects in three provinces shows a fragmented sector, with a large number of contractors each implementing 1-3 contracts. Of the three provinces surveyed, Vientiane Capital has the largest number of projects (22), which were divided among 20 different contractors. Vientiane Province has nine contracts tendered to eight contractors, while Borikhamxai Province has seven contracts with six contractors. The majority of these contracts cover short distances, with 64% of the contracts awarded for distances of less than 20km. Only three of the contracts awarded cover more than 50km. The contracts tendered in the three provinces have an overall value of 923.6 USD million, with contract size

ranging from approximately 2.8 USD million to 174.3 USD million. Additional details of the review can be found in Annex A.

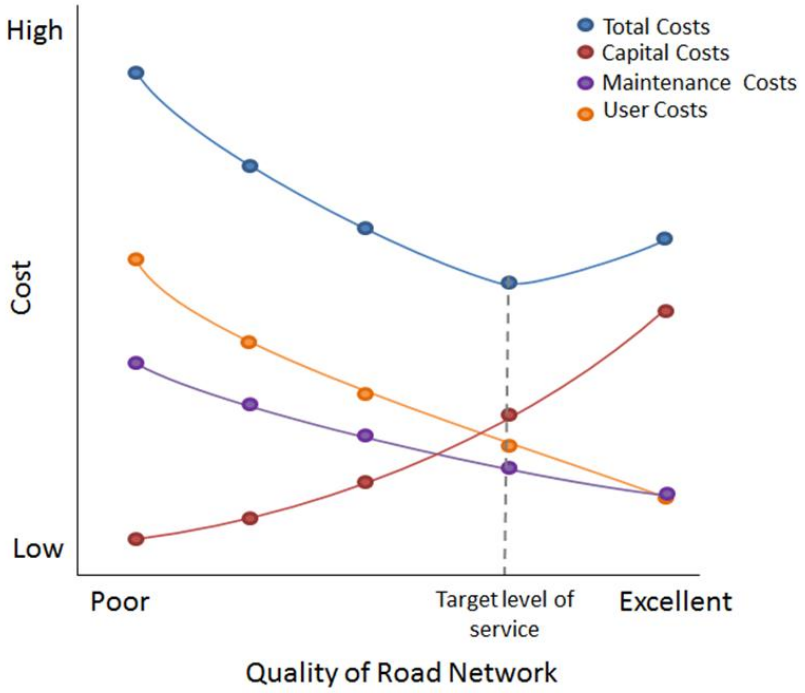
1.5.5 Maintenance

Regular road maintenance is critical to the sustainability of road assets over the long-term. Failing to conduct routine maintenance reduces the lifespan of the asset and will cause the road to fall into disrepair. Rehabilitating or reconstructing a severely damaged road is much more expensive than routine maintenance, and has been estimated to cost six times more than maintenance after three years of neglect, rising to 18 times the cost after five years. Regular maintenance ensures the economic benefits of the road network persist throughout the asset's expected lifespan.

In addition to reducing rehabilitation costs for the government, regular maintenance also minimizes ongoing costs for the users. Poorly-maintained roads cause damage to vehicles and increase safety risks for drivers. Journey times will increase if the road is sufficiently deteriorated, as drivers will be forced to travel at lower speeds, reducing the economic benefits provided by the road.

Routine maintenance, however, does have costs for the government (materials and labor) and users (delayed journey times during periods of maintenance). The optimal level of maintenance is one that minimizes costs while maximizing benefits. Figure 1 below demonstrates the tradeoffs to providing a continuous level of service while minimizing the costs to all parties. Achieving the target level of service requires ongoing maintenance, in addition to the initial capital investment. Failing to conduct routine maintenance will reduce the quality of the road asset, shifting the level of service to the left. Total costs will rise as this occurs, with maintenance and user costs increasing rapidly as the asset deteriorates.

Figure 1.2: Optimizing Highway Costs and Service Levels



At the national level, the Laotian government has recognized the importance of routine maintenance for existing road assets. The government established the Road Maintenance Fund (RMF) in 2001 to fund ongoing maintenance needs. Overseen by an advisory board, RMF consists of representatives from the public and private sectors, as well as appointed members of the general public. Funded primarily through a fuel surcharge, RMF had annual revenues of 23 USD million in 2010, enough to cover 40% of the annual maintenance needs of the country. The balance of the fund is expected to increase due to an increased demand for fuel and the government raising the fuel surcharge.

The National Transport Strategy 2009-2015 prioritizes maintenance and the Laotian government has worked with donors to address the sustainability of its road network. The World Bank is currently funding a project in Lao PDR to perform routine maintenance and rehabilitation on selected national and provincial roads, as well as build the capacity of the MoPWT and DPWTs to plan future maintenance programs. Previously the World Bank, along with the Swedish International Development Cooperation Agency, Nordic Development Fund, Asian Development Bank, Australian Agency for International Development, and Government of Japan, financed two road maintenance programs for Lao PDR. The availability of donor funds,

however, has been uncertain and has been reduced significantly during past economic downturns. Moreover, the rapid increase in the RMF's annual revenues has reduced the funding gap for road maintenance that has historically been filled by donor funds.

Nevertheless, the maintenance financing gap continues to persist at the provincial level. The RMF is not yet sufficient to finance all routine maintenance and the funds are prioritized for national highways. In 2010 the RMF funded 80% of the maintenance needs of these highways but only 10% of the ongoing maintenance needed on provincial and local roads. The problem is compounded when DPWTs do not receive their full budget allocation and are forced to choose between funding maintenance and constructing new roads. Political priorities usually result in financing new road projects, leaving existing assets to deteriorate further.

Lao PDR's road network faces several challenges that will increase the demand for maintenance in the coming years. The country's rapid economic growth has led to heavier traffic volumes, increasing the need for ongoing repairs to ensure the quality of the road network. Trade growth within the GMS region is forecast to continue, placing additional demands on existing infrastructure while also increasing the need for new road assets. Lao PDR's road network is also susceptible to damage from natural disasters, which are becoming increasingly severe as a result of climate change. Two typhoons hit the country in 2011, causing extensive damage to the road network. Emergency repairs from these types of disasters place additional demands on the limited resources available for the sector.

Summary

Lao PDR is well-poised to benefit from the rapidly growing Greater Mekong Subregion. A robust transport network, in addition to improvements in other infrastructure sectors, will help to ensure that Lao profits from increased trade with its fast growing neighbors like China and Vietnam. To achieve such a strong transport network and thus work towards achieving the country's land-linked vision, Lao PDR should prioritize best practice in road maintenance as well as look into public-private partnership contract structures as a way of inviting private sector investment to the sector.

The country has had some mixed experiences using PPP structures to build and finance infrastructure, most notably and successfully in the hydropower sector with Nam Theun 2 and other giant dams. Learning from these experiences and instituting procurement best practice will

enable the country to select the most suitable PPP structure, given the project needs, the availability of private finance and the country's broader economic situation.

Part II: Piloting a PPP Approach on the 13N and 13S Upgrade Projects

Part II: Piloting a PPP Approach on the 13N and 13S Upgrade Projects

2. 1 Prioritizing Investment on Key Corridors

Lao PDR faces increasing demand for its road network with increased trade within the GMS region and greater motorization within the country. This trend is expected to continue, with investments in the road sector critical to achieving the government's land-linked strategy. To meet its overall funding needs, Lao PDR's road and bridge network requires an estimated 1.13 USD billion in investment in the next decade.[35] In the five years from fiscal 2005-2010, however, the government's total expenditure in the transport sector only reached 130.5 USD million.[36] During this period international donors contributed an additional 312.2 USD million in investments to the sector.[37] Given these limited resources, the government must prioritize road projects that receive public investment and encourage greater private investment in the road network, not only in new construction but also in maintenance.

As the backbone of Lao PDR's road network, National Route 13 (NR13) is a priority corridor critical to achieving the government's land-liked vision. Stretching from the Chinese border in the north to the Cambodian border in the south, the road runs through the capital city of Vientiane and is the most heavily traveled route in the country. The highway connects Lao PDR to major trading partners within the GMS region and the majority of goods travel across this route.

This part of the report uses the following sections of NR13 as the basis for analyzing whether a PPP approach to upgrading and rehabilitating this key highway could be piloted:

- 13N (section between Vientiane and Vang Vieng)
- 13S (section between Vientiane and Paksan)

The analysis incorporates a traffic and revenue study, cost analysis and financial analysis of different PPP options.

[35] Queiroz, Ceasar. Project Pipeline Screening and Initial Feasibility Assessment of Potential Road Infrastructure PPPs in Lao PDR. Prepared for PPIAF. p. 1
[36] Data provided by the MoWPT, includes investments in water way and erosion prevention projects
[37] Data provided by the MoWPT

2.1.1 The 13N and 13S Corridors

The 13 North (13N) and 13 South (13S) are sections of NR13 that stretch approximately 150km north and south of Vientiane, respectively. Figure 2.1 below illustrates the location of these two corridors.

The 13N, which runs from Vientaine to Vang Vieng, is a single lane carriageway that carries both local and long distance traffic. There is a relatively concentrated population along this section of NR13, unlike the low population densities that characterize most of the country. In addition to trade and local traffic, the route is also popular with tourists visiting Vang Vieng. 13N runs through a relatively flat plain area, with some gentle hills up to Phônhông. After this section, the topography becomes much more mountainous, making journeys along the northern sections more difficult.

The 13S runs from Vientiane to Paksan and is predominately a single lane carriageway that carries both local and long-distance traffic. Population densities are generally lower than on 13N but traffic flows are generally higher as the highway links the wider Mekong region and the commercial center of Vientiane. The topography of the road is generally flat and the majority of the alignment meanders along the Mekong River.

Figure 2.1: Location of Project Road

2.2 Traffic Forecasting and Analysis

Traffic volumes carried by the NR13 in future years will be determined by a combination of complex factors. These will include the overall level and pattern of trips in the corridors, the time and cost savings that the NR13 provides compared to alternative routes, the cost of using NR13 and the willingness and ability of people to pay that cost. For this purpose, a traffic and revenue study has been carried out for the NR13. The full details of the study are contained in Annex B and a summary of the approach and findings is provided below.

2.2.2 Traffic Data Collection

Four types of Traffic Surveys were undertaken on NR13 in March/April/May 2013 by Lao-Asie Consultants Group:

- Manual Classified Counts at 8 locations
- Classified Turning Count at km21
- Roadside Interview Surveys at 4 locations (2903 interviews)
- Travel Time Surveys

All surveys were undertaken successfully. They provided valuable information relating to the vehicle composition, daily traffic volumes, origin-destinations, trip purpose, trip frequency, trip length and the willingness to pay a toll of existing drivers using the NR13.

The highest volumes of traffic were observed at km13 Don Noun on NR13 South (20,400 AADT). Traffic volumes decline to around 13,000 AADT at km21 then to around 4,000 AADT at Palai and towards Paksan. The highest volumes of traffic on the NR13 North were counted at km19 (14,000 AADT). Traffic declines to around 7,000 AADT south of Phônhông, around 3,000 AADT at Hinheup bridge and increases towards Vang Viang (6,000 AADT).

2.2.3 Traffic Capture Model

A Traffic Capture Model was constructed to provide traffic and revenue forecasts by vehicle category for NR13 between 2013 and 2050. The traffic data collected in March/April/May 2013 on the NR13 formed the basis of the model. Road network distances and travel times were collated for all strategic roads in the study area. The model incorporates an exponential (logit) function to predict the assignment of traffic on the road network according to the total cost of trips. Behavioral parameters such as drivers' values of time and motorway bonus were determined from benchmarking with other studies. Vehicle Operating Costs were based on the

cost of fuel per liter in Lao. The model has been used to test the impact of changing toll levels, willingness to pay and traffic growth rates on the traffic and revenue forecasts for NR13.

2.2.4 Traffic Growth

Vehicle registration data has been kindly provided by the Ministry of Public Works and Transport (MoPWT). The average annual growth of all vehicle types in the three Provinces of Vientiane Capital, Vientiane Province and Borikhamxai Province has been extremely high by international standards at 15% per annum between 2000 and 2012. The proportion of motorcycles in the total registered vehicles (70%) is also extremely high by international standards. As economic growth continues and car ownership becomes more widespread, the proportion of motorcycles is expected to decline. Another indication of the recent economic growth is the relatively high growth of registered commercial vans.

Regression analysis has been undertaken with the vehicle registration data against historic economic growth in order to develop a relationship that can be extrapolated to predict the future growth of traffic. Strong regression relationships were determined between economic growth and vehicle registration growth for Vientiane Capital. The traffic growth multiplier with GDP is assumed to decline over time as car ownership and the economy of Lao develops. By 2040 the growth of cars, jeeps, taxis, pick-ups, Light Goods Vehicles (LGV) and Heavy Goods Vehicles (HGV) is assumed to be at parity with GDP growth. Motorcycle growth was assumed to decline over time as car ownership increases.

2.2.5 Illustrative Toll Strategy

An illustrative toll strategy has been designed to indicate the potential toll revenue that could be collected from NR13. Three potential toll plazas locations have been identified on 13N and 13S. Illustrative toll tariffs have been based on an average toll of 300 Kip/km for Class 2 vehicles (cars, jeeps, taxis and pick-ups). The tariff charged to motorcycles has been set at 50% of the toll charged for cars, jeeps, taxis and pick-ups. The tariffs charged for Light Goods Vehicles and Heavy Goods Vehicles has been set at 1.5 and 3 times the Class 2 tariff (car, jeep, taxis and pick-up). These multiples of the Class 2 tariff for LGV and HGV are consistent with international practice.

2.2.6 Traffic and Revenue Forecasts

With the continuation of strong economic growth in Lao, traffic on NR13 is predicted to increase significantly. The following table presents total traffic forecasts for 13N and 13S assuming no

upgrading and without tolls (Do-Minimum) at the locations where traffic counts were undertaken in 2013 for key forecast years until 2050.

Table 2.1: Do-Minimum Total Traffic Forecasts (AADT)

13S	Km13	Km22.5	Km89	Km139
2013	20,400	11,300	4,100	3,600
2015	27,100	15,100	5,500	4,800
2020	40,600	23,200	8,800	7,800
2030	53,100	32,800	13,600	12,300
2040	62,400	40,200	17,500	16,000
2050	72,200	47,600	21,100	19,500
13N	**Km19**	**Km67**	**Km93**	**Km146**
2013	14,300	7,400	2,900	6,100
2015	19,200	9,800	3,800	8,200
2020	29,600	15,000	5,800	12,500
2030	41,900	20,900	8,100	17,600
2040	51,400	25,400	9,900	21,600
2050	60,800	29,900	11,700	25,500

Source: PPIAF Estimates

The Do-Something traffic and revenue forecasts assume that the NR13 will be upgraded and tolled at the locations and tariffs indicated in the illustrative toll strategy. The traffic forecasts for the illustrative toll strategy are provided for the 13N and 13S separately in the following table.

Table 2.2: Do-Something Traffic Forecasts (AADT)

13S	Km22.5 (TP1)	Km89 (TP2)	Km139 (TP3)
2015	12,000	4,700	3,100
2020	18,700	7,600	5,100
2030	27,200	12,000	8,500
2040	33,900	15,600	11,400
2050	40,400	18,900	13,900
13N	**Km19 (TP4)**	**Km67 (TP5)**	**Km93 (TP6)**
2015	10,900	4,200	2,600
2020	17,100	6,800	4,000
2030	25,400	11,000	5,600
2040	32,000	14,400	6,900
2050	38,300	17,500	8,100

Source: PPIAF Estimates, TP=Toll Plaza

The revenue forecasts for the illustrative toll strategy are provided for 13N and 13S separately in the following table.

Table 2.3: Do-Something Annual Revenue Forecasts (Kip billion/USD million at 2013 prices)

Forecast Year	Kip billion			USD million		
	13N	13S	Total	13N	13S	Total
2015	65.53	88.74	154.28	8.74	11.83	20.57
2020	107.95	145.73	253.68	14.39	19.43	33.82
2030	179.05	245.41	424.46	23.87	32.72	56.59
2040	237.65	328.72	566.37	31.69	43.83	75.52
2050	291.43	405.23	696.66	38.86	54.03	92.89

Indicative annual revenues of 154.28 Kip billion (20.57 USD million) are estimated in 2015 rising to 700 Kip billion (93 USD million) in 2050 based on the illustrative toll strategy and assumed traffic growth. Around 58% of the total revenues are forecast to be collected from the 13S toll plazas.

2.2.7 Sensitivity Tests

Sensitivity tests have been undertaken on the Do-Something traffic and revenue forecasts to assess the impact of lower and higher toll tariffs, values of time and traffic growth.

Because relatively few attractive alternative routes exist around the illustrative toll plaza locations, higher toll tariffs are forecast to result in higher toll revenue (and vice versa). Traffic levels are not very sensitive to toll tariffs (because few alternative routes exist). The final toll tariff should be based on public acceptance and affordability.

The Low and High Cases can be used to define the 'envelope of uncertainty' around the Central (Base) Case forecasts for alternative outcomes of drivers' values of time and annual traffic growth. The Low and High Case forecasts range -/+9% around the Base Case forecasts in 2015. Due to the compounding nature of the traffic growth assumptions, by 2050 the Low and High Case forecasts range between -34%/+50% around the Base Case forecasts respectively. The forecasting assumptions regarding future traffic growth therefore exert a significant influence on the forecasts of traffic and revenue for the NR13.

2. 3 Project Description and Cost Estimations

2.3.1 Specifying Corridor Improvements

The Do-Minimum traffic forecasts (with a design year of 2040) have been used to specify the required lane geometry for the proposed upgrades to the 13N and 13S highways. Maximum peak-hour Do-Minimum traffic flows were compared against a capacity value of 2,200 passenger car units per hour per lane (pcu/h/ln)[38] to obtain vehicle to capacity ratios for the various sections of the two highways. The capacity value of 2,200 pcu/h/ln will accommodate traffic at a free flow speed of 60 mph (or 95 kph) and therefore high quality service levels should be achievable throughout a typical day provided that traffic flows are below this capacity value (i.e. the vehicle to capacity ratios is less than 100%). Using this approach, the lane geometry specifications outlined in Table 2.4 were deemed appropriate for the various sections of the highways.

Table 2.4: Proposed Upgrade Specifications for the 13N and 13S Projects

	Existing Lane Configuration	Vehicle: Capacity Ratio[39]	Proposed Lane Configuration	Vehicle: Capacity Ratio [40]
13N				
Section 1 - Road 450 to Phônmouang	2 lanes (1x1)	217%	4 lanes (2x2)	95%
Section 2 - Phônmouang to Phônhông	2 lanes (1x1)	76%	4 lanes (2x2)	38%
Section 3 - Phônhông to Vang Vieng	2 lanes (1x1)	62%	2 lanes (1x1)	62%
13S				
Section 1 - Vientiane to km21	4 lanes (2x2)	131%	6 lanes (3x3)	87%
Section 2 – km21 to Naxay	2 lanes (1x1)	137%	4 lanes (2x2)	69%
Section 3 - Naxay to Paksan	2 lanes (1x1)	53%	4 lanes (2x2)	26%

The 13N section between Phônhông and Vang Vieng was assumed to not be widened and instead only minor safety improvements have been assumed. This decision was taken due to both the low forecast traffic flows and the challenging topography of the section (i.e.

[38] Transport Research Board: National Research Council, *Highway Capacity Manual (Section 12-3)*, 2000
[39] Based on maximum peak-hour Do-Minimum traffic flows for 2040
[40] Based on maximum peak-hour Do-Minimum traffic flows for 2040

mountainous terrain). There is unlikely to be the need for additional capacity for this section and therefore it would be very difficult to justify the large additional costs of providing it.

The upgraded roads are assumed to follow MoPWT design standards whereby a typical 4 lane-road (2+2) has a carriageway width of 18 meters, including 3.4m lanes and 1m shoulders and median. The proposed specifications should provide very high service levels for all sections.

2.3.2 Construction Costs

Construction costs for the proposed upgrading have been calculated by Lao-Asie Consultants Group (LACG) and their detailed report is contained in Annex C. For both the 13N and 13S, LACG made a bill of quantities and unit cost assessment for improving the roads to both a four-lane (2+2) highway and an eight-lane (4+4) highway using either asphalt or concrete surfacing. This analysis was subsequently used to estimate capital costs for the proposed upgrade projects.

Table 2.5: Construction Costs for the 13N and 13S Upgrades (Kip billion – 2013 Prices)

	Proposed Lane Configuration	Distance (KM)	Construction Cost : Asphalt - Kip billion	Construction Cost: Concrete - Kip billion
13N				
Section 1 - Road 450 to Phôngmouang	4 lanes (2x2)	22	340	641
Section 2 - Phômouang to Phônhông	4 lanes (2x2)	34	535	1008
Section 3 - Phônhông to Vang Vieng	2 lanes (1x1) – safety improvements only	80	8	8
Total 13N		**136**	**883**	**1,658**
13S				
Section 1 - Vientiane to km21	6 lanes (3x3)	26	475	417
Section 2 – km21 to Naxay	4 lanes (2x2)	26	482	847
Section 3 - Naxay to Paksan	4 lanes (2x2)	79	1380	2492
Total 13S		**131**	**2,337**	**3,755**

The construction costs estimated here are only indicative in nature and require significant revision during a full feasibility study when a more detailed assessment will be carried out.

2.3.3 Operating and Maintenance Costs

LACG also calculated operations and maintenance costs. Details of their methodology can be found in Appendix C. Operating and maintenance costs have been estimated at 22 billion Kip per annum and 30 billion Kip per annum respectively (2013 prices)

2. 4 PPP Options Analysis

In order to make the outlined upgrades to NR13, the Government of Lao should consider using a public-private partnership structure, as it could enable more private sector participation and transfer key risks to the private sector, particularly operating and maintenance risks. The following section provides an overview of the varying PPP structures and we evaluate their relative merits against the situation in Lao PDR.

2.4.1. Overview of PPPs

PPPs "cover a wide range of innovative contracting, project delivery and financing arrangements;" thus, no single, internationally-accepted definition exists. [41] Furthermore, different countries have adopted different definitions as their PPP programs evolved. Nonetheless, these definitions center on a common understanding of a PPP as a:

> *…long-term contract between a government and a private entity for the provision of a public asset or service, in which the private party bears significant risk and management responsibility*.[42]

Many forms of PPPs are used in infrastructure provision, though the most important aspect to forming a PPP from a public policy perspective centers on sharing risks and responsibilities between the private and public sectors.[43] Take two fictional transport PPPs as an illustration of this concept. A simple form of a transport PPP arrangement with minimal private sector engagement and thus, minimal risk borne by the private sector, could involve contracting out individual operations such as design, paving or maintenance of a highway. On the other end of the private sector engagement spectrum, a government could opt to use the "Design Build Finance Operate Manage (DBOM)" model to construct a highway. In this case, the government

[41] Rall, Jaime et al. *Public-Private Partnerships for Transportation: A Toolkit for Legislators*. National Conference of State Legislators. October 2010

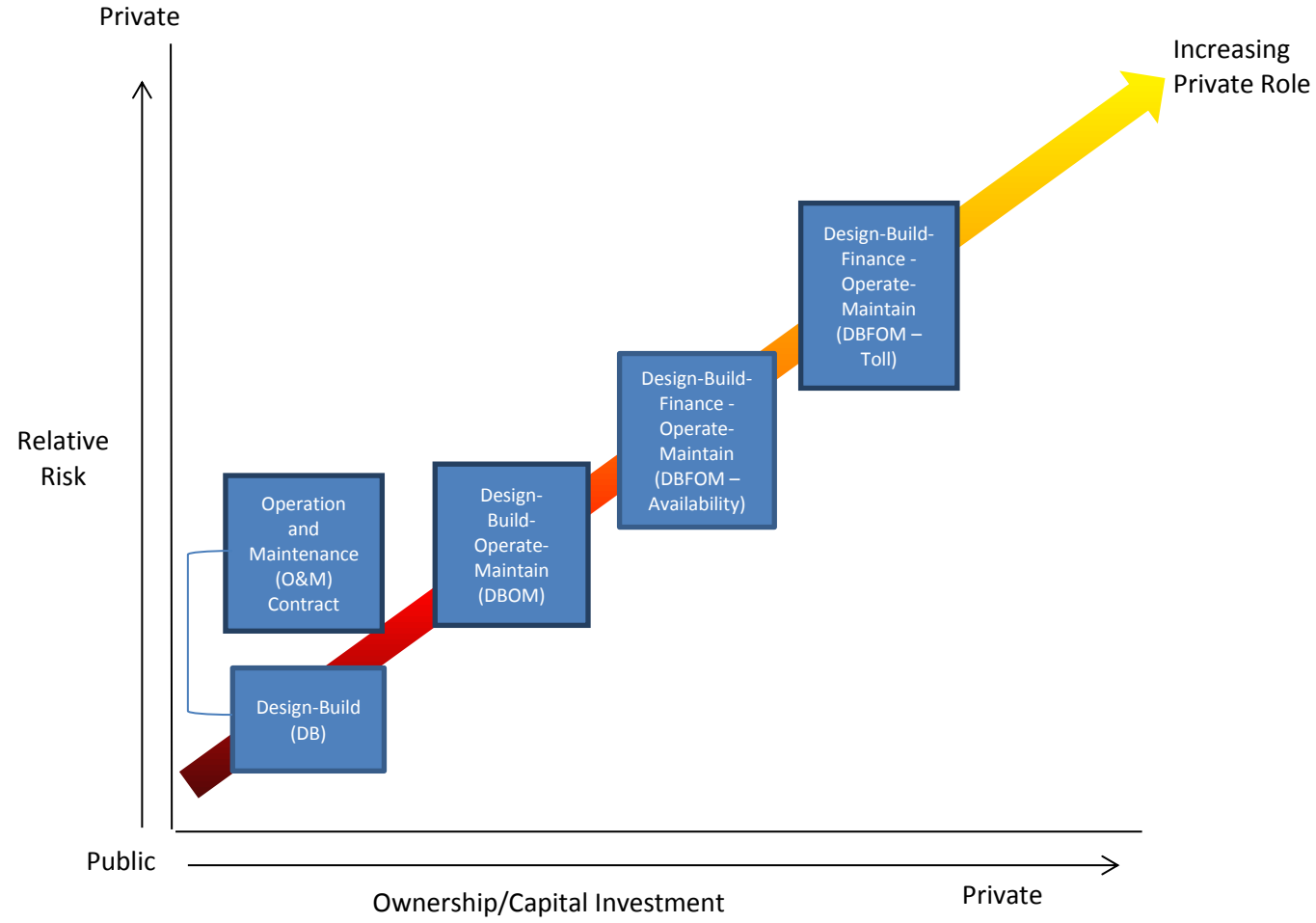
[42] http://www.ppiaf.org/sites/ppiaf.org/files/documents/Note-One-PPP-Basics-and-Principles-of-a-PPP-Framework.pdf

[43] http://www.brookings.edu/~/media/research/files/papers/2011/12/08%20transportation%20istrate%20puentes/1208_transportation_istrate_puentes.pdf

may provide tax exempt status for the project but no direct funding.[44] The private sector on the other hand would likely finance the construction of highway, build the highway, and operate the highway over a long, pre-determined time period, and then transfer the operation and ownership of the highway to the government. In doing so, the private sector assumes greater risk than it did in the first example.

The private sector can assume a variety of roles – designing, building, operating, maintaining or financing a facility and in some cases assuming limited term ownership – in a PPP. Thus, there exist a range of PPP project delivery models with varying degrees of private sector engagement and as such, varying degrees of risk being borne by the private sector. The figure below illustrates the key project delivery models.

Figure 2.2: Public-Private Partnership Spectrum



[44] ibid

Each of these PPP delivery options distributes roles, responsibilities and risks related to the construction, maintenance and financing of an infrastructure asset. As a result, from a government perspective, each PPP contract structure comes equipped with its own advantages and challenges. At the high level though, governments should use a PPP structure to provide an infrastructure or service, as PPPs can improve the outcomes of an infrastructure by:

- ***Providing an alternative source of finance to traditional government borrowing***. Private sector finance is typically more expensive than concessional loans from multilateral and bilateral institutions, but may help increase investment in infrastructure if the government is otherwise financially constrained.[45] Moreover, the presence of private sector finance (especially banks) can provide significant due diligence over a contractor's ability to meet its obligations under a PPP contract, because lenders are acutely aware that if the contractor is too weak or suffers from poor performance then the lender's capital is at risk. In this sense, banks are incentivized to ensure the performance of the contractor is sustainable and will thus perform a monitoring role that in a traditional procurement is left solely with the government. Global experiences with of PPPs show that this role is often better performed by lenders than by governments.

- ***Achieving better value for money.*** PPP structures can do this through risk transfer and efficient allocation of risks. Certain models of PPP involve whole of life costing, as the contractor who may manage the design, operation and maintenance of an asset will strike an efficient balance between construction costs and operation and maintenance costs. Finally, PPPs can achieve better value for money by leveraging the private sector's expertise.[46]

- ***Improving the sustainability of public services***. PPPs can greatly decrease for the government the variability of the cost of providing a service. This decreases the vulnerability of the service and of the government's fiscal position to unexpected shocks. This benefit arises directly from sharing the risks of service provision with the private party—provided, of course, the private party is sufficiently competent to manage the

[45] http://www.ppiaf.org/sites/ppiaf.org/files/documents/Note-One-PPP-Basics-and-Principles-of-a-PPP-Framework.pdf
[46] ibid

risks and responsibilities allocated to it through the PPP contract.[47]This is often a key motivation for seeking private sector participation in operating and maintaining roads.

- ***Improving accountability in public expenditure***. PPPs can do this by transferring service delivery risk to the private party. This means the government only pays for services delivered at the specified quality over the contract period. This is in contrast with traditional public procurement, where the government often has no recourse when, for example, construction quality is revealed after the event to be lower than expected.[48]

At the more detailed level, specific PPP contract types bring varying advantages. Several PPP contract types ranging from low private sector involvement to more private sector involvement are highlighted below.

***Operations and Maintenance Contract (O&M)* -** In this PPP contract type, the government designs and constructs an infrastructure asset using traditional procurement, and then a private contractor operates and manages the asset over an extended contract period. O&M contracts provide limited potential for improvements in efficiency and performance, though they may introduce some incentives for efficiency or improved revenue collection, by defining performance targets and basing a portion of the remuneration on their fulfillment. This contract type can be useful where the private sector proves unwilling or unable to accept a large amount of risk. [49]

Design Build Operate Maintain (DBOM) – Under a DBOM PPP project delivery structure, the private contractor designs and constructs the infrastructure asset and operates and maintains it for a specified period of time after construction. This contractual arrangement can instill a 'whole life' cost mentality on the contractor. The contractor is incentivized to deliver a higher-quality product in order to avoid higher maintenance and improvement costs during the operations phase. [50] However, under this structure the investment costs are shouldered entirely by government and no private sector investment is sought. This model is difficult for budget-

[47] ibid
[48] ibid
[49] "Key Features of Management/O&M Agreements" accessed <http://ppp.worldbank.org/public-private-partnership/agreements/management-and-operating-contracts>
[50] Rall, Jaime et al. *Public-Private Partnerships for Transportation: A Toolkit for Legislators*. National Conference of State Legislators. October 2010

constrained governments to implement. However, such an approach is not reliant on thin and infant private finance markets (as is the case in Lao PDR). Under this structure, the contractor can be remunerated by toll revenues or government payments (e.g. construction milestone payments, availability payments) or both.

Design Build Finance Operate Maintain (DBFOM) – Under this contract structure, the private sector assumes responsibility for executing the entire project – completing the design and construction, raising funds to finance construction, and operating and maintaining the asset throughout the project term (typically between 20 – 40 years). A DBFOM structure can vary according to how the contractor is remunerated – there are two models that exist at either end of the payment spectrum:

(a) DBFOM – availability payment. The private sector receives a fixed availability payment from the government for the asset. The government typically retains demand risk, toll rate risk, etc. This contract type instills a 'whole of life' cost mentality on the contractor; allows private financing to meet some of the funding requirements and allows for the government to pay for the project over its life, rather than upfront. The availability payment is de facto a mortgage payment that is set sufficiently high so that the contractor can operate the road to the required contractual standard, repay debt and allow shareholders to make a reasonable profit. The availability payment can be funded from toll revenues and government budgets. However, the availability payment does represent a long-term (multi-year) financial liability for government which can be difficult to manage when government budgets typically have a short-term (often single-year) horizon. Likewise, if toll revenues turn out to be lower than forecast, then the recourse to government budgets increases and this can be a significant contingent liability. However, such a model does give the government greater regulatory and political freedom to set and manage toll rates.

(b) DBFOM – toll. The private sector collects and retains tolls and receives no availability payment from the government. This classic concession-type model involves the private sector assuming the risk that traffic and revenue will meet or exceed forecasted levels. This approach reduces the financial exposure of government to lower levels of tolled traffic but likewise concedes the potential financial gain from higher than anticipated traffic levels. Moreover, the uncertainty surrounding the forecasting of future traffic levels can either reduce the appetite of private sector investors or increase the cost of financing for the project. In many

toll road PPPs, the level of traffic in the early years of the contract generate insufficient revenues to allow the contractor to service its debt and provide a sufficient profit to investors. In such a situation, contractors will typically require government financial support, which may be through a capital subsidy (or contribution) which brings down the amount of private finance to a level that can be serviced by low traffic flows or through an ongoing subsidy/revenue support mechanism. Consequently, such a model does not necessarily reduce the financial and fiscal impact on government budgets. Likewise under this model, the government will need to forego a significant amount of freedom in toll-setting and its plans for expanding the competing 'free-to-use' road network because the contractor will require greater certainty on its revenues.

In addition to the models presented above, DBFOM contracts can also be designed which share the revenue risk. For example, a 'shadow' toll mechanism could be designed whereby a government payment is linked to the amount of traffic using the road, even if the contractor itself does not receive the tolls directly from the user. Under this model, a contractor will bid how much toll it will receive at different traffic levels (typically lower tolls at high traffic levels, and higher tolls at low traffic levels). This allows some of the risk of lower traffic levels to be shared. However, contractors will still require certainty on the 'real' toll-setting mechanism of the government and its plans for improving the competing road network. Alternatively, the government could still transfer revenue risk but provide a guarantee to provide payment to the contractor if revenues fell below a specified threshold. This kind of guarantee is often attractive as it allows comfort to debt providers that repayments can still be made if estimated traffic significantly falls below expected levels. However, such a guarantee still places a contingent liability on government that might be difficult to manage.

All DBFOM models have the advantage of transferring significant risks and attracting private sector finance to help relieve the pressure on upfront capital budgets. However, private finance is typically more expensive than public sources and as such the government will typically still face both direct and contingent liabilities. Moreover, the transaction costs of such models are higher. In combination, these factors mean that the government must undertake a detailed analysis of whether such models represent value for money to the government.

2.4.2 Key Considerations for Investigating PPP Options

Prior to analyzing specifically which of these PPP delivery models might be appropriate in the context of the 13N and 13S projects, it is important to revisit some of the findings from Part 1 of this study and assess the context of Lao PDR's readiness to undertake a major PPP project.

There are a number of key constraints present in the existing PPP market both in Lao and globally that will dictate what kind of model is likely to be appropriate.

Availability and Appetite of Private Finance

Private sector finance for PPP projects generally consists of a mix of equity, provided by investors, and third-party debt, provided by banks or through financial instruments like bonds. In principle, equity investors will bear any losses suffered by the project first, and lenders will suffer only after the equity investment is lost. Thus, equity investors expect a higher return for this risk.[51]

When investigating PPP options, the Laotian government will likely wish to explore private financing sources, due to its budget constraints. However, as mentioned in Part 1 of this report, the availability of private finance in the Laotian market may be limited in size due to relatively low levels of local currency (Kip) finance, as well as limited liquidity and appetite from international financiers in what is still an infant project finance market. Contractors may be able to seek finance from multilateral and bilateral sources (e.g., International Finance Corporation and export credit agencies) but this too is a finite funding source. On that basis, we conservatively estimate that a maximum of 250 USD million of private sources of finance would be available to the first highway PPP project in Lao. However, it is important to note that even to achieve this level of private finance the project is likely to require a 'standard' risk allocation that does not transfer unmanageable risks to the private sector. In this sense, there is a clear linkage between risk allocation and the appetite of private financiers as, without an appropriate risk allocation, the project will not be deemed bankable.

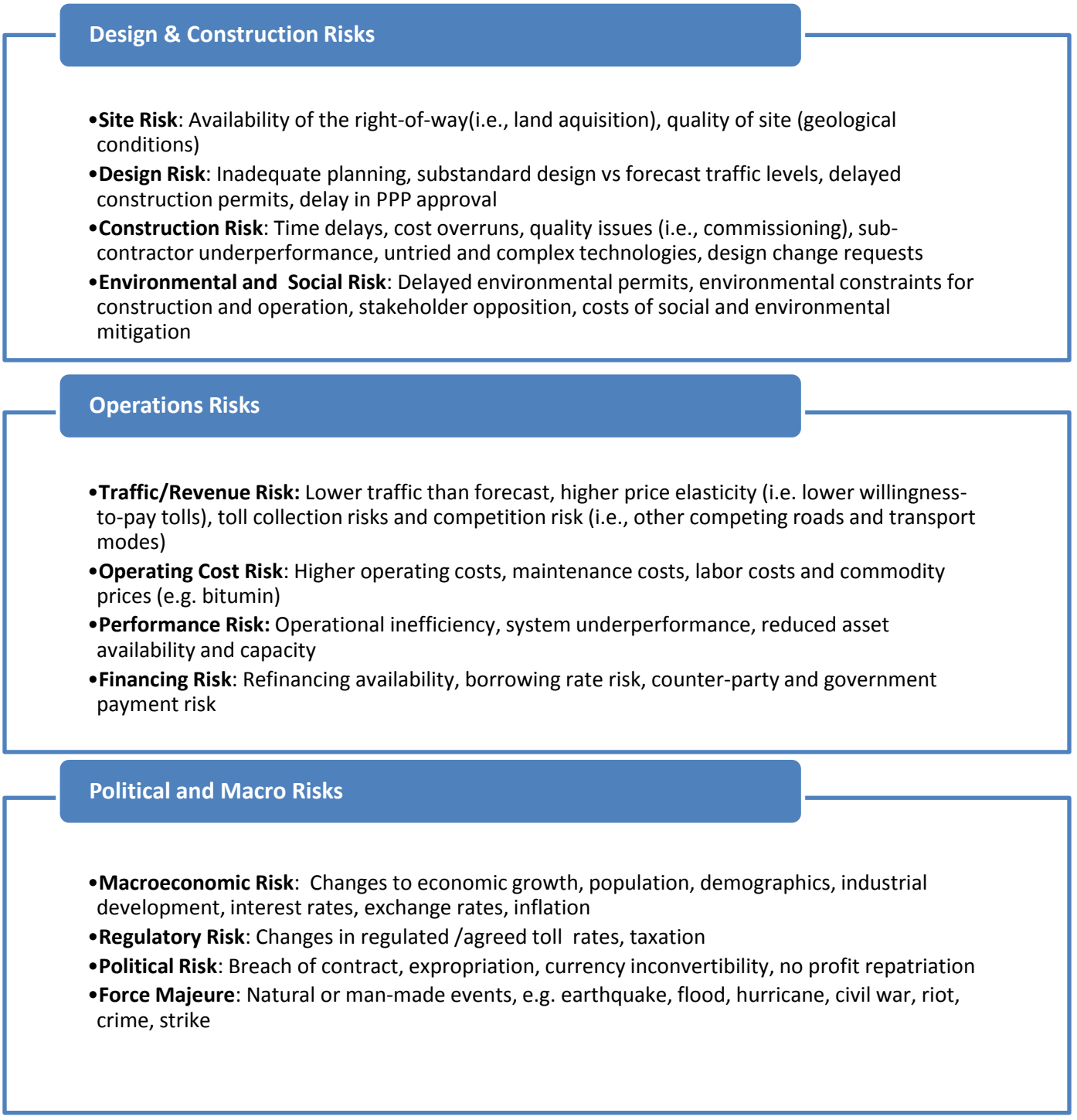
Risk Allocation

Infrastructure projects are almost inevitably risky. Risks arise at each stage of the project's life cycle and must be divided carefully between the public and private sector partners of the PPP. The allocation of risk should follow the general principle that risks are best allocated to the project party that is best positioned to manage each particular risk. Misjudgment of this risk allocation could lead to severe consequences – including inadequate incentives for the private contractor (e.g., profiteering), reduced private sector appetite and/or bankruptcy or costly government bail-outs (i.e., project failure).

