Dampier Port Authority

Report for New Dampier Marine Services Facility
Traffic Study
November 2009
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1. Introduction

1.1 Background

The Dampier Port Authority (DPA) is in the detailed planning stage for construction of the new Dampier Marine Services Facility (DMSF) at the existing Dampier Port. GHD has been engaged to develop and undertake the preliminary design and preparation of performance specifications documents for the new DMSF. In addition a traffic study is required to review the adequacy of the existing road infrastructure.

This study is to consider the probable effects on Mof Road, King Bay Road, Burrup Peninsula Road and Dampier Highway taking into account the following:

- for Gorgon Rock assuming rock is sourced from BGC and/or Cemex
- for DMSF Quarry rock assuming source is the Pluto rock stockpile and/or Cemex and/or Mt Regal
- MOF Rd traffic will also be affected by Pluto Modules. Road closures are currently limited to two possible windows 10-11am and 3-4pm every day, although the range is between 3 and 10 movements per week over the life of the project.
- on average there are 7 movements per week. Pluto 2 will be similar.
- inside the port, the shoulders opposite Lower Laydown Area are designed to be used as a parking bay by trucks awaiting offloading from the DCW e.g. Rail cart imports for RIO and scrap steel exports etc.
- normal Port traffic

Based on the findings, the study is to determine if any mitigation measures are required and if so based on a cost benefit analysis what measures should be taken including one or more of the following possible alternatives:

- control using Traffic Management
- construct a truck staging/parking area (approximately opposite Hearsons Cove turn off and move vehicles up in convoy
- widen MOF Rd inside Port
- widen MOF Rd outside of Port
- construct alternative access into Port, e.g. through Lot 565 (environmental and Heritage issues and also with regard to future use of Lot 565, quarry and then laydown area)
- options for temporary and permanent routes into DMSF through Lot 565, subject to avoidance of heritage sites.

It is noted that the Port is keen to have an alternative access into the Port if it is cost effective.
Tasks have included:

- Review existing traffic volumes.
- Undertake site inspection and review existing public roads and intersections to identify and requirements for upgrade. Consider the operation of Burrup Peninsula Road/King Bay Road intersection.
- Review available plans of road layouts
- Review crash data at key intersections to identify any existing safety issues.
- Undertake a traffic count at the intersection of Burrup Peninsula Road/King Bay Road during the am and pm peak hours 6-9am and 4-6pm to confirm the current operation.
- Review locations for a truck marshalling area.
- Confirm likely traffic movements to be generated by the proposed works based on client information.
- Review alternative access opportunities into the Port and provide input to the study team. (Undertake desk top study based on available survey/contour data and current plan) There is a need to produce some alternative designs through Lot 565 and for MoF Road widening. Drawings are required so quantities can be calculated and impact on surrounding area determined.
- Recommend any mitigation measures to accommodate traffic movements. Including indicative costs. (indicative based on likely cost per m as conceptual design drawings have not been included)
- Prepare cost benefit analysis of measures where feasible.
- Prepare report documenting the outcomes of the traffic investigation and recommendations for improvements. Including relevant drawings of proposed mitigation measures, suitable for a cost benefit analysis.
1.2 Site Location

Dampier Port is located to the north of Karratha and the proposed site is shown in Figure 1. The proposed development will be located to the Northeast of the existing Dampier Cargo Wharf (DCW). The location of the site has been chosen based on a series of studies commissioned by DPA.

Figure 1 Location Plan

1.3 Dampier Marine Services Facility (DMSF)

A description of the project is provided as follows:

*Dampier Marine Services Facility (DMSF)* - The key objective of the DMSF project is to provide improved and increased cargo berthing facilities and laydown areas to support the exceptional growth and expected increase in activity in the oil, gas, mining, downstream processing and infrastructure industries in Australia’s North West, in the longer term. The DMSF will also address the existing shortage in cargo berthing capacity and will alleviate some of the issues associated with the availability of laydown areas at the Port of Dampier. The facility will also minimise berthing congestion, inefficiencies and reduce the risk of berthing related incidents and accidents in the port. The DMSF is proposed to be located just east of the existing DCW in the Port of Dampier and is proposed to be constructed in two stages:

*Stage 1* includes the construction of: a seawall and reclamation area; dredging of swing basin and berthing pockets, laydown areas constructed from dredge fill; a heavy load-out/rock load-out land backed
wharf; an enhanced large vehicle and services access corridor; upgrades to the existing MOF Road; and the provision of utilities and associated infrastructure. Construction is planned for mid 2010.

Stage 2 includes the construction of: a 300m double sided cargo handling wharf (jetty) which would provide 6 berths of 100m in length; construction of a Roll-on Roll-off cargo handling wharf suitable for bulk container movements; and completion of the provision of utilities and associated infrastructure.
2. **Existing Road Network**

2.1 **Existing Road Network**

This section considers the surrounding road network including the current traffic volumes, operational performance and crash data.

Figure 1 indicates the location of the proposed Dampier Marine Services Facility (DMSF) and Figure 2 provides an area plan.

2.1.1 **Potential Routes for the Transport of Materials to/from the Site**

The transportation of materials to and from the DMSF will be influenced by the following:

- for Gorgon Rock assuming rock is sourced from BGC and/or Cemex,
- for DMSF Quarry rock assuming source is the Pluto rock stockpile and/or Cemex and/or Mt Regal.
- MOF Rd traffic will also be affected by Pluto Modules. Road closures are currently limited to two possible windows 10-11am and 3-4pm every day; although on average there are only 3-7 movements per week. Pluto 2 will be similar.

This assessment considers the main access to the site including Mof Road, King Bay Road and the route along Burrup Peninsula Road, Karratha – Dampier Road, Madigan Road, NW Coastal Highway.

**Figure 1 – Location Plan**
2.1.2 Road Network Characteristics

The following table indicates the road classification of the local road network likely to be used and the road capacity in terms of vehicles per day (i.e. mid block capacity) and current utilisation (where available). The mid block capacity is based on a good level of service and is not the physical capacity of the road. It should also be noted that peak hour traffic volumes and intersections impact on the road operation and efficiency.

Table 2.1 Existing Local Road Network Characteristics

<table>
<thead>
<tr>
<th>Location</th>
<th>Road Geometry</th>
<th>Road Classification</th>
<th>Capacity (vpd)</th>
<th>Existing Traffic Volume (vpd) (a)/(b)</th>
<th>B-Double and above</th>
<th>Year</th>
<th>Volume/Capacity Ratio (Daily) (c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mof Road</td>
<td>Single carriageway, 1 lane in each direction. Steep grade up from King Bay Road and then down a steep grade to DMSF</td>
<td>Local Distributor Industrial</td>
<td>6,000 vpd</td>
<td>1453 vpd (b)</td>
<td>1%</td>
<td>2008</td>
<td>0.242</td>
</tr>
<tr>
<td>Mof Roads South of WEL Haul Road</td>
<td>As above</td>
<td></td>
<td>6000 vpd</td>
<td>1021 vpd (b)</td>
<td>3.8%</td>
<td>2009</td>
<td>0.170</td>
</tr>
<tr>
<td>King Bay Road</td>
<td>Single carriageway, 1 lane in each direction.</td>
<td>Local Distributor Industrial</td>
<td>6,000 vpd</td>
<td>3,558 vpd (b)</td>
<td>5.2%</td>
<td>2009</td>
<td>0.627</td>
</tr>
<tr>
<td>Burrup Peninsula Road</td>
<td>Single carriageway, 1 lane in each direction.</td>
<td>State Road/Primary Distributor</td>
<td>12,000 vpd</td>
<td>5,024 (836 vph evening peak hour) (a)</td>
<td>1.6%</td>
<td>March 2008</td>
<td>0.419</td>
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<tr>
<td>Location</td>
<td>Road Geometry</td>
<td>Road Classification</td>
<td>Capacity (vpd)</td>
<td>Existing Traffic Volume (vpd) (a)/(b)</td>
<td>B-Doubling and above</td>
<td>Year</td>
<td>Volume/Capacity Ratio (Daily) (c)</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Karratha –Dampier Road</td>
<td>Single carriageway, 1 lane in each direction (planned upgrade to dual carriageway, 2 lanes in each direction)</td>
<td>State Road/Primary Distributor</td>
<td>12,000vpd</td>
<td>9,761vpd (1,256vph evening peak hour) (a)</td>
<td>1.2%</td>
<td>March 2008</td>
<td>0.813</td>
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<tr>
<td>(north of Tip Road)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madigan Road</td>
<td>Single carriageway, 1 lane in each direction</td>
<td>State Road/Primary Distributor</td>
<td>12,000vpd</td>
<td>3,090vpd (368vph, evening peak hour) (a)</td>
<td>7.2%</td>
<td>March 2009</td>
<td>0.258</td>
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<tr>
<td>North West Coastal Highway</td>
<td>Single carriageway, 1 lane in each direction</td>
<td>State Road/Primary Distributor</td>
<td>12,000vpd</td>
<td>744vpd (63vph evening peak hour) (a)</td>
<td>15.9%</td>
<td>March 2008</td>
<td>0.062</td>
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<tr>
<td>(west of rail crossing)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North West Coastal Highway</td>
<td>Single carriageway, 1 lane in each direction</td>
<td>State Road/Primary Distributor</td>
<td>12,000vpd</td>
<td>1,841vpd (a)</td>
<td>10.2%</td>
<td>Oct 2009</td>
<td>0.153</td>
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<td>(west of Karratha –Dampier</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Road)</td>
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<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

a. Source of traffic data: Main Roads WA
b. Source of traffic data Dampier Port Authority
c. Capacity based on Road Reserves Review Document
Hourly Traffic Volumes – Burrup Peninsula Road (Directional)

The following chart indicates the traffic flow in Burrup Peninsula Road over a typical Thursday in October 2006 and is shown here to give an indication of peak hours. The latest volumes in 2009 are higher.

Based on the available traffic data, most roads in the vicinity of the proposal have significant available capacity (daily) to accommodate additional traffic. However peak hour traffic volumes are high, particularly on Burrup Peninsula Road and Karratha – Dampier Road and will result in difficulties accessing Burrup Peninsula Road during the am and pm peak hour. The recorded peak in November 2009 was 839vph (6-7 am).and 916vph (4-5 pm), 5-6pm volumes were similar.
Hourly Traffic Volumes – Mof Road (North of King Bay Road)

The above chart indicates current average hourly traffic flow in Mof Road immediately north of King Bay Road. Peak periods are 6-7am and 4-5pm.

King Bay Road Average Hourly Traffic November 2009

The above chart indicates current average hourly traffic flow in King Bay Road east of Mof Road. Peak periods are 6-7am and 4-5pm.
### 2.2 Road Reserve Ownership and Responsibility

#### Table 2.2 Existing Local Road Network Characteristics

<table>
<thead>
<tr>
<th>Location</th>
<th>Road Geometry</th>
<th>Road Classification</th>
<th>Responsibility</th>
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</thead>
<tbody>
<tr>
<td>Mof Road</td>
<td>Single carriageway, 1 lane in each direction. Steep grade up from King Bay Road and then down a steep grade to DMSF</td>
<td>Local Distributor Industrial</td>
<td>Shire of Roebourne, DPA from approximately the Service Corridor down to DCW</td>
</tr>
<tr>
<td>King Bay Road</td>
<td>Single carriageway, 1 lane in each direction.</td>
<td>Local Distributor Industrial</td>
<td>Shire of Roebourne</td>
</tr>
<tr>
<td>Burrup Peninsula Road</td>
<td>Single carriageway, 1 lane in each direction</td>
<td>State Road/Primary Distributor</td>
<td>Main Roads WA</td>
</tr>
<tr>
<td>Karratha – Dampier Road (north of Tip Road)</td>
<td>Single carriageway, 1 lane in each direction (planned upgrade to dual carriageway, 2 lanes in each direction)</td>
<td>State Road/Primary Distributor</td>
<td>Main Roads WA</td>
</tr>
<tr>
<td>Madigan Road</td>
<td>Single carriageway, 1 lane in each direction</td>
<td>State Road/Primary Distributor</td>
<td>Main Roads WA</td>
</tr>
<tr>
<td>North West Coastal Highway (west of rail crossing)</td>
<td>Single carriageway, 1 lane in each direction</td>
<td>State Road/Primary Distributor</td>
<td>Main Roads WA</td>
</tr>
<tr>
<td>North West Coastal Highway (west of Karratha – Dampier Road)</td>
<td>Single carriageway, 1 lane in each direction</td>
<td>State Road/Primary Distributor</td>
<td>Main Roads WA</td>
</tr>
</tbody>
</table>

#### 2.3 Liaison with Main Roads

The following outlines a summary of discussion held with Main Roads on 22 September 2009 regarding the transport of materials to a site in Burrup Peninsula Road:

- Main Roads are planning a significant upgrade to Karratha - Dampier Road to include extension of the existing dual carriageway to Burrup Peninsula Road. The priority at the intersection of Karratha-Dampier Road and Burrup Peninsula Road is likely to change and be redesigned for Karratha-Dampier Road to continue into Burrup Peninsula Road. The project will be tendered later this year or
early next year. Construction is planned to commence in March 2010 and will take 12 months to construct. The new carriageway will occur on the south side of the existing alignment. (This will coincide with construction of DMSF and may add to traffic impacts)

- The current intersections of, Madigan Road/Karratha-Dampier Road and Madigan Road/NW Coastal Highway are designed to accommodate triple road trains.
- Any concessional loading requirements will need to be arranged with Main Roads Heavy Haulage unit.
- The transport logistics for construction need to be confirmed. Will components be pre assembled and if so where will they come from?
- Is there a requirement for oversize loads if so where will they come from?
- There may be a need to avoid the transport of material at peak times.

