

INFORMATION NOTE

ODW 9.03



ATC FORWARDER

Introduction

This Information Note is one of a series derived from a Technical Development Branch (TDB) Outdoor Workshop (ODW). It is produced as a guide to part of a harvesting system suitable for use in small scale broadleaf woodlands. ODWs are a TDB initiative designed to offer practical advice to practical people through presentation, demonstration and user guidance.

The ODW programme will involve repeating trials and introducing new systems around Great Britain, so that a wide range of sites, systems and practitioners can be included.

Information has been gathered from equipment and method trials based at a single location. This information therefore must be taken as indicative only. Variation could be expected for other operations where factors such as terrain, crop specification, product specification, operating distances or operator efficiency differ.

The System

The ATC forwarder comprises any 4WD ATC (ideally > 350 cc) with a purpose built ATC forwarding trailer. The system is suitable for the extraction of small diameter shortwood timber on level to moderately sloping ground (up to $\approx 30\%$).

Information collected during a case study (1998) on another site (Table 1) has been used in the calculation of outputs and costs (Table 2).

Load size is dependant on terrain and access. On level sites with access along unsurfaced tracks and into the wood along racks, load sizes up to 0.55 m^3 should be



attainable. Extracting over a distance of 100 m, output should be above $2.0 \text{ m}^3/\text{shr}$. This gives an extraction cost of $\text{£}5.30/\text{m}^3$ and when felling is included the total system cost is $\text{£}13.30/\text{m}^3$ assuming a felling output of $1.12 \text{ m}^3/\text{shr}$. Use of marginal costs can reduce extraction output cost to $\text{£}1.00/\text{m}^3$.

Extraction of larger loads is possible subject to trailer capacity and manufacturers' recommendations.

The system has the following attributes:

- Uses a standard ATC.
- Simple to set up and use.
- Equipment need not be solely dedicated to timber extraction.

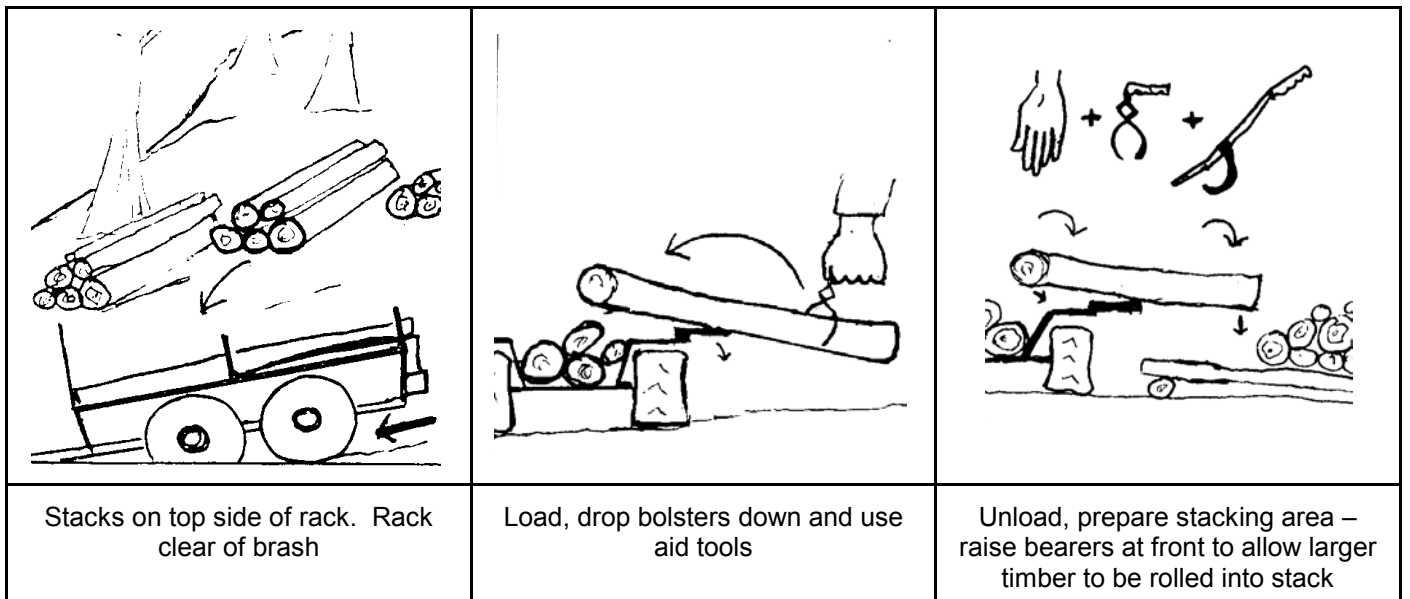
Table 1

Case Study: Site and Crop Characteristics

Soil	Free draining clay loam over shale. Depth to 200 cm plus.	Species	Syc/Ash/some Be/Oak	Age(yrs)	10 - 60
Vegetation	Well developed herb layer with sporadic bramble, shrub layer in places and some regen.	Form	Some good stems, but generally poor, squirrel damage.		
Terrain	Slope 15% - 45% with occasional steep snap falling to a level area adjacent to a stream.	Thinning volume (m ³ /ha)		50	
Access	Loosely metalled farm tracks running up/down hill on either side of wood. Roughly surfaced track in upper wood. Unsurfaced narrow track in lower wood.	Average tree (m ³) (thinned)		0.087	
		Average piece (m ³)		0.023	

Figure 1

System Layout



Costing Options

There are various options for costing operating systems (Table 2) but it is possible to get combinations of these costings.

The highest costing (option A) assumes all equipment has been purchased new and all labour has been fully charged to the operation.

The intermediate costing (option B) assumes that some equipment has been purchased secondhand and all labour has been fully charged to the operation.

The lowest costing (option C) assumes that certain elements of the cost eg labour may not be charged.

Table 2

Case Study: Machine Description and Costing

Item	Specification	Capital Cost* (£)	Hourly Cost (£/hr)			
			A	B	C	
(A=Full, B=Intermediate, C=Marginal)						
ATC	Yamaha YFM 600FW Grizzly. 600 cc, 37 HP 4 stroke petrol engine. On command 4WD with high and low ratio automatic gear boxes giving 10 forward and 2 reverse gears. Equipped with wheel chains and Garp hitch (see comments section).	5 000 (new) 2 000 (used)	2.24	1.48	0.50	
Forwarding trailer	TFM Engineering. Low ground pressure tyres on twin wheel bogie axle. Fitted overrun, hand operated and parking brakes. 0.5 tonne capacity. Drop down bolsters.	1 600 (new)	0.60	0.60	0.60	
Operator	£64.00/day on 8 hr day	-----	8.00	8.00	----	
Total extraction			10.84	10.08	1.10	
Felling	Man £8.00/hr, saw £1.00/hr	-----	9.00	9.00	9.00	
* Costs estimated in 1998			Total	19.84	19.08	10.10

Output and Cost

All outputs are based on an extraction distance of 100 m. Data have been modelled to represent varying access and slope conditions.

Usually access is the main factor which effects travel speed. To some degree it will also effect load size, especially during periods of heavy rain when routes may become slippery. The extraction data shown below has been used to represent various access levels:

Good - unsurfaced track 50 m
- stump free rack 50 m

Moderate - stump free rack 70 m
- in wood 30 m

Poor - stump free rack 20 m
- in wood 80 m

The degree of slope along the extraction route will usually be the main factor which effects load size. It may also effect travel speed. Estimated load sizes for various access levels and extraction slopes are shown in Table 3.

Table 3

Estimated Load Size (m³)

Access	Extraction Slope		
	Level	Gentle	Moderate
Good	0.55	0.45	0.35
Moderate	0.5	0.35	0.25
Poor	0.5	0.3	0.15

Typical outputs for an ATC forwarder are shown in Table 4. They have been produced using the extraction distances and load sizes shown in Table 3 and by modelling time study data.

Table 4

Output (m³/shr)

Access	Extraction Slope		
	Level	Gentle (20%)	Moderate (30%)
Good	2.05	2.00	1.90
Moderate	1.70	1.55	1.36
Poor	1.45	1.16	0.77

Outputs are for skilled and accustomed operators. shr = Standard Hour (Includes allowances of 22% for Personal Needs and Rest, and 17% for Other Work such as refuelling)

Cost data based on the outputs is given in Table 5.

Table 5

Cost (£/m³)

Cost Option	Access	Extraction Slope		
		Level	Gentle	Moderate
A	Good	5.29	5.42	5.70
	Moderate	6.38	6.99	7.97
	Poor	7.48	9.34	14.08
B	Good	4.92	5.04	5.30
	Moderate	5.93	6.50	7.41
	Poor	6.95	8.69	13.09
C	Good	0.54	0.55	0.58
	Moderate	0.65	0.71	0.81
	Poor	0.76	0.95	1.43

Comments on Trial Performance

General: The Yamaha ATC can be fitted with a **Garp** hitch. Weight on a standard tow hitch is distributed over the rear ATC wheels. With the Garp, tow hitch weight is moved to the centre of the bike and redistributed over all 4 wheels. The Garp hitch is designed and manufactured in Sweden (see suppliers) only for Polaris ATCs. TDB brought the first Garp into Britain in 1997. In conjunction with the Swedish supplier and Yamaha, TDB had a hitch reproduced and modified by TFM Engineering to fit a Yamaha ATC. The modified hitch is a prototype and is only for trial purposes.

Access along good level tracks will enable load sizes to be optimised. The tracks need not be surfaced and a width of 2 m is sufficient. Tracks narrower than this can

be used but are not recommended as main extraction routes.

If track construction is planned then it is important that suitable turning points are included. Steep sections along the track should be avoided. Even short steep sections can hinder a successful harvesting operation. Where uphill extraction along the track is required, tight corners should be avoided. Access from the woodland to the track should not be steep. If necessary access ramps with a gentle slope should be constructed.

Outputs for ATC forwarding systems are sensitive to slope and access. Small reductions in access standards and increases in slope will often cause outputs to fall quickly.

Extraction should be carefully planned. Informal routes or racks through the wood should be identified before felling. These should be kept free of brash and timber and allow for easy turning. Circular routes are best.

On sites with poor access or steeper slopes extraction should be planned to allow part loads to be extracted over the worst terrain. The load can then be 'topped up' once the machine is on better terrain.

Wheel chains should be used on most sites to aid traction. Ballasting over the ATC front wheels may be necessary. Loose gravelly surfaces on steep farm tracks can give the ATC traction problems.

Safety: Training is essential. Refer to FASTCo Safety Guide 701 for Health & Safety Guidance. In particular a motor cycle helmet with peak conforming to BS 6658 Type B should be worn when operating an ATC. If combining ATC use with forest operations which require a safety helmet to be worn (with earmuffs and visor if appropriate), then the motor cycle helmet must be replaced with a safety helmet for the duration of these operations. The motor cycle helmet should be put back on before again using the ATC.

Refer to the manufacturer's operating manual for maximum permissible loading limits. For the Yamaha YFM 600FW used during this trial the maximum load on the tow hitch should not exceed 550 Kgf. Additionally the Health & Safety Executive state that towing weight should not exceed 2 x the weight of the ATC for an un-braked trailer or 4 x for a trailer with brakes.

Brakes on the forwarding trailer are essential for safe and controlled downhill extraction.

Extraction routes should be planned and identified before work begins. In most circumstances routes should be brash free. This reduces the risk of brash snagging and damaging the ATC, puncturing tyres and piercing the plastic panels around the operating position. Brash will also cause loss of traction in wet or damp weather.

A **Risk Assessment** should be done for all forest operations. In particular with an ATC forwarder, manual handling is a concern. Good positioning of the trailer

during loading, good trailer design incorporating drop down bolsters and the use of aid tools all help to improve handling. However, if a risk assessment indicates that produce size is too large for safe handling then an alternative system should be used.

Within site constraints, timber should be stacked adjacent to extraction routes and on sloping ground on the top side. This will improve loading ergonomics and improve efficiency.

TDB Publications

Information from ODWs will be published by TDB. Associated publications available now are:

- Report 22/92 - Manual Handling of Loads.
- Report 25/93 - The Gorge Trials - A Case Study of Small Scale Extraction Techniques.
- Technical Note 25/96, Harvesting, Extraction & Processing of Low Grade Broadleaves: Case Study.

Acknowledgements

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Suppliers

Item	Supplier
Trailer - TFM Multi- Role Forestry Trailer	Mr Fergus McFarlane, TFM Engineering Unit 1 Ghyll Mill, New Hutton Kendal, Cumbria LA8 0AJ Tel: 01539 733881
ATC - Yamaha YFM 600FW Grizzly	Yamaha Motor UK Ltd Sopwith Drive, Brooklands Weybridge, Surrey KT13 0UZ Tel: 01932 358000
Garp Hitch	Bo Karlstrand, Ytterocke Production Ytterocke 2717, 830 02 Mattmar, Sweden Tel/Fax: 0046 640 45119

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