



NT Department of Transport & Regional  
Development Australia NT  
Feasibility Assessment Central Arnhem Road Upgrade

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Appendix A – Consultation meeting minutes

# 1. Introduction

This section of the report outlines the background and purpose of the Feasibility Assessment.

## 1.1 Setting the scene

A number of studies have been commissioned by the NT Government to assess the current availability and condition of infrastructure in remote indigenous regions in the Northern Territory. These include:

- *Infrastructure in Remote Indigenous Communities: Part of the Solution to Closing the Gap* submission to Infrastructure Australia (July 2013)
- *Northern Territory Regional Infrastructure Study* project (September 2014)
- *Northern Territory Regional Infrastructure Study, Output Three: Infrastructure Prioritisation* project.

A lack of adequate infrastructure has a direct impact on the economic sustainability of remote communities across Australia, and the ability of these communities to contribute to the economy. Further, the remote regions are located close to natural features that would stimulate economic activity and development; however there are limitations on access due to inadequate roads.

Improvements to the condition and reliability of infrastructure within these remote communities would assist in stimulating economic development and delivering economic, social and environmental benefits, but requires assistance from the Australian Government for initial and ongoing funding requirements.

## 1.2 Vision

The vision for this project is that by 2025 Nhulunbuy will be connected to the National Highway Network via a sealed road.

## 1.3 Purpose

This report outlines the Feasibility Assessment that has been undertaken in order to determine the most appropriate option that will address the problems identified, and that will deliver benefits appropriate for the remote communities, the residents and stakeholders.

The Feasibility Assessment builds upon the aforementioned prior work completed which assessed critical infrastructure requirements within Northern Territory regions.

## 1.4 Outcomes

The desired outcomes from this Feasibility Assessment include:

- The selection of a preferred option that connects Nhulunbuy to the National Highway Network via a sealed road that is reliable, safe and delivers an economic useful life in accordance with the engineering specifications
- Ability for communities in the Arnhem Land region to have access to health and education services, and be able to contribute to economic growth through employment and business outcomes
- Ability for residents and visitors to travel to visit family and friends, and participate in community events

- Increase the potential to attract additional revenue from tourism, opportunities for mining and resource exploration and development, and primary industry development in the region, to contribute towards Regional Economic Development.

## 1.5 Objectives

The objective of the project is to assess the multiple project options available for upgrading major arterial roads in the Arnhem Land region, which will provide essential infrastructure for indigenous communities.

The current road connecting Nhulunbuy to the Arnhem Land region is unsealed, subject to significant road closure days, and presents a significant safety risk to all users. An upgraded, safe road that can be used with increased frequency over the long term will enable regional access for community residents, visitors and tourists, providing increased transport options, community connection, and economic stimulation.

The multiple project options will be analysed under two analysis methods, and based on the outcomes of the analyses, a preferred option will be selected for presentation to Infrastructure Australia in a funding submission request. The project options assessment will be undertaken in accordance with the framework developed for the aforementioned previous studies, and adapted for this Feasibility Assessment, and will link the key investment parameters to the potential social and economic benefits for the region.

## 1.6 Principles

The Feasibility Assessment framework has been developed based on the following core principles:

- **Infrastructure management:** infrastructure investment should provide a reliable solution that offers sufficient capacity to meet demand, enable safe passage for all users and be designed with consideration of environmental impacts and natural resource management. Infrastructure management should be monitored to ensure asset life meets the design standards consistent with engineering standards and project objectives.
- **Social values:** the health and education of community residents, as well as respect for cultural values, customs, relationships and economic participation are to be considered and managed to ensure that the maximum potential is realised as a result of any investment.
- **Land tenure:** although not specific to this Feasibility Assessment, land tenure agreements and rights are to be discussed and considered as part of planning for infrastructure in order to consider and respect the historical and current land tenure and ownership; ensuring ongoing relationships between Indigenous elders and government are maintained and strengthened.
- **Economic development:** infrastructure investment should be supported by appropriate strategies to ensure economic drivers of tourism, mining and resource development and primary industries are promoted and maintained within regional communities.

These principles are aligned to the key project drivers and have been developed based on the outcomes of consultations undertaken with government and industry representatives.

## 2. Project framework

This section of the report outlines the project framework that has been developed to address the problems to be resolved by the project.

The project framework will be used to identify the problems that are to be overcome, the challenges and limitations within the region that have led to the problems, and the potential options for overcoming the challenges and resolving the problems.

### 2.1 Project definition

The NT Department of Transport ('Government') and Regional Development Australia NT are keen to understand the full potential economic and social benefits of upgrading roads in the Arnhem Land region. These roads are to support the economic development of the region, as well as the Nhulunbuy transition, following the closure of the Rio Tinto Alumina processing plant.

A Feasibility Assessment will be undertaken across a range of road upgrade options. The concluding report will be submitted to Infrastructure Australia for funding approval.

### 2.2 Problem identification

The poor state of roads in the Arnhem Land region, including the lack of all-weather, year-around access, presents a significant barrier for community access to education, health and essential services, and limits potential for economic development in the region around tourism, mining and primary industries.

Nhulunbuy remains the only large regional centre in the Northern Territory not connected to the National Highway Network via a sealed road.<sup>1</sup> This limits the access options for community residents, tourists and industry operators in and out of the region. As a result, cultural, employment and training opportunities are restricted.

Each year a number of road closure days are observed along the Central Arnhem Road (connecting Katherine to Nhulunbuy) and Oenpelli Road (connecting Jabiru to Gunbalanya). Table 1 outlines the total number of days that each of the roads was either closed or deemed impassable in a given financial year period.

Table 1: Days closed or impassable, 2011 – 2014

Year	Central Arnhem Road	Oenpelli Road
2014*	126	106
2013	85	125
2012	181	107
2011	214	168

\* 2014 value to end September 2014. There is a possibility of further road closures in 2014.

Source: GHD analysis based on data provided from Department of Infrastructure, NT, 2014.

<sup>1</sup> *Central Arnhem Road Upgrades*, Northern Territory Government Department of Transport, 2014

## 2.3 Problem assessment

A review of the work completed to date has highlighted a number of root causes of the problems within the Arnhem Land region. Root causes that have been identified as contributing to the problem include:

- Lack of funding for construction of a sealed road connecting Nhulunbuy to other towns within Arnhem Land limits possibility of increased access for all road users in and out of the region by road.
- Lack of land tenure across Arnhem Land due to the Aboriginal Land Rights Act restricts delivery of infrastructure upgrades. Access to native title land limits the planning of infrastructure upgrades that will benefit community connections, economic development, tourism, primary industries, and resource exploration in the region.
- Difficulty in accessing, or inability to access the region via road limits the potential growth in the tourism market, which would drive local business expansion, employment and enterprise in terms of construction, operation and maintenance of new assets to meet increased demand. Any growth as a result of an expanded tourism market could be potentially large growth.
- Poor road conditions limit the connection between supply and demand, impacting both the agricultural and fisheries industry and the consumers through increased time and cost of transporting goods from port to purchase point. Efficiency and competitive advantage in commercial operations will be a key driver in the economic sustainability of these primary industries such as fisheries, cattle and buffalo.
- Poor road conditions constrain the development and expansion of the mining and resources industry, due to limited accessibility for and movement of production input machinery for mining and resource exploration, as well as restricted maximum allowable tonnage.
- Current expenditure by government on employees accessing the region in and around Nhulunbuy is high; a solution to the problem would result in considerable potential savings to government.

In addition to the prior studies that have been commissioned by the NT Government, as outlined in section 1.1, consultation with a number of Government, industry and community based stakeholders was undertaken to identify the key issues prevalent in the regions.<sup>2</sup> The findings from these consultations are provided as an appendix to this report.

## 2.4 Option generation

Government's development of options for this Feasibility Assessment has aimed to address the identified problem regarding lack of essential infrastructure for indigenous communities in the Arnhem Land region.

The project options have been generated considering the results of the recent *Northern Territory Regional Infrastructure Strategy Phase Three: Infrastructure Prioritisation* project, and incorporate the primary arterial roads connecting Nhulunbuy, in the north-eastern corner of Arnhem Land, with surrounding communities of Gapuwiyak and Ramingining. These roads enable access to the region that stimulates economic development, through tourism, mining and resources exploration and development of primary industries.

The options have been generated based on upgrading the following roads in the Arnhem region (Figure 1):

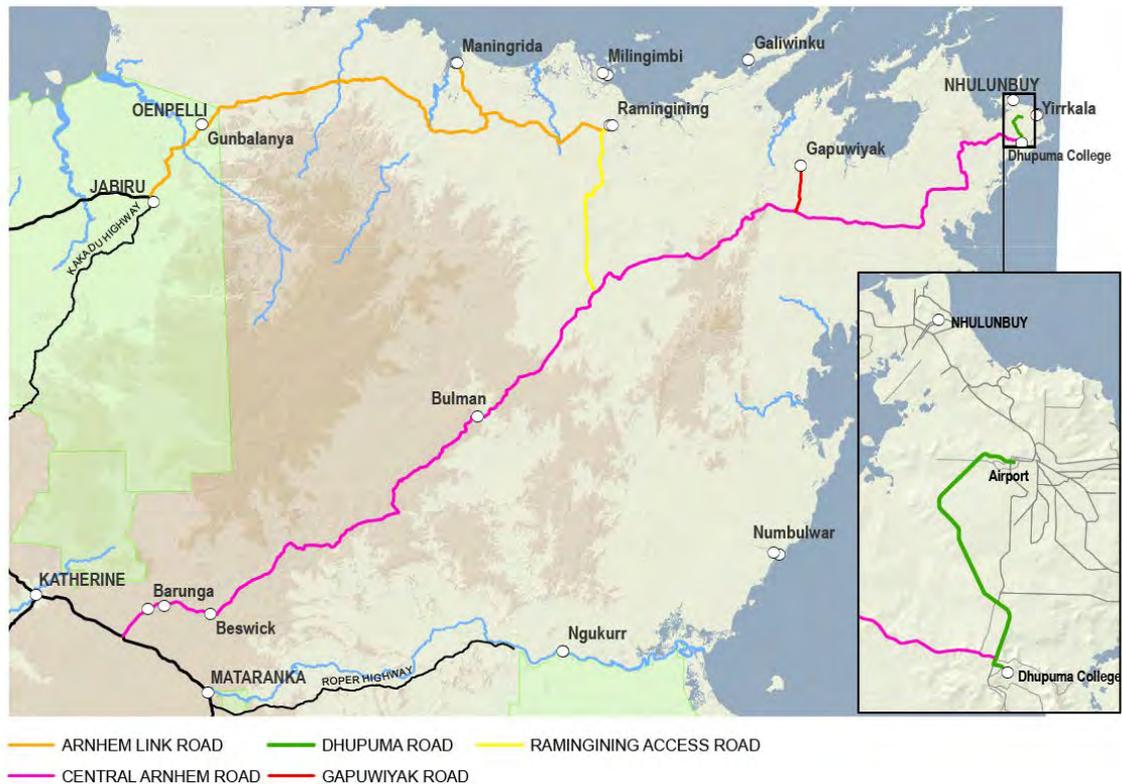
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<sup>2</sup> Consultation summary is included as an appendix to the final report.