2.4 High Wide Load Considerations

The transportation of any oversize loads will be subject to appropriate traffic control and traffic management.

2.5 Crash Data

This section identifies the 5 year crash record at key intersections in close proximity to the proposed works.

2.5.1 King Bay Road/Burrup Peninsula Road

There have been no reported crashes in 5 years based on advice from Main Roads Road WA.

2.5.2 King Bay Road/Mof Road

There have been no reported crashes in 5 years based on advice from Main Roads Road WA.

2.5.3 King Bay Road/Mermaid Rd

There have been no reported crashes in 5 years based on advice from Main Roads Road WA.

2.5.4 King Bay Road/Streckfuss Place

There has been 1 reported crash in 5 years based on advice from Main Roads Road WA.
2.5.5 Karratha- Dampier Road /Burrup Peninsula Road

Summary of Intersection Crashes

<table>
<thead>
<tr>
<th>Street 1</th>
<th>DAMPIER RD</th>
<th>Authority Name</th>
<th>ROEBOURNE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street 2</td>
<td>BURRUP PENINSULA</td>
<td>Region</td>
<td>PILBARA</td>
</tr>
<tr>
<td>Street 3</td>
<td>Cost</td>
<td>$89,335</td>
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<tr>
<td>Intersection Classification</td>
<td>State Road Only (including National Highway)</td>
<td>Total Crashes</td>
<td>3</td>
</tr>
</tbody>
</table>

Crash Details

<table>
<thead>
<tr>
<th>Rear End</th>
<th>Side Swipe</th>
<th>Right Angle</th>
<th>Right Thru</th>
<th>Wet</th>
<th>Night</th>
<th>Ped</th>
<th>Cycle</th>
<th>Truck</th>
<th>Motorcycle</th>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

The above table does not indicate a safety issue at the intersection.

2.5.6 Hearson Cove Road/Burrup Peninsula Road

Summary of Intersection Crashes

<table>
<thead>
<tr>
<th>Street 1</th>
<th>BURRUP PENINSULA</th>
<th>Authority Name</th>
<th>ROEBOURNE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street 2</td>
<td>HEARSON COVE RD</td>
<td>Region</td>
<td>PILBARA</td>
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<td>Street 3</td>
<td>Cost</td>
<td>$29,778</td>
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<tr>
<td>Intersection Classification</td>
<td>State and Local Roads</td>
<td>Total Crashes</td>
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Crash Details

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<tr>
<th>Rear End</th>
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<th>Right Angle</th>
<th>Right Thru</th>
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<th>Night</th>
<th>Ped</th>
<th>Cycle</th>
<th>Truck</th>
<th>Motorcycle</th>
<th>Casualty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
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</tbody>
</table>

The above table does not indicate a safety issue at the intersection.
### 2.5.7 Karratha-Dampier Road/Bayly Avenue

<table>
<thead>
<tr>
<th>Street 1</th>
<th>DAMPIER RD</th>
<th>Authority Name</th>
<th>ROEBOURNE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street 2</td>
<td>BAYLY AVE</td>
<td>Region</td>
<td>PILBARA</td>
</tr>
<tr>
<td>Street 3</td>
<td></td>
<td>Cost</td>
<td>$193,483</td>
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<tr>
<td>Intersection Classification</td>
<td>State and Local Roads</td>
<td>Total Crashes</td>
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**Crash Details**

<table>
<thead>
<tr>
<th>Rear End</th>
<th>SideSwipe</th>
<th>Right Angle</th>
<th>Right Thru</th>
<th>Wet</th>
<th>Night</th>
<th>Ped</th>
<th>Cycle</th>
<th>Truck</th>
<th>Motorcycle</th>
<th>Casualty</th>
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<tr>
<td>0</td>
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The above table does not indicate a safety issue at the intersection.

### 2.5.8 Karratha Road-Dampier Road/Dampier Salt Road

<table>
<thead>
<tr>
<th>Street 1</th>
<th>DAMPIER RD</th>
<th>Authority Name</th>
<th>ROEBOURNE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street 2</td>
<td>Dampier Salt Rd</td>
<td>Region</td>
<td>PILBARA</td>
</tr>
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<td>Street 3</td>
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<td>Cost</td>
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<tr>
<td>Intersection Classification</td>
<td>State and Local Roads</td>
<td>Total Crashes</td>
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**Crash Details**

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<thead>
<tr>
<th>Rear End</th>
<th>SideSwipe</th>
<th>Right Angle</th>
<th>Right Thru</th>
<th>Wet</th>
<th>Night</th>
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</table>

The above table does not indicate a safety issue at the intersection.
### 2.5.9  Karratha-Dampier Road/Seven Mile Road

<table>
<thead>
<tr>
<th>Summary of Intersection Crashes</th>
</tr>
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<tbody>
<tr>
<td><strong>Street 1</strong></td>
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<td><strong>Street 2</strong></td>
</tr>
<tr>
<td><strong>Street 3</strong></td>
</tr>
<tr>
<td><strong>Intersection Classification</strong></td>
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</table>

<table>
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<td><strong>Rear End</strong></td>
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</table>

The above table does not indicate a safety issue at the intersection.

### 2.5.10  Karratha-Dampier Road/Madigan Road

<table>
<thead>
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<th>Summary of Intersection Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Street 1</strong></td>
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<tr>
<td><strong>Street 2</strong></td>
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<td><strong>Street 3</strong></td>
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<tr>
<td><strong>Intersection Classification</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Crash Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rear End</strong></td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

The above table does not indicate a safety issue at the intersection.
### 2.5.11 Burrup Peninsula Road (Karratha-Dampier Road to King Bay Road)

<table>
<thead>
<tr>
<th>Summary of Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Street 1</strong> Burrup Peninsula Road (King Bay Road to Karratha-Dampier Road)</td>
</tr>
<tr>
<td><strong>Street 2</strong></td>
</tr>
<tr>
<td><strong>Street 3</strong></td>
</tr>
<tr>
<td><strong>Intersection Classification</strong> State Road Only (including National Highway)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Crash Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear End</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

The above table does not indicate a safety issue along this section of road.

### 2.5.12 Karratha –Dampier Road (Burrup Peninsula Road to Madigan Road)

<table>
<thead>
<tr>
<th>Summary of Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Street 1</strong> Karratha-Dampier Road (Burrup Peninsula Road to Madigan Road)</td>
</tr>
<tr>
<td><strong>Street 2</strong></td>
</tr>
<tr>
<td><strong>Street 3</strong></td>
</tr>
<tr>
<td><strong>Intersection Classification</strong> State Road Only (including National Highway)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Crash Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear End</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>8</td>
</tr>
</tbody>
</table>

The above table does indicate a safety issue along this section of road. The proposed upgrade to dual carriageway will improve the safety of this section of road.
### 2.5.13 Northwest Coastal Highway (SLK 1098.55 to 1107.58) - Madigan Road to Karratha-Dampier Road

<table>
<thead>
<tr>
<th>Summary of Crashes</th>
<th>roadmap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street 1</td>
<td>NW Coastal Highway (Madigan Road -- Karratha-Dampier Road)</td>
</tr>
<tr>
<td>Authority Name</td>
<td>ROBEOURNE</td>
</tr>
<tr>
<td>Street 2</td>
<td>Region                     PILBARA</td>
</tr>
<tr>
<td>Street 3</td>
<td>Cost</td>
</tr>
<tr>
<td>Intersection Classification</td>
<td>State Road Only (including National Highway)</td>
</tr>
<tr>
<td>Total Crashes</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Crash Details</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear End</td>
<td>0</td>
</tr>
<tr>
<td>Side Swipe</td>
<td>0</td>
</tr>
<tr>
<td>Non Collision</td>
<td>1</td>
</tr>
<tr>
<td>Hit Animal</td>
<td>0</td>
</tr>
<tr>
<td>Wet</td>
<td>0</td>
</tr>
<tr>
<td>Night</td>
<td>0</td>
</tr>
<tr>
<td>Hit object</td>
<td>2</td>
</tr>
<tr>
<td>Head on</td>
<td>0</td>
</tr>
<tr>
<td>Truck</td>
<td>4</td>
</tr>
<tr>
<td>PDO</td>
<td>5</td>
</tr>
<tr>
<td>Casualty</td>
<td></td>
</tr>
</tbody>
</table>

The above table does not indicate a safety issue along this section of road.

### 2.5.14 Northwest Coastal Highway (SLK 1098.55 to 1085.24) - Madigan Road to Karratha Station Road

<table>
<thead>
<tr>
<th>Summary of Crashes</th>
<th>roadmap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street 1</td>
<td>NW Coastal Highway (Madigan Road -- Karratha Station Road)</td>
</tr>
<tr>
<td>Authority Name</td>
<td>ROBEOURNE</td>
</tr>
<tr>
<td>Street 2</td>
<td>Region                     PILBARA</td>
</tr>
<tr>
<td>Street 3</td>
<td>Cost</td>
</tr>
<tr>
<td>Intersection Classification</td>
<td>State Road Only (including National Highway)</td>
</tr>
<tr>
<td>Total Crashes</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Crash Details</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear End</td>
<td>0</td>
</tr>
<tr>
<td>Side Swipe</td>
<td>0</td>
</tr>
<tr>
<td>Non Collision</td>
<td>2</td>
</tr>
<tr>
<td>Hit Animal</td>
<td>1</td>
</tr>
<tr>
<td>Wet</td>
<td>0</td>
</tr>
<tr>
<td>Night</td>
<td>2</td>
</tr>
<tr>
<td>Hit object</td>
<td>0</td>
</tr>
<tr>
<td>Head on</td>
<td>0</td>
</tr>
<tr>
<td>Truck</td>
<td>3</td>
</tr>
<tr>
<td>PDO</td>
<td>0</td>
</tr>
<tr>
<td>Casualty</td>
<td></td>
</tr>
</tbody>
</table>

The above table does not indicate a safety issue along this section of road.
2.6 Crash Rate

The following section compares the crash rate per Million Vehicle Km Travelled (MVKT) on Burrup Peninsula Road with the network average.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Traffic Volume</td>
<td>5,024vpd</td>
</tr>
<tr>
<td>Distance</td>
<td>7.03km</td>
</tr>
<tr>
<td>Crashes in 5 years</td>
<td>8</td>
</tr>
<tr>
<td>Crash Rate/ MVKT</td>
<td>0.62</td>
</tr>
<tr>
<td>Network Average Crash Rate/ MVKT</td>
<td>0.49</td>
</tr>
</tbody>
</table>

The above table indicates the crash rate is higher than the network average; however the recorded crash numbers are relatively low and does not indicate a significant crash problem.
3. Forecast Traffic Volumes

3.1 Forecast Traffic Movements

As indicated in Section 2 current traffic volumes in Mof Road are around 1,021 vpd.