[51] Farquharson, Edward et al. *How to Engage with the Private Sector in Public-Private Partnerships in Emerging Markets*. 2010 The World Bank

Types of risks that must be considered when developing a PPP infrastructure project, can be loosely grouped into three categories: i) design and construction risks; ii) operational risks; and iii) political and macro risks. Some of these risks include but are not limited to those listed in Figure 2.3 below.

Figure 2.3: Types of Risks involved in a toll road PPP project



The ability of the private sector to manage each of these risks in the context of the 13N and 13S projects will help decide the appropriate contractual structure and will also dictate how attractive

the project will be to private investment. The table below shows how key risks are typically shared between the government and the contractor under each of the contractual structures. The green rows in the table below highlight the risks that we think the private sector could manage in the context of the 13N and 13S projects, based on our understanding of the capacity of the contractor market in Lao PDR and the likelihood of interest in the project from international contractors and financiers. The yellow rows highlight the risks that we think cannot be fully transferred to the private sector and will therefore need to be shared with the public sector or mitigated through contractual agreement or through third-party guarantees. Failure to mitigate or share these risks adequately in the contractual structure is likely to significantly reduce private sector appetite for the project. Therefore these risks must inform the ultimate design of the structure. The non-highlighted rows represent risks that will be difficult to transfer to the private sector and/or mitigate. These risks will likely need to be retained and managed by the government.

Table 2.6: Risk Sharing Arrangements of PPP Contractual Types

	DB +O&M	DBOM	DBFOM avail.	DBFOM toll	Comments
Land Acquisition	×	×	×	×	Private sector has little or no control over process
Construction	✓	✓	✓	✓	Private sector can bring best practice and can best manage supply chain costs & program etc
Toll revenue	×	✓	×	✓	Toll revenues might not be sufficient to cover costs, so government may have to support private sector Financiers might not have an appetite for this risk due to uncertainty of forecasting process and foreign exchange risk. This may mean that alternative mitigation methods are used such as availability payments or minimum revenue guarantees
Government Payment Risk	✓	✓	✓	✓	If contract structure requires multi-year payment streams (e.g. through an availability payment) then private sector may be concerned about government's continued willingness and ability to pay. Thus mitigation methods may be required – e.g. securing toll revenues in a holding account (e.g. escrow), risk guarantees
Operations and Maintenance	✓	✓	✓	✓	Private sector can manage this risk and bring innovation through its supply chain, typically on a fixed price basis
Force majeure	×	×	✓	✓	Private sector has very little control over catastrophic events. It can insure against some of these risks, but this may be expensive to manage and may not be value for money. Given the infancy of PPP in Lao PDR, it may be inappropriate to transfer this risk for the 13N and 13S projects

	DB +O&M	DBOM	DBFOM avail.	DBFOM toll	Comments
Political	×	+	+	+	Private sector can do little to manage risks such as nationalization, payment default and regulatory/toll changes. This can be a major risk to the private sector for which insurance is available but will add cost to the project
Financing Risks					
Interest rate	×	×	✓	✓	Banks can typically offer fixed interest rate loans for a defined period through hedging mechanisms.
Inflation	✓*	✓*	✓	✓	Contractor is typically able to manage inflation risk through agreements with its sub-contractors who will provide fixed price contracts. Toll rate inflation is typically agreed through an indexation formula specified PPP contract
Refinancing Risk	×	×	✓	✓	Debt is typically shorter in maturity than the duration of the contract, creating a refinancing risk. There is no guarantee of sufficient lender appetite in the future when the debt matures (i.e., uncertainty over condition of financial markets) and there is the risk of lower than anticipated toll revenues, which could further undermine the ability of the contractor to attract fresh capital. This is a difficult risk for the contractor to manage and in all likelihood they would require their revenues to be sufficiently high enough to ensure that any debt can be fully repaid by the maturity date. This may mean that they will need to charge either higher toll rates or require an availability payment which is set at a rate that allows debt to be adequately repaid over the tenor.
Foreign exchange	×	×	✓	✓	If international banks lend to the projects it will typically be in hard currency (e.g., USD) but toll revenues are likely to be in Kip. This creates a mismatch in revenue and debt service leaving the contractor exposed to fluctuations in exchange rate. Such risk is difficult to manage and if transferred will likely be reflected in high interest rates or

	DB +O&M	DBOM	DBFOM avail.	DBFOM toll	Comments
					expensive hedging costs.

Key:

✓ = risk largely passed to private sector
✖ = risk largely retained by Government
* = during construction phase only
+ = risk is shared

Risk can be transferred to private sector

Risk can potentially be transferred to private sector

Government must take risk

Contractor Appetite

Inherent in the government's choice to adopt a PPP option is the desire and need to engage with the private sector. From the contractor's point of view, perceptions of the government's commitment to the project, the competence of the public sector team and its advisers, the timing and way in which information is released to the market, and the quality of information is important. Major contractors and investors will scrutinize many issues and risks including: the cost, time and quality of the PPP bid process; the stability of the legal and regulatory framework; the criteria used to evaluate bids; and the security of the project's income stream.[52]

As discussed in Part 1 of this report, Lao's road construction industry consists of a large number of contracting firms that appear to have limited capacity to implement large projects. The majority of these firms are procured for a single project, which range in length from 2.4 km to 57.6 km (see Annex A for additional details), with the maximum contract size being close to 175 USD million. It is therefore questionable whether local contractors would have the capacity to implement large highway PPP projects such as 13N and 13S without support from international or regional contractors. Moreover, international or regional contractors may also bring much needed private finance to fund the project; this may be bilateral funding (e.g., export credits) or project or corporate finance from their relationship banks. On that basis, it will be important to structure a project that might be attractive to international and regional contractors. To do this, the government will need to adequately market (or advertise) the project, ensure the project risk allocation is reasonable and further strengthen the PPP legal and regulatory framework to ensure that larger contractors might be attracted to the market.

The presence of international or regional contractors need not mean that local Laotian contractors are excluded. Even with a large regional or international Engineering, Procurement & Construction (EPC) contractor leading the development of the projects, the local construction and materials supply chain is still likely to be required due to closer proximity, cost and resource availability offered by local contractors. The government can go further by specifying in the bidding process that each bidder must provide evidence of the participation of the local contractor market.

[52] Farquharson, Edward et al. *How to Engage with the Private Sector in Public-Private Partnerships in Emerging Markets*. 2010 The World Bank

2.5 Analyzing Possible PPP options

Having provided an overview of the different PPP contractual structures and their varying risk allocations, the following section provides a quantitative and qualitative assessment of the validity of each option for the proposed upgrading of the NR13 projects (as described in Section 2.3).

The quantitative analysis has been undertaken using a financial model. The assumptions contained in this model are outlined in the table below

Table 2.7: Assumptions of the Financial Model

	DB+O&M	DBOM	DBFOM availability	DBFOM toll
Economic assumptions				
Annual inflation	5%	5%	5%	5%
Government of Lao discount rate (nominal)	10%	10%	10%	10%
Corporation tax rate	28%	28%	28%	28%
Concession assumptions				
Concession length	28 years	28 years	28 years	28 years
Target blended equity IRR	N/A	N/A	17%	20%
ODA/IFI financing assumptions				
Underlying Cost of Debt	3%	3%	3%	3%
Margin	1%	1%	1%	1%
Tenor	15 years	15 years	15 years	15 years
Arrangement fee	0.3%	0.3%	0.3%	0.3%
Private finance assumptions				
Cover Ratio (ADSCR)	N/A	N/A	1.40	1.50
Arrangement fee	N/A	N/A	3%	3%
Commitment fee	N/A	N/A	5%	5%
All in interest rate (incl.	N/A	N/A	12%	10%

margins)				
Tenor	N/A	N/A	10 years	10 years
Total private sector funding capacity	N/A	N/A	USD 250m	USD 250m
Modelling Approach				
Description of Model	Government pays construction milestone payments to D&B contractor. O&M contractor is paid an annual availability payment for making the road available	Government pays integrated (DBOM) contractor milestone construction payments and an annual availability payment for making the road available	Government pays an availability payment for the duration of the contract. It also provides a capital subsidy beyond the defined USD 250 million threshold of private sector finance	Government provides a capital subsidy to a level that allows contractor to meet debt service requirements. It also provides a capital subsidy beyond the defined USD 250 million threshold of private sector

The financial model has been populated with the cost and revenue estimates outlined earlier in Part 2 of this study. To reflect the global trend for publicly procured infrastructure projects to suffer from cost overruns and delays, we have applied the following conservative uplift factors to the construction costs for the DB+O&M and DBOM models[53,54]

- DB+O&M: 10% uplift
- DBOM: 5% uplift

The following sections summarize the analysis.

[53] National Audit Office, *The Private Finance Initiative: The First Four, Design, Build, Finance and Operate Roads Contracts*, 1998: This study found that DBFOM contracts were likely to generate net quantifiable financial savings of 13 per cent

[54] Arthur Andersen and Enterprise LSE, *Value for Money Drivers in the Private Finance Initiative*, 2000: This study analyzed 29 public projects that used a PPP approach and calculated on average predicted financial savings of 17 per cent

Design-Build Contract plus Operating and Maintenance Contract (DB +O&M)

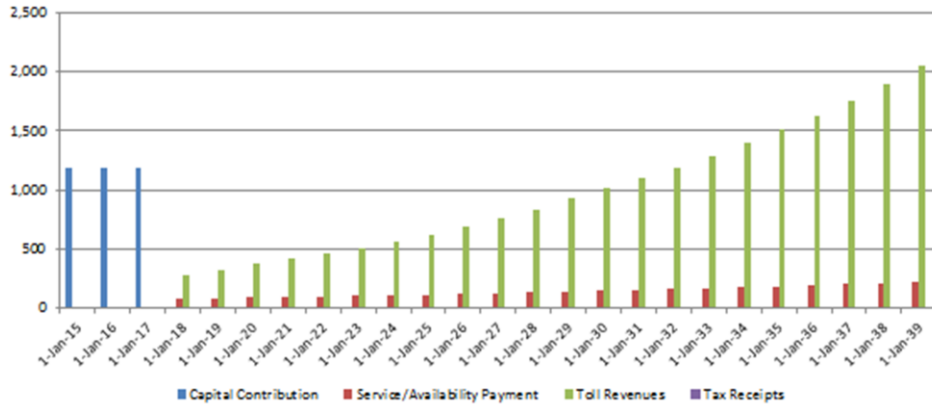
Financing Plan (billion Kip)

Sources and Uses	
Uses:	
Construction Costs	3543
Interest & Fees	301
Total Uses	**3844**
Sources:	
Government	3844
Commercial Debt	0
Equity	0
Total Sources	**3844**

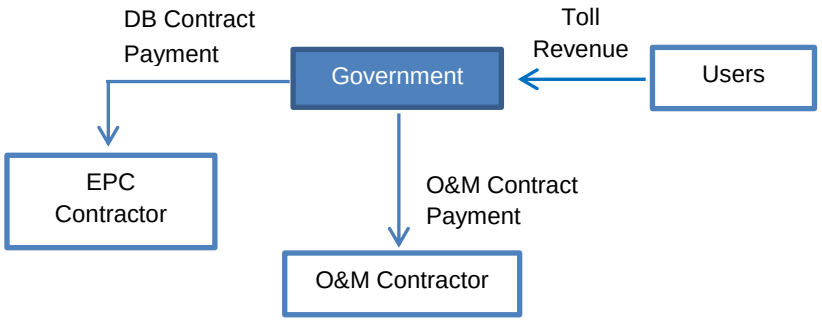
Government Balance Sheet (billion Kip)

	Nominal	NPV
Capital Contribution	(3,543)	(1,129)
Service/Availability Payment	(3,098)	(582)
Toll Revenues	21,583	3,464
Tax Receipts	113	21
Net Government Asset/(Liab	**15,055**	**1,774**

Government Cash Flows (billion Kip)



Contractual Structure



Advantages

- The most deliverable model
- Government retains long-term value of asset – asset is profitable over the long-term
- Operations risk transferred to the private sector
- Routine maintenance reduces future rehabilitation costs
- Flexibility to allow for shared demand risk

Disadvantages

- Does not include private sector financing. The government must finance the entire project, placing additional strain on the budget
- Does not achieve whole of lifecycle costing mentality
- Long-term contract creates long-term liabilities. This requires the government to shift to a multi-year budget mentality
- Demand risk likely retained by the government

Design-Build-Operate-Maintain (DBOM)

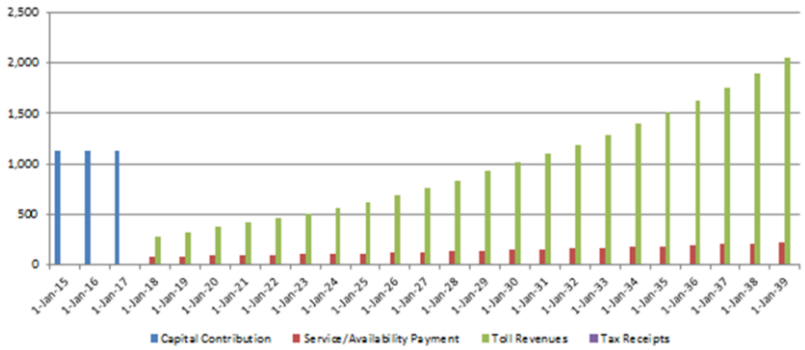
Financing Plan (billion Kip)

Sources and Uses	
Uses:	
Construction Costs	3382
Interest & Fees	288
Total Uses	**3670**
Sources:	
Government	3670
Commercial Debt	0
Equity	0
Total Sources	**3670**

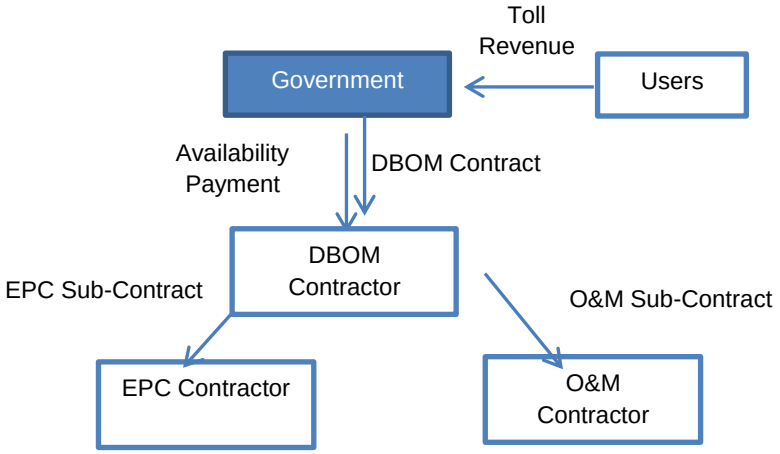
Government Balance Sheet (billion Kip)

	Nominal	NPV
Capital Contribution	(3,382)	(1,129)
Service/Availability Payment	(3,098)	(582)
Toll Revenues	21,583	3,464
Tax Receipts	113	21
Net Government Asset/(Liab	**15,216**	**1,774**

Government Cash Flows (billion Kip)



Contractual Structure



Advantages

- Achieves whole of lifecycle costing
- Government retains long-term value of asset – asset is profitable over the long-term
- Maintenance and construction risks are transferred to the private sector
- Does not rely on private financing, reducing transaction costs

Disadvantages

- Does not include private sector financing. The government must finance the entire project, placing additional strain on the budget
- Long-term contract creates long-term liabilities. This requires the government to shift to a multi-year budget mentality
- Doubts over contractor capacity to undertake a bundled construction, operations and maintenance contractor

Design-Build-Finance-Operate-Maintain (DBFOM) – Availability

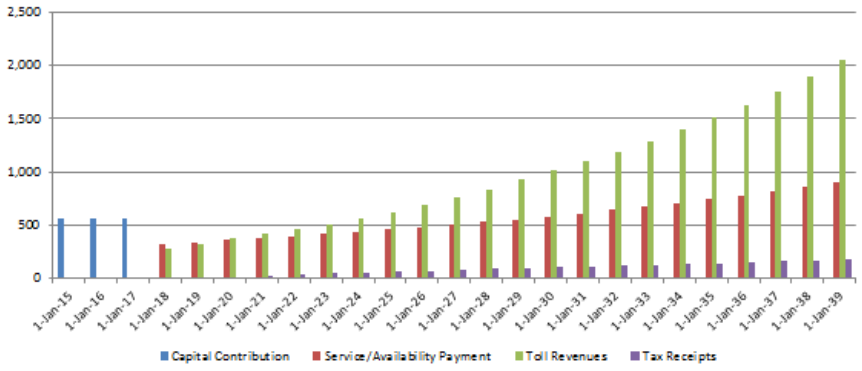
Financing Plan (billion Kip)

Sources and Uses	
Uses:	
Construction Costs	3221
Interest & Fees	494
Total Uses	**3715**
Sources:	
Government	1845
Commercial Debt	1360
Equity	509
Total Sources	**3715**

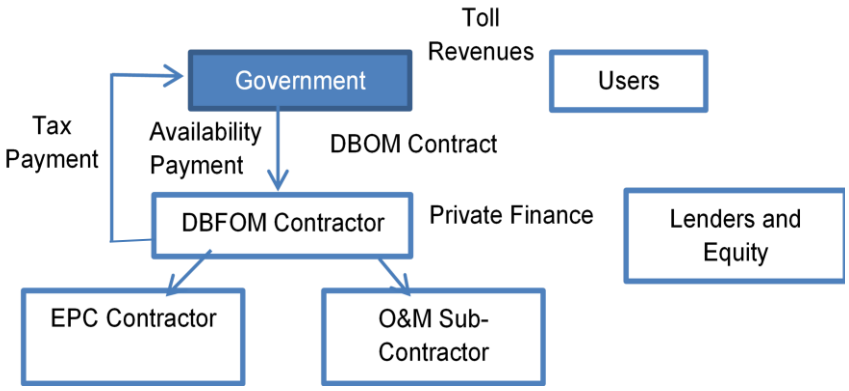
Government Balance Sheet (billion Kip)

	Nominal	NPV
Capital Contribution	(1,701)	(1,129)
Service/Availability Payment	(12,487)	(2,346)
Toll Revenues	21,583	3,464
Tax Receipts	2,008	293
Net Government Asset/(Liab	**9,403**	**282**

Government Cash Flows (billion Kip)



Contractual Structure



Advantages

- Achieves whole of lifecycle costing
- Maintenance and construction risks are transferred to the private sector
- Private finance incentivizes on time and on budget delivery
- Leverages private sector financing, reducing short-term pressure on the government's budget
- Allows the government to pay for the project over its life, rather than upfront
- Government retains long-term value of asset – asset is profitable over the long-term

Disadvantages

- Long-term contract creates long-term liabilities, including contingent liabilities. Requires shift to a multi-year budget mentality
- Government will have to manage perceived payment risk of a multi-year contract
- Foreign exchange risk arises from hard currency debt and local currency (Kip) revenue. Government will likely need to bear this risk and provide a hard currency availability payment.

Design Build Finance Operate Maintain (DBFOM) – Toll

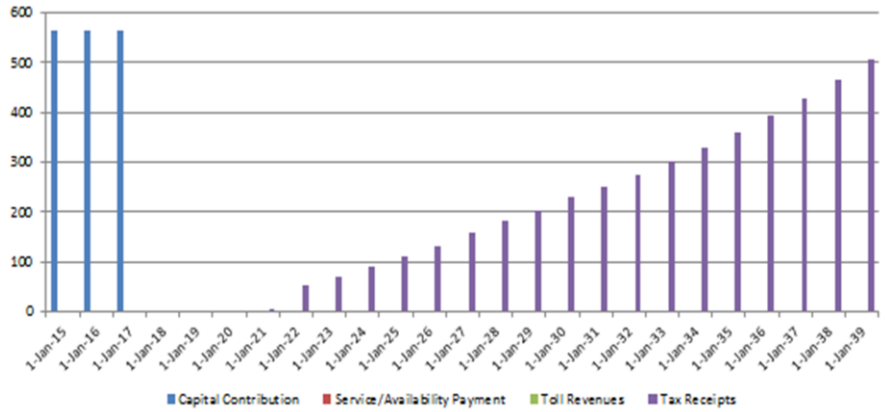
Financing Plan (billion Kip)

Sources and Uses	
Uses:	
Construction Costs	3221
Interest & Fees	484
Total Uses	**3705**
Sources:	
Government	1831
Commercial Debt	1185
Equity	688
Total Sources	**3705**

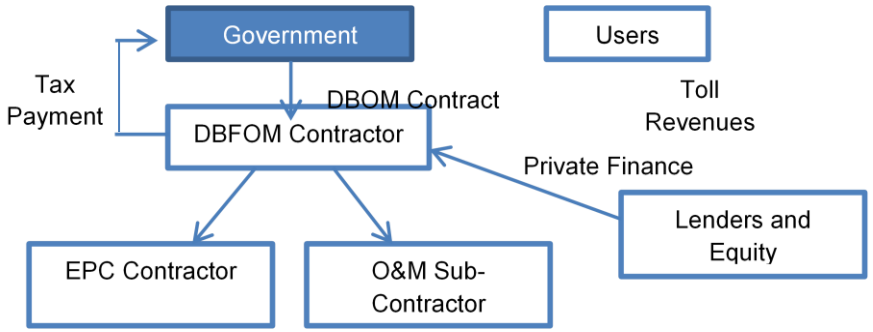
Government Balance Sheet (billion Kip)

	Nominal	NPV
Capital Contribution	(1,688)	(1,129)
Service/Availability Payment	0	0
Toll Revenues	0	0
Tax Receipts	4,566	605
Net Government Asset/(Liab	**2,878**	**(524)**

Government Cash Flow (billion Kip)



Contractual Structure



Advantages

- Achieves whole of lifecycle costing
- Maintenance and construction risks are transferred to the private sector
- Demand risk fully transferred to the private sector
- Contractor incentivized to deliver project on time and on budget
- Leverages private sector financing, reducing short-term pressure on the government's budget
- Allows the government to pay for the project over its life, rather than upfront

Disadvantages

- Government surrenders valuable asset
- Difficult to deliver due to limited appetite for transfer of revenue risk
- Government will likely need to provide a subsidy or minimum revenue guarantee to attract private sector financing
- Foreign exchange risk arises from hard currency debt and local currency (Kip) revenue
- High transaction costs

2. 5 Options Analysis Summary and Recommendation

The options analysis undertaken for the 13N and 13S project has highlighted a number of key findings which are summarized in the bullet points below:

- **Asset Value:** The financial modeling exercise has shown that the upgrading of the 13N and 13S highways and subsequent tolling would create two valuable cash assets regardless of whether the project is procured by the public or private sector. Compared to a greenfield project, the costs of widening an existing road are relatively low whilst strong forecasted traffic growth with minimal competition from other routes provides a strong future revenue base. These factors combine to create a profitable asset whether it is publicly or privately procured. For example, using the DB+O&M model, the government would earn a net profit of nearly 15,000 billion Kip (2 billion USD) from their ownership of the asset. This is an important finding of the study which shows the government that it needs to think carefully about whether it should concede the asset and if so how, when and for how much it should do so given the infancy of the PPP market in Lao PDR.

- **The need for government financial support and recourse to budgets:** Despite the underlying financials and value of the project being strong, government is still likely to need to provide significant financial support to the project regardless of which model is adopted. The DB+O&M and DBOM models will require a significant upfront capital investment of around 3,500 billion Kip (500 million USD) plus a large on-going commitment to pay for operating and maintenance services (although toll revenues should cover this expenditure). Likewise, a DBFOM with an availability payment structure, whilst reducing upfront government investment creates a long-term mortgage-type liability, albeit this should be mostly fundable through toll revenues. Even a DBFOM option with toll revenue risk transferred will require government upfront capital subsidy so that the amount of private finance is reduced to a level whereby it is possible for the contractor to service debt when traffic and revenue levels are low in the early years of the contract. Again, government needs to carefully consider whether conceding future revenues whilst also investing significant capital is both politically and financially acceptable.

- **Deliverability:** Lao PDR undoubtedly has an infant and as yet untested PPP market. This has to be factored into the decision-making process for what kind of delivery model is appropriate. Ideally, a model would be adopted that maximizes risk transfer and minimizes the recourse to government budgets; however such a model (e.g., the DBFOM-toll model) simply may not be achievable. The capacity of the local finance and contractor markets is likely to be too low for such complex structures. Likewise, there is uncertainty surrounding the appetite from international and regional contractors and financiers, particularly if there is a heavy allocation of risks to the private sector. Thus, the most deliverable (or achievable) structure would be to undertake a DB+O&M contract whereby donor finance could be used to fund the construction of the asset and then a multi-year operating contract (or concession) could be let to a private partner. Such a contract could also transfer revenue risk (through a lease payment) or government could retain the risk through a simple long term service contract. This would achieve the transfer of key risks and would provide the demonstration effect for subsequent more complex projects that a multi-year PPP can be delivered in Lao PDR. It would of course be desirable for the government to attract private capital but there is clear trade-off for the government here between developing a PPP project which can be delivered in this infant market and the amount of risk transferred to the private sector and the amount of private capital available.

- **Bankability:** The thin nature of the local finance market will likely mean that any model that requires private finance (i.e., DBFOM models) is likely to have to seek it from either international/regional commercial lenders, multilateral lenders (e.g. ADB or IFC) or bi-lateral enterprises (e.g. state development banks). Some or all of these financiers may be required to lend in hard currency (e.g., USD) and therefore will likely require that project revenues are equally in hard currency so as to avoid a mismatch in debt service and revenue and any resulting foreign exchange fluctuation risk. This is likely to prevent the direct transfer of revenue risk under a DBFOM-type model and instead another form of hard-currency denominated payment is likely to be required (e.g., availability payments or shadow tolls). Moreover, to attract international/regional finance will also require a risk-allocation that is deemed ‘on-market’ (or bankable) – i.e., the risk allocation is not unduly skewed towards the private sector. One key risk would be the payment risk associated with an availability or shadow toll payment. Lenders may not be comfortable with the strength of a long-term commitment (or promissory) from

government to make these payments and may require additional security. To achieve this might require the ring-fencing of a proportion of toll revenues in a reserve account that can be credited to the contractor in the event of non-payment from the government. Alternatively third-party insurance might be sought to protect against this risk (e.g., the World Bank's Partial Risk Guarantee product).

- **Scale:** In an infant PPP market, the scale of a pilot project is vitally important. On the one hand, the project should not be too large and complex so as to raise questions of affordability or deliverability. On the other hand, it should not be too small so as to reduce the appetite of potential bidders or lead to an inefficient maintenance operation across a short distance of road network which would lead to an unnecessary duplication of existing plant and machinery. A project that combined the 13N and 13S widening/upgrades into a single project would create a funding requirement in excess of 500 USD million. This may be perceived as too large a project by the private sector and it might not be an optimal size for piloting a PPP approach to road construction and maintenance. A smaller project would mean less technical preparation work by government, lower budget/fiscal pressure on government, less initial land acquisition and a higher proportion of the funding requirement could be met by private capital (if this is desired). Most of all, a pilot project must be manageable in terms of cost and complexity because its success is vital to provide a demonstration effect to subsequent projects. On that basis, it would seem prudent to move forward with the widening and upgrade of just one of the roads for a pilot project. There is no reason why a follow-on project could not be planned and initiated shortly afterwards but the approach should first be piloted and sent to market before the other road is launched.

Based on the findings of the technical, traffic and options analysis contained in this study, we believe that all the models that were analyzed could be applied in the context of Lao PDR but those incorporating private finance would need to be very carefully structured. However, we would make the following recommendations with regard to the government's approach to procuring the 13N and 13S projects as a PPP project:

- **Recommendation 1:** We would recommend that the government proceeds with a smaller scale pilot project than the upgrading of 13N and 13S to Vang Vieng and Paksan respectively. Instead, we propose that a smaller pilot project that upgrades 13N to

Phonghong and 13S to Ban Naxay (near Km 64), would be the most appropriate pilot project.

- **Recommendation 2a:** If the government is able to and can afford to finance the pilot project from its budget or donor funds then we believe that a DB+O&M contract represents the most efficient model for a country that has only limited experience in PPPs and multi-year contracts. The long-term operating contract could be structured to transfer or retain traffic risk but would transfer key operations and maintenance risks.

- **Recommendation 2b:** If the government cannot afford to finance the pilot project in its entirety and needs to attract private capital then we would propose that a DBFOM model is adopted with an availability payment (or shadow toll) structure. We do not recommend a full transfer of revenue risk would likely reduce private sector appetite and would potentially not represent value for money for government as it would surrender significant upside in revenues, whilst also requiring that the government make a significant capital contribution upfront.

- **Recommendation 3:** The government must undertake a full feasibility study to validate these findings and this must include a significant market sounding to fully assess appetite for the pilot project

In Part 3 of the study, we outline a roadmap for the government to implement these recommendations. We analyze the reduced scale project (which we refer to from now on as the pilot PPP project) in more detail and outline key next steps in the project cycle.

3. Roadmap to Implementation

Part III: Roadmap to Implementation

3.1 Defining a Pilot Project

The analysis in section 2 of this report has outlined the value of undertaking the rehabilitation and widening of the 13N and 13S highways as a single project using various PPP models.

However, the construction of 13N and 13S to Vang Vieng and Paksan respectively may be too large for a single project, particularly as Lao has a limited track record of PPP projects. The size, complexity, and cost of a single project may also be too large for contractor capacity and financier appetite. Affordability for the public sector is also a concern, as the government will need to provide significant support to the project under all of the PPP models discussed above.

Following discussion with MoPWT, we have therefore analyzed a project with reduced scale that would be a more suitable candidate for piloting a PPP approach. We envisage this pilot will involve the rehabilitation and widening of 13N as far as Phonghong (approximately 57km in distance) and 13S as far as the intersection of 13S/NH10 (approximately 54km in distance). The 10km section of the 13S between Vientiane and KM21 has not been assumed to be widening but would be re-surfaced and rehabilitated. The sections to Vang Vieng and Paksan on the 13N and 13S respectively have not been included in this pilot project, however in reality it could be possible to include the operations and maintenance of these sections within a PPP project and likewise if quality and safety improvements were made, it could be possible to toll these sections. However for simplicity, we have assumed that these sections will remain un-tolled and under the management of MoPWT.

The table overleaf provides a more detailed specification of the pilot project.

Table 3.1: Specification of Pilot Project

	Proposed Lane Configuration	Distance (KM)	Type of Improvement	Toll Plaza
13N				
Section 1 - Road 450 to Phôngmouang	4 lanes (2x2)	22	Widening	Yes
Section 2 - Phômouang to Phônhông	4 lanes (2x2)	35	Widening	Yes
Total 13N		**57**		
13S				
Section 1a - Vientiane to km21	4 lanes (2x2)	10	Major Resurfacing	No
Section 1b – km21 to Ban Noen	4 lanes (2x2)	18	Widening	Yes
Section 2 – Ban Noen to 13S/HN10	4 lanes (2x2)	26	Widening	Yes
		54		

The pilot project was chosen as a suitable pilot project for the following reasons:

- These sections of 13N and 13S are more heavily trafficked and therefore need investment sooner
- Rehabilitating these sections of the 13N and 13S will deliver greater benefits due to its higher traffic volume
- Construction and land acquisition for this project appear to be less complex and carry more manageable risks
- The funding requirement for this project is more manageable. It is also sized at a level whereby there is potential for the private sector to meet a significant proportion of the funding requirement
- The project is of sufficient length of highway (111km) to justify a separate operating and maintenance operation, as would be required under a PPP
- This project could act as a demonstration project to be followed by the 13N project

Based on the recommendations in Section 2, we have analyzed this pilot project using the DB+O&M and DBFOM models, the results of which are presented below. As discussed in Part 2 of this report, we believe these models represent the most efficient and deliverable options in

the context of Lao PDR. The pilot project has been analyzed using both models under a base scenario, as well as optimistic and pessimistic cases to provide a full range of potential outcomes. For the DBFOM model, we have assumed that the funding requirement will be met equally by the private sector and public sector (i.e. 50/50 split). All values presented in the tables and graphs below are denominated in billions of Kip.

3.1.1 Analysis of Pilot Project under DB+O&M Structure

We believe that the DB+O&M model is the most efficient structure for the pilot project. In addition to being the most deliverable of the PPP structures examined in this report, the DB+O&M model provides the highest net present value (NPV) benefit to government.

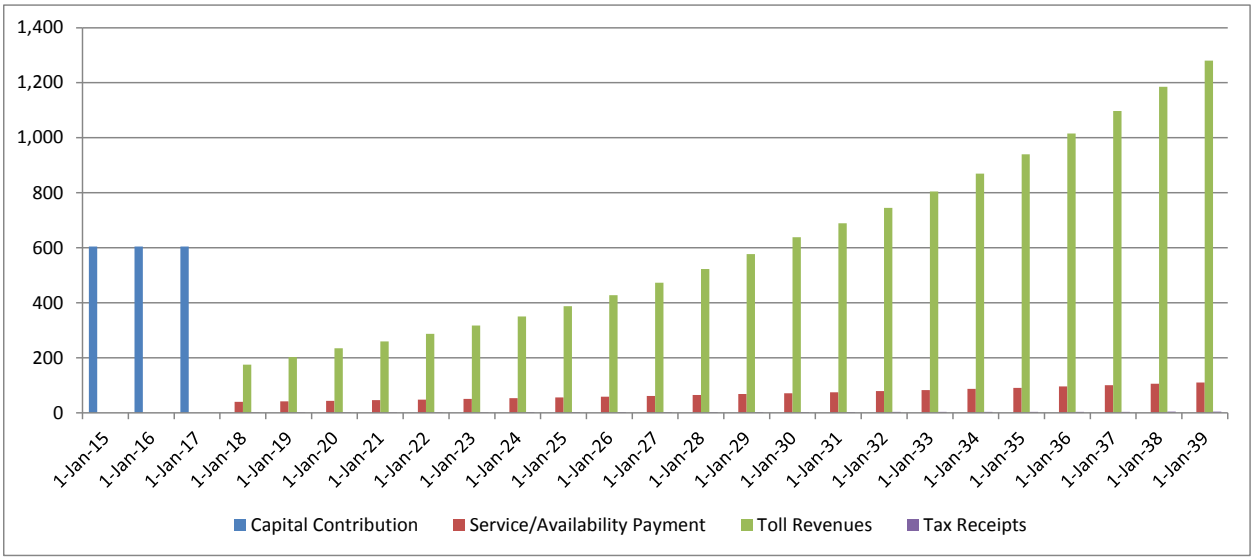
As indicated in the table below, a pilot project structured as a DB+O&M will require significant upfront government support and capital contributions. These costs could be difficult to finance if the government's budget is constrained and its ability to obtain concessional financing is limited. However, the higher upfront costs result in lower availability payments in this structure than the DBFOM model, which reduces the government's long-term payment liabilities.

Table 3.2. Government balance sheet for DB+O&M (base case)

Billion Kip	Nominal Value	Net Present Value
Cost to the Government		
Capital Contribution	(1,813)	(1,129)
Availability Payments	(1,525)	(286)
Total Cost to Government	(3,338)	(1,415)
Government Income		
Toll Revenue	13,477	2,165
Tax Receipts	56	10
Total Government Income	13,532	2,175
Net Government Asset (Liability)	**10,149**	**760**

Under the DB+O&M model the government retains control of the asset and the toll revenues. The toll revenues should be sufficient to cover the availability payment and provide additional government revenues for the entire lifecycle of the project, which is illustrated in graph 3.1 below. As the toll revenue is projected in excess of the availability payments by a sizable margin for the entire project, the project will continue to be viable even if the traffic is considerably less than forecast. This scenario is explored further under the pessimistic case below.

Graph 3.1 Government cash flow for Pilot Project - DB+O&M (base case billion Kip)



The simplicity of the DB+O&M structure and the level of risk transferred under this model make it an appropriate structuring choice for the first PPP in Lao PDR's highway sector. The government will need to consider whether it has the budget capacity to meet the capital funding requirements under this model. If it can meet these requirements, we recommend the government pursue the pilot project under this structure.

3.1.2 Analysis of Pilot Project under DBFOM (Availability) Structure

If the government would prefer to use private finance to fund a significant portion of the capital costs, or does not have the budget to meet the large capital cost funding requirements, we recommend the DBFOM structure for the pilot project. As we discussed in Part 2 of this report, this structure is likely to require more ongoing government support because private financing adds additional costs to the project, reducing the overall cash value of the project to government.

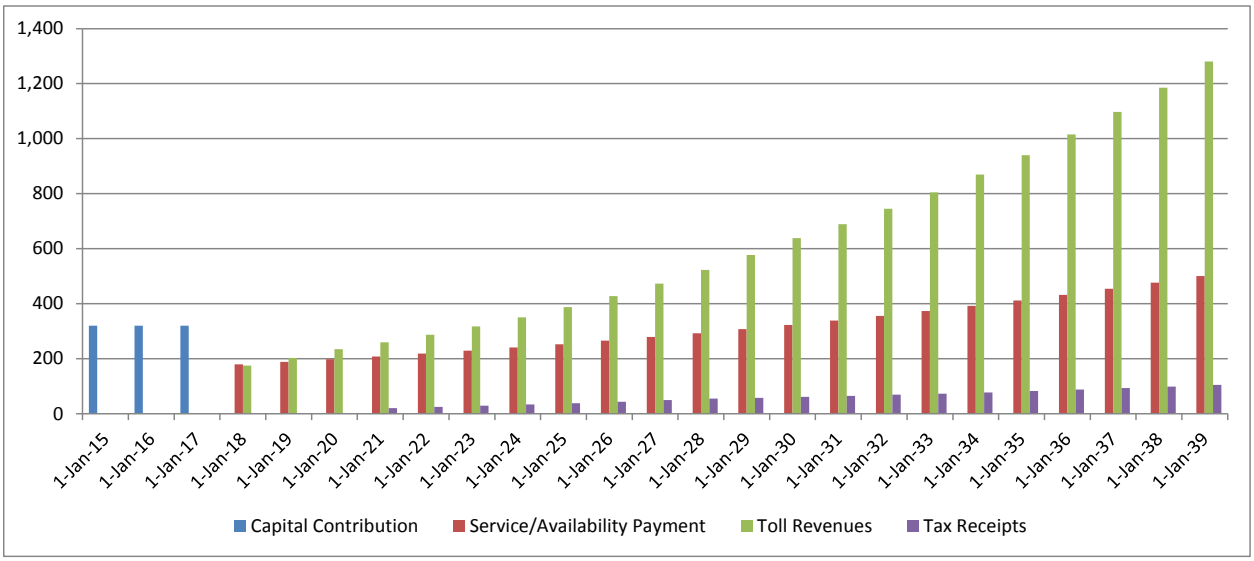
However, this option is a viable structure for introducing private finance to Lao PDR's highway sector. It also reduces the upfront costs to the government, which could be a key factor depending on the government's budget constraints. The tradeoff to the reduced government capital contribution is, however, that the government will be required to pay higher availability payments to the contractor. These payments will expose the government to large payment liabilities for the duration of the contract.

