O.E.C.D. Approval 343
Report 618
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REPORT ON TEST IN ACCORDANCE WITH O.E.C.D. TEST CODE FOR AGRICULTURAL TRACTORS

LEYLAND MODEL 154 TRACTOR



Test No.: R.70/5514/O.E.C.D.

Manufacturer: Leyland Motors (Scotland) Ltd,
Bathgate, West Lothian, Scotland

NATIONAL INSTITUTE OF AGRICULTURAL ENGINEERING
Wrest Park . Silsoe . Bedford

This Bulletin is based on engineering tests in accordance with the O.E.C.D. Tractor Code. It does not contain an evaluation of the performance of the tractor on practical farm work

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SPECIFICATION OF TRACTOR

Manufacturer:	Leyland Motors (Scotland) Ltd, Bathgate, West Lothian, Scotland
Selected and submitted for test by:	The manufacturer
Place of running-in:	Bathgate
Duration of running-in:	50 hours

Tractor

Make:	Leyland Motors
Model:	154
Type:	Four wheel, rear wheel driven
Serial No:	25D/301093/4810

Engine

Make:	Leyland Motors	Model:	15T
Type:	Indirect injection diesel	Serial No:	15T/218/D303

Cylinders:	4 cylinders, vertical, in-line, 2·875 in (73·0 mm) bore x 3·50 in (88·9 mm) stroke, capacity 90·9 in^3 (1·49 l), compression ratio 23·0:1, overhead in-line valves
Fuel system:	AC-Delco Model E mechanical fuel feed pump with hand primer; one C.A.V. replaceable paper element filter on pressure side of lift pump and sediment bowl on suction side, gauze strainer in lift pump; capacity of fuel tank 7 UKgal (31·8 l); C.A.V. type DPA 324 7E 090 fuel injection pump, Serial No. 1833 ZK, manufacturer's production setting: 3·9 – 4·1 cm^3 for 200 injections at 1100 rev/min pump speed (test bench figures); C.A.V. type BDN 0 SPC 6389 injector nozzles, injector setting 135 atm (140 kg/cm^2)
Governor:	C.A.V. hydraulic, incorporated in fuel injection pump, governed range of engine speed 650 to 2800 rev/min, rated engine speed 2500 rev/min
Air cleaner:	Burgess oil bath with centrifugal pre-cleaner above hood, oil capacity 1 pt (0·57 l)

Lubrication system: Forced feed from concentric rotor type pump with metal strainer in sump; Tecalemit full flow replaceable element filter, total oil capacity 7¾ pt (4·4 l); recommended oil change period 200 h

Cooling system: Water cooled, no loss sealed system, pressurized at 7 lb/in² (0·49 kg/cm²), impeller assisted with 12½ in (318 mm) dia, 6-blade belt driven fan, thermostat for temperature control, cooling water capacity 8½ pt (4·8 l)

Starting system: Electrical, 12V Lucas type M45G solenoid engaged starter motor with over-run clutch, operable only with gear selector lever in "start" position, heater plugs in combustion chambers for cold starting

Electrical system:

Voltage:	12, positive earth
Generator:	Lucas type C40T
Battery:	Lucas type D13, lead acid, capacity 60 Ah at 20 hour rating

Transmission

Clutch: Borg and Beck single plate dry clutch, 9¼ in (235 mm) dia, pedal operated

Gearbox: Own make constant mesh type, 9 forward speeds and 3 reverse

Rear axle and final drive: Own make, crown wheel and pinion and differential with final drive through outboard mounted reduction gears; hand lever operated differential lock

Oil capacities: Gearbox and transmission 19 pt (10·8 l), final drives 2¼ pt (1·3 l) each; oil change period 800 h

Gear	Number of engine revolutions for 1 revolution of driving wheel	*Nominal travelling speed at 2500 rev/min rated speed of engine, mile/h	(km/h)
Forward			
1	297·81	1·04	(1·67)
2	211·55	1·46	(2·35)
3	153·86	2·01	(3·23)
4	109·41	2·83	(4·55)
5	77·72	3·98	(6·40)
6	56·52	5·47	(8·80)
7	40·91	7·56	(12·16)
8	29·06	10·65	(17·14)
9	21·14	14·64	(23·56)
Reverse			
1	109·67	2·82	(4·54)
2	77·90	3·97	(6·39)
3	56·66	5·46	(8·79)

*Calculated with tyre rolling radius of 20·8 in (528 mm)

