THE ECONOMICS OF ROAD TRANSPORT OF BEEF CATTLE

NORTHERN TERRITORY AND QUEENSLAND CHANNEL COUNTRY

1959

BUREAU OF AGRICULTURAL ECONOMICS | CANBERRA | AUSTRALIA

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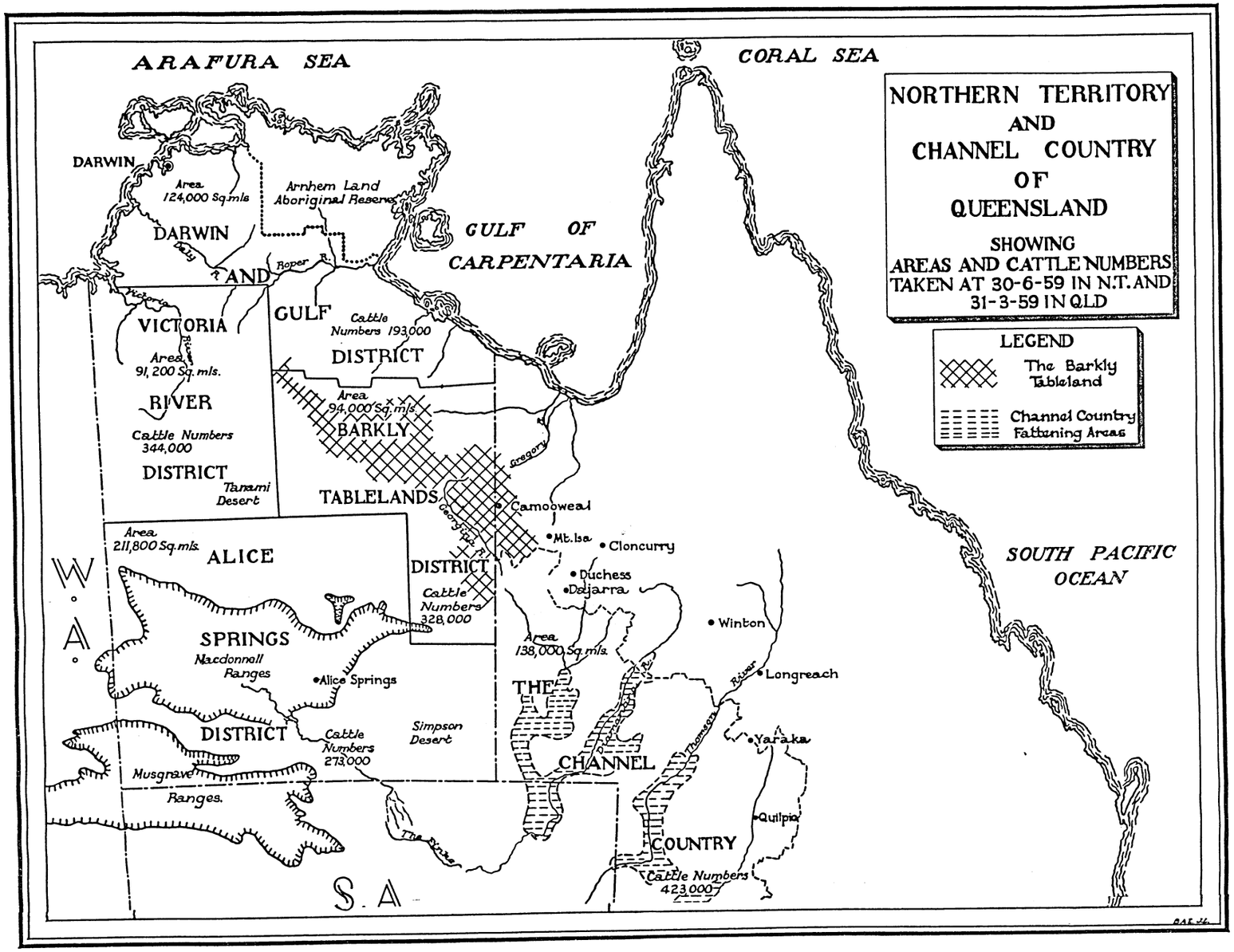
ARAFURA SEA
CORAL SEA
NORTHERN TERRITORY AND CHANNEL COUNTRY OF QUEENSLAND
SHOWING AREAS AND CATTLE NUMBERS TAKEN AT 30-6-59 IN N.T. AND 31-3-59 IN QLD
LEGEND
The Barkly Tableland
Channel Country Fattening Areas
DARWIN
Area 124,000 Sq.mls
Arnhem Land Aboriginal Reserve
DARWIN
AND
GULF OF CARPENTARIA
Roper R.
VICTORIA
RIVER
DISTRICT
Area 91,200 Sq.mls.
Cattle Numbers 344,000
Tanami Desert
GULF
DISTRICT
Cattle Numbers 193,000
Area 94,000 Sq.mls.
BARKLY
TABLELANDS
Gregory R.
Georgina R.
Camooweal
Mt. Isa
Cloncurry
Duchess
Dajarra
Area 211,800 Sq.mls.
ALICE
SPRINGS
DISTRICT
Macdonnell Ranges
Alice Springs
Cattle Numbers 328,000
Area 138,000 Sq.mls.
THE
CHANNEL
COUNTRY
Cattle Numbers 423,000
Winton
Longreach
Thomson River
Yaraka
Quilpie
Simpson Desert
Cattle Numbers 273,000
Musgrave Ranges.
The Diamantina
W.A.
S.A
SOUTH PACIFIC OCEAN

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PREFACE.

The Bureau of Agricultural Economics has undertaken an investigation of the economics of road transport of beef cattle in the remote parts of Australia inadequately served by railways. The survey commenced in 1958 when investigations were carried out in the pastoral areas of Western Australia and a report entitled "The Economics of Road Transport of Beef Cattle - Western Australian Pastoral Areas" was subsequently issued. This report, the second in the series, concerns investigations recently completed in the Northern Territory and Channel Country of Queensland.

These economic enquiries have been undertaken as part of the Bureau's normal programme of research into the problems of the beef cattle industry. It is recognized that effective internal transport is an important factor in beef cattle production: the use of motor transport can lead to an avoidance of the weight losses and deaths which often occur when cattle are walked to railheads or killing centres, especially when stock route conditions are adverse. Younger chiller-type animals may be turned off, and younger store cattle moved to fattening areas elsewhere. In time of drought, when stock routes are closed, herds may be moved to agistment in other districts.

The enquiries preceding this report were carried out during the period June to September, 1959. The Bureau is indebted to the Northern Territory Pastoral Lessees' Association and the Centralian Pastoralists' Association for their co-operation, and to the pastoralists interviewed, for their advice, assistance and hospitality. Considerable information and assistance were most generously given by the road hauliers, stock and station agents, pastoral companies, and Commonwealth and State authorities. The Commonwealth Department of Territories gave valuable help particularly in connection with the planning of the survey, while the co-operation and assistance received from officers of the Northern Territory Administration Division, especially the Animal Industry Branch, did much to ensure the success of the investigations in the Territory. Thanks are due to the Commonwealth Department of Shipping and Transport; and also to the Queensland Department of Agriculture and Stock not only for the information which was freely supplied but also for its practical advice and assistance.

Field investigations were in charge of Mr. W.T. Allen who also prepared the report, assisted by Messrs. J. Van Holst Pellekaan and W. Bodle.

A.C.B. MAIDEN
Director
Bureau of Agricultural Economics

Canberra, A.C.T.
May, 1960

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SUMMARY.

PART I: THE DISTRIBUTION AND MOVEMENTS OF CATTLE.

1. The Alice Springs District accounts for 24% of the cattle in the Northern Territory, the Barkly Tableland District 29%, the Victoria River District 30% and the Darwin and Gulf District 17%.

2. Figures available suggest that cattle numbers in the Northern Territory have increased by 28% since 1937. The Alice Springs District showed a fourfold increase while in the Barkly Tableland District an increase of 20% occurred. In the Darwin and Gulf District and the Victoria River District numbers have until recently shown a downward trend.

3. In the Queensland Channel Country cattle numbers have increased by 24% since 1945.

4. Quarantine regulations applying to the Northern Territory prohibit the movement of cattle from pleuro-pneumonia affected areas to the southern states except by road transport for immediate slaughter. Store cattle from the Alice Springs District may be marketed freely in the pleuro-free areas of the South.

5. Cattle from the tick-infested areas of the Northern Territory are only permitted to enter Queensland or to move south if regulations regarding dippings have been satisfied.

6. The total number of cattle turned off from the Northern Territory during 1958-59 was :-

Alice Springs District	82,700 (81,000 South Australia, 1,700 local consumption)
Darwin & Gulf District	16,600 (4,000 Queensland, 6,400 exported via Darwin, 6,200 Darwin local supply)
Victoria River District	22,600 (9,700 Queensland, 9,300 Wyndham, 3,300 export through Darwin, 300 Darwin local supply)
Barkly Tableland	51,100 (50,100 Queensland, 1,000 South Australia)
Origin unknown	2,500 (for local consumption)
	175,500

In addition to the above, inter-property transfers accounted for approximately 20,000 head.

7. The annual average turn-off for the Channel Country during the seasons 1952 to 1956 was 65,000 head, and for the ten year period to 1957, some 50,000 head per annum.

8. In 1958-59 some 22% of all cattle turned off in the Northern Territory were road transported, mostly in the Alice Springs District where 35% of the total turn-off was road trained, largely to railheads. In the Barkly Tableland District, the only other area in the Northern Territory where road train movements of any consequence occurred, about 15% of the total turn-off was road transported.

9. Only a small number of cattle were road transported in the Channel Country, probably not more than 10% during the 1959 season.

PART II: COST OF ROAD TRANSPORT.

1. There are two distinct hauls of beef cattle in the Northern Territory. The most important is the movement in the Alice Springs District to the local railheads, while the other is from Helen Springs to Camooweal, and Mt. Isa railhead.

2. Nineteen road trains, operated by the major hauliers in the Northern Territory are examined in this study. An average annual distance of 16,600 miles was completed by these trains.

3. The road trains included in the survey have been placed in three separate groups, namely large diesels, medium diesels and petrol vehicles. The average costs for the three groups are given below.

—	Large diesels	Medium diesels	Petrol vehicles
	£. s. d.	£. s. d.	£. s. d.
Cost per road train per 100 miles loaded	132. 4. 10	43. 17. 2	57. 7. 2
Cost per bullock per 100 miles	2. 0. 1	1. 19. 10	2. 14. 8
Cost per ton - mile	9.6	9.6	1. 1.1

The cost per unit varied by as much as 70% between highest and lowest values in any one group. This variation was due principally to the different capacity of road trains, and the variation in the annual mileage.

4. Comparison between the three groups of road trains shows that large diesels are potentially the most economic vehicles to operate for the transport of cattle in the Northern Territory. Costs were calculated for a cost-model powered by a 170 b.h.p. diesel prime mover with two trailers attached - the train carried a total of 60 bullocks. The operational cost for this train was estimated to be approximately 27s. per bullock per 100 miles for an annual distance travelled of 40,000 miles.

5. Net returns to hauliers averaged approximately 4s.,5s. and -9s. per bullock per 100 miles for the large diesels, medium diesels and petrol vehicles respectively.

6. Sales tax and the tax on diesel fuel together represent an increase of approximately 9.2% on the operational costs of the above road train.

7. Sealed roads in the Territory could reduce the costs of road transport by approximately 2s. per bullock per 100 miles.