Table 3.3 Government balance sheet for DBFOM (base case)

Billion Kip	Nominal Value	Net Present Value
Cost to the Government		
Capital Contribution	(961)	(598)
Availability Payments	(6,914)	(1,299)
Total Cost to Government	(7,875)	(1,897)
Government Income		
Toll Revenue	13,477	2,165
Tax Receipts	1,169	174
Total Government Income	14,646	2,339
Net Government Asset (Liability)	**6,771**	**441**

While the toll revenues should be sufficient to cover the availability payment in the long-term, a small cash shortfall may occur in the first two years of operations. The government will therefore need to identify additional sources of revenue to fund the availability payments during this period. In addition, should the traffic levels be less than forecast this gap will expand, increasing the government's liabilities. This is explored below in the risk analysis in the pessimistic case.

Graph 3.2 Government cash flow for Pilot Project: DBFOM (base case billion Kip)



3.2. Risk Analysis

At this early stage of analysis the level of certainty surrounding cost, revenue, and financing assumptions is low. Significant risks therefore surround the estimates of the fiscal cost of the project to the government.

On this basis we have undertaken preliminary risk analysis of the pilot project and developed a pessimistic and optimistic forecasting case to show the range of the cost of the project to government.

3.2.1 Optimistic Case

The optimistic case presents the best-case scenario. It includes the following assumptions relative to the base case:

- 20% increase in forecast toll revenues
- 20% decrease in construction costs
- 10% decrease in operating costs

This case is the "best case" scenario given the information on cost, revenue and financing that is currently available. This is subject to change as additional data is gathered in the feasibility stage.

DB+O&M

The value of a DB+O&M pilot project structure increases considerably under the optimistic case. The government retains the upside of the increased traffic volumes and also benefits from the reduction in lower construction and operating costs, which are reflected in the reduced capital contribution and availability payments.

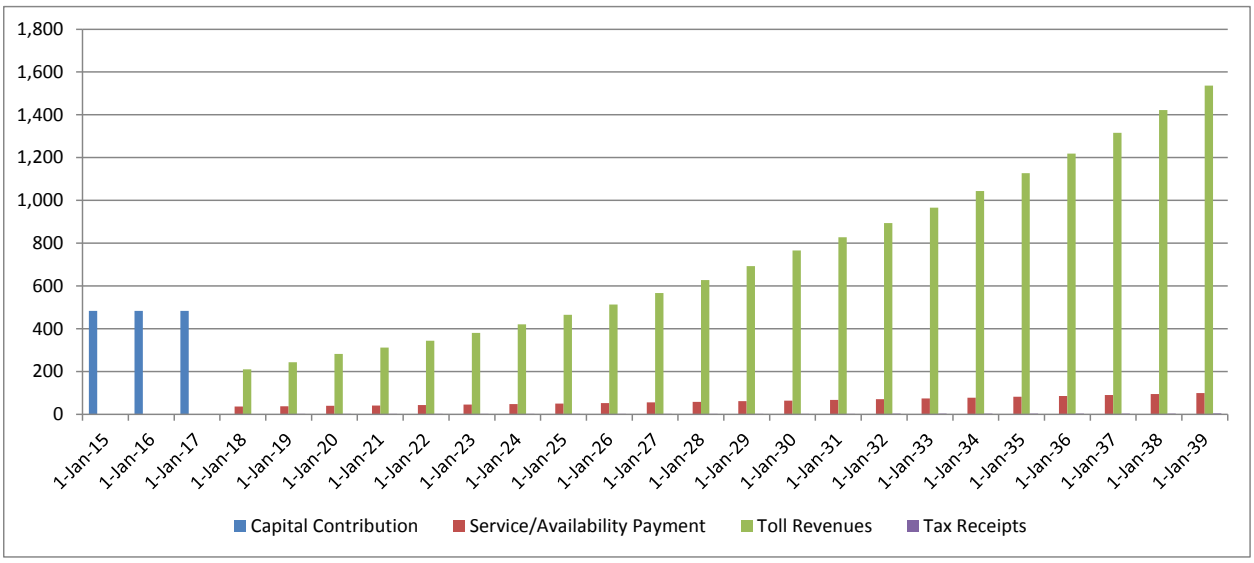
Table 3.4. Government balance sheet for DB+O&M (optimistic case)

Billion Kip	Nominal Value	Net Present Value
Cost to the Government		
Capital Contribution	(1,450)	(903)
Availability Payments	(1,373)	(258)
Total Cost to Government	(2,823)	(1,161)

Government Income		
Toll Revenue	16,172	2,598
Tax Receipts	50	9
Total Government Income	16,222	2,607
Net Government Asset (Liability)	**13,399**	**1,446**

Graph 3.3 below illustrates the increased government cash flows across the entire project lifecycle under the optimistic scenario. The toll revenues greatly exceed the availability payments to the O&M operator throughout the project, generating considerable surplus revenue for the government.

Graph 3.3 Government cash flow for Pilot Project DB+O&M (optimistic case billion Kip)



DBFOM – Availability

Similar to the DB+O&M structure, the DBFOM model also provides greater value to the government under the optimistic scenario. The government retains the upside of the increased traffic volumes and benefits from reduced availability payments due to lower construction and operating costs. There is a greater overall increase in the NPV of the project under the DBFOM, because the reduced costs lower both the government's capital contribution and the private funding requirement. The reduction in private finance in turn lowers the cost of the availability payment over the life of the asset, as there is less debt and interest to repay. However, this

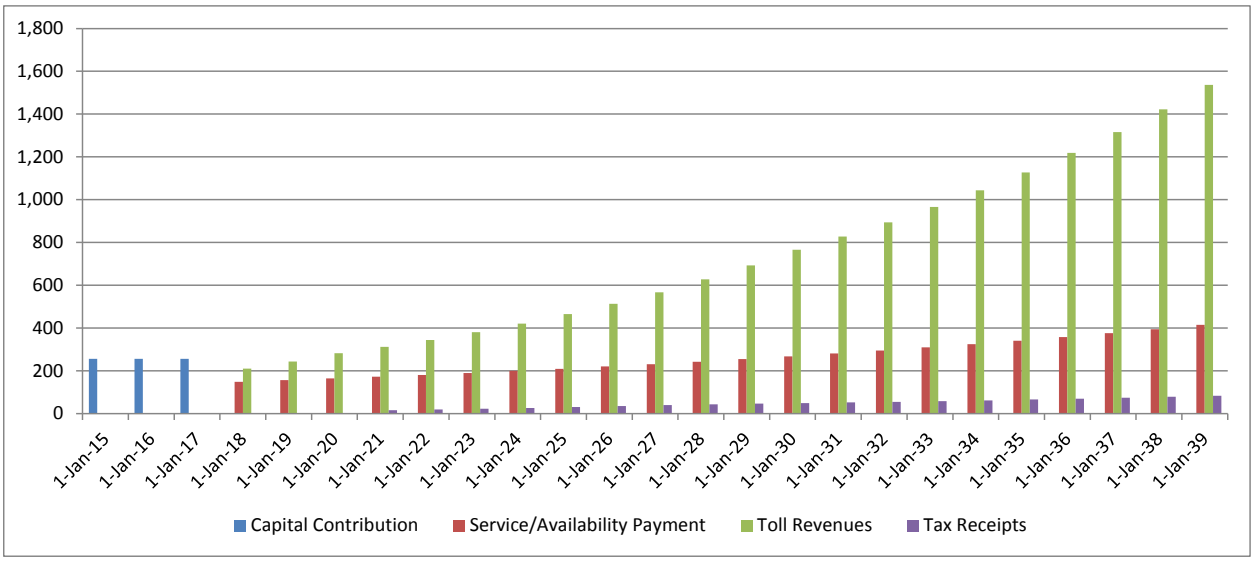
structure still provides a lower NPV than the DB+O&M model because of the comparatively higher cost of private finance.

Table 3.5 Government balance sheet for DBFOM (optimistic case)

Billion Kip	Nominal Value	Net Present Value
Cost to the Government		
Capital Contribution	(769)	(479)
Availability Payments	(5,728)	(1,076)
Total Cost to Government	(6,496)	(1,555)
Government Income		
Toll Revenue	16,172	2,598
Tax Receipts	932	138
Total Government Income	17,104	2,772
Net Government Asset (Liability)	**10,608**	**1,181**

Under the optimistic case, the toll revenues exceed the availability payment in every operating period. This removes the funding gap that occurred in the first two years of operation in the base scenario.

Graph 3.4 Government cash flow under for Pilot Project: DBFOM (optimistic case billion Kip)



3.2.2 Pessimistic Case

The pessimistic case presents the scenario combining the lowest traffic forecast with increased construction and operating costs. It includes the following assumptions relative to the base case:

- 20% decrease in forecast toll revenues
- 20% increase in construction costs
- 10% increase in operating costs

DB+O&M

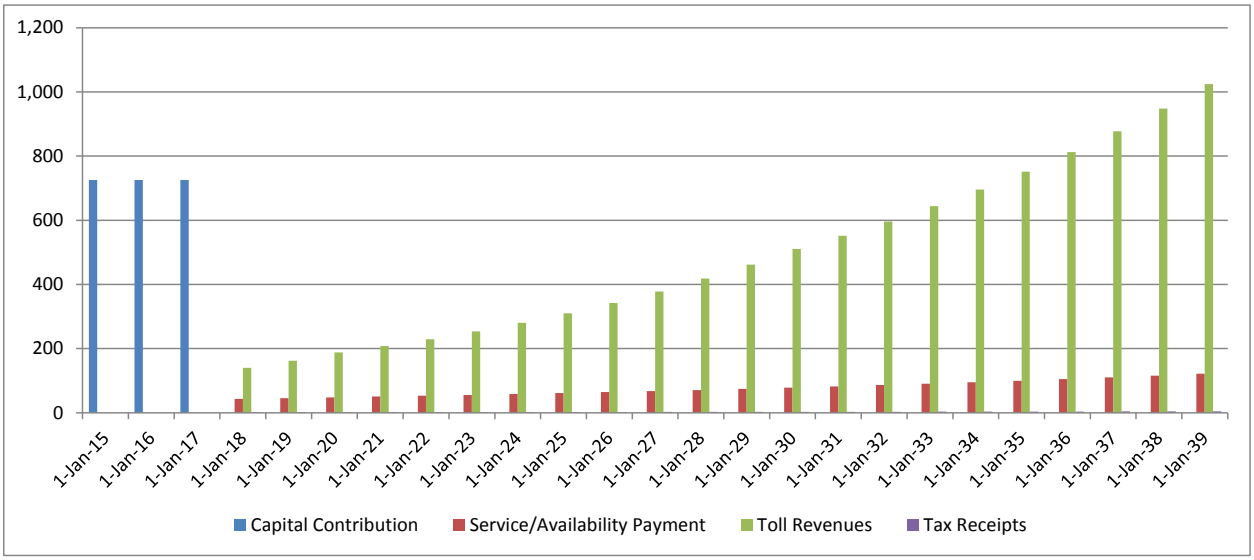
The DB+O&M structure proves robust under the pessimistic case, providing a reduced, but still positive, NPV of the project. However, under the pessimistic assumptions the required capital contribution is significantly increased from the base case. It may be difficult for the government to fund the increased up-front payments if it has a constrained budget.

Table 3.6 Government balance sheet for DB+O&M (pessimistic case)

Billion Kip	Nominal Value	Net Present Value
Cost to the Government		
Capital Contribution	(2,175)	(1,355)
Availability Payments	(1,678)	(315)
Total Cost to Government	(3,853)	(1,670)
Government Income		
Toll Revenue	10,781	1,732
Tax Receipts	61	12
Total Government Income	10,842	1,743
Net Government Asset (Liability)	**6,989**	**74**

Graph 3.5 illustrates the increased capital contribution required under the pessimistic case. If the government is willing to finance these costs and has the budget capacity to do so, the availability payment could still be wholly financed from the toll revenues with additional revenue generated for the government.

Graph 3.5 Government cash flow under for 13S DB+O&M (pessimistic case billion Kip)



Therefore, even under the pessimistic assumptions the DB+O&M structure remains a viable model for the pilot project.

13S DBFOM – Availability

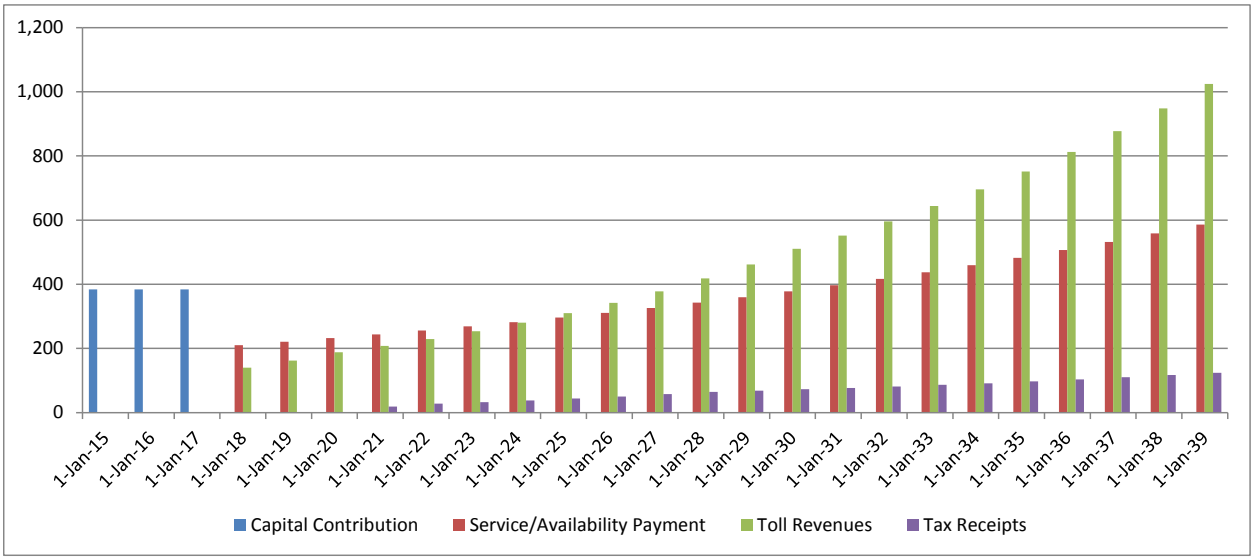
Applying the pessimistic case to the DBFOM availability model highlights the potential long-term liabilities of this structure. Overall, the DBFOM model has a negative NPV, indicating that it there would be a funding gap that the government would have to address under the pessimistic case.

Table 3.7 Government balance sheet for DBFOM (pessimistic case)

Billion Kip	Nominal Value	Net Present Value
Cost to the Government		
Capital Contribution	(1,153)	(718)
Availability Payments	(8,101)	(1,522)
Total Cost to Government	(9,254)	(2,240)
Government Income		
Toll Revenue	10,781	1,732
Tax Receipts	1,371	201
Total Government Income	12,153	1,933
Net Government Asset (Liability)	**2,898**	**(306)**

The government's costs increase more in the DBFOM model than the DB+O&M in the pessimistic case because additional private sector financing is required to fund the project. As shown in Graph 3.6 below, the lower toll revenues are not sufficient to cover the increased availability payments for several years of operations. The government would therefore need to identify other sources of revenue to meet this funding requirement, increasing the pressure on its budget.

Graph 3.6 Government cash flow under for Pilot Project DBFOM (pessimistic case billion Kip)



The risk analysis demonstrates the wide range of potential outcomes of the project and need for more detailed feasibility studies to be conducted.

3.3. Policy Choices

If the government chooses to move forward with the 13S pilot project it will need to carefully consider several policy choices necessary to make the project a success and minimize its own fiscal risk. The government's policy choices will need to take into account, among others, the following factors:

- **The impact of higher or lower tolls.** While higher tolls are likely to make the project more profitable, they could also raise concerns about ability to pay. Setting the toll rates too high could reduce user willingness-to-pay and reduce support from local communities for the project. Likewise, tolls that are set too low will potentially over

government budgets and will not be reflective of the benefits realized by users of the road. This is a difficult policy balance for the government between the extents to which the government (i.e. taxpayers) or users (i.e. drivers) should fund the road. Additional studies on the appropriate toll rate and user willingness-to-pay will need to be conducted for the feasibility report to inform this policy choice.

- **Vehicle weight control.** The government may have to consider opening new weighbridges or allowing the private operator to control and enforce weight limits. If maintenance risks are transferred to the private sector (as envisaged under all of our models) then this is a key consideration.
- **Development of a competing 'free-to-use' road network.** The government will need to consider its plans to develop the broader road network when deciding whether to pursue the pilot project. Developing a competing, non-tolled roadway will reduce traffic on 13S, thereby reducing government revenues from tolls or will potentially reduce appetite for the private sector to take or share any of the revenue risk.
- **Development of competing modes of transport** (e.g., high-speed rail). As with competing roads, the government will need to consider the pilot project in the broader context of its plans to develop Lao PDR's overall transportation network. Introducing a competing transportation mode may reduce traffic on 13S, thereby reducing government revenues from tolls or requiring the government to compensate the operator for lost revenue.

The government should therefore consider its broader development plans for the transportation sector when deciding whether to pursue the 13S pilot project. It should also consider what policy changes will be necessary and how future policy changes could impact the project when deciding whether to pursue the 13S pilot.

3.4. Managing Payment/Counterparty Risk

As discussed in Part 2 of this report, it is unlikely that the government will be able to fully transfer the revenue risk to the private sector. If revenue risk is successfully transferred to the private sector, it is likely to come at a very high cost, which will reduce the value for money of the project. Models in which the government retains the revenue risk and pays a service or availability fee to the contractor are likely to more acceptable to the private sector and provide

greater value for money. The payment can be funded from the government-collected toll revenues, as was highlighted in the analysis of the potential pilot project structures.

However, contractors and lenders are likely to require some security for future government payments in a multi-year contract. As these contracts create significant future payment liabilities for the government, it will need to provide comfort to contractors and lenders than these payment obligations will be honored. The government will therefore need to consider its willingness to provide securities for the project, which could include:

- **Ring-fencing of toll revenues.** Toll revenues would be paid into a reserve/escrow account that would be managed by a third party. This account could be called upon to meet payment obligations in the event of government non-payment.
- **Third-party guarantees on non-payment.** A third-party (most likely an IFI, such as MIGA – Multilateral Investment Guarantee Agency) would provide a guarantee to cover payment obligations in the event of non-payment by the government.

Both of the securities listed above have costs for the government (e.g., delayed access to project revenue, premium costs) that the government will need to consider when evaluating its options for the project.

3.5. Next Steps: Feasibility Study and Capacity Building

The next steps to move the project forward include undertaking a more detailed project feasibility study, which is envisaged under a proposed IDA operation. The feasibility stage should continue to study the themes outlined in this viability assessment and should include:

- The development of a reference design for the project
- Robust cost estimates
- Further traffic data collection and development of the traffic model. This should include willingness to pay surveys
- Market sounding of potential contractors, lenders, equity providers and bilateral/multilateral agencies to understand their appetite for the pilot project

In addition to undertaking a detailed feasibility study, the government should also work with PPIAF and other IFIs to identify any gaps within the existing legal and regulatory frameworks. The government should also work with these institutions to identify any weaknesses in its PPP

enabling environment, as these may provide obstacles that prevent the successful delivery of the project. Areas that are likely to require technical assistance include:

- Identification and analysis of required changes to the legal framework
- Institutional strengthening through the development of policy guidance for PPPs and tolling
- Building the DoPWT and MoPI's capacity to implement and oversee PPP contracts
- Assessment and management of contingent liabilities under PPPs

The government should also consider how the project would affect its broader transportation sector development plans and related policies, as discussed above in section 3.3. These policies and the enabling environment will be critical to delivering a successful project, particularly as this will be Lao PDR's first PPP in the highway sector. Developing a well-structured, bankable pilot project for the 13S will demonstrate the government's commitment to private sector participation in infrastructure and assist the country to develop additional projects in the future.

Annex A: Contractor Capacity Assessment

LAO PEOPLE'S DEMOCRATIC REPUBLIC
PEACE INDEPENDENCE DEMOCRACY UNITY PROSPERITY

MINISTRY OF PUBLIC WORKS AND TRANSPORT
DEPARTMENT OF PLANNING

ASSESSMENT OF THE ENABLING ENVIRONMENT FOR PPPs IN LAO ROAD SECTOR

REPORT ON ASSESSMENT OF CONTRACTOR CAPACITY IN LAOS PDR

Prepared by

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LAO - ASIE CONSULTANTS GROUP

April 2013

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1. BACKGROUND

The Government of Lao (GoL) has set targets in the national Social and Economic Development plan (NSEDP) for road network development over the next five years as follows: (i) all rural roads should be passable year-round, (ii) 920 km of the core road network serving regional and domestic connectivity shall be constructed and expanded, (iii) the road network shall be improved with climate/disaster resilience standards. Further, the NSEDP highlights the need for further regional integration through improvement of economic corridors, development of transport logistics, and trade facilitation. A number of mega-projects related to improvement of the transport sector have been identified, including expanding and upgrading several airports and upgrading the core road network.

The NSEDP also highlights the need for mobilization of resources from all possible sources including the public budget, development partners, and the private sector. Given scarce public funds and improvement needs in the social sectors, the challenge is how the sector will prioritize its needs and also mobilize resources from other sources of funds, including efficient sourcing from the private sector. To this end, it is crucial for the Ministry of Public Works and Transport (MPWT) to enhance its strategic management capacity in order to more effectively manage and develop the sector and increase its role.

A Public Private Infrastructure Advisory Facility (PPIAF) housed at the World Bank was formed in order to support an initial feasibility assessment of the potential of PPPs for road network development in the Lao PDR (i.e. Route 13N and 13S), which was carried out in early 2012. The report concluded that there is high potential for the two proposed pilot road projects to be successful PPP projects. It was also recommended that, as a next step, a feasibility study of the two projects be carried out. The GoL has requested the World Bank's assistance in conducting the feasibility study.

2. OBJECTIVE

To improve the GoL's capacity to assess the viability of potential PPP projects and to provide guidance on establishing a viable enabling environmental for developing highway projects.

3. SCOPE OF WORK

More specifically, the tasks for the Technical Consultant will include but are not limited to the following:

- Task one: Develop a database of all road and bridge construction projects completed in the last five years.

Database should (as a minimum) include the following fields:

- *Name of Project*
- *Length of Project*
- *Estimated Construction Value*
- *Name of Contractor*
- *National of Contractor*
- *Type of Contract*
- *During of Construction Works*
- *Standard of the road project*

4. DETAIL OF ROAD CONSTRUCTION PROJECT

4.1 Road Improvement Projects under DPWT of Vientiane Capital

There are 22 road improvement projects currently underway or planned under the DPWT of Vientiane capital to be implemented during the period of 2011-2015. Most of these projects are investments by local contractors (private sector). The construction costs for each project depend on the characteristics of the road such as type of surface, road width, and road furniture (***see details in annex 1***).

4.2 Road Improvement Projects under DPWT of Vientiane Province

There are nine road improvement projects currently underway or planned under the DPWT of Vientiane province scheduled to be implemented during the period of 2012-2018. Most of these projects are investments by local contractors (private sector). The construction costs for each project depend on the standard of the road such as type of surface, road width, and road furniture (***see details in annex 1***).

4.3 Road Improvement Projects under DPWT of Bolikhamsai Province

There are seven road improvement projects underway or planned under the DPWT of Bolikhamsai province scheduled to be implemented during the period of 2011-2016. Most of these projects are

investments by local contractors (private sector). The construction costs for each project depend on the standard of the road such as type of surface, road width, and road furniture (***see details in annex 1***).

5. DETAIL OF ROAD MAINTENANCE PROJECT

5.1 Paved Road Maintenance

5.2.1 Routine Road Maintenance

- Performance-Based Contract during (PBC) 2006-2009

During this timeframe the trial project for PBC was implemented, and only three provinces were selected to have 132 km of national paved road constructed, at a cost of 13,293,720,800 Kip ***(see details in annex 2.1-1).***

- Performance-Based Contract during (PBC) 2007-2010

Fifteen provinces have been selected for the PBC with a length of 2,557 km of national paved road constructed, at a cost of 11,574,854,953 Kip (***see details in annex 2.1-2***).

-Performance-Based Contract during (PBC) 2008-2011

Six provinces have been selected for the PBC to have 881 km of national paved road constructed, at a cost of 49,979,661,118 Kip (***see details in annex 2.1-3***).

-Performance-Based Contract during (PBC) 2009-2012

Three provinces have been selected for the PBC with a length of 299 km of national paved road constructed, at a cost of 13,387,881,800 Kip (***see details in annex 2.1-4***).

5.2.2 Rehabilitation Work

Road 13N from Km 44 to Km 154 have been rehabilitated during year 2012-2013 and this work has divided into four contracts (***see details in annex 2.2***).

5.2 Unpaved Road Maintenance

Nationwide unpaved road maintenance projects have been collected for the last three fiscal years as follows:

5.2.1 Fiscal Year-2010

The MPWT made allocations for 17 provinces by drawing on three funding sources (RMF=66.7%, IDA=25% and Province=8.3%) for a total budget of $3,217,485 USD. Re-gravelling comprised the most significant component of this budget with a length of 478 km and a width of 5m on average (***see details in annex 3.1***).

5.2.2 Fiscal Year 2010-2011

The MPWT made allocations for 16 provinces by drawing on three funding sources (RMF=66.7%, IDA=25% and Province=8.3%) for a total budget of $4,266,000 USD. Re-gravelling comprised the most significant component of this budget with a length of 668 km and a width of 5m on average (***see details in annex 3.2***).

5.2.3 Fiscal Year-2012

The MPWT made allocations for 17 provinces by drawing on three funding sources (RMF=66.7%, IDA=25% and Province=8.3%) for a total budget of $5,624,374 USD. Re-gravelling and spot improvement comprised the most significant component of this budget with a length of 437 km and a width of 5m on average (***see details in annex 3.3***).

6. DETAIL OF BRIDGE CONSTRUCTION

Few bridges have been constructed during the last five years, and at this time the consultant has investigated selected bridge construction projects accompanied by data as follows:

6.1 Makhiow and Vanghou Bridges

The Makhiow concrete bridge cost approximately $1,530,420 USD, and is 50 meters long and 15 meters wide (***see details in annex 4.1***).

The Vanghou concrete bridge cost approximately $880,021 USD, and is 33 meters long and 15 meters wide (***see details in annex 4.2***).

ANNEX 1

Cost of Road Construction

Annex 1: Details of Road Construction Project

Details of Road Construction Projects

Project name	Project location	Length(km)	Cost	Contractor	Nationality	Type of contract	Duration	Type of surface	Width(m)	Furniture
Vientiane Capital										
Nonpapao-Phonthan-Thatluang raod construction	Sisattanak and Setsettha districts	1.5	23.37BK	SKC Construction Company Ltd	Lao		2011-2015	Concrete	10	
		2.036	30.60BK						8	
Sangthong district center to vte	Sangthong district	22.7	77.08BK	Viencharean Construction	Lao		2011-2015	DBST	8	
Dongbang-Nasala-Nabong	Xaythany district	21	48.591BK	Thavisok R&BCC	Lao		2011-2015	DBST	7.9	
Vangsay-Samke-Soknoi	Setsettha district	4	102.854BK	Souksada H&RCC	Lao		2011-2015	Concrete	12	
Soknoi-km21-R450-Nakhuay	Setsettha district	3.74	49.713BK	Sampasane R&BCC	Lao		2011-2015	Concrete	12	
Nongteng-Viengkham-Banmai1	Sikhodtabong district	7.8	186.213BK	Patthana DCC	Lao		2011-2015	Concrete	12	
Viengkham-Banmai2	Sikhodtabong district	8	288.973BK	Sengthavisay	Lao		2011-2015	Concrete	12	
Donedeng-Tanmixay	Chanthabouly district	5.6	188.591BK	Tangchalern	Lao		2011-2015	Concrete	12	
Road No. T5	Vientiane capital	5.2	115.077BK	Somphoumy	Lao		2011-2015	Asphalt	15	
Road No. T6	Vientiane capital	7	147.720BK	Thanoukhan and Vientiane Motor	Lao		2011-2015	Asphalt	15	
Huakhua-Nakhuay	Setsettha district	7	152.003BK	Argicultural Promotion and	Lao		2011-2015	Asphalt	17	

				Construction						
Tv station-Nongnieng-Huakhua	Vientiane capital	6.2	192.566BK	Doaheuangsong	Lao		2011-2015	Concrete	17	
Nakhounnoi-Thangon	Vientiane capital	12.6	90.344BK	Phetbandith	Lao		2011-2015	DBST	11	
Samke-Amone-Nongnieng	Setsettha district	2.41	63.805BK	Huangcharean	Lao		2011-2015	Concrete	12	
Donenokkhoum-Sangveay-Choumphet	Sisattanak district	4.87	88.982BK	Asia Patthana	Lao		2011-2015	Concrete	14	
Suanmone-Sangveay-Dongsavath	Sisattanak district	2.99	56.830BK	Asia Patthana	Lao		2011-2015	Concrete	14	
Lao-Thai road-Donepamay-Suanmone	Sisattanak district	2.8	56.280BK	Asia Patthana	Lao		2011-2015	Concrete	14	
Thatluangneua-Phonkheng	Setsettha district	2.025	70.049Bk	Phethavone	Lao		2011-2015	Concrete	7	
Road No.11-BanPhao-Maknoa	Pakngum district	32.5	429.547BK	Fongsamout	Lao		2011-2015	Concrete	12	
Km22-Huachieng-R450	Xaythany district	19	524.847BK	Saha Construction	Lao		2011-2015	Concrete	18	
Khamsavath-Dongkhamxang-Nahai	Hadsaifong district	21	594.812BK	Nouansavanh	Lao		2011-2015	Asphalt	12	
Bannongniow-Nongteng	Sikhodtabong district	7.78	33.484BK	Alisouk	Lao		2011-2015	DBST	9	
Vientiane province										
Road No. 0125 Improvement		25.9	40.056BK	Keophosy R&B con. Company	Lao		2012-2015	DBST	7	
Road No. 4505 Improvement		25.3	66.514BK	Inthalangsy R&B con.	Lao		2012-2016	DBST	8	

				Company						
Road No 10 (Phonhong to Phonmy)	Phonhong district	8.05	32.890BK	Trade and Industry Chamber	Lao		2012-2014	Concrete	21	
Road No 10 (Phonmy to Thalath)		6.26	27.950M$	Sibounheang R&B con. Company	Lao		2013-2015	Concrete	21	
Road No. 4507 (Department of Finance to Pakcheng)		6.2	27.670M$	Dengnoy Patthana R&B con. Company	Lao		2012-2014	Concrete	24	
Road No. 4507 (Pakcheng to Napho)	Viengkham district	12	29.534M$	Dalavan Trade and Services	Lao		2012-2014	Concrete	16	
Road No. 4501 Improvement		132	1,336BK	Heangsy R&B con. Company	Lao		2013-2018	DBST	9	
Safue to Tanpiow	Thoulakhom district	13.13	28.305BK	Dengnoy Patthana R&B con. Company	Lao		2013-2015	DBST	7	
Ban Napheng-MuangHom raod construction	Thoulakhom district	60	206BK	Maliny R&B Con. Company	Lao		2010-2014	DBST	7	
Bolikhhamsai province										
Khonekhuang to Nanam	Pakkading district	30	130.305BK	KhamphaySana Group	Lao		2011-2013	DBST	8	
Road No. 5107	Paksan district	25	78.188BK	CheungHuang Lao-Viet			2012-2014	DBST	7	
Road 1E		31.35	170.605BK	Phetsamone Construction	Lao		2012-2014	DBST	8	
Vienthong district center road project	Viengthong district	6.37	41.503BK	Namtha	Lao		2011-2013	DBST	7&9	

Vienthong district center road project	Viengthong district	6	21.767BK	Kongkorsang for special economic	Lao		2011-2013	DBST	7&9	
Ban PhonNgam to Vietnam boder	Xaichamphone district	43	178.823BK	Duangchalern Patthana Con. Ltd	Lao		2013-2016	DBST	7	
District Center to Vietnam border	Xaichamphone district	57.6	445.261BK	Duangchalern Patthana Con. Ltd	Lao		2011-2014	DBST	7	

ANNEX 2

Cost of paved Maintenance

Annex 2.1-1: Performance-Based Contract for National Road

Performance Base Contract for National Road during 2006 to 2009

No.	Povince	Road No.	Section	Type of surface	Length (Km)	Contract Amount (kip)
1	2	3	4		5	6
I	Luangphabang	13N	246 - 296	DBST	50.00	6,195,010,800
II	Vientiane	13N	196 - 246	DBST	50.00	4,500,000,000
III	Vientaine cap.	13N	012 - 044	DBST	32.00	2,598,710,000
Grand Total					132	13,293,720,800

Annex 2.1-2: Performance-Based Contract for National Road

Performance-Based Contract for National Road during 2007 to 2010

No.	Province	Road No.	Section	Type of surface	Length (Km)	Contract Amount (kip)
1	2	3	4		5	6
I	**Phonsaly**				**82.00**	**366,648,750**
1		**19**	00 - 82	DBST	**82.00**	**366,648,750**
II	**Borkeo**				**34.00**	**157,550,889**
2		**R3**	00 - 34	Asphalt	**34.00**	**157,550,889**
III	**Oudomxay**				**139.00**	**833,879,596**
3		**2W**	00 - 70	DBST	**70.00**	**419,879,600**
4		**2W**	70 - 139	DBST	**69.00**	**413,999,996**
IV	**Huaphan**				**47.00**	**281,048,000**
5		**1C**	228 - 275	DBST	**47.00**	**281,048,000**
V	**Xiengkhuang**				**224.00**	**1,343,678,111**
6		**7**	42 - 266	DBST	**224.00**	**1,343,678,111**
VI	**Luangphabang**				**242.00**	**1,552,036,273**

7		7	00 - 42	DBST	42.00	304,499,989
8		13N	296-386	DBST	90.00	674,896,701
9		13N	386-496	DBST	110.00	572,639,583
VII	Veintiane				265.00	1,335,128,192
10		13N	44 - 94	DBST	50.00	123,944,444
11		13N	94 - 144	DBST	50.00	150,012,533
12		13N	144 - 176	DBST	32.00	96,008,021
13		13N	176 - 196	DBST	20.00	89,993,750
14	Trail project	13N	196 - 246		50.00	750,000,000
15		10	33 - 96	DBST	63.00	125,169,444
VIII	Vientiane capital				91.50	225,642,122
16		13S	12- 66	DBST	54.00	129,579,984
17		10	0-33	DBST	37.50	96,062,138
IX	Borlikhamxay				315.00	773,150,005
18		8	00-132	DBST	132.00	415,800,000
19		13S	66 - 249	DBST	183.00	357,350,005
X	Khammuane				227.00	861,881,086
20		12	55 - 147	DBST	92.00	364,716,666

21		13S	249 - 384	DBST	135.00	497,164,420
XI	Savannahket				156.00	465,609,750
22		13S	384-436	DBST	52.00	153,649,750
23		13S	437 - 541	DBST	104.00	311,960,000
XII	Salavan				138.00	699,700,305
24		13S	541 - 623	DBST	82.00	196,584,000
25		1H+20	00-26 & 26-56	DBST	56.00	503,116,305
XIII	Champasak				357.00	748,908,456
26		13S	623-660	DBST	37.00	94,700,000
27		13S	675-719	DBST	44.00	110,270,000
28		13S	719-774	DBST	55.00	144,698,000
29		13S	774-821	DBST	47.00	127,418,200
30		16E	8-50	DBST	42.00	108,587,200
31		16E	50-85	DBST	35.00	95,128,900
32		16W	1 - 44	DBST	43.00	32,057,667
33		13S	660 - 675	DBST	15.00	7,064,489
34		20	0 - 39	DBST	39.00	28,984,000
XIV	Xekong				69.00	272,494,667
35		16E+1I	87-138 & 0-18	DBST	69.00	272,494,667

XV	**Attapue**				**170.90**	**1,657,498,751**
36		**1I**	00 - 59	DBST	**59.00**	**230,777,778**
37		**18B**	00-15 & 46-55	DBST	**24.00**	**305,997,639**
38		**18B**	15-26 & 70-80	DBST	**21.00**	**267,747,639**
39		**18B**	26-37 & 80-90	DBST	**21.00**	**267,753,611**
40		**18B**	37-46 & 99-111.9	DBST	**21.90**	**279,222,917**
41		**18B**	55-70 & 90-99	DBST	**24.00**	**305,999,167**
Grand Total					**2,557.40**	**11,574,854,953**

Annex 2.1-3: Performance-Based Contract for National Road

Performance-Based Contract for National Road during 2008 to 2011

No.	Province	Road No.	Section	Type of surface	Length (Km)	Contract Amount (kip)
I	**Phonsaly**				**157.00**	**6,817,366,000**
1		1B	00 - 55	DBST	55.00	2,571,800,000
2		1B	55- 109	DBST	54.00	2,522,360,000
3		2E	52 - 100	DBST	48.00	1,723,206,000
II	**Luangnamtha**				**298.90**	**18,281,675,118**
4		R3+3A	00 - 84.9	DBST	84.90	5,469,290,000
5		17A	00 - 70	DBST	70.00	3,767,708,758
6		17B	00 - 72	DBST	72.00	4,406,400,000
7		3(ADB)	46,8 - 118,8	DBST	72.00	4,638,276,360
III	**Oudomxay**				**52.00**	**2,289,184,000**
8		2E	00 - 52	DBST	52.00	2,289,184,000
IV	**Huaphan**				**192.00**	**10,343,782,000**
9		1C	275 - 347	DBST	72.00	3,882,814,000
10		6	00 - 92	DBST	92.00	4,951,500,000
11		6	92 - 120	DBST	28.00	1,509,468,000
V	**Luangphabang**				**102.00**	**5,142,703,500**
12		1C	00 - 102	DBST	102.00	5,142,703,500
VI	**Vientiane capital**				**79.64**	**7,104,950,500**