Power take-off	At rear of tractor, $1\frac{3}{8}$ in (34·9 mm) dia, 6-spline; height above ground $20\frac{7}{8}$ in (530 mm); proportional engine speed
Speeds: low ratio	598 rev/min at 2500 rev/min rated engine speed, 540 rev/min (standard p.t.o. speed) at 2258 rev/min engine speed
high ratio	1026 rev/min at 2500 rev/min rated engine speed, 1000 rev/min (standard p.t.o. speed) at 2438 rev/min engine speed; direction of rotation clockwise viewed from driving end
Belt pulley	Attachable to rear of tractor in three alternative positions, p.t.o. driven $9\frac{1}{4}$ in (235 mm) dia x $6\frac{1}{4}$ in (159 mm) face width, 3258 ft/min (993 m/min) and 1345 rev/min at rated engine speed 2500 rev/min (p.t.o. high ratio). Engine speed 2380 rev/min at standard linear speed 3100 ft/min (945 m/min); direction of rotation optional, depending on position of unit
Power lift	Hydraulic, Dowty gear type pump, belt driven from engine crankshaft pulley, supplying oil from separate reservoir to ram cylinder and 2 external tappings, single lever operation; Category 1 implement linkage, depth control by varying draught link pivot positions; oil capacity 16 pt (9·1 l); oil change period 800 h
Drawbar	
Swinging drawbar:	Radius of swing 28 in (711 mm) and $32\frac{1}{4}$ in (819 mm), lateral adjustment 24 in (610 mm) and 27 in (686 mm), vertical heights to centre of clevis, 8 positions from $11\frac{1}{8}$ in (283 mm) to $22\frac{3}{8}$ in (568 mm) changed by inverting drawbar and clevis, drawbar hole to take 1 in (25 mm) dia pin, distance behind rear axle centre $23\frac{1}{4}$ in (591 mm) and $27\frac{1}{2}$ in (699 mm), position relative to p.t.o. 10 in (254 mm) and $14\frac{1}{4}$ in (362 mm) to rear, pivot position relative to rear wheel centre $8\frac{1}{2}$ in (216 mm) forward
Linkage drawbar:	Drawbar fixed on lower links with central hole and 4 holes 25/32 in (20 mm) dia spaced $2\frac{1}{2}$ in (64 mm) apart either side of centre, vertical adjustment from $10\frac{1}{2}$ in (267 mm) to $21\frac{1}{2}$ in (546 mm) changed by adjustable stay links, distance from rear wheel centre 29 in (737 mm) with lower links horizontal

Hitch	Rear pick-up hitch optional, not fitted
Steering	Cam Gears worm and nut type with double drag links
Brakes	Girling multi-disc type mounted on outer end of high speed axle shafts, operated independently or together by two brake pedals, or together by the use of a third pedal which incorporates a brake balancing mechanism; preselective latch on pedals for parking

Wheels

Steering wheels:	Two at front, Dunlop Tractor TF9 5·00 - 15 tyres, 4-ply rating; maximum permissible weight on each tyre 755 lb (342 kg) at 36 lb/in² (2·5 kg/cm²); track width 44 in (1118 mm) by 2 in (51 mm) steps to 68 in (1727 mm) changed by extending front axle
Driving wheels:	Two at rear, Goodyear Traction Sure Grip 12·4/11 - 24 tyres, 4-ply rating; maximum permissible weight on each tyre 1935 lb (878 kg) at 14 lb/in² (1·0 kg/cm²); track width 44 in (1118 mm) by 4 in (102 mm) steps to 72 in (1829 mm) changed by reversing wheels and offset lug type rims
Wheelbase:	67 in (1702 mm)

Tractor and ballast weights (without driver but with tanks full)

Weight without ballast	Front:	929 lb (421 kg)
	Rear:	1347 lb (611 kg)
	Total:	2276 lb (1032 kg)
Ballast	Front:	Weights - 2 per wheel, total 282 lb (128 kg)
	Rear:	Weights - 7 per wheel, total 1096 lb (497 kg)
		Liquid - 660 lb (299 kg)
	Additional:	2 front frame weights and frame, total 212 lb (96 kg)
Weight with full ballast	Front:	1489 lb (675 kg)
	Rear:	3037 lb (1378 kg)
	Total:	4526 lb (2053 kg)

Seat	Own make, metal pan with cushion, range of adjustment 4½ in (114 mm) fore and aft