- Central Arnhem Road (from Stuart Highway turn-off to the Dhupuma Road intersection)
- Dhupuma Road (from Dhupuma College to Melville Bay Road)
- Gapuwiyak Road (from Central Arnhem Road to Gapuwiyak Road)
- Ramingining Road (from Central Arnhem Road to the intersection of the Ramingining Access Road intersection)
- Arnhem Link Road, including Oenpelli Road, through to Ramingining.

The previous work undertaken has highlighted that each of these options is worth evaluating as part of the Feasibility Assessment<sup>3</sup>.

Figure 1: Map of road upgrade options



## 2.5 Option prioritisation

The preferred options have been prioritised based on how best they meet the Infrastructure Australia theme of “providing essential indigenous infrastructure, via improved services for indigenous communities”, and resolve the root causes of the problem as identified earlier.

The options have also been prioritised based on how best they address the following attributes:

- Deliver tangible changes, in terms of addressing the problems identified, in the medium to long term
- Supported by project stakeholders, including the project sponsors, key focus groups and the community members
- The proposed scope is complimentary to long-term plans for the Arnhem Land region and does not create any negative consequential impacts

<sup>3</sup> Refer to *Northern Territory Regional Infrastructure Strategy Phase Three: Infrastructure Prioritisation list*, GHD, 2014.

- The project scope has manageable implementation risks and provides an opportunity for an alternative option if the project context were to change.

The degree to which each of the options meets the above attributes has been outlined in the following sections of this report.

# 3. Project options analysis

## 3.1 Introduction

The Feasibility Assessment requires that each project option (as well as a base case ‘do nothing’ option) be assessed by two analysis frameworks; a MCA and a BCA.

The MCA assessment technique allows both qualitative and quantitative assessment of the benefits and impacts of each option to be considered. Each option is ‘scored’ according to how well the proposed project option is considered to contribute towards a set of predefined criteria.

The BCA assessment enables a quantitative assessment of the incremental benefits and costs of a project option compared to a base case to be undertaken. The BCA provides an indication of how well a project option delivers net economic benefits to society over the appraisal period.

## 3.2 Project options considered

Table 2 provides an overview of the project options that have been considered as part of the Feasibility Assessment.

Table 2: Project options for consideration

Option	Option	Description
Option 0	Base case	Under this option there will be no upgrade to any of the roads in the Arnhem Land region.  Current maintenance programs will continue with the same level of funding and additional funding for maintenance and repairs will only be provided where deemed critical.
Option 1	Central Arnhem Road	Central Arnhem Road, from the Stuart Highway turn-off to the Dhupuma Road intersection.
Option 2	Central Arnhem Road and Dhupuma Road	As per Option 1, including Dhupuma Road (from Dhupuma College to Melville Bay Road).
Option 3	Central Arnhem Road to Gapuwiyak	Central Arnhem Road from Dhupuma Road to the intersection of the Gapuwiyak Road, plus Gapuwiyak Road and Dhupuma Road.
Option 4	Central Arnhem Road to Gapuwiyak and Ramingining	Central Arnhem Road from Dhupuma Road to the intersection of the Ramingining Access Road, plus Gapuwiyak Road and the Ramingining Access Road, as well as Dhupuma Road.
Option 5	Central Arnhem Road to Gapuwiyak and Ramingining ,and the Arnhem Link Road	Central Arnhem Road from Dhupuma Road to the intersection of the Ramingining Access Road intersection, plus Gapuwiyak Road and the Arnhem Link Road (including Oenpelli Road) as well as Dhupuma Road.

Under each of the project options outlined, current maintenance programs will continue with the same level of funding on sections of road that are not upgraded under the project option i.e. for Option 1, only Central Arnhem Road will be upgraded and Dhupuma Road will continue to be maintained under the current maintenance program.

The options outlined above have been assessed in order to understand the potential economic and social benefits of upgrading roads in and around the region, in particular looking at linking Nhulunbuy to the remainder of the Northern Territory via either the Central Arnhem Road or the Arnhem Link Road.

The options assessment process enables each option to be assessed in a structured, objective and evidence based manner that allows identification of preferred options that address the problems efficiently.

## 4. Multi Criteria Analysis

### 4.1 Introduction

This section of the draft report outlines the MCA methodology and the results from the MCA assessment. The options assessed under the MCA framework included a base case 'do nothing' option and the five project options, as outlined in Table 2.

### 4.2 Background

In July 2013 the *Infrastructure in Remote Indigenous Communities: Part of the Solution to Closing the Gap* submission to Infrastructure Australia was undertaken, which included a MCA/Cost Effective Analysis (MCA/CEA). This approach was used for application to the remote Indigenous community reform and investment framework, ranking projects based on their risks, social outcomes and cost effectiveness. The tool was designed to rank projects within communities or across communities.

Central Arnhem Road was identified as critical infrastructure to be further considered within the Arnhem Land region. The project options for this Feasibility Assessment have been developed based on the potential impact that each road upgrade option would have on the economy and regional communities.

### 4.3 MCA methodology

For the MCA component of the Feasibility Assessment, GHD has adopted the same set of primary criteria as adopted for the *Infrastructure in Remote Indigenous Communities* MCA. These primary criteria have been reviewed for project relevance and additional criteria specific to this project included to establish the final set of criterion.

### 4.4 Multi Criteria Analysis process

The MCA assessment technique was adopted for the initial analysis of the project options as it enables qualitative and quantitative benefits and impacts of the options to be considered. The MCA technique requires that a judgement be made regarding how the proposed project options will contribute towards a series of criteria, which have been chosen to reflect the benefits or key objectives of the project.

The methodology used in the MCA includes the following steps:

- Determine a set of primary and secondary criteria linked to the project drivers/objectives and benefits. The options evaluation framework has considered multiple criteria based on (and considering):
  - Infrastructure risk profile (including capacity and reliability)
  - Environmental impact
  - Social impact
  - Economic impact
  - Project objectives and benefits.
- Assign a weighting (%) to the criteria based on the relative importance of each criteria. The weighting should be assigned based on the findings from the consultation conducted with stakeholders (see Appendix A), and giving consideration to the prior submission to Infrastructure Australia.

- Assess each option against the criteria by assigning a score (ranging from 7 to 1) to reflect the extent to which each option meets the criteria (Table 4). The higher the score, the larger the impact that the criterion has on the option. A lower score indicates that the option would result in a worse outcome relative to the base case, or current situation.
- The weighting of each criterion are considered to arrive at a final assessment score (highest possible score of 7). This score is then used to rank the options.

In all MCA assessment, the methodology that informs the options is considered to be on an 'incremental' basis compared to the base case 'do nothing' option.

#### 4.5 MCA evaluation framework

The MCA for this project was based around an evaluation framework using four key criteria, as outlined in Table 3. The evaluation criteria have been outlined in further detail in section 4.8.

Table 3: MCA evaluation criteria

Primary criteria	Primary criteria weighting	Secondary criteria	Secondary criteria weighting	Overall weighting
Infrastructure risk	25%	Capacity	20%	5%
		Reliability	20%	5%
		Safety	20%	5%
		Environment	20%	5%
		Design life	20%	5%
Social outcomes	30%	Health	15%	5%
		Education	20%	6%
		Economic participation (small business focus)	20%	6%
		Home and community	25%	8%
		Culture	20%	6%
Project investment analysis	15%	Project cost effectiveness analysis	100%	15%
Regional Economic Development	30%	Tourism	35%	11%
		Mining/resources	30%	9%
		Agriculture	35%	11%^
<b>TOTAL</b>	<b>100%</b>			<b>100%</b>

## 4.6 Scoring system

GHD has adopted the *Prioritisation scoring basis* scoring system as developed by MomeNTum for the *Northern Territory Regional Infrastructure Study* project in September 2014.

The scoring system assigns a score ranging from 7 to 1 to each of the primary and secondary criterion for each of the options. Table 4 provides a description of the scoring system that has been employed. A score of 7 indicates that the option would have a very large impact (compared to the base case), while a score of 1 indicates that the option would have no impact, or a negative impact compared to the base case.

Table 4: Assessment scoring

Score	Description
7	Very large impact compared to the current situation e.g. the existing infrastructure is unable to meet current demand, is unreliable and unsafe, has evident environment risks, infrastructure is still being used past the design life.
6	Large impact compared to the current situation
5	Significant impact compared to the current situation
4	Moderate impact compared to the current situation
3	Minor impact compared to the current situation
2	Very minor impact compared to the current situation
1	No impact/negative impact compared to the current situation e.g. the existing infrastructure is able to meet all demand without limitation or loss of service, there are no identified safety risks or recorded safety incidents, there are no identified risks for the environment, the design life remaining for the existing infrastructure is more than 80%.

### 4.6.1 The scoring process

Using the same set of primary and secondary assessment criteria for each of the project options and the base case option, scores were assigned to each criterion based on the perceived level of impact that the project option would have compared to the current situation. Feedback obtained from consultations with government and industry was factored into the scoring process.

In undertaking the MCA the scoring results from the *Northern Territory Regional Infrastructure Study, Output Three: Infrastructure Prioritisation* scoring was considered, to ensure alignment with the methodology applied and outcomes achieved under the **Transport** stream of that project.

## 4.7 Cost Effectiveness Analysis

Using national standard costs of infrastructure construction, a CEA has been undertaken for each of the project options. The CEA assessment takes into account the life of the infrastructure proposed, as well as the Capital Expenditure (CAPEX) and Operational Expenditure (OPEX) costs over the life of the project. From this a Net Present Value (NPV) for the project option is

calculated. The NPV is divided across the population served by the infrastructure, to arrive at a CEA score. The resulting CEA scores are then used to rank each of the project options.

This ranking allows the prioritisation of the investment decision based on rankings determined by assessing the proposed project risks, benefits and costs.

## 4.8 Evaluation criteria

The evaluation criteria and weightings were based on the broader project objectives, as well as consideration of the analysis from the *Northern Territory Regional Infrastructure Study, Output Three: Infrastructure Prioritisation*. The evaluation framework comprised of four primary criteria and 14 secondary criteria (Table 3).

The primary evaluation criteria were selected for their rounded approach to ensuring that all aspects of the project would be delivered by the best performing option. The options were scored against the following measures of performance.

The secondary criteria enable the options to be scored against a set of measures that are linked to qualitative or quantitative outcomes. The secondary criteria have been selected for their potential to express the objective of the primary criteria and indicate the impact of the option on the result and outcomes of the project.