DPA have provided an indication of truck movements associated with the DMSF and subsequent Chevron works based on various scenarios:

- Worst Case Scenario (No Woodside Stockpile)
- Woodside Stockpile available and provide 75% of core
- Woodside stockpile available and provide 100% of core
- Chevron requirement Rock Armour 1800,000t

Details are shown in the tables provided in Appendix G.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Mof Road (from King Bay Road) vpd</th>
<th>Mof Road (from King Bay Road) 10hr day vph</th>
<th>Mof Road (from King Bay Road) 20hr day vph</th>
<th>Form Woodside Stockpile and into Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Woodside Stockpile</td>
<td>760 vpd (two way)</td>
<td>76vph</td>
<td>38vph</td>
<td>0</td>
</tr>
<tr>
<td>Woodside Stockpile available 75% core</td>
<td>304 vpd (two way)</td>
<td>30vph</td>
<td>15vph</td>
<td>200 vpd</td>
</tr>
<tr>
<td>Semis</td>
<td>(30vph)</td>
<td>(15vph)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50t dump trucks</td>
<td>(20vph)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Woodside Stockpile available 100% core</td>
<td>153 vpd (two way)</td>
<td>15.4vph</td>
<td>7.6vph</td>
<td>268 vpd</td>
</tr>
<tr>
<td>Semis</td>
<td>(15.4vph)</td>
<td>(7.6vph)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50t dump trucks</td>
<td>(13.4vph)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chevron Rock Armour (1800,000t)</td>
<td>Mof Road (from King Bay Road) vpd</td>
<td>Mof Road (from King Bay Road) 10hr day vph</td>
<td>Mof Road (from King Bay Road) 20hr day vph</td>
<td>Fom Woodside Stockpile and into Port</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>----------------------------------</td>
<td>------------------------------------------</td>
<td>------------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Cemex or BGC</td>
<td>654 vpd (two way)</td>
<td>65 vph</td>
<td>33 vph</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chevron Rock Armour (1800,000t) Double Semis</th>
<th>Mof Road (from King Bay Road) vpd</th>
<th>Mof Road (from King Bay Road) 10hr day vph</th>
<th>Mof Road (from King Bay Road) 20hr day vph</th>
<th>Fom Woodside Stockpile and into Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cemex or BGC</td>
<td>327 vpd (two way)</td>
<td>33 vph</td>
<td>16 vph</td>
<td>0</td>
</tr>
</tbody>
</table>

It is assumed that Chevron will only operate after construction of the seawall.

The above tables indicate a significant increase in truck volumes on Mof Road from King Bay Road. The worst case scenario of ‘No Woodside Stockpile’ indicates an additional 760 vpd (trucks) resulting in 1781 vpd (all vehicles) on Mof Road. The best case scenario, i.e. 100% of the core from Woodside stockpile would add around 153 vpd (trucks) resulting in 1174 vpd (all vehicles) on Mof Road.

The Chevron operation will then add around 654 vpd onto Mof Road after construction of the seawall.

In view of the heavy vehicle operation and the topography of the road a Passenger Car Equivalent (PCE) factor is applied to the truck volumes to estimate traffic volumes for assessment purposes. The following factors apply. A value of 40 vph is assumed for typical one way off peak periods.

**Table 3.1 Current Passenger Car Equivalent on Mof Road (one way) per Hour**

<table>
<thead>
<tr>
<th>Austroads Class</th>
<th>Rolling Terrain PCE Factor</th>
<th>Current % on Mof Road</th>
<th>40 vph one way used for estimation</th>
<th>PCE’s per hour (one way)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>70.2%</td>
<td>28.08 vph</td>
<td>28.08 vph</td>
</tr>
<tr>
<td>2</td>
<td>1.3</td>
<td>0.2%</td>
<td>0.08 vph</td>
<td>0.104</td>
</tr>
<tr>
<td>3 to 5</td>
<td>3.5</td>
<td>18%</td>
<td>7.2 vph</td>
<td>25.2</td>
</tr>
<tr>
<td>6 to 9</td>
<td>5</td>
<td>7.8%</td>
<td>3.12 vph</td>
<td>15.6</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>0.7%</td>
<td>0.28 vph</td>
<td>2.8 vph</td>
</tr>
<tr>
<td>11</td>
<td>10</td>
<td>3.1%</td>
<td>1.24 vph</td>
<td>12.4 vph</td>
</tr>
</tbody>
</table>
The following table indicates the one way PCE’s for Mof Road for the various scenarios based on a 10 hour operation. A PCE factor is applied based on semi trailer use.

Table 3.2 Total PCE’s on Mof Road including DMSF Traffic (vph) – One Way

<table>
<thead>
<tr>
<th>Austroads Class</th>
<th>Rolling Terrain PCE Factor</th>
<th>Current % on Mof Road</th>
<th>40vph one way used for estimation</th>
<th>PCE’s per hour (one way)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>22</td>
<td>0%</td>
<td>0vph</td>
<td>100%</td>
</tr>
</tbody>
</table>

The above table indicates a worst case scenario of 274vph (PCE’s per hour) one way outside of the peak am and pm peak hour and represent an increase of 225%. Whilst the physical capacity of the road is not exceeded the performance will be impacted due to additional delays.

King Bay Road East of Mof Road

The current average hourly (off peak) volume along King Bay Road is around 250vph two way or 125vph one way. Adding the DMSF traffic (worst case) will result in 326vph two way and 163vph one way on King Bay Road. The daily traffic volumes will increase from 3558vpd to 4318vpd.

3.1.1 Other Likely Development

Transport movements from other planned development which may also impact on Port traffic is summarised as follows:
Table 3.3 Indication of other Transport Movements

<table>
<thead>
<tr>
<th>Proponent</th>
<th>Transport movements during operation (vpd)</th>
<th>Two Way Movement (vpd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burrup Nitrates (Amonium Nitrate Plant)</td>
<td>15 trucks 70t capacity</td>
<td>30 trucks</td>
</tr>
<tr>
<td></td>
<td>3-4 trucks 25t capacity</td>
<td>6-8 trucks</td>
</tr>
<tr>
<td>Dyno Nobel (Amonium Nitrate Production)</td>
<td>25 trucks per day</td>
<td>50 trucks</td>
</tr>
<tr>
<td></td>
<td>50 double road trains per day to Port during import shipments.</td>
<td>(100 trucks)</td>
</tr>
<tr>
<td>Nova Strategies/Archean (Gas Urea Plant)</td>
<td>No figures provided (twice size of Burrup Fertilizer)</td>
<td>50 trucks assumed</td>
</tr>
<tr>
<td>Toll Energy (logistics requirements for Oil and LNG exploration, development and production)</td>
<td>10 road trains per day, 40 local transport movements, double road train access to Port</td>
<td>100 trucks</td>
</tr>
<tr>
<td>Woodside</td>
<td>No figures provided. For construction significant movement to/from Port, rock to/from quarry, personnel by bus.</td>
<td>(200 trucks)</td>
</tr>
<tr>
<td></td>
<td>Potential LNG expansion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Laydown area to facilitate efficient construction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Utilities – power generation</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>538</td>
</tr>
</tbody>
</table>

Source: Burrup Industrial Estate Study of the Optimal Uses of the Remaining Available Sites (GHD October 2009) for Department of State Development.
The above table indicates a potential increase in large truck movements upwards of 500 vpd when the above projects become operational. Significant movements can also be anticipated during the construction phase for these projects. Workforce movements are also likely to be significant.
4. **Route Assessment**

4.1 **Timing of Construction**

It is understood that the proposed DMSF is planned for construction in late 2011 for an 18 month period.

The planned upgrade of Karratha-Dampier Highway is planned to commence in March 2010 over a period of 12 months. Any planning or construction delays for the Highway upgrade have potential to impact on the DMSF project.

Potentially there are a number of other projects as identified in Table 3.3 which may be constructed over the next few years which may coincide with the DMSF project.

4.2 **Key Intersections**

Key intersections in the vicinity of the site include:

- MoF Road/King Bay Road
- King Bay Road/Burrup Peninsula Road
- Burrup Peninsula Road/Karratha-Dampier Road
- Madigan Road/Karratha-Dampier Road
- Madigan Road/NW Coastal Highway

4.3 **MoF Road Access Road**

MoF Road is the main access to the DPA port facilities. The road is currently providing access to the Port and laydown areas. Previous studies have identified several limitations associated with the geometry and capacity of the road. Requirements for upgrading of the road are discussed in the following section.

MoF Road currently carries around 1,021 vpd.

DPA comment in the Burrup Industrial Estate Report (GHD October 2009) is as follows:

*Single access route into the Port of Dampier – The MOF Road is the only road which allows access to the DPA port facilities, which is a significant issue with respect to emergency response and should accidents occur. This road has a number of limitations and is already experiencing some congestion. With the expected increase in activity in the oil, gas and mining industries, access via MOF Road to existing and planned DPA port facilities requires improvement and more efficient road access, to enable safe travel of heavy vehicles and port related traffic. Therefore, the DPA is planning for an alternative access route/corridor into the port and needs to secure land for this purpose.*

Currently the only road access to the port area is via MoF Road. The grades on this road are steep, in excess of 6% in some locations, and are onerous to negotiate for laden vehicles leaving the port area descending the steep incline and entering ascending the incline. The existing seal width is 6.6-7m and unsealed shoulder widths of 1.5m. The following table obtained from Connell Hatch report summarises the current geometry.
Table 4.1 Mof Road Existing Design

<table>
<thead>
<tr>
<th>Item</th>
<th>Existing Design Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Speed</td>
<td>60km/h King Bay Road to Gatehouse, 40km/h thereafter</td>
</tr>
<tr>
<td>Seal Width</td>
<td>Varies to 7.0m</td>
</tr>
<tr>
<td>Crossfall</td>
<td>Varies minimum 1.5m, maximum 5.0m.</td>
</tr>
<tr>
<td>Vertical Grades</td>
<td>Maximum 6.65%</td>
</tr>
</tbody>
</table>

Mof Road within the Port is 8m wide 2 coat seal with 4m wide 1 coat seal shoulders.

As part of the future development plans, it would be beneficial to investigate options for the realignment of Mof Road from King Bay Road. Connell Hatch has previously considered alternative road alignment to Mof Road and a plan is included in Appendix E.

Should triple road trains (RAV Categories 9-10) access MoF Road then it would require upgrading to include improved intersection geometry to accommodate turning requirements. Main Roads Restricted Access Vehicle Route Assessment Guidelines indicates a seal width requirement of 7.6m and a carriageway width of 10.6m. The maximum grade based on the Main Roads document is 6%.

Main Roads WA advise that Mof Road is approved to Network 6 (36.5m Double RT). The Main Roads document indicates a minimum seal width of 6.9m and 9.7m carriageway width for these vehicles.

It should be noted that the above minimum widths would not accommodate adequate passing width in the event of a breakdown or emergency.

Main Roads WA definitions for Permit Network 6 and 10 vehicles are shown in Appendix A.

Mof Road, north of King Bay Road view to north.
If a laden vehicle breaks down on Mof Road between King Bay Road and the Gate, in either direction, there is limited opportunity for other large vehicles to pass.

Current traffic volumes indicate 1021 vpd and around 111 vph peak hour and 70-80 vph at off peak times. Assuming a breakdown occurs resulting in road closure during the peak hour, potentially a queue of 60
vehicles will occur in each direction, adding 35-40 vehicles for each subsequent hour. If no alternative route is available the impacts would be significant to the Port operations. The impacts will potentially be compounded due to the DMSF project. Whilst the risks would appear to be relatively low based on the current crash history the client has advised there have been breakdowns and displaced loads in the past. (GHD have recently designed an emergency access for Fremantle Ports following trucks overturning and blocking the main access route into and out of the Port.)

It is recommended that a plan is prepared showing the feasibility and implications of widening Mof Road.

**Recommendations**

In view of the increased heavy vehicle activity and steep grades and risk of restricted access due to a breakdown, it is strongly recommended that consideration should be given to sealing the shoulders and widening where practicable to allow the construction of a climbing lane/emergency breakdown lane. The feasibility and impacts need to be confirmed by a conceptual drawing.

### 4.3.1 Delays to Traffic on Mof Road

The following compares travel time delays to traffic on Mof Road between King Bay Road and the security gate based on the current operation and adding an additional lane.

**No passing lane**

An average travel speed of 30km/h is assumed due to slow moving trucks.

1100m x 30km/h ave speed will take 2.22min.

**With Passing Lane on one side**

An average speed of 50km/h is assumed for light traffic.

Assume 1100m x 50km/h ave speed will take 1.32min.

Therefore 2.22 minutes – 1.32 minutes = 0.9 minutes saving per vehicle if an additional lane is constructed. As all light vehicles would not be impacted by a slow moving vehicle, an average of 0.45 minutes per light vehicle has been assumed for each direction. The proportion of heavy vehicles is currently around 30%. Section 3 indicates truck traffic during construction could increase on Mof Road depending on the scenario by 760vpd, 304vpd or 153vpd.

The potential cumulative travel time saving is therefore likely to be significant. Based on current activity 1021vpd/2 x 0.7 (light vehicles) x 0.45 minutes/60= 2.68 hours per day.

Also refer to Section 5.

The above would indicate significant cumulative travel time saving with increased traffic over time if Mof Road is widened.

The following information is described from **Austroads Road Design Guidelines** in relation to climbing lane provision.

- Only provided on inclines.
- Warranted where truck speeds fall to 40km/h or less
Traffic volumes exceed 5-700 vpd with very restricted overtaking opportunity or 900-1200 vpd with restricted overtaking opportunity. Percentage of slow vehicles is 5-20%. Actual for Mof Road is 30% currently and will increase to 58%. Volumes will be around 1800 vpd.