8. The average capital investment in vehicles and equipment in the Territory is approximately £28,180, £4,910 and £4,450 for the large diesels, medium diesels and petrol vehicles respectively.

PART III: THE SUITABILITY OF VEHICLES.

1. Apparently the most satisfactory vehicle on earth-formed roads is a 200 b.h.p. prime mover pulling two trailers with a total capacity of approximately 60 bullocks. Two trains using 250 b.h.p. prime movers and pulling two trailers, with a total capacity of 80 large bullocks, have been operating successfully on the bitumen roads.

2. It has been suggested that vehicles require a moderately high ratio of brake horsepower to weight for satisfactory operation to reduce wear and tear to a minimum, speed up turn-around, increase the distance cattle can be transported in a single haul, and reduce the jolting, bruising and fatigue of cattle.

3. Large trains provide certain economies of operation. In the Alice Springs District most vehicles are considerably smaller than the optimum size, partly due to poor roads but mainly to lack of capital, while low annual mileage travelled often results in uneconomic operation.

4. The size of the road train is limited by road conditions, the need to avoid jolting and sway, and the number of cattle available for loading at particular points.

PART IV: THE SUITABILITY OF ROADS.

1. Cattle can be successfully transported only on first class earth roads which are maintained in good condition during the period of turn-off.

2. Most earth-formed roads in the Northern Territory are unsuitable for the road transport of cattle, some 85% of these being graded bush tracks. In the Channel Country there are a number of well-improved roads but due to problems of flooding they are deficient for the road transport of cattle. In these remote areas satisfactory maintenance of roads is a problem.

3. The standard of road required depends amongst other things on the type and number of cattle to be transported, the length of the turn-off season, the nature of the country and the climatic conditions of the area. In the remote areas under consideration it appears that, generally speaking, the standard of road that can be justified on a benefit - cost basis is an earth formed road of "Class B" or "Class C" standard, although there may be exceptions.

4. If road transport in the Northern Territory develops according to the expected pattern, consideration should be given to bituminising the road from the Barkly Highway to Ranken Dip and perhaps the extension to Connell's Dip.

5. Suggestions have been made for sealing the road from Currawilla to Quilpie in the Channel Country. This road would be most important if road transport developed here, but the level to which it can be economically developed will depend on the attitude of pastoralists to the use of road transport, and certain other factors, the influence of which are at present unascertainable.

6. Access roads to properties both in the Northern Territory and the Channel Country are generally poor. However, this problem could be largely overcome by the provision of trucking facilities at strategic points, including centrally situated dips.

PART V: THE DEVELOPMENT OF ROAD TRANSPORT.

1. Road transport of beef cattle is as yet only in its infancy in the Northern Territory and Channel Country of Queensland, but in the Alice Springs District, where it has been increasingly used during the last three years, pastoralists have become aware of its many advantages, especially its effectiveness in speedily marketing small numbers of prime stock and moving drought-affected stock out of the area.

2. Some lessees have objected to the use of road transport for marketing cattle on the grounds of its costly nature and the fact that it can cause excessive bruising. In the case of fat cattle the additional cost of road transport is more than compensated for by improved market prices. In the case of store cattle the cost argument is valid under present conditions but this could be largely overcome by turning off weaner-type stores and using more efficient transport. In many cases the causes of bruising are due to factors outside the control of the haulier, e.g. poor roads and rough treatment by stockmen during mustering and loading.

3. Certain organizational problems exist in the use of road transport including the lack of vehicles in the number required and suitable loading facilities, and the need for the co-ordination and streamlining of road and rail services.

4. Road transport has certain limitations as a means of marketing cattle. These arise mainly from the effect of distance on costs and on the condition of the cattle. Except in the cases of small mobs, it is more economic to use station droving plants where the distance involved is less than 100 miles. Experience has shown that cattle travel well in transport for up to 16-18 hours.

5. The fact that cattle can be road transported for long distances in a single stage largely overcomes the need for resting paddocks and facilities.

6. The price that can be paid for road transport depends very much on the market price for cattle. The average net price of £30 a head on trucks at Alice Springs received for fat cattle in 1958-59 would have justified road transport up to 444 miles, while the average net price of £20 on trucks for store cattle would have permitted an economic haul of up to 222 miles.

PART VI: SCOPE FOR THE INCREASED USE OF ROAD TRANSPORT.

1. Further development of road transport will depend on its increased acceptance by pastoralists, increased turn-off, marketing considerations and road development. In the Alice Springs District a large portion of the annual turn-off of 60,000 to 80,000 head is from areas where road transport could be economically used. Some 70% of the annual turn-off from the Victoria River District is from areas where the use of road transport, with improved roads, could be economic. On the Barkly Tableland an average of 60,000 head of cattle, mainly stores, cross into Queensland each year from areas accessible to road transport. The proportion of turn-off from the Darwin and Gulf District which might be road transported is difficult to assess.

2. In the Channel Country, a large proportion of the annual turn-off of approximately 50,000 to 60,000 head could be road transported if a suitable system of roads and loading facilities were available.

3. There is a considerable potential for increased turn-off in each of the above areas. The realization of this potential will depend to a large extent on the maintenance of a high level of prosperity within the industry. In the short run, prospects are good.

4. If road transport were used, younger cattle could be marketed and a more uniform age of turn-off achieved. This would mean a larger annual turn-off which in turn would lead to an increased demand for transport.

5. There is an increasing demand by cattle fatteners in the South for young store cattle from Central Australia. An efficient transport service at reasonable prices can assist this integration and ensure its smooth development.

6. Should agricultural development be successfully undertaken in the Top End and fattening areas established, road transport could be effectively utilized to bring in store cattle from the adjacent breeding areas.

7. The development of road transport would be affected to some extent by the traditional practice of walking cattle for excessive distances across the Barkly Tableland to fattening properties in Queensland.

NORTHERN TERRITORY AND QUEENSLAND CHANNEL COUNTRY SURVEY LOCATION MAP NO. 1

SCALE OF MILES

100 0 100 200 300

·REFERENCE·

Sealed Roads.....

Other Roads & Tracks ..

Dist. & Shire Boundaries

Stock Routes.....

Stations .....

Towns & Junctions

ARAFURA SEA

GULF OF CARPENTARIA

DARWIN

Van Diemen Gulf

DARWIN & GULF DISTRICT

Arnhem Land

Adelaide River

Daly R.

Katherine R.

Katherine

Manbulloo

Mataranka

Elsey

Larrimah

Victoria R.

Coolibah

Auvergne

To Wyndham

Victoria River D.

Humbert R.

Top Springs

Daly Waters

Nutwood Downs

McArthur R.

Roper R.

Vanderlin Is.

Mallapunyah

To Wyndham

Limbunya

Wave Hill

Newcastle Waters

Ucharonidge

Anthony Lagoon

Nicholson R.

Burketown

Normanton

Croydon

Forsayth

Cairns

Townsville

Gregory R.

BARKLY TABLELAND

Helen Springs

Brunette Downs

Banka Banka

Brunchilly

Connell's Dip

Alexandria

Rockhampton D.

Ranken Dip

Alroy Downs

Rockland

Tennant Creek

Soudan

Camooweal

Dobbyn

Avon D.

Austral D.

Yelvertoft

Barkley Downs

Mt Isa

Cloncurry

Hughenden

VICTORIA RIVER DISTRICT

Tanami Desert

To Gordon D.

The Granites

Lake Nash

Elkedra

Argadargada

Urandangi

Duchess

Dajarra

Walgra

Anningie

Ammaroo

Mt Doreen

Mt Allan

Mt Skinner

Woodgreen

Mt Swan

Mt Riddoch

Jervois Range

Tobermorey

BOULIA SHIRE

Roxborough Downs

Boulia

Winton

Marion Downs

Springvale

Longreach

Rockhampton

Narwietooma

Alice Springs

Todd River

Macdonnell Ranges

Deep Well

Henbury

ALICE SPRINGS DISTRICT

Simpson Desert

DIAMANTINA SHIRE

Bedourie

Kamaran

Glengyle

Monkira

BARCOO SHIRE

Jundah

Yaraka

Currawilla

Blackall

Morney

Windorah

Roseberth

Birdsville

Tanbar

Ayers Rock

Erldunda

Kulgera

To Adelaide

QUILPIE SHIRE

Mt Howitt

Quilpie

Eromanga

Charleville

Thargomindah

Cunnamulla

BULLOO SHIRE

BRISBANE

To Broken Hill

To Bourke

WESTERN AUSTRALIA

SOUTH AUSTRALIA

NEW SOUTH WALES

INTRODUCTION.

In those remote parts of Australia where there are no railways, the use of road transport for the overland movement of stock is the only alternative to droving. While it has many other uses, such as the short haul of stock to railheads and inter-property transfers of cattle, it is for long distance hauls that road transport has become increasingly important. Its development has been given impetus by the continuing shortage of satisfactory drovers and the need to turn off younger and better quality cattle in order to meet changing market requirements.

The apparent advantages of the use of motor vehicles include the following:

(a) cattle may be delivered speedily to meatworks without the loss of weight that often occurs during droving, particularly when seasonal conditions are adverse or when stock routes are eaten out;

(b) younger fat cattle, which could not endure a long droving trip, may be turned off;

(c) store stock which are too young for droving long distances over difficult stock routes may be transported to fattening areas, thus assisting in the turn-off of young fat cattle;

(d) cattle from tick-free areas may be taken through infested areas without losses from tick fever; and

(e) cattle which might otherwise be lost may be moved quickly from drought-affected areas.

Road transport of beef cattle is by no means a new development in Australia; records show that as far back as the late 'twenties, cattle were moved by motor transport in the Meekatharra area of Western Australia. The vehicles used, typified by the Diamond "T", had a carrying capacity of about fifteen medium-sized bullocks and would be regarded as small compared with many of the vehicles used today. Such ventures were usually economically unsound because of excessive wear and tear (due partly to poor road conditions and the unsuitability of the vehicles) and the relatively small pay load carried. However, particularly during the post-war period, there has been a trend towards the use of high-powered diesel-operated prime movers, hauling a greatly increased pay load. This has resulted in considerably reduced operating expenses per unit carried. Significant advances have also been made in improving the design and structure of tyres, previously an important limiting factor in the efficiency of operations. The result has been to broaden the field in which road transport may be used and to increase the length of hauls. The increased economic efficiency resulting from technological advances in the automobile and allied industries could not have been realized without the provision of more suitable roads, which have reduced delays and improved operating schedules. Most roads, however, still need considerable development.

PART I: THE DISTRIBUTION AND MOVEMENT OF CATTLE.

DISTRIBUTION.

Northern Territory.

There are four fairly distinct cattle regions in the Northern Territory, each corresponding largely, but not completely, to an Administrative District. They are the Darwin and Gulf District, the Victoria River District, the Alice Springs District and the Barkly Tableland District (See Map No. 1). For convenience the use of these Districts has been adopted in this report. Due to their distance from markets, their state of development and the nature of their road and rail facilities, these Districts may be regarded as remote, for the purposes of the survey. A brief description of the four Districts is given in Appendix A.

From Table No. I it will be noted that at the end of June 1959 the number of cattle in the Northern Territory was estimated at 1,138,000 or 114,000 less than in the previous year. From 1937 to 1959 numbers increased in the Territory by 28%. This development has not been linear, and Graph I gives an indication of the fluctuations which have been largely due to the variations in seasonal conditions, although the trend has also been influenced by the level of management and the availability of markets. In the light of the estimated potential in these Districts an increase of only 28% is not particularly gratifying. Most of this increase took place in the Alice Springs District where numbers rose from about 70,600 in 1937 to 353,200 in 1958, an increase of 400%. Continuing drought conditions, however, caused heavy losses in 1959 on some leases which together with the consequent sale of large numbers of store cattle, reduced numbers in this District to 273,000 head.