### 4.8.1 Infrastructure risk

This criterion was included to consider the risk profile of the infrastructure of the project against five secondary criteria (capacity, reliability, safety, environment, design life), and how each option would be affected by these risks.

#### Capacity

This criterion considers the ability of the infrastructure to meet demand e.g. the permit conditions and infrastructure limitations on a maximum number of vehicles allowed to access the road and the maximum allowable freight tonnage.

#### Reliability

This criterion considers the reliability of the infrastructure with reference to the consistency in availability of service delivery and the likelihood of service interruption or failure to perform to the intended purpose.

#### Safety

This criterion assesses the safety of the infrastructure under usual operations, considering road alignment, stream crossings, dust issues and road surface.

#### Environment

This criterion assesses how each option would impact the environment. Consideration has been given to impacts on native vegetation, dust reduction, drainage and erosion (e.g. sediment runoff), and the environmental footprint that would result from the project.

#### Design life

This criterion assesses the economic useful life (given appropriate maintenance levels) of the infrastructure, given an appropriate level of maintenance in accordance with the engineering specification. This differs from the actual useful life of the asset as it considers maintenance quality and levels, as well as condition of use.

#### 4.8.2 Social outcomes

This criterion was included to assess the likely impacts of each option on the community, including residents, visitors and businesses, against five secondary criteria (health, education, economic participation, home and community and culture).

The criterion considered whether the option would be able to deliver health and education benefits to the regional communities, as well as how well the needs to the community would be met. Cultural considerations of the affected regions have also been considered.

##### **Health**

This criterion considers the potential health benefits for the community from each project option. This includes accessibility of health services (e.g. hospitals, medical centres), as well as reduced negative health impacts on residents and visitors (e.g. dust from unsealed roads that pass communities).

##### **Education**

This criterion considers the potential educational benefits from each project option, taking into account the ease of access to education services due to road condition, accessibility (e.g. road closures), and community access to educational facilities.

##### **Economic participation**

This criterion considers the ability for small businesses in remote communities to participate in economic development as a result of the project option. This includes any opportunities that limit or promote employment, small business development, and business and individual income.

##### **Home and community**

This criterion considers the impact that the project option has on members of the community being able to access community facilities (e.g. pools, libraries), visit friends and family, and participate in social activities such as sporting competitions.

##### **Culture**

This criterion considers the promotion of Indigenous culture in and around the affected communities, and how the project option impacts cultural development. This includes Indigenous language, promotion of art, ability to participate in cultural ceremonies and events, promotion of native title, land rights and cultural heritage.

#### 4.8.3 Project investment analysis

This criterion incorporates the CEA into the MCA, calculated by spreading the costs of the key inputs to the project option for the life of the proposed infrastructure across the population served by the project option. This allows the project risks, social outcomes and cost of delivery to be considered at a community level in order for a score to be allocated.

#### 4.8.4 Regional Economic Development

This criterion was included to assess the likely economic impact of each option at the Regional Economic Development level. This enables an assessment to be undertaken considering the impact of the project option on stimulating/promoting economic development in the region.

## Tourism

This criterion considers the impact of the project option on promoting and stimulating tourism to the region. This includes consideration of access for tourists, accessibility of essential services (e.g. fuel, accommodation), and road accessibility.

## Mining/resources

This criterion considers the ability for the mining/resources industry to further develop and expand as a result of the project option. This includes accessibility for movement of machinery for mining and resource exploration production (e.g. production inputs), as well as limitations on maximum allowable tonnage.

## Primary industries

This criterion considers the impact of the project option on agricultural development in the region, including accessibility of primary industry inputs and production and improvement to operator costs. Consideration has been given to cattle, buffalo, fisheries, horticulture, and timber industries.

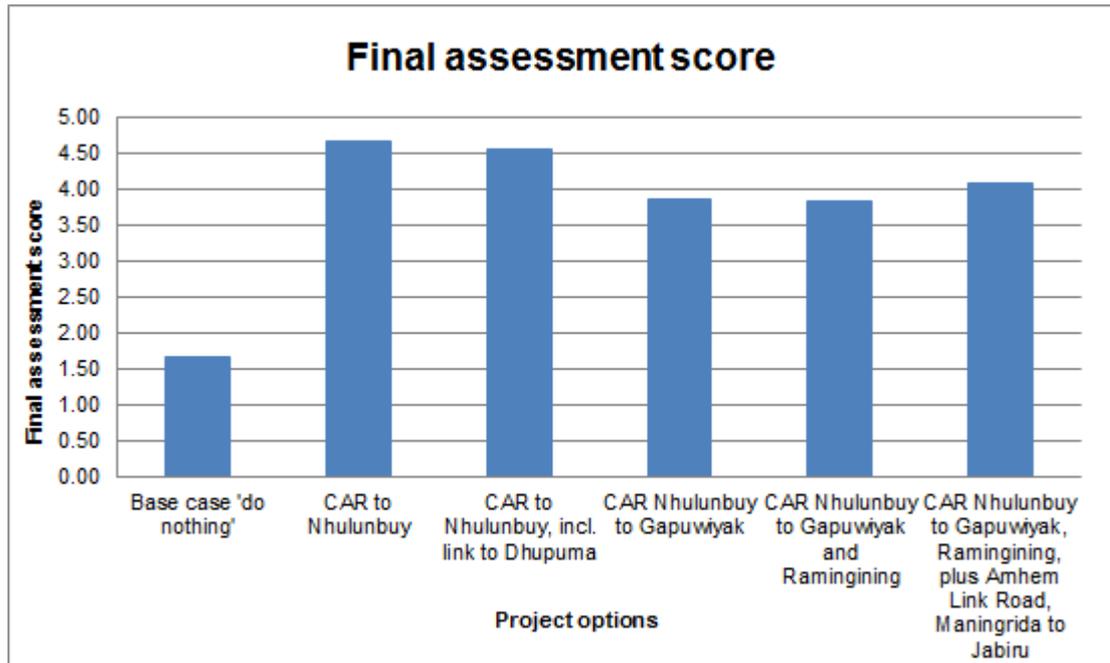
## 4.9 Outcomes

A summary of the MCA evaluation results is presented in Table 5. Figure 2 provides an illustration of the comparison of the results.

Table 5: Multi Criteria Analysis assessment results

Option	Infrastructure risk	Social outcomes	Project investment analysis	Regional Economic Development	Final assessment score
Option 0 – Base case	1.80	2.45	0.00	1.65	<b>1.68</b>
Option 1 – Central Arnhem Road	5.40	4.65	4.00	4.35	<b>4.65</b>
Option 2 – Central Arnhem Road and Dhupuma Road	5.40	4.85	3.00	4.35	<b>4.56</b>
Option 3 – Central Arnhem Road to Gapuwiyak	4.20	4.40	6.00	2.00	<b>3.87</b>
Option 4 – Central Arnhem Road to Gapuwiyak and Ramingining	4.20	4.40	5.00	2.35	<b>3.83</b>
Option 5 – Central Arnhem Road to Gapuwiyak and Ramingining, and the Arnhem Link Road	5.00	5.05	2.00	3.40	<b>4.09</b>

Figure 2: Multi Criteria Analysis results



As shown in Table 5 and Figure 2, **Option 1 – Central Arnhem Road to Nhulunbuy** performed the best against the MCA. This option is best able to meet the primary and secondary criteria, receiving the highest final assessment score of all options. The results have been driven by the option best meeting infrastructure risk parameters and best delivering Regional Economic Development opportunities.

The results of the MCA provide a convincing case against the base case, or 'do nothing' option, which, when assessed, was considered to have minimal impact on the MCA criteria.

# 5. Benefit Cost Analysis

## 5.1 Introduction

This section of the report outlines the BCA methodology and the results from the BCA assessment. The options assessed under the BCA framework included the base case 'do nothing' option and two project options:

- Option 1 – Central Arnhem Road
- Option 2 – Central Arnhem Road and Dhupuma Road.

A key requirement for detailed economic assessment under Stage Seven of the Infrastructure Australia Reform and Investment Framework is a Benefit Cost Analysis (BCA). As an analytical tool, a BCA expresses costs and benefits in monetary terms and indicates the degree to which the project case will generate net economic benefits to society over the appraisal period. It can also be used to evaluate and compare economic viability of regional projects.

## 5.2 Benefit Cost Analysis methodology

A BCA model has been built and used to analyse the project case, calculating a Benefit Cost Ratio (BCR), which will be used to determine the feasibility of the project in terms of delivery of benefits. The BCA is consistent with the Department of Finance and Administration Handbook of Cost Benefit Analysis (2006), and in accordance with Stage Seven of the Infrastructure Australia Reform and Investment Framework.

In preparing the BCA for the base case and project case options, the relevant economic, social and environmental costs and benefits have been identified and quantified. Sensitivity analysis has been applied to assess the impacts of changes in key variables on measures such as CAPEX, OPEX and other key performance measures.

## 5.3 Benefit Cost Analysis process

The BCA is based on the following methodology:

- Definition of the project objective
- Definition of the base case and project cases
- Definition of the alternative project case scenarios and sensitivity tests to be applied to the results
- Identification of the benefits and costs that may be expected under the base case and the project cases
- Quantification of the benefits and costs over the appraisal period
- Generation of the net economic worth measures, including NPV and BCR
- Sensitivity analysis on key variables
- Interpretation of results and conclusion.

Net economic worth has been measured by the following criteria:

- NPV: the present value of the incremental benefits of the project case minus the present value of the incremental costs of the project case. Projects with a positive NPV have net benefits over the appraisal period.

- BCR: the ratio of the present value of the incremental benefits of the project case to the present value of the incremental costs of the project case. Projects with a BCR greater than 1.0 provide net economic benefits over the appraisal period.

## 5.4 Assumptions

The BCA prepared for this Feasibility Assessment considers a set of assumptions consistent across the base case and the project cases, and that are aligned to Infrastructure Australia requirements. Table 6 outlines the general assumptions that have been used in the analysis of both the base case and project case options.

Table 6: Benefit Cost Analysis assumptions

Item	Assumption
Evaluation period	30 years, from 2016 to 2045
Discount rate	A 7% per annum real discount rate has been applied in the calculation of Present Value.  Sensitivity tests at 4% and 10% have been undertaken.
Pricing year	All costs and benefits in the analysis have been presented in 2014 prices (\$2014).
Vehicle growth rate	The Annual Average Daily Traffic (AADT) growth rate has been derived from data <sup>4</sup> and is assumed to be 1.8% p.a.
Road lengths	Central Arnhem Road: 646 km (59 km sealed, 587 km unsealed) Dhupuma Road: 18 km (3 km sealed, 15 km unsealed) Total length: 664 km (62 km sealed, 602 km unsealed) <sup>5</sup>
Speed limit <sup>6</sup>	<b>Light vehicles:</b> Unsealed road: 70 km/hr Single lane sealed standard: 100 km/hr Two lane sealed standard: 110 km/hr <b>Heavy vehicles:</b> Unsealed road: 50 km/hr Single lane sealed standard: 80 km/hr Two lane sealed standard: 90 km/hr
Freight task	The freight task is projected to grow at the same rate as the Nhulunbuy population <sup>7</sup> : <ul style="list-style-type: none"> <li>• 1.89% per annum from 2012 to 2017</li> <li>• 1.50% per annum from 2017 to 2022</li> </ul>

<sup>4</sup> Department of Transport Annual Traffic Report, Northern Territory Government, 2012

<sup>5</sup> Central Arnhem Road Upgrades, Northern Territory Government – Department of Transport, 2014; Dhupuma Road Upgrade, Northern Territory Government – Department of Transport, 2014.