A distance of 160m on a 6% grade will reduce a truck speed to 40 km/h.

On steep grades where truck speeds can reduce to a crawl speed less than 20 km/h and a full climbing lane cannot be provided, passing bays may provide an improvement to traffic flow.

A passing bay in the order of 100m long that allows a slow vehicle to pull aside to allow a following vehicle to pass and is appropriate on:
- long grades over 8%
- high proportion of heavy vehicles
- low overall traffic volumes
- construction cost too high for full climbing lane.

Current traffic data on Mof Rd indicates an average speed south of WEL haultroad of 47 km/h.

Total volumes including DMSF volumes will result in around 1 vehicle per minute in each direction.

**Main Roads Guidelines for Assessing the Suitability of Routes for Restricted Access** Vehicles states the following in relation to steep ascending grades:

- The speed of RAV's ascending long and steep grades can be reduced to the extent that the speed differential is hazardous for vehicles approaching from behind. If possible steep ascending lanes should have overtaking lanes.
- Situations where RAV speeds fall to 40 km/h is considered the threshold at which drivers will seek to overtake a slower vehicle regardless of whether or not adequate sight distance is available.
- Grades should not exceed 6% for Category 6 (double road trains) vehicles to avoid stalling and 5% for Category 10 (triple road trains).

The above would appear to confirm that at least a partial climbing partial lane would be of benefit and it is therefore strongly recommended that the feasibility of the construction of a full or partial climbing lane is progressed.

### 4.3.2 Congestion at Security Gate

Clearly there will be significant cumulative delays at the security gate when construction traffic is fully operational. If each entering truck is held, for example; 1 minute, the following lost time per day will result:

- 380 additional entering trucks will result in 6.33 hours lost time every day.
- 252 (quarry + Woodside stockpile) additional entering trucks will result in 4.2 hours lost time every day.
- 210 (quarry + Woodside stockpile) additional entering trucks will result in 3.5 hours lost time every day.

A number of mitigation measures are considered to minimise delay during the construction process:

- Provide each driver with a key card, remote control or transponder to allow avoidance of security checks.
This option would appear to be a simple solution and could be set up for approved vehicles only. There are potential issues if technology fails, drivers lose remote controls, transponders are unreliable, new drivers are used and other traffic attempt to follow the approved truck through the gate. May still be delay due to other Port traffic. However with adequate planning, signage and appropriate instruction would appear to be a possible solution.

- Each driver to be in radio contact with the security gate to allow access.

This option would appear to be a simple solution and could be set up for approved vehicles only but is unlikely to satisfy Port security requirements. There are potential issues if technology fails, security personnel are busy with other Port traffic, and other traffic attempt to follow the approved truck through the gate. May still be delay due to other Port traffic. However with adequate planning, signage and appropriate instruction would appear to be a potential solution subject to Port security requirements.

- Controlled entry of a convoy of trucks from a marshalling area to allow a number of trucks through at once i.e. 6 trucks.

This option would minimise delays for each vehicle if arrival and access is controlled. Port security requirements still need to be complied with.

- Construct a bypass of the security gate for trucks only with remote access and separate from light vehicle entry. Adequate waiting area required for vehicles to park for driver to complete necessary security procedures.

Segregation of user entry will enhance through movement. Port security measures to be complied with.

- Entry to be via a new alternative access off Mof Road.

A new well designed alternative route would overcome most delay issues. A security barrier or similar would be required with key card or remote to prevent unauthorised access and comply with Port security requirements.

**Table 4.2 Summary of Measures**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Comments</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry to be via a new alternative access off Mof Road.</td>
<td>Likely significant benefit by reducing delay caused by other traffic entering the Port</td>
<td>1</td>
</tr>
<tr>
<td>Construct a bypass of the security gate for trucks only with remote access and separate from light vehicle entry. Adequate waiting area required for vehicles to park for driver to complete necessary security procedures.</td>
<td>Likely significant benefit by reducing delay caused by other traffic entering the Port Segregates heavy and light vehicles and vehicles requiring to complete security procedures</td>
<td>2</td>
</tr>
<tr>
<td>Measure</td>
<td>Comments</td>
<td>Ranking</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Controlled entry of a convoy of trucks from a marshalling area to allow a number of trucks through at once i.e 6 trucks.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
* Still likely to be delayed by other traffic entering the Port.  
* Would provide greater benefit if convoy could use separate entry | 3       |
| Provide each driver with a key card, remote control or transponder to allow avoidance of security checks. |  
* Still likely to be delayed by other traffic entering the Port. | 4       |
| Each driver to be in radio contact with the security gate to allow access. |  
* Still likely to be delayed by other traffic entering the Port. | 5       |

**Recommendation**

In order to reduce potential congestion at the security gate it is recommended that consideration is given to the construction of a new access road off Mof Road or a segregated controlled entry.

**4.3.3 New Access Road off Mof Road**

The extension of the port area to the east opens up significant amounts of waterfront land and offers scope for a realigned access to the port area. Such realignment would provide a major benefit to port users due to the potentially flatter grade and offers an alternative access to the port should Mof Road be closed.

A new access road is proposed as shown on the drawing in Appendix B. There would be significant benefit for this road allowing heavy vehicle to avoid the steep grade approaching the gate and steep descent into the Port and would also provide improved safety benefits.

**Recommendations**

Construct a new access road as indicated on the drawing in Appendix B. GHD are preparing plans.

**4.4 Alternative Access into Port**

**4.4.1 General**

The main access roads into the Port are via King Bay Road and Mof Road. There is concern that Port operations will be severely restricted if an emergency or breakdown occurs restricting or preventing
access into the Port. Whilst there does not appear to be a current safety issue on these roads, there have been incidence of breakdowns and spilled loads resulting in delays and impacts to Port operations.

With the increase in heavy vehicle activity due to the DMSF project, the Chevron project and other planned development on the Burrup the likelihood of a breakdown/emergency occurring increases. The development of an alternative access into the Port would have significant benefit and could also provide an opportunity to provide an improved intersection with Burrup Peninsula Road.

An overview of the road network indicates it is vulnerable to a failure with significant impacts to Port operations should a breakdown or emergency occur.

It is recommended that a route alignment study is undertaken to confirm the feasibility and impacts and the following options are available for further consideration:

4.4.2 Alternative Mof Road Alignment

Connell Hatch has previously considered alternative road alignment to Mof Road and a plan is included in Appendix E.

Option 1 (Red on plan)
- The alignment ties in to King Bay Road to the east of the Brambles Yard in Lot 575.
- Maximum grade is 5%
- The horizontal curve radii are adequate for a design speed of 60km/hr.
- The option has large earthworks.
- Estimated costs (2004) were $30,499

Option 1a (Green on plan)
- The alignment ties in to the existing intersection with King Bay Road.
- Maximum grade is 5%
- The horizontal curve radii are adequate for a design speed of 60km/hr.
- The option has large earthworks.
- Estimated costs (2004) were $11,925,000

Option 2 (Blue and Red on Plan)
- The alignment ties in to King Bay Road to the east of the Brambles Yard in Lot 575.
- Maximum grade is 5%, reduces grade to jetty to 4.5%.
- The horizontal curve radii are adequate for a design speed of 60km/hr.
- The option has large earthworks.
- Estimated costs (2004) were $27,534,000

Option 2a (Dark Blue and Red on Plan)
- The alignment ties in to the intersection with King Bay Road.
- Maximum grade is 5%, does not reduce grade to the jetty.
- The horizontal curve radii are adequate for a design speed of 60km/hr.
The option has large earthworks.
Estimated costs (2004) were $24,889,000

4.4.3 Access from Burrup Peninsula Road
A detailed study would be required for an alternative alignment adjacent to the service corridor from Burrup Peninsular Road as there are likely to be a number of issues including grade, heritage, environmental, geotechnical, drainage etc.

It is recommended therefore that a route alignment study is undertaken to assess the feasibility of access from Burrup Peninsular Road.

4.5 Mof Road/King Bay Road Intersection
Mof Road/King Bay Road is a three way intersection designed to accommodate B-Doubles. There is no localised widening in King Bay Road to allow through traffic to pass right turning traffic. The site is constrained by culverts, pipelines and other infrastructure which would impact on opportunities for any significant widening.

Large trucks turning right into Mof Road were observed to cut the corner and have some potential for conflict with other traffic using this intersection. If additional traffic is introduced improvements to the geometry would be required as indicated on the plan in Appendix F.

Increased turning traffic will potentially add to delay for through traffic on King Bay Road and it would be desirable for localised widening to allow through traffic to pass right turning traffic, however site constraints would appear to prevent this.

If a breakdown/accident occurred at the intersection significant delays would occur for traffic on both King Bay Road and Mof Road, which would reinforce the need for an alternative access.

King Bay Road/Mof Road Intersection – View to West
King Bay Road/Mof Road Intersection - Southbound approach

Recommendation

Upgrade intersection where feasible due to site constraints, to accommodate a 36.5m double road train turning in and out lane correct. A detailed survey base is required to enable auto tracking to be undertaken however indicative requirements are shown on the sketch in Appendix F.

4.6 King Bay Road

King Bay Road is a single carriageway and carries around 3,760 vpd. It has a posted speed of 60km/h. It was observed that large trucks are not able to negotiate the intersections with Mermaid Road and Streckfuss Road lane correct and has some potential for conflict with other traffic using these intersections.

The carriageway width is 7m with varying width unsealed shoulders.

Driveways, shoulders and edge of seal are in poor condition at some locations. There is also evidence of loose material from the unsealed shoulders being dragged onto the road. The observations would indicate that the unsealed shoulder should be sealed for a minimum width of 500mm to protect the edge.
The King Bay Road /Streckfuss Road intersection is constrained by pipelines on the north side of King Bay Road.

It is also apparent that large vehicles cannot access from driveways into King Bay Road lane correct. The pavement surface is in poor condition west of Mermaid Road. There are no intersection warning signs along King Bay Road.
The sealing of shoulders will minimise damage to the edge of seal and also improve passing space should a breakdown occur. There would appear to be limited opportunity for significant widening of King Bay Road.

Recommendation

It is recommended that the shoulders are sealed for a minimum width of 500mm along King Bay Road to minimise damage to the edge of seal and also improve passing space.

It is recommended that intersection warning signs are provided along King Bay Road where required.

It is recommended that key intersections are upgraded where practicable to accommodate the design vehicles.

4.6.1 Pedestrians

It is noted there are no footpaths throughout the Port area. Little pedestrian activity was observed within the Port area; however it would seem likely for occasional pedestrian movement to occur between businesses and parked vehicles.

Recommendation

It is recommended that as part of future Port planning consideration should be given to a pedestrian path network particularly to any planned lunch bar facilities.

4.7 Burrup Peninsula Road/King Bay Road Intersection

The intersection is give way controlled and has a Type C treatment incorporating a painted right turn lane and left turn lane. A safety barrier system is in place on the southwest corner to protect an embankment. The line marking associated with the intersection treatment is worn and in poor condition.

During observations at 5pm heavy southbound traffic was observed on Burrup Peninsula Road and would result in difficult access for traffic exiting King Bay Road onto Burrup Peninsula Road should traffic volumes increase significantly.

Widening of the intersection to accommodate an acceleration lane would appear to be constrained by surrounding infrastructure.

The intersection currently accommodates B-Doubles and triple road trains.

This intersection has street lighting.
King Bay Road/Burrup Peninsula Road Intersection – Northbound approach along Burrup Peninsula Road

King Bay Road/Burrup Peninsula Road Intersection – Southbound approach along Burrup Peninsula Road
King Bay Road/Burrup Peninsula Road Intersection – Eastbound approach along King Bay Road

A peak hour intersection count was undertaken to identify current traffic volumes and typical delays at peak times. Between 5pm and 5.15pm delays of 2-3 minutes was common. A summary of the classified turning volumes is shown in the following table.
<table>
<thead>
<tr>
<th></th>
<th>King Bay Road</th>
<th>King Bay Road North</th>
<th>Burrup Peninsula Road North</th>
<th>Burrup Peninsula Road North</th>
<th>Burrup Peninsula Road South</th>
<th>Burrup Peninsula Road South</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>Left out</td>
<td>Right Out</td>
<td>SB</td>
<td>Right into King Bay Rd</td>
<td>Left into King Bay Rd</td>
<td>NB</td>
</tr>
<tr>
<td></td>
<td>Class 1-2</td>
<td>Class 3-9</td>
<td>Class 10-12</td>
<td>Class 1-2</td>
<td>Class 3-9</td>
<td>Class 10-12</td>
</tr>
<tr>
<td>6-7am</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>25</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>7-8am</td>
<td>14</td>
<td>4</td>
<td>9</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>8-9am</td>
<td>9</td>
<td>9</td>
<td>2</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>4-5pm</td>
<td>8</td>
<td>1</td>
<td>0</td>
<td>209</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>5-6pm</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>133</td>
<td>19</td>
</tr>
</tbody>
</table>
In order to improve the operation of the intersection at peak times the following opportunities are considered:

**Acceleration lane in Burrup Peninsula Road for right turning traffic from King Bay Road.**
- Considerable distance is required to accommodate all vehicles, for a design speed of 90km/h; 330m is required and for 100km/h; 450m is required. 600m is available to an existing access road on the east side of Burrup Peninsula Road.
- The road curves to the east.
- Likely constraints due to existing infrastructure.
- A conceptual drawing is required to confirm the feasibility

**Roundabout**
- Will accommodate all turning traffic.
- Likely stability issues for large laden trucks.
- Likely site constraints due to other infrastructure.
- Impacts on all traffic on Burrup Peninsula Road at all times.
- A conceptual drawing is required to confirm the feasibility and land requirement.

**Peak Hour Traffic Signals**
- Could be set up to accommodate peak flow periods.
- May be contrary to expectation as there are no other traffic signals in the region.
- Likely to be significant queuing on Burrup Peninsula Road at peak times. Peak hour intersection turning counts would be required and Sidra analysis undertaken to provide an indication of likely impacts.
- Could be confusing during off peak times.
- Land requirement could probably be minimised.
- Will increase rear end collision potential but reduce right angle collision potential and severity.

**Traffic Signals**
- Would accommodate peak flow periods.
- May be contrary to expectation as there are no other traffic signals in the region.
- Avoids any confusion during off peak times.
- Likely to be significant queuing on Burrup Peninsula Road at peak times. Peak hour intersection turning counts would be required and Sidra analysis undertaken to provide an indication of likely impacts.
- Land requirement could probably be minimised.
- Will impose some additional delay to traffic on Burrup Peninsula Road.
- Will increase rear end collision potential but reduce right angle collision potential and severity.
Analysis

Sidra analysis has been undertaken for a signalised intersection to determine the likely operation based on current and forecast traffic volumes. Forecast traffic volumes also include likely increases from surrounding development (refer to Table 3.3). The following layout refers.

The analysis indicates that traffic signals will operate to a good level of service (A/B) assuming a cycle time of 100-110 seconds. The analysis indicates that traffic will clear the intersection in one cycle.

The analysis indicates that traffic signals could be an acceptable solution.

Any consideration of traffic signals will require a review of traffic speeds through the intersection and a reduction to 60km/h is recommended particularly in view of the required southbound merge if this layout is adopted.

A further comment about the installation of traffic signals is that benefits will be provided for intersections downstream if the southbound through movement is also signalised by creating gaps in the major traffic stream.

Liaison with Main Roads indicates that traffic signals are unlikely to be supported, a preferred solution is to avoid peak hours or consider alternative measures i.e an acceleration lane.
Recommendations

Whilst traffic signals will accommodate the traffic movements at the intersection their installation is unlikely to gain support from Main Roads WA.

The alternative is to avoid peak hour operation for traffic exiting onto Burrup Peninsula Road (6-7am and 4-6pm).

It is recommended therefore that the hauling of rock is not undertaken between 6-7am and 4-6pm.

In the longer term the upgrade of the intersection should be pursued with Main Roads WA to include a concept plan on a surveyed background to assess the feasibility or an acceleration lane for traffic turning right from King Bay Road.

4.8 Burrup Peninsula Road (between King Bay Road and Karratha-Dampier Road)

4.8.1 Burrup Peninsula Road/Hearson Cove Road Intersection

There are no intersection warning signs on Burrup Peninsula Road. There is no street lighting at this intersection.

Recommendations

It is recommended that Main Roads WA install intersection warning signs.

4.8.2 Burrup Peninsula Road east of Hearson Cove Road Intersection

The edge line is worn and in poor condition at some locations.

Recommendations

It is recommended that Main Roads remark edge line in Burrup Peninsula Road where required.

4.9 Burrup Peninsula Road/Karratha-Dampier Road Intersection

The intersection has an acceleration lane for the left turn from Burrup Peninsula Road into Karratha-Dampier Road. Burrup Peninsula Road is give way controlled with signs doubled up. There is a left turn lane from Karratha-Dampier Road into Burrup Peninsula Road. Safety barrier is in place on Karratha-Dampier Road and on the north east and south east corners to protect embankments. There is no street lighting at this intersection. As discussed earlier in this report the intersection will be upgraded to include a changed priority from east to north

Recommendations

No measures recommended.

4.10 Karratha- Dampier Road (Burrup Peninsula Road to Madigan Road)

As discussed in Section 2.2, Main Roads advise that Karratha -Dampier Road will be upgraded from the current single carriageway to dual carriageway in 2010.
There is likely to be disruption to traffic movements as part of the proposed road upgrade and construction activity for the proposed DMSF and operation could be impacted depending on the actual timing of both projects.

4.10.1 Cemex Quarry Access 4 Way Intersection
A 4 way intersection currently exists at the access to the Cemex Quarry at the end of a down hill section of Karratha-Dampier Road, triple road trains enter and exit the quarry. The intersection is treated with painted right turn islands. Large trucks including triple road trains laden with rocks and sand regularly use this intersection. It is anticipated that the operation and safety of this intersection will be improved as part of the proposed dual carriageway works. The dual carriageway design should ensure adequate intersection warning signs are included to maximise awareness of the intersection.

Recommendations
It is recommended the design consultant to maximise awareness of this intersection as part of the dual carriageway design.

4.11 Karratha – Dampier Road/Madigan Road Intersection
This is a channelised intersection incorporating a median island, with right and left turn pockets in Karratha-Dampier Road. The intersection is designed to accommodate triple road trains. This intersection has street lighting.

Recommendations
No measures recommended.

4.12 Madigan Road
There is an access to the Gap Ridge Accommodation Village which has regular turning traffic. Southbound through traffic on Madigan Road are not able to pass right turning traffic.

Pavement marking is worn in some locations.

Recommendations
It is recommended that Main Roads consider the need for localised widening of Madigan Road at the intersection with Gap Ridge Accommodation Camp to allow through traffic to pass right turning traffic.

It is recommended that Main Roads remark pavement marking where required along Madigan Road.

4.13 Madigan Road/NW Coastal Highway
A left turn pocket is incorporated in NW Coastal Highway. The intersection is designed to accommodate triple road trains. This intersection has street lighting.

Recommendations
No measures recommended.
4.14 NW Coastal Highway west of Madigan Road

NW Coastal Highway is a single carriageway with one lane in each direction. The recently opened Karratha-Tom Price Road intersects with NW Coastal Highway.

A railway crossing is located approximately 350m west of the new road, the crossing is controlled by a barrier and flashing lights.

Recommendations

No measures recommended.

4.15 Truck Marshalling Area

Consideration has been given to potential locations for truck marshalling areas to allow managed truck access to the facility. The Lots referred to in this section are shown on plans in Appendix C.

4.15.1 Main Roads Comment

Main Roads WA comments from the Burrup Industrial Estate Report (GHD 2009) indicate the following:

Development is occurring in an area that is difficult to service by road. There are very few opportunities for laydown, breakdown and parking of large vehicles – specifically oversize loads and restricted access vehicles such as triple and quad road trains. This often leads to operators parking in unsafe locations so that they do not have to make longer journeys to collect other parts of their load.

Land has been set aside for proposed developments which lock up parcels of land for several years. Over the years many of these proposals have not come to fruition meaning that the land remains vacant. It is considered that some of this land could be put to use as laydown areas – at least for an interim period whilst development is occurring.

If the area was to become fully developed then it still stands to reason that the area should be serviced by a laydown / breakdown facility that is in close proximity to the area – this is the one key element that the development is missing and should be considered as the highest priority to address.

Many proponents develop their projects with what seems like very little consideration for the transport task required to service both the construction and operation of the project. We consider it critical that each and every project should be placing greater emphasis on this aspect of their development at the early stages so that the impacts can not only be understood – but potentially addressed, and in a timeframe relevant to the project. Furthermore, this aspect should be one of the fundamentals that is considered by DSD, in consultation with MRWA, in the approval process.

It is critical that MRWA is kept fully informed of the progress and demands of future projects so that we can plan future projects to address the forthcoming needs. This is because our process of planning, justifying, funding and delivering projects takes a considerable period of time.

4.15.2 DPA

It is understood from requirements provided by Chevron that DPA have discussed securing a dedicated truck marshalling area. DPA comments from the Burrup Industrial Estate Report (GHD 2009) indicate the following:
Efficient transport access to the Dampier Port is critical for the development of the Pilbara region and economic growth. One way to increase the efficiency of transport access to the DPA port facilities is through the provision of truck marshalling/staging areas in close proximity to the port area. These areas would allow road-train trucks to break-up before proceeding onto the Materials Offloading Facility (MOF) Road to the port facilities, thus smoothing traffic demands.

Such a facility would also provide the opportunity to better manage freight transport into the port by allowing trucks to park in the marshalling/staging area where they can wait and be ready to be called up by the port/management staff to proceed to MOF Road. This near port off-site marshalling capacity would allow the best use of remaining land near the wharf facilities by not having to allocate excessive truck queuing areas, thus maximizing the best-use of the lands.

These management techniques will also improve safety; it will alleviate congestion on MOF Road and undesirable queuing. Areas in close proximity to the Port of Dampier therefore need to be identified to enable the development of a truck marshalling/staging area. These areas could also potentially provide some additional lease-able laydown area for the port.

4.15.3 Burrup Peninsula Road (Lot 454, 464)

DPA have advised of a location opposite Hearsons Cove intersection. Access could be formed to Burrup Peninsula Road, however sight distance to the south would need to be carefully considered in any design in view of the curve in the road, i.e. the site is located on the inside of a curve.

The land referred to in this section is as follows:

Location: part of Lot 454 on deposited plan 194584.

Status: unallocated Crown Land

Primary Interest holder: State of Western Australia

Part reserve for Industrial Development and Easement for Epic Energy for petroleum pipeline access.

Location: part of Lot 464 on deposited plan 194584.

Status: Reserve without management order

Primary Interest holder: State of Western Australia

Part reserve for Industrial Development and Easement for Epic Energy for petroleum pipeline access.

The area is identified as a National Heritage Listed Area and approval would be required to use this area. It was previously used as a pipe lay down area in 1982 however this was before the current legislation was introduced. A schematic design is shown in Appendix D. Main Roads WA have asked for a plan to consider in relation to access to Burrup Peninsula Road. (Area 272m x 86m)

4.15.4 Burrup Peninsula Road (Lot 669)

Other potential locations for further investigation include the west side of Burrup Peninsula Road approximately 3.6km and 4.6km north of Karratha-Dampier Road. Access could be formed to the long straight section of Burrup Peninsula Road.

However the land on the west side of Burrup Peninsula Road would require further investigation in relation to land ownership, ethnographic issues, drainage, location of gas pipeline etc and agreement
with Main Road WA. A conceptual plan would be required showing the precise location, access and size together with supporting information.

The land referred to in this section is as follows:

Location: part of Lot 669 on deposited plan 32484.
Status: unallocated Crown Land.

Primary Interest holder: State of Western Australia
Location: part of Lot 678 on deposited plan 32810.
Primary Interest holder: State of Western Australia.

Burrup Peninsula Road approximately 3.6km north of Karratha Dampier Road - View to South
Sites within Lot 669 include Sites K and J previously identified in the Burrup Industrial Estate Report for Dept of State Development has some potential.

4.15.5 Griffin Road

There is a vacant area of land on the west side of Griffin Road. It is likely that the intersection would need to be upgraded to accommodate B-Doubles. The disadvantage of this location is the down grade from King Bay Road.

The site would require further investigation in relation to land ownership, ethnographic issues, drainage, location of gas pipeline etc and agreement with Dampier Port Authority. A conceptual plan would be required showing the precise location, access and size together with supporting information.

The land referred to in this section is as follows:

Location: part of Lot 475 on deposited plan 194622.

Status: Reserve under management Order. For the purpose of Port purposes.

Primary Interest holder: Dampier Port Authority
4.15.6 Truck Marshalling Area Conclusions

The outcomes of this report indicate that in view of the geometry of Mof Road, additional traffic volumes generated by the development, the demand for laydown areas and Main Roads WA comments suggest that the provision of a truck marshalling/laydown area would have some benefit. It would provide a
holding area if a curfew is imposed during peak hours and reduce the informal operation at other locations currently used for breakdown/laydown etc. There are also opportunities to provide toilet, kiosk, washdown facilities etc. The area and access should be illuminated.

It is anticipated that a layout could be adopted for DPA designed for triple road trains if required and for all movements to and from Burrup Peninsula Road. An area developed off Burrup Peninsula Road opposite Hearsen Cove Road should include a left turn lane. A schematic plan is shown in Appendix D. The area is 272m x 86m.

4.16 Current Restricted Access Vehicle (RAV) Route

Burrup Peninsula Road is currently approved for Network 10 (Triple RT, B Double and 2 dogs etc) all the way to the Woodside Access Rd, SLK 9.25

King Bay Rd is approved to Network 10, MOF Rd is only approved to Network 6 (36.5m Double RT).

4.17 Traffic Restrictions During Construction of DMSF.

The traffic volumes on Burrup Peninsula Road are high during the am and pm peak hours and as a result access to Burrup Peninsula Road is difficult during these times. The situation will be compounded during the construction of the DMSF and also due to the likely surrounding development as identified in Section 3.1.1. There would seem to be significant potential safety issues if increased numbers of large slow moving traffic movements are introduced to the King Bay Road/Burrup Peninsula Road intersection or to Burrup Peninsula Road during peak hours.

It is concluded that truck operation associated with DMSF should be restricted, i.e. no hauling of rock between 6-7am and 4-6pm unless the intersection of King Bay Road/Burrup Peninsula Road is upgraded.

There would seem little justification to restrict truck movements at night as traffic flows reduce significantly; the King Bay Road/Burrup Peninsula Road intersection is illuminated.

There is a potential safety issue if 50 tonne dump trucks from the Woodside stockpile and semi trailers operate together during hours of darkness. It is critical therefore that mitigation measures are considered to minimise any potential conflict and should include:

- Check design of intersection of haul road and MOE Road using autotrack for 50t dump truck.
- Traffic controllers at the intersection of the haul road and MOE Road together with signage as part of a traffic management plan.
- Appropriate lighting
- Adequate briefing of drivers
- Appropriate flashing amber lights on the dump trucks
5. Summary of Findings

A summary of the findings from this study are provided in two parts:

- Port and Immediate Surrounds and;
- Broader Area

5.1 Port and Immediate Surrounds

- Based on the available traffic data, most roads in the vicinity of the proposal have significant available capacity (daily) to accommodate additional traffic. However, peak hour traffic volumes are high, particularly on Burrup Peninsula Road and Karratha – Dampier Road and will result in difficulties accessing Burrup Peninsula Road (from King Bay Road or from a marshalling area) during the am and pm peak hour.
- The following table summarises the ownership and responsibility of the roads likely to be impacted by the construction works traffic.

<table>
<thead>
<tr>
<th>Location</th>
<th>Road Geometry</th>
<th>Road Classification</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mof Road</td>
<td>Single carriageway, 1 lane in each direction. Steep grade up from King Bay Road.</td>
<td>Local Distributor Industrial</td>
<td>Shire of Roebourne</td>
</tr>
<tr>
<td>King Bay Road</td>
<td>Single carriageway, 1 lane in each direction.</td>
<td>Local Distributor Industrial</td>
<td>Shire of Roebourne</td>
</tr>
<tr>
<td>Burrup Peninsula Road</td>
<td>Single carriageway, 1 lane in each direction.</td>
<td>State Road/Primary Distributor</td>
<td>Main Roads WA</td>
</tr>
</tbody>
</table>

- There have been no reported crashes at the King Bay Road/Burrup Peninsula Road intersection or the King Bay Road/Mof Road intersection in 5 years based on advice from Main Roads Road WA.
- The crash investigation does not indicate a significant safety issues at the intersections with King Bay Road.
- The crash investigation for Burrup Peninsula Road (King Bay Road to Karratha – Dampier Road) does not indicate a safety issue along this section of road. The review indicates the crash rate is higher than the network average; however, recorded crash numbers are relatively low.
- MOF Road is the main access to the DPA port facilities. The road is currently providing access to the port and laydown areas. Previous studies have identified several limitations associated with the geometry and capacity of the road. This current study confirms the deficiencies of this route due to the width of seal, size of vehicles, grade and lack of an emergency/breakdown lane.
If a laden vehicle breaks down on Mof Road between King Bay Road and the Security Gate, in either direction, there is limited opportunity for other large vehicles to pass.

In view of the increased heavy vehicle activity and steep grades on Mof Road consideration should be given to sealing the shoulders and widening where practicable to allow the construction of a climbing lane/emergency breakdown lane.

Significant queues and delays will occur if a breakdown impacts on Mof Road.

The proposed works are likely to generate in the order of 153, 304 or 760 truck movements per day (two way) onto Mof Road depending on the source location of rock. This emphasise the need to provide an alternative access into the Port.

Following completion of the seawall Chevrons will potentially add in excess of 600 trucks per day to Mof Road and king Bay Road.

Mof Road currently carries around 1,021vpd and could increase to around 1800vpd due to truck activity associated with the works.

The realignment of Mof Road with a new intersection with King Bay Road would provide reduced grades and would also provide significant benefit for large trucks and alternative access in the event of a breakdown or emergency.

Potential congestion at the security gate caused by a significant increase in laden trucks would be improved by the construction of an alternative access off Mof Road or a segregated truck access adjacent to the existing gate. Port security requirements must be accommodated for any new access.

Main Roads WA advise that Mof Road is approved to Network 6 (36.5m Double Road Train) and King Bay Road Network 10 (Triple Road Trains)

The Mof Road/King Bay Road intersection is constrained by culverts, pipelines and other infrastructure and would appear to impact on opportunities for any significant widening. Large trucks turning right into Mof Road were observed to cut the corner and have some potential for conflict with other traffic using this intersection. If triple road trains or increased Double Road Trains are introduced improvements to the geometry would be required.

King Bay Road is a single carriageway and carries around 3,558vpd. It has a posted speed of 60km/h. It was observed that large trucks are not able to negotiate the intersections with Mermaid Road and Streckfuss Road lane correct and has some potential for conflict with other traffic using these intersections.

Driveways, shoulders and edge of seal are in poor condition at some locations along King Bay Road. There is also evidence of loose material from the unsealed shoulders being dragged onto the road. The observations would indicate that the unsealed shoulder should be sealed for a minimum width of 500mm to protect the edge.

The King Bay Road /Streckfuss Road intersection is constrained by pipelines on the north side of King Bay Road.

The King Bay Road /Mermaid Road intersection is constrained by valves on the north side of King Bay Road.

It is noted there are no footpaths throughout the Port area.
The intersection of King Bay Road/Burrup Peninsula Road is currently under give way control and incorporates a Type C treatment i.e. painted right turn lane and constructed left turn lane in Burrup Peninsula Road. Peak Hour intersection counts indicate significant delays for exiting traffic during the evening peak hour which will be exacerbated by additional traffic movements. Upgrade of this intersection would appear to be constrained by infrastructure. Main Roads WA are not supportive of traffic signals. Any upgrade will require a concept drawing on a survey base to determine the feasibility. An alternative solution is to avoid peak hour operation i.e 6-7am and 4-6pm.

Potentially there are a number of other projects as identified in Table 3.1 which may be constructed over the next few years which may coincide with the DMSF project.

The Chevron project could potentially add up to 650 trucks per day to Mof Road following construction of the seawall.

The would be significant benefit in providing alternative access into the Port as the current road network would appear to be very vulnerable should a breakdown occur resulting in a road closure and subsequent impacts to Port operations.

A detailed study would be required for an alternative alignment adjacent to the service corridor from Burrup Peninsula Road as there are likely to be a number of issues including grade, heritage, environmental etc. It is recommended therefore that a route alignment study is undertaken to assess the feasibility of access from Burrup Peninsula Road.

5.1.1 Alternative Access into Port

The main access roads into the Port are via King Bay Road and Mof Road. There is concern that Port operations will be severely restricted if an emergency or breakdown occurs restricting or preventing access into the Port. Whilst there does not appear to be a current safety issue on these roads, there have been incidence of breakdowns and spilled loads resulting in delays and impacts to Port operations.

An overview of the road network indicates it is vulnerable to a failure with significant impacts to Port operations should a breakdown or emergency occur.

With the increase in heavy vehicle activity due to the DMSF project and other planned development on the Burrup the likelihood of breakdown/emergency occurring increases. The development of an alternative access into the Port would have significant benefit and could also provide an opportunity to provide an improved intersection with Burrup Peninsula Road.

Based on the findings of this study it is strongly recommended that an alternative access is developed by way of an additional route into the Port (via Burrup Peninsula Road or the parallel to Mof Road) or the provision of a passing lane in Mof Road. The construction of an alternative access into the Port is considered to be the best long term solution.

Connell Hatch has previously considered alternative road alignment to Mof Road and a plan is included in Appendix E.

A detailed study would be required for an alternative alignment adjacent to the service corridor from Burrup Peninsula Road as there are likely to be a number of issues including grade, heritage, environmental etc.

It is recommended therefore that a route alignment study is undertaken to assess the feasibility of access from Burrup Peninsula Road.
5.2 Broader Area

- Based on the available traffic data, most roads in the vicinity of the proposal have significant available capacity (daily) to accommodate additional traffic. However, peak hour traffic volumes are high, particularly on Burrup Peninsula Road and Karratha - Dampier Road and will result in difficulties accessing Burrup Peninsula Road during the am and pm peak hours.

- The following table summarises the ownership and responsibility of the roads likely to be impacted by the construction works traffic.

<table>
<thead>
<tr>
<th>Location</th>
<th>Road Geometry</th>
<th>Road Classification</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burrup Peninsula Road</td>
<td>Single carriageway, 1 lane in each direction</td>
<td>State Road/Primary Distributor</td>
<td>Main Roads WA</td>
</tr>
<tr>
<td>Karratha - Dampier Road (north of Tip Road)</td>
<td>Single carriageway, 1 lane in each direction (planned upgrade to dual carriageway, 2 lanes in each direction)</td>
<td>State Road/Primary Distributor</td>
<td>Main Roads WA</td>
</tr>
<tr>
<td>Madigan Road</td>
<td>Single carriageway, 1 lane in each direction</td>
<td>State Road/Primary Distributor</td>
<td>Main Roads WA</td>
</tr>
<tr>
<td>North West Coastal Highway (west of rail crossing)</td>
<td>Single carriageway, 1 lane in each direction</td>
<td>State Road/Primary Distributor</td>
<td>Main Roads WA</td>
</tr>
<tr>
<td>North West Coastal Highway (west of Karratha - Dampier Road)</td>
<td>Single carriageway, 1 lane in each direction</td>
<td>State Road/Primary Distributor</td>
<td>Main Roads WA</td>
</tr>
</tbody>
</table>

- Main Roads are planning a significant upgrade to Karratha - Dampier Road to include extension of the existing dual carriageway we/sy of Madigan Road to Burrup Peninsula Road. The priority at the intersection of Karratha - Dampier Road and Burrup Peninsula Road is likely to change and be redesigned for Karratha-Dampier Road to continue into Burrup Peninsula Road. The project will be tendered later this year or early next year. Construction is planned to commence in March 2010 and
will take 12 months to construct. The new carriageway will occur on the south side of the existing alignment.

- The proposed upgrade of Karratha-Dampier Highway is planned to commence in March 2010 over a period of 12 months. Any planning or construction delays for the Highway upgrade have potential to impact on the DMSF project.

- The crash investigation for Burrup Peninsula Road (King Bay Road to Karratha –Dampier Road) does not indicate a safety issue along this section of road. The review indicates the crash rate is higher than the network average; however recorded crash numbers are relatively low.

- The crash investigation for Karratha-Dampier Road between Burrup Peninsula Road and Madigan Road does indicate a safety issue along this section of road. The proposed upgrade to dual carriageway will improve the safety of this section of road.

- The intersection of Burrup Peninsula Road /Karratha-Dampier Road will be modified as part of the proposed Karratha-Dampier Road upgrade and is likely to include changed priority to favour Karratha-Dampier Road (East) to Burrup Peninsula Road (north).

- Potentially there are a number of other projects as identified in Table 3.1 which may be constructed over the next few years which may coincide with the DMSF project.

- Madigan Road is designed as a heavy haulage route; however improvements could be made at the intersection with the Gap Ridge Accommodation Village to allow large southbound vehicles to pass right turning traffic.(Main Roads WA issue)
6. Proposed Measures and Cost Benefit

This section considers the proposed key measures to improve and address traffic management issues and provides a cost benefit ratio. It should be noted that the costs and benefits can only be indicative at this stage as detailed costs are not available. Benefits are based on assumptions and can only provide an indication only.

"The preliminary cost estimates presented in this section have been developed solely for the purpose of comparing and evaluating competing options. They are sufficiently accurate to serve this purpose. They cannot be used for budget-setting purposes as common elements between options may have been omitted and/or the works not fully scoped. A functional design is recommended if a budget estimate is required."

