Report 597/O.E.C.D.
January 1969

REPORT ON TEST IN ACCORDANCE WITH O.E.C.D. TEST CODE FOR AGRICULTURAL TRACTORS OF

B.M.C. NUFFIELD MODEL 3/45 TRACTOR

Manufactured by: B.M.C Scotland,
Truck and Tractor Division,
Bathgate,
West Lothian, Scotland



Test No.: R.68/5504/O.E.C.D.

This report has been approved by the O.E.C.D. Coordinating Centre (C.N.E.E.M.A., France) as being in accordance with the O.E.C.D. Tractor Test Code
Date of Approval: 31st December 1968 *Serial No.:* 260

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:	B.M.C. Scotland, Truck and Tractor Division, Bathgate, West Lothian, Scotland
Selected and submitted for test by:	The manufacturer
Place of running-in:	B.M.C. (Scotland) Limited
Duration of running-in:	50 hours

Tractor

Make:	B.M.C. Nuffield
Model:	3/45
Serial No.:	45N 100938

Engine

Make:	B.M.C.	Model:	28TD
Type:	Direct injection diesel	Serial No.:	28TD/1397/2658

Cylinders:	3 cylinders, vertical, in-line, 3.937 in (100 mm) bore x 4.724 in (120 mm) stroke, capacity 173 in^3 (2.84 l), compression ratio 16.5:1, overhead valves, replaceable wet cylinder liners
Fuel system:	AC type U fuel feed pump, gauze filter in tank, Simms dual paper element filters incorporating sediment bowls on delivery side of feed pump, fuel tank capacity 15½ UKgal (70.5 l); Simms type P4824 injection pump, Serial No. CM 11566, manufacturer's production setting for injection pump 13.85 pt/h (7.87 l/h) - 13.43 pt/h (7.63 l/h) at 1500 rev/min engine speed on full load; Simms type NL 341 injector nozzles, injection pressure 175 atm (183 kg/cm^2)
Governor:	Simms mechanical, incorporated in fuel injection pump, governed range of engine speed 600 to 2380 rev/min, rated engine speed 2200 rev/min
Air cleaner:	Cooper's paper element type with centrifugal pre-cleaner above hood
Lubrication system:	Forced feed from eccentric rotor type pump with metal strainer in sump, A.P. replaceable paper element full flow filter, oil capacity 15 pt (8.5 l), recommended oil change period 200 h

Cooling system:	Water cooled, impeller assisted with 16 in (406 mm) dia 2-blade belt driven fan, cooling water capacity 17½ pt (9.7 l), thermostat for temperature control, no loss system, fitted with expansion tank, pressurized at 10 lb/in^2 (0.70 kg/cm2)
Starting system:	Electrical, 12V Lucas type M50G solenoid engaged starter motor, operable only with gear selector lever in neutral position; excess fuel device on fuel injection pump for cold starting
Electrical system	Voltage: 12 Generator: Lucas type C40T Battery: Lucas type BHV 17A, lead acid, capacity 98 Ah

Transmission

Clutch:	Borg and Beck dual dry clutch, two 11 in (279 mm) dia plates, one pedal operated for gearbox drive and one hand lever operated for p.t.o. drive
Gearbox:	Own make, sliding gear, 10 forward and 2 reverse speeds
Rear axle and final drives:	Own make, crown wheel and bevel pinion with spur gear final drives; pedal operated mechanical differential lock
Oil capacity:	Gearbox and rear axle 96 pt (54.6 l)

Gear	Number of engine revolutions for 1 revolution of driving wheel	Nominal travelling speed for 2200 rev/min rated speed of engine, mile/h	(km/h)
Forward			
1	225.3	1.43	(2.30)
2	177.7	1.82	(2.93)
3	142.5	2.26	(3.64)
4	112.4	2.87	(4.62)
5	89.19	3.62	(5.82)
6	70.33	4.59	(7.39)
7	49.49	6.52	(10.49)
8	39.03	8.27	(13.31)
9	23.34	13.82	(22.24)
10	18.41	17.53	(28.21)
Reverse			
1	76.96	4.19	(6.74)
2	60.67	5.32	(8.56)