<sup>6</sup> Upgrading the Tanami Road, Economic Impact Study, Cummings Economics, October 2011

<sup>7</sup> Parsons Brinckerhoff, 2014

Item	Assumption
	<ul style="list-style-type: none"> <li>• 1.29% per annum from 2022 to 2032</li> <li>• 1.22% per annum from 2032 to 2045.</li> </ul>
Infrastructure capital expenditure	Capital expenditure includes upgraded stream crossings, earthworks, pavements and sealing, and land acquisition.
Operational expenditure	Operational expenditure includes asset replacement, and ongoing repairs and maintenance costs.
Tourism expenditure	<p>Daily expenditure by visitors to the region has been assumed as follows:</p> <ul style="list-style-type: none"> <li>• Business travellers: \$304 per day</li> <li>• Holiday (adventure travellers): \$437 per day</li> <li>• Holiday (caravanners/ campers): \$75 per day</li> <li>• Visiting friends and relatives: \$40 per day</li> <li>• Other: \$215 per day.</li> </ul>
Economic evaluation	The economic evaluation considers the costs and benefits of government organisations, private sector enterprises, individuals (including Indigenous communities, residents, tourists), and the environment.

## 5.5 Exclusions

Benefits and costs that have not been considered under the BCA include:

- An in-depth traffic demand analysis along the entire length of Central Arnhem Road and Dhupuma Road.
- Benefits that may accrue from increased mining exploration and horticultural developments.
- Socio economic benefits such as increased employment and the benefits from an increase in access to education. The qualitative analysis undertaken in the MCA component of the Feasibility Study, as well as the commentary in the BCA section of this report has attempted to address this exclusion.

## 5.6 Base case

### 5.6.1 Definition

The base case assumes that there is no change to current infrastructure along Central Arnhem Road or Dhupuma Road during the appraisal period between 2016 and 2045. Road users will continue to be impacted by current levels of road closure and load restricted days.

### 5.6.2 Assumptions

The base case makes the following assumptions:

- Vehicle composition (percentage of private cars, commercial cars, light and heavy commercial vehicles as a proportion of the total traffic fleet)<sup>8</sup> will remain constant over the appraisal period (Table 7).

Table 7: Base case traffic fleet composition

Vehicle class	Traffic composition (2014)	Traffic composition (2045)
Private cars (Class 1 – 2)	42.19%	42.19%
Commercial cars (Class 1 – 2)	42.19%	42.19%
Light commercial vehicles (Class 3)	13.65%	13.65%
Heavy commercial vehicles (Class 4 – 9)	1.52%	1.52%
B-Double/road trains (Class 10-12)	0.46%	0.46%

Source: NT Traffic Report, NT Government, 2012

- The composition of the total freight task transport fleet is outlined in Table 8. It has been assumed that over time there will be a slight transition towards road transport away from barge, due to increasing costs of barge operations and the time it takes to transport freight via barge services.

Table 8: Base case freight task composition

Freight mode	Freight composition (2015 – 2018)	Freight composition (2045)
Freight transported by barge	95.57%	90.00%
Freight transported by air	0.02%	1.00%
Freight transported by road	4.41%	9.00%

Source: GHD analysis

- Estimated travel times are outlined in Table 9. These travel times have been calculated based on the maximum allowable speed that can be travelled by light and heavy vehicles on unsealed, single lane sealed and two lane sealed roads, as shown in Table 6.

Table 9: Base case travel times

Vehicle class	Central Arnhem Road	Dhupuma Road	Total travel time
Light vehicles	8.98 hr (8 hr 59 min)	0.24 hr (15 min)	<b>9.22 hr</b> <b>(9 hr 14 min)</b>
Heavy vehicles	12.48 hr (12 hr 29 min)	0.34 hr (21 min)	<b>12.82 hr</b> <b>(12 hr 50 min)</b>

Source: GHD analysis

<sup>8</sup> Department of Transport Annual Traffic Report, Northern Territory Government, 2012

- The number of days that Central Arnhem Road and Dhupuma Road are closed, or impose load restrictions across the different vehicle classes is shown in Table 10.

Table 10: Base case closure days

Vehicle class	Closure days/ load restricted days	Open days
Private cars (Class 1 – 2)	146	219
Commercial cars (Class 1 – 2)	146	219
Light commercial vehicles (Class 3)	166	199
Heavy commercial vehicles (Class 4 – 9)	186	179
B-Double/road trains (Class 10-12)	186	179

Source: NT Department of Transport data, provided 2014; GHD analysis.

- It has been assumed that the composition of total tourism under the base case will remain the same as the current composition over the appraisal period, as outlined in Table 11. This is due to limited incentive to increase visitation to the area due to difficulty of accessibility. Tourists are more likely to increase visitation where there is ease of accessibility.

Table 11: Project case tourism composition

Tourism classification	Tourism composition (current)	Tourism composition (by 2045)
Business travellers	70%	70%
Holidays (adventure travellers)	10%	10%
Holiday (caravanners/ campers)	10%	10%
Visiting friends and relatives	5%	5%
Other	5%	5%

Source: Regional Report, Kakadu and Arnhem Land Region, Tourism NT, May 2014.

- The current condition of the unsealed portion of Central Arnhem Road is assumed to be at road quality 'E', while the sealed portion is at road quality 'S3'.<sup>9</sup>
- Payload utilisation under the base case is assumed to be 85% on the prime leg (into the Nhulunbuy region), and 3% on the back haul leg (out of the Nhulunbuy region).

### 5.6.3 Cost estimates

#### Infrastructure CAPEX

Under the base case there are no infrastructure works or improvements undertaken, therefore there will be no associated CAPEX cost.

<sup>9</sup> Northern Territory Regional Infrastructure Study, Output Two, MomeNTum, December 2014

## Infrastructure OPEX

The assumed OPEX under the base case has been calculated based on the ongoing repair and maintenance costs for each Central Arnhem Road and Dhupuma Road as outlined in Table 12.

Table 12: Base case ongoing repairs and maintenance costs

	Unsealed road (\$p.km.)	Sealed road (\$p.km.)	Total cost (p.a.)
Central Arnhem Road	\$10,367	\$12,969	\$6,850,600
Dhupuma Road	\$10,401	\$12,969	\$194,922
<b>Total OPEX</b>			<b>\$7,045,522</b>

Source: Central Arnhem Road Upgrades, Northern Territory Government – Department of Transport, 2014; Dhupuma Road Upgrade, Northern Territory Government – Department of Transport, 2014.

OPEX on existing infrastructure will be incurred annually throughout the entire duration of the appraisal period.

## 5.7 Project options

### 5.7.1 Definition

#### Option 1 – Central Arnhem Road

Option 1 assumes that upgrades to stream crossings, earthworks, pavement works and road sealing will be undertaken along the entire length of Central Arnhem Road (646 km) between 2016 and 2018. Dhupuma Road will remain open and operational under the current repair and maintenance programs, however will not receive any upgrade treatment.

Road users on Central Arnhem Road will experience reduced road closure and load restricted days as a result of the upgrades, while road users on Dhupuma Road will continue to be impacted by current levels of road closure and load restricted days.

#### Option 2 – Central Arnhem Road and Dhupuma Road

Option 2 assumes that upgrades to stream crossings, earthworks, pavement works and road sealing will be undertaken along the entire length of each Central Arnhem Road (646 km) and Dhupuma Road (18 km) between 2016 and 2018.

Road users on both roads will experience reduced road closure and load restricted days as a result of the upgrades.

### 5.7.2 Assumptions

The project cases are based on the following assumptions:

- Under both project options, the vehicle composition on Central Arnhem Road will transition towards an increased proportion of heavy vehicles (including B-doubles), and reduced proportions of cars and light commercial vehicles. The vehicle composition on Dhupuma Road will remain constant over the appraisal period under Option 1, as outlined in Table 13.

Table 13: Project case traffic fleet composition

Vehicle class	Traffic composition (2014)	Option 1 – Central Arnhem Road only (2045)		Option 2 – Central Arnhem Road and Dhupuma Road (2045)
		Traffic composition Central Arnhem Road (2045)	Traffic composition Dhupuma Road (2045)	
Private cars (Class 1 – 2)	42.19%	40.00%	42.19%	40.00%
Commercial cars (Class 1 – 2)	42.19%	40.00%	42.19%	40.00%
Light commercial vehicles (Class 3)	13.65%	5.00%	13.65%	5.00%
Heavy commercial vehicles (Class 4 – 9)	1.52%	10.00%	1.52%	10.00%
B-Double/road trains (Class 10-12)	0.46%	5.00%	0.46%	5.00%

Source: NT Traffic Report, NT Government, 2012

- The composition of the total freight task transport fleet is outlined in Table 14. It has been assumed that there will be a significant transition away from barge towards road transport, due to potential cost savings of road transport and the time saving of transporting freight via road rather than via barge services. Under the project case it is assumed that this transition will begin to occur upon completion of the upgrades and will be completed by 2021.

Table 14: Project case freight task composition

Freight mode	Freight composition (2015 – 2018)	Freight composition (by 2021)
Freight transported by barge	95.57%	5.00%
Freight transported by air	0.02%	1.00%
Freight transported by road	4.41%	94.00%

Source: GHD analysis

- Where upgrades have been made under the project case the travel times are assumed to increase. The upgrades will result in a two lane sealed road which can accommodate these faster travel times. The estimated travel times under the project case are outlined in Table 15. The total travel time on Central Arnhem Road will increase under both project options, however under Option 1 there will have been no upgrade treatment to Dhupuma Road, thus no change in travel time compared to the base case.