Table No. I.

Distribution of Cattle: Northern Territory[a].

At 30 June 1959

District	Cattle Nos.	% of Total
	'000	%
Darwin & Gulf	193	17
Victoria River	344	30
Barkly Tableland	328	29
Alice Springs	273	24
Total	1,138	100%

(a) These figures are obtained from lessees' annual stock returns which in some cases may not be particularly accurate.

Source: Northern Territory Administration, Animal Industry Branch, Thirteenth Annual Report, 1958-59

The trend in numbers of cattle in the Darwin and Gulf and Victoria River Districts has, over the last 21 years, been in a downward direction. Graph 1 however shows that cattle numbers have shown a limited increase in recent years.

The factors influencing this trend, especially the lack of satisfactory markets, will be discussed in a later part of the report. In the Barkly Tableland District numbers have not increased significantly over this period due largely to the effect of recurrent droughts assisted no doubt by the inadequacy of waters. Due to unfavourable seasonal conditions, the numbers in this region fell by more than 40,000 during the year 1958-59.

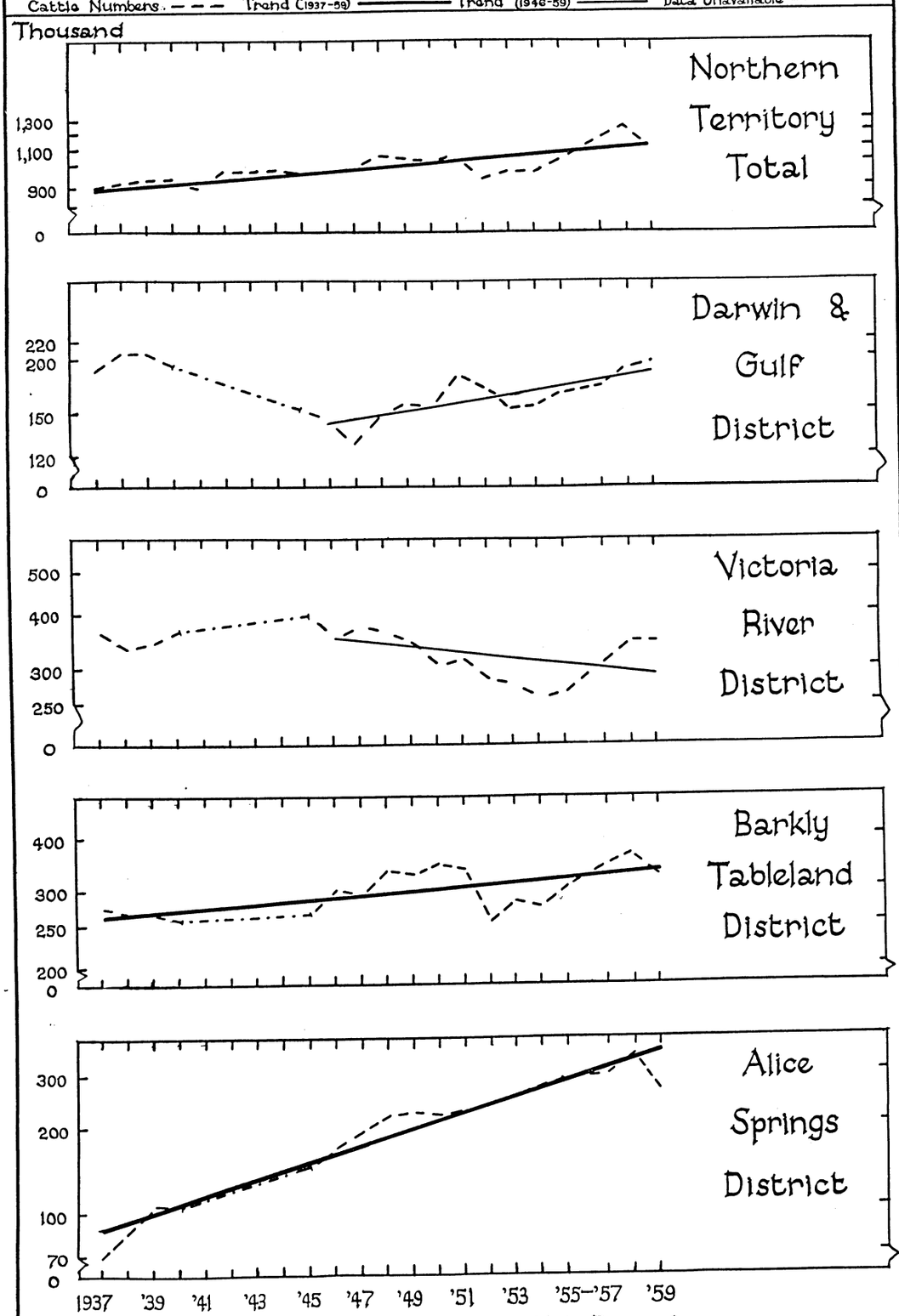
Channel Country: Queensland.

Kelly[1] has estimated that the Queensland Channel Country comprises the whole of Diamantina Shire, most of Boulia, Barcoo and Bulloo Shires, about 70% of Winton Shire and more than a third of Quilpie

(1) J.H. Kelly The Beef-Cattle Industry in the Leichhardt-Gilbert Region of Queensland p.70. Bureau of Agricultural Economics, Canberra.
For a brief description of the Channel Country see Appendix A.

Graph 1

Trends in Cattle Numbers 1937–59 – Northern Territory By Districts



Note.. Numbers were taken on the 31st December in the years 1937–55 and on the 30th June in 1957–58–59.

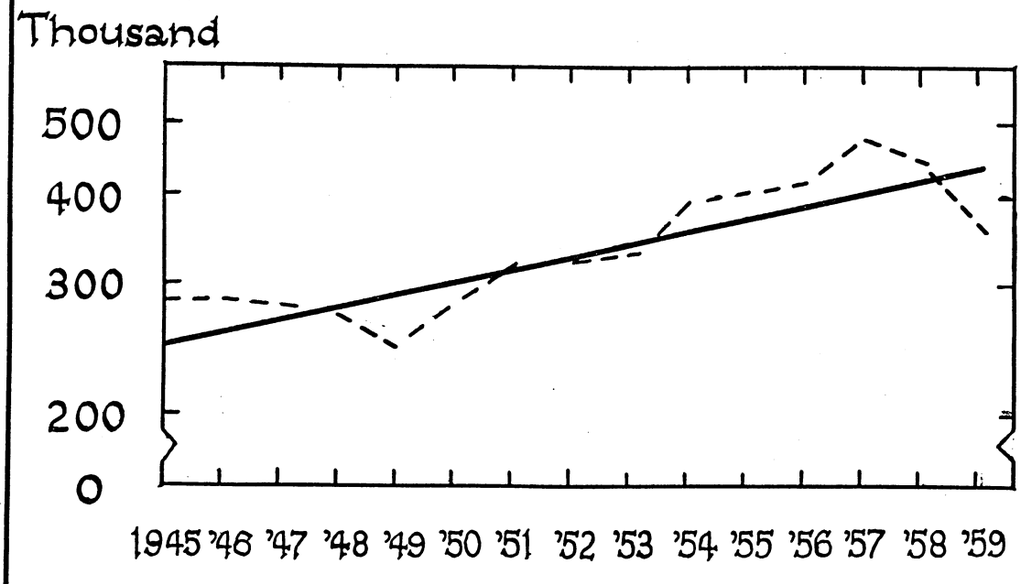
R.H.

Graph 2

Trends in Cattle Numbers 1945-59

Queensland Channel Country

Cattle Numbers ------ Trend ——————



Note.. Numbers are taken on 31st March each year.

R.H.

Shire. This region is mainly a fattening area drawing a considerable proportion of its store cattle from the Barkly Tableland, while some of the major company interests in this latter region also control fattening properties in the Channel Country. Because of the integration of these two regions, the Channel Country of Queensland has been included with the Northern Territory in this investigation.

Cattle numbers in the recognized Channel Country of Queensland, as estimated at 31 March 1959, are shown in Table No. 2. Almost 80% of these are in the Far Western Statistical Division while the remaining 20% are in the South Western Statistical Division. The remoteness of a large part of the region in relation to railheads and the stores market, combined with the effects of periodic droughts, suggests that road transport could play an important role in the marketing of cattle.

Graph II, which indicates an upward trend in cattle numbers, clearly shows the effect of seasonal fluctuations during the period of 1945-1959, the period for which figures are available. Overall numbers have increased by 48% over the period. As will be seen later, further development depends not only on the improvement of management, but to a great extent on provision of improved cattle transport facilities.

Table No. 2.

Distribution of Cattle: Channel Country: Queensland.

At 31 March 1959

Shire	Cattle Nos.	% in Channel Country (a)	Nos. in Channel Country	% of Total
	'000		'000	
Diamantina	93	100	93	26
Boulia	100	80	80	23
Winton	58	70	41	12
Quilpie	61	40	24	7
Bulloo	63	80	50	14
Barcoo	87	75	65	18
Total	462		353	100

(a) Percentages as published by J.H. Kelly in The Beef Cattle Industry in the Leichhardt-Gilbert Region of Queensland, op. cit.

Source: Deputy Commonwealth Statistician, Brisbane.

EFFECT OF QUARANTINE REGULATIONS.

Quarantine regulations affect cattle movement in two ways:-

(a) by restricting the movement of cattle from pleuro-pneumonia infected areas; and

(b) by imposing controls for the prevention of the spread of cattle tick.

Restrictions on the Movement of Cattle from Pleuro-Infected Areas.

In February 1956 the northern boundary of the pleuro-free area in South Australia was extended from what had become known as the "Quorn line" to the 19th South parallel of latitude. The north-eastern boundary, however, was designed to exclude the Barkly stock route, which is used by large numbers of store cattle from affected areas. As will be seen from Map No. 2, the eastern boundary follows the 137th East meridian of longitude. From the above date the free movement of cattle from the northern areas to the Alice Springs District and the movement of stores from east of the Great Lakes to the western half of the pastoral areas of northern South Australia has been prohibited. Thus, for the purposes of this investigation, all cattle coming south from the Victoria River, Darwin and Gulf, and Barkly Tableland Districts, and cattle entering South Australia from the Channel Country of Queensland, are subject to quarantine restrictions. The main effects of these restrictions are :-

(i) cattle from the areas subject to restrictions cannot move into protected areas of the Northern Territory, South Australia, Victoria or New South Wales except under strict supervision for immediate slaughter at Alice Springs, Tennant Creek or Adelaide;

(ii) cattle for immediate slaughter from these areas are permitted to pass through protected areas only if they are transported. Duplicate yards for the control of such cattle being trucked to Adelaide have been erected at Alice Springs, Marree, Port Augusta and Adelaide; and

(iii) store cattle from the Alice Springs District can be marketed freely in the pleuro-free areas of south-eastern South Australia, Victoria and New South Wales. The recent provision of duplicate yards at Adelaide has made it possible to market store cattle there for distribution to other areas and other states.

Store cattle crossing into Queensland may not cross the border unless they have been free of pleuro outbreaks for the preceeding sixty days. All such cattle are inoculated prior to leaving the stations.

Tick Control.