Power take-off	At rear of tractor, $1\frac{3}{8}$ in (34.9 mm) dia, 6-spline, height above ground $28\frac{1}{2}$ in (724 mm); proportional engine speed giving 655 rev/min at 2200 rev/min rated engine speed, 540 rev/min standard p.t.o. speed at 1813 rev/min engine speed; direction of rotation clockwise viewed from driving end
Belt pulley	Not fitted for test
Power lift	Own make, hydraulic, gear pump driven independently from the main clutch, operated either together with or independently of the power take-off by selector lever, supplies oil from transmission to a ram cylinder and external tappings. Category 1 and 2 implement linkage with depth control from draught response
Drawbar	Swinging drawbar as tested, vertical heights above ground to centre of clevis, maximum $21\frac{3}{8}$ in (543 mm), minimum $12\frac{3}{4}$ in (324 mm), changed by inverting drawbar; distance from rear axle $35\frac{5}{8}$ in (905 mm), position relative to p.t.o. 14 in (356 mm) to rear, lateral adjustment $24\frac{1}{2}$ in (622 mm), pivot position relative to rear wheel centre $8\frac{3}{8}$ in (213 mm) to rear
Hitch	Towing hitch combined with front weight carrier, height above ground to centre of clevis $26\frac{3}{8}$ in (670 mm)
Steering	Cam Gears, worm and peg type with single drag link
Brakes	Girling multi-disc brakes mounted on final drive pinion shafts, operated independently or together by pedals, hand lever with ratchet operating both brakes for parking
Wheels	
Steering wheels:	Two at front, Dunlop Tractor TF9 6.00 - 16 tyres, 6 ply rating; maximum permissible weight on each tyre 1260 lb (572 kg) at 48 lb/in^2 (3.4 kg/cm^2); track widths 52 in (1321 mm) by 2 in (51 mm) steps to 68 in (1727 mm) changed by extending front axle
Driving wheels:	Two at rear, Dunlop Fieldmaster RT40 13 - 28 tyres, 6 ply rating; maximum permissible weight on each tyre 3320 lb (1506 kg) at 18 lb/in^2 (1.3 kg/cm^2); track widths 56 in (1422 mm) by 4 in (102 mm) steps to 80 in (2032 mm) changed by reversing wheels and offset lug type rims
Wheelbase:	75 in (1905 mm)

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

Weight without ballast	Front:	1898 lb (861 kg)
	Rear:	3260 lb (1479 kg)
	Total:	5158 lb (2340 kg)
Ballast	Front:	Weights - 1 per wheel, total 177 lb (80 kg)
		- 4 frame weights and frame, total 259 lb (117 kg)
		Water - nil
	Rear:	Weights - 7 per wheel, total 1473 lb (668 kg)
		Water - 1154 lb (523 kg)
Weight with full ballast	Front:	2408 lb (1092 kg)
	Rear:	5813 lb (2637 kg)
	Total:	8221 lb (3729 kg)

Seat

Bostrom, with matching back rest, parallelogram linkage; torsion bar suspension adjustable for driver's weight, hydraulic damping; range of adjustment 3 in (76 mm) fore and aft

Number of grease points

Whole tractor: 12

Overall dimensions

Overall length:	Without ballast weights 10 ft 0 in (3.05 m) to rear of rear tyres
	With front frame weights 11 ft $3\frac{3}{4}$ in (3.45 m) to rear of rear tyres
Overall width:	Without ballast weights 5 ft $11\frac{1}{2}$ in (1.82 m) at 56 in (1422 mm) track
	With ballast weights 6 ft $7\frac{1}{2}$ in (2.02 m) at 56 in (1422 mm) track
Overall height:	To top of steering wheel $62\frac{3}{8}$ in (1584 mm)
	To top of exhaust pipe $85\frac{1}{2}$ in (2172 mm)
Minimum ground clearance:	To underside of drawbar frame $15\frac{1}{2}$ in (394 mm)