13	**Under DPWT**				27.17	2,521,074,000
	Chinaymo to Somhong			DBST	7.10	
	Nongnieng to Dongkhamxang			DBST	15.57	
	Nongteng to Nongvienkham			DBST	4.50	
14	**Under DPWT**				35.27	2,726,276,500
	Donedeng to Huayhong to Tanmixay			Asphalt	5.30	
	Raod outside NUOL			DBST	2.57	
	Phontong to Dongdok & Phonsavang to Nongtha			Concrete	7.70	
	Kompara to Km5			Concrete	5.30	
	Km6 to TV station			Concrete	2.40	
	Dongdok- to Sikert			DBST	12.00	
15	**Under VUDA**				17.20	1,857,600,000
	Khampheng Meang (T4)			Asphalt	10.90	1,177,200,000
	Asean (T2)			Asphalt	6.30	680,400,000
Grand total					881.54	49,979,661,118

Annex 2.1-4: Performance-Based Contract for National Road

Performance-Based Contract for National Road during 2009 to 2012

No.	Povince	Road No.	Section	Type of surface	Length (Km)	Contract Amount (kip)
1	2	3	4		5	6
I	**Xiengkhuang**				**115.00**	**6,198,681,800**
1		**1D**	00 - 31	DBST	**31.00**	**1,666,661,800**
2		**1C**	00 - 84	DBST	**84.00**	**4,532,020,000**
II	**Vientiane**				**64.00**	**3,859,200,000**
3		**11**	140 - 204	DBST	**64.00**	**3,859,200,000**
III	**Luangphabang**				**50.00**	**3,330,000,000**
4		**13N**	246 - 296	DBST	**50.00**	**3,330,000,000**
Grand Toatal					**229.00**	**13,387,881,800**

Annex 2.2: Rehabilitation Work

Road 13N Rehabilitation Project

Length	8,319	m
Width	8	
Number of point	81	m

Contract N VTE03-1112-PM-NR03, Km86+000 to KM126+000

MAC	Activity	Unit	Quantity	Price	Amount
211	Resealing	m^2			
411	Scarify of old surface	m^2	54,610	5,000	273,050,000
412	Executing unsuitable material	m^3			0
413	Repair of wearing course	m^3	2,087.32	76,000	158,636,320
414	Repair of base course	m^2	10,265.86	246,000	2,525,401,560
415	Prime coat	m^2	49,146	13,000	638,898,000
416	First seal	m^2	49,149	25,000	1,228,725,000
416	Second seal	ml	43,688	22,000	961,136,000
433	Construction of ditches	ml	6,538	20,000	130,760,000
	Testing				20,000,000
	Total				**5,936,606,880**

Annex 2.2: Rehabilitation Work

Road 13N Rehabilitation Project

Length	5,970 m
Width	8 - 10 - 11m
Number of point	65 m

Contract N VTE02Œ1112ŒPMŒNR02, Km44+000- Œ KM86+000

MAC	Activitiy	Unit	Quantity	Price	Amount
211	Resealing	m^2	139.97	22,000.00	3,079,362.00
411	Scarify of old surface	m^2	65,480.00	5,000.00	327,400,000.00
412	Executing unsuitable material	m^3	108.00	20,000.00	2,160,000.00
413	Repair of wearing course	m^3	2,229.52	76,000.00	169,443,520.00
414	Repair of base course	m^2	12,371.18	248,000.00	3,068,052,640.00
415	Prime coat	m^2	59,510.00	13,000.00	773,630,000.00
416	First seal	m^2	59,510.00	25,000.00	1,487,750,000.00
417	Second seal	m^2	53,540.00	22,000.00	1,177,880,000.00
433	Construction of ditches	ml	3,450.00	20,000.00	69,000,000.00
	Testing				20,000,000.00
	Total				**7,098,395,522**

Annex 2.2: Rehabilitation Work

Road 13N Rehabilitation Project

Length	7,450	m
Width	8 to 9	m
Number of point	85	

Contract N VTE04Œ1112ŒPMŒNR04, Km126+000- Œ KM154+000

MAC	Activity	Unit	Quantity	Price	Amount
211	Resealing	m^2			
411	Scarify of old surface	m^2	5,200	74,871	389,329,200
412	Executing unsuitable material	m^3			
414	Repair of base course	m^3	250,000	13,975.3	3,493,830,000
415	Prime coat	m^2	13,000	66,552	865,176,000
416	First seal	m^2	25,000	66,552	1,663,800,000
417	Second seal	m^2	21,000	58,233	1,222,893,000
433	Construction of ditches	ml	18,000	1,110	19,980,000
	Testing	PS	20,000,000	1	20,000,000
	Total				**7,675,008,200**

Annex 2.2: Rehabilitation Work

Road 13N Rehabilitation Project

Length	5,461	m
Width	9	m
Number of point	41	

Contract N VTE05Œ1112ŒPMŒNR05, Km126+000- Œ KM154+000

MAC	Activity	Unit	Quantity	Price	Amount
411	Scarify of old surface	m^2	69,406	5,000	347,030,000
413	Executing unsuitable material	m^3	422	85,000	35,870,000
414	Repair of wearing course	m^3	12,988	250,000	3,247,000,000
415	Repair of base course	m^2	61,956	12,600	780,645,600
416	Prime coat	m^2	61,956	25,800	1,598,464,800
417	First seal	m^2	54,506	20,700	1,128,274,200
431	Second seal	ml	12	840,000	10,080,000
433	Construction of ditches	ml	2,340	17,600	41,184,000
	Testing				20,000,000
	Total				**7,208,548,600**

ANNEX 3

Cost of Unpaved Maintenance

Annex 3.1: Cost of Unpaved Maintenance Project

Cost of Unpaved Maintenance Project FY 2009-2010

Project name (Road No.)	Project location	Length (km)	Cost (kip)	Contractor	Nationality	Type of contract	Duration	Type of surface	Width (m)	Furniture
0126	Vientiane Cap	20.00	1,266,498,500	Firm	Lao	Regravelling	2009-2010	Gravel	5	
1202	Phongsaly	19.00	1,470,282,500	Firm	Lao	Regravelling	2009-2010	Gravel	5	
2205	Bokeo	22.00	1,078,495,000	Firm	Lao	Regravelling	2009-2010	Gravel	5	
1503	Luangnamtha	22.00	1,097,838,000	Firm	Lao	Regravelling	2009-2010	Gravel	5	
1803 1851	Oudomsay	42.00	824,498,605	Firm	Lao	Regravelling	2009-2010	Gravel	5	
2501	Luangprabang	20.00	1,104,033,000	Firm	Lao	Regravelling	2009-2010	Gravel	5	
3602	Sayyabouly	24.00	1,353,387,600	Firm	Lao	Regravelling	2009-2010	Gravel	5	
3610	Sayyabouly	30.00	1,696,596,780	Firm	Lao	Regravelling	2009-2010	Gravel	5	
3204	Houaphanh	30.00	1,965,000,000	Firm	Lao	Regravelling	2009-2010	Gravel	5	
3908	Xiengkhouang	32.00	2,242,970,000	Firm	Lao	Regravelling	2009-2010	Gravel	5	
3908	Xiengkhouang	19.00	1,299,358,000	Firm	Lao	Regravelling	2009-2010	Gravel	5	
0125	Vientiane Pro	20.00	1,442,780,500	Firm	Lao	Regravelling	2009-2010	Gravel	5	
4504	Vientiane Pro	30.00	2,273,807,000	Firm	Lao	Regravelling	2009-2010	Gravel	5	
5504	Borikhamxay	20.00	806,555,000	Firm	Lao	Regravelling	2009-2010	Gravel	5	
5507&5528	Khammouan	30.00	1,215,500,000	Firm	Lao	Regravelling	2009-2010	Gravel	5	

5501	Savannakhet	30.00	2,485,132,000	Firm	Lao	Regravelling	2009-2010	Gravel	5	
14A	Champasack	18.20	1,352,076,720	Firm	Lao	Regravelling	2009-2010	Gravel	5	
7501	Sekong	12.00	894,808,000	Firm	Lao	Regravelling	2009-2010	Gravel	5	
9001	Attapeu	14.00	835,510,000	Firm	Lao	Regravelling	2009-2010	Gravel	5	

Annex 3.2: Cost of Unpaved Maintenance Project

Cost of Unpaved Road Maintenance Project FY 2010-2011

Project name (Road No.)	Project location	Length (km)	Cost (USD)	Contractor	Nationality	Type of contract	Duration	Type of surface	Width (m)	Furniture
106	Vientiane Cap	11.50	126,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
0122	Vientiane Cap	8.20	98,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
1202	Phongsaly	14.50	166,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
1502	Lungnamtha	25.00	146,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
2203	Lungnamtha	11.30	94,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
1863	Oudomxay	19.60	182,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
2201	Bokeo	22.00	175,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
2504	Luangprabang	46.00	170,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
2508	Luangprabang	20.00	118,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
3613	Sayyaboury	37.00	170,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
3612	Sayyaboury	30.00	157,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
3201	Houaphanh	35.00	196,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
3206	Houaphanh	69.00	149,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
3901	Xiengkhuang	17.10	246,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
3903	Xiengkhuang	25.00	135,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
4505	Vientiane Pro	27.24	247,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
4507	Vientiane Pro	22.95	296,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
5103	Borikhamxay	24.00	143,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
5504	Khammuan	52.10	168,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
6307	Savannaket	33.40	164,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
6303	Savannaket	26.00	246,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
6902	Salavan	45.70	166,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
7824	Champasack	18.00	178,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
7501	Sekong	5.00	188,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	
9047	Attapue	22.70	142,000	Firm	Lao	Regravelling	Apr-Dec 2011	Gravel	5	

Annex 3.3: Cost of Unpaved Maintenance Project

Cost of Unpaved Maintenance Project FY 2011-2012

Project name (Road No.)	Project location	Length (m)	Cost (USD)	Contractor	Nationality	Type of contract	Duration	Type of surface	Width (m)	Furniture
1201	Phongsaly	34,000	260,000	Firm	Lao	Regravelling	Dec. 11-Jun 12	Gravel	5	
1501	Lungnamtha	23,000	451,878	Firm	Lao	Regravelling/ Spot Improv.	Dec. 11-Jun 12	Gravel	5	
1801	Oudomxay	24,000	288,696	Firm	Lao	Regravelling	Dec. 11-Jun 12	Gravel	5	
2201	Bokeo	18,000	369,989	Firm	Lao	Regravelling/ Spot Improv.	Dec. 11-Jun 12	Gravel	7	
2501	Luangprabang	25,000	312,000	Firm	Lao	Regravelling	Dec. 11-Jun 12	Gravel	5	
3611	Sayaboury	35,000	421,464	Firm	Lao	Regravelling/ Spot Improv.	Dec. 11-Jun 12	Gravel	5	
3202	Houaphan	40,000	370,715	Firm	Lao	Regravelling	Dec. 11-Jun 12	Gravel	4	
3901	Xiengkhuang	21,825	273,600	Firm	Lao	Regravelling	Dec. 11-Jun 12	Gravel	5	
4503	Vientiane Pro.	8,900	369,624	Firm	Lao	Regravelling	Dec. 11-Jun 12	Gravel	6	
5101	Borikhamxay	29,500	271,716	Firm	Lao	Regravelling	Dec. 11-Jun 12	Gravel	5	
5507	Khammuan	60,100	490,000	Firm	Lao	Regravelling/ Spot Improv.	Dec. 11-Jun 12	Gravel	6	
6309	Savannaket	2,600	252,000	Firm	Lao	Regravelling	Dec. 11-Jun 12	Gravel	6	
6901	Salavan	2,200	411,600	Firm	Lao	Regravelling/ Spot Improv.	Dec. 11-Jun 12	Gravel	6	
7812	Champasack	22,500	270,513	Firm	Lao	Regravelling	Dec. 11-Jun 12	Gravel	6	
7501	Sekong	30,600	599,760	Firm	Lao	Regravelling/ Spot Improv.	Dec. 11-Jun 12	Gravel	6	
9001	Attapue	60,000	254,819	Firm	Lao	Regravelling	Dec. 11-Jun 12	Gravel	6	

ANNEX 4

Bridge Construction Cost

Annex 4.1: Makhiow Bridge Construction

Vientiane capital

Department of Public Works and Transport

Location: **Ban Makhiow, Hadsaifong district**

Length: **50m**

Width: **15m**

Contractor: **HouanSup Patthena Construction Com., Ltd**

Type of contract: **Design and Build**

Duration: **2012-2014**

Type of bridge: **Concrete**

Bill No.	Works Description	Cost (kip)
100	Provision sum	632,664,000
200	Earth Works	1,050,480,000
300	Road Surface	1,587,360,000
400	Drainage systems	0
500	Structure	5,411,840,000
600	Element and furniture	1,057,800,000
	Total from Bill No. 100-600	9,740,144,000

	Tax (10%)	974,014,400
	Survey and design	146,102,160
	Project miscellinous (10%)	974,014,400
	Project controling and management	409,086,048
	Grand Total	**12,243,361,008**
	Grand Total ($)	**1,530,420**
	Cost per meter (kip/ml)	**244,867,220**

Annex 4.2: Vanghou Bridge Construction

Vientiane capital
Department of Public Works and Transport

Cost of Vanghou Bridge Construction

Location: Ban Vanghou, Hadsaifong district
Length: 33m
Width: 15m
Contractor: HouanSup Patthena Construction Com., Ltd
Type of contract: Design and Build
Duration: 2012-2014
Type of bridge: Concrete

Bill No.	Works Description	Cost (kip)
100	Provision sum	724664000
200	Earth Works	755375000
300	Road structure	0
400	Drainage systems	0
500	Structure	3479080000
600	Other element	641650600

Total from Bill No. 100-600	**5,600,769,600**
Tax (10%)	560,076,960
Survey and design	84,011,544
Project miscellinous (10%)	560,076,960
Project controling and management	235,232,323
Grand Total (kip)	**7,040,167,387**
Grand Total ($)	**880,021**
Cost (kip) per meter	**213,338,406**

Annex B: Traffic and Revenue Study

1. Forecasting Road Traffic

Traffic volumes carried by the NR13 in future years will be determined by a combination of complex factors. These will include the overall level and pattern of trips in the study area, the time and cost savings that the NR13 provides compared to alternative routes, the cost of using NR13 and the willingness and ability of people to pay that cost. The approach adopted to prepare future traffic forecasts for NR13 examines each of these features within a rigorous flexible and transparent methodology.

Traffic forecasts have been prepared for two different scenarios, namely:

- Do-Minimum Scenario – NR13 will not be improved and remain un-tolled
- Do-Something Scenario – NR13 will be improved and tolls will be charged to the road user

The key features of the methodology are shown in Figure 1. The three key aspects of the methodology include:

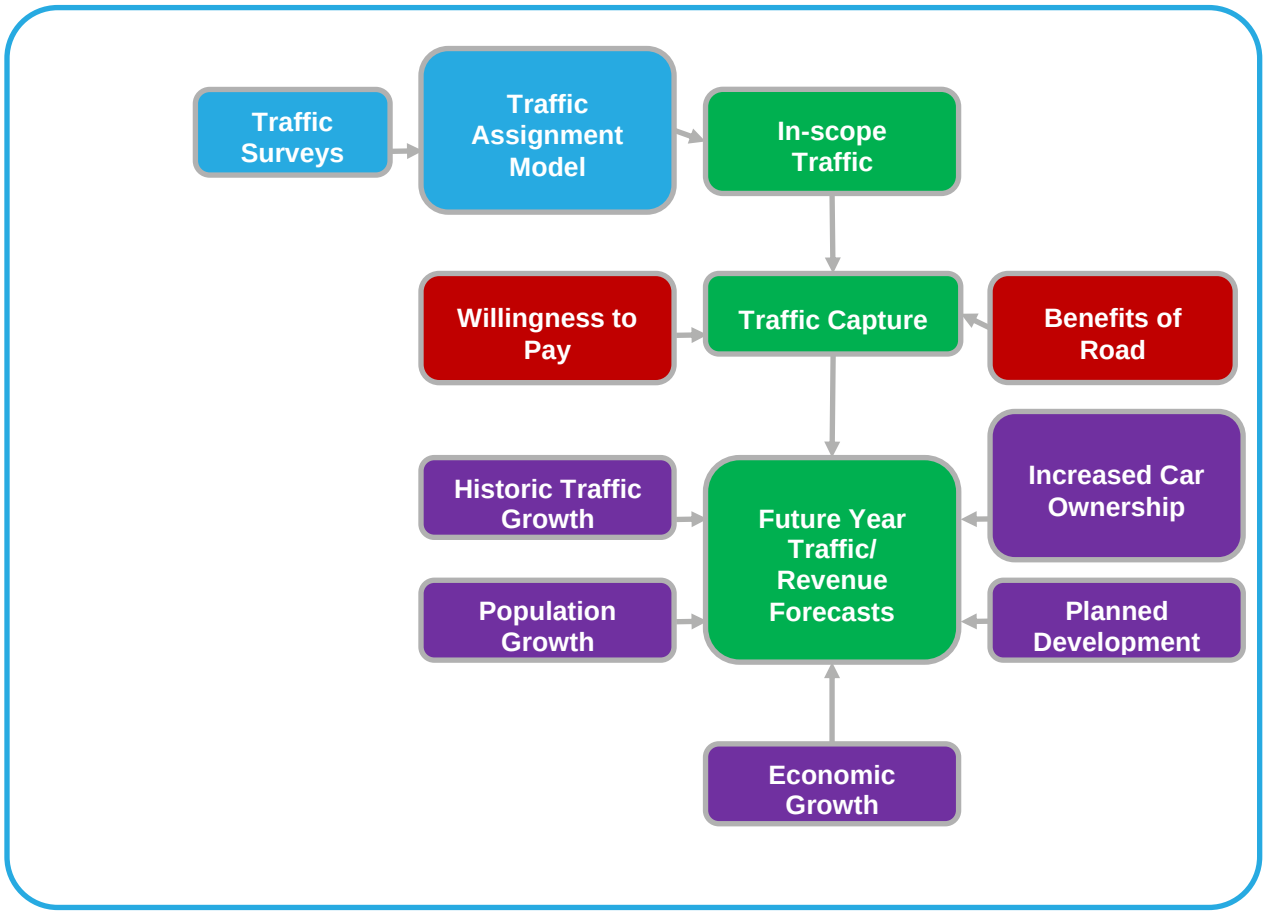
- Defining the existing traffic demand that *could* use NR13 (**In-Scope Traffic**);
- Estimating the proportion of the 'in-scope' traffic that *will* use NR13 (**Traffic Capture**); and
- Forecasting future year traffic growth to estimate traffic (and revenue) during the term of the concession (**Traffic Forecasts**)

In-scope Traffic

It is essential that a full understanding of the trip movements using the existing road and an assessment of route choice options is undertaken at the outset of a traffic study. In the case of the existing NR13, the 'in-scope' traffic – traffic which could potentially use the improved road if tolled or un-tolled – is equivalent to the existing traffic on the road. Existing traffic levels and trip patterns are observed by traffic surveys and a computer-based Traffic Assignment Model is often built to act as a platform for the base year traffic analysis.

Traffic Assignment Models comprise two major elements: the trip matrices; and, a description of the existing and future road network of the study area. Matrices are built from data collected during Roadside Interview surveys (RSI) and supplemented by traffic counts. Drivers are asked several questions regarding their present trip including, their origin and destination, trip purpose, and type of vehicle. The study area is divided into homogenous traffic zones. Matrices are built for different vehicle types to reflect their different trip patterns and route choice behavior.

Figure 1: Methodology Overview



The existing road network is described in the Traffic Assignment Model in terms of average travel speeds, road capacities and road link lengths. The Traffic Assignment Model assigns the trip matrices to the network to simulate the existing route choices available to drivers in the NR13 corridor. The output of the model, in terms of the assigned traffic flows on each section of the road, is then validated against total traffic count data to ensure that the Traffic Assignment Model provides a satisfactory representation of the existing road network.

Traffic Capture

The proportion of 'in-scope' traffic likely to be captured by the improved NR13 will depend on two principal factors:

- the advantages of NR13; and
- (if NR13 is tolled) the willingness of drivers to pay for time savings, superior road quality and safety

If these can be quantified for each origin-destination combination in the study area, a Traffic Capture Model can be developed that will predict the level of traffic that will choose to use the road. Total journey costs for vehicles using the road (including a toll if applicable) are compared to the cost of using an alternative route. An exponential mathematical (logit) function is used to allocate traffic flows to the NR13, or an alternative, according to the difference in total costs of each route option.

Traffic Forecasts

The growth of traffic in future years will itself depend on a number of key factors:

- Recent traffic growth on NR13;
- Growth in the wealth and level of economic activity, which in turn will lead to higher levels of car ownership and higher rates of trip making within each household;
- Growth in employment and population in the NR13 corridors; and
- Growth in the volume of freight carried between countries, factories, distribution and retail centers.

Information relating to recent traffic growth and growth in vehicle registrations in the study area generally forms the basis of future year forecasts. This data is supplemented with historic and predicted economic data and population data if available. Forecasts of future traffic growth are subsequently applied to the base year traffic forecast to estimate future year traffic (and revenues) over the length of the concession term.

2. Traffic Data Collection

Four types of Traffic Surveys were undertaken on NR13 in March/April/May 2013 by Lao-Asie Consultants Group as shown in the following table.

Table 1: Traffic Surveys and Data Collected

Survey Type	Number	Time Period	Data Collected
Manual Classified Count	8	12/24 hours	• Vehicle Composition • Daily Traffic Levels • Hourly Traffic Profiles (Weekdays/Weekend)
Classified Turning Count	1	12 hours	• Vehicles travelling from 13S towards Friendship Bridge • Daily Traffic Levels • Weekday Hourly Profile

Roadside Interview Surveys	4	12 hours	• Sample Origin-Destinations • Trip Purpose • Trip Frequency • Trip Length • Registration Plate Color • Willingness to pay a toll (Yes/No/Maybe)
Travel Time Surveys	6	Off Peak	• Average travel times and distance on 13N, 13S and alternative routes

Photographs of the Roadside Interview surveys in operation are shown in Figure 2.

Figure 2: Roadside Interview surveys in operation

Figures 3 and 4 display the traffic survey locations and the estimated Annual Average Daily Traffic (AADT) at each location.

Figure 3: Location of Traffic Surveys and estimated AADT on 13S (% HGV)

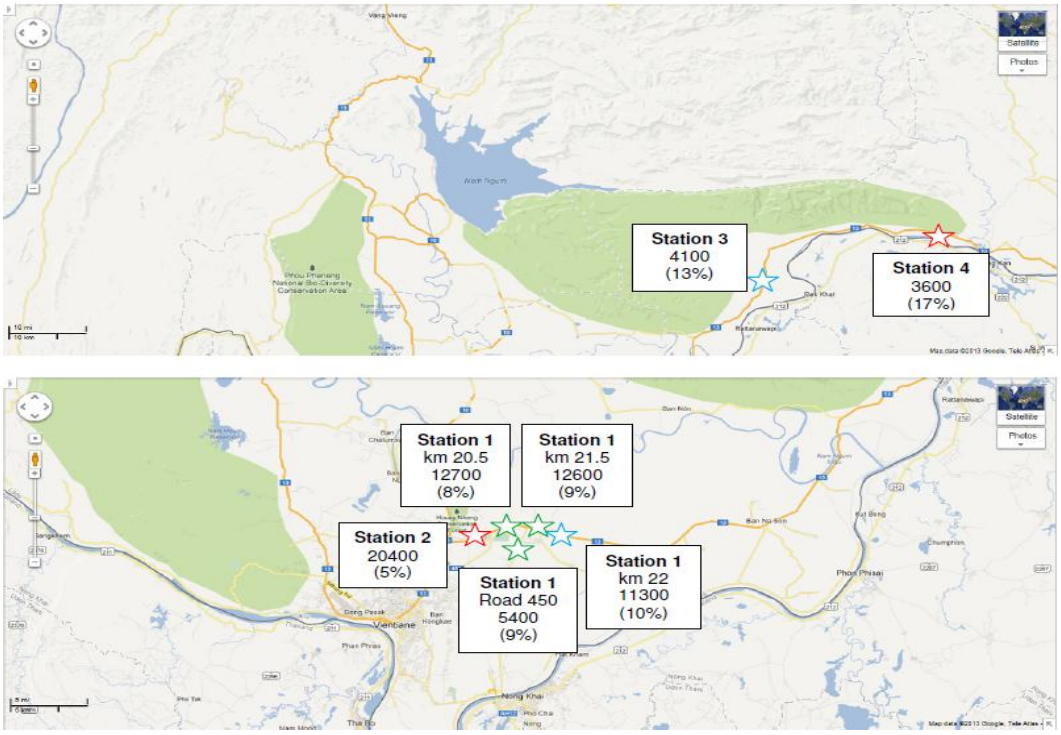
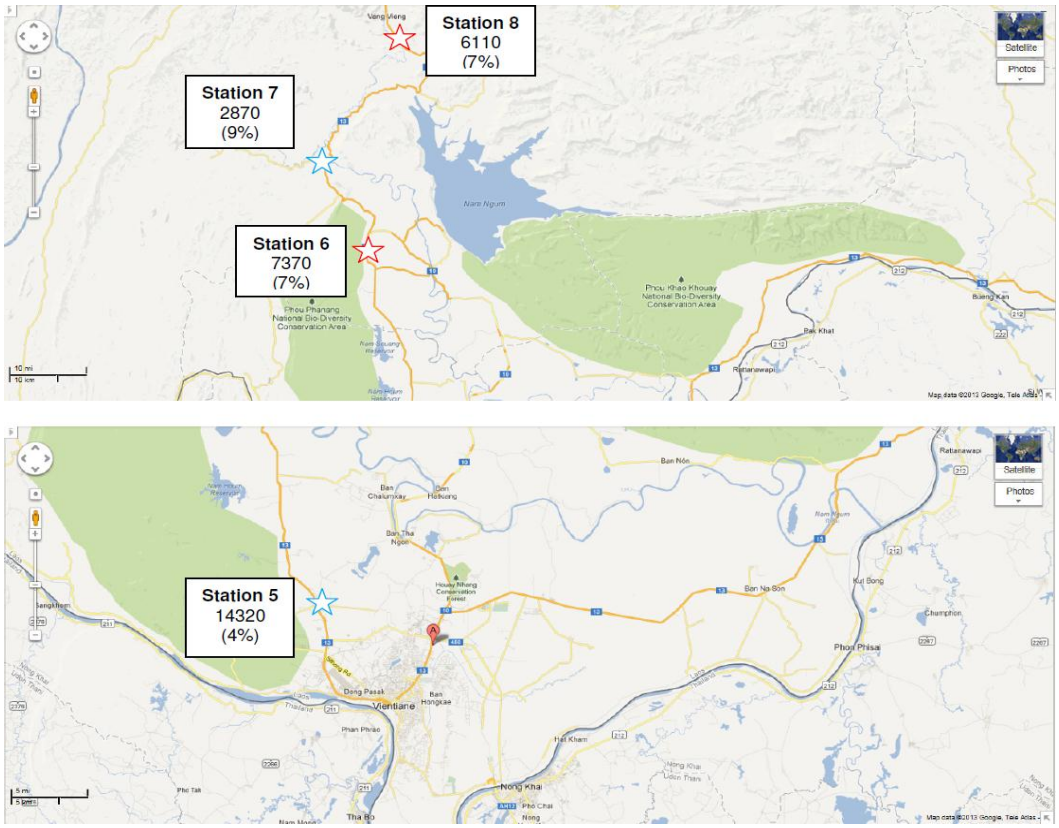


Figure 4*:* Location of Traffic Surveys and estimated AADT on 13N (% HGV)



The highest volumes of traffic were observed at km13 Don Noun (Station 2) on 13S (20,400 AADT). Traffic volumes decline to around 13,000 AADT at km21 (Station 1) then to around 4,000 AADT at Station 3 km89 (Palai) and towards Paksan (Station 4).

The highest volumes of traffic on the 13N were counted at km19, 14,000 AADT at Station 5. Traffic declines to around 7,000 AADT at Station 6 south of Phônhông, around 3,000 AADT at Hinheup bridge (Station 7) and increases towards Vang Vieng to 6,000 AADT at Station 8.

Key findings from the traffic surveys include:

- **Roadside Interview Surveys:** 2903 Interviews were undertaken in one direction at 4 RSI sites. Sample rates of 17%-18% were achieved at semi-urban stations (1 and 5) and 33% at rural stations (3 and 7).
    - 32% commuters, 26% Personal Business, 42% Other Purposes
    - 45% trips longer than 45 minutes
    - 93% of drivers said they were willing to pay a toll for better roads
- **Manual Classified Counts:** Very high proportions of motorcycles, typically 40-50%, were observed except at very rural locations
    - Cars, jeep, taxi and pick-ups comprise 25-40% of total traffic
    - Light goods vehicles 8-14% of total traffic
    - Heavy Goods Vehicles 4-15%, higher proportions at rural locations
- **Travel Time Surveys:** The average speed on 13N and 13S is 67 kph.
    - NR10 average speed = 57 kph
    - NR4 average speed = 33 kph

3. Traffic Capture Model Development

The objectives of building the Traffic Capture Model were the following:

- To provide a robust platform to prepare traffic and revenue forecasts by vehicle category for 13N and 13S between 2013 and 2050
- To enable comparisons to be made between the Do-Minimum and the Do-Something traffic forecast scenarios
- To provide the flexibility to test the impact of changing toll levels, willingness to pay and traffic growth rates on the traffic and revenue forecasts for 13N and 13S
- To assess the impact of trip suppression at toll plaza locations where alternative routes do not exist

The Traffic Capture Model has been created using the following approach:

- Cleaned sample interview data was factored to observed traffic counts at 24 hour Annual Average Daily Traffic (AADT) volumes
- Data was aggregated to 4 vehicle types: motorcycles, cars/ jeeps/taxis/pick-ups, Light Goods Vehicles (LGV), Heavy Goods Vehicles (HGV)
- Origin-destination trip matrices (46 zones x 46 zones) by vehicle type were created by District, Province and Country
- Aggregated trip matrices by vehicle type were created for common study area entry points (26 zones x 26 zones)
- Road network distances and travel times were collated for all strategic roads in the study area (NR10, NR4 etc.) using the Traffic Assignment Model
- A logit-based spreadsheet model was been built incorporating assignment-based time and distance skims for all observed traffic movements in the study area
- Behavioral parameters were determined from benchmarking with other studies
- Traffic growth rates were applied to forecast future traffic volumes

Traffic Capture Model Inputs are shown in the following table:

Table 2: Traffic Capture Model Inputs

Behavioral Parameter	Definition, Source and Value
Values of Time (VoT)	• The value of 1 hour of a driver's time • Adopted from traffic study in Vietnam for the World Bank • Adjusted for Lao GDP per capita (95% of Vietnam GDP p.c. based on WB database) • Motorcycles 9,600 Kip/hour • Cars, Jeeps, Taxis, Pick-ups 38,400 Kip/hour • Light Goods Vehicles 46,500 Kip/hour • Heavy Goods Vehicles 107,000 Kip/hour
Vehicle Operating Costs (VOC)	• The cost of operating a vehicle • Car VOC based on cost of petrol per km for an average car • 10,490 Kip/liter unleaded, 9400 Kip/liter diesel • Heavy Goods Vehicle VOC taken from traffic study in Vietnam for the World Bank
Motorway Bonus	• The 'bonus' associated with superior road standards including safety • Relationship adopted from traffic study in Vietnam for the World Bank • 10% of VoT per hour applied on per kilometer basis
Exponential (logit) function	• Mathematical function used in Traffic Capture Model • Scaling parameter calibrated based on the traffic capture rate

	• Trip suppression elasticity varies by trip length. • Calibrated based on judgment and realistic assessment of the impact of a toll on a captive market (if no toll-free alternative route is available)

The average speed of traffic using 13N and 13S which is currently 67kph has been assumed to increase to 80-90kph when the road improvements have taken place.

The new bridge across the Nam Ngum river in Vientiane Province has been included in the Do-Minimum forecast scenario. The new bridge makes the strategic route via NR4 and NR10 an attractive alternative route between Paksan and Vang Vieng.

Traffic Capture Model Outputs are shown in the following table:

Table 3: Traffic Capture Model Outputs

Variable	Comments
Forecast Scenarios	• Existing road network • Do-Minimum road network without Improvements to 13N and 13S un-tolled • Do-Something road network with Improvements to 13N and 13S tolled
Traffic Capture	• Toll Plaza • Vehicle Type
Traffic Forecasts	• Toll Plaza • Vehicle Type • 13N/13S • 2015 to 2050
Revenue Forecasts	• Toll Plaza • Vehicle Type • 13N/13S • 2015 to 2050

4. Traffic Growth

Historic Traffic Growth

Historic traffic data, which would indicate recent traffic growth on the NR13 corridor, is not available. However, the following information has been collated which is indicative of historic traffic growth in the study area:

- Comprehensive vehicle registration data by Province 2000-2012
- Population statistics 2009-2011
- Fuel sales 2001-2012
- Freight Transport Statistics

- Imports and Exports by country

Vehicle registration data by Province has been kindly provided by the Ministry of Public Works and Transport (MoPWT). The data has been aggregated into four vehicle classes: motorcycles; cars, jeeps, taxis and pick-ups, Light Goods Vehicles (LGV) and Heavy Goods Vehicles (HGV).

Table 4: Growth of Vehicle Registrations by Province 2000-2012

	Vientiane Capital	Vientiane Province	Borikhamxai Province	Total
Total Vehicles 2012	535,535	57,081	30,426	623,042
Annual Growth 2000-2012				
Total Vehicles	**14%**	**17%**	**27%**	**15%**
Motorcycles	13%	17%	27%	14%
Cars, jeeps, taxis, pick-ups	17%	20%	32%	18%
Vans (LGV)	26%	24%	38%	26%
Goods vehicles (HGV)	9%	11%	14%	9%
% Total Vehicles in 2012				
Motorcycles	69%	76%	79%	70%
Cars, jeeps, taxis, pick-ups	24%	17%	16%	23%
Vans (LGV)	4%	2%	2%	4%
Goods vehicles (HGV)	3%	4%	2%	3%
Car Ownership per 1000 inhabitants	**142**	**18**	**16**	**80**

Source: MoPWT

The average annual growth of all vehicle types in the three Provinces of Vientiane Capital, Vientiane Province and Borikhamxai Province has been extremely high by international standards. Total vehicle registrations increased by over 500% between 2000 and 2012.

The proportion of motorcycles in the total registered vehicles (70%) is also extremely high by international standards. As economic growth continues and car ownership becomes more widespread, the proportion of motorcycles is expected to decline. Another indication of the recent economic growth is the growth of registered commercial vans which have been increasing at a higher rate than other vehicles.

Car ownership per 1000 inhabitants for all provinces and particularly for Vientiane and Borikhamxai Provinces is extremely low. There is huge potential for future growth of car ownership in the NR13 corridors.

Recent population growth in the three Provinces is shown in the following table. The total population of the study area is distributed as follows:

- 51% Vientiane Capital
- 32% Vientiane Province
- 17% Borikhamxai Province

Table 5: Population Statistics by Province 2009-2011

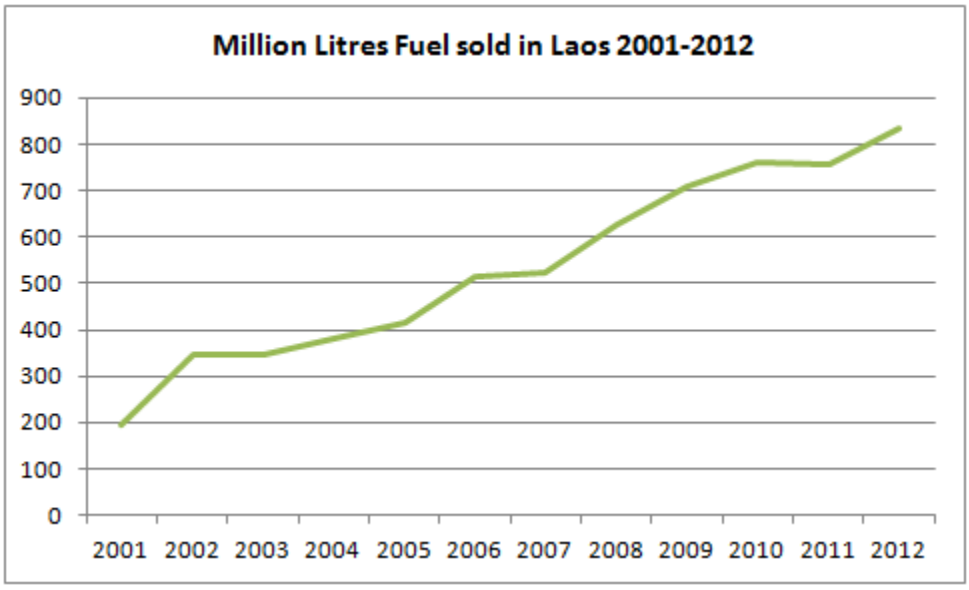
	Lao	Vientiane Capital	Vientiane Province	Borikhamxai Province	Total in Study Area
2009	6.127m	754,384	467,452	256,371	1,478,207
2010	6.256m	768,743	480,440	264,513	1,513,696
2011	6.385m	783,032	493,593	272,794	1,549,419
Annual Growth 2009-2011	2.1%	1.9%	2.8%	3.2%	2.4%

Source: Lao Statistics Bureau Yearbook 2011

Population growth in Vientiane and Borikhamxai Provinces has recently been showing higher growth than Vientiane Capital. Road 13N serves Vientiane Province and 13S serves Borikhamxai Province, both Provinces have been experiencing relatively high population growth compared to Vientiane Capital.

Fuel sales in Lao have grown consistently with vehicle registration growth. Figure 5 shows the steady growth of fuel sales in the country since 2001. Fuel sales have grown by an average of 14% per annum between 2001 and 2012 (identical to total vehicle growth in Vientiane Capital).

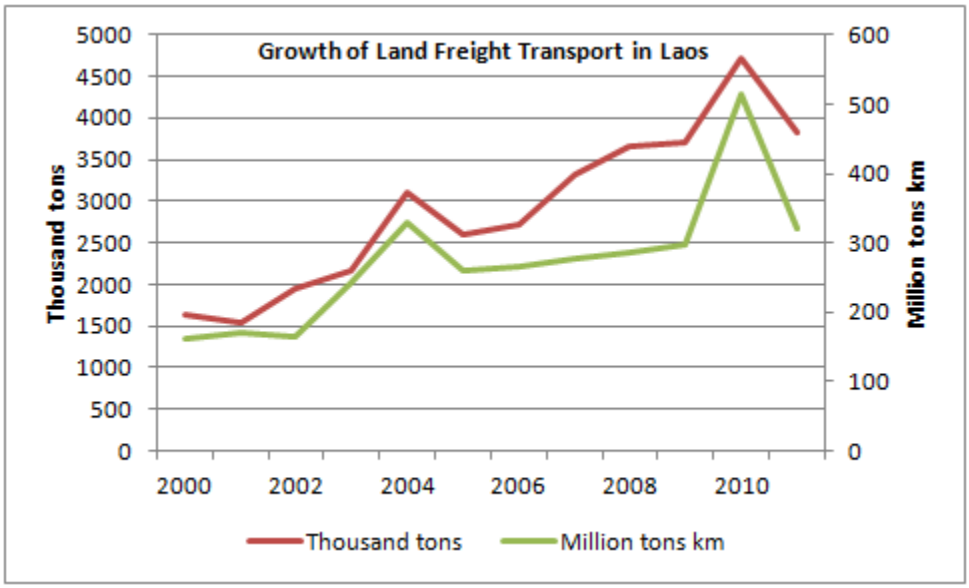
Figure 5: Growth of Fuel Sales



Source: MoPWT

Figure 6 displays the growth of land freight transport in Lao. The annual average growth of freight carried by land was 9% between 2000-2011 which is consistent with the growth of registered Heavy Goods Vehicles shown earlier. Ton kms increased sharply in 2010. This effect was possibly due to new road provision in Lao (Road 450 etc.).