That part of the Northern Territory south of the 20th parallel of latitude is in the tick-free area (See Map No. 2). Cattle coming into this area are given a clean treatment, i.e. stock are dipped until clean and then given one additional dipping.

Tick-infested cattle are not permitted to enter Queensland, and to comply with this ruling the Animal Industry Branch of the Northern Territory Administration controls a number of dips strategically situated on the major stock routes through which all cattle travelling along those routes must pass. Before reaching the Queensland border cattle might receive up to five dippings. Road transported cattle are given only one dipping or spraying, which is usually carried out before they are loaded on the transports. There are, in addition to those mentioned, dips on the Queensland border at Camooweal and Lake Nash, supervised by officers of the Queensland State Department of Agriculture and Stock. Cattle arriving at a clearing dip such as Lake Nash are dipped if free of tick and allowed to pass on. If however they are infested on arrival they are dipped, held for five days and re-inspected. Cattle coming through Camooweal are dipped and then clean dipped at Yelvertoft, except road transported cattle which are cleared at Camooweal.

The tick-free area in Western Queensland is roughly defined by the Camooweal-Cloncurry road. Cattle going from the north into the tick-free area must be clean dipped, while those going for immediate slaughter need to be dipped only once.

Problems may arise with road transported store cattle if they are unsatisfactorily sprayed, or for any other reason reach the border in a tick-infested condition. This could mean delays of more than five days, and the additional handling involved could considerably increase the cost of road transport.

The movement of cattle from the Northern Territory to Western Australia is unrestricted, as all stock routes from the Territory lead into ticky areas in Western Australia.

MOVEMENTS.

Table No. 3 shows approximate numbers of cattle moved from the remote areas in the Northern Territory and their destinations for the year 1958-59. The direction of these movements is indicated on Map No. 2.

Table No. 3:

Cattle Movements from the Northern Territory.

Year ended 30 June 1959.

Destination	Darwin Gulf	V.R.D.	Barkly T'land	Alice Springs	Not known	Total
South Australia	-	-	1,000	80,968	-	81,968
Queensland	4,026	9,700	50,077	-	-	63,803
Wyndham	-	9,294	-	-	-	9,294
Philippines)						3,928
Hong Kong)						3,451
Queensland,) Via Darwin)	6,446	3,313	-	-	-	2,380
Local Consumption						
Darwin	6,154	318	-	-	-	6,472
Alice Springs	-	-	25	1,747	-	1,772
Other N.T. Towns	-	-	-	-	2,500	2,500
Total	16,626	22,625	51,102	82,715	2,500	175,568

Source: Partly ex Northern Territory Admin. Animal Husbandry Branch Thirteenth Annual Report, 1958-59.

Note: For numbers forwarded to each destination during period 1948-49 to 1958-59 see Appendix B.

NORTHERN TERRITORY AND QUEENSLAND CHANNEL COUNTRY CATTLE TURN-OFF & NUMBER EXPORTED THROUGH MAJOR OUTLETS 1958-59 MAP NO. 2

SCALE OF MILES
100 0 100 200 300

To Philippines & Hong Kong
7,400
2,400
To Queensland
DARWIN
16,000
Darwin - Gulf District
Adelaide Riv.
1,000
Fountain Head
3,000
Katherine
500
300
Mataranka
3300
5,900
Larrimah
2,000
To Wyndham
9,300
9,700
Victoria Riv. District Total No.344,000
Top Springs
Darwin & Gulf District Total No.193,000
4,000
Wollogorang
To Q'ld. Stations
Newcastle Waters
17,200
Wave Hill
Victoria River District
14,000
21,000
Barkly Tableland District
Tot. No.328,000
Tick Area Boundary
18,700
Camooweal 52,300
Mt Isa 41,200
To Townsville
Lake Nash 6,900
2,000
Butru & Dajarra 58,500
Winton 82,400
To Rockhampton
W. A.
Alice Springs Distn.
Alice Springs District Total No.273,000
15,500
16,500
17,000
Alice Springs 49,000
4,500
9,300
Deep Well
2,800
Rumbalara
Finke
18,400
Abminga
400
To Adelaide 82,100
Plains-Dajarra Area Boundary
Boulia
Channel Country Total No. 353,000
Diamantina
Barcoo
Channel Country Turn-Off Approx. 65,000
Quilpie
Quilpie 34,500
To Brisbane
Bulloo
9,400
Cunnamulla
To Brisbane
BRISBANE
14,500
Marree
Hungerford
10,100
7,600
Barringun
To other stations
To other stations
11,400
Bourke
S. A.
N. S. W.

This dissection in some cases is an approximation, but the figures are sufficiently accurate to indicate the pattern of cattle movements.

During 1958-59 some 12,500 fats and 51,300 store cattle crossed into Queensland. This was considerably less than the number usually available for export, owing to adverse seasonal conditions in the previous year and early part of 1958-59 which caused heavy losses on some leases. Cattle railed from the Alice Springs District in the year under review were nearly 18,000 more than the previous highest total of 64,234 in 1956. This was mainly due to the sale of large numbers of stores from drought-affected Centralian leases to buyers from South Australia, Victoria and New South Wales, who were anxious to restock after the drought of the previous year in those States. More than 17,000 head of store cattle were walked from company-owned properties in the Victoria River District to the staging depot at Helen Springs for transfer to Queensland properties.

Table No. 3 shows that of the total Northern Territory turn-off in 1958-59 some 28% came from the Barkly Tableland, 47% from the Alice Springs District, 13% from the Victoria River District and 10% from the Darwin and Gulf District.

Table No. 4 compares numbers transported by road to the various destinations in 1958-59 with the total exported to each of these markets in that year.

Table No. 4:

Number of Cattle Road Transported Compared with Total

Turn-Off: 1958-59

Destination	Total exported	Numbers road transported	% of total turnoff
South Aust. and Alice Springs local supply	83,740	29,010	35
Queensland	63,800	9,630	15
Wyndham	9,290	-	-
Export through Darwin and Darwin Local Supply	16,230	410	3
Other N.T. Towns	2,500	260	10
Total	175,560	39,310	22

Source: Northern Territory Administration, Animal Industry Branch (Unpublished Data).

In addition to the above, 939 cattle, including 598 bulls, were road transported from railheads to Northern Territory properties, and 1,714 cattle, including 282 bulls, were road transported in intra-Territory movements.

Darwin and Gulf District.

Some 37% of the turn-off from this District went to meet the local Darwin demand, while another 24% mainly from stations in the eastern section, were exported to Queensland. The remaining 39% of turn-off went to supply the live cattle trade with the Philippines, Hong Kong and Queensland. Trade with the Philippines was revived in October 1957 after a lapse of three years, and since then more than 5,800 head of cattle have been exported to that market. The Philippine market demands good quality beef, and the

Northern Territory Administration states that it is difficult to find a regular supply of the class of cattle required, in the "Top End", i.e. those parts of the Darwin and Gulf, Barkly Tableland and Victoria River Districts, for which Darwin is the natural outlet. Since the latter half of 1958 a market in Hong Kong has been established, and cattle have also been transported by sea to Cairns and Brisbane. From Table No. 3 it will be seen that during 1958-59 the Hong Kong market accounted for 3,451 head of turn-off, while 2,380 head of cattle were forwarded by sea to Queensland. It was expected at the time of the investigation that another 2,200 would be shipped to Queensland before September 1959 and that possibly 1,000 a month would be supplied to Asian markets, mainly Hong Kong. The Hong Kong market, established in November 1958, is confidently expected to expand if buying arrangements can be stabilized. This market requires boner-type beef and suffers from strong competition from Queensland buyers for the American market. It is forecast that in the long run the Hong Kong market could be capable of absorbing 20,000 head a year.

The present annual turn-off from the Top End is about 25,000 head. With a local demand by Darwin for some 6,500 head, there is available for export, under present conditions, about 18,500, or barely sufficient to meet estimated current export requirements.

Sending cattle from the Top End to the Alice Springs or Adelaide markets is usually limited by distance; but during the present season cattle have been road trained from Ucharonidge Station to Alice Springs, a distance of more than 500 miles, and a large proportion of these were forwarded to the Adelaide market. The cattle arrived in Alice Springs in good condition.

Road transport has not been used to any great extent in the Top End. Table No. 4 shows that only about 3% of cattle going to Darwin were road transported. Such movements as occured in 1958-59 mainly comprised cattle from the eastern section of the Victoria River District going to the railhead at Katherine, and those from nearby properties going to the Larrimah railhead. There was also a limited number of interstation movements of bulls. At present the poor condition of roads restricts the use of road transport to those properties situated close to railheads or the Stuart Highway. Recently 250 head of mixed cattle were road transported from Mataranka station to Winton in Queensland, a distance of approximately 1,100 miles. There were only two deaths, but a considerable amount of bruising occured and cattle were very fatigued on arrival at Camooweal. It is unlikely that such a movement would be economic except under very favourable price conditions.

The traditional method of moving cattle in this region is to walk them to the railhead. Trucking yards have been established at the railheads at Adelaide River, Fountain Head, Katherine, Mataranka and Larrimah; main stock routes feeding these being:

(a) Coolibah stock route which serves to bring cattle from west of the Stuart Highway to the railhead at Katherine; and

(b) the Dry River stock route which is used by stock travelling from the Top Springs area to the Katherine railhead.

Unless burnt out, the supply of feed on these routes is adequate for the number of cattle using them. During the period November-April stock routes are impassable mainly owing to wet conditions, but after this there is a good body of feed with relatively small numbers of stock using the routes. A watering problem which has existed on the Dry River route is being dealt with in 1959-60 by the provision of three new waters.

The numbers of cattle coming to each railhead between 1 July 1958 and 30 May 1959, and their destinations, are shown below. The origin of a further 500 railed in June is not known but was probably Katherine.

Railhead	Numbers railed and Destination		
	Local	Export	Total
Larrimah	1,030	930	1,960
Mataranka	1,860	4,030	5,890
Fountain Head	400	500	940
Katherine	320	3,310	3,630
Adelaide River	1,900	1,120	3,010
Total	5,550	9,890	15,430

The majority of cattle coming into railheads do not walk excessive distances. For example, cattle walking into Katherine, with the exception of stock from some Victoria River District properties such as Monteginni and Killarney, do not walk more than 150 miles, and in most cases the distance is less than 100 miles. Cattle coming into the Larrimah railhead do not travel more than 150 miles.

In spite of the above, it is thought that road transport would have something to offer in the marketing of cattle from this District, especially in view of the fact that cattle for export are paid for on a liveweight basis at Darwin. It takes approximately 17 days to walk cattle 150 miles into the Mataranka railhead and owing to shipping delays which frequently occur, cattle may be in hand on the stations for two weeks before being walked in. Should a stores market be developed at Katherine (on the basis of its agricultural potential) road transport could be utilized in the marketing of both fats and stores. Also, the development of the export market depends on cattle being turned off for the greater portion of the year and this is impossible without using road transport.

The standards of animal husbandry, and station improvements, on many properties are rather poor due, in no small way, to the inadequate market outlets which existed until recently. Lack of stock control is largely responsible for the great variation in the age of turn-off, from two years to more than eight years. (The majority of bullocks being turned off are probably in the five year age group). Although it is unlikely that road transport could by itself substantially reduce the average age of turn-off, nevertheless, in combination with suitable market conditions, this could be achieved.

The role of road transport in improving the efficiency of the cattle industry in the Top End region will be fully discussed in a later section.