Indicative costs used, detailed plans are required for more accurate costings.

6.1 Mof Road (King Bay Road to Gate)

In order to improve the route into the Port for Double Road trains due to grades and lack of breakdown and passing facilities it is considered that Mof Road should be upgraded to incorporate a breakdown lane.

A design plan is required in order to establish feasibility and likely costs.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation of passing lane</td>
<td>$Costs to be determined following drafting of widening.</td>
</tr>
<tr>
<td>Saving in travel time to following vehicles if passing lane constructed.</td>
<td>Assume 0.45 minute saving on average per vehicle x 1021vpd/2 x 0.7 (light vehicles) x ($19.20/Hr (a) + $28.80/Hr (a))/60 = $285/day (if one lane added)</td>
</tr>
</tbody>
</table>

**With Passing Lane**

Assume 1100m x 50km/h ave speed will take 1.32 minutes.

**No passing lane**

1100m x 30km/h ave speed will take 2.22 minutes. Therefore 2.22 minutes – 1.32 minutes = 0.9 minutes saving per vehicle if lane constructed. Assume 0.45 minutes per light vehicle.

Potential crash cost saving (Assumes 1 crash requiring medical treatment, saving per year) | $34,000 (b) |

Cost Benefit

(a) Source: Akcelik & Associates Pty Ltd Sidra Solutions. Time cost per person $19.20/hr, time cost per vehicle $28.80/hr.
6.2 Mof Road (Inside the Port)

The treatment of this section will depend on the outcome of feasibility into widening Mof Road from King Bay Road. If the construction of a passing lane is feasible in Mof Road from King Bay Road then this should be continued inside the Port.

6.3 Security Gate – Alternative Access

A segregated access would benefit truck access to the Port and is considered for BCR.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>$Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Segregated Access at Security gate</td>
<td>$100,000 assumed</td>
</tr>
<tr>
<td>Potential travel time saving</td>
<td>153 trucks per day one way currently + 380 proposed trucks one way for DMSF x 30 sec saving (assumed)= 266.5 minutes per day (4.44 Hours/Day) Saving $213 per day</td>
</tr>
<tr>
<td>Cost Benefit (based on 2 year operation)</td>
<td>2.2</td>
</tr>
</tbody>
</table>

(a) Source: Akcelik & Associates Pty Ltd Sidra Solutions. Time cost per person $19.20/hr, time cost per vehicle $28.80/hr

6.4 King Bay Road/Mof Road Intersection

The intersection should be upgraded to accommodate the swept paths for a double road train.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>$Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve swept path for double road train by localised widening</td>
<td>$50,000 (assumed)</td>
</tr>
<tr>
<td>Potential crash cost saving (Assumes 1 crash damage only) (a)</td>
<td>$13,655</td>
</tr>
<tr>
<td>Cost Benefit</td>
<td>3.1</td>
</tr>
</tbody>
</table>

(a) Source: Akcelik & Associates Pty Ltd Sidra Solutions. Time cost per person $19.20/hr, time cost per vehicle $28.80/hr

6.5 Truck Marshalling Area

The forecast increase in truck movement associated with the works indicates 1 laden truck every 1.5 minutes (over 10 hours) or 3.15 minutes (over 20 hours) on average. There would be advantages of providing a truck marshalling area to ensure a controlled operation and reduce congestion and queuing.
in Mof Road. The sites so far considered on Burrup Peninsula Road are within the National Heritage Listing area. The site adjacent to Griffin Road would appear to be unsuitable in view of the grades of Griffin Road (6%) which is the maximum grade for Restricted Access Vehicles. The preferred areas considered for BCR is as follows:

- A) on Burrup Peninsula Road opposite Hearson Cove intersection

Estimated costs to construct a truck marshalling area for location A is $500,000.

Schematic drawings are shown in Appendix D.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>$Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location A – Burrup Peninsula Road Opposite Hearson Cove Road</td>
<td>$500,000 assumed</td>
</tr>
<tr>
<td>Construction of Truck Marshalling Area and access</td>
<td></td>
</tr>
<tr>
<td>Time cost per person (a)</td>
<td>$19.20/hr</td>
</tr>
<tr>
<td>Time cost per vehicle (a)</td>
<td>$28.80/hr</td>
</tr>
<tr>
<td>Vehicle operating cost per litre (a)</td>
<td>$1.80/litre</td>
</tr>
<tr>
<td>Crash Cost Saving; damage only crash per year assumed.</td>
<td>$13,655</td>
</tr>
</tbody>
</table>

Assumption: There are likely to be significant benefits for DPA, associated with the provision of a marshalling area as documented in this report i.e., breakdown area, holding area at times of curfew, maintenance area, opportunity for movement by convoy, high wide load waiting area, clos facility to the Port, reduction in indiscriminate of road verges or unsuitable areas etc. The cost benefits are however difficult to quantify and a cost benefit is not provided.

(a) Source: Akcelik a Associates Pty Ltd Sictra Solutions. Time cost per person $19.20/hr, time cost per vehicle $28.80/hr

(b) Source Main Roads Crash Costs

6.6 Burrup Peninsula Road/King Bay Road Intersection

The current operation includes significant delays during the evening peak hour for traffic exiting King Bay Road turning right into Burrup Peninsula Road. As traffic volumes increase and if 24 hour 7 day operation occurs this intersection has significant potential for congestion, delay and safety issues caused by traffic attempting to enter the major traffic stream at peak times.

It is considered that the safest solution is to introduce traffic signals which will accommodate current and future peak activity however Main Roads WA have indicated they are unlikely to support this.
A conceptual design incorporating an acceleration lane would be required to confirm the feasibility of this unsignalised option.

The alternative is to avoid peak hour operation for traffic exiting onto Burrup Peninsula Road.

A benefit cost has not been considered at this stage.

### 6.7 King Bay Road

Driveways, shoulders and edge of seal are in poor condition at some locations along King Bay Road. There is also evidence of loose material from the unsealed shoulders being dragged onto the road. The observations would indicate that the unsealed shoulder should be sealed for a minimum width of 500mm to protect the edge of seal.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Rate/m²</th>
<th>Area</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seal shoulders</td>
<td>$80/m²</td>
<td>3.6km x 0.5m</td>
<td>$144,000 assumed</td>
</tr>
<tr>
<td>(500mm)</td>
<td></td>
<td>=1800m²</td>
<td></td>
</tr>
</tbody>
</table>

| Maintenance Cost   | $2000 assumed |
| Saving/year        |               |

| Cost Benefit       | 1.2           |
7. Recommendations

Following the assessment of the impacts of the proposed DMSF the following recommendations are made:

7.1 Port and Immediate Surrounds

Mof Road (King Bay Road to Security Gate)
In view of the increased heavy vehicle activity and steep grades it is strongly recommended that consideration should be given to sealing the shoulders and widening where practicable to allow the construction of a climbing lane/emergency breakdown lane.

Mof Road (internal)
It is recommended that any upgrade of Mof Road from King Bay Road should be continued into the Port.

Security Gate
In order to reduce potential congestion at the security gate it is recommended that consideration is given to the construction of a new access road off Mof Road or a segregated controlled entry.

Mof Road/King Bay Road Intersection
It is recommended the intersection is upgraded where feasible due to site constraints, to accommodate 36.5m double road train turning into and out of Mof Road lane correct. It is recommended that the intersection is checked on a survey base using autotrack for the appropriate design vehicle.

A sketch plan is shown in Appendix F.

King Bay Road
It is recommended that the shoulders are sealed for a minimum width of 500mm along King Bay Road to minimise damage to the edge of seal and also improve passing space.

It is recommended that intersection warning signs are provided along King Bay Road where required.

It is recommended that key intersections are upgraded where practicable to accommodate the turning requirements for design vehicles.

Pedestrians
It is recommended that as part of future Port planning consideration should be given to a pedestrian path network particularly to any planned lunch bar facilities.

King Bay Road/Burrup Peninsula Road Intersection
It is recommended that the hauling of rock is not undertaken between 6-7am and 4-6pm through the King Bay Road/Burrup Peninsula Road intersection.

In the longer term it is recommended the upgrade of the intersection should be pursued with Main Roads WA to include a concept plan on a surveyed background to assess the feasibility of an acceleration lane for traffic turning right from King Bay Road.
Truck Marshalling Area Burrup Peninsula Road opposite Hearson Cove Intersection

It is recommended that a truck marshalling area is constructed in Burrup Peninsula Road opposite Hearson Cove Intersection. A left turn lane is required in Burrup Peninsula Road. A conceptual plan on a survey base should be submitted to Main Roads for their comment and approval. An internal area of 272m x 86m is shown on the plan in Appendix D there is also scope for a larger area to be developed as required.

It is recommended that street lights are installed at the intersection of the marshalling area and Burrup Peninsula Road.

It is recommended that the marshalling area is illuminated.

There is also potential to provide facilities to include toilets, kiosk, wash down areas etc.

Any implications for heritage and appropriate approval need to be assessed.

Alternative Access into Port

A detailed study would be required for an alternative alignment adjacent to the service corridor from Burrup Peninsula Road as there are likely to be a number of issues including grade, drainage, heritage, environmental etc.

In view of the potential for significant impact to Port operations due to a breakdown on the existing road network it is recommended that a route alignment study is undertaken to assess the feasibility of access from Burrup Peninsula Road.

In view of the potential for significant impact to Port operations due to a breakdown on the existing road network it is recommended that a route alignment study is progressed to confirm the feasibility of constructing a parallel road to Mof Road and this be fully costed and compared with any possible access from Burrup Peninsula Road.

Traffic Management

It is recommended that truck operation associated with DMSF should be restricted, i.e no hauling of rock between 6-7am and 4-6pm.

There is a potential safety issue if 50 tonne dump trucks from the Woodside Stockpile and semi trailers operate together during hours of darkness. It is critical therefore that mitigation measures are considered to minimise any potential conflict and it is recommended that the following measures are implemented:

- Check design of intersection of haul road and Mof Road using autotrack for 50t dump truck and modify if required.
- Traffic controllers at the intersection of the haul road and Mof Road together with signage as part of a traffic management plan.
- Appropriate lighting
- Adequate briefing of drivers
- Appropriate flashing amber lights on the dump trucks.
7.2 Broader Area

The following recommendations relate to the roads controlled by Main Roads WA and are documented as part of the study outcomes for their consideration.

Burrup Peninsula Road/Hearson Cove Road Intersection

It is recommended that Main Roads WA install intersection warning signs.

Burrup Peninsula Road east of Hearson Cove Road Intersection

It is recommended that Main Roads remark edge line in Burrup Peninsula Road where required.

Cemex Quarry Access 4 Way Intersection

It is recommended that the dual carriageway design should ensure adequate intersection warning signs are included to maximise awareness of the intersection.

Madigan Road Access to Gap Ridge Accommodation Village

It is recommended that Main Roads consider the need for localised widening of Madigan Road at the intersection with Gap Ridge Accommodation Camp to allow through traffic to pass right turning traffic.

It is recommended that Main Roads remark pavement marking where required along Madigan Road.
Appendix A

Permit Network 6 and 10 Vehicles
## Permit network 10

Only vehicles described in the table are restricted to Permit Network 10.

Please refer to the Class 2/3 RAV Period Permit operating conditions for full vehicle descriptions and conditions.

- Vehicle descriptions and configurations
- Network 10 road tables (PDF 15-page 19KB)
- Permit Network 10 Addendum 25/6/2008 (PDF 35KB)
- Network 10 road maps

<table>
<thead>
<tr>
<th>Class</th>
<th>VEHICLE DESCRIPTION AND CONFIGURATION</th>
<th>March 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>AST (m)</td>
</tr>
<tr>
<td>Cat. 10</td>
<td>Prime mover, semi-trailer towing two 6 axle dog trailers</td>
<td>(A) &gt;36.5 &lt;53.5</td>
</tr>
<tr>
<td>Cat. 10</td>
<td>B-double towing a 2 or 3 axle converter dolly with two semi-trailers (double b-double, DB)</td>
<td>(A) &gt;36.5 &lt;53.5</td>
</tr>
<tr>
<td>Cat. 10</td>
<td>B-double towing two dog trailers</td>
<td>(A) &gt;36.5 &lt;53.5</td>
</tr>
<tr>
<td>Cat. 10</td>
<td>Double road train towing b-double trailers</td>
<td>(A) &gt;36.5 &lt;53.5</td>
</tr>
<tr>
<td>Cat. 10</td>
<td>Prime mover, semi-trailer towing a six axle dog trailer and converter dolly</td>
<td>(A) &gt;36.5 &lt;53.5</td>
</tr>
</tbody>
</table>

Class 3

Cat. 10 | Prime mover, semi-trailer towing a <five axle dog trailer and converter dolly | (A) >36.5 <53.5 | 84 | (A) >4.5 note (4) | Either | 8 |

**KEY:** ① : Minimum axles required ② : Optional Axles.

**LEGEND:**
- AST = Axle Spacing Table
- L = Length
- MLN = Max. Loaded Mass
- SAG = Steer Axle Group
- H = Height
- AG = Axle Group

**NOTES:**
1. Operators using a Class & Category of Restricted Access Vehicle (RAV) outlined in this document must operate that class of RAV in accordance with the PERMIT OPERATING CONDITIONS and only on the network specified;
2. These diagrams are a visual indication of the vehicle only;
3. Operators must refer to the PERMIT OPERATING CONDITIONS for the full vehicle description;
4. The height of the vehicle can exceed 4.3m but MUST NOT exceed 4.6m when:
   (i) it is carrying livestock
   (ii) it is carrying a crate to carry livestock
   (iii) it is carrying vehicles on one or more than one deck
5. Pig Trailer Only.

### Individual network maps

Map sheets for this network can be downloaded individually as per the below index.

State of Western Australia
**Permit network 6**

Only vehicles described in the table are restricted to Permit Network 6.

Please refer to the Class 2/3 RAV Permitted Permit operating conditions for full vehicle descriptions and conditions.

- Vehicle descriptions and configurations
- Network 6 road tables (113 pages PDF 492 KB)
- Permit Network & Regulation 2/3/2009 (PDF 60KB)
- Network 6 roads maps

<table>
<thead>
<tr>
<th>Class</th>
<th>VEHICLE DESCRIPTION AND CONFIGURATION</th>
<th>AST (m)</th>
<th>L (m)</th>
<th>H (m)</th>
<th>S/HG</th>
<th>AG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat. 6</td>
<td>Prime-mover, semi-trailer towing 6 axle dog trailer</td>
<td>(A) &gt;77,5 &lt;35,5</td>
<td>87,5</td>
<td>64,6 (6)</td>
<td>Either</td>
<td>5</td>
</tr>
<tr>
<td>Cat. 6</td>
<td>Prime-mover towing 3 semi-trailers (0-trip)</td>
<td>(A) &gt;77,5 &lt;35,5</td>
<td>87,5</td>
<td>64,6 (6)</td>
<td>Either</td>
<td>5</td>
</tr>
<tr>
<td>Cat. 6</td>
<td>Double Road Train and Converter Dolly</td>
<td>(A) &gt;77,5 &lt;35,5</td>
<td>87,5</td>
<td>64,6 (6)</td>
<td>Either</td>
<td>5</td>
</tr>
</tbody>
</table>

KEY: @ : Minimum axles required ☐ : Optional Axles.

**LEGENDS:**
- AST = Axle Spacing Table
- L = Length
- HLM = Loaded Mass
- S/HG = Steer Axle Group
- H = Height
- AG = Axle Group

**NOTES:**
1. Operators using a Class & Category of Restricted Access Vehicle (RAV) outlined in this document must operate that class of RAV in accordance with the PERMIT OPERATING CONDITIONS and only on the network specified;
2. These diagrams are a visual indication of the vehicle only;
3. Operators must refer to the PERMIT OPERATING CONDITIONS for the full vehicle description;
4. The height of the vehicle can exceed 4.3m but MUST NOT exceed 4.6m when:
   - (1) it is built to carry livestock
   - (2) is carrying a crane to carry livestock
   - (3) for carrying vehicles on more than one deck
5. Pig Trailer Only.

**Individual network maps**

Map sheets for this network can be downloaded individually as per the below index.

---

**Metropolitan**

State of Western Australia

Appendix B

Alternative Access Road and Widening of Mof Road
Appendix C
Lot Location Plans
RECORD OF QUALIFIED CERTIFICATE OF
CROWN LAND TITLE
UNDER THE TRANSFER OF LAND ACT 1893
AND THE LAND ADMINISTRATION ACT 1997

NO DUPLICATE CREATED

The undenominated land is Crown land in the name of the STATE OF WESTERN AUSTRALIA, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.

LAND DESCRIPTION:

LOT 454 ON DEPOSITED PLAN 194584

STATUS ORDER AND PRIMARY INTEREST HOLDER:
(FIRST SCHEDULE)

STATUS ORDER/INTEREST: UNALLOCATED CROWN LAND

PRIMARY INTEREST HOLDER: STATE OF WESTERN AUSTRALIA

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

Warning: (1) A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required. Lot as described in the land description may be a lot or location.
(2) The land and interests etc. shown herein may be affected by interests etc. that can be, but are not, shown on the register.
(3) The interests etc. shown herein may have a different priority than shown.

END OF CERTIFICATE OF CROWN LAND TITLE

STATEMENTS:
The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: LR3115-891 (454/DP194584).
PREVIOUS TITLE: This Title.
PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AREA: SHIRE OF ROOBURNE.

NOTE 1: A000001A CORRESPONDENCE FILE 02024-1998-01RO.
NOTE 2: SUBJECT TO SURVEY - NOT FOR ALIENATION PURPOSES
NOTE 3: LAND PARCEL IDENTIFIER OF DE WITT LOCATION 454 ON SUPERSEDED PAPER CERTIFICATE OF CROWN LAND TITLE CHANGED TO LOT 454 ON DEPOSITED PLAN 194584 ON 27-AUG-02 TO ENABLE ISSUE OF A DIGITAL CERTIFICATE OF TITLE.
NOTE 4: THE ABOVE NOTE MAY NOT BE SHOWN ON THE SUPERSEDED PAPER CERTIFICATE

END OF PAGE 1 - CONTINUED OVER
RECORD OF CERTIFICATE OF CROWN LAND TITLE
UNDER THE TRANSFER OF LAND ACT 1893
AND THE LAND ADMINISTRATION ACT 1997

NO DUPLICATE CREATED

The undersigned land is Crown land in the name of the STATE of WESTERN AUSTRALIA, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.

[Signature]
REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 464 ON DEPOSITED PLAN 194584

STATUS ORDER AND PRIMARY INTEREST HOLDER:
(FIRST SCHEDULE)

STATUS ORDER/INTEREST: RESERVE WITHOUT MANAGEMENT ORDER

PRIMARY INTEREST HOLDER: STATE OF WESTERN AUSTRALIA

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)


Warning: A current search of the details of the land should be obtained where detail of position, dimensions or area of the lot is required. Lot as described in the land description may be a lot or location.

-----------------------------------------END OF CERTIFICATE OF CROWN LAND TITLE-----------------------------------------

STATEMENTS:
The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

PREVIOUS TITLE: This Title.
PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AREA: SHIRE OF ROEBOURNE.

NOTE 1: A000001A SUBJECT TO SURVEY - NOT FOR ALIENATION PURPOSES
NOTE 2: LAND PARCEL IDENTIFIER OF DE WITT LOCATION 464 ON SUPERSEDED PAPER

END OF PAGE 1 - CONTINUED OVER
RECORD OF CERTIFICATE OF CROWN LAND TITLE
UNDER THE TRANSFER OF LAND ACT 1893 AND THE LAND ADMINISTRATION ACT 1997

NO DUPLICATE CREATED
The undermentioned land is Crown land in the name of the STATE of WESTERN AUSTRALIA, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.

EG Roberts
REGISTRAR OF TITLES

LAND DESCRIPTION:
LOT 475 ON DEPOSITED PLAN 194622

STATUS ORDER AND PRIMARY INTEREST HOLDER:
(FIRST SCHEDULE)

STATUS ORDER/INTEREST: RESERVE UNDER MANAGEMENT ORDER

PRIMARY INTEREST HOLDER: DAMPIER PORT AUTHORITY OF POST OFFICE BOX 285, DAMPIER (XE L002331) REGISTERED 8 JULY 2009

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. L002330
   L002331
   RESERVE 50259 FOR THE PURPOSE OF PORT PURPOSES REGISTERED 8.7.2009.
   MANAGEMENT ORDER, CONTAINS CONDITIONS TO BE OBSERVED, WITH POWER TO LEASE FOR ANY TERM NOT EXCEEDING 21 YEARS, SUBJECT TO THE CONSENT OF THE MINISTER FOR LANDS. REGISTERED 8.7.2009.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
Let as described in the land description may be a lot or location.

END OF CERTIFICATE OF CROWN LAND TITLE

STATEMENTS:
The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

PREVIOUS TITLE: This Title.
PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AREA: SHIRE OF ROEBOURNE.

NOTE 1: A000001A LAND PARCEL IDENTIFIER OF DE WITT LOCATION 475 ON SUPERSEDED PAPER CERTIFICATE OF CROWN LAND TITLE CHANGED TO LOT 475 ON DEPOSITED PLAN 194622 ON 06-SEP-02 TO ENABLE ISSUE OF A DIGITAL CERTIFICATE OF TITLE.

END OF PAGE 1 - CONTINUED OVER
RECORD OF CERTIFICATE OF CROWN LAND TITLE
UNDER THE TRANSFER OF LAND ACT 1993
AND THE LAND ADMINISTRATION ACT 1997

NO DUPLICATE CREATED

The undersigned land is Crown land in the name of the STATE of WESTERN AUSTRALIA, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.

REGISTRAR OF TITLES

LAND DESCRIPTION:
LOT 669 ON DEPOSITED PLAN 32484

STATUS ORDER AND PRIMARY INTEREST HOLDER:
(First Schedule)

STATUS ORDER/INTEREST: UNALLOCATED CROWN LAND

PRIMARY INTEREST HOLDER: STATE OF WESTERN AUSTRALIA

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(Second Schedule)

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
Lot as described in the land description may be a lot or location.

END OF CERTIFICATE OF CROWN LAND TITLE

STATEMENTS:
The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: DP32484 [Sheet 1].
PREVIOUS TITLE: LR3062-334.
PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AREA: SHIRE OF ROEOUBRNE.

NOTE 1: K780912 CORRESPONDENCE FILE 00521-1966-04RO

LANDGATE COPY OF ORIGINAL NOT TO SCALE Thu Oct 29 14:51:48 2009 JOB 33222524
Appendix D

Truck Marshalling Area
BLUE lines - PEPL (Pilbara Energy Pipe Lines) Easements, owned by Epic and managed by DBP
ORANGE lines - DBP easements
Appendix E

Realignment of Mof Road (Connell Wagner Plans)
Appendix F

Mof Road/King Bay Road Intersection
INDICATIVE WIDENING TO ACCOMMODATE
RIGHT TURNING "DOUBLE-ENDER TRAIN"
(SUBJECT TO ROAD TRACKING ON
SHEPPARD BASE)

ADJACENT
SEAL AND
REPAIR EDGE
OR SEAL

CUT BACK SEAL AND
RESEAL MATCHING
NEATLY TO ADJACENT
EXISTING LEVELED
EXISTING POTHOLES

BRAMLES YARD

KING BAY ROAD

MOF ROAD / KING BAY ROAD INTERSECTION
Appendix G

Forecast Truck Volumes
<table>
<thead>
<tr>
<th>Type of Waste</th>
<th>Quantity (T/ha)</th>
<th>Tonnage (T)</th>
<th>Rates of Application (T/day)</th>
<th>Duration (Days)</th>
<th>Total Tons (T)</th>
<th>Total Hours (h)</th>
<th>Total Minutes (min)</th>
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<tbody>
<tr>
<td>Type A</td>
<td>100</td>
<td>10</td>
<td>2</td>
<td>50</td>
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<td>Type B</td>
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<td>Type C</td>
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<td>6</td>
<td>150</td>
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<td>45,000</td>
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<td>Type D</td>
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<td>Type E</td>
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**Note:** The rates of application are based on the average tons of waste per hectare. The total hours and minutes are calculated based on the total tons of waste to be applied and the rates of application.
### Single Semi Tippers

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<th>Armour (1,800,000t)</th>
<th>Quantity (T)</th>
<th>Tonnes /load</th>
<th>Loads</th>
<th>Duration (days)</th>
<th>Loads/day</th>
<th>Loads/hr (10hr day)</th>
<th>Loads/hr (20hr day)</th>
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**TOTAL**

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<th>327.3</th>
<th>32.7</th>
<th>16.4</th>
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Truck every (along MOF Rd)  (Based on single semi's)  

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<th>1.83</th>
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### Double Semi Tippers

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<th>Quantity (T)</th>
<th>Tonnes /load</th>
<th>Loads</th>
<th>Duration (days)</th>
<th>Loads/day</th>
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**TOTAL**

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Truck every (along MOF Rd)  (Based on single semi's)  

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<th>Reviewer</th>
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<tr>
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<td>S McDermott</td>
<td>M Ryan</td>
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