Figure 6: Freight Transport Statistics



Source: Lao Statistics Bureau Yearbook 2011

In 2010, 74% of exports from Lao went to Intra-ASEAN countries:

- 71% to Thailand
- 3% to Vietnam

In 2010, 86% of imports to Lao came from Intra-ASEAN countries:

- 76% from Thailand
- 7% from Vietnam

Trade with Vietnam, China and Cambodia (potential traffic for 13N and 13S) form a very small proportion of sales at present. There is significant potential for future growth.

Future Traffic Growth

The most comprehensive traffic data source indicating the historic growth of traffic by Province is the Vehicle Registration data provided by the MoPWT. Regression analysis has been undertaken with this traffic data against historic economic growth in order to develop a relationship that can be extrapolated to predict future growth of traffic.

Vehicle registrations in the three Provinces under consideration (Vientiane Capital, Vientiane and Borikhamxai) have been growing at the following multiples of Gross Domestic Product (GDP) growth:

Table 6: Traffic Growth against GDP 2000 - 2012

Multiple of GDP (R^2)	Vientiane Capital	Vientiane Province	Borikhamxai Province
Class 1 Motorcycles	2.37 (0.80)	2.85 (0.67)	4.77 (0.42)
Class 2 Car, jeep and pick-up	2.96 (0.83)	4.07 (0.51)	5.74 (0.49)
Class 3 Light Goods Vehicles (Van)	4.60 (0.85)	9.49 (0.44)	16.80 (0.18)
Class 4 Heavy Goods Vehicles	2.13 (0.30)	2.00 (0.39)	2.33 (0.33)

Source: PPIAF

Strong regression relationships were determined between economic growth and vehicle registration growth for Vientiane Capital. The regression output (shown in red) for Vientiane Capital has been used for future traffic growth in the study area due to:

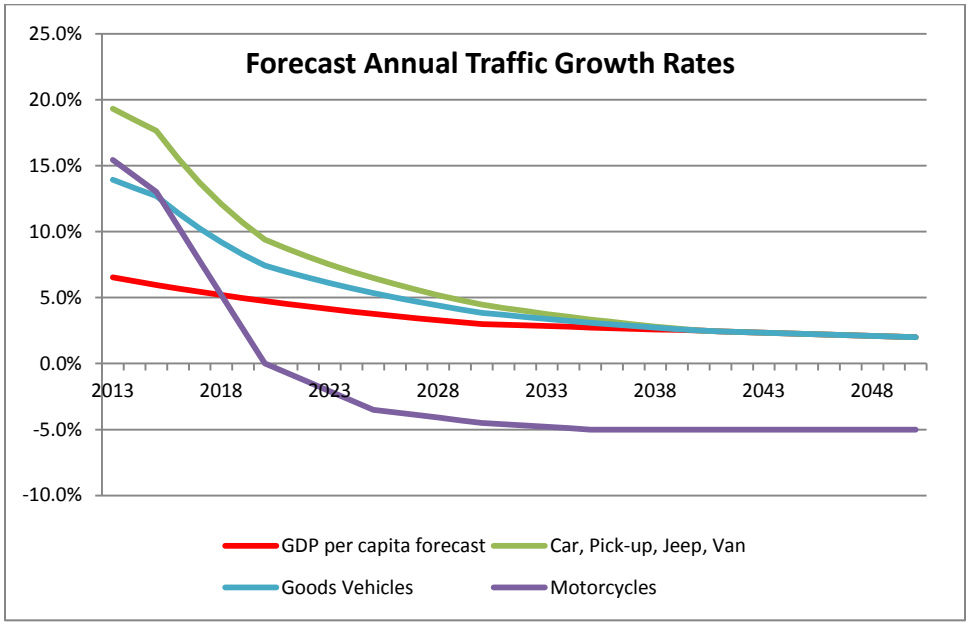
- Superior consistency of Vehicle Registration data in Vientiane Capital
- Strongest correlation between Vehicle Registration data and GDP growth in Vientiane Capital
- The domination of Vientiane Capital traffic on 13N and 13S

The observed relationship between economic growth and Light Goods Vehicles (LGV) was considered very high for future predictions. LGV traffic has therefore been assumed to grow in line with cars, jeeps, taxis and pick-up vehicles. The traffic growth multiplier with GDP is assumed to decline over time as car ownership and the economy of Lao develops. By 2040 the growth of cars, jeeps, taxis, pick-ups, LGVs and Heavy Goods Vehicles (HGV) is assumed to be at parity with GDP growth.

Motorcycle growth was assumed to decline over time as car ownership increases. By 2020, the number of registered motorcycles is expected to decline year-on-year as cars, jeeps, taxis and pick-ups become the dominant vehicle type in Lao.

The predicted future growth of traffic by vehicle type resulting from the historic regression relationships with GDP is shown in the following figure.

Figure 7: Predicted Future Traffic Growth per annum



Source: PPIAF

GDP forecasts for Lao have been taken from the IMF April 2013 World Economic Outlook.

5. Illustrative Toll Strategy

An illustrative toll strategy has been designed to indicate the potential toll revenue that could be collected from 13N and 13S. The location of the toll plazas is based on the following:

- An understanding of existing trip movements at the plaza locations
- Avoidance of excessive local trips (necessity for local discounts)

A balance has been sought between:

- The number of toll plazas (Operating Costs) and
- The size of toll tariff (Affordability) charged for the associated road length
- % Local or captive traffic without alternative route

The proposed Toll Strategy is illustrative based on international experience and affordable toll tariffs:

- Fewer toll plazas would require higher toll tariffs to generate the same level of revenue forecasts although operating costs would be lower
- Conversely more toll plazas would permit lower toll tariffs to be charged in order to generate the same revenue forecasts but operating costs would be higher

Figures 8 and 9 display the illustrative Toll Plaza locations.

Figure 8: Location of Illustrative Toll Plazas on 13N

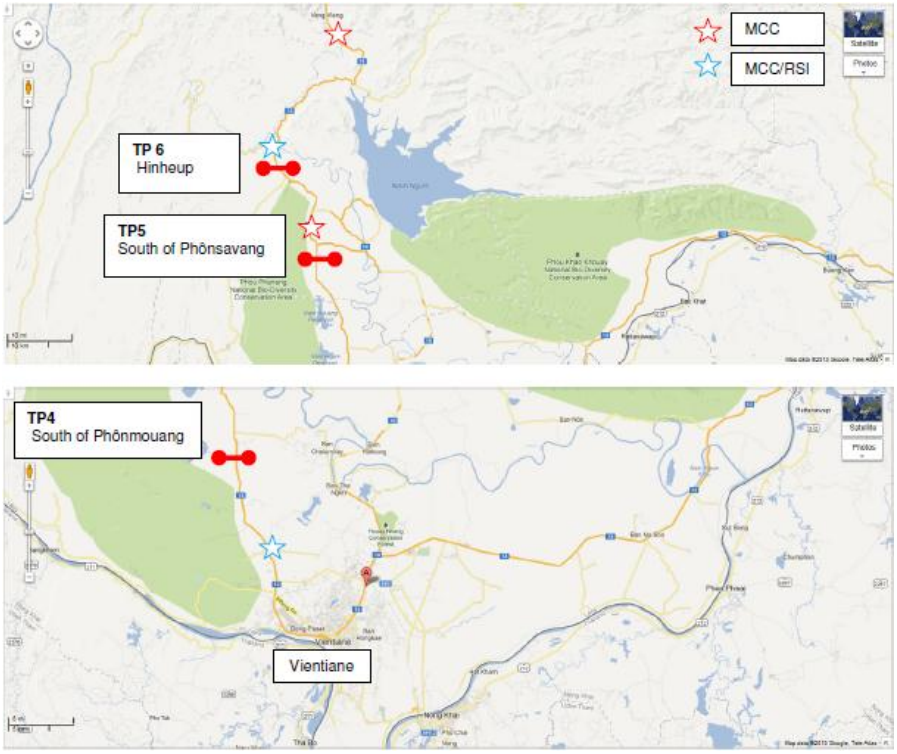
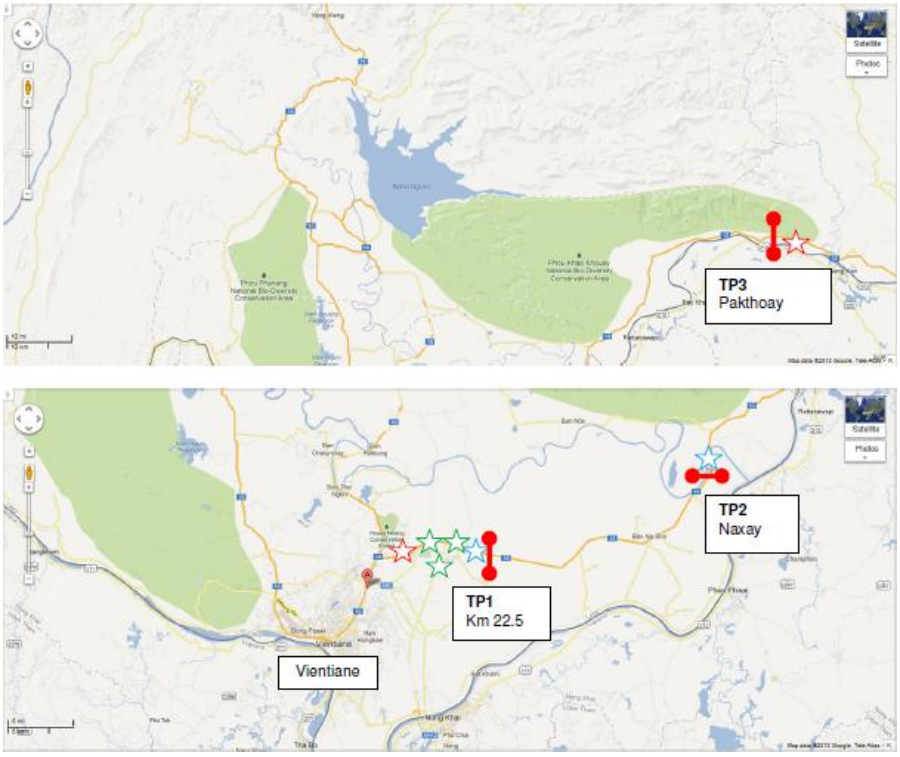


Figure 9: Location of Illustrative Toll Plazas on 13S



The illustrative toll tariffs, based on an average toll of 300 Kip/km for Class 2 vehicles (cars, jeeps, taxis and pick-ups), are displayed in the following table. The distance associated with each toll plaza is also shown.

Table 7: Illustrative Toll Plazas and Toll Tariffs

Kip 2013 prices	Toll Plaza 1	Toll Plaza 2	Toll Plaza 3
	Don Noun - Ban Woen	Ban Woen – Ban Naxay	Ban Naxay - Paksan
Distance tolled (km)	25.60	26.00	78.80
1. Motorcycles	3840	3900	11820
2. Cars, Jeeps, Taxis & Pick-ups	7680	7800	23640
3. Light Goods Vehicles	11520	11700	35460
4. Heavy Goods Vehicles	23040	23400	70920
Kip 2013 prices	**Toll Plaza 4**	**Toll Plaza 5**	**Toll Plaza 6**
	Road 450 - Phônmouang	**Phônmouang - Phônhông**	**Phônhông - Vang Vieng**
Distance tolled (km)	21.50	33.80	80.00
1. Motorcycles	3225	5070	12000
2. Cars, Jeeps, Taxis & Pick-ups	6450	10140	24000
3. Light Goods Vehicles	9675	15210	36000
4. Heavy Goods Vehicles	19350	30420	72000

Source: PPIAF

The tariff charged to motorcycles has been set at 50% of the toll charged for cars, jeeps, taxis and pick-ups. The tariffs charged for Light Goods Vehicles and Heavy Goods Vehicles has been set at 1.5 and 3 times the Class 2 tariff (car, jeep, taxis and pick-up). These multiples of the Class 2 tariff for LGV and HGV are consistent with international practice.

6. Traffic and Revenue Forecasts

Traffic forecasts have been prepared for two different scenarios:

- Do-Minimum Scenario – NR13 will not be improved and remain un-tolled
- Do-Something Scenario – NR13 will be improved and tolled

Do-Minimum Scenario

With the continuation of strong economic growth in Lao, traffic on 13N and 13S - which forms the back-bone of the country - is predicted to increase significantly. The following table presents total traffic forecasts for 13N and 13S at the locations where traffic counts were undertaken in 2013 for key forecast years until 2050.

Table 8: Do-Minimum Total Traffic Forecasts (AADT)

13S	Km13	Km22.5	Km89	Km139
2013	20,400	11,300	4,100	3,600
2015	27,100	15,100	5,500	4,800
2020	40,600	23,200	8,800	7,800
2030	53,100	32,800	13,600	12,300
2040	62,400	40,200	17,500	16,000
2050	72,200	47,600	21,100	19,500
13N	**Km19**	**Km67**	**Km93**	**Km146**
2013	14,300	7,400	2,900	6,100
2015	19,200	9,800	3,800	8,200
2020	29,600	15,000	5,800	12,500
2030	41,900	20,900	8,100	17,600
2040	51,400	25,400	9,900	21,600
2050	60,800	29,900	11,700	25,500

Source: PPIAF

Over the next 37 years until 2050, traffic levels on the 13N and 13S are predicted to increase by 250-440% due to increasing economic wealth and car ownership. Traffic on the busiest sections of the NR13 closest to Vientiane is predicted to increase to 53,100 vehicles AADT at km13 Don Noun and 41,900 vehicles at km19 by 2030. On the rural sections of NR13 traffic is predicted to increase 8,000 – 18,000 AADT depending on location.

To put these levels of traffic growth into perspective, total vehicle registrations in the three Provinces of Vientiane Capital, Vientiane and Borikhamxai over the 12 years between 2000 and 2012 increased by 504%.

Do-Something Scenario

The Do-Something traffic and revenue forecasts assume that the 13N and 13S will be tolled at the locations and tariffs indicated in the illustrative toll strategy.

The traffic forecasts for a tolled road will always be less than the traffic forecasts for an un-tolled road because a proportion of drivers will either not make their previous trip (trip suppression), share a vehicle to make a trip (when previously multiple vehicles were used) or use an alternative cheaper route.

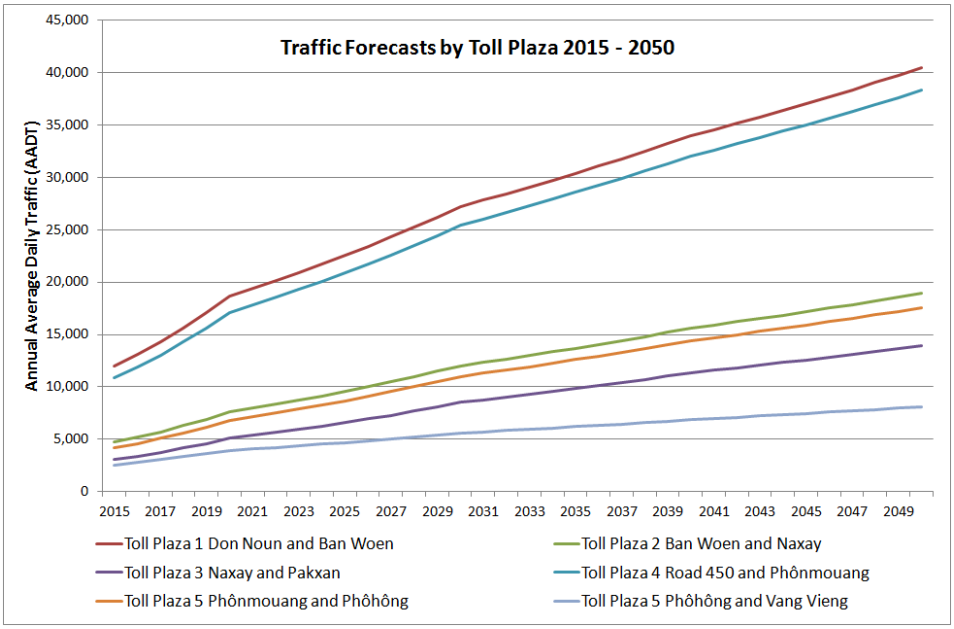
The following table and figure present total traffic forecasts for 13N and 13S at the toll plaza locations for key years until 2050.

Table 9: Do-Something Total Traffic Forecasts (AADT)

13S	Km22.5 (TP1)	Km89 (TP2)	Km139 (TP3)
2015	12,000	4,700	3,100
2020	18,700	7,600	5,100
2030	27,200	12,000	8,500
2040	33,900	15,600	11,400
2050	40,400	18,900	13,900
13N	**Km19 (TP4)**	**Km67 (TP5)**	**Km93 (TP6)**
2015	10,900	4,200	2,600
2020	17,100	6,800	4,000
2030	25,400	11,000	5,600
2040	32,000	14,400	6,900
2050	38,300	17,500	8,100

Source: PPIAF

Figure 10: Do-Something Traffic Forecasts by Toll Plaza



Source: PPIAF

The assumed 'capture' of traffic, the ratio of tolled traffic compared to the forecast traffic if the road was un-tolled, is provided in the following table for 2015 traffic levels.

Table 10: Traffic Capture at 2015 Traffic Levels

13S	Km22.5 (TP1)	Km89 (TP2)	Km139 (TP3)
	79%	85%	65%
13N	Km19 (TP4)	Km67 (TP5)	Km93 (TP6)
	57%	43%	68%

Source: PPIAF

The generally lower traffic capture rates on the 13N reflect the lack of alternative routes around the toll plazas and the impact of trip suppression. In reality, lower toll tariffs for local traffic movements may be provided resulting in lower levels of trip suppression.

The assumed 'capture' of traffic by toll class is shown in the following table for 2015 traffic levels.

Table 11: Traffic Capture at 2015 Traffic Levels

Toll Class	Vehicle Type	% Capture
1	Motorcycles	49%
2	Car, jeep, taxis, pick-up	74%
3	Light Goods Vehicles	75%
4	Heavy Goods Vehicles	74%
All	Total Vehicles	61%

Source: PPIAF

Motorcycles are expected to show the lowest level of traffic capture due to trip suppression when no alternative route exists for local traffic movements. The capture rates for other vehicles are expected to be around 75% which is typical for rural toll roads elsewhere.

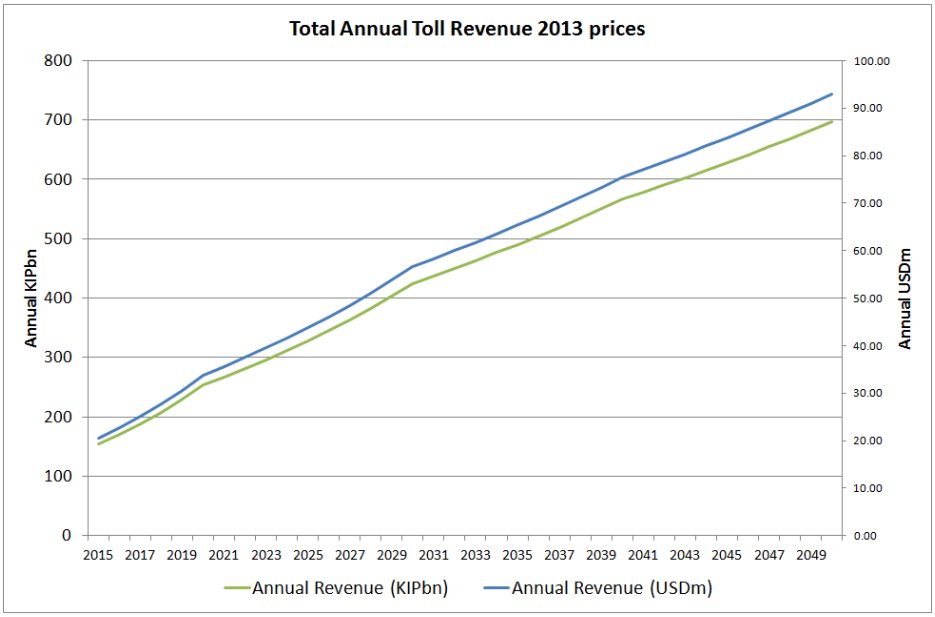
The revenue forecasts for the illustrative toll strategy are provided for the 13N and 13S separately in the following table and figure.

Table 12: Do-Something Annual Revenue Forecasts (Kip billion/USD million at 2013 prices)

Forecast Year	KIP billion			USD million		
	13N	13S	Total	13N	13S	Total
2015	65.53	88.74	154.28	8.74	11.83	20.57
2020	107.95	145.73	253.68	14.39	19.43	33.82
2030	179.05	245.41	424.46	23.87	32.72	56.59
2040	237.65	328.72	566.37	31.69	43.83	75.52
2050	291.43	405.23	696.66	38.86	54.03	92.89

Source: PPIAF

Figure 11: Do-Something Revenue Forecasts for 13N and 13S



Source: PPIAF

Indicative annual revenues of 154.28 billion Kip (20.57 USD million) are estimated in 2015 rising to 700 billion Kip (93 USD million) in 2050 based on the illustrative toll strategy and assumed traffic growth. Around 58% of the total revenues are forecast to be collected from the 13S toll plazas.

The contribution of revenue by vehicle class is shown below:

Table 13: Proportion of Toll Revenue by Toll/Vehicle Class

	Class 1 Motorcycles	Class 2 Cars, jeeps, taxis & pick-ups	Class 3 Light Goods Vehicles	Class 4 Heavy Goods Vehicles
2015	15%	35%	21%	28%
2020	12%	38%	23%	27%
2030	5%	42%	26%	27%
2040	2%	44%	27%	27%
2050	1%	44%	27%	28%

Source: PPIAF

Motorcycles are assumed to be charged at 50% of the Class 2 toll. Even with the discount there is likely to be an element of trip suppression of these largely local trips. The proportion of motorcycles is predicted to decline sharply over time as economic wealth and car ownership increases. Drivers are expected to upgrade their motorcycles for cars as disposable income increases. As a result, the proportion of revenue collected from cars, jeeps, taxis and pick-ups is forecast to increase over time. Revenues from Light Goods Vehicles increase in proportion over time, reflecting their historic relatively high growth which is expected to continue in future.

7. Sensitivity Tests

Three types of sensitivity tests have been undertaken for the Do-Something traffic and revenue forecasts:

- Central (Base) Case Toll Tariff tests
- Low/High Case Scenarios
- Shortening of upgrade works, removal of TP3 and TP6

Toll Tariff Sensitivity

The illustrative toll tariff for Class 2 vehicles (car, jeep, taxis and pick-up) was 300 Kip/km. Forecasts for lower and higher toll levels of 150 Kip/km and 450 Kip/km have also been prepared as shown in the following table.

Table 14: Toll Tariff Sensitivity Test Annual Revenue Forecasts (Kip billion/USD million at 2013 prices)

Forecast Year	Kip billion			USD million		
	150 Kip/km	300 Kip/km	450 Kip/km	150 Kip/km	300 Kip/km	450 Kip/km
2015	85.42	154.28	213.63	11.39	20.57	28.48
2020	139.74	253.68	352.29	18.63	33.82	46.97
2030	231.32	424.46	593.14	30.84	56.59	79.09
2040	307.24	566.37	793.59	40.96	75.52	105.81
2050	377.16	696.66	977.29	50.29	92.89	130.31

Source: PPIAF

Because relatively few attractive alternative routes exist around the illustrative toll plaza locations, higher toll tariffs are forecast to result in higher toll revenue (and vice versa). If toll levels of 450 Kip/km (+50% Base Case) are charged to Class 2 vehicles whilst maintaining the same multipliers for the other toll classes, revenues could increase by 38%. The table above indicates that traffic levels are not very sensitive to toll tariffs (because few alternative routes exist). The final toll tariff should be based on public acceptance and affordability.

Low/High Case Scenarios

Revenue forecasts have been provided for the Do-Something Scenario for three cases:

- Central (Base) Case
- Low Case
- High Case

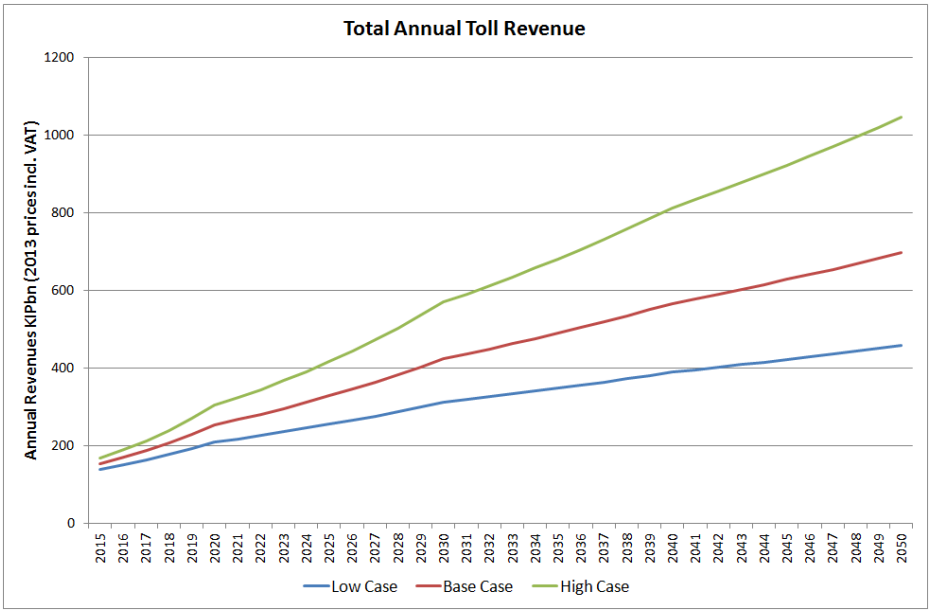
The Low and High forecasts were based on adjusting the Value of Time and traffic growth rates by -/+20% to assess the impact of these assumptions on the traffic and revenue forecasts. The following table and figure display the results of the sensitivity test.

Table 15: Low/High Sensitivity Test Annual Revenue Forecasts (Kip billion/USD million at 2013 prices)

Forecast Year	Kip billion			USD million		
	Low Case	Base Case	High Case	Low Case	Base Case	High Case
2015	139.91	154.28	168.19	18.65	20.57	22.43
2020	208.90	253.68	304.12	27.85	33.82	40.55
2030	311.53	424.46	570.62	41.54	56.59	76.08
2040	389.03	566.37	813.18	51.87	75.52	108.42
2050	457.64	696.66	1045.68	61.02	92.89	139.42

Source: PPIAF

Figure 12: Low/High Sensitivity Test Annual Revenue Forecasts



Source: PPIAF

The Low and High Cases can be used to define the 'envelope of uncertainty' around the Central (Base) Case forecasts for alternative outcomes of drivers' values of time and annual traffic growth. The Low and High Case forecasts range -/+9% around the Base Case forecasts in 2015. Due to the compounding nature of the traffic growth assumptions, by 2050 the Low and High Case forecasts range between -34%/+50% around the Base Case forecasts respectively.

The Value of Time itself does not exert a significant impact on the forecasts of toll revenue, -/+ 20% drivers' value of time affects the toll revenue forecasts by between -4%/+3% respectively.

However as expected, the assumptions regarding future traffic growth impact upon the toll revenues quite significantly. For example -/+ 20% annual traffic growth results in -23%/+30% revenue forecasts respectively at 2030 traffic levels. The forecasting assumptions regarding future traffic growth therefore exert a significant influence on the forecasts of traffic and revenue for the 13N and 13S.

Shortening of Construction Works

A further sensitivity test has been undertaken which assumes the 13N and 13S upgrading extends to km64 and Phônhông and only safety improvements are carried out on the road as far as Paksan and Vang Vieng. Because it may be difficult to toll users for road sections which have not been substantially improved, it has been assumed that TP3 (Pakthoay) and TP6 (south of Hinheup) are removed from the scheme. The following table displays the revenue forecasts based on a Class 2 toll tariff of 300 Kip/km (2013 prices).

Table 16: Shortened Scheme Annual Revenue Forecasts (Kip billion/USD million at 2013 prices)

Forecast Year	KIP billion			USD million		
	13N	13S	Total	13N	13S	Total
2015	43.91	52.65	96.57	5.85	7.02	12.88
2020	73.03	85.98	159.01	9.74	11.46	21.20
2030	122.90	142.20	265.10	16.39	18.96	35.35
2040	164.03	188.88	352.91	21.87	25.18	47.05
2050	201.56	231.92	433.48	26.88	30.92	57.80

Source: PPIAF

The removal of TP3 and TP6 results in a reduction of forecast revenues from 20.57 USD million to 12.88 USD million, -37% compared to the Base Case revenue forecasts.

A further sensitivity test displays the revenue forecasts for the shortened scheme at the lower toll of 150 Kip/km.

Table 17: Shortened Scheme Annual Revenue Forecasts (Kip billion/USD million at 2013 prices)

Forecast Year	KIP billion			USD million		
	13N	13S	Total	13N	13S	Total
2015	25.74	27.17	52.91	3.43	3.62	7.05
2020	42.31	44.26	86.57	5.64	5.90	11.54
2030	69.68	72.79	142.46	9.29	9.70	19.00
2040	92.16	96.44	188.60	12.29	12.86	25.15
2050	112.83	118.28	231.11	15.04	15.77	30.82

Source: PPIAF

8. Traffic Study Conclusions

Traffic data collected during a comprehensive data collection exercise in March/April/May 2013 has been used to form the basis of Do-Minimum and Do-Something traffic and revenue forecasts for the 13N and 13S. The Do-Minimum scenario assumes that the NR13 is improved between Road 450 and Vang Vieng (13N) and km21 and Paksan (13S) but remains un-tolled. The Do-Something scenario assumes the NR13 is improved and tolled at 6 toll plazas, 3 plazas located on 13N and 3 plazas located on 13S.

Analysis of historic vehicle registrations and economic growth has been used to prepare future traffic growth forecasts by vehicle type which have been applied to the existing traffic flows on the NR13 to prepare the Do-Minimum traffic forecasts until 2050.

The Do-Something traffic and revenue forecasts have been prepared using a bespoke Traffic Capture Model. An illustrative toll strategy based on a Class 2 tariff of 300 Kip/km (2013 prices) was applied in the Traffic Capture Model to predict tolled traffic levels at each plaza by vehicle type. Traffic and revenue forecasts have been prepared for the Base Case scenario and alternative Low and High Case scenarios to define the 'envelope of uncertainty' surrounding the forecasts. Sensitivity tests on toll tariffs demonstrate that higher toll tariffs could result in higher toll revenues. However the toll tariffs applied at the toll plaza should be affordable and acceptable to the public. A further sensitivity test has considered the impact of upgrading the 13N as far as Phônhông and 13S as far as km64 with the removal of the toll plazas at Pakthoay and south of Hinheup.

The tolled NR13 could generate annual revenues of 154.28 Kip billion (20.57 USD million) in 2015 rising to 700 Kip billion (93 USD million) in 2050 based on the illustrative toll strategy and assumed traffic growth. Around 58% of the total revenues are forecast to be collected from the 13S toll plazas, 42% from the 13N toll plazas.

Outline Viability Study for a Highway PPP Project

Road 13, Lao
Traffic Survey Report
July 2013

Report Overview

- Project Road
- Traffic Survey Description
- Survey Locations
- Survey Programme
- Survey Findings:
  - Manual Classified Counts
  - Classified Turning Counts
  - Roadside Interview Surveys
  - Travel Time Surveys
- Next Steps

Project Road

- Road 13, highway ‘backbone’ of Lao
- Connects China in the north to Cambodia in the south via Vientiane, the capital of Lao PDR
- North of Vientiane, ’13N’
- South of Vientiane, ’13S’
- Scope of the PPP Viability Study extends approximately 150km north and south of Vientiane:
  - 13N Vientiane – Vang Vieng
  - 13S Vientiane – Paksan
- Generally single carriageway road carrying local and long distance traffic

Traffic Survey Description (1)

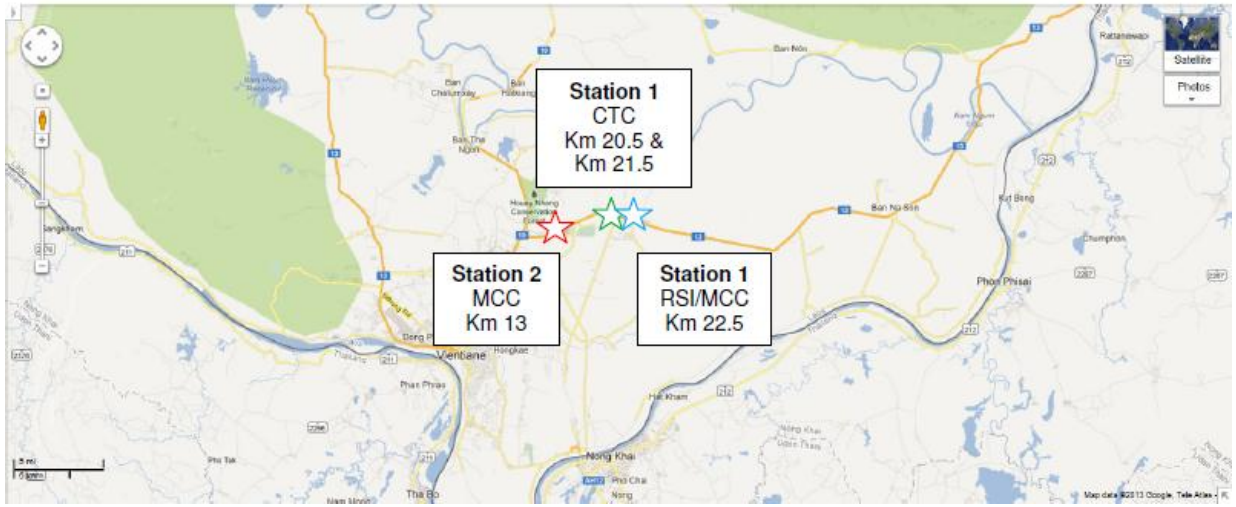
4 Types of Traffic Surveys undertaken on Road 13 North/South in March/April 2013 by Lao-Asie Consultants:

- Manual Classified Counts:
  - 10 Vehicle Classes, 8 Locations, 12/24 hour counts
  - Data provides:
    - Vehicle Composition
    - Daily Traffic Levels
    - Hourly Traffic Profiles (Weekdays/Weekend)
- Classified Turning Counts:
  - 10 Vehicle Classes, 1 Location, 12 hour count
  - Data provides:
    - Vehicles travelling from 13S towards Friendship Bridge
    - Daily Traffic Levels
    - Weekday Hourly Profile

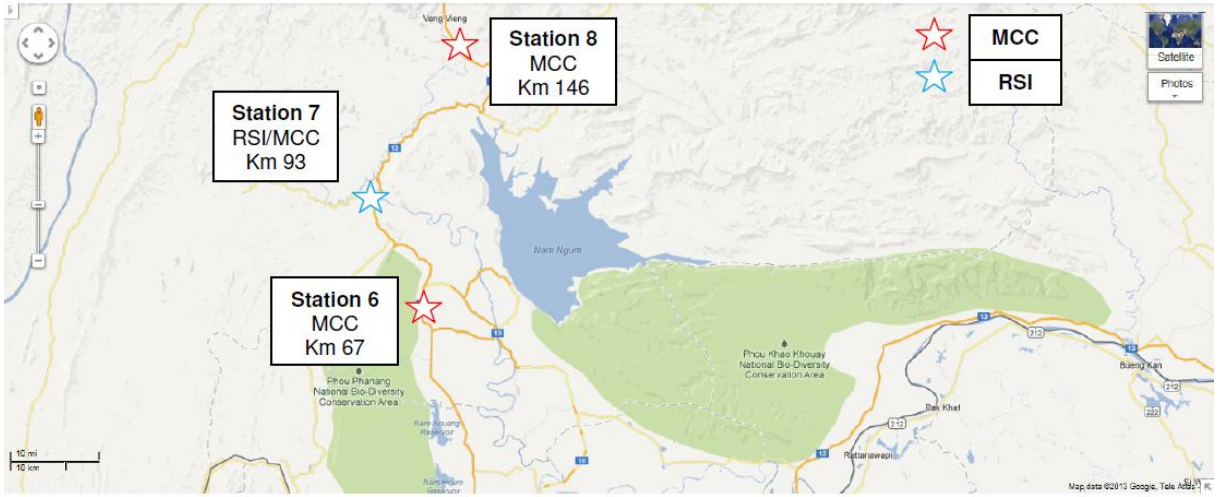
Traffic Survey Description (2)

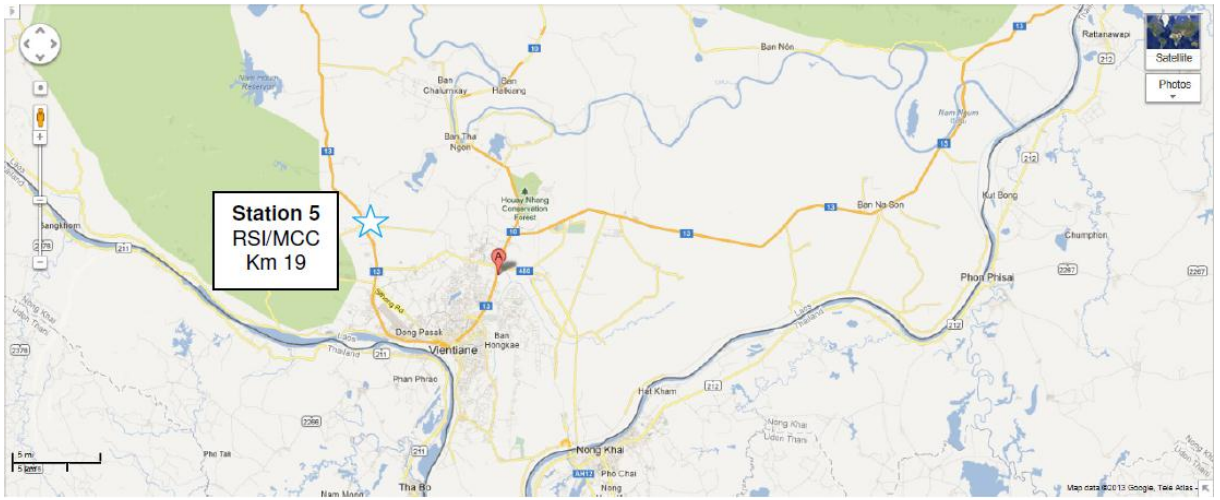
- Roadside Interview Surveys:
  - 8 Vehicle Classes, 4 Locations, 12 hour weekday
  - Data provides:
    - Sample Origin-Destinations
    - Trip Purpose
    - Trip Frequency
    - Trip Length
    - Registration Plate Colour
    - Willingness to pay a toll (Yes/No/Maybe)
- Travel Time Surveys:
  - 6 routes
  - Data provides:
    - Average travel times and distance on Road 13 and alternative routes