In 1958 the price paid for cattle exported through Darwin was 5d. per lb. liveweight. The average price for the 1959 season was 5½d. per lb. while the price at the local abattoirs was 5¼d. per lb. liveweight. Droving charges are approximately 9s.0d. per head per 100 miles while other charges, including freight to Darwin from say Katherine, weighing, shunting and feeding, might amount to £2.11s.5d. per head.

Victoria River District.

Wyndham is the major outlet for this District, absorbing 41% of the total turn-off in 1958-59. Another 43% of the total turn-off in that year went as store cattle to Queensland fattening properties, while 15% were exported through Darwin to the overseas markets and Queensland. The remaining 1% went to the local Darwin market.

Approximately 70% of the cattle going directly to Queensland were turned-off by one major property. These cattle, aged three years and upwards, would walk more than 700 miles before reaching the associated fattening property in Queensland. Provided there were no hold-ups caused, for instance, by outbreaks of pleuro-pneumonia, the journey would take from 13 to 14 weeks. The majority of these cattle would be turned off as fats in the second season after their arrival in Queensland.

In most years approximately 12,000 to 14,000 store cattle, mainly from Wave Hill and Limbunya stations, are walked to the lessee company's staging depot at Helen Springs. The cattle are then walked or road transported to company-held properties in Queensland, the operation being completed in the following season. However, owing to a build-up of stock numbers at Helen Springs caused by dry conditions prevailing in some pastoral areas, no cattle were brought in from the Victoria River District in 1957-58. These factors were chiefly responsible for the transfer of the large number, more than 20,000 stores, in the year under review. All cattle are, at present, walked out of this District. Road transport cannot be used to any extent until roads have been considerably improved.

Distances travelled by cattle walking to Wyndham vary from less than 200 miles from properties situated in the north, to about 300 miles for cattle coming from the extreme south of the region. The stock route to Wyndham is regarded as being hard in most seasons. It is rough, and stony in parts, and pastoralists state that in the northern end available feed is sour. Average weight losses per bullock on this trip were estimated by pastoralists on four survey properties at approximately 60 lb. dressed weight. All cattle travelling this route are fat stock for the Wyndham meatworks. A large percentage of male cattle in the region are ready for turn-off as fats at three years of age, but pastoralists claim that cattle turned off to Wyndham must be four years of age if excessive weight losses on the journey are to be avoided. The age of stock travelling this route is therefore four years and upwards. Although the average time taken for cattle to walk to Wyndham is only about 28 days, owing to the rough nature of certain parts of the District some cattle might be in hand up to four weeks before the muster is completed and cattle handed over to the drovers.

The Murranji Track from Top Springs to Newcastle Waters is not regarded by pastoralists as good. Although well watered it becomes badly eaten out in most seasons after the first few thousand head of stock have passed over it. During the 1959 season some 30,000 head of cattle used this route. There are some rough stony sections near Top Springs, and stock losses occur due both to cattle straying and to unidentifiable causes, in many cases thought to be Ironwood poisoning. Losses may be high if "rushes" occur due to stock breaking away into Lancewood scrubs and the Bullwaddy which skirts the route. This route is only used by stores.

The Auvergne stock route to Jasper Gorge and the Wave Hill stock route to Top Springs are regarded by the pastoralists concerned as being satisfactory under reasonable seasonal conditions. Some lameness in stock is caused by rough stony country between Auvergne and Victoria River Downs stations. Except for small numbers of stock from properties in the eastern section of the region, destined for the Philippines, all cattle passing over these routes are store stock.

Estimates of stock losses on the above routes given by pastoralists visited in this region (including killers allowed to droving plants) suggest that losses to Wyndham might be 3% to 4%. Losses en route to Helen Springs and Newcastle waters average about 2% but losses of up to 4% are not infrequent. Losses of stock walking to Katherine might be 3% to 4%, while losses to Queensland might be conservatively estimated at 6%.

Lack of suitable market outlets has also affected the development of this District. As previously mentioned, fat cattle to Wyndham travel up to 350 miles over a very indifferent route, and many stores walking to Queensland travel distances of up to 1,000 miles. Although some pastoralists apparently accept this long droving trek across the Murranji and Barkly stock routes as traditional there are a number of properties which would take advantage of any outlets developed in the Northern Territory. The beneficial effects of the development of a stores market at Katherine and an export abattoir at Darwin will be discussed in later sections. At present, owing to marketing problems, many fat cattle are held back and marketed with the main body of stores. Given suitable roads, road transport might offer a solution to the marketing of such stock.

Contract droving rates in this District vary according to the size of the mob and the distance travelled. The charge for mobs of 1,350, the usual size of mobs travelling to Queensland, averages 5s.0d. per head per 100 miles, while the charge for mobs of 600 or more, applicable to most mobs going to Wyndham, is 7s.6d. per head per 100 miles or 8s.3d. if the distance involved is less than 300 miles. For mobs of less than 600 the charge is 9s.0d. per head per 100 miles.

Survey properties sending fat cattle to Wyndham during the 1958 season received a gross return of about £23 per bullock. They expect an average price for the present season of approximately £30 per head, due to the effect of the increased overseas demand for manufacturing-quality beef.

The Alice Springs District.

Approximately 98% of the total turn off from the Alice Springs District in 1958-59 was railed to southern markets, the remaining 2% being consumed locally. The numbers of stock railed from each of the five railway sidings in the Alice Springs District during 1958-59 were as follows:-(3)

Alice Springs	46,830
Deep Well	13,831
Rumbalara	3,838
Finke	16,366
Abminga	1,103

The ratio of stores to fats going south depends largely on seasonal conditions. It will be apparent from its geographical situation that this District suffers from prolonged droughts.

The age of turn-off from here has been systematically reduced so that today a large proportion of fats turned off are from two to three years old, probably in the range of 450-600 lb. dressed weight. Stores are generally turned off in the age range of $1\frac{1}{2}$ to $2\frac{1}{2}$ years.

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(3) Northern Territory Administration, Animal Industry Branch
Thirteenth Annual Report, 1958-59.

Largely owing to feed availability fat cattle for the Adelaide market are turned off mainly in the period April to June, but with road transport an increasing number of pastoralists are marketing cattle most of the year round. This enables them to turn off fat cattle at their peak, and reduces the risk of economic loss due to falling market prices. Because of the limited nature of the Adelaide market, prices are reputed to be greatly influenced by the size of yardings.

Prices for handy-weight bullocks ruling in the Adelaide market for each month of 1958 are shown below, in shillings.

—	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Price per 100 lb. D.W.	140	145	150	140	145	170	150	210	220	160	135	140

Source: South Australian Stock Salesmen's Assoc. Official Report.

The prices show a definite peak in August and September. Over a ten year period, prices in these two months were approximately 11% higher than the annual average price. Under such conditions road transport can be used to advantage.

Store stock which go to the south and south-east of South Australia for fattening are generally turned off from August to September, to coincide with the spring flush in those areas. However, there has been a growing demand for store cattle from the Northern Territory in both New South Wales and Victoria, and this was sufficient in 1958-59 to cause a further peak in turn-off of stores during January and February.

A large proportion of cattle moving in the Alice Springs District are road transported. These generally go to butchers at Alice Springs or the Alice Springs railhead, while a limited number are road transported to the railhead at Finke. Road transport is restricted to these two railheads because roads to other railway sidings are poor. In 1958-59 the following numbers were road transported:-

Destination	Number	Type of Cattle
South Australia from Alice Springs	6,278	fats
South Australia from Alice Springs	16,880	stores
South Australia from Finke	2,534	fats
South Australia from Finke	2,070	stores
Alice Springs Butchers	1,244	fats
Total	29,006	

In addition to the above, approximately 200 head of stock including bulls were moved from the above two railheads. These movements accounted for 35% of the total number of cattle forwarded from the Alice Springs District in 1958-59. During 1957-58 the total number of cattle road transported were :-

Destination	Number	Type of Cattle
South Australia from Alice Springs	13,306	fats
South Australia from Finke	39	fats
Alice Springs Butchers	405	fats
Total	13,750	—

The large increase of 111% in the total numbers road transported is partly due to the continuation of dry conditions, and is emphasized by the fact that although in 1957-58 no store cattle were road transported, in 1958-59 they accounted for some 65% of all cattle transported.

This District is adequately served by stock routes with the North-West route serving cattle from the north-west, the Sandover route catering for cattle from the north-east and the short Arltunga route serving stations to the east of Alice Springs. The Hugh River route feeds into Deep Well, while the Goyder route is used by stock coming into Finke. If desired, cattle from the District may enter Queensland via the Sandover route through Lake Nash.

Stock routes are generally well watered. However, this is a ten inch rainfall area, and because rainfall is uncertain and spasmodic, dry conditions often prevail. As the area is extensive, some sections of stock routes may become impassable during dry seasons due to lack of stock feed. In some cases alternative stock routes have been constructed, but this has only been partially successful as sections of both may become impassable. Also, duplication is costly as each water costs approximately £5,000 and waters are required every 15 miles.

Droving losses in the region are generally in the vicinity of 1% or 2%. However, each year cases of heavy losses during droving occur due to "rushes" caused for example by storms. Losses on these occasions might be as high as 10%.

The distances cattle are walked vary from 40 to 50 miles for cattle from properties close to Alice Springs to more than 250 miles for cattle from remoter areas such as the Georgina River. Droving times may therefore vary from a few days up to 30-40 days. Droving charges are in the vicinity of 15s.0d. per head per 100 miles for fats and 10s.0d. per head for stores. These changes depend on the size of the mob and the distance travelled. Road transport charges vary from £2. 5s. 0d. to £2. 10s. 0d. per fat bullock per 100 miles, depending on the distance travelled and the haulier employed.

Marketing charges for cattle from Alice Springs might be more than £10 per head for fat stock road-transported 150 miles and then railed to Adelaide. Road transport charges account for £3. 7s.6d., railage £4. 12s. 6d., commission £2. 0s. 0d. and 9s. 9d. for miscellaneous charges such as feeding and other costs at Marree, untrucking, paddocking and droving.

Cattle travelling to Adelaide are off-loaded, fed and watered at Marree some 500 miles south of Alice Springs. This is a scheduled 24 hour rest but it has been stated that, owing to rail delays, the spell is often about 20 hours. It was further alleged that delays of several hours can occur after reloading at Marree and again at Port Pirie during the change-over from the Commonwealth to State Railways. Cattle inspected in the yards at Gepp's Cross market exhibited a considerable degree of tail and buttock bruising. Agents were inclined to place the blame for this largely on train delays which cause cattle to become restless.

A large proportion of cattle railed to Adelaide receive a spell in the Alice Springs yards before trucking. It is generally agreed that a 24 hour spell before loading, with some hand feeding, assists stock to settle down.

The Barkly Tableland District.

With the exception of about 2% that went as fats to the Adelaide Market or Alice Springs butchers, the 1958-59 turn-off from this District went wholly to Queensland. Some 12,500 fats went to Mt. Isa butchers, or to rail at Mt. Isa or Dajarra for Queensland meatworks, while 37,000 went as stores to Queensland fattening properties, mainly to company-owned properties in the Channel Country. Some 42,700 of these crossed the border at Camooweal while 6,800 crossed at Lake Nash.