Table 15: Project case travel times

Option	Vehicle class	Central Arnhem Road	Dhupuma Road	Total travel time
Option 1 – Central Arnhem Road only	Light vehicles	5.87 hr (5 hr 52 min)	0.24 hr (15 min)	<b>6.11 hr</b> <b>(6 hr 7 min)</b>
	Heavy vehicles	7.18 hr (7 hr 11 min)	0.34 hr (21 min)	<b>7.52 hr</b> <b>(7 hr 32 min)</b>
Option 2 – Central Arnhem Road and Dhupuma Road	Light vehicles	5.87 hr (5 hr 52 min)	0.16 hr (10 min)	<b>6.04 hr</b> <b>(6 hr 2 min)</b>
	Heavy vehicles	7.18 hr (7 hr 11 min)	0.20 hr (12 min)	<b>7.38 hr</b> <b>(7 hr 23 min)</b>

Source: GHD analysis

- The upgrades will reduce the number of days that Central Arnhem Road and Dhupuma Road are closed, or impose load restrictions across the different vehicle classes, as shown in Table 16. Under both options the number of days that Central Arnhem Road is open will increase, however under Option 1 Dhupuma Road will still be subject to a restricted number of closure days.

Table 16: Project case open days

Vehicle class	Option 1 – Central Arnhem Road only		Option 2 – Central Arnhem Road and Dhupuma Road
	Central Arnhem Road open days	Dhupuma Road open days	
Private cars (Class 1 – 2)	335	219	335
Commercial cars (Class 1 – 2)	335	219	335
Light commercial vehicles (Class 3)	325	199	325
Heavy commercial vehicles (Class 4 – 9)	315	179	315
B-Double/road trains (Class 10-12)	315	179	315

Source: NT Department of Transport data, provided 2014; GHD analysis.

- It has been assumed that the composition of total tourism under the project case will change over the appraisal period as outlined in Table 17. Under the project case it has been assumed that the proportion of adventure travellers, caravanning/ camping tourists and visitors to relatives and friends will increase, due to improved access in and around the region. This will reduce the overall proportion of total business travellers and travellers for other purposes.

Table 17: Project case tourism composition

Tourism classification	Tourism composition (current)	Tourism composition (by 2045)
Business travellers	70%	60%
Holidays (adventure travellers)	10%	14%
Holiday (caravanners/ campers)	10%	14%
Visiting friends and relatives	5%	7%
Other	5%	5%

Source: *Regional Report, Kakadu and Arnhem Land Region, Tourism NT, May 2014.*

- Post upgrades it is assumed that both Central Arnhem Road and Dhupuma Road will be sealed to road quality 'S5'. Under Option 1 only Central Arnhem Road will be at road quality 'S5', while Dhupuma Road will remain at quality 'E', but will both be at quality 'S5' under Option 2.<sup>10</sup>
- Payload utilisation under the project case is assumed to increase to 90% on the prime leg (into the Nhulunbuy region), and to 15% on the back haul leg (out of the Nhulunbuy region).

### 5.7.3 Cost estimates

#### Infrastructure CAPEX

Both project options include CAPEX works in the form of upgrades to stream crossings, earthworks, pavement and sealing, however under Option 1 CAPEX will only be undertaken on Central Arnhem Road.

The infrastructure CAPEX for Option 1 is outlined in Table 18 and for Option 2 in Table 19.

Table 18: Option 1 infrastructure CAPEX

	Stream crossings	Earthworks, pavement and sealing	Total cost
Central Arnhem Road	\$100,000,000	\$432,188,400	\$532,188,400
Dhupuma Road	\$0	\$0	\$0
<b>Total CAPEX</b>	<b>\$100,000,000</b>	<b>\$432,188,400</b>	<b>\$532,188,400</b>

Source: *Central Arnhem Road Upgrades, Northern Territory Government – Department of Transport, 2014; Dhupuma Road Upgrade, Northern Territory Government – Department of Transport, 2014; Northern Territory Regional Infrastructure Study, Output Three, MomeNTum, 2014.*

Table 19: Option 2 infrastructure CAPEX

	Stream crossings	Earthworks, pavement and sealing	Total cost
Central Arnhem Road	\$100,000,000	\$432,188,400	\$532,188,400

<sup>10</sup> Northern Territory Regional Infrastructure Study, Output Two, MomeNTum, December 2014

	Stream crossings	Earthworks, pavement and sealing	Total cost
Dhupuma Road	\$500,000	\$12,500,000	\$13,000,000
<b>Total CAPEX</b>	<b>\$100,500,000</b>	<b>\$444,688,400</b>	<b>\$545,188,400</b>

Source: Central Arnhem Road Upgrades, Northern Territory Government – Department of Transport, 2014; Dhupuma Road Upgrade, Northern Territory Government – Department of Transport, 2014; Northern Territory Regional Infrastructure Study, Output Three, MomeNTum, 2014.

It has been assumed that the asset life for upgraded stream crossing structures is 100 years, and 40 years for earthworks, pavements and sealing.<sup>11</sup> The residual values of assets have been included in the BCA.

### Infrastructure OPEX

The assumed annual OPEX for Option 1 is outlined in Table 20 and for Option 2 in Table 21.

It is assumed that OPEX costs on existing infrastructure will be incurred annually throughout the entire duration of the appraisal period, and for new infrastructure will begin to be accrued from the first year after completion of the CAPEX works.

Under Option 1, given that there will be no upgrades undertaken on Dhupuma Road, ongoing OPEX the same as under the base case will be accrued annually each year of the appraisal period and will be equal to the OPEX for Dhupuma Road under the base case.

Table 20: Option 1 infrastructure CAPEX

	Asset replacement (p.a.)	Ongoing repairs and maintenance (p.a.)	Total cost (p.a.)
Central Arnhem Road	\$8,600,000	\$6,900,000	\$15,500,000
Dhupuma Road	\$0	\$194,922	\$194,922
<b>Total OPEX</b>	<b>\$8,600,000</b>	<b>\$7,094,922</b>	<b>\$15,694,922</b>

Source: Central Arnhem Road Upgrades, Northern Territory Government – Department of Transport, 2014; Dhupuma Road Upgrade, Northern Territory Government – Department of Transport, 2014.

Table 21: Option 2 infrastructure CAPEX

	Asset replacement (p.a.)	Ongoing repairs and maintenance (p.a.)	Total cost (p.a.)
Central Arnhem Road	\$8,600,000	\$6,900,000	\$15,500,000
Dhupuma Road	\$200,000	\$230,000	\$430,000
<b>Total OPEX</b>	<b>\$8,800,000</b>	<b>\$7,130,000</b>	<b>\$15,930,000</b>

Source: Central Arnhem Road Upgrades, Northern Territory Government – Department of Transport, 2014; Dhupuma Road Upgrade, Northern Territory Government – Department of Transport, 2014.

<sup>11</sup> Asset life values confirmed with NT Department of Transport 12 December 2014.

## 5.8 Benefits

The primary factor that will lead to a realisation of benefits under the project case is increased value from primary industries as a result of providing an efficient freight transport access route in and out of the region.

Quantifiable benefits will flow as a result of increased access to the area for tourists and producers. The incremental benefits that are likely to have the largest impact on the project case include the following:

- Primary industries
- Savings in freight task cost
- Savings in Vehicle Operating Costs (VOC)
- Tourism expenditure
- Travel time cost saving.

The quantifiable benefits that have been calculated under the project case are based on potential realisation of savings and have been outlined in further detail below.

### Primary industries

Increased value-add from primary industry development and production will occur as a result of providing an efficient freight transport access route in and out of the region. It has been assumed that the two main primary industries that will add value are in buffalo and fisheries (prawns and demersal). Upgrades to Central Arnhem Road will provide a time and cost efficient route over which to transport produce from these industries.

There would be a significant increase in the potential production value-add from the buffalo industry, where buffalo exports out of the East Arnhem region would expand to approximately 15,000 head per annum.<sup>12</sup> This would be driven by the availability of a sealed road to transport the livestock.

The fisheries industry would realise potential from being able to transport cold product via road to Darwin (the main demand centre), which would be faster than via shipping. Increased development could attract up to 20 additional fishing boats to Gove Port, with the potential to return up to 4,500 tonne of fishery product per year<sup>13</sup>. Of this, it has been assumed that approximately 50% could be transported via road.

### Freight task cost saving

The assumed transition from barge transport towards road transport under the project case provides significant cost savings due to the lower cost of transporting a container via road compared to by barge. Freight task cost savings will be realised as access to Central Arnhem Road is improved due to the upgrades and more of the freight task is handled via road.

### Savings in VOC

The total VOC for each vehicle class have been calculated as a function of the price of operational costs, the length of road covered by a vehicle, the speed at which the vehicle is travelling and the road quality condition (including road surface, roughness, gradient and vehicle speed).<sup>14</sup>

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<sup>12</sup> Consultation with NT Cattleman's Association, November 2014

<sup>13</sup> *Nhulunbuy Wharf: Access and potential use by seafood industry*, Department of Primary Industry and Fisheries, 2014

<sup>14</sup> *Principles and Guidelines for Economic Appraisal of Transport Investment and Initiatives*, TfNSW, 2013

Potential savings in VOC may arise due to a reduction in the key cost drivers, and could be realised due to light and heavy vehicles operating more efficiently e.g. a decrease in the VOC would indicate that the option is ideal and could result in operating and productivity savings.

The impact of VOC savings on induced demand has been considered in the BCA. It is likely that a reduction in VOC will encourage additional users along the route due to the potential increase in user benefits. The incremental reduction in VOC for road users has been applied to the applicable benefits of the project case over the base case to arrive at an induced demand factor.

## Tourism

The Central Arnhem Road is the only road that provides access into Nhulunbuy for residents, tourists and tourism operators, however is in poor condition and is accessible only to high clearance vehicles. The road is not recommended for those towing caravans and access permits will not be granted to those towing caravans. Increased ease of access both to essential services (e.g. fuel and accommodation) as well as road accessibility to different attractions and reduced travel times may help to stimulate tourism to the region.

At present the key tourism industries are fishing charter holidays, island visits, local and regional art galleries and the Gama Festival.

Tourism NT has stated that the Central and East Arnhem regions would significantly benefit from increased tourism visitation to the area, so long as the road is maintained throughout the wet and dry seasons. Improved road conditions would promote and stimulate self-drive tourists to visit the region and to encourage repeat visitation from past visitors keen to see new sights. This would provide an opportunity for tourism operators to establish new ventures, further stimulating the local economy and driving local employment.<sup>15</sup>

## Travel time cost saving

The upgrade of Central Arnhem Road and Dhupuma Road from the currently unsealed majority to a fully sealed two lane road will enable traffic to travel at higher speed limits. The reduction in average travel time will result in increased efficiencies in transporting freight, as well as improved ease of access via road for tourists, local residents and freight operators.

It should however be noted that while the actual travel time per vehicle is reduced which leads to a reduction in total travel time cost per vehicle, the overall total number of vehicle hours is likely to increase. This is due to an increase in the number of days that Central Arnhem Road and Dhupuma Road will be open, combined with an increase in traffic numbers from natural growth. As a result, the results of the BCA are impacted by a negative travel time saving, presented in this BCA as a cost.