Lighting

	Height above ground of centre, in (cm)	Size, in (cm)	Distance from outside edge of tractor at 56 in (1422 mm) wheel track, to centre, in (cm)
Headlights	37 (94.0)	4 (10.2) dia	$29\frac{1}{4}$ (74.3)
Side lights	52 (132.1)	$4\frac{1}{2}$ (11.4) x 2 (5.1)	$7\frac{1}{4}$ (18.4)
Rear lights	$51\frac{1}{2}$ (130.8)	$4\frac{1}{2}$ (11.4) x 2 (5.1)	$6\frac{3}{4}$ (17.1)
Reflectors	47 (119.4)	$2\frac{3}{4}$ (7.0) x $1\frac{1}{4}$ (3.2)	$6\frac{3}{4}$ (17.1)

Unrestricted beam angle of headlight in plan view 60°

FUELS AND LUBRICANTS USED IN TESTS

Laboratory and track tests

Fuel:	Diesel oil, density 0.845 at 60°F (15.6°C), Cetane No. 53, to Class A, B.S.2869:1957
Engine oil:	SAE 20
Transmission oil:	SAE 20W/30

COMPULSORY TESTS

1. MAIN POWER TAKE-OFF PERFORMANCE

Date and location of tests: 2nd August 1968; 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					
40.9 (41.5)	2200	655	2.37 (10.77)	0.490 (219)	17.2 (3.84)
Standard p.t.o. speed (540 rev/min)					
37.8 (38.3)	1813	540	2.00 (9.09)	0.447 (200)	18.9 (4.22)
Standard belt speed of 3100 ft/min (945 m/min)					
			Not applicable		
Speed recommended by the manufacturer for drawbar work					
40.9 (41.5)	2200	655	2.37 (10.77)	0.490 (219)	17.2 (3.84)
Fuel consumption at part loads					
35.4 (35.9)	2243	668	2.09 (9.50)	0.500 (224)	16.9 (3.77)
0	2383	710	0.86 (3.91)	-	-
18.1 (18.4)	2296	684	1.40 (6.36)	0.653 (292)	12.9 (2.88)
40.9 (41.5)	2200	655	2.37 (10.77)	0.490 (219)	17.2 (3.84)
9.3 (9.4)	2343	698	1.11 (5.05)	1.010 (452)	8.4 (1.87)
26.9 (27.3)	2274	677	1.72 (7.82)	0.540 (242)	15.7 (3.50)

No load, maximum engine speed: 2383 rev/min

Equivalent crankshaft torque at maximum power: 97.6 lb ft (13.5 kg m)

Maximum equivalent crankshaft torque: 116.4 lb ft (16.1 kg m) at 1430 rev/min engine speed

Mean atmospheric conditions:

temperature	66°F (19°C)
pressure	30.00 in Hg (762 mm Hg)
relative humidity	66%

Maximum temperature:

coolant	179°F (82°C)
engine oil	234°F (112°C)
fuel	86°F (30°C)

2. DRAWBAR PERFORMANCE

Date of tests: 18th September - 11th October 1968 Type of track: Tarmacadam Height of drawbar above ground: 18½ in (470 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)	Specific fuel consumption, 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)													
1st L	*22.6 (22.9)	6750 (3062)	1.26 (2.03)	2271	15.0	0.685 (306)	12.3 (2.74)	179 (82)	68 (20)	183 (84)	67 (19)	75	29.28 (744)
1st H	*28.4 (28.8)	6750 (3062)	1.58 (2.54)	2235	15.0	0.660 (295)	12.8 (2.86)	180 (82)	72 (22)	179 (82)	63 (17)	69	29.27 (743)
2nd L	32.6 (33.1)	6200 (2812)	1.97 (3.17)	2198	12.1	0.619 (277)	13.7 (3.06)	181 (83)	72 (22)	192 (89)	67 (19)	75	29.28 (744)
2nd H	35.0 (35.5)	5000 (2268)	2.63 (4.23)	2173	8.0	0.576 (258)	14.7 (3.28)	182 (83)	86 (30)	198 (92)	62 (17)	74	29.28 (744)
3rd L	36.0 (36.5)	4000 (1814)	3.37 (5.42)	2187	5.9	0.563 (252)	15.0 (3.35)	184 (84)	80 (27)	180 (82)	62 (17)	74	29.91 (760)
3rd H	35.9 (36.4)	3050 (1383)	4.41 (7.10)	2194	4.1	0.571 (255)	14.8 (3.30)	185 (85)	73 (23)	185 (85)	62 (17)	79	29.86 (758)
4th L	36.6 (37.1)	2150 (975)	6.38 (10.27)	2205	2.8	0.562 (251)	15.0 (3.35)	180 (82)	70 (21)	177 (81)	58 (14)	88	29.86 (758)
4th H	35.9 (36.4)	1650 (748)	8.17 (13.15)	2202	2.0	0.566 (253)	14.9 (3.32)	177 (81)	83 (28)	182 (83)	69 (21)	81	29.56 (751)
(ii) Five hour test at 75% of pull at maximum power													
3rd L	28.4 (28.8)	3000 (1361)	3.54 (5.70)	2245	4.0	0.597 (267)	14.2 (3.17)	183 (84)	77 (25)	223 (106)	66 (19)	80	29.96 (761)
(iii) +Five hour test at pull corresponding to 15% wheelslip in test (i)													
1st H	-	6750 (3062)	1.66 (2.67)	-	-	-	-	181 (83)	73 (23)	216 (102)	60 (16)	83	30.00 (762)
(iv) Maximum power (unballasted)													
2nd H	29.7 (30.1)	4450 (2019)	2.50 (4.02)	2248	15.0	-	-	181 (83)	-	208 (98)	63 (17)	84	29.73 (755)
3rd L	35.2 (35.7)	4000 (1814)	3.30 (5.31)	2211	9.5	-	-	182 (83)	-	200 (93)	61 (16)	89	29.73 (755)
3rd H	35.7 (36.2)	3100 (1406)	4.32 (6.95)	2190	5.6	-	-	180 (82)	-	200 (93)	67 (19)	62	29.68 (754)
4th L	35.9 (36.4)	2180 (989)	6.18 (9.94)	2150	3.5	-	-	179 (82)	-	190 (88)	67 (19)	75	29.68 (754)
4th H	35.0 (35.5)	1650 (748)	7.94 (12.78)	2148	2.5	-	-	177 (81)	-	174 (79)	66 (19)	66	29.68 (754)

Total oil consumption during ten hours duration of tests (ii) and (iii) 0.175 lb/h (79.4 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 - 52 in (1321 mm)
Rear - 56 in (1422 mm)

	With brakes		Without brakes	
	Right hand	Left hand	Right hand	Left hand
Radius of turning space	10 ft 10 in (3.30 m)	10 ft 6½ in (3.21 m)	11 ft 9½ in (3.59 m)	12 ft 1 in (3.68 m)
Radius of turning circle	10 ft 4 in (3.15 m)	10 ft 0½ in (3.06 m)	11 ft 3½ in (3.44 m)	11 ft 7 in (3.53 m)

5. LOCATION OF CENTRE OF GRAVITY

Height above ground	30.2 in (767 mm)
Distance forward from the vertical plane containing the axis of the rear wheels	27.1 in (688 mm)
Distance from the median plane of the tractor	0

6. BRAKING

Date of tests: 4th and 10th October 1968

Type of track: Tarmacadam

Cold brakes

	Tractor without ballast		Tractor ballasted	
Travelling speed of tractor, mile/h (km/h)	15.5	(25.0)	15.5	(25.0)
Maximum deceleration, ft/s^2 (m/s^2)	16.5	(5.0)	18.7	(5.7)
Stopping distance, ft (m)	19.1	(5.8)	18.5	(5.6)
Force on brake pedal, lb (kg)	70	(32)	76	(34)

Brake fade characteristics (hot tests)

Maximum deceleration hot/maximum deceleration cold x 100: 93%

Stopping distance cold/stopping distance hot x 100: 100%

Force on pedal cold/force on pedal hot x 100: 93%

Efficiency of handbrake: Satisfactory

Pull on handbrake: 115 lb (52 kg)

7. MEASUREMENT OF AMBIENT NOISE EMITTED BY THE TRACTOR

Date of tests:	4th October 1968	
Type of sound level meter:	Brüel and Kjoer Type 2203	
Type of track:	Tarmacadam	
Results of tests:	gear	5th H
	travelling speed before acceleration	14.1 mile/h (22.8 km/h)
	sound level	90 dBA

8. NOISE MEASUREMENTS AT THE DRIVER'S EAR LEVEL

Date of tests:	4th October 1968
Type of sound level meter and octave filter:	Brüel and Kjoer Type 2203 with octave filter set Type 1612
Type of track:	Tarmacadam

Results of Tests

Gear	Travelling speed, mile/h (km/h)	Loudness, sones
3rd H	4.52 (7.27)	155

9. POWER LIFT AND HYDRAULIC PUMP PERFORMANCE

Date and location of tests: 22nd and 25th November 1968; N.I.A.E., Silsoe, Bedford, U.K.

Hydraulic fluid

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

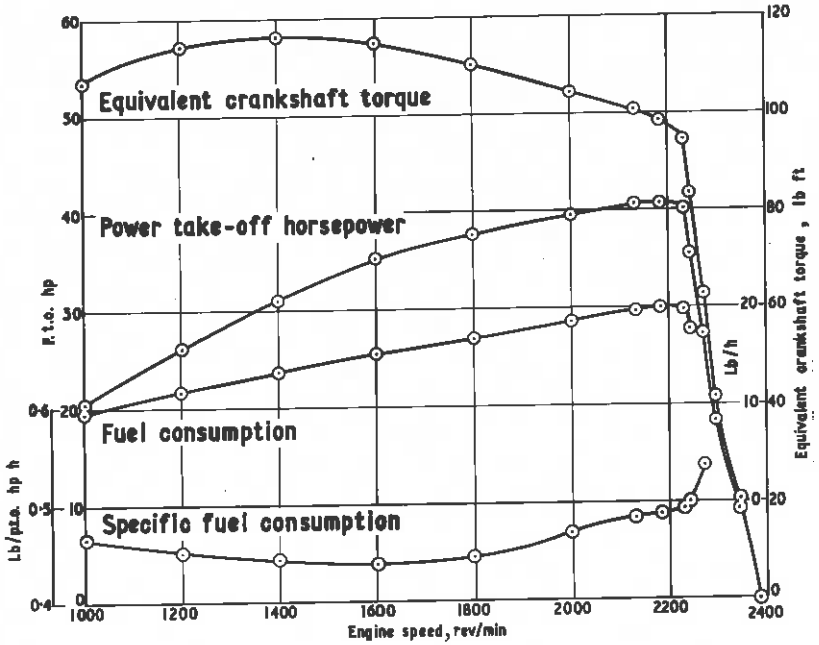
	Vertical movement, in (mm)	Maximum force exerted through full range, lb (kg)	Pressure, lb/in^2 (kg/cm^2)	Linkage load at which unballasted front end of tractor lifts off the ground, lb (kg)
Linkage giving maximum mechanical advantage				
At lower hitch points (height above ground in down position 15 in (381 mm))	22 (559)	5200 (2359)	2740 (193)	3300 (1497)
On the frame 24 in (610 mm) to rear of lower hitch points	28 (711)	4160 (1887)	2740 (193)	2000 (907)
Linkage giving minimum mechanical advantage				
At lower hitch points (height above ground in down position 8 in (203 mm))	23 (584)	5000 (2268)	2740 (193)	3400 (1542)
On the frame 24 in (610 mm) to rear of lower hitch points	24½ (622)	4500 (2041)	2740 (193)	2000 (907)

Type of linkage lock for transport	Mechanical	
Opening pressure of the cylinder over pressure relief valve (manufacturer's figures):	Not applicable, mechanical lock	
Pump characteristics		
i) opening pressure of relief valve:	2000 lb/in^2	(141 kg/cm^2)
sustained pressure of the open relief valve:	2870 lb/in^2	(202 kg/cm^2)
Pump delivery rate at external tapping		
ii) at minimum pressure (rated engine speed):	6.76 gal/min	(30.7 l/min)
iii) at maximum hydraulic power:	6.82 gal/min	(31.0 l/min)
delivery pressure:	2100 lb/in^2	(148 kg/cm^2)
power:	10.03 hp	(10.17 metric hp)
15. REPAIRS AND ADJUSTMENTS DURING TESTS	None	
REMARKS	None	

Officer in charge: D.W. SMITH

Head of Testing Division: T.C.D. MANBY

Date: 6th January 1969



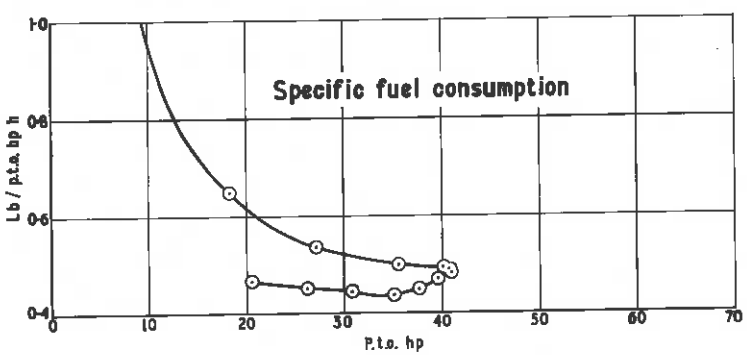


Fig. 1 Power take-off test

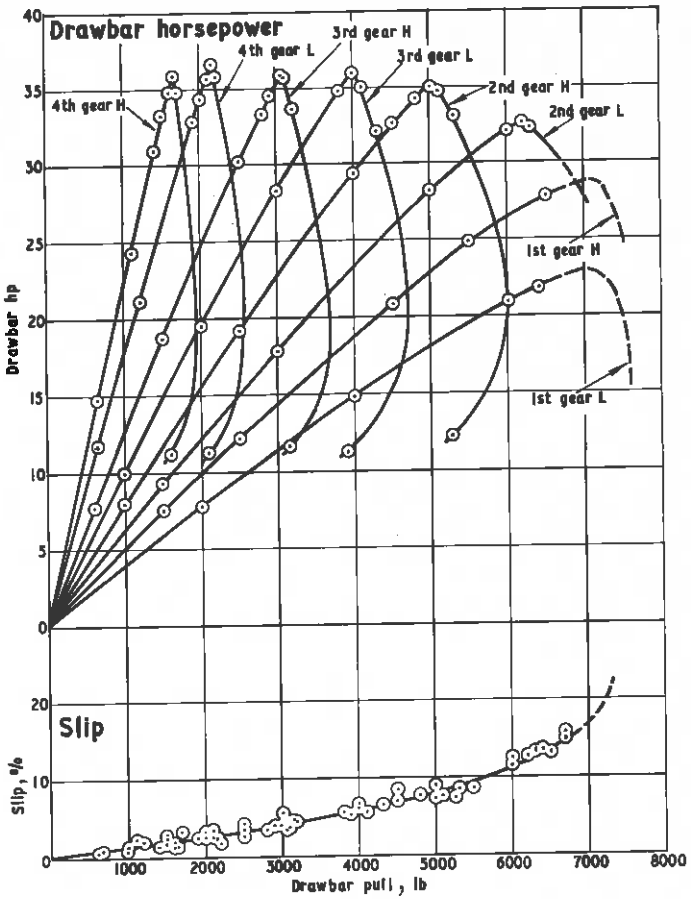


Fig. 2 Drawbar test on tarmacadam, with ballast

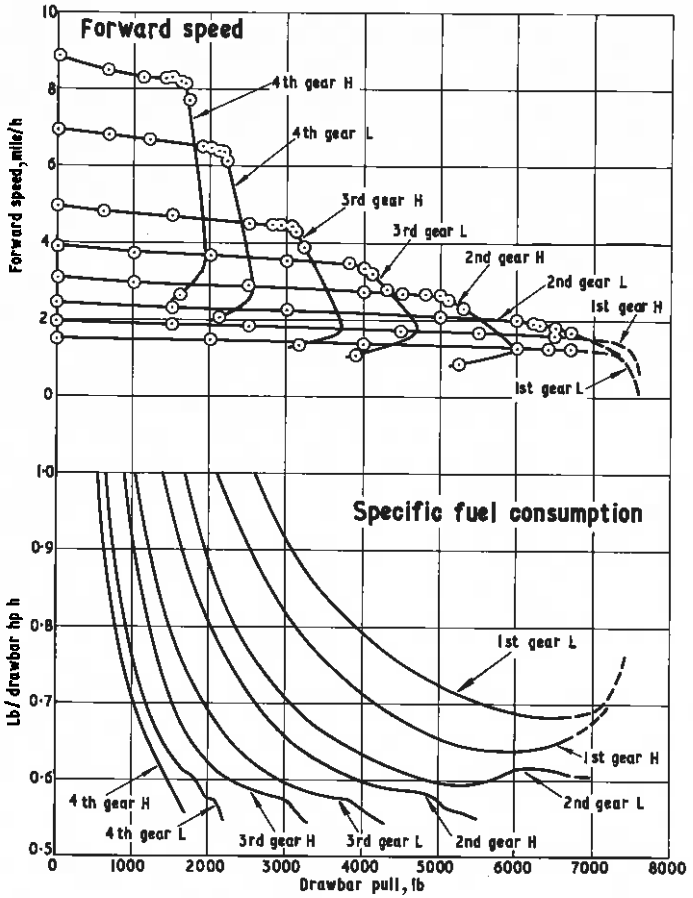


Fig.3. Drawbar test on tarmacadam, with ballast

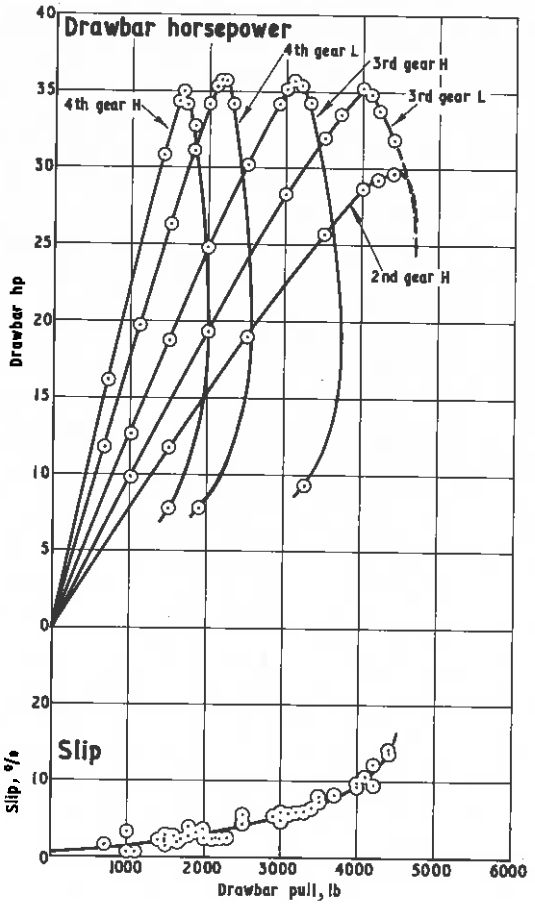


Fig. 4. Drawbar test on tarmacadam, without ballast

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