Traffic Survey Locations (13S)



Traffic Survey Locations (13N)





Survey Programme

Date	Survey Type	Location	Time Period
Monday 25th March 2013	RSI/MCC/CTC (Pilot)	13S Km 21 (Station No.1)	PM
Wednesday 27th March 2013	MCC	13S Km 13 (Station No.2)	07:00 – 19:00
Thursday 28th March - Monday 1st April 2013	MCC	13S Km 21 (Station No.1)	12:00 noon – 12:00 noon
Wednesday 3rd April 2013	RSI/MCC* CTC	13S Km 22.5 (Station No.1) 13S Km 20.5 & 21.5 (Station No.1)	07:00 – 19:00
Thursday 4th April 2013	RSI/MCC	13S Km 89 (Station No.3)	07:00 – 19:00
	MCC	13S Km 139 (Station No.4)	07:00 – 19:00
Tuesday 9th April 2013	RSI/MCC	13N Km 19 (Station No.5)	07:00 – 19:00
Wednesday 1st May 2013	Travel Time	Routes A, B	Off Peak
Thursday 2nd May 2013	Travel Time	Routes D, E	Off Peak
Friday 3rd May 2013	Travel Time	Route F	Off Peak
Thursday 9th May 2013	Travel Time	Route C	Off Peak

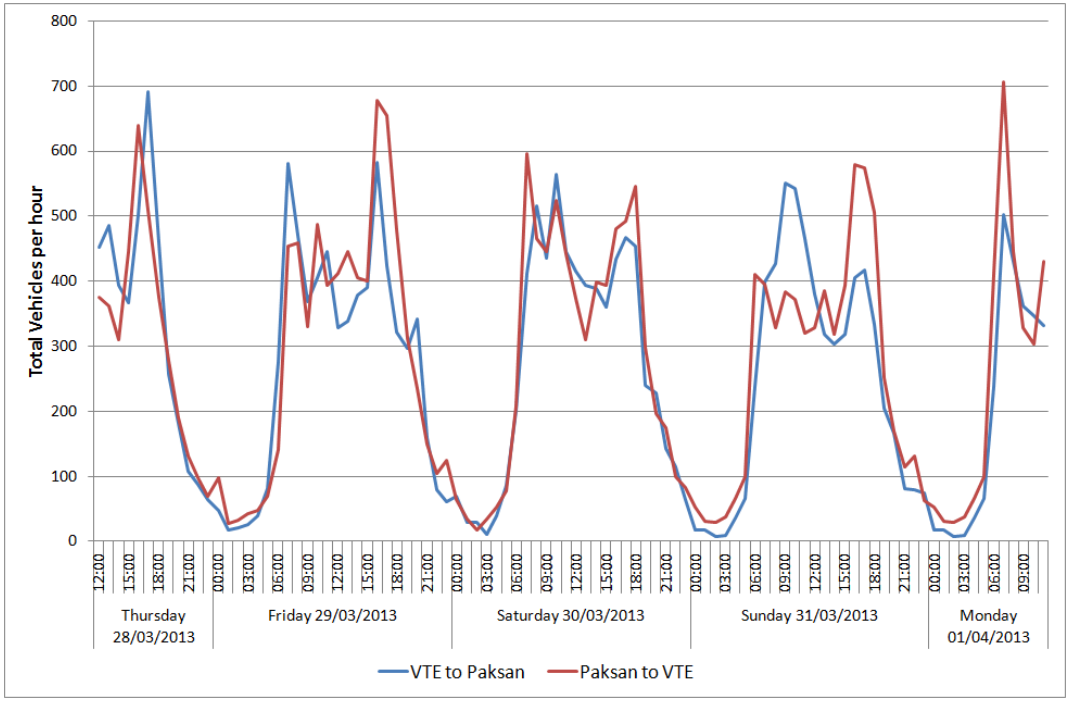
* Station 1 RSI/MCC was undertaken at km 22.5 for safety reasons

Survey Operation

Vehicle Categories

Vehicle Type	ໝວດ: ພາສາຍານພາຫະນະ
1. Hand Tractor	1. ລົດໄຖນາ ເດີນຕາມ
2. Motorcycle	2. ລົດຈັກ
3. Tuk-tuk	3. ຕຸກ ໆ
4. Car, jeep, taxi & pick-up	4. ລົດເກ໋ງ, ລົດຈີບ, ແທັກຊີ,ລົດກະບະ
5. Small bus & modified pick-up (max 14 seats)	5. ລົດເມນ້ອຍ, ລົດໂດຍສານ 14ບ່ອນນັ່ງ
6. Medium & Heavy bus (over 14 seats)	6. ລົດເມຂະໜາດກາງ 25ບ່ອນນັ່ງ,ລົດເມ ຂະໜາດໃຫ່ຍກ່ວາ 25ບ່ອນນັ່ງ
7. Light truck (less than 4t)	7. ລົດບັນທຸກເບົາ ຕ່ຳກ່ວາ 5 ໂຕນ
8. Medium truck 2 axles	8. ລົດບັນທຸກຂະໜາດ ກາງ 2 ເພົາ
9. Heavy truck 3 & 4 axles	9. ລົດບັນທຸກໜັກ (3 ຫ໊ຼ 4 ເພົາ)

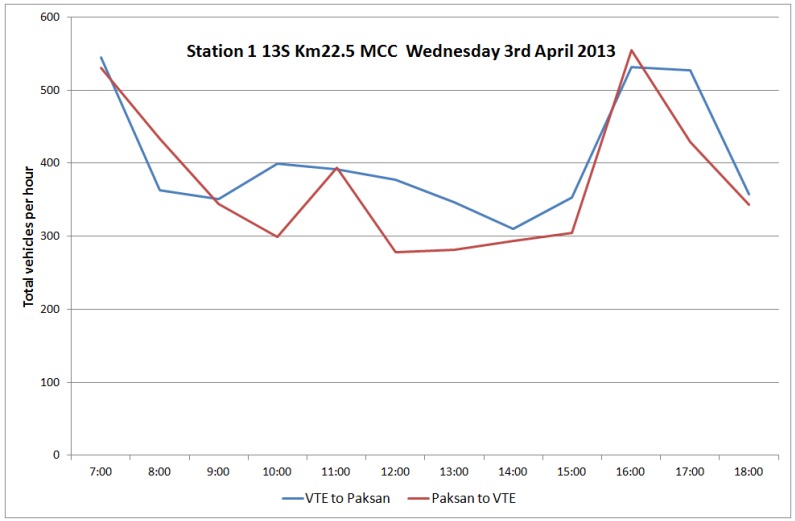
24 hour MCC 13S

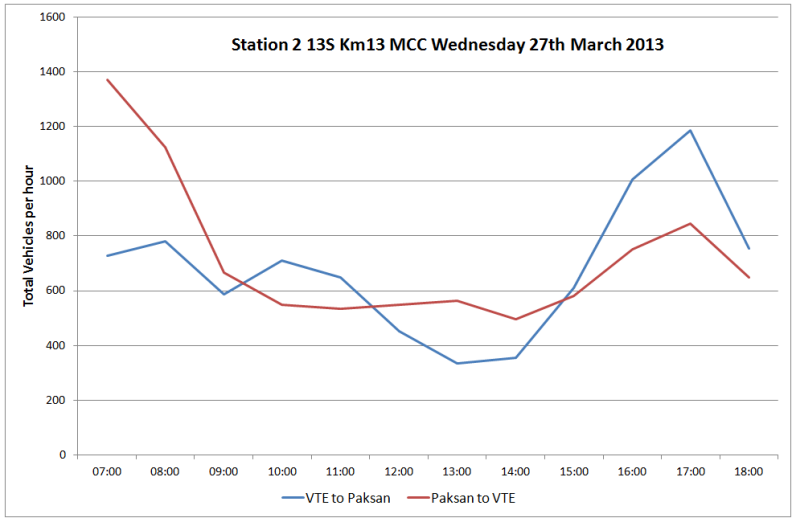


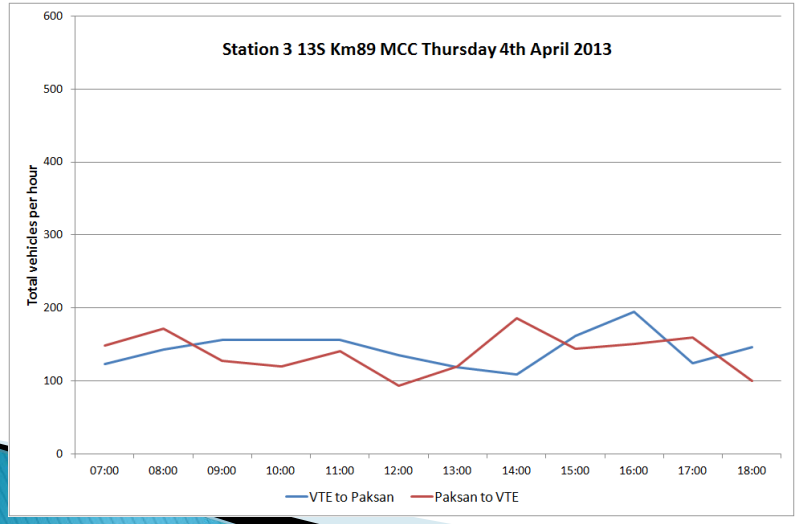
Station 1 Km21:

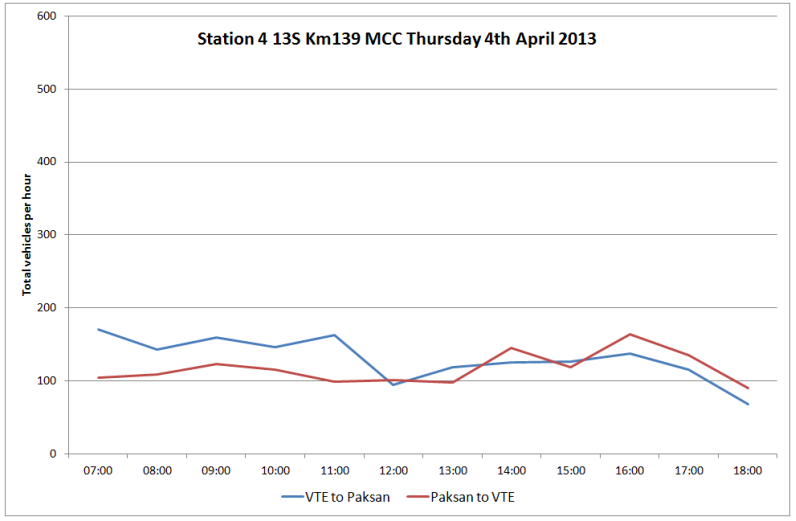
- 24 hour count Thursday noon – Monday noon
- Saturday traffic similar to Mon-Fri traffic
- Annualization factors assume 13 Public Holidays
- Data used to calculate 12 hour AWT to 24 hour AADT conversion factor of 1.21

Manual Classified Counts 13S

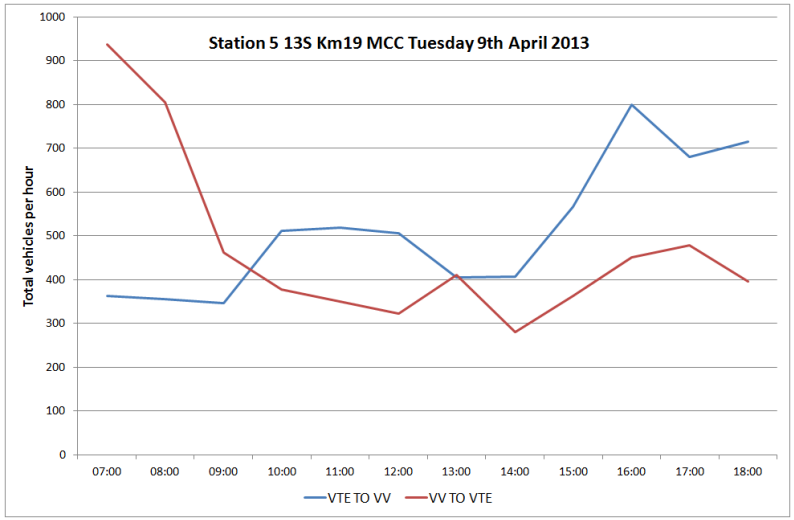


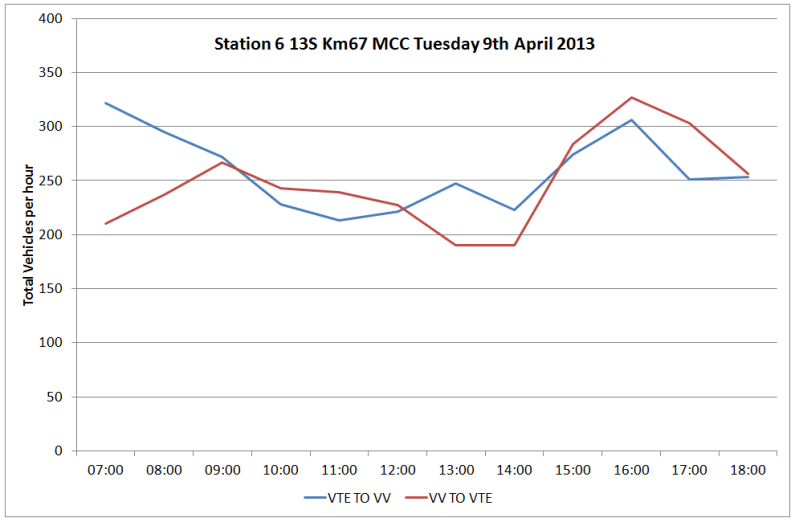


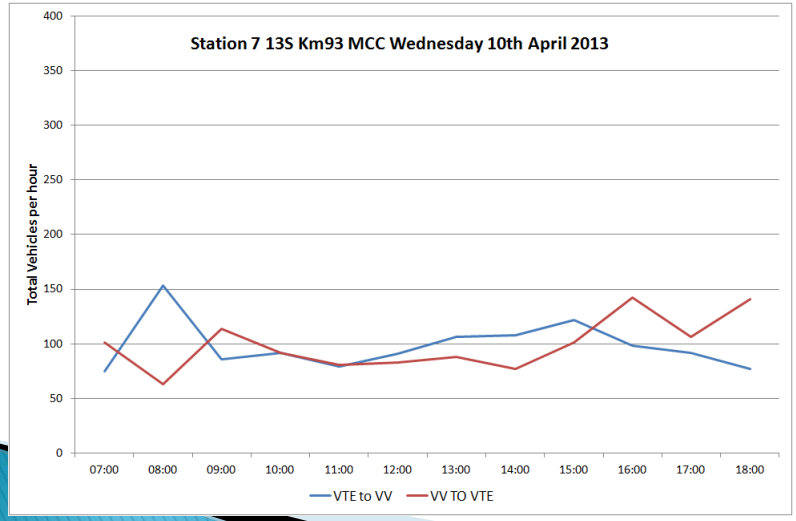


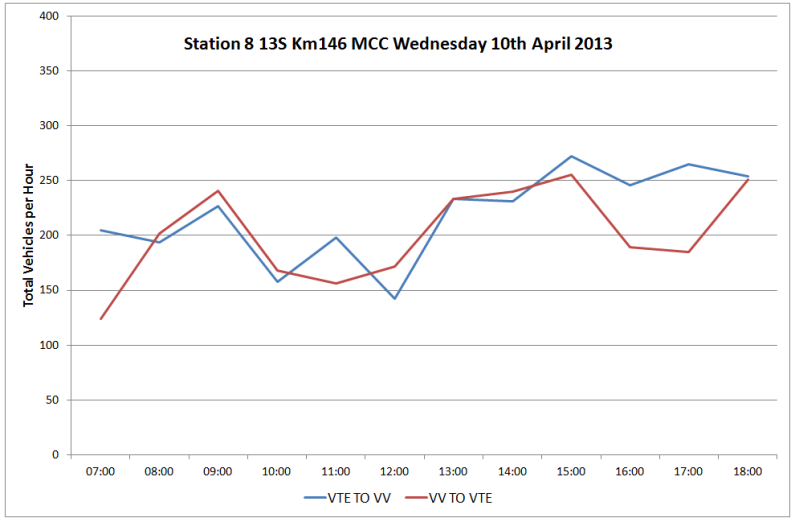


Manual Classified Counts 13N

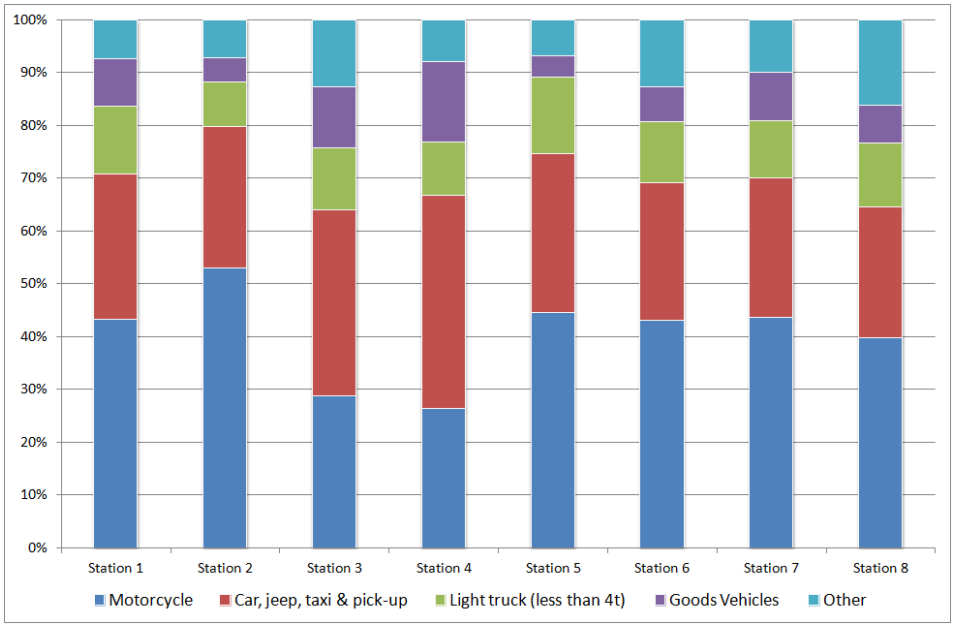








Vehicle Composition



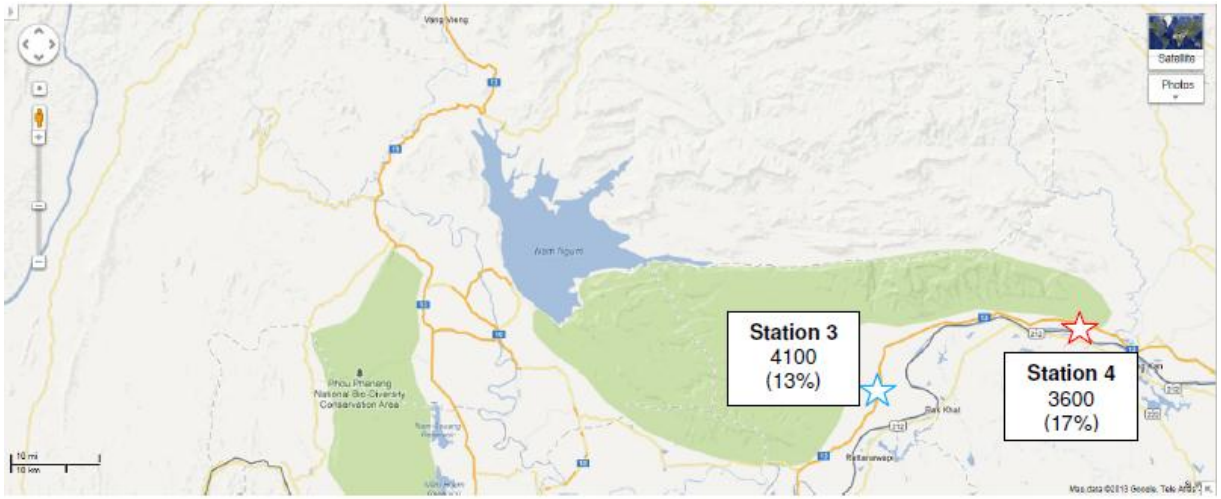
Vehicle composition:

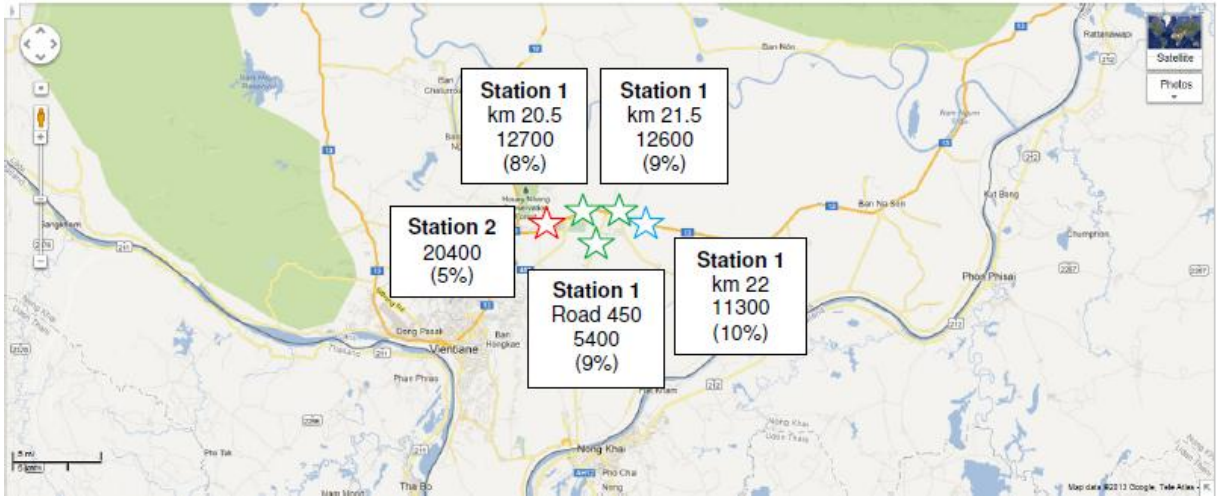
- Very high proportions of motorcycles – typically 40-50% except at very rural locations
- Cars, jeep, taxi and pick-ups comprise 25-40% of total traffic
- Light goods vehicles 8-14% of total traffic
- Heavy Goods Vehicles 4-15%, higher proportions at rural locations

Classified Turning Counts
13S Km20.5 – Km21.5 (12 hour AWT)

% Heavy Goods Vehicles

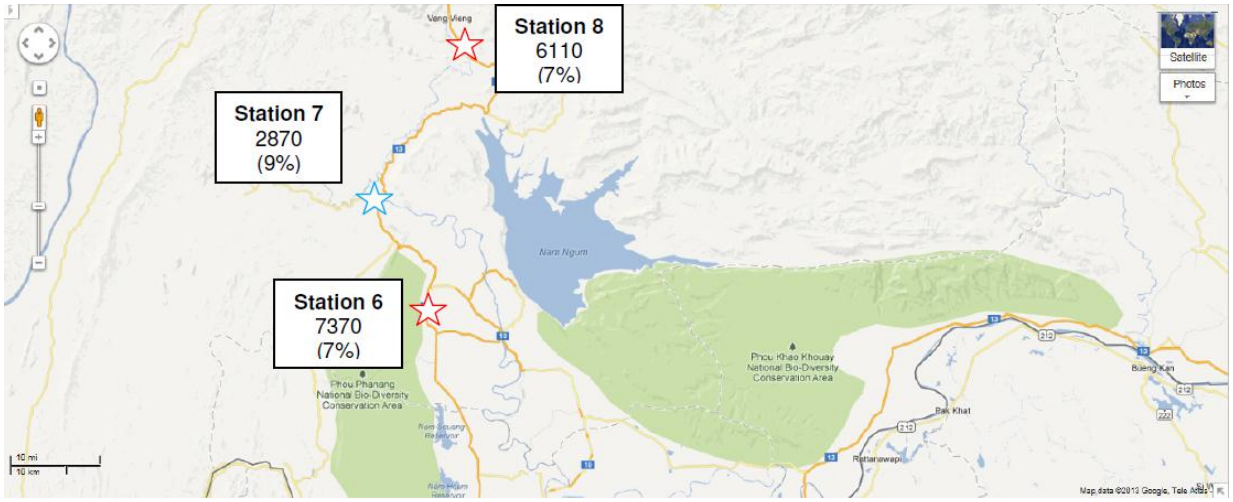
Estimated AADT (13S)





% Heavy Goods Vehicles

Estimated AADT (13N)



% Heavy Goods Vehicles

Roadside Interview Surveys

Station No.	Location	Date	Time Period	Interviews	After cleaning	MCC	Sample Rate
1	13S km22.5	Wednesday 3rd April 2013	0700 - 1900 hours	881	877	4853	18.1%
3	13S km89	Thursday 4th April 2013	0700 - 1900 hours	583	580	1724	33.6%
5	13N km19	Tuesday 9th April 2013	0700 - 1900 hours	1082	1051	6179	17.0%
7	13N km93	Wednesday 10th April 2013	0700 - 1900 hours	401	395	1189	33.2%
All				**2947**	**2903**	**13945**	**20.8%**

Would you pay a toll for better roads?	Yes	No	Maybe
1	95%	2%	3%
3	84%	4%	12%
5	95%	1%	3%
7	93%	1%	7%
All Stations	**93%**	**2%**	**5%**

RSI Information

- 2903 Interviews undertaken in one direction at 4 RSI sites
- Sample rates:
  - 17%-18% at semi-urban stations (1 and 5)
  - 33% at rural stations (3 and 7)
- RSI data cleaned and re-coded where necessary
- RSI data coded to 2 levels:
  - District
  - Province

- Key Findings:
  - 93% of drivers said they were willing to pay a toll for better roads
  - 32% commuters, 26% Personal Business, 42% Other Purposes
  - 37% daily trips, 15% < once per month (25% at Station 3)
  - 45% trips longer than 45 minutes

RSI information

Station No.	Motorcycle	Car, jeep, taxi & pick-up	Light truck (less than 4t)	Goods Vehicles	Other	Total
1	3%	68%	18%	10%	1%	100%
3	2%	61%	17%	18%	2%	100%
5	3%	69%	22%	5%	0%	100%
7	11%	52%	24%	13%	1%	100%
All Stations	**4%**	**65%**	**20%**	**10%**	**1%**	**100%**

Vehicle Type

Station No.	Commuting to/from work	Employer's Business	Personal Business	Recreational or Leisure	Education	Shopping
1	31%	17%	32%	8%	2%	10%
3	21%	26%	33%	11%	1%	8%
5	34%	11%	23%	13%	4%	15%
7	44%	17%	13%	14%	1%	10%
All Stations	**32%**	**17%**	**26%**	**11%**	**2%**	**11%**

Trip Purpose

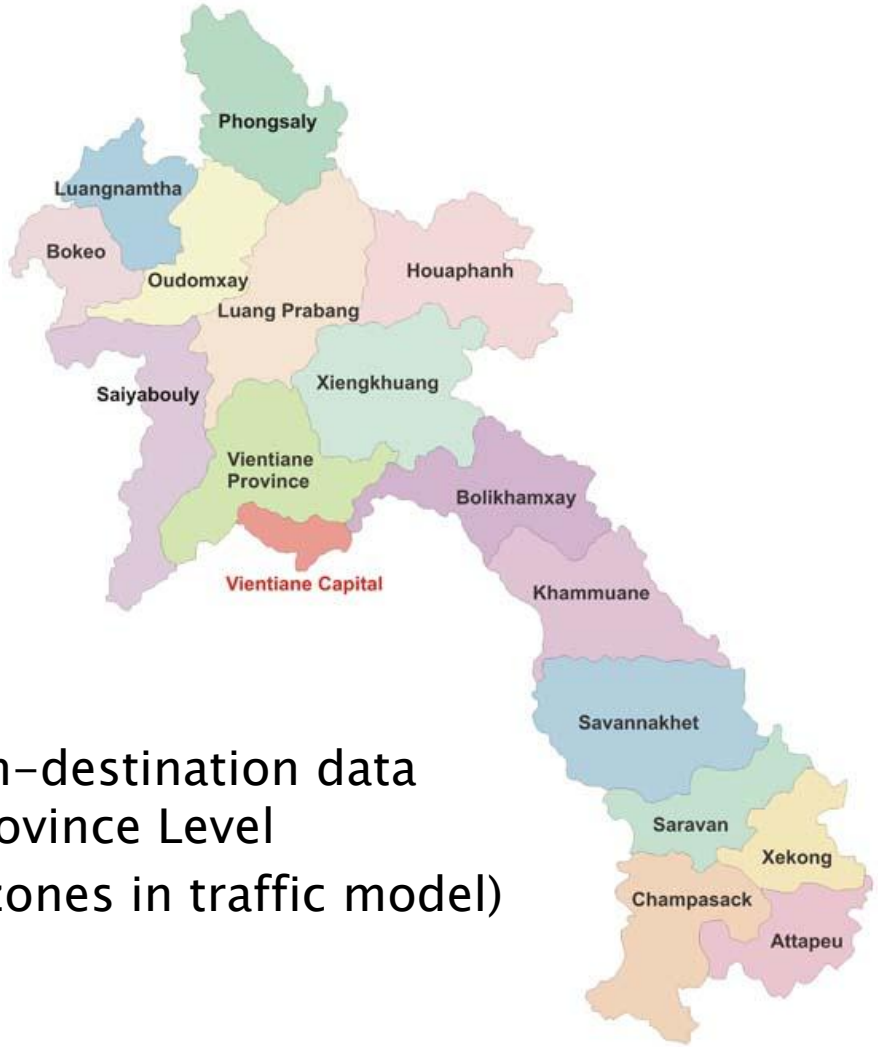
Station No.	Daily	2 or 3 times per week	Once a week	2 or 3 times per month	Once a month	< Once a month
1	36%	25%	8%	10%	8%	13%
3	30%	15%	7%	16%	7%	25%
5	46%	20%	11%	8%	6%	9%
7	24%	18%	10%	17%	13%	18%
All Stations	**37%**	**20%**	**9%**	**12%**	**8%**	**15%**

Trip Frequency

Station No.	< 15 minutes	15-30 minutes	30-45 minutes	45-60 minutes	60-90 minutes	> 90 minutes
1	4%	11%	14%	16%	18%	38%
3	7%	8%	3%	3%	3%	76%
5	6%	12%	17%	22%	20%	24%
7	7%	4%	3%	5%	8%	73%
All Stations	5%	10%	11%	14%	14%	45%

Trip Length

Lao Provinces



- Summary origin-destination data described at Province Level
- (District Level zones in traffic model)

Station 1 13S Km 22.5

	P. Attapu	P. Borikhamxai	P. Champasak	P. Houaphan	P. Khammouan	P. Salavan	P. Savannakhet	P. Vientiane Capital	P. Vientiane Province	P. Xiangkhouang	Vietnam	Grand Total
P. Bokeo		1						1				2
P. Louang-Namtha							1					1
P. Louangphabang					1		1	3				5
P. Vientiane Capital	2	**131**	17	2	35	6	25	576	10	20	1	**825**
P. Vientiane Province		12	1		8	1	1	8				31
Thailand		3	3					6				12
China			1									1
Grand Total	2	**147**	22	2	44	7	28	**594**	10	20	1	**877**

- Station 1 is located in Vientiane Capital Province:
  - 66% internal Provincial Trips
  - 15% trips between Vientiane Capital Province and Borikhamxai
  - 17% long distance trips between other Provinces (incl. International)

Station 3 13S Km 89

	P. Attapu	P. Borikhamxai	P. Champasak	P. Houaphan	P. Khammouan	P. Salavan	P. Savannakhet	P. Vientiane Capital	P. Vientiane Province	P. Xiangkhouang	Vietnam	Grand Total
P. Bokeo			1									1
P. Borikhamxai		121						1	2			124
P. Louang-Namtha		1			1		1					3
P. Louangphabang		1	1		1							3
P. Vientiane Capital	4	189	32	11	56	5	54	5	25	47	1	429
P. Vientiane Province	1	9	1	1	2		2			2		18
Thailand		1										1
Vietnam		1										1
Grand Total	5	323	35	12	60	5	57	6	27	49	1	580

- Station 3 is located in Borikhamxai Province:
  - 21% internal Provincial Trips
  - 33% trips between Vientiane Capital Province and Bolikhamxai
  - 43% long distance trips between other Provinces (incl. International)

Station 5 13N Km 19

	P. Bokeo	P. Louang-Namtha	P. Louangphabang	P. Vientiane Capital	P. Vientiane Province	P. Xiangkhouang	P. Phongsali	P. Oudomxai	China	Grand Total
P. Attapu					1					1
P. Borikhamxai			1	2	6					9
P. Khammouan				1	3					4
P. Savannakhet				1						1
P. Vientiane Capital	2	1	15	619	379	2	2	1	1	1022
P. Vientiane Province					2					2
P. Xiangkhouang				1						1
Thailand				2	8					10
Vietnam				1						1
Grand Total	2	1	16	627	399	2	2	1	1	1051

- Station 5 is located in Vientiane Capital Province:
  - 59% internal Provincial Trips
  - 33% trips between Vientiane Capital Province and Vientiane Province
  - 2% long distance trips between other Provinces (incl. International)

Station 7 13N Km 93

	P. Attapu	P. Borikhamxai	P. Champasak	P. Khammouan	P. Savannakhet	P. Vientiane Capital	P. Vientiane Province	Thailand	Grand Total
P. Bokeo	1				1	2	1		5
P. Louang-Namtha		1		1		10	1		13
P. Louangphabang			1		1	43	3		48
P. Oudomxai				1		8			9
P. Phongsali						2			2
P. Vientiane Province					1	143	134	3	281
P. Xaignabouli	1					9	14		24
P. Xiangkhouang					1	9			10
China				1		2			3
Grand Total	2	1	1	3	4	228	153	3	395

- Station 7 is located in Vientiane Province:
  - 34% internal Provincial Trips
  - 36% trips between Vientiane Capital Province and Vientiane Province
  - 25% long distance trips between other Provinces (incl. International)

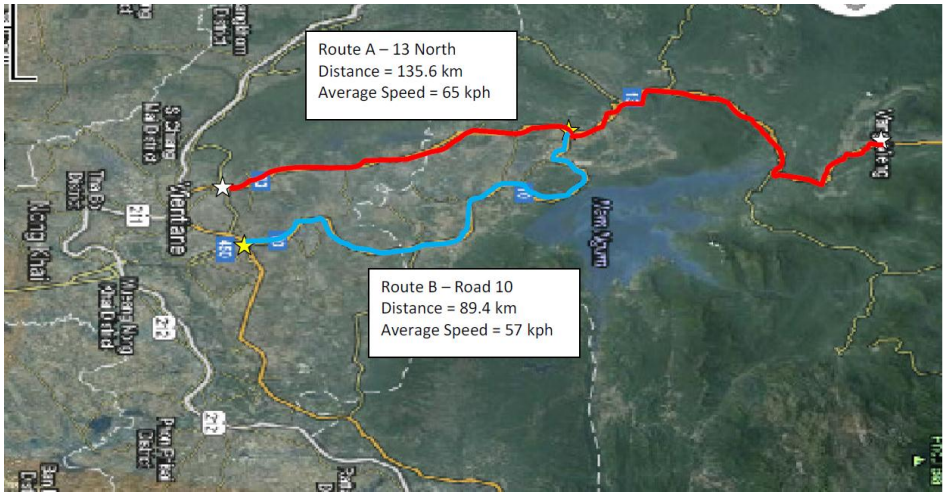
Travel Time Surveys

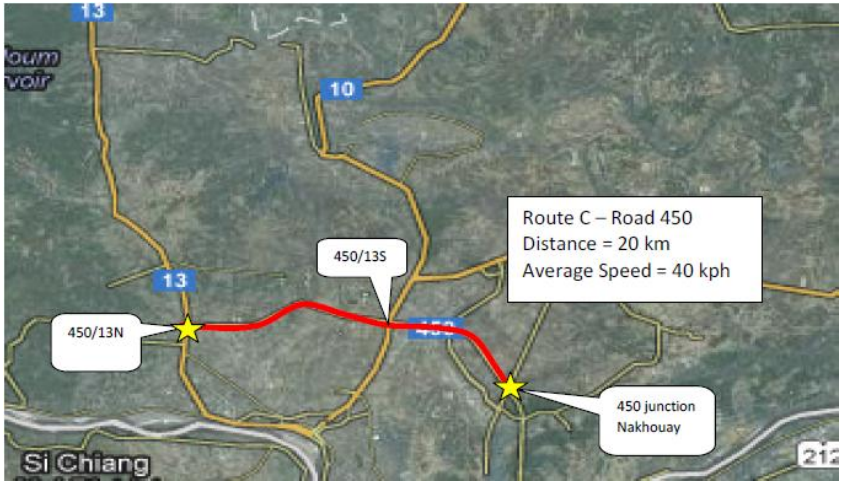
- Routes A – F surveyed 1-9 May 2013

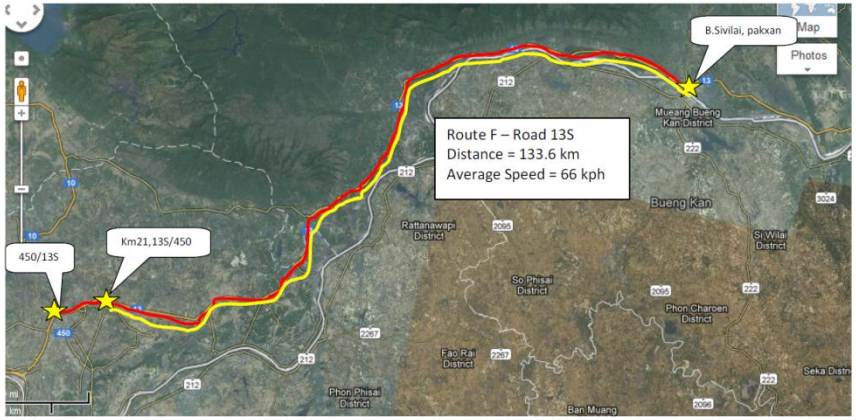
- Key Findings:
  - Road 13 (North and South) average speeds = 66/67 kph
  - Road 10 average speed = 57 kph
  - Road 4 average speed = 33 kph
  - 'Mekong Route' average speed = 34 kph
  - Road 450 average speed = 40 kph

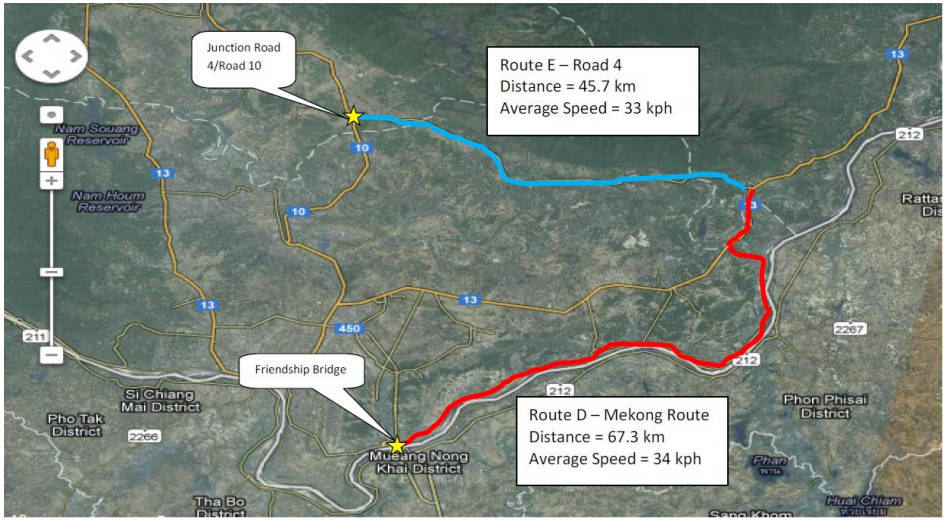
  - 13N between Road 450 and Vang Vieng **136km**
  - 13S between Road 10 and Pakxan **134km**

Travel Time Surveys









Next Steps

- Base Year Model (2013):
  - 4 classes: Motorcycles, Cars, Light Goods Vehicles, Heavy Goods Vehicles
  - RSI data factored to MCC
  - Road network representation from Travel Time surveys
  - Construction of logit spreadsheet model
- Behavioural Parameters
  - Values of time based on benchmarking
  - Vehicle operating costs based on real petrol prices (for cars)
  - If not alternative route exists, trip suppression (using elasticities)
- Traffic Growth
  - Econometric model based on historic vehicle registration data
  - Low/Central/High Traffic Growth Scenarios to be tested
- Toll Strategy
  - Plaza locations
  - Toll tariffs

Outline Viability Study for a Highway PPP Project

Road 13, Lao
Traffic Growth Hypothesis
July 2013

Report Overview

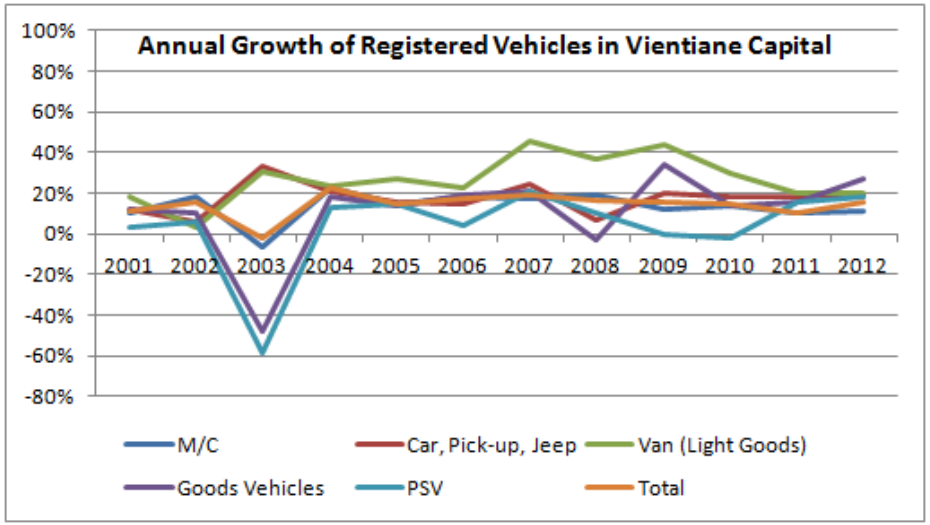
- Growth of registered vehicles:
  - Vientiane Capital
  - Vientiane Province
  - Borikhamxai Province
- Population growth
- Fuel sales
- Imports/Exports Sales by Country
- Regression Analysis
- Traffic growth forecasts

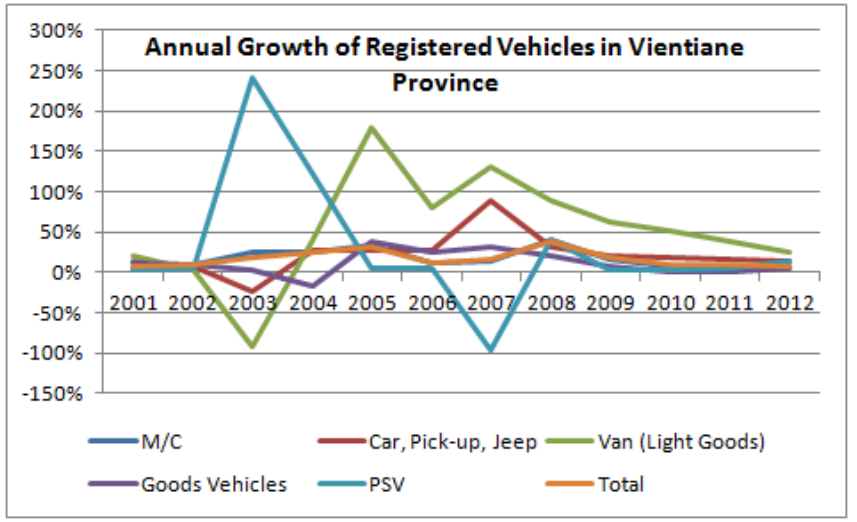
Growth of Registered Vehicles

	Vientiane Capital	Vientiane Province	Borikhamxai Province	Total
Total Vehicles 2012	535,535	57,081	30,426	623,042
Annual Growth 2000-2012				
Total Vehicles	**14%**	**17%**	**27%**	**15%**
Motorcycles	13%	17%	27%	14%
Cars, jeeps, pick-ups	17%	20%	32%	18%
Vans	26%	24%	38%	26%
Goods vehicles	9%	11%	14%	9%
% Total Vehicles in 2012				
Motorcycles	69%	76%	79%	70%
Cars, jeeps, pick-ups	24%	17%	16%	23%
Vans	4%	2%	2%	4%
Goods vehicles	3%	4%	2%	3%
Car Ownership per 1000 inhabitants	142	18	16	80

Source: Vehicle Registration Data provided by the Ministry of Public Works and Transport (MoPWT)

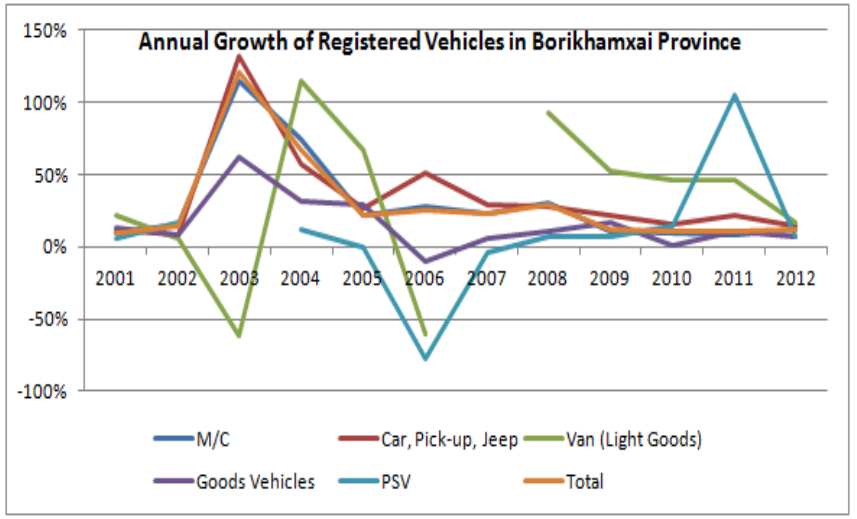
Growth of Registered Vehicles





- Vientiane Capital vehicle growth most consistent of all 3 Provinces
- Long term growth trends appear consistent
- Short term data recording issues apparent
- Strong growth of van traffic (4% of total)

- Annual vehicle growth extremely high compared to most countries



Source: Vehicle Registration Data provided by the MoPWT

Population Growth

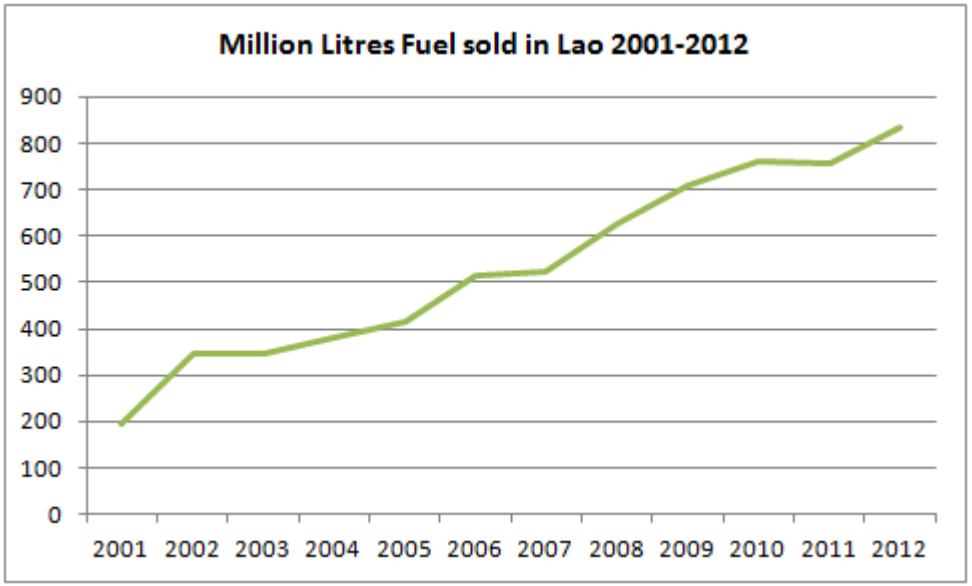
	Lao	Vientiane Capital	Vientiane Province	Borikhamxai Province	Total in Study Area
2009	6.127	754,384	467,452	256,371	1,478,207
2010	6.256	768,743	480,440	264,513	1,513,696
2011	6.385	783,032	493,593	272,794	1,549,419
Annual Growth 2009-2011	2.1%	1.9%	2.8%	3.2%	2.4%

Source: Lao Statistics Bureau Yearbook 2011

- Population of study area:
  - 51% Vientiane Capital
  - 32% Vientiane Province
  - 17% Borikhamxai Province
- Vientiane and Borikhamxai Provinces showing higher growth than capital
- Indicative of future traffic demands on 13N and 13S

Fuel Sales

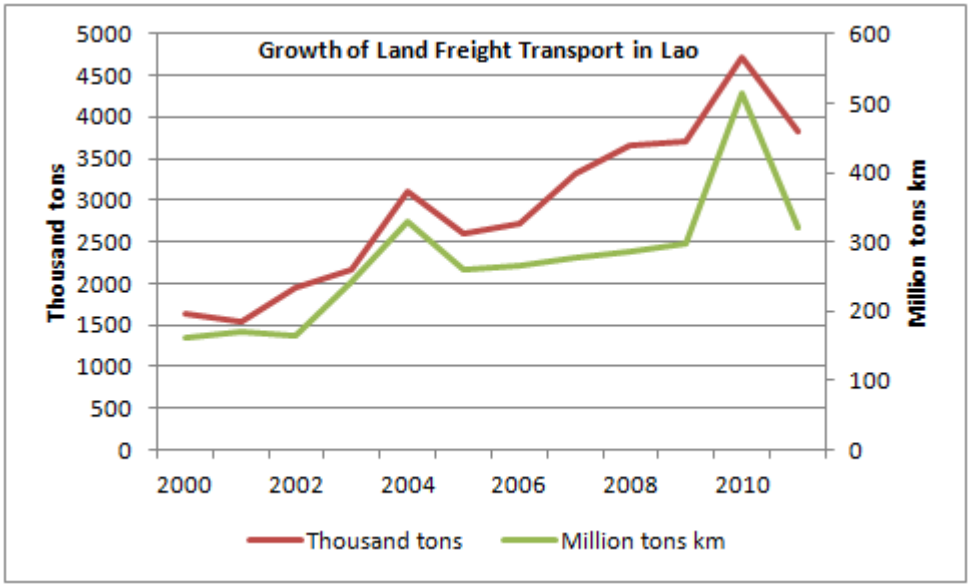
- Annual average growth of fuel sales of 14% between 2001 and 2012
- Consistent with growth of Registered Vehicles (14% in Vientiane Province)



Source: Data provided by the Government of Lao

Freight Transport

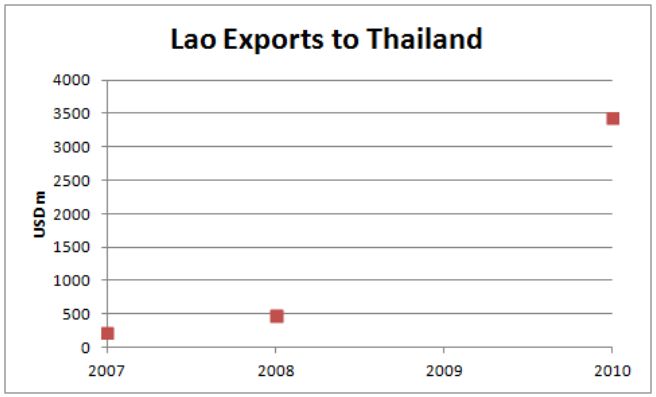
- Annual average growth of freight carried by land was 9% between 2000-2011
- Consistent with growth of Registered Goods Vehicles
- Ton kms increased in 2010 possibly due to new road provision in Laos (Road 450 etc.)

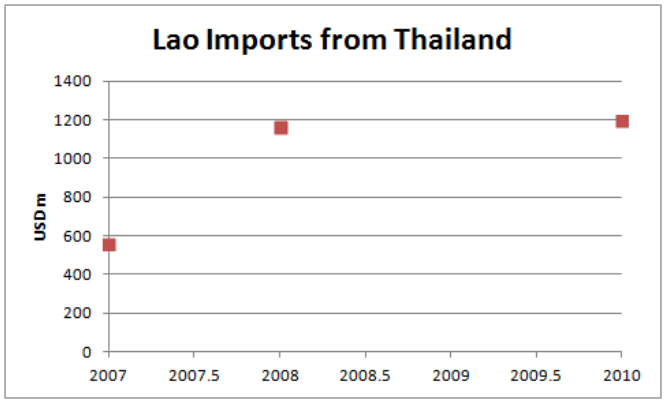


Source: Lao Statistics Bureau Yearbook 2011

Imports/Exports by country

- In 2010, 74% of exports from Lao went to Intra-ASEAN countries:
  - 71% to Thailand
  - 3% to Vietnam
- In 2010, 86% of imports to Lao came from Intra-ASEAN countries:
  - 76% from Thailand
  - 7% from Vietnam
- Trade with Vietnam, China and Cambodia (potential vehicles for Road 13) form a very small proportion of sales at present





Source: Lao Statistics Bureau 2011

Regression Analysis

- Historic and forecast population figures appear scarce
- Annual vehicle registration data by province and vehicle type between 2000 and 2012 is comprehensive,
- Regression analysis undertaken between registered vehicles by province and national economic growth
- Resulting multipliers of economic growth as the following:

Multiple of GDP	Vientiane Capital	Vientiane Province	Borikhamxai Province
Motorcycles	2.37	2.85	4.77
Car, jeep and pick-up	2.96	4.07	5.74
Light Goods Vehicles (Van)	4.60	9.49	16.80
Goods Vehicles	2.13	2.00	2.33

Note: Light Goods Vehicle (LGV) growth considered extremely high. Future LGV traffic assumed to grow at Car, Jeep and Pick-up vehicle growth rates

- Strong relationships determined between economic growth and vehicle registration growth for Vientiane Capital
- Vientiane Capital regression output used for study area (red text) due to:
  - Superior consistency of Vehicle Registration data
  - Domination of Vientiane Capital traffic on Road 13 study area

Traffic Growth Model

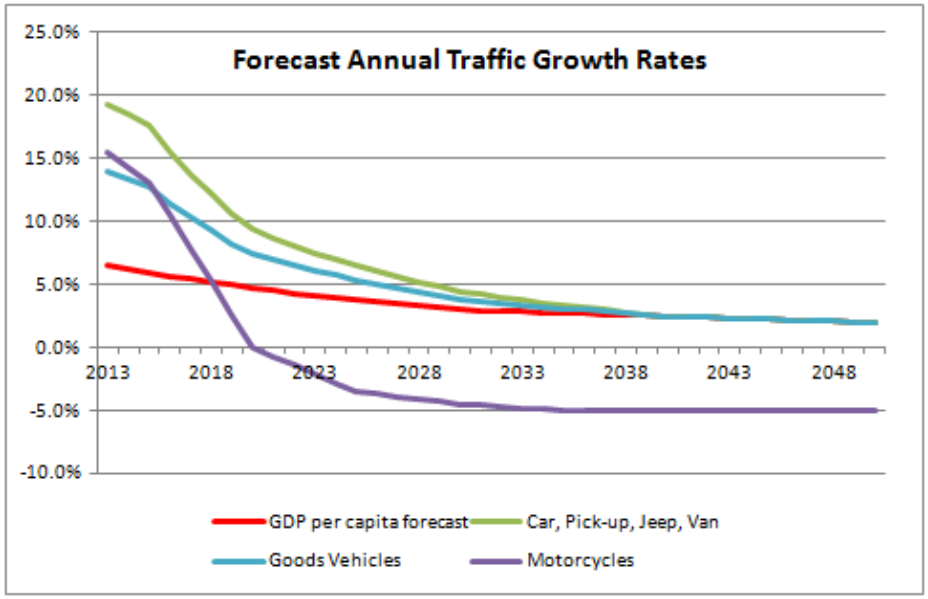
- GDP multiplier assumed to decline over time as car ownership increases
- Reverts to GDP growth in 2030:

2013-2015	GDP Multiplier
GDP per capita and Car, jeep and pick-up	2.96
GDP per capita and Goods Vehicles	2.13
2015-2020	
GDP per capita and Car, jeep and pick-up	1.98
GDP per capita and Goods Vehicles	1.57
2020-2030	
GDP per capita and Car, jeep and pick-up	1.49
GDP per capita and Goods Vehicles	1.28
2030-2040	
GDP per capita and Car, jeep and pick-up	1.00
GDP per capita and Goods Vehicles	1.00
2040-2050	
GDP per capita and Car, jeep and pick-up	1.00
GDP per capita and Goods Vehicles	1.00

- GDP growth per capita forecasts taken from IMF World Economic Outlook April 2013 until 2018 declining over time

Year	GDP per capita forecast
2013	6.5%
2014	6.2%
2015	6.0%
2020	4.7%
2025	3.8%
2030	3.0%
2040	2.5%
2050	2.0%

Traffic Growth Model



- Traffic forecasts produced separately for: Motorcycles, Car, Pick-up, Jeep, Vans and Goods vehicles
- Motorcycle growth assumed to decline over time due to rising car ownership

- Highest growth predicted for cars, pick-ups, jeeps and vans as recently observed and reflecting predicted high car ownership increases in the future
- Lower growth forecast for Goods Vehicles, although still substantially higher than national economic growth as recently observed

Outline Viability Study for a Highway PPP Project

Road 13, Lao
Model Development Report and
Final Traffic and Revenue Forecasts
July 2013

Report Overview

- Traffic Capture Model
  - Methodology
  - Behavioural parameters
  - Road Network description
  - Toll Strategy
  - Road 13 Improvements
  - Model Validation
  - Traffic Growth
- Final Traffic Forecasts
- Final Revenue Forecasts
- Sensitivity Tests

Traffic Capture Model

- Objectives:
  - To provide a robust platform to prepare traffic and revenue forecasts by vehicle category for 13N and 13S between 2013 and 2050
  - To enable comparison between the Do-Minimum and the Do-Something traffic forecast scenarios
  - To provide the flexibility to test the impact of changing toll levels, willingness to pay and traffic growth rates on the traffic and revenue forecasts
  - To assess the impact of trip suppression at plaza locations where alternative routes do not exist
- A logit-based spreadsheet model has been built incorporating assignment-based time and distance skims for all observed traffic movements in the study area
- Inputs include: Trip matrices, road network definitions (Do-minimum and Do-Something), behavioural parameters, toll strategy, traffic growth rates
- Outputs include: Annual traffic forecasts by toll plaza and vehicle type, revenue forecasts and traffic capture/suppression reporting

Methodology

The **Traffic Capture Model** has been created using the following approach:

- Cleaned sample interview data was factored to observed traffic counts at 24 hour Annual Average Daily Traffic (AADT) volumes
- Data was aggregated to 4 vehicle types: motorcycles, cars/ jeeps/pick-ups, Light Goods Vehicles (LGV), Heavy Goods Vehicles (HGV)
- Origin-destination trip matrices (46 zones x 46 zones) by vehicle type were created by District, Province and Country
- Aggregated trip matrices by vehicle type were created for common study area entry points (26 zones x 26 zones)
- Road network distances and travel times were collated for all strategic roads in the study area
- Assigned traffic flows validated were against observed traffic count data
- Number of trips, travel times and distances between each origin-destination in the study area were determined for 4 scenarios: the existing road network, the Do-Minimum road network and with the improved 13N/13S with/without toll plazas
- Behavioral parameters were determined from benchmarking with other studies
- Traffic growth rates were applied to forecast future traffic volumes

Traffic Capture Model Inputs (1)

1. Behavioural Parameters

2013 Values

	Value of Time (VoT) Kip per hour	Vehicle Operating Costs Kip per km	Motorway Bonus (MB) Kip/km	Willingness to Pay Kip per hour
1. Motorcycles	9600	250	960	67200
2. Cars, Jeeps, Taxis & Pick-ups	38400	1150	3840	268800
3. Light Goods Vehicles	46500	1500	4650	325500
4. Heavy Goods Vehicles	107000	3400	10700	749000

2. Traffic Growth

Traffic Growth (per annum)

	2013-2015	2015-2020	2020-2030	2030-2040	2040-2050
1. Motorcycles	13.6%	5.1%	-3.1%	-4.9%	-5.0%
2. Cars, Jeeps, Taxis & Pick-ups	18.1%	12.3%	6.4%	3.3%	2.2%
3. Light Goods Vehicles	18.1%	12.3%	6.4%	3.3%	2.2%
4. Heavy Goods Vehicles	13.0%	9.3%	5.3%	3.1%	2.2%

5. Elasticity of Demand for Captive Market

	>25km	<25km	Other
Local Captive Traffic	-2.5	-10.0	-10.0

6. Logit Parameters

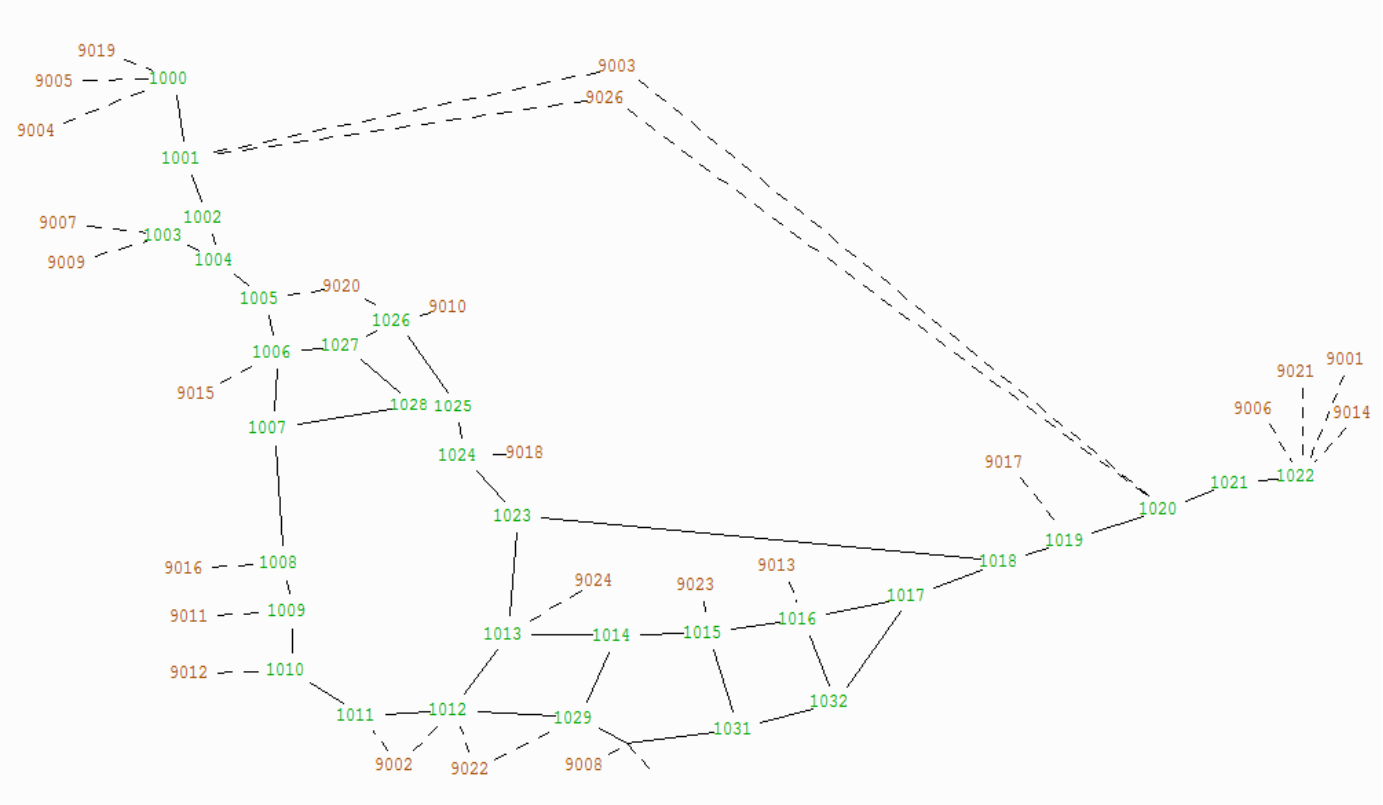
Scaling Parameter	-0.0080

Behavioural Parameters

- Values of Time, Motorway Bonus and Willingness to Pay
  - Taken from Halcrow report 'Ninh Binh – Bai Vot Expressway PPP Viability Study' July 2012 for the World Bank
  - Adjusted for Lao GDP per capita (95% of Vietnam GDP per capita based on WB database)
- Vehicle Operating Costs:
  - Car VOC based on cost of petrol per km for an average car
  - 10,490 Kip/liter unleaded and 9,400 Kip/liter diesel
  - HGV VOC taken from Systra/MVA report 'Provision of Technical Advisory to Support the Development of a Public-Private Partnership ("PPP") for an Expressway Project in Phan Thiet, Vietnam' July 2012
- Logit parameters:
  - Scaling parameter calibrated based on the traffic capture rate
  - Trip suppression elasticity varies by trip length. Calibrated based on judgement and realistic assessment of the impact of a toll on a captive market (if not toll-free alternative route is available)

Traffic Capture Model Inputs (2)

- **Strategic road network** description within the 13N and 13S study area



Traffic Capture Model Inputs (3)

- **Toll Strategy**

3. Toll Tariffs

Toll Tariff calculations (2013 prices incl. VAT)	
Car Toll Tariff (Kip per km)	300
Motorcycle Multiple	0.5
LGV Multiple	1.5
HGV Multiple	3

Road 13 South			
2013 prices incl. VAT	**Toll Plaza 1**	**Toll Plaza 2**	**Toll Plaza 3**
Road Section between:	Don Noun and Ban Woen	Ban Woen and Ban Naxay	Ban Naxay and Paksan
Distance tolled (km)	25.60	26.00	78.80
1. Motorcycles	3840	3900	11820
2. Cars, Jeeps, Taxis & Pick-ups	7680	7800	23640
3. Light Goods Vehicles	11520	11700	35460
4. Heavy Goods Vehicles	23040	23400	70920

Road 13 North			
2013 prices incl. VAT	**Toll Plaza 4**	**Toll Plaza 5**	**Toll Plaza 6**
Road Section between:	Road 450 and Phônmouang	Phônmouang and Phônhông	Phônhông and Vang Vieng
Distance tolled (km)	21.50	33.80	80.00
1. Motorcycles	3225	5070	12000
2. Cars, Jeeps, Taxis & Pick-ups	6450	10140	24000
3. Light Goods Vehicles	9675	15210	36000
4. Heavy Goods Vehicles	19350	30420	72000

Toll Strategy Motivation

Toll Plaza locations based on:

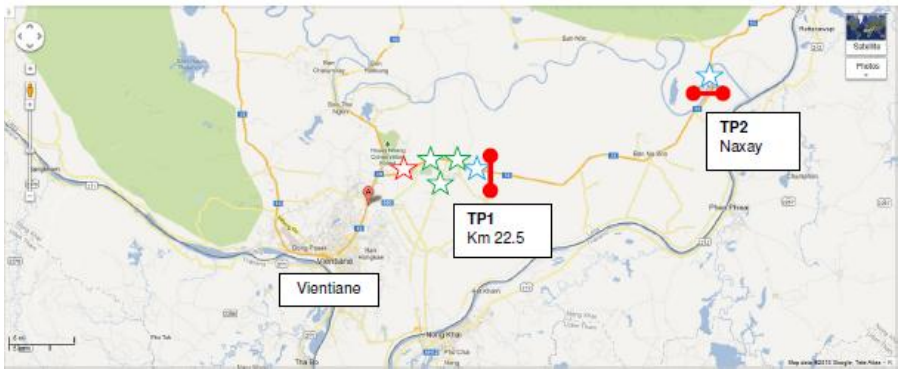
- Appreciation of existing trip movements at the plaza locations
- Avoidance of excessive local trips (necessity for local discounts)
- A balance is sought between:
  - Number of plazas (Operating Costs) and
  - Size of toll tariff (Affordability) charged for associated road length

- % Local or captive traffic without alternative route

TP1	TP2	TP3	TP4	TP5	TP6
44%	42%	47%	75%	50%	54%

- Proposed Toll Strategy is *illustrative* based on international experience and affordable toll tariffs
- Fewer toll plazas would require higher toll tariffs to generate same revenue forecasts although operating costs would be lower
- Conversely more toll plazas would allow the toll tariffs to be lower to generate the same revenue forecasts but operating costs would be higher

Toll Strategy



Traffic Capture Model Inputs (4)

- **Potential Road 13 Improvements**
- To estimate the impact of the Road 13 improvements on the attractiveness of the road the following average speeds have been assumed:

Road Section	Existing	Future
13S Don Noun – Km 22	70 kph	70 kph
13S Km22 – Pakthouay	59-78 kph	90 kph
13S Pakthouay – Paksan	50 kph	80 kph
13N Road 450 – Phônmouang	59 kph	80 kph
13N Phônmouang – Phônsavang	70 kph	90 kph
13N Phônsavang – Phônhông	63 kph	80 kph
13N Phônhông – Hinheup	72 kph	90 kph
13N Hinheup – Vang Vieng	56 kph	80 kph

- New bridge across the Nam Ngum river in Vientiane Province has been included in the Do-Minimum forecast scenario

Model Validation

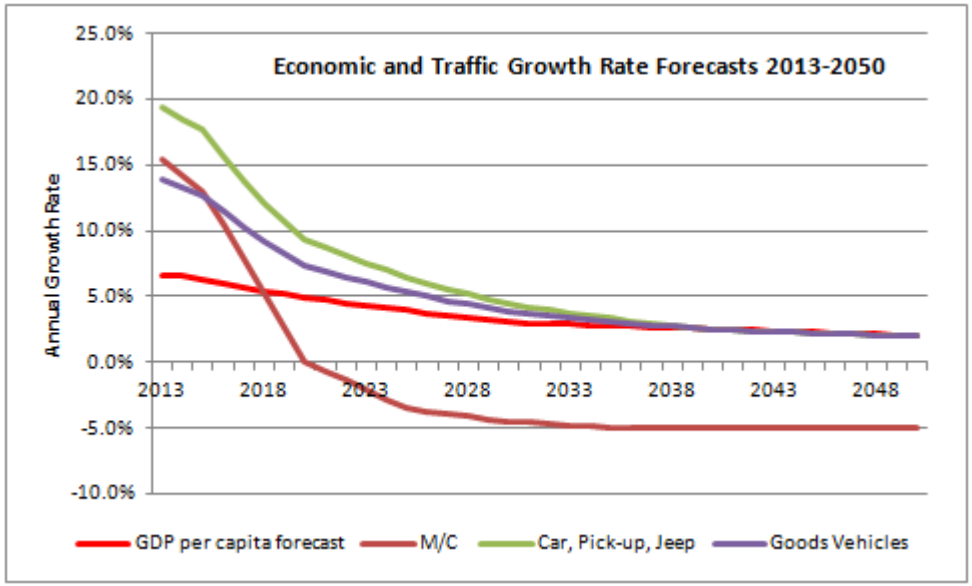
- High Level Traffic Model Validation by vehicle type at RSI locations (AADT):

Count	Traffic Model					Traffic Count					GEH Statistic				
Station	Class 1	Class 2	Class 3	Class 4	Total	Class 1	Class 2	Class 3	Class 4	Total	Class 1	Class 2	Class 3	Class 4	Total
RSI 1	5368	3378	1540	986	11272	5281	3361	1568	1109	11319	1	0	1	4	0
RSI 3	1418	1722	572	632	4344	1355	1655	548	546	4104	2	2	1	4	4
RSI 5	7248	4602	2208	618	14676	6852	4619	2228	622	14321	5	0	0	0	3
RSI 7	1244	846	336	292	2718	1386	845	346	293	2870	4	0	1	0	3

- Class 1: Motorcycles
- Class 2: Cars, Jeeps, Taxis & Pick-ups
- Class 3: LGVs
- Class 4: HGVs

- GEH statistic used to assess the 'closeness of fit' of the traffic model output to the traffic count. Values of 5 or less are considered satisfactory
- Unobserved local traffic movements at traffic count stations 2, 4, 6 and 8, excluded from the original traffic matrices which were built from stations 1, 3, 5 and 7 were added to the Traffic Capture Model

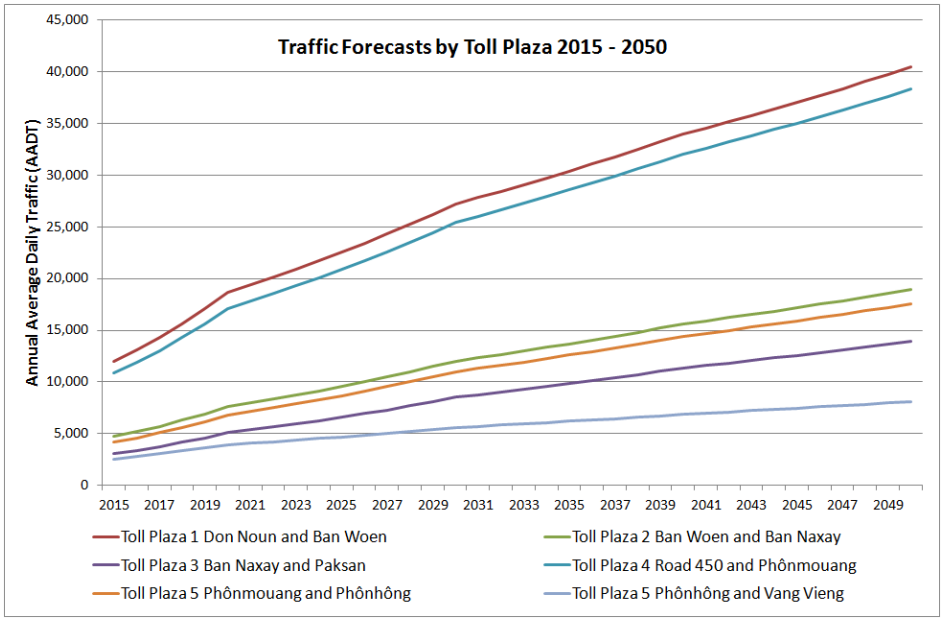
Traffic Growth



- 'Traffic Growth Hypothesis' report describes derivation of growth forecasts
- Traffic growth forecasts applied separately for: Motorcycles (M/C), Car, Pick-up, Jeep, LGVs and HGVs
- Growth rates predicted until 2050

- Based on historic relationship between growth of registered vehicles and GDP
- Highest growth predicted for cars, pick-ups, jeeps and LGVS as recently observed and reflecting predicted high car ownership increases in the future
- Lower growth forecast for HGVs although still substantially higher than national economic growth as recently observed
- Motorcycle growth declines sharply with growth of car ownership

Final Traffic Forecasts



- Traffic forecasts previously supplied for the Do-Minimum forecast scenario (v4)
- Opening Year forecasts for the Do-Something tolled scenario:
  - TP1 12,000 AADT
  - TP2 4,700 AADT
  - TP3 3,100 AADT
  - TP4 10,900 AADT
  - TP5 4,200 AADT
  - TP6 2,600 AADT