Figures obtained from the Animal Industry Branch, Northern Territory Administration, show that 9,620 head of the above turn-off including 1,270 fats and 8,350 stores, were road transported. These included more than 8,000 head of store stock from Helen Springs depot going to company-owned properties near Camooweal in Queensland, a distance of approximately 400 miles. The fat stock, all of which were destined for Mt. Isa butchers, came from properties near the Queensland border, the maximum distance transported being about 200 miles, mainly on a bitumen-surfaced road. From March 1958, the beginning of the transport season, to mid-August 1959, the date of interview, more than 19,000 head of cattle had been road transported from Helen Springs to Queensland.

The male cattle turn-off from here ranges from 2-5 years, with the 2-3 year age group predominating. In the Channel Country this modal group would be turned off as 4 and 5 year-old fats. It is apparent that the age of turn-off from here is influenced quite considerably by seasonal conditions existing both on the Tableland and in the fattening areas.

As mobs walked out of the Barkly Tableland are large, being about 1,250 head, droving rates are comparatively low, approximately 5s.0d. per head per 100 miles. Distances travelled vary from 640 miles for stock on the western border of the region going to Dajarra, to 120 miles for cattle from properties near the Queensland border going to Mt. Isa. Cattle from company-owned properties on the Barkly Tableland going to associated fattening properties in the Channel Country may travel up to 400 miles.

Both the Barkly stock route, the major route for Barkly Tableland turn-off, and the South Barkly route which serves some of the properties immediately north of the Barkly Highway, are well improved with waters every 15 miles. The seasons in this District are comparatively regular compared with the Alice Springs District, and in the majority of years there is an abundance of feed on these routes at the commencement of the droving season. There is no reason therefore why store cattle travelling these routes, with the exception of stock travelling towards the end of the season, should not arrive at the border in good condition in most years. Pastoralists visited stressed one problem, namely the difficulty of obtaining the services of good drovers capable of handling large mobs of cattle, and painstaking in their duties. The stock route from Camooweal to Mt. Isa, a distance of 117 miles, is very poor. Much of it consists of stony hills grassed with Spinifex, and in places with a dense cover of Turpentine bush. Officers of the Animal Industry Branch of the Northern Territory Administration suggest that fat cattle might lose up to 112 lb. liveweight by the time they arrive at Mt. Isa. This is supported by evidence given by Mt. Isa butchers, who estimate that fat cattle from properties near the Queensland border in a normal year lose about 40 lb. dressed weight on the walk in. Their opinion is that by the time the "tail" of a mob is slaughtered, weight losses might be as high as 70-80 lb. dressed weight. It is estimated that 2% of fat cattle coming in are lost owing to lameness and other causes. One company has stated that losses of cattle walking across from the West Barklys are likely to be in the vicinity of 3%. Road transport has proved its value in transporting fat cattle into Mt. Isa. Cattle can be transported from Camooweal to Mt. Isa in five to six hours compared with some 20 days taken to walk in.

A further stock route serving the region is that down the Georgina River to Lake Nash. This route is supplied by surface water which is adequate except in drought years. However, large numbers of station cattle have access to the frontage country on the Georgina and the route becomes badly eaten out. It has been unusable for the last two seasons, mainly for this reason. The suggestion has been made that weight losses in cattle travelling this route to Dajarra, under favourable conditions, might be a little more than half those on the Mt. Isa route.

There are no permanent loading facilities in the District under the control of the Northern Territory Administration. Cattle road trained from Helen Springs use permanent station facilities, while other properties have used temporary loading facilities either on the property or at Frewena Dip on the South Barkly route. Advice has recently been received that the provision of permanent loading facilities at all dips on the Barkly and South Barkly stock routes is being undertaken by the Animal Industry Branch of the Northern Territory Administration.

Fat bullocks turned off survey properties in 1957-58 realized approximately £30 per head on the property. Store prices ranged between £10. 10s. 0d. and £17. As has been noted, the turn-off of fats from the Barkly Tableland in 1958-59 was 12,500, the usual turn-off in favourable years under present conditions.

It is confidently expected by the Northern Territory Administration that some properties in the south-west of the District will send cattle to southern markets, now that duplicate handling facilities have been established at Alice Springs and Adelaide. Although only 205 head had been road trained south from the quarantine area at the time of the survey, it was suggested that this number might increase to several thousand a year if conditions were satisfactory.

Channel Country of Queensland.

Although a large percentage of the fat turn-off from the Channel Country is railed to Brisbane, numbers of stock find their way via the railway system to meatworks at Townsville and Cairns. A considerable number from the south-west corner of the region is forwarded to Adelaide via Marree, while others go to the meatworks at Bourke.

The numbers of stock railed during the financial years 1956-57, 1957-58, and 1958-59 from each of the major railheads serving the Channel Country, including Marree (S.A.), are shown in Table No. 5. In addition to these, some 10,000 head a year cross into N.S.W. via Hungerford to the meat works at Bourke or to N.S.W. stations. A large percentage of these is from the Channel Country.

Table No. 5:

Number of Stock Railed from Major Channel Country

Railheads for Financial Years 1956-57 to 1958-59.

Railhead	Numbers railed		
	1956-57	1957-58	1958-59
Dajarra	46,047	49,430	37,076
Butru	12,574	15,503	21,389
Winton	53,716	57,355	82,363
Quilpie	57,705	44,954	34,538
Marree	20,453	13,692	14,496
Cunnamulla	-	8,667	9,415

Sources: Queensland Railways Report of the Commissioner for Railways for Year Ending 30 June 1958: Commonwealth of Australia, Commonwealth Railway Operations for Year 1957-58: and unpublished data.

The above figures are not limited to stock coming from the Channel Country, as for example, stock railed from Dajarra include a large number of cattle from the Northern Territory, but in most cases Channel Country cattle form a substantial percentage. The turn-off from this region is not known for the three years shown in Table No. 5, but Kelly (4) has estimated the average annual turn-off for the five year period ending 1956 as 65,000 head, and for the ten year period to 1957 as 50,000 head per annum. The number is likely to have been somewhat less than 65,000 in the last two years, especially in 1958, owing to the effects of adverse seasonal conditions. The drought effect has to some extent been minimized in Table No. 5 by using financial years instead of actual turn-off periods. Details of the numbers of cattle walked across the Queensland border to Bourke in each of the above years are not available.

Cattle numbers road transported to the major Channel Country railheads during 1957-58 are not known but they would have been small. Approximately 4,000 head were road transported to Quilpie railhead during the 1959 season to the end of September but this was to some extent due to the state of stock routes. It is apparent, however, that in the Quilpie area the demand for the road transport of fat cattle by both butchers and pastoralists is growing, and at least three local hauliers are currently engaged in moving cattle. Of interest at the time of the survey was the movement by road of 3,000 head from Coonamarra to Bulloo Downs, a distance of over 600 miles.

Although loading facilities have been provided at Coonaberry Creek west of Eromanga, stations using road transport generally provide their own. Marion Downs station in the north of the region has well constructed loading facilities . Prior to 1956 this station road transported cattle to Dajarra, but the operation was not wholly successful due to excessive bruising.

Some good drovers are available in the district but pastoralists state that it is becoming increasingly difficult to obtain satisfactory men. Also, many of the better drovers are elderly and this poses a problem of replacement.

Stock routes in the region are generally quite good in normal years. In drought periods sections of many routes "go out", owing either to lack of feed or lack of surface water or both. Comments on the major routes are given below.

Bedourie to Winton via Monkira and Diamantina Lakes. Conditions are generally good on this route and weight losses negligible. Normally, losses are in the vicinity of 1% but in dry seasons may be higher, and losses of up to 5% have been recorded. Distances walked by stock using this route range from less than 100 miles to approximately 400 miles.

Bedourie to Dajarra. On this route with good drovers, losses in a normal year range from nil for properties within 100 miles of Dajarra to a little more than 1% for cattle from Bedourie. The route suffers from lack of water at the Dajarra end and stock walked in from properties near Bedourie, a distance of some 220 miles, lose about 40-50 lb. dressed weight in a normal year. Cattle from properties close to the railhead lose very little weight.

(4) J.H. Kelly, Bureau of Agricultural Economics, Canberra, unpublished papers.

Bedourie to Marree. As this route is through drought-susceptible areas, and some watering facilities are inadequate, weight losses in travelling stock are often excessive. Pastoralists have estimated that normal weight losses might be up to 70 lb. dressed weight on this 400 mile walk. Losses vary from 1% to 8% depending on the season and the ability of drovers.

Currawilla to Quilpie. This route is good except for some stony country along the last 30 miles. Stock travel up to a little more than 250 miles, and in a normal season weight losses in travelling stock are small, being about 30-40 lb. dressed weight for cattle from the extreme end of the route. Losses are generally in the vicinity of 1% to 2% but under certain conditions these may increase considerably.

Mt. Howitt to Eromanga. There are no made stock waters on this route and part is quite stony, although this hard country can be avoided by using an alternative route. Droving losses and weight losses on this 150 mile trip are generally small, but under adverse seasonal conditions weight losses may be as high as 50 lb. dressed weight.

Channel Country to Bourke. This route is dependent on natural surface water and in a dry year is closed to cattle coming from the Mt. Howitt area. Stock travel up to 400 miles but stock losses in a normal season would not be more than 1%, and weight losses would be negligible as the route is through soft country.

Some pastoralists stated that by the time cattle are slaughtered in Brisbane, weight loss may be in the vicinity of 100 lb. dressed weight. This is the result of rough handling, excessive travelling, poor feeding, fretting, etc. Furthermore, stock walked to railhead arrive in a very travel-stained condition. The rail trip from Quilpie to Brisbane takes two days, with a 12 hour rest at Chinchilla. With road transport to the railhead, cattle could be marketed speedly, without loss of bloom or condition.

Fat cattle are turned off in mobs of 500 to 700, contract droving charges varying from £180 to £200 weekly, or approximately 11s. 0d. per head per 100 miles. Road transport charges are in the vicinity of 8s. 8d. per mile per the equivalent of a railway "K" wagon, (approximately 18 head of fat bullocks) or 8s. 0d. per mile in the case of long hauls and large numbers. On a per head basis the charge would be 45s. to 48s. per 100 miles. Store cattle, where turned off, are turned off in mobs of 1,250.

The major turn-off period for fat cattle from the area is from May to the end of August or September, depending on the distance of stations from the railhead. After this time difficulties associated with storms and high temperatures, become excessive. Prices for first and second export-quality ox (650-700 lb.) ruling in the Cannon Hill market during 1958 ranged from 139s. to 179s. per 100 lb., with peak prices in the period September to October. Figures over a ten year period to 1959 show that peak prices at Cannon Hill often occur in October and November, with high prices still being maintained in December. If cattle must be walked to railheads, advantage cannot be taken of these high prices but road transport may offer a solution.

Marketing charges for a fat bullock going to the Brisbane and Adelaide markets are estimated as shown below. The item "miscellaneous" includes such charges as feeding, untrucking, paddocking and miscellaneous droving.

Item	Destination	
	Adelaide	Brisbane
	£. s. d.	£. s. d.
Commission	2. 0. 0	1.12. 6
Railage	3. 9. 0	4. 6. 0
Droving	1. 8. 0	1. 3. 0
Miscellaneous	17. 0	8. 0
Total	7.14. 0	7. 9. 6

The railway freight for bullocks going from Yaraka to Rockhampton (537 miles) is about 5s. 0d. per head less than for bullocks railed from Quilpie to Brisbane (621 miles). As the price paid at Rockhampton over a period of years appears to be lower than the price paid at Brisbane by the amount of the freight from Rockhampton to Brisbane (about £3 per head for bullocks weighing approximately 650 lb. dressed weight), there is an economic incentive, other things being equal, for pastoralists to use the Quilpie railhead rather than the Yaraka railhead. This in part accounts for the small number of stock railed annually from Yaraka.