The impact of travel time savings on induced demand has been considered in the BCA. It is believed that a reduction in travel time costs will encourage additional users along the route. The incremental differences in travel time costs for road users have been applied to the applicable benefits of the project case over the base case to arrive at an induced demand factor.

## 5.9 Costs

The key cost areas that will impact the incremental costs and overall benefits of the project case will reduce any cost saving benefits that may arise. Significant cost items occur due to the necessity for additional expenditure to ensure that the project case can proceed (i.e. CAPEX), as well as ongoing additional costs over the appraisal period (e.g. OPEX).

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<sup>15</sup> *Road Infrastructure Priorities for Tourism*, Tourism NT, June 2014

The significant costs that are likely to have an impact on the project case include:

- Capital expenditure
- Operational expenditure
- Externalities and environmental costs
- Crash costs
- Travel time costs.

The costs that have been calculated under the project case are outlined in further detail below.

### **Capital expenditure**

Upgraded stream crossings (bridges) as well as the construction of a new two lane sealed road on each Central Arnhem Road and Dhupuma Road will require an outlay of CAPEX which will be realised as a cost under the project case.

As outlined in section 5.7.3, CAPEX will total approximately \$532.2 M for Option 1 and \$545.2 M for Option 2.

### **Operational expenditure**

The upgrade and construction of Central Arnhem Road and Dhupuma Road will demand an additional asset replacement and ongoing repair and maintenance budget.

As outlined in section 5.7.3, OPEX on Central Arnhem Road will be approximately \$15.5 M per annum under both project options, and OPEX on Dhupuma Road will be approximately \$430,000 per annum under Option 2. Under Option 1 Dhupuma Road will have associated OPEX at the same rate as the base case, approximately \$194,922 per annum.

### **Externalities and environmental costs**

Environmental benefits are realised when there is a reduction of negative environmental effects, such as greenhouse gas emissions (GHG), air pollution or noise impacts.

Under the project case, an increase in the number of vehicles along the route will result in an increased total costs from environmental externalities. The growth in AADT combined with an increase in the number of days that Central Arnhem Road and Dhupuma Road will be open under the project case will lead to an increase in total vehicles, which will increase the total externalities cost.

### **Crash costs**

Any incremental decrease in crash costs is perceived as a benefit to Government, society and road users. As a change to individual types of crashes as a result of the project cannot be estimated, the historical crash frequency and associated crash costs have been assumed in order to derive total crash costs.

Due to the methodology that has been employed in the model, an increase in AADT and the number of days that Central Arnhem Road and Dhupuma Road are open will result in an increase in the total net tonne kilometres travelled along the route. From this it has been calculated that the incidence of crashes will increase in line with the increase in net tonne kilometres.

It may seem counterintuitive that crash costs will increase under the project case when road quality condition has been upgraded to an improved standard (i.e. from condition 'E' and 'S3' to 'S5'). Detailed analysis would need to be undertaken to determine whether there would be a positive impact from the improved road conditions.

## Travel time costs

As outlined in section 5.8, the upgrades would enable traffic to travel at higher speed limits. This reduction in average travel time will result in a reduction in actual travel time per vehicle, leading to a reduction in total travel time cost per vehicle.

However, although it would seem logical that an increase in allowable speed limit would lead to a decrease in travel time cost, the overall total number of vehicle hours (travel time) is incurred due to an increase in the number of days that Central Arnhem Road and Dhupuma Road will be open. Multiplying the total travel time by the travel cost parameters, results in a net travel time cost under the project case.

## 5.10 Non-quantifiable costs and benefits

There are a number of costs and benefits that have not been quantified as part of this BCA, possibly due to minimal available information or lack of suitable economic parameters.

This section of the report outlines the possible impacts that may arise as a result of the project case and includes the following:

- Employment
- Mining and resources development
- Additional stimulation of primary industries
- Barge operations
- Government expenditure on transfers (e.g. air fares, FIFO payments)
- Education benefits
- Health impacts
- Social and cultural impacts from education, exposure.

### Employment

The stimulation of local and regional employment may arise from a variety of factors, including increased construction activities from the planning stage to the construction phase, through to increased tourism and demand for hospitality and recreational services.

In order to fully assess the economic impact on employment, and the resulting impact on Gross Regional Product (GRP) and Gross State Product (GSP), an economic impact assessment would need to be undertaken.

### Mining and resources development

The current condition of Central Arnhem Road limits the opportunity for mining and resource exploration and development, constricting regional economic development. Consultation found that if an access route into the south-eastern area of East Arnhem existed, there would be interest in exploring possible future development of bauxite, gas and oil. Currently the region is untested for zinc, oil and gas; however without access to the region, there is little incentive to consider exploration applications and tenure grants.

The potential for increased efficiency and productivity of heavy vehicles along Central Arnhem Road, in particular, could add value to the mining and resources industries established, and looking to explore and develop in the region. There may also be an incentive to increase the volume of operations through further development and investment in operational infrastructure.

### **Additional primary industries**

Although this Feasibility Assessment has considered the value add from buffalo and fisheries (prawn and demersal) industries, it has not quantified the potential value add from cattle, aquaculture, other fisheries (e.g. trepang), or horticulture and timber.

It could be expected that there would be significant potential growth of these industries given upgraded access to the Central and East Arnhem region due to the possibility to move produce via a time and cost efficient mode of transport. However, without sufficient parameters for calculating the potential economic benefits that could be derived from expansion across these industries, no analysis has been undertaken.

### **Barge operations**

Throughout the BCA it has been assumed that there will be reduced utilisation of barge operations for transport of freight. The analysis has not taken into account the current impact on externality and crash costs as a result of barge operations.

In order to fully incorporate the impact on barge operations into the analysis, additional consultation and adequate inputs would be required, including future barge infrastructure and fleet upgrade requirements for barge operations, the willingness for competition between barge and road operators that compete for freight transport in the future, and the outlook for the barge and shipping industry in NT.

### **Government expenditure**

Facilitation of government employee travel in and around of the region would be likely to change as a result of upgrades to the road. There are currently approximately 400 government employees in the region who are entitled to fares in and out, which has an associated cost of \$4,000 – \$5,000 per person per year. Housing is not subsidised as the area is not considered remote enough.

Although it would be unlikely that government employees would drive into the region rather than fly (from Cairns or Darwin) as part of their ordinary business travel plans, upgrades to Central Arnhem Road would increase opportunity for access to other areas within the region. This may drive future expansion of Nhulunbuy and neighbouring communities, placing downward pressure on housing prices and travel costs.

### **Education**

Upgrades to Dhupuma Road would provide an incentive for Dhupuma College to reopen, which would in turn provide residents in and around the Nhulunbuy community access to increased education opportunities. The potential benefits of this opportunity have not been quantified in this BCA but it is likely that the positive social impact from increased access to education would be significant.

### **Health**

Upgrades to Central Arnhem Road would provide improved access to townships and medical health services along the route for all residents and visitors in the case of a health emergency. It should however be noted that emergency health services in and out of the region would likely continue in the form of air transport services.

Further to the increased health benefits from improved access, transitioning from an unsealed road to a sealed road would reduce the potential negative impact on health from dust.

## Social and cultural impacts

The potential social and cultural impacts to the region that could arise from upgrades to Central Arnhem Road and Dhupuma Road include improved access for tourists and visitors, which would increase awareness of social and community factors experienced in remote communities; increased visitation to local art galleries and places of cultural significance; and promotion of and increased visitation to festivals such as Gama Festival (accessible via Dhupuma Road).

It is difficult to quantify the potential economic costs and benefits that would arise from these social and cultural factors as relevant parameters are difficult to define. The known impact to society from increased education about remote communities, the culture and the challenges that are part of everyday life should be considered as part of any qualitative analysis.

### 5.11 Outcomes

A summary of the BCA evaluation results is presented in Table 22. These results include the impact of induced demand on road users and operators.

Table 22: Benefit Cost Analysis results

	Option 1 – Central Arnhem Road	Option 2 – Central Arnhem Road and Dhupuma Road
PV costs	\$731.8 M	\$817.0 M
PV benefits	\$354.7 M	\$354.1 M
NPV	-\$377.1 M	-\$462.9 M
BCR	0.48	0.43

As shown in Table 22, **Option 1 – Central Arnhem Road** has returned the highest BCR and NPV of the two options. This indicates that Option 1 is best able to deliver economic benefits to the community compared to Option 2.

Both options have returned a BCR less than 1.0, which indicates that neither option will provide net economic benefits over the appraisal period. These results are largely attributable to the significant CAPEX and OPEX costs associated with the upgrades, as well as the impact of additional traffic volumes (from AADT growth and increased number of days that the roads are accessible) on crash costs, externalities and travel time costs.

The results of the BCA, when considered along with the results of the MCA and the non-quantifiable costs and benefits outlined in section 5.10, provide sufficient material to consider as part of the project prioritisation decision making process.

### 5.12 Sensitivity testing

Sensitivity testing has been undertaken on the key parameters including:

- Discount rate (tested at 4.0% and 9.0%)
- Increase in AADT growth rate to 3.0%
- Increase and reduce CAPEX by 10%
- Increase and reduce OPEX by 10%.

The results of the sensitivity tests are outlined in Table 23.

Table 23: Sensitivity test results

Sensitivity test	Option 1 – Central Arnhem Road		Option 2 – Central Arnhem Road and Dhupuma Road	
	NPV	BCR	NPV	BCR
No changes	-\$377.1 M	0.48	-\$462.9 M	0.43
Discount rate 4.0%	-\$372.5 M	0.59	-\$507.3 M	0.51
Discount rate 9.0%	-\$373.3 M	0.43	-\$439.4 M	0.39
Increase AADT growth rate to 3.0%	-\$426.4 M	0.45	-\$528.5 M	0.40
Increase CAPEX by 10%	-\$421.1 M	0.46	-\$508.1 M	0.41
Decrease CAPEX by 10%	-\$333.0 M	0.52	-\$417.8 M	0.46
Increase OPEX by 10%	-\$383.7 M	0.48	-\$469.8 M	0.43
Decrease OPEX by 10%	-\$370.4 M	0.49	-\$456.1 M	0.44

From the results it is evident that a decrease in CAPEX would have the most significant impact in reducing the NPV of each of the options, while an increase in the AADT growth rate would have the most significant impact on the NPV of each of the options.

The BCA is also sensitive to changes in parameters such as the assumed sale price of fisheries product, tourism expenditure per day and the assumed freight task transport costs.

### 5.13 Interpretation of results

Although it may seem logical that an upgrade to road infrastructure quality and condition on Central Arnhem Road and Dhupuma Road would lead to an increase in benefits, the results of the analysis show that an improvement to the quality of the road that result in increased open days along Central Arnhem Road and Dhupuma Road would lead to a decrease in the NPV and BCR.

The primary reason for this is that the project case has assumed an overall increase in total vehicles and total vehicle kilometres travelled along the route. Further, additional traffic, without a known improvement to environmental efficiency, will increase the externality costs.

These results highlight the importance of considering non-quantifiable costs and benefits along with the quantifiable costs and benefits when evaluating transport project, especially in regional centres such as Central and East Arnhem Land.

## 6. Conclusions and recommendations

Based on the findings of this Feasibility Assessment GHD makes the following conclusions:

- Although it delivers the lowest BCR and NPV, **Option 2 – Central Arnhem Road and Dhupuma Road** is the recommended option. It has been chosen as the recommended option due to the potential of the non-quantifiable benefits as outlined in Section 5.10 that include:
  - Additional employment opportunities throughout the planning and construction phases, as well as from material supply demand.
  - Increased access to educational opportunities from the possible re-opening of Dhupuma College. These benefits have not been quantified for benefit (or cost) to the community but would be a significant impact if available.
  - Health impacts from increased length of upgraded road, reducing impact of dust on local residents and visitors.
  - Social and cultural impacts and increased tourism expenditure from the possible expansion of Gama Festival (accessible via Dhupuma Road).
- If the decision was made to proceed with Option 2, GHD would suggest that Dhupuma Road would be treated to upgrades prior to Central Arnhem Road. As the shorter section of road this would see construction completion sooner and would enable the accrual of a portion of the benefits as soon as possible.
- Where projects are expected to stimulate economic growth in a region, a high proportion of the benefits will be derived from new or generated users.
- A core objective of the prioritised projects has been the ability of the projects to improve the feasibility for increased economic activity across the regional employment industries of tourism and primary industries, and to a less extent that has not been quantified in this BCA, for the mining and resources industry. It would be appropriate that the potential economic activity that could be 'unlocked' by investment in enabling infrastructure is captured in the BCA.<sup>16</sup>

GHD makes the following recommendations with regards to next steps:

- Consideration is given to the non-quantifiable costs and benefits outlined in section 5.10.
- An Economic Impact Assessment be undertaken to determine the overall impact of each project option on local, regional and state employment, Gross Regional Product and Gross State Product.
- Any potential for environmental efficiency improvements as a result of improved road conditions should be investigated and used in further economic analysis. It could reasonably be assumed that an improvement to the carriageway from road quality 'E' or 'S3' to road quality 'S5' would improve the operational performance of the traffic.
- Any potential for crash rate improvement as a result of improved road quality conditions should be investigated for further economic analysis. An improvement in the quality of the carriageway could reduce the crash rate, reducing the overall crash costs of the

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<sup>16</sup> Northern Territory Regional Infrastructure Study, Output Three: Infrastructure Prioritisation, CBA Methodology Paper, MomeNTum, 2014

project case, even where there is an increase in net tonne kilometres and total traffic numbers.

- It should also be considered that an increase in allowable travel speed can increase the potential for crash rates. Further investigation should be undertaken into the impact of increased speed limits on crash rates in these rural areas.
- Consideration of the economic outlook will be vital, as this drives tourism demand. The historical strength of the Australian dollar had shifted Australian domestic tourism to overseas markets and deterred international inbound tourism. A shift in markets and a weakening of the Australian dollar may see a reversal of this trend, but this will likely be gradual.

# Appendices

# Appendix A – Consultation meeting minutes



NT Department of Transport &  
Regional Development Australia NT  
Feasibility Assessment  
Central Arnhem Road Upgrade  
Consultation Meeting Minutes

February 2015

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# 1. Department of Chief Minister

Date: Friday 26 September 2014  
Time: 10.00 am (ACST) – 11.00 am (ACST)  
Location: Dial in – GHD to call Jim Rogers on mobile (0428 058 668)  
Participants: **GHD**  
David Rolland (DR) – Executive Consultant, GHD  
Ainsley Nigro – Senior Consultant, GHD  
**Department of Chief Minister**  
Jim Rogers – Transition Co-ordinator, East Arnhem

## 1.1 Purpose of meeting

DR outlined the purpose of the meeting, provided an overview of the project scope and confirmed that we are seeking information relating to the key issues that will be raised in the business case, both quantitative and qualitative. GHD will be aiming to quantify the benefits as much as possible.

## 1.2 Discussion

- The road is not really used as a major arterial road, more as a 4WD and adventure track/ tourism road.
- The region has a lot of high value geology potential, especially around the Blue Mud Bay region – undertaking geological data collection at the moment.
- There are bauxite tenements in the region – **Ian Scrimgeour** will have more information on mining in the region.
- Take advice regarding port volumes/ trade ‘with a grain of salt’ – highly competitive environment now that curtailment of refinery has happened.
- Toll: prior to curtailment, an estimated 120 containers brought into Nhulunbuy per week out of Darwin (assume back loaded with empties) – 2 barges per week.
- Since curtailment, this has halved, and only 1 barge visits per week (approx. capacity 60 containers).
- Seaswift: estimated 24 – 25 containers brought in per week using smaller barges than Toll.
- Population shift discussed in section 1.3.
- The Department has prepared a demographics report that includes some private section growth and loss models and service delivery gain and loss models.
- See that there are some fisheries and tourism development opportunities in the region.
- Two projects on the horizon:
  - Red mud ponds valorisation (**Ryan Skeena from Rio Tinto potentially could provide more information**).
  - Remediation of ponds involves encapsulation (huge project potentially driving approximately \$100 m industry for a number of years).

- The tenure of the town is critical, will revert to Aboriginal Freehold Land if no new tenures by 2033/ 2053.

### 1.3 Future demand and capacity

- There has been an overall drop in containers around 30 – 40%, consistent with the population shift that has been experienced in line with the refinery curtailment.
- In June 2013 the Nhulunbuy population was approx. 4,000, currently it is just in excess of 3,000 and is expected to fall to 2,400 by the end of 2014/ March 2015.
- There has been no significant shift in population throughout the wider region.
- The Department has not undertaken any estimates in regards to the impact to the private sector from the refinery curtailment or population shift.
- Rio Tinto to make decisions regarding the refinery itself.
- Approx. 30,000 vehicles cross Savannah Way from Queensland each year. Open up the track to Nhulunbuy and capture some of the 4WD and adventure travellers.
- Boarding school facilities in region have been suggested – access is needed for parents to visit children and children to get home – likely to draw students from Gapuwiyak area.

### 1.4 Infrastructure gaps

- There is no caravan park, few services in Nhulunbuy for tourists, this needs development.
- Development of the CAR would increase the grey nomad visits to the area – similar to the Darwin/ Pine Creek/ Jabiru triangle.
- A loop road has huge potential for tourism.

### 1.5 Questions/ additional people to speak to

- John Stafford
- Neil McDonald (Primary Industries)
- Glenn Schipp (Fisheries) – good resource for report that discusses port access.

### 1.6 Points for report

- CAR acts as a spine link, providing opportunities for access to other areas within the region. It is a 4WD favoured road that is tourist accessible.
- Potential savings to government in terms of payback.
- Currently 400 government employees in region who are entitled to fares out (cost of \$4,000 – 5,000 per person per year = \$1.6 M – \$2 M cost to government).
- Housing not subsidised as not considered remote enough.

### 1.7 Next steps

- Jim to send demographics report (CGU) to GHD.
- GHD to send maps of water/ soil and areas suitable for pasture etc to Jim.

### 1.8 Meeting close

## 2. Department of Primary Industries and Fisheries

Date: Monday 29 September 2014  
Time: 9.00 am (ACST) – 10.00 am (ACST)  
Location: Webex dial in for all participants  
Participants: **GHD**  
David Rolland (DR) – Executive Consultant, GHD  
Ainsley Nigro – Senior Consultant, GHD  
**Department of Primary Industries and Fisheries**  
Lorraine Corowa – Director Major Economic Projects (DPIF)  
Neil MacDonald – Director Pastoral  
Ian Curnow – Executive Director Fisheries

### 2.1 Purpose of meeting

DR provided background to the project, highlighting that the project is looking at access to Nhulunbuy mainly by road. GHD is interested in hearing DPIF's views on timber, horticulture, cattle and fisheries, especially any recreational fishing that could lead to tourism. GHD is hoping to build a base case that can be built on to develop project options.

### 2.2 Discussion

Ian Curnow outlined the fisheries industry and mentioned that there is data from industry regarding possible future growth.

- Currently access to a wharf and fuel is difficult – due to the lack of facilities operators are unlikely to use the port.
- Boats usually have their home base in Darwin.
- The commercial industry has a couple of operators who have indicated that they would base in Nhulunbuy fulltime if they had access to water and fuel.
- Department has introduced fisheries mentoring programs (around Milingimbi).
- Noted a story about fish that was taken into a local store – 100's of kgs of fish were sold in a couple of hours to the locals – clearly demand exists.
- A new road would be useful to connect the supply to the demand.
- Cold storage facilities are required at the port – crucial for the fishery industry.

Neil MacDonald discussed the cattle and buffalo industry.

- There was once no interest in buffalo but now it is quite in demand.
- Vietnam and China are major purchasers – exported as livestock and as meat (price dependent).
- Potential to increase buffalo volumes more significantly than current numbers.
- At present about 140,000 head is demanded from Australia.

- Vietnam likely to demand approx. 60,000 head per year.
- The Department is aiming for around 20,000 of this demand to be provided by the Arnhem area, with 15,000 transported along the Central Arnhem Road.
- Note: There are not that many head of buffalo towards the Gove peninsula end of Arnhem Land. The main centres are around Bulman and Blue Mud Bay.
- The cattle/ buffalo industry unlikely to use the whole CAR but need access to get double decker road trains into pastoral/ grazing areas via road.
- Current cost of transport is against the industry.
- Segment the CAR, Mainoru/ Wongalara, wouldn't develop the road for cattle but might for buffalo.
- Essentially, need efficiency and competitive advantage to sustain the industry.
- Need staging points throughout Arnhem land to calm the cattle, earmark, brand etc.

Lorraine Corowa discussed the impact of road upgrades in the area.

- Tourism would like a loop road across the top from Nhulunbuy to Maningrida.
- Better road planning could remove access through any major ceremonial areas.
- A road to Numbulwar is low priority but is a potential missing link.

Regarding forestry and horticulture:

- It takes 20 years from planning to production.
- Forestry industry likely to produce laminate for plywood, rehabilitation on old mines.
- Road transport would be good, but would likely look to ship out of Gove.
- Need to be able to bring the gear in in order to set up the industry.
- Need to be able to find cheaper machinery/ fuel inputs.

### 2.3 Future demand and capacity

Lorraine discussed the potential for trepang (sea cucumbers, sand fish):

- Have not yet landed a big investor.
- There are concerns about sending divers into croc-infested waters so would need to consider dragging nets behind trawlers.
- Could be exported to Asia and premium markets around Australia.
- Opportunity to use Nhulunbuy as a base for the shark fisheries industry if sufficient access and infrastructure.

### 2.4 Infrastructure gaps

- Access to a wharf, water and fuel at Nhulunbuy is difficult.
- Adequate road infrastructure for machinery and inputs to access production areas.
- Adequate road infrastructure for double decker live produce trucks to access pastoral/ grazing areas.

## 2.5 Questions/ additional people to speak to

- **Lorraine offered to provide better estimates of cattle numbers hopefully by Tuesday 30 September.**

## 2.6 Points for report

## 2.7 Next steps

DPIF to provide following data when available:

- **Spreadsheet that contains the number of boat and their fuel demands**
- **Estimates of cattle numbers in region.**

## 2.8 Meeting close

## 3. NT Tourism

Date: Monday 29 September 2014  
Time: 11.00 am (ACST) – 11.30 am (ACST)  
Location: Webex dial in for all participants  
Participants: **GHD**  
David Rolland (DR) – Executive Consultant, GHD  
Ainsley Nigro – Senior Consultant, GHD  
**NT Tourism**  
Angela Collard  
Jay Ashton

### 3.1 Purpose of meeting

DR outlined the background of the project, emphasising that this is a separate piece of work to previous engagements. The project will be undertaken in two parts, with a primary focus on the Central Arnhem Road. GIS team will digitise the existing corridor as part of the first piece of work, while we will undertake a detailed options analysis of several options. A full Benefit Cost Analysis will be performed on the preferred option.

DR also explained the segments that are being considered as options and aligned these to the current Tourism Prioritisation projects that Angela and Jay are aware of.

### 3.2 Discussion

Angela and Jay have already provided several pieces of information prior to the meeting. These included:

- *Road Infrastructure Priorities for Tourism*, NT Tourism, June 2014
- *Regional Report Kakadu & Arnhem Land Region*, Tourism NT, Report Period 2011 – 2013, publication date May 2014 (<http://tourismnt.com.au/en/research/regional-profiles>)
- *Regional Report Katherine & Surrounds*, Tourism NT, Report Period 2011 – 2013, publication date April 2014 (<http://tourismnt.com.au/en/research/regional-profiles>).

GHD is primarily interested in whether NT Tourism has any detail down to community level so that GHD can attempt to make an estimate of the base line.

Jay advised that there are low volumes of information from the area, and acknowledged that the CAR would make a significant impact on the region.

- Historically ABS recorded data on the region however this is no longer available.
- In order for NT Tourism to collate their information they have combined several years of data (see Regional Reports).
- **Tourism's 'Strategy 2020' paper includes projected numbers/ figures.** Those used could be used as a basis for base line? Refer to page 12/ 13 of this document for reference to visitor economy.

### 3.3 Future demand and capacity

- Consider “what could be?” Believe that need a vision before the investment will come.

- There is scope for eco-lodges and camps.
- Adventure tourism is big in the region.
- NT Tourism is targeting education tourism at the moment.
- School buses could visit if the road were open.
- Cultural tourism benefits, with potential to 'close the gap' and increase social awareness.

### 3.4 Infrastructure gaps

There are limited hotel/ accommodation facilities in Nhulunbuy – demand for accommodations would result in upgrade demand.

### 3.5 Questions/ additional people to speak to

Contact Matt Grooby – Lirrawee Association regarding the 'Yolngu Homeland Visitor Infrastructure Plan'. This is a 'visioning' document.

### 3.6 Points for report

- Any gain is potentially a major gain.
- Ability to open up an area that has so much potential and so much to offer. Kakadu is getting 'tired' and needs a lot of funding and investment.

### 3.7 Next steps

- NT Tourism to send 'Strategy 2020' paper to GHD.
- GHD to potentially contact Matt Grooby (Lirrawee Association).

### 3.8 Meeting close

## 4. NT Road Transport Association

Date: Monday 29 September 2014

Time: 1.00 pm (ACST) – 1.30 pm (ACST)

Location: Webex dial in for all participants

Participants: **GHD**

David Rolland (DR) – Executive Consultant, GHD

Ainsley Nigro – Senior Consultant, GHD

**NT Road Transport Association**

Louise Bilato (NT RTA)

Michael Swartz (Wildman River Stock Contractors)

### 4.1 Purpose of meeting

DR explained that GHD have been engaged to undertake a Feasibility Assessment of the access to Nhulunbuy, via the CAR, and also considering other options, total five options. The preferred option will be taken to a Benefit Cost Analysis for presentation to government.

### 4.2 Discussion

Michael discussed the trucking industry:

- A road with downtime of less than a month would have a significant impact.
- Major stream crossing upgrades to be considered.
- The current road alignment is relatively good, given the hills and rivers. Needs to be better in terms of reduced corrugation and reduced need for closure days.
- Single trucks are able to access without permits.
- Doubles need to apply for permits.
- Triples are limited by creek crossing and bridges.
- There is no charge for permits, and permits are annual. Usually expire around December and reapply mid-Feb after the January period.
- There are safety issues to consider – dust, speed and size of road trains.
- There is a pilot study in place around farms towards the Gove area.
- Corridor should not be NLC controlled if money is spent on upgrading the road, i.e. lift the restrictions placed by NLC.
- Trucking industry transport a number of different commodities including:
  - Fuel
  - Demountables
  - Food
  - Construction materials
  - Steel
  - Radioactive materials

- 'You name it, we carry it'

#### 4.3 Future demand and capacity

#### 4.4 Infrastructure gaps

- Quality of the road needs to be improved – a well-equipped 4WD designed for the purpose is very bumpy at 40 km/ hr – trucks are limited to travelling at 25 km/ hr and would not have the same 'comforts' of the 4WD.
- No need for truck parking bays on CAR – use the budget better elsewhere.

#### 4.5 Questions/ additional people to speak to

- Sid Stirling, member for Nhulunbuy and NLC senior advisor. Has a comprehensive understanding of politics and history of the region.

#### 4.6 Points for report

- Heavy vehicles are a small proportion of road traffic compared to overall road users.
- Road users are primarily from the communities – cars are not built to deal with these roads, which present a road safety concern.

#### 4.7 Next steps

#### 4.8 Meeting close

## 5. Department of Mines and Energy

Date: Monday 29 September 2014  
Time: 3.00 pm (ACST) – 3.30 pm (ACST)  
Location: Webex dial in for all participants  
Participants: **GHD**  
Ainsley Nigro – Senior Consultant, GHD  
**Department of Mines and Energy**  
Ian Scrimgeour

### 5.1 Purpose of meeting

AN outlined the background of the project, noting that several options will be assessed via a detailed options analysis, and the preferred option will undergo a Benefit Cost Analysis prior to presentation to Government. AN also outlined the options that are being considered.

### 5.2 Discussion

- Ian asked if the road to Ngukkur is being considered, as this would be valuable to mining exploration. Emphasised this point.
- The potential benefits for the mining industry will be dependent on access for exploration in the area.
- Granted tenure includes:
  - Bauxite close to Gove
  - Rio Tinto mining manganese (limited resource)
- Would be benefits for getting machinery into the exploration sites – machinery is needed for exploration and to accelerate the process of exploration.
- If discoveries were made:
  - Gas transfer infrastructure not so important – can use a pipeline.
  - Oil transfer would need transport, this would perhaps be a significant requirements, via trucking. Otherwise would be shipped out of Gove.
  - The road upgraded is needed either way to get the machinery inputs in and out of sites.

### 5.3 Future demand and capacity

- Gapuwiyak/ Numbulwar areas are untested for zinc, oil and gas. Hope to see more ground getting granted over the next 5 years.
- Bulman zinc field (although not going to get huge).
- Currently under application for diamond exploration around the central part of Arnhem Land.
- Permits and access having to be granted is a threat to the industry, although the appetite for exploration is changing.

- To consider ‘where do they want to go and how can we make it happen without upsetting anyone else?’.
- May find that in 10 years’ there has still been no exploration, although there is a desire for economic development in the region.
- Ground could be granted for oil and gas exploration in the next few years – if this occurred it would take:
  - About 18 months for anything to progress on ground (approvals etc.).
  - Drilling would occur over another couple of years.
  - For non-conventional product, production (if product found) would take at least 10 years.
  - For conventional resource product, small scale production could take approx. 6 years.

#### 5.4 Infrastructure gaps

- Year round access.
- Quality of the road.
- Heavy machinery access is needed e.g. petroleum drilling needs large numbers of trucks and materials to be brought in by road.

#### 5.5 Questions/ additional people to speak to

- The Director of Mining Development (Steve Katsenko) may have thoughts regarding cost savings and implications of the CAR upgrade. Ian to contact Steve.

#### 5.6 Points for report

#### 5.7 Next steps

- Ian to contact Steve Katsenko regarding additional thoughts on cost savings and implications of the CAR upgrade.

#### 5.8 Meeting close

## 6. NT Farmers Association

Date: Friday 21 November 2014  
Location: Telephone interview – 0405 287 344 (Grant Fenton)  
Participants: **GHD**  
David Rolland (DR) – Executive Consultant, GHD  
**NT Farmers Association**  
Grant Fenton (CEO)

### 6.1 Discussion

- Horticulture – there are good soils in part but expect small quantities of produce.
  - It would not be on the 100,000 ha scale being considered for the future development of Northern Australia.
- Sealing of the Central Arnhem Road would be pivotal to future development of horticulture in East Arnhem in getting produce out – a game changer.
- There is already a banana farm in Gove.

### 6.2 Future demand and capacity

### 6.3 Infrastructure gaps

### 6.4 Questions/ additional people to speak to

- Centrefarm is developing horticulture on indigenous land and there may be interest in the marrying of potential in this area.

### 6.5 Points for report

### 6.6 Next steps

### 6.7 Meeting close

## 7. NT Cattleman's Association

Date: Friday 21 November 2014  
Location: Telephone interview – 0417 642 076 (David Warriner)  
Participants: **GHD**  
David Rolland (DR) – Executive Consultant, GHD  
**NT Cattleman's Association**  
David Warriner (President)

### 7.1 Discussion

- David believes there is not much in buffalo in the sense of an expanding industry.
- The industry mainly involves mustering of young buffalo (up to 400 kg) for the live export trade.
- Usually doesn't include bulls or cows i.e. choose non wild beasts for ease of transport and slaughter.
- Current sale prices are \$1.50/kg at the ship.
- Live cattle in a good position in the NT and agriculture/ cattle need to work together. A major constraint to increasing numbers of cattle is land tenure.
- Live cattle currently fetching \$2.00 to \$2.40 / kg at the ship.

### 7.2 Future demand and capacity

### 7.3 Infrastructure gaps

### 7.4 Questions/ additional people to speak to

### 7.5 Points for report

### 7.6 Next steps

### 7.7 Meeting close

GHD

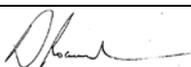
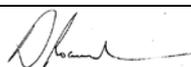
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