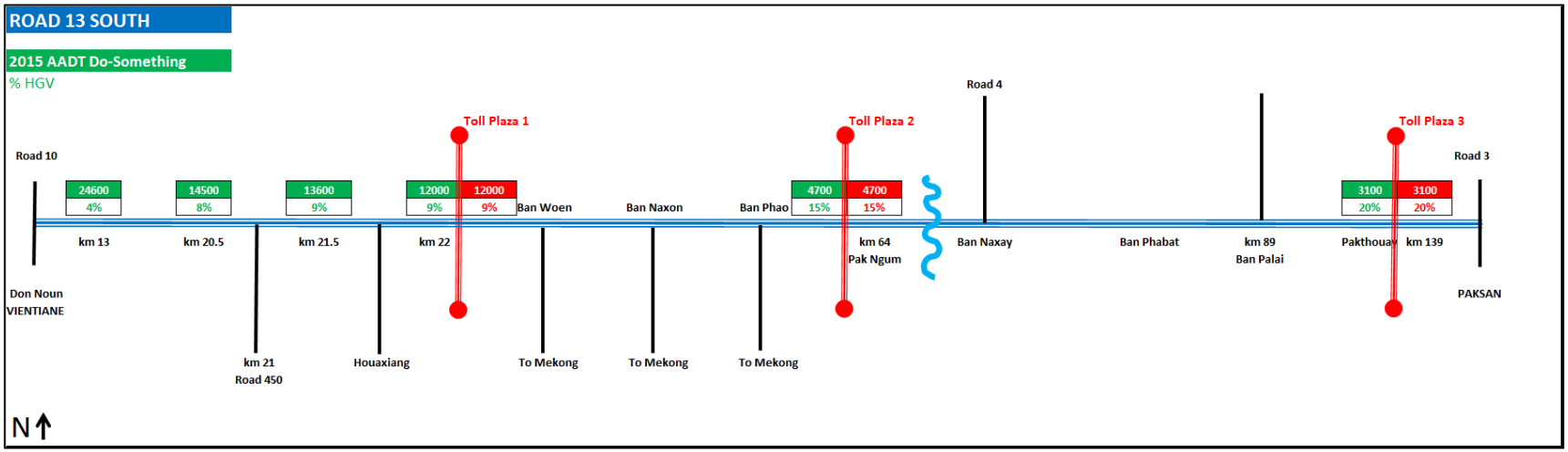
- Traffic Capture in 2015 by Toll Plaza

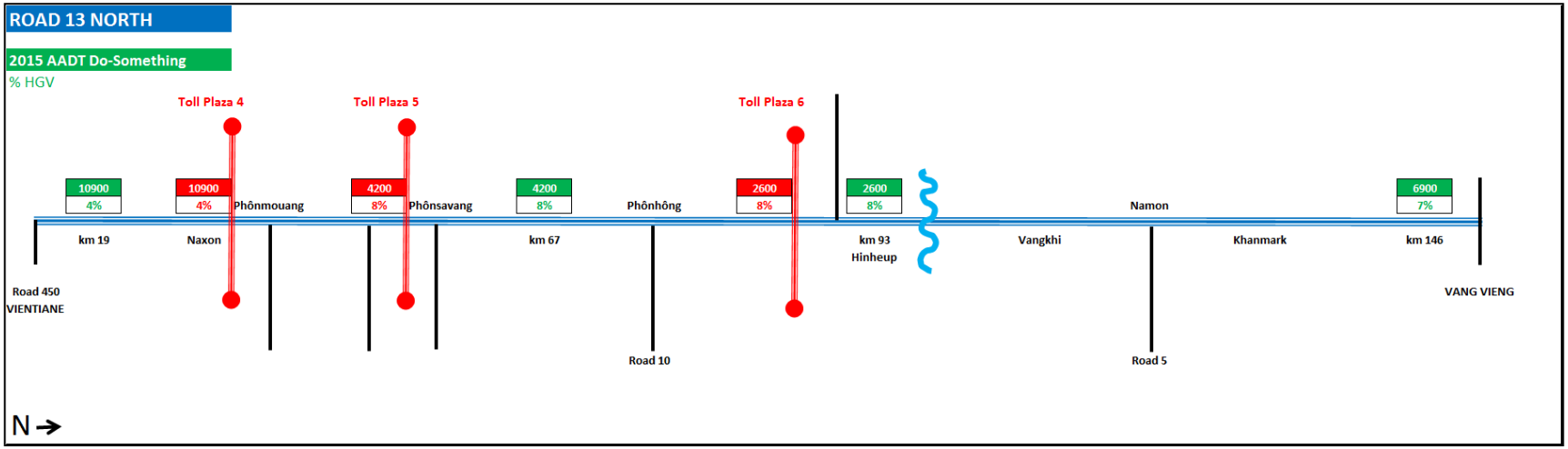
Plaza	TP1	TP2	TP3	TP4	TP5	TP6
% Un-tolled traffic	79%	85%	65%	57%	43%	68%

- Traffic Capture in 2015 by Vehicle Type

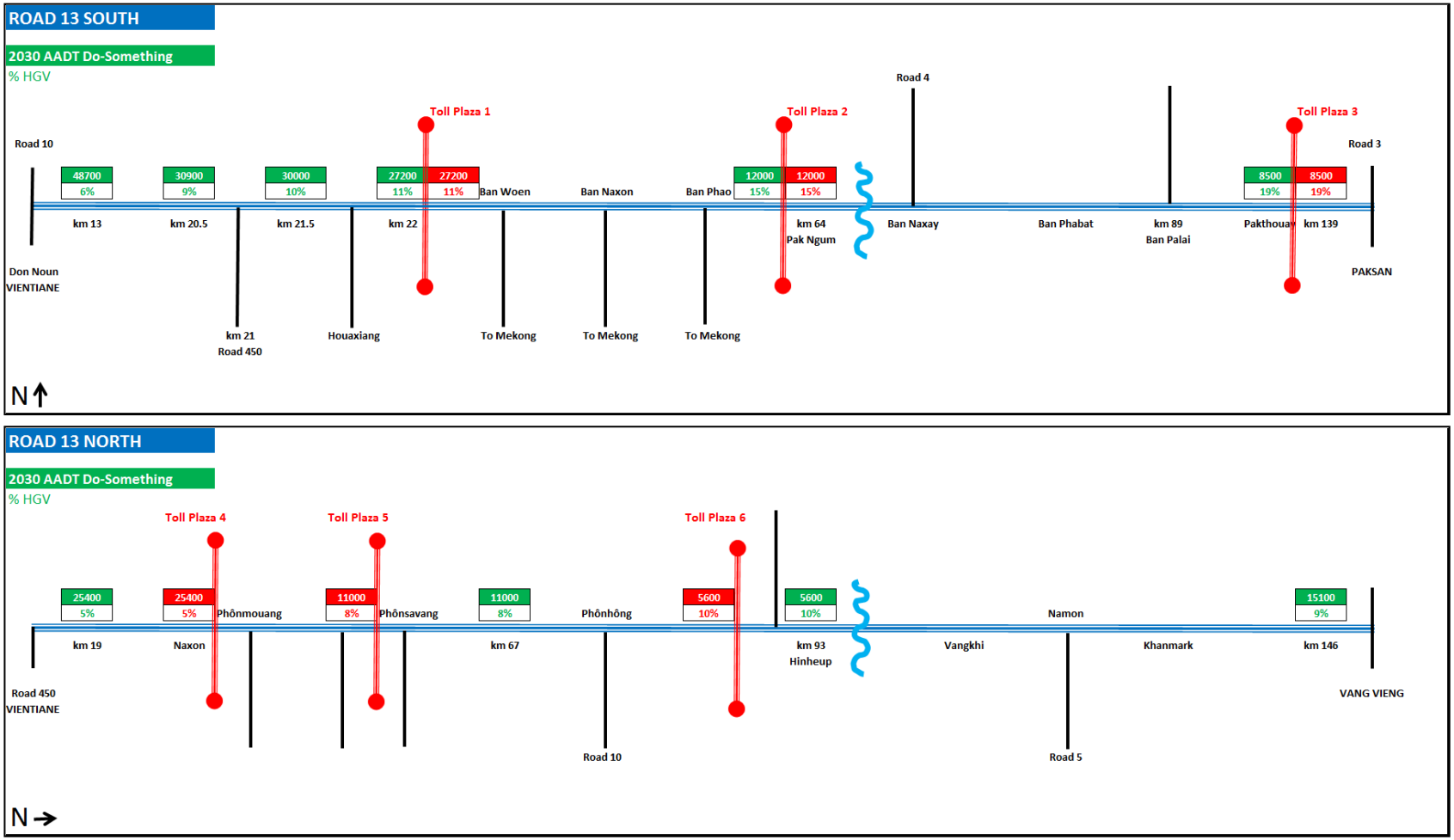
Plaza	M/Cs	Cars etc.	LGV	HGV
% Un-tolled traffic	49%	74%	75%	74%

Final Traffic Forecasts 2015

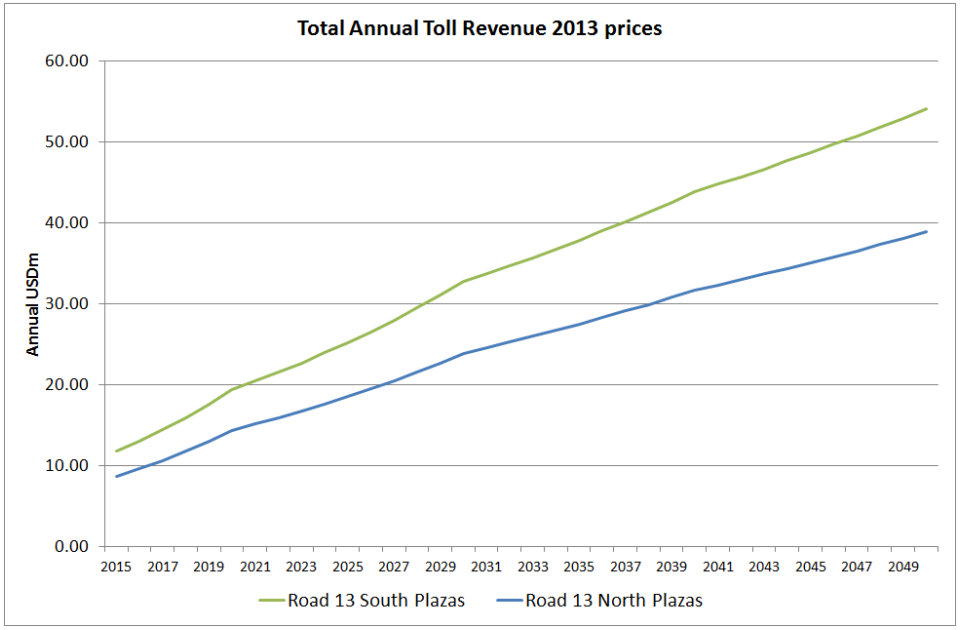




Final Traffic Forecasts 2030



Final Revenue Forecasts



- Revenue Forecasts in selected years

Road 13 All Plazas			
2013 prices incl. VAT	Daily Revenue (Kip million)	Annual Revenue (Kip billion)	Annual Revenue (USD million)
2015	422.68	154.28	20.57
2020	695.02	253.68	33.82
2025	899.02	328.14	43.75
2030	1162.89	424.46	56.59
2035	1343.31	490.31	65.37
2040	1551.71	566.37	75.52
2045	1720.95	628.15	83.75
2050	1908.66	696.66	92.89

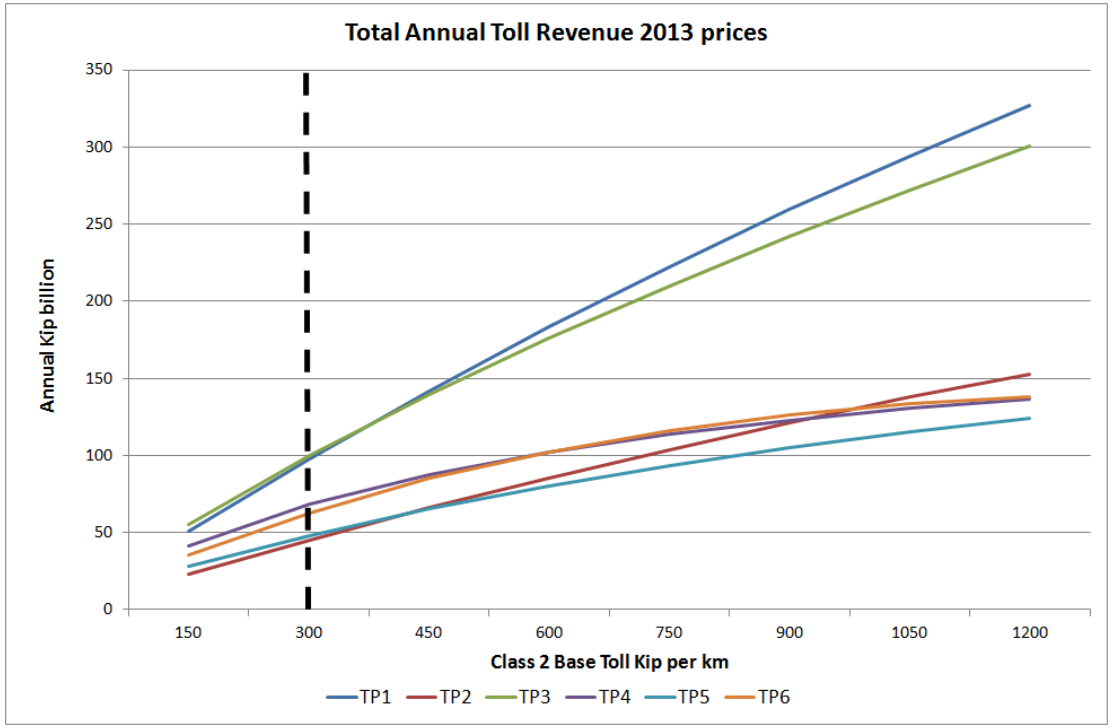
- Annual revenue growth:

Road 13 All Plazas	
2013 prices incl. VAT	Daily Revenue (KIPm)
2015-2020	10.5%
2020-2025	5.3%
2025-2030	5.3%
2030-2035	2.9%
2035-2040	2.9%
2040-2045	2.1%
2045-2050	2.1%

- Annual forecast revenue of 154 Kip billion (20.6 USD million) at 2015 traffic levels:
  - 58% Road 13 South
  - 42% Road 13 North
- Revenue contribution by vehicle class:

Road 13 All Plazas	%
1. Motorcycles	15%
2. Cars, Jeeps, Taxis & Pick-ups	35%
3. Light Goods Vehicles	21%
4. Heavy Goods Vehicles	28%
Total	100%

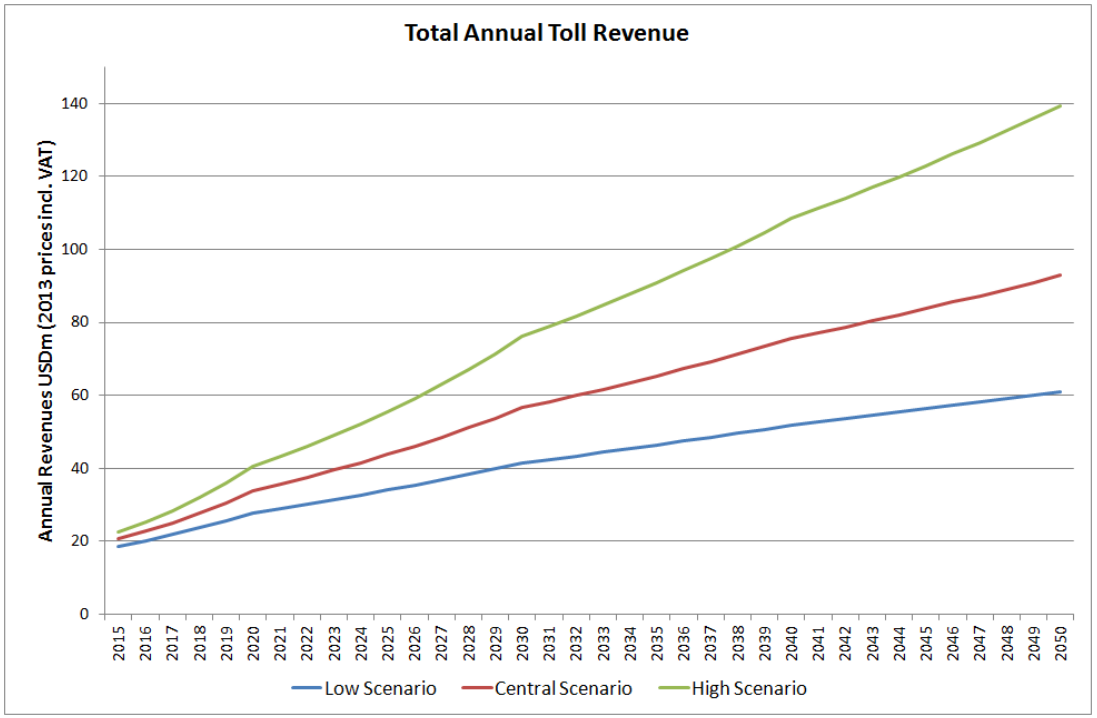
Sensitivity Tests (1)



- Revenue Optimizsation by Toll Plaza
- Toll tariffs range 150 – 1200 Kip/km (Class 2 tariff)
- Tariff must be affordable and publically acceptable
- Illustrative Base Toll 300 Kip/km
- Long distance drivers have a choice of routes, local drivers are captive

- TP1: traffic levels are relatively high, toll tariffs are relatively low, alternative route is poor
- TP3: traffic levels are relatively low, high proportion of long distance traffic, toll tariffs relatively high, no alternative route

Sensitivity Tests (2)



- Low and High Scenarios prepared by varying:
- Value of Time +/- 20%
- Traffic Growth +/- 20%

- At 2015 Traffic Levels
  - Low -9%
  - High +9%

- At 2030 Traffic Levels
  - Low -27%
  - High +34%

- Forecasts relatively insensitive to changes in Value of Time:
  - -20% VoT results in -4% revenues
  - +20% VoT results in +3% revenues
    - Traffic Growth Rates at 2030 Traffic Levels:
      - -20% Traffic Growth from 2013 results in -23% revenues
      - +20% Traffic Growth from 2013 results in +30% revenues

Annex C: Cost Analysis

LAO PEOPLE'S DEMOCRATIC REPUBLIC
PEACE INDEPENDENCE DEMOCRACY UNITY PROSPERITY

MINISTRY OF PUBLIC WORKS AND TRANSPORT
DEPARTMENT OF PLANNING

ASSESSMENT OF THE ENABLING ENVIRONMENT FOR PPPs IN LAO ROAD SECTOR

TASK 2

REPORT ON REVIEW PROPOSED PROJECTS AND PROVIDE INDICATIVE FUNDING REQUIREMENT

Prepared by

ລາວ - ອາຊີ ຄອນຊາວແຕນສ ກຼຸ ບ
LAO - ASIE CONSULTANTS GROUP

JUNE 2013

LAO PEOPLE'S DEMOCRATIC REPUBLIC
MINISTRY OF PUBLIC WORKS AND TRANSPORT
DEPARTMENT OF PLANNING

ASSESSMENT OF THE ENABLING ENVIRONMENT FOR PPPs IN THE LAO ROAD SECTOR

REPORT ON TASK TWO

Prepared by

ລາວ - ອາຊີ ຄອນຊາວແຕັນສ໌ ກຼຸບ
LAO - ASIE CONSULTANTS GROUP

19 June 2013

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1. Background

The Government of Lao (GoL) has set targets in the National Social and Economic Development Plan (NSEDP) for road network development over the next five years as follows: (i) all rural roads should be passable year-round, (ii) 920 km of the core road network serving regional and domestic connectivity shall be constructed and expanded, (iii) the road network shall be improved with climate/disaster resilience standards. Further, the NSEDP highlights the need for further regional integration through improvement of economic corridors, development of transport logistics, and trade facilitation. A number of mega-projects related to improvement of the transport sector have been identified, including expanding and upgrading several airports and upgrading the core road network.

The NSEDP also highlights the need for mobilization of resources from all possible sources including the public budget, development partners, and the private sector. Given scarce public funds and improvement needs in the social sectors, the challenge is how the sector will prioritize its needs and also mobilize resources from other sources of funds, including efficient sourcing from the private sector. To this end, it is crucial for the Ministry of Public Works and Transport (MPWT) to enhance its strategic management capacity in order to more effectively manage and develop the sector and increase its role.

A Public Private Infrastructure Advisory Facility (PPIAF) housed at the World Bank was formed in order to support an initial feasibility assessment of the potential of Public Private Partnerships (PPPs) for road network development in the Lao PDR (i.e. Route 13N and 13S), which was carried out in early 2012. The report concluded that there is high potential for the two proposed pilot road projects to be successful PPP projects. It was also recommended that, as a next step, a feasibility study of the two projects be carried out. The GoL has requested the World Bank's assistance in conducting the feasibility study.

2. Objective

To improve the GoL's capacity to assess the viability of potential PPP projects and to provide guidance on establishing a viable enabling environment for developing highway projects.

3. Scope of Work

More specifically, the tasks for the Technical Consultant will include but are not limited to the following:

Task two:

(1) Develop benchmark (per km) cost rate estimates based on recent road and bridge projects in Laos for the following:

- *Cost per km per lane of rehabilitated/widened carriageway*
- *Cost per km of different surface type and standard of road*
- *Cost per km of hard shoulder if any*
- *Cost per km(or meter) of the following:*
    - *Cost per toll booth operation (based on international research)*
    - *Cost per overloading control operation*

(2) Undertake full site visit of roads 13N and 13S to establish:

- *Number and length of bridges that need to be rehabilitated or rebuilt*
- *Length of new or rehabilitated culverts (pipe and box culverts)*
- *Length of new or rehabilitated embankment*
- *Length of new or rehabilitated safety barriers*
- *Length of new road markings/road safety measures*
- *Length of new or rehabilitated environmental mitigation measure*
- *Number of property and areas of land required.*

4. Cost rate estimates for road and bridge projects in Laos

4.1 Cost per km and lane of rehabilitated/widened carriageway

According to the road construction projects in Vientiane capital and Vientiane province, the cost per km and lane are as follow:

Concrete Surface				
Name of project	***Construction cost (kip)***	***Length (km)***	***No. of lanes***	***Cost/km/lane (kip)***
Lao-Thai road-Donepamay-Suanmone, Sisattanak district, Vientiane capital	56,280,000,000	2.8	4	5,025,000,000
Donenokkhoum-Sangveay-Choumphet, Sisattanak district, Vientiane capital	88,982,000,000	4.87	4	4,567,864,476
Phonhong to Phonmy, Vientiane province	263,120,000,000	8.05	4	8,171,428,571
Pakcheng to Napho, Vientiane province	236,272,000,000	12	4	4,922,333,333
Average cost per km per lane				**5,671,656,595**

Asphalt Concrete Surface				
Name of project	*Construction cost (kip)*	*Length (km)*	*No. of lanes*	*Cost/km/lane (kip)*
Road No. T5, Vientiane capital	115,077,000,000	5.2	4	5,532,548,077
Huakhua-Nakhuay, Vientiane capital	152,003,000,000	7	4	5,428,678,571
Khamsavath-Dongkhamxang-Nahai, Vientiane capital	594,812,000,000	21	4	7,081,095,238
Average cost per km per lane				**4,510,580,472**

4.2 Cost per km for different surface type and standard of road

4.2.1 Cost of a four lane road

According to the road design standards of the MPWT, the width of a four lane road is 32 meters in total. Detailed figures are shown in the table below:

Shoulder	*Lane 4*	*Lane 3*	*Lane 2*	*Lane 1*	*Center*	*Lane 1*	*Lane 2*	*Lane 3*	*Lane 4*	*Shoulder*
1m	3.37m	3.37m	3.37m	3.37m	1m	3.37m	3.37m	3.37m	3.37m	1m
Total width is 32 meters										

The cost estimation for the road 13 north is for road improvement from 9 to 18 meters, new bridge construction, land acquisition and safety measurement. The applied unit rate is from the latest (2012) unit rate of Ministry of Public Works and Transport. The summary is as follow:

Section	Asphalt concrete road (kip)		Concrete road (kip)	
	Total cost	Cost per km	Total cost	Cost per km
Vientiane -Phonhong	**823,369,029,268**	***13,722,817,154***	**1,660,018,950,272**	***27,666,982,505***
Vientiane -Vangvieng	Not suitable to build four lanes road from Vientiane to Vangvieng due to high quantity of cut and fill.			
Vientiane -BanHai	**797,515,595,248**	***18,546,874,308***	**1,400,315,988,623**	***32,565,488,108***
Vientiane -Paksan	**1,954,295,424,551**	***15,149,576,935***	**3,773,921,170,801**	***29,255,202,874***

Details calculation is in annex 01.

4.2.2 Cost of a two lane road

According to the road design standards of the MPWT, the width of a two lane road is 18 meters in total. Detailed figures are shown in the table below:

Shoulder	*Lane 2*	*Lane 1*	*Center*	*Lane 1*	*Lane 2*	*Shoulder*
1m	3.37m	3.37m	1m	3.37m	3.37m	1m
Total width is 18 meters						

The cost estimation for the road 13 north is for road improvement from 9 to 18 meters, new bridge construction, land acquisition and safety measurement. The applied unit rate is from the latest (2012) unit rate of Ministry of Public Works and Transport. The summary is as follow:

Section	Asphalt concrete road (kip)		Concrete road (kip)	
	Total cost	Cost per km	Total cost	Cost per km
Vientiane -Phonhong	**336,726,728,518**	***5,612,112,142***	**886,674,655,559**	***14,777,910,926***
Vientiane -Vangvieng	**286,972,684,141,015**	***2,049,804,886,722***	**288,251,568,618,265**	***2,058,939,775,845***
Vientiane -BanHai	**326,801,821,086**	***7,600,042,351***	**722,427,954,336**	***16,800,650,101***
Vientiane -Paksan	**794,616,353,404**	***6,159,816,693***	**1,990,695,360,904**	***15,431,746,984***

Details calculation is in annex 02.

4.3 Cost per unit

The MPWT have collected and compared the cost of each item from the road and bridge construction projects funded by the ADB (ADB-4 up to ADB-11), the World Bank and other donors. These details are attached in Annex 03.

4.4 Cost per toll booth operation

ThaNgone Bridge and Lao-Thai Friendship Bridge toll booths have been investigated and the data was summarized as follow:

Description	Lao-Thai Friendship Bridge cost (USD)	ThaNgone Bridge cost (USD)
Development of software system		
CCTV accessories		
RFID controlling system accessories		
Maintenance		
Controlling building		
Services building		
Automatically entry/exit way		
Construction, installation and advertisement		
Training, internal and external study visit		
Power system		
Total for infrastructure and tools	**55,000**	**20,000**
Operating cost	21,000 USD per month	5,000 USD per month

4.5 Cost per overloading control operation

The Ministry of Public Works and Transport enacted regulation No.2157/MPWT for punishment of overloading on April 4th 2000. The fees are shown in the table below:

Weight (Ton)	Road defect fee (kip)	Overloading service fee (kip)	Road management fee for 1km (kip)	Overloading fee (kip/trip/vehicle)
0.5-0.9	6,700	300	7,000	50,000
1.0-1.5	8,300	400	87,000	50,000
1.6-2.0	9,700	500	10,200	50,000
2.1-2.5	11,400	600	12,000	50,000
2.6-3.0	13,400	700	14,100	50,000
3.1-3.5	16,200	800	17,000	50,000
3.6-4.0	18,500	900	19,400	50,000
4.1-5.0	25,000	1,250	26,250	50,000
5.1-6.0	35,000	1,750	36,750	50,000
6.1-7.0	46,500	2,300	48,800	50,000
7.1-8.0	65,000	3,250	68,250	50,000
8.1-9.0	95,000	4,700	99,700	50,000
9.1-10.0	130,000	6,500	136,500	50,000
10.1-11.0	175,000	8,700	183,700	50,000
11.1-12.0	228,000	11,400	239,400	50,000
>12.1	295,000	15,000	310,000	50,000

4.6 Cost of maintenance with different surface type

4.6.1 DBST road maintenance cost

There are three types of road maintenance namely: routine maintenance, periodic maintenance and emergency maintenance. The routine maintenance and periodic maintenance can be estimated but the emergency maintenance will not be included.

Estimated Cost of DBST Road Maintenance		
Maintenance type	**Cost (kip)**	**Remark**
Routine	19,006,363	Every year
Periodic	3,072,402,000	Resealing every ten years
Emergency	-	Not included
Total cost per km	9,787,396,890	For 30 years

4.6.2 Asphalt concrete maintenance cost

There are three types of road maintenance namely: routine maintenance, periodic maintenance and emergency maintenance. The routine maintenance and periodic maintenance can be estimated but the emergency maintenance will not be included.

Estimated Cost of Asphalt Concrete Road Maintenance		
Maintenance type	**Cost (kip)**	**Remark**
Routine	36,000,000	Every year
Periodic	796,801,500	Resealing every ten years

Emergency	-	Not included
Total cost per km	**3,470,404,500**	For 30 years

4.6.3 Concrete road maintenance cost

It is very difficult for estimation of the maintenance per kilometer per year but from the past experience the cost of maintenance activities can be specified below:

Repair Type	Unit Repair Cost (USD)	Expected Life Extension
Reseal joints and cracks	$0.75-1.25/ft (hot pour)	3-8 years
Retrofit edge drains	$2.00-$4.00/ft	Life of existing pavement
Partial depth repair	$325-$500/ yd^3	3-10 years
Diamond grinding	$1.80-$7.80/yd^2	8-12 years
Thin ACOL	$1.45-$3.25/yd^2	5-15 years
Restore load transfer	$25-$35/dowel	10-15 years
Cross stitching	$9-$10/bar	10-15 years
Slab under sealing	$1.30-$1.40/yd^2	3-6 years
Full depth repair	$90-$100/ yd^2	10-15 years

5. Road 13N and 13S investigation

5.1 Number and length of bridges that need to be rehabilitated or rebuilt

5.1.1 Bridges on Road 13N (Vientiane capital to Vangvieng)

There are 31 concrete bridges on road 13N. They are all nine meters wide and the total length is 1,452.4 meters. All of them were built before 2000 except for the Hinhup Bridge. The details are shown in the table below:

No.	Station	Name	Width (m)	Length (m)	Type	Location
1	19+000	XayMoun	9	19	Concrete	Naxaythong, VTE capital
2	22+000	HuaySone	9	25	Concrete	Naxaythong, VTE capital
3	31+300	NamHoum	9	22	Concrete	Naxaythong, VTE capital
4	37+000	NamXuang	9	47	Concrete	Naxaythong, VTE capital
5	55+700	Namphanay	9	25	Concrete	Phonhong, VTE province
6	63+500	HuayThon	9	20	Concrete	Phonhong, VTE province
7	66+400	Namcheng	9	69	Concrete	Phonhong, VTE province
8	73+900	Namchim	9	40	Concrete	Phonhong, VTE province
9	94+000	NamLik	9	195	Concrete	Hinheup, VTE province
10	102+200	HuaySuan	9	37	Concrete	Hinheup, VTE province
11	102+400	PongXong	9	40	Concrete	Hinheup, VTE province
12	103+800	HinTid (1)	9	30	Concrete	Hinheup, VTE province
13	106+900	HinTid (2)	9	30	Concrete	Hinheup, VTE province
14	111+200	DokMai (1)	9	28	Concrete	Hinheup, VTE province

15	112+100	KorKhai (1)	9	28	Concrete	Hinheup, VTE province
16	114+100	KorKhai (2)	9	20	Concrete	Hinheup, VTE province
17	114+700	DokMai (2)	9	23	Concrete	Hinheup, VTE province
18	116+200	HuayPhuang	9	26	Concrete	Hinheup, VTE province
19	116+500	LanFai	9	25	Concrete	Hinheup, VTE province
20	117+400	VangKhee (1)	9	26	Concrete	Hinheup, VTE province
21	117+900	VangKhee (2)	9	34	Concrete	Hinheup, VTE province
22	120+000	NamPath	9	41	Concrete	Hinheup, VTE province
23	124+876	Somesanouk	9	40	Concrete	Hinheup, VTE province
24	128+000	PaMoam (1)	9	51	Concrete	Vangvieng, VTE province
25	129+629	PaMoam (1)	9	26	Concrete	Vangvieng, VTE province
26	132+800	HuayMor (1)	9	40	Concrete	Vangvieng, VTE province
27	135+328	HuayMor (2)	9	26	Concrete	Vangvieng, VTE province
28	136+000	HuayMor (3)	9	23.3	Concrete	Vangvieng, VTE province
29	140+950	NamNgat	9	60	Concrete	Vangvieng, VTE province
30	142+300	NamMone	9	46	Concrete	Vangvieng, VTE province
31	150+950	NamNgam	9	27	Concrete	Vangvieng, VTE province

5.1.2 Bridges on Road 13S (Km21+000 to Paksan)

There are 12 bridges on road 13S. All of them are nine meters wide and the total length is 1,068 meters. Most of them are built with concrete except for the NamNgum Bridge (piers with concrete, girders of steel and top structure of concrete). All of the bridges were built during the 1990s. The details are shown in the table below:

No.	Station	Name	Width (m)	Length (m)	Type	Year	Location
1	63+400	NamNgeum	9	254	Concrete	1985	PakNgum dist. VTE capital
2	73+000	NamHong	9	23	Concrete	1986	Thaphabath district, BKX province
3	91+900	NamHee	9	78	Concrete	1993	Thaphabath district, BKX province
4	92+700	NamMang	9	128	Concrete	1993	Thaphabath district, BKX province
5	106+900	NamJing	9	67	Concrete	1994	Thaphabath district, BKX province
6	110+100	NamLo	9	79	Concrete	1994	Paksan district, BKX province
7	117+300	NamKup	9	80	Concrete	1994	Paksan district, BKX province
8	122+200	NamThuay	9	81	Concrete	1994	Paksan district, BKX province
9	124+100	Dongkam	9	28	Concrete	1991	Paksan district, BKX province
10	140+600	NamNgeup	9	120	Concrete	1995	Paksan district, BKX province
11	147+005	NamXan	9	114	Concrete	1995	Paksan district, BKX province

5.2 Length of new or rehabilitated culverts (pipe and box culverts)

5.2.1 Existing culverts on Road 13N (Vientiane capital to Vangvieng)

Most of the pipe and box culverts were installed during the improvement of the road 13N in 2000s and only a few of them have been installed later on. The culverts on road 13N are summarized in the table below:

Vientiane to Phonhong				
No.	**Dimension**	**No. of location**	**Length (m)**	**Type**
1	60	4	56	Concrete pipe
2	80	7	104	Concrete pipe
3	2Ø80	1	14	Concrete pipe
4	100	4	73	Concrete pipe
5	2Ø100	3	45	Concrete pipe
6	3Ø100	1	14	Concrete pipe
7	4Ø100	1	14	Concrete pipe
8	150	1	15	Concrete pipe
9	2Ø150	4	57	Concrete pipe
10	3Ø150	1	13	Concrete pipe
11	100x100	3	50	Concrete box
12	150x200	1	15	Concrete box
13	150x300	1	14	Concrete box
14	300x300	1	15	Concrete box
15	200x300	2	25	Concrete box
16	200x400	1	13	Concrete box
17	200x100	1	14	Concrete box
18	200x200	2	27	Concrete box
19	200x250	1	14	Concrete box
20	2x150	1	14	Concrete arch
Phonhong to Vangvieng				
No.	**Dimension**	**No. of location**	**Length (m)**	**Type**
1	60	10	154	Concrete pipe
2	80	43	692	Concrete pipe
3	2Ø80	1	36	Concrete pipe
4	100	85	1,427	Concrete pipe
5	2Ø100	12	302	Concrete pipe
6	150	15	290	Concrete pipe
7	2Ø150	3	120	Concrete pipe
8	3Ø150	2	48	Concrete pipe
9	5Ø150	1	100	Concrete pipe
10	100x100	1	14	Concrete box

5.2.2 Existing culverts on Road 13S (Km21+000 to Paksan)

Most of the pipe and box culverts were installed during the improvement of road 13N in 1995s and only few of them have been installed later on. The culverts on road 13N are summarized in the table below:

Km 21+000 to Banhai				
No.	**Dimension**	**No. of location**	**Length (m)**	**Type**
1	60	1	20	Concrete pipe
2	80	13	233	Concrete pipe

3	100	3	58	Concrete pipe
4	2Ø150	2	34	Concrete pipe
5	80x80	1	10	Concrete box
6	100x100	4	47	Concrete box
7	100x80	1	10	Concrete box
8	100x150	1	10	Masonry with concrete slap
9	100x200	1	13	Concrete box
		Banhai to Paksan		
No.	**Dimension**	**No. of location**	**Length (m)**	**Type**
1	3Ø60	1	60	Concrete pipe
2	80	44	851	Concrete pipe
3	2Ø80	1	44	Concrete pipe
4	100	37	743	Concrete pipe
5	2Ø100	2	90	Concrete pipe
6	150	8	172	Concrete pipe
7	2Ø150	10	412	Concrete pipe
8	4Ø150	1	80	Concrete pipe
9	2x2.2x2.5	1	15	Concrete box
10	2x3.5x3.5	1	18	Concrete box
11	2x3.5x3.5	1	18	Concrete box

5.3 Length of new or rehabilitated embankment

5.3.1 Embankment on Road 13N (Vientiane capital to Vangvieng)

The investigation shows that most of this section is rolling area, therefore the embankment is only about 20 km compared to the whole length of the road which 143 km. The height of the embankment is between one and three meters, except between km 71+000 and km75+000 where the height is about four meters. The Office of Public Works and Transport and Department of Public Works and Transport have reported that the height of the embankment is sufficient and that widening the road should only be considered when the road needs to be improved.

5.3.2 Embankment on Road 13S (Km21+000 to Paksan)

From the investigation of road 13S, most of this section is flat and therefore the embankment is about 100 km of the whole length of the road which is 127 km. The height of the embankment is between one and five meters. OPWT and DPWT have reported that the height of the embankment is sufficient and that widening the road should only be considered when the road needs to be improved.

5.4 Length of new road markings/road safety measures

The road marking/road safety measures on road 13N from Vientiane capital to Vangvieng district (150km) and on road 13S from Vientiane capital (km 21+000) to Paksan district center,

Borlikhamxai province (127 km) is very poor, therefore the whole length of these sections should be improved when the new construction starts.

5.5 Environmental mitigation measure

New or extended road development will always have an impact on the surrounding environment, e.g. fragmentation of nature areas. In order to prevent or decrease these impacts, mitigation measures are developed. The range of mitigation measures is broad and new alternatives and effectiveness studies are frequently published.

The chosen mitigation measure for a road depends on planning culture, available technology, economy, wishes from the financier and environmental restrictions. The result is not always successful but through site visits in different countries the knowledge and experience in the field have been exchanged and the insight into the different mitigation measures and their application deepened.

Important to consider in the choice of mitigation measure are:

- *If the measure is suitable for the specific case and place.*

  Even though a mitigation measure has been successful in one case it is always necessary to look at local circumstances. For example, an ecoduct should be placed where animals normally cross the road; otherwise there is a large risk of them not using it.

- *If the mitigation measure is necessary.*

  In some cases, such as fragmentation of nature, it might be more useful for the fauna if the effort was spent on upgrading the nature on one side of the road instead of on a passage. The presence of threatened or sensitive species should receive extra attention when affected.

- *Cost versus benefits when choosing type of mitigation measure.*

  The most expensive and newest type of mitigation measure might not always be the most efficient.

5.6 Number of properties and areas of land required

According to the standard design for a class one road (32m wide), the area of land required is reserved in the Road Law (25m to either side of the center line) and even where the higher embankment (4m between km 71+000 and km 76+000 on road 13N and between km 103+000 and km 105+000 on road 13S) will be constructed the area of land required is only 48m.

The properties need to moved from the road area are temporary/extended houses, low voltage electrical poles within the villages, fruit trees and pipe culverts that villagers have installed in the ditches in front of their houses.

6. Conclusion and recommendation

6.1 Conclusion

- The average cost of concrete road construction per km and per lane is **5,671,656,595** kip while the cost of asphalt road construction per km and per lane is **4,510,580,472** kip. This cost is the average calculated from road development projects in Vientiane capital and Vientiane province.
- There are 40 concrete bridges, 9m wide and with a total length of 1,452.4m on road 13N and there are 12 bridges, 9m wide and with a total length of 1,068m on road 13S.
- There are different types of pipe and box culverts on road No.13 and most of them have been built during 1995s on road 13S and during 2000s on road 13N.
- The embankment on road No.13 is not very high, except between km71+000 and km76+000 on road 13N and between km103+000 and km 105+000 on road 13S where the height is around 4m.
- The road markings/road safety measures on road No.13 are very poor and need to be improved along the whole length of the road.
- The properties that will be moved from the road area are temporary/extended houses, low voltage electrical poles within the villages, fruit trees and pipe culverts that villagers have installed in the ditches in front of their houses.

6.2 Recommendations

- A four lane road can be built from Vientiane to Phonhong and from Vientiane to Paksan but from Phonhong to Vangvieng the cost estimation is very high.
- All the bridges need to reconstruct to suit the new carriageways.
- Most of the pipe and box culverts can be extended, except for one with masonry and concrete slab on road 13S.