Table No. 6.

Size and Capacity of Road Trains.

Group	Make and type of prime mover	Power of prime mover	Type of train	Number of trailers	Total length of train(a)	Number of axles	Number of wheels	Number of bullocks carried
		b.h.p.			(ft.)			
1. Large diesels	B 63 Mack	170	Prime mover & trailer	2	140	11	42	80
	Rolls Royce Viscount	250	Prime mover & trailer	2	130	11	42	80
	Rolls Royce Viscount	250	Prime mover & trailer	2	130	11	42	80
	Diamond T.	225	Prime mover & trailer	3	141	15	34	80
	A.E.C. Diesel	200	Prime mover & trailer	2	74	7	26	40
	Mack	170	Prime mover & trailer	1	80	7	18	40
2. Medium diesels	G.M.C.	91	Prime mover & semi-trailer	1	50	5	18	27
	B.M.C.	86	Prime mover & semi-trailer	1	44	3	10	22
	B.M.C.	130	Prime mover & semi-trailer	1	45	3	10	20
	B.M.C.	105	Prime mover & trailer	1	38	4	14	20
	Commer 3 Diesel	n.a.(b)	Prime mover & semi-trailer	1	48	3	10	20
3. Petrol vehicles	Ford	166	Prime mover & semi-trailer	1	48	3	10	22
	A.E.C.	n.a.(b)	Prime mover & trailer	1	42	4	14	22
	Ford 1957	166	Prime mover & semi-trailer	1	48	3	10	22
	Ford 1958	166	Prime mover & trailer	1	42	4	14	20
	Ford 1956	166	Prime mover & semi-trailer	1	48	3	10	20
	Ford 1957	166	Prime mover & semi-trailer	1	48	3	10	20
	Chevrolet	140	Prime mover & semi-trailer	1	48	3	10	20
	Bedford	115	Prime mover & trailer	1	40	4	14	20

(a) This length excludes the length of couplings in the case of prime movers with trailers. For most road trains in the Territory each coupling is approximately 5 feet.

(b) n.a. = not available.

PART II: THE COST OF ROAD TRANSPORT.

Cattle transport in the Northern Territory is largely confined to two major areas. The more important is the Alice Springs District where cattle are brought in from outlying stations to the railheads at Alice Springs and Finke. The average length of haul for the 17 road trains studied in this area is approximately 276 miles. Of lesser importance numerically is the movement of cattle from the Barkly Tableland, mainly from Helen Springs to Camooweal for transfer to fattening properties or to rail at Mt. Isa. Cattle from here are road trained mainly to Camooweal and to the Larrimah railhead. Two trains were studied in this area, each travelling approximately 31,000 miles a year.

In the Queensland Channel Country, one major operator controls seven road trains, including four large trains powered by 175 b.h.p. Mack diesel prime movers. At the time of the investigation, however, he was not available, and it has not been possible to interview him since. Costs for these vehicles are therefore not included in this report.

Eleven road hauliers interviewed during the investigation operated 19 road trains for the transport of cattle, and details of the type of units used are shown in Table No. 6. Horsepower varies from approximately 90 b.h.p. for the small diesels to 250 b.h.p. for the very large diesels pulling two large trailers. This variation in power of the prime movers is in marked contrast to the situation in Western Australia[1] where the range in horsepower was between 125 b.h.p. and 150 b.h.p., all prime movers being diesels. In this study, the 19 road trains have been divided into three groups according to brake-horsepower ratings and type of prime mover engine, namely large diesels, medium diesels and petrol vehicles. The number of vehicles in each category, together with the average annual mileage travelled by each group during 1958-59 transporting cattle, are shown below.[2]

—	No. of trains	b.h.p.	Average total mileage applicable R/T cattle
(a) Large diesels	6	130 and over	18,500
(b) Medium diesels	5	less than 130	18,000
(c) Petrol vehicles	8	100 to 166	15,000

TREATMENT OF COSTS.

Calculation of costs has been based on estimates supplied by road hauliers in the survey, for the period 1958-59. Cattle accounted for nearly all livestock carried; sheep and horse numbers were insignificant. Transport costs have therefore been based on cattle figures only. Methods used to determine each cost item are tabulated below.

(i) Fuel, oil and grease.

The quantity of fuel used was calculated from road hauliers' estimates of the fuel performance of their vehicles. The price of fuel used was that ruling at Alice Springs (diesel fuel at 4s. 2d. per gallon, and petrol 4s. 11d. per gallon including tax). With diesel-powered prime movers the 1s.0d. per gallon diesel tax has been shown as a separate cost. Oil and grease costs were also calculated from estimates made by hauliers, the prices being those ruling at Alice Springs. One haulier operating outside the Alice Springs District did not pay these prices for fuel, oil and grease. In his case, the actual price paid for these items has been used.

(ii) Tyres and tubes.

The economic life of tyres and tubes depends on many factors, and is different for each road train. Important factors are road surface conditions, loads carried, type of tyres and tubes used, and skill of drivers. Road hauliers estimated tyre life to be between 15,000 miles for small vehicles and 30,000 miles for larger vehicles. Tyre size ranged from 8.25 x 20 on petrol vehicles to 1400 x 20 on very large road trains, four types being used, nylon, rayon, rubber and rubber with steel reinforcing.

The percentage of hauliers using recapped tyres is relatively small. The cost of recapping an 8.25 x 20 (10 ply) tyre is approximately £16 at Alice Springs, compared with £40 for a new tyre, with a life expectancy of about half that of a new tyre. For larger tyres the cost of recapping is relatively less, compared with the cost of a new tyre. The nature of roads has an important bearing on the useful life of

(1) The Economics of Road Transport of Beef Cattle, Western Australian Pastoral Areas, 1958. Bureau of Agricultural Economics, Canberra.

(2) Some hauliers were operating for period less than a year, in which cases costs were calculated according to the number of months of operation.

tyres and the possibility of recapping them. Tyres used on unsealed roads for long periods are often unsuitable for retreading, since their walls often become fractured or staked before the treads wear out. Approximately 50% of the total distance travelled by the 19 road trains in the survey was on bitumen roads, the remainder being on unsealed roads of various kinds. For individual hauliers there was a variation of between 30% and 100% in the distance travelled on bitumen roads. In view of the above, the life of tyres was based on haulers' estimates, and the possibility of recapping was not considered.

The price of tyres and tubes used was the retail price at Alice Springs, except in the case of the haulier operating outside the Alice Springs District - in this case the actual price paid for tyres was used. Tyres and tubes were regarded as expendable items. The full charge for replacement has been taken into account with no allowance for depreciation.

(iii) Drivers' wages.

This includes all wages paid to drivers, including the value of board and bonuses. However it excludes the value of food supplied to drivers while on the road - this has been calculated separately under heading (iv). In cases where an owner also drives, two-thirds of the imputed wage has been costed under this heading of drivers' wages, while the remaining one-third has been debited to supervision.

(iv) Tucker boxes.

This item has been mentioned above and is the cost of food consumed by drivers while on the road.

(v) Registration and Third Party Insurance.

Registration in the Northern Territory is based on the tare weight of the prime movers and trailers. The rates are as follows: for British-made prime movers and trailers, 4s. 6d. and 6s. 0d. per cwt. tare respectively: for foreign-made units this is increased by 1s. 0d. per cwt. tare on both prime movers and trailers.(3)

Third party insurance is £17.13s.0d. per year for all vehicles with a tare weight greater than two tons, plus an additional 10s. 0d. per year for each trailer. (3)

With vehicles purchased during the financial year 1958-59, registration and third party insurance costs have been calculated on a pro rata basis for the number of months in operation. The registration and third party insurance for lessee hauliers are half those for commercial hauliers. However, for the purposes of this comparative study, rates to commercial hauliers have been used.

(vi) Other insurance.

This includes insurance costs for plant and vehicles as well as workers' compensation premiums. These costs were all obtained from individual hauliers.

(vii) Repairs and maintenance of vehicles.

Repairs by owner - Materials - This is the actual cost of materials used in repairs to raod trains carried out by the owners.

Wages - Wages paid to workshop and other maintenance staff are included under this item.

Garage Repairs - This is the cost of repairs and periodic overhauls done at commercial garages in Alice Springs or Adelaide, and includes both the cost of materials and labour.

(viii) Depot and administration costs.

Supervision - The main component of this cost is that charge for part of the owner's time which, it is considered, relates to duties of a supervisory nature. As mentioned earlier, two-thirds of the owner's wage has been allocated to drivers' wages if he himself is a driver, the remainder being allocated to supervision. Where an owner does not drive, his full wage has been charged as a supervision cost. The imputed wage for an owner is £30 per week. Where supervisors are employed, the actual wage paid is included here.

Office Charges - This includes all the other expenses incurred in the administration of a cattle road transport service. Main items are accounting fees, costs of stationery, telephones and telegrams, electricity charges, wages of office personnel and also the operating costs of vehicles used in the administration of the business.

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(3) Northern Territory of Australia. Motor Vehicles Ordinance 1949-1958 - 2nd Schedule.

(ix) Depreciation.

Prime movers - The rate of depreciation allowed by the Commissioner of Taxation on heavy vehicles is 20% per annum, implying a useful life of five years. However, it seemed unreasonable in this study to depreciate all road trains at the rate of 20% per annum, when the annual mileage varied from a minimum of 4,500 miles [4] to a maximum of 31,000 miles. A depreciation therefore based on the estimated technical life (in miles) of the vehicle appeared more appropriate. For a calculation of depreciation to be made on this basis an average technical life of vehicles in each category has been estimated from information supplied by the hauliers. The imputed life of each group is:

(i)	large diesels	-	240,000 miles
(ii)	medium diesels	-	180,000 miles
(iii)	petrol vehicles	-	90,000 miles

To calculate the depreciation for the 1958-59 transport season, the original cost, less the value of tyres and 10% residual value, has been used as the prime value. Depreciation per mile has been calculated by dividing the prime value by the estimated technical life of the vehicle.

Trailers - In the Western Australian investigation [5] trailers were depreciated at the rate of 10% per annum. In the Northern Territory, however, because of the low annual mileage travelled by most trains, it was decided to base depreciation on the estimated mileage-life of trailers. The life of all trailers was estimated at 400,000 miles, and depreciation per mile was calculated as for prime movers.

Depot plant and vehicles - Rates of depreciation allowed by the Commissioner of Taxation vary according to the type of equipment. Those for the more commonly used items of plant and equipment are as follows: [6] brick, stone or concrete buildings 1%; other types of buildings 3%; most garage machinery 5%; and radio transmitters 15%.

In the case of staff quarters the rate of depreciation allowed is 33%, but this is essentially an incentive rate, and does not reflect the useful life of buildings; therefore for hauliers possessing staff quarters, the rate of depreciation used was 3%, similar to that specified by the Commissioner of Taxation for structures not built of brick, stone or concrete.

(x) Interest.

An allowance of 6% on the average capital investment in prime movers and trailers at 1 July 1958 has been made. This is the bank overdraft rate to non-primary producers.

Numbers Carried.

Costs per bullock per 100 miles loaded have been based on hauliers' estimates of average number of large bullocks carried per road train. The range in carrying capacity and the average capacity for each group of road trains is given below.

—	Range (bullocks)	Average (bullocks)
Large diesels	40 - 80	66
medium diesels	20 - 27	22
petrol vehicles	20 - 22	21

Variable and Fixed Costs.