Number of grease points

Whole tractor:	10

Overall dimensions

Overall length:	9 ft 1½ in (2·78 m) without ballast weights; 9 ft 9 in (2·97 m) with front frame weights fitted
Overall width:	60½ in (1537 mm) at 48 in (1219 mm) track, no ballast weights; 90¾ in (2305 mm) at 48 in (1219 mm) track with 7 weights per wheel
Overall height:	51 in (1295 mm) to top of steering wheel; 74⅜ in (1892 mm) to top of exhaust pipe
Minimum ground clearance:	12¾ in (324 mm) to underside of engine sump

Lighting

	Height above ground of centre, in	(cm)	Diameter, in	(cm)	Distance from outside edge of tractor at 48 in (1219 mm) wheel track to centre, in	(cm)
Headlights	25⅜	(64·5)	4⅞	(12·4)	17½	(44·5)
Side lights	46½	(118·1)	2	(5·1)	10½	(26·7)
Rear lights	46½	(118·1)	2	(5·1)	10½	(26·7)
Reflectors	45½	(115·6)	2⅛	(5·4)	13	(33·0)

Unrestricted beam angle of headlight in plan view 60°

FUELS AND LUBRICANTS USED IN TESTS

Fuel:	Diesel oil, density 0·8295 at 60°F (15·6°C), Cetane No. 53, to Class A, B.S.2869:1957
Engine oil:	S.A.E. 20W/30
Transmission oil:	S.A.E. 10W/30

COMPULSORY TESTS

1. MAIN POWER TAKE-OFF PERFORMANCE

Date and location of tests: 14th August 1969; N.I.A.E., Silsoe, Bedford, U.K.

Type of dynamometer: Water brake, Heenan and Froude

Horsepower (Metric hp)	Speeds, rev/min		Fuel consumption,		
	Engine	P.t.o.	UKgal/h (l/h)	lb/hp h (g/metric hp h)	hp h/UKgal (metric hp h/l)
Maximum power - 2 hour test					
21·0 (21·3)	2568	614	1·29 (5·86)	0·511 (229)	16·2 (3·61)
Standard p.t.o. speed (540 rev/min)					
19·2 (19·5)	2258	540	1·15 (5·23)	0·498 (222)	16·7 (3·73)
Standard belt speed of 3100 ft/min (945 m/min)					
		Not applicable			
The speed recommended by the manufacturer for drawbar work					
20·6 (20·9)	2500	598	1·26 (5·73)	0·507 (227)	16·4 (3·86)
Fuel consumption at part loads					
18·1 (18·4)	2602	622	1·19 (5·41)	0·546 (244)	15·2 (3·39)
0	2781	665	0·54 (2·45)	-	-
9·3 (9·4)	2666	638	0·83 (3·77)	0·743 (332)	11·2 (2·50)
21·0 (21·3)	2568	614	1·29 (5·86)	0·511 (229)	16·2 (3·61)
4·7 (4·8)	2715	649	0·68 (3·09)	1·191 (533)	7·0 (1·56)
13·7 (13·9)	2633	630	1·01 (4·59)	0·612 (274)	13·6 (3·03)

No load, maximum engine speed: 2781 rev/min

Equivalent crankshaft torque at maximum power: 43·0 lb ft (5·9 kg m)

Maximum equivalent crankshaft torque: 50·3 lb ft (7·0 kg m) at 1400 rev/min engine speed

Mean atmospheric conditions: temperature 76°F (24°C); pressure 29·69 in Hg (754 mm Hg); relative humidity 51%

Maximum temperature: coolant 215°F (102°C); engine oil 205°F (96°C); fuel 80°F (27°C)

The following results were obtained with the p.t.o. in high ratio

Horsepower (Metric hp)	Speeds, rev/min		Fuel consumption,		
	Engine	P.t.o.	UKgal/h (l/h)	lb/hp h (g/metric hp h)	hp h/UKgal (metric hp h/l)
Maximum power - 2 hour test					
21·5 (21·8)	2567	1053	1·31 (5·96)	0·507 (227)	16·4 (3·66)
Standard p.t.o. speed (1000 rev/min)					
20·7 (21·0)	2438	1000	1·25 (5·68)	0·500 (224)	16·6 (3·70)
The speed recommended by the manufacturer for drawbar work					
21·0 (21·3)	2500	1026	1·27 (5·77)	0·503 (225)	16·5 (3·68)

2. DRAWBAR PERFORMANCE

Date of tests: 27th October - 18th November 1969 Type of track: Concrete Height of drawbar above ground: 16½ in (419 mm)

Gear	Horse-power (metric hp)	Drawbar pull, lb (kg)	Speed, mile/h (km/h)	Engine speed, rev/min	Wheel-slip, %	Specific fuel consumption, lb/drawbar hp h (g/metric drawbar hp h)	drawbar hp h/UKgal (metric drawbar hp h/l)	Temperature, °F(°C) Coolant	Fuel	Engine oil	Atmospheric conditions Temperature, °F (°C)	Relative humidity, %	Pressure, in Hg (mm Hg)
(i) Maximum power (ballasted)													
1	* 8·9 (9·0)	3850 (1746)	0·87 (1·40)	2508	15·0	0·842 (377)	9·9 (2·21)	167 (75)	80 (27)	158 (70)	59 (15)	89	30·25 (768)
2	*12·5 (12·7)	3850 (1746)	1·22 (1·96)	2503	15·0	0·723 (323)	11·5 (2·57)	168 (76)	82 (28)	167 (75)	59 (15)	89	30·25 (768)
3	16·5 (16·7)	3700 (1678)	1·67 (2·69)	2480	14·0	0·643 (288)	12·9 (2·88)	181 (83)	78 (26)	162 (72)	58 (14)	88	30·25 (768)
4	17·3 (17·5)	2500 (1134)	2·60 (4·18)	2477	8·4	0·637 (285)	13·0 (2·90)	171 (77)	75 (24)	153 (67)	57 (14)	88	30·25 (768)
5	17·7 (17·9)	1825 (828)	3·64 (5·86)	2454	5·8	0·627 (280)	13·2 (2·94)	171 (77)	73 (23)	153 (67)	55 (13)	88	30·47 (774)
6	17·6 (17·8)	1325 (601)	4·98 (8·01)	2410	4·0	0·640 (286)	13·0 (2·90)	178 (81)	74 (23)	130 (54)	61 (16)	78	30·47 (774)
7	17·2 (17·4)	925 (420)	6·97 (11·21)	2400	2·9	0·651 (291)	12·7 (2·83)	173 (78)	76 (24)	133 (56)	63 (17)	79	30·47 (774)
(ii) Five hour test at 75% of pull at maximum power													
5	13·8 (14·0)	1370 (621)	3·78 (6·08)	2485	4·1	0·685 (306)	12·1 (2·70)	165 (74)	69 (21)	161 (72)	59 (15)	83	30·16 (766)
(iii) +Five hour test at pull corresponding to 15% wheelslip in test (i)													
2	-	3850 (1746)	1·33 (2·14)	-	-	-	-	170 (77)	80 (27)	171 (77)	56 (13)	82	30·17 (766)
(iv) Maximum power (unballasted)													
3	*11·9 (12·1)	2475 (1123)	1·80 (2·90)	2590	15·0	-	-	166 (74)	-	153 (67)	38 (3)	91	29·84 (758)
4	*16·7 (16·9)	2475 (1123)	2·53 (4·07)	2572	15·0	-	-	167 (75)	-	152 (67)	38 (3)	91	29·84 (758)
5	13·4 (13·7)	1800 (816)	3·83 (6·16)	2548	7·5	-	-	169 (76)	-	148 (64)	44 (7)	78	29·67 (754)
6	18·6 (18·9)	1300 (590)	5·37 (8·64)	2520	4·8	-	-	169 (76)	-	124 (51)	38 (3)	91	29·67 (754)
7	18·2 (18·5)	950 (431)	7·18 (11·55)	2500	3·1	-	-	168 (76)	-	141 (61)	38 (3)	91	29·38 (746)

Total oil consumption during ten hours duration of tests (ii) and (iii) 0·075 lb/h (34·0 g/h)

*Maximum power available at 15% wheelslip

+Test (iii) was carried out with additional ballast and the results for power, slip and fuel consumption have no practical significance

3. and 4. TURNING SPACE AND TURNING CIRCLE

Details of wheel equipment: As in specification, without ballast

Track of wheels: front - 44 in (1118 mm)
rear - 48 in (1219 mm)

	With brakes		Without brakes	
	Right hand	Left hand	Right hand	Left hand
Radius of turning space	9 ft 5 in (2·87 m)	8 ft 11 in (2·72 m)	10 ft 7 in (3·23 m)	10 ft 1 in (3·07 m)
Radius of turning circle	9 ft 2 in (2·79 m)	8 ft 8 in (2·64 m)	10 ft 4 in (3·15 m)	9 ft 9 in (2·97 m)

5. LOCATION OF CENTRE OF GRAVITY

Height above ground	20·4 in (518 mm)
Distance forward from the vertical plane containing the axis of the rear wheels	26·4 in (671 mm)
Distance from the median plane of the tractor	0

6. BRAKING

Date of tests: 10th November 1969 and 30th April 1970

Type of track: Concrete

Cold brakes

	Tractor without ballast		Tractor ballasted	
Travelling speed of tractor, mile/h (km/h)	14·7	(23·7)	14·7	(23·7)
Maximum deceleration, ft/s² (m/s²)	13·5	(4·1)	18·6	(5·7)
Stopping distance, ft (m)	17·3	(5·3)	21·8	(6·6)
Force on brake pedal, lb (kg)	114	(52)	186	(84)
Force exerted on brake pedal to achieve deceleration of 2·5 m/s² lb (kg)	40	(18)	50	(24)

Brake fade characteristics (hot tests)

Maximum deceleration hot/maximum deceleration cold x 100:	101%
Stopping distance cold/stopping distance hot x 100:	90%
Force on pedal cold/force on pedal hot x 100:	89%
Efficiency of parking latch:	Satisfactory hot and cold
Pull on handbrake:	None fitted

7. MEASUREMENT OF AMBIENT NOISE EMITTED BY THE TRACTOR

Date of tests:	5th November 1969	
Type of sound level meter:	Brüel and Kjaer Type 2203	
Type of track:	Concrete	
Results of tests:	gear	9th
	travelling speed before acceleration	11·0 mile/h (17·7 km/h)
	sound level	81 dBA

8. NOISE MEASUREMENTS AT THE DRIVER'S EAR LEVEL

Date of tests:	5th November 1969
Type of sound level meter and octave filter:	Brüel and Kjaer Type 2203 and 1612
Type of track:	Concrete

Results of Tests

Gear	Travelling speed, mile/h (km/h)	Loudness, Sones
5th	3·71 (5·97)	90

9. POWER LIFT AND HYDRAULIC PUMP PERFORMANCE

Date and location of tests: 7th - 15th April 1970; N.I.A.E., Silsoe, Bedford, U.K.

Hydraulic fluid:

Make and type:	Shell tractor oil Universal
Viscosity:	20W/30
Viscosity index:	105

	Vertical movement, in (mm)	Maximum force exerted through full range, lb (kg)	Pressure, lb/in² (kg/cm²)	Linkage load at which unballasted front end of tractor lifts off the ground, lb (kg)
Linkage giving maximum mechanical advantage At lower hitch points (height above ground in down position 9½ in (241 mm))	27 (686)	1432 (650)	2400 (169)	- -
On the frame 24 in (610 mm) to rear of lower hitch points	40½ (1029)	1093 (496)	2400 (169)	1153 (523)
Linkage giving minimum mechanical advantage At lower hitch points (height above ground in down position 4 in (102 mm))	30¾ (781)	1352 (613)	2400 (169)	- -
On the frame 24 in (610 mm) to rear of lower hitch points	51½ (1308)	753 (342)	2400 (169)	- -

Type of linkage lock for transport: Mechanical

Opening pressure of the cylinder over pressure relief valve (manufacturer's figures): None fitted

Pump characteristics

i) opening pressure of relief valve: 2100 lb/in² (148 kg/cm²)

sustained pressure of the open relief valve: 2400 lb/in² (169 kg/cm²)

Pump delivery rate at external tapping

ii) at minimum pressure (rated engine speed): 3·89 gal/min (17·7 l/min)

iii) at maximum hydraulic power: 3·68 gal/min (16·7 l/min)

delivery pressure: 2100 lb/in² (148 kg/cm²)

power: 5·44 hp (5·52 metric hp)

OPTIONAL TESTS

11. PERFORMANCE AT THE BELT PULLEY

Date and location of tests: 21st August 1969; N.I.A.E., Silsoe, Bedford, U.K.

Type of dynamometer: Water brake, Heenan and Froude

Horsepower (Metric hp)	Speeds, rev/min		Fuel consumption,		
	Engine	Belt Pulley	UKgal/h (l/h)	lb/hp h (g/metric hp h)	hp h/UKgal (metric hp h/l)
Maximum power - 2 hour test					
19·8 (20·1)	2566	1382	1·30 (5·91)	0·545 (244)	15·2 (3·39)
Standard belt speed of 3100 ft/min (945 m/min)					
19·0 (19·3)	2386	1285	1·20 (5·46)	0·525 (235)	15·8 (3·52)
The speed recommended by the manufacturer for drawbar work					
19·5 (19·8)	2500	1346	1·26 (5·73)	0·537 (240)	15·4 (3·44)
Fuel consumption at part loads					
17·1 (17·3)	2612	1407	1·17 (5·32)	0·569 (255)	14·6 (3·26)
0	2767	1490	0·55 (2·50)	-	-
8·7 (8·8)	2669	1437	0·86 (3·91)	0·824 (369)	10·1 (2·25)
19·8 (20·1)	2569	1383	1·30 (5·91)	0·545 (244)	15·2 (3·39)
4·5 (4·6)	2716	1463	0·71 (3·23)	1·311 (586)	6·3 (1·41)
12·9 (13·1)	2628	1415	1·02 (4·64)	0·653 (292)	12·7 (2·83)

No load, maximum engine speed: 2767 rev/min

Equivalent crankshaft torque at maximum power: 40·5 lb ft (5·6 kg m)

Maximum equivalent crankshaft torque: 50·1 lb ft (6·9 kg m) at 1400 rev/min engine speed

Mean atmospheric conditions:
temperature 65°F (18°C)
pressure 29·86 in Hg (758 mm Hg)
relative humidity 66%

Maximum temperature:
coolant 208°F (98°C)
engine oil 199°F (93°C)
fuel 73°F (23°C)

15. REPAIRS AND ADJUSTMENTS DURING TESTS

During preliminary tests a new hydraulic lift pump and a high pressure hydraulic pipe were fitted.

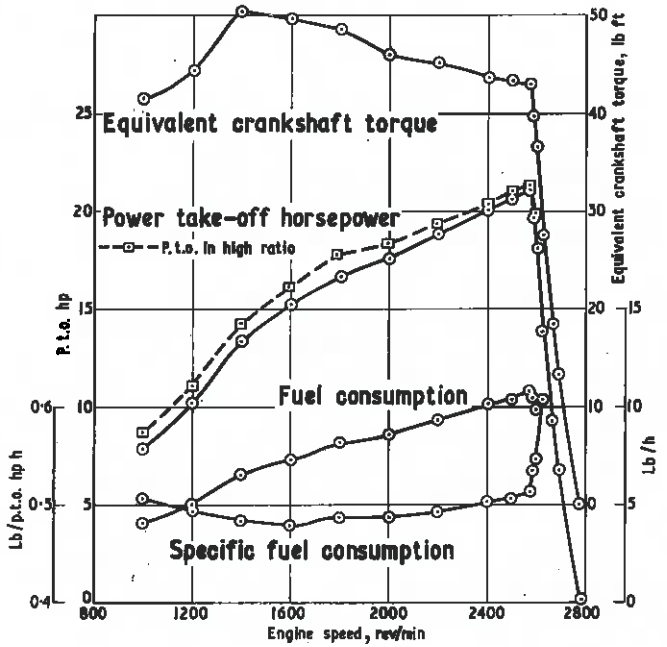
REMARKS

Oil leaked from around the engine dipstick during drawbar tests.

Officer in charge: D.W. SMITH

Head of Tractor and Ergonomics Department: J. MATTHEWS

Date: 4th August 1970



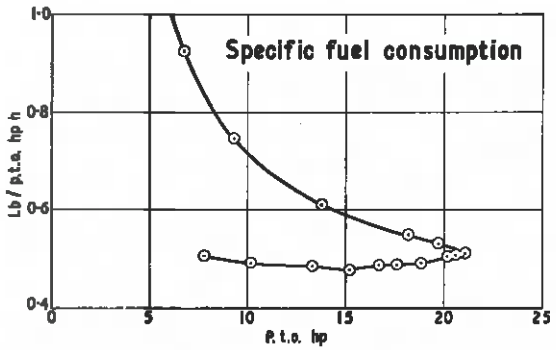
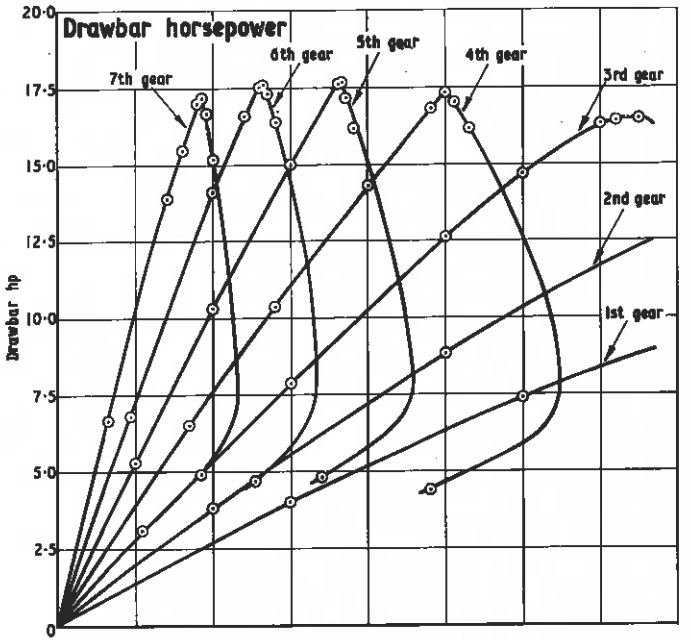


Fig.1. Power take-off test



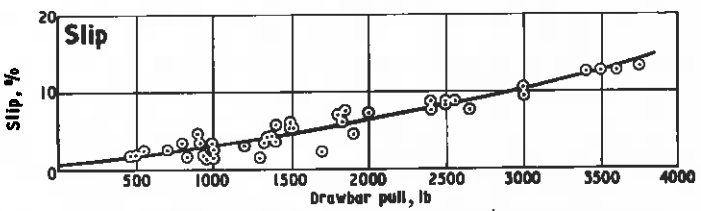


Fig.2. Drawbar test on concrete, with ballast

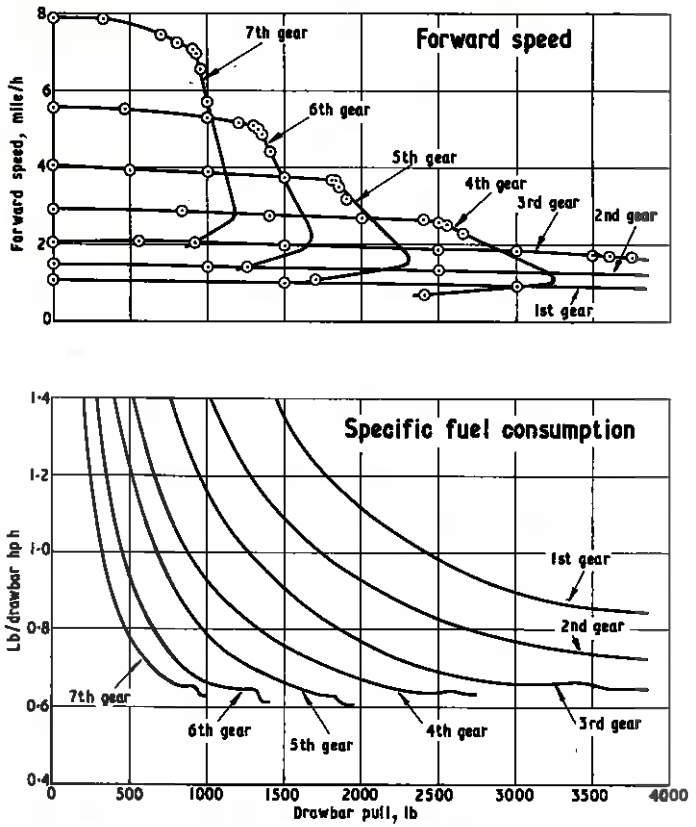


Fig.3. Drawbar test on concrete, with ballast

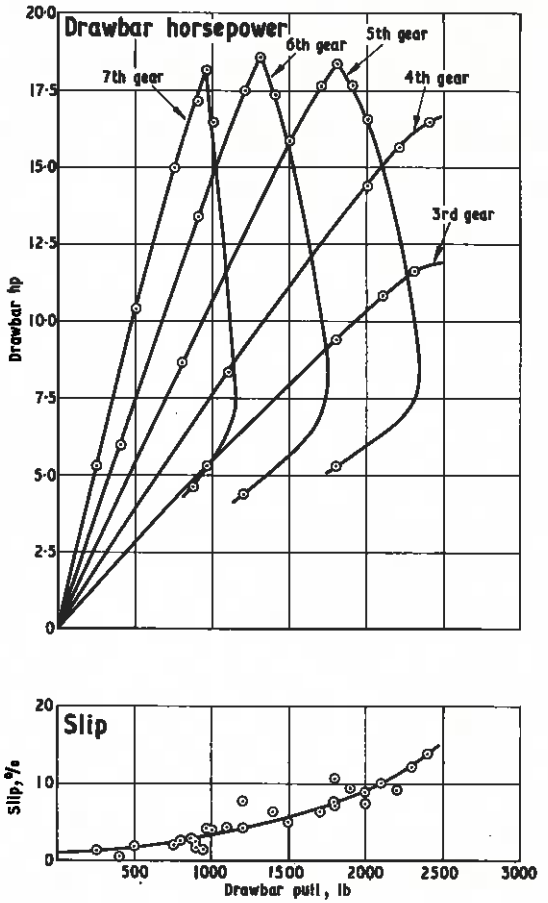
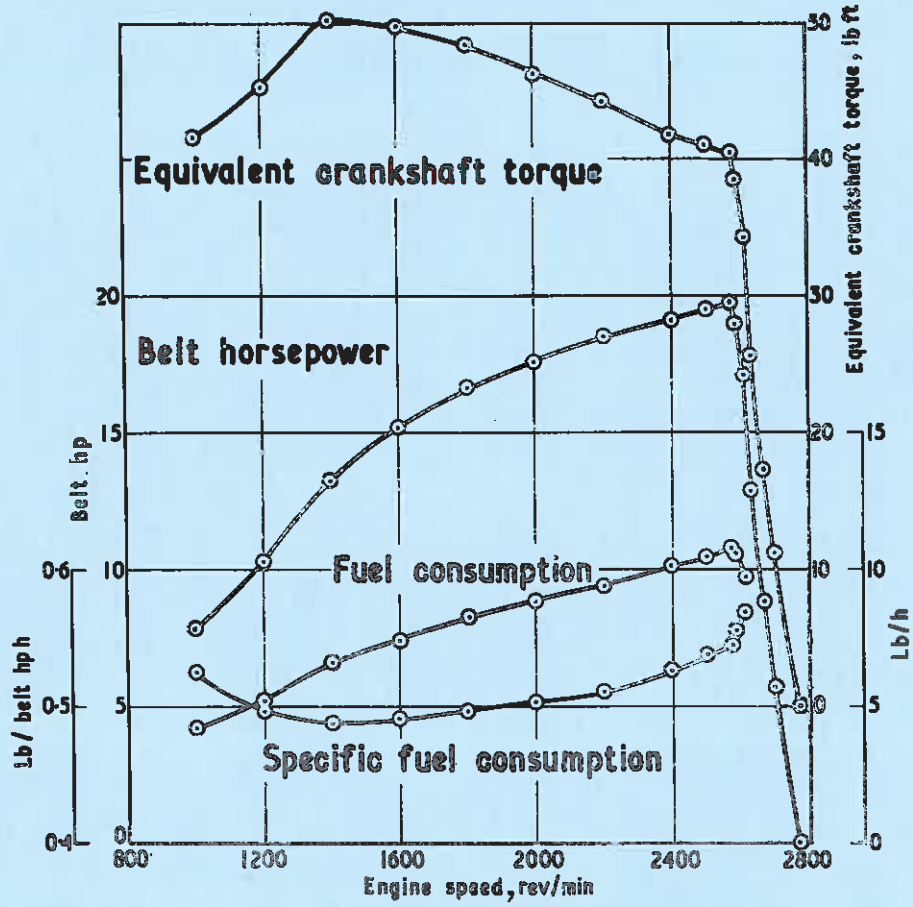


Fig.4. Drawbar test on concrete, without ballast



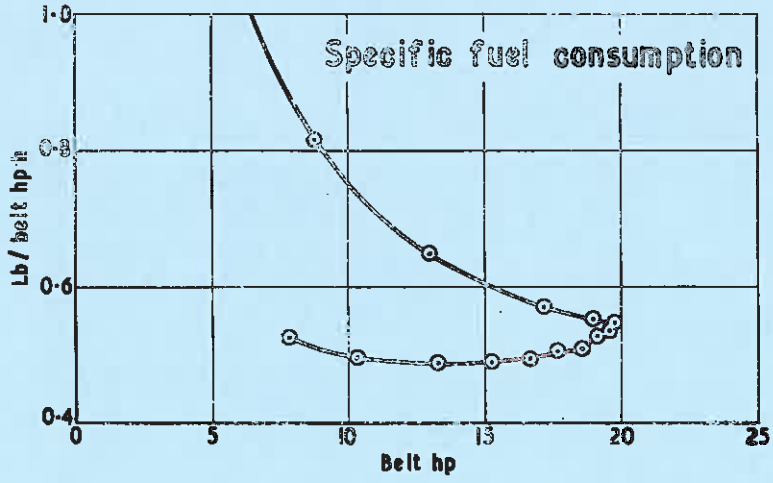


Fig. 5. Belt test

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