	<b>ACACIA FOREST INDUSTRIES SDN BHD</b> STANDARD OPERATING PROCEDURE FOREST MANAGEMENT PLANNING	Document No.: AFI/SUPP/11
		Date Issued : 01/03/2011
		Last Update: 24/02/2016
Section: SUPPLY CHAIN	Work Scope Area: ALL FMA	Revision No: 2
Activity: Road Construction, Road Upgrading & Maintenance		Responsible Person: Infrastructure Manager
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## STANDARD OPERATING PRODEDURE (SOP)

### 1.0 TITLE PLANTATION ROAD SPECIFICATIONS

### 2.0 OBJECTIVE

To carry out road planning, construction, road upgrading & road maintenance according to clearly defined rules and regulations, ensuring

- a high quality of plantation road infrastructure
- reduced negative impacts on the environment
- safe traffic and transportation conditions on plantation roads

### 2.0 PERSON(S) IN CHARGE (PIC)

- Supply Chain Manager - Overall responsibility of the forest road network
- Infrastructure Manager – Responsibility for scheduling daily road construction and maintenance activities and ensuring the activities are in line with this SOP.
- Infrastructure Supervisor – Responsible for supervision of machine operators and coordinating dialing activities in line with this SOP.
- Resource Forester – Responsible for the appropriate planning of new roads and identification of old roads to be used for timber transport.

### 3.0 JUSTIFICATION AND SCOPE

A well planned and maintained road network is essential to ensure efficient and cost effective forest access and timber transport activities. A well designed road system also plays an important role in reducing environmental impacts as well as controlling and suppressing forest fires.


### 4.0 ROAD PLANNING

Roads and tracks must be planned to ensure efficient and economic harvesting and haulage practices and with the least overall adverse environmental impact. Planning must provide a road network in line with road classification standards (refer Section 6 Road Classification) and density that is the minimum necessary to achieve operational efficiency. Road planning activities must include:

- Consultation with all relevant stakeholders including adjacent landholders, nearby villages (via the ketua kampung/JKKK), neighboring companies and relevant government agencies;
- A survey of the proposed road alignment should be undertaken to prove the alignment, check watercourse-crossing points and identify construction or environmental issues.
- Advice and endorsement from the relevant Harvesting Manager where primary or secondary access roads or where structures, instability, drainage design or safety issues are involved.

### 5.0 ROAD LOCATION

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INFRA MANAGER	SUPPLY CHAIN MANAGER

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Roads must be located to best optimise protection of forest values and protection areas with particular focus on;


- catchment and riparian protection:
  - interference with natural drainage systems;
  - where possible, the catchment area above the road; and
  - the number of watercourse crossings.
- road alignment – by minimising the total necessary road length, soil disturbance and grade;
- minimise earthworks where possible and facilitate drainage by:
  - locating the road on naturally drained or easily drainable features such as ridge tops, benches and gentle slopes;
  - avoiding areas prone to instability or flooding;
  - avoiding the use of box cuts, which are difficult to drain, unless overall impact is less than alternative locations;
  - limiting side cutting and avoiding potential instability by restricting construction to side slopes less than 30 degrees; and
  - balancing cuts and fills to minimise transport or wastage of fill material.

## 6.0 ROAD CLASSIFICATION

Acacia Forest Industries characterizes its road network into three classes:

CLASS	DESCRIPTION	SERVICABLE AREA
PRIMARY ROAD	All weather road (ideally graveled but not always) designed to accommodate a high volume of timber harvesting traffic. Normally double lane for transporting logs to public road network or processing sites such as log yards.	10 Cpt OR > 500ha
SECONDARY ROAD	A road connecting compartment areas with the primary road system for the purpose of log transport. Normally not graveled and can be either double or single lane.	< 10, > 1 Cpt OR < 500, > 30ha
FEEDER ROAD	A temporary road used to transport logs from within a compartment to a secondary road. Used by logging trucks and harvesting machinery. Not graveled, single lane and normally only requires minor soil disturbance to construct. Feeder roads are drained and closed after harvesting/transport activities are concluded and usually replanted.	1 Cpt OR < 30ha

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## 7.0 ROAD DESIGN & SPECIFICATION

### PRIMARY ROAD

PARAMETER	SPECIFICATION
TARGET DENSITY	≤ 10 m/ha
NUMBER OF LANES	2 Lanes
SPEED LIMIT	≤ 40 km/hr
ROAD WIDTH	≤ 5-6 M
SUBGRADE CONDITION	Well Compacted & Stable
ROAD CAMBER	≥ 1: 20 (3 degrees)
ROAD CROSS INCLINATION	≥ 1: 33 (1 degree)
ROAD INCLINATION (MAXIMUM)	≤ 12 degrees
LENGTH OF ROAD INCLINATION (MAXIMUM)	≤ 200 m
BRIDGE WIDTH	≥ 4 m
BRIDGE MAXIMUM PERMISSABLE PAYLOAD (TARGET)	≤ 60 tones

### SECONDARY ROAD


PARAMETER	SPECIFICATION
DENSITY	≤ 30 m/ha
NUMBER OF LANES	1 or 2 lanes (if 1 passing bays provided)
SPEED LIMIT	≤ 30 km/hr
ROAD WIDTH	≤ 4 – 5 M
SUBGRADE CONDITION	Well Compacted & Stable
ROAD INCLINATION (MAXIMUM)	≤ 15 degrees
LENGTH OF ROAD INCLINATION (MAXIMUM)	≤ 200 m
BRIDGE WIDTH	≥ 3 m
RIDGE MAXIMUM PERMISSABLE PAYLOAD (TARGET)	≤ 60 tones

### FEEDER ROAD

PARAMETER	SPECIFICATION
DENSITY	≤ 50 m/ha
NUMBER OF LANES	1 lane
SPEED LIMIT	≤ 20 km/hr
ROAD INCLINATION (MAXIMUM)	≤ 20 degrees
ROAD WIDTH	≤ 3 m
ROAD SURFACE	Smooth mineral soil surface, tree stumps removed

## 8. WATER COURSE CROSSINGS

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Proposed or upgraded crossings on haul roads must be capable of accommodating the traffic and watercourse flows, and be safe, stable, and not pose an environmental threat. Crossing sites must be identified and located before construction commences.

Crossings must be sited in straight sections of the watercourse where practicable with low and stable bank formations where approaches will cause minimal disturbance.

Align crossings, as close as practical, at right angles to the water flow. Design drainage to divert road water to stable vegetated areas so it can be filtered prior to entry to the watercourse (Refer section 9 Drainage Requirements).

Causeways and fords are suitable for crossings that are used infrequently, where usage occurs during periods of low flow or where regular flooding prevents economic or effective bridge construction. Sites must be naturally stable or engineered to provide function and environmental protection. Approaches must be gravelled or otherwise stabilised to minimise turbidity in wet crossings.

## 9. DRAINAGE REQUIREMENTS

Roads and tracks must be provided with an effective drainage system, to meet normal rainfall events, and to maintain the load bearing capacity of the pavement, minimise soil erosion from either the pavement or drains, and minimise sedimentation of watercourses.

All roads must use natural drainage where present, otherwise appropriate drainage must be constructed and maintained in an effective state during and after the completion of use. Pavement materials and surfacing must provide a stable, load bearing and smooth surface that will provide for overland flow and shed water. Suitable, on-site or imported, materials consisting of a mixture of graded stone and clay binder must be placed and compacted. Patch gravelling should be done as necessary to maintain function and/or avoid road surface damage.


Drainage design should ensure flow without scour and erosion. Drainage, where required, is constructed and spaced in accordance with Table 1 below.

Table 1. Drainage spacing requirements.

Slope (Degrees)	Drainage Spacing (m)
< 5	100
>5 <15	40
>15	20

Drainage must discharge on to stable areas of undisturbed vegetation, a stable site, into debris or an energy dissipating structure and not directly into watercourses or onto exposed soil or fill slopes.

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Locate drains at critical locations such as:

- significant changes in slope or direction
- points of concentration of overland flow
- 10m before any watercourse crossing or junction with another track or landing,

Berms along the edge of the track should be breached at the set drainage spacing intervals to allow water to drain from the road where suitable discharge conditions are available.

**Road profile** – Road pavements should be shaped to shed surface water to either both or one side of the road. The profile may involve a crowned formation, be outsloped or insloped. The crossfall grade should be in the order of 1 to 3 degrees to shed water without causing erosion of the surface. The profile should be maintained by grading and compaction and ensure that edge berms or shoulder vegetation does not impede the shedding of water or cause longitudinal scour of the road surface.

For Feeder roads which are normally flat bladed-tracks, maximum use should be made of natural cross fall or drainage. The surface should be maintained to assist cross drainage.

**Table drains** – Table drains are drains at the side of and parallel to the road to catch and convey runoff water. Table drains must:

- have a flat bottomed, 'v'-shaped or dished profile;
- be built, where possible, at least 300mm below the level of the top of the formation at the outer edge of the shoulder;
- set, where possible, at a gradient of 1 to 3 degrees to guarantee flow without scour,
- where table drains pass through box cutting and cannot be drained by turnout drains, steps must be placed at drainage spacing intervals to reduce drain gradient and dissipate water flow energy safely.
- Discharge should aim to disperse water flow and deposit suspended sediment before runoff enters a watercourse.


**Turnout drains** – Turnout drains divert water from table drains away from the road. They must be built to ensure that:

- in the absence of natural drainage, drains are spaced in accordance with Table 1;
- the table drain is blocked at its junction with the turnout drain to ensure water does not bypass the turnout drain;
- drain outflows have a fall of 1 to 3 degrees, with a maximum 5 degrees, using a curved alignment as necessary, to keep the flow to a non-erosive velocity;
- Drain outflow must disperse water on to stable ground or vegetation; and
- drains do not directly enter buffer zones but are diverted into surrounding vegetation

**Culverts** - Culverts are pipe or box structures that allow water to be channelled under the road from one side to the other. The construction of culverts should ensure that:

- All culverts installed are adequate in size and length for the maximum water flow.
- All pipes or box culverts are installed on prepared and compacted sub-surfaces to ensure stability and longevity.

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- Pipes must be set to have a fall of 1 to 3 degrees, be surrounded by compacted fill and have suitable material in place to prevent erosion under the pipes.
- Culvert inlets and outlets are adequately protected to minimise erosion from flow entering or discharging from the drain.

## 10. MAINTENANCE

Access roads and tracks must be maintained to ensure a stable and good running surface, effective drainage and safe use. Road surfaces, crossings and drainage systems must be inspected sufficiently to ensure that they are functional, safe and in a stable state. All drains must be inspected thoroughly and repaired before the onset of the wet season and during and after periods of heavy rainfall.

Maintenance techniques must:

- return usable material to the pavement and avoid lowering the road surface in a way that impedes surface drainage or concentrates flow along the road edge;
- restore the road profile and smooth the road surface using compaction to strengthen, seal and preserve pavement life;
- restore drainage systems including any erosion control devices;
- ensure water can freely drain from the surface and is not blocked by vegetation or a berm unless the berm is used as part of the drainage system;
- minimise or avoid disturbance to soils adjacent to the road;
- avoid deposition of spoil or sediment into watercourses;
- manage road-side vegetation to maintain safety and road-edge bank stability;

## 11. RELATED DOCUMENTATION

Forest Road Specifications for West Malaysia

PREPARED BY	APPROVED BY
INFRA MANAGER	SUPPLY CHAIN MANAGER