(a) Variable costs. These vary with the total mileage travelled by vehicles, and include items such as fuel, oil and grease expenses, diesel tax, repairs and depreciation of vehicles.

(b) Fixed costs. These do not vary with mileage travelled and, as will be seen, are a major part of road hauliers' expenses in the Northern Territory. Costs in this category include drivers' wages, insurance, registration of vehicles, depot expenses and interest on capital.

(4) This was the actual mileage for 6 months operation, costs of an annual nature being adjusted accordingly.
(5) The Economics of Road Transport. op.cit.
(6) Income Tax Order No. 1217 (1956 Revision) Schedule of Rates of Depreciation.

COST ANALYSIS.

For the present cost analysis, operating costs are expressed in terms of "miles loaded", loaded mileage for the purposes of this study being that distance travelled loaded with cattle. This presentation was possible, as fairly accurate records of miles travelled by hauliers in the Northern Territory were available from the Animal Industry Branch of the Northern Territory Administration. In this analysis it has been assumed that there was no backloading. This assumption was made in the Western Australian Survey, (7) and from information available from hauliers co-operating in this study it appears equally valid here. Backloading will be discussed in greater detail later.

Cost per ton-mile is based on the assumption that one mature bullock weighs a half ton. Operating costs for vehicles in each group are discussed separately.

(a) Large Diesels.

The average operational costs of the six road trains in this group are shown in Table No. 7, their range of costs being shown below.

—	Lowest cost	Highest cost	Average cost
	£. s. d.	£. s. d.	£. s. d.
Cost per road train per 100 miles loaded	65. 5. 1	150.17. 3	132. 4.10
Cost per bullock per 100 miles	1.12. 8	2. 3. 6	2. 0. 1
Cost per ton-mile	7.8	10.4	9.6

Although the range is quite wide, consideration of individual road train operations shows good reason for this, the principal one being the great variation in mileages travelled by the vehicles of this group in the year under review. These varied from 6,500 to 31,000 miles, with an average of 18,500 miles.

The effect of low mileage is reflected in costs per train, per bullock and per ton-mile. The importance of mileage to the cost structure of hauliers in the Northern Territory will be discussed later. However, mileage is not the complete explanation of these cost differences, as the size and capacity of vehicles also have their effect on per bullock and per ton costs. The main cost items affected here are the variable costs such as fuel, oil and grease, tyres and tubes, cost of materials and the cost of garage repairs; but some fixed charges do depend on size, in that size of trains is reflected in capital values which determine interest and depreciation charges on rolling stock.

Although the average figures in Table No. 7 are only a rough guide, they indicate a number of important features. Tyres and tubes, and the cost of repairs and maintenance of vehicles, together account for over 39% of the total costs. The importance of tyres and tubes can be explained by the greater number of tyres on the large trains (see Table No. 6), the conditions under which vehicles are operating and the high average price of tyres and tubes. The average number of tyres on the road trains in this group is 34, with an average cost of 5.89s. per bullock per 100 miles compared with 24 on the trains in the Western Australian Survey (8) where the average cost per bullock per 100 miles was 4.15s. As the ratio of capacity to tyre numbers is much the same both in the Northern Territory and Western Australia, the major influence responsible for the additional per unit costs in the case of vehicles in this study would appear to be the wear and tear caused by the condition of roads, including the effects of staking of tyres on the many narrow roads in the Alice Springs District. The effect of poor roads becomes more significant when it is realized that vehicles here are operating partly on bitumen roads, while in Western Australia they operated wholly on earth roads which, however, were generally formed and which were considerably wider than roads in this part of the Northern Territory.

The high level of repairs and maintenance in this group is unduly inflated by the inclusion of two road trains which are maintained by a permanent staff, and which incurred very high costs for replacement parts in the survey year. Their costs for items such as depreciation and interest on depot plant and vehicles, are also abnormally high. The effect of excluding these two road trains from the group can be seen in the table below.

(7) The Economics of Road Transport. op.cit.

(8) The Economics of Road Transport. op.cit.

Table No. 7.

Cost of Transporting Cattle by Road Train:

Large Diesels

(Average of 6 Road Trains)

Item	Cost per			Cost as per cent of Total
	Road train per 100 miles loaded	Bullock per 100 miles(b)	Ton - mile(b)	
	£	shillings	pence	%
Cash Costs				
Fuel, oil and grease	8.18	2.48	.60	6.1
Diesel tax	2.31	.70	.17	1.7
Tyres and tubes	19.45	5.89	1.41	14.8
Drivers' wages (a)	15.62	4.73	1.14	11.8
Tucker boxes	2.90	.88	.21	2.1
Registration & 3rd Party Insurance (a)	1.63	.49	.12	1.2
Other insurance (a)	.56	.17	.04	.4
Repairs and maintenance of vehicles				
Repairs by (Materials	21.36	6.47	1.54	16.3
Owners (Wages (a)	11.12	3.37	.81	8.4
Garage repairs	-	-	-	-
Depot & administration costs				
Supervision (a)	6.99	2.12	.51	5.3
Office charges (a)	7.41	2.25	.54	5.6
Total	97.53	29.55	7.09	73.7
Depreciation				
Prime movers and trailers	12.34	3.74	.90	9.3
Depot plant and vehicles (a)	6.58	2.00	.48	5.0
Total	18.92	5.74	1.38	14.3
TOTAL CASH COSTS AND DEPRECIATION	116.45	35.29	8.47	88.0
Interest at 6%				
Prime movers and trailers (a)	7.13	2.16	.52	5.4
Depot plant and vehicles (a)	8.66	2.62	.63	6.6
Total	15.79	4.78	1.15	12.0
TOTAL COSTS	132.24	40.07	9.62	100.0
TOTAL VARIABLE COSTS	66.54	20.16	4.83	50.3
TOTAL FIXED COSTS	65.70	19.91	4.79	49.7

(a) Fixed costs which must be met regardless of mileage.

(b) Average capacity of road train = 66 bullocks (approx. 33 tons). Average annual mileage = 18,500.

Table No. 8

Cost of Transporting Cattle by Road Train - Large Diesels.

(Average of 4 Road Trains)

Item	Cost per			Cost as per cent of total
	Road train per 100 miles loaded	Bullock per 100 miles	Ton mile	
	£	shillings	pence	%
Fuel, oil and grease (incl. diesel tax)	12.11	4.04	.97	10.7
Tyres and tubes	19.42	6.47	1.55	17.5
Drivers' wages and tucker boxes	18.82	6.28	1.51	17.1
Repairs and maintenance	20.66	6.89	1.65	18.7
Depreciation	13.47	4.49	1.08	12.2
Interest	10.32	3.44	.83	9.4
Other costs	15.65	5.21	1.25	14.2
Total	110.45	36.82	8.84	100.0

Although drivers' wages and tucker boxes are not the greatest single cost item as was the case with the Western Australian hauliers, (9) they still play an important part in hauliers' costs in the Northern Territory, ranking a close third to repairs and maintenance, and tyres and tubes.

(b) Medium Diesels.

The average operational cost of the five vehicles in this group is shown in Table No. 9, while the range of costs is shown below.

—	Lowest Cost	Highest Cost	Average Cost
	£. s. d.	£. s. d.	£. s. d.
Cost per road train per 100 miles loaded	30. 4. 5	70.12.10	43.17. 2
Cost per bullock per 100 miles	1.10.3	2.12. 4	1.19.10
Cost per ton-mile	7.3	12.6	9.6

Here, as with the large diesel group, the costs have a very wide range. The magnitude of the "highest cost" figures is due to the inclusion of one lessee haulier who, because he completed only a very low mileage (approximately 4,500 miles) in the year under review, had high fixed costs per unit transported. If this train is excluded, then the highest cost is £2 0s. 7d. per bullock per 100 miles. The importance of drivers' wages and tucker boxes in this group is illustrated by the fact that it represents 23.6% of the total costs compared with 23.7% for hauliers in Western Australian pastoral areas.(10) The prominence of drivers' wages as a cost (21.4% of total costs) reflects the practice of employing drivers for the whole year. Tyres and tubes also represent one of the major costs, accounting for 13.6% of total costs.

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(9) The Economics of Road Transport. op.cit.
(10) The Economics of Road Transport. op.cit.

Table No. 9

Cost of Transporting Cattle by Road Train : Medium Diesels

(Average of 5 Road Trains)

Item	Cost per			Cost as percent of total
	Road train 100 miles loaded	Bullock per 100 miles(b)	Ton mile(b)	
	£	Shillings	pence	%
Cash Costs				
Fuel, oil and grease	4.50	4.10	.98	10.2
Diesel tax	1.15	1.04	.25	2.6
Tyres and tubes	5.98	5.43	1.30	13.6
Drivers' wages (a)	9.34	8.49	2.04	21.4
Tucker boxes	.97	.88	.21	2.2
Registration and 3rd Party Insurance(a)	.45	.41	.10	1.1
Other insurance (a)	1.10	1.00	.24	2.5
Repairs and maintenance of vehicles				
Repairs by (Materials	2.26	2.06	.49	5.1
Owners (Wages (a)	1.05	.95	.23	2.4
Garage repairs	5.94	5.40	1.30	13.6
Depot and administration costs				
Supervision (a)	3.35	3.05	.73	7.6
Office charges (a)	1.14	1.04	.25	2.6
Total	37.23	33.85	8.12	84.9
Depreciation				
Prime movers and trailers	3.73	3.39	.81	8.5
Depot plant and vehicles (a)	.67	.61	.15	1.5
Total	4.40	4.00	.96	10.0
TOTAL CASH COSTS AND DEPRECIATION	41.63	37.85	9.08	94.9
Interest (at 6%)				
Prime movers and trailers (a)	1.92	1.74	.42	4.4
Depot plant and vehicles (a)	.31	.28	.07	.7
Total	2.23	2.02	.49	5.1
TOTAL COSTS	43.86	39.87	9.57	100.0
TOTAL VARIABLE COSTS	24.53	22.30	5.34	55.8
TOTAL FIXED COSTS	19.33	17.57	4.23	44.2

(a) Fixed costs which must be met regardless of mileage.
(b) Average capacity of road train = 22 bullocks (approx. 11.0 tons). Average annual mileage = 18,000.

A feature not apparent from the tables is the practice of employing two drivers on large diesels, and only one on the smaller vehicles. If the annual mileages for the latter were increased much beyond the maximum travelled in 1958-59 it might be necessary to emply two drivers. This would have the effect of increasing drivers' wages and tucker box costs per unit.

(c) Petrol vehicles.

Table No. 10 shows the itemized average costs for the eight vehicles in this group. Their range of costs is shown below.

—	Lowest Cost	Highest Cost	Average Cost
	£. s. d.	£. s. d.	£. s. d.
Cost per road train per 100 miles loaded	40.13. 3	67. 4.11	57. 7. 2
Cost per bullock per 100 miles	2. 0. 8	3. 1. 2	2.14. 8
Cost per ton-mile	9.8	1. 2.7	1. 1.1

The wide range here is not caused by differences in size and capacity of vehicles as with the large and medium diesels, and therefore must be attributed almost entirely to the large differences in annual mileage travelled. This varied between 6,500 and 25,000 miles per road train. The average mileage per train, namely 15,000 miles, is also lower. Fuel, oil and grease costs are higher than for the diesel-powered vehicles, the main reason being the higher cost of petrol and the better performance of diesel-powered prime movers. Fuel, oil and grease costs are 14.6% of the total costs, compared with 7.8% for large diesels and 12.8% for medium diesels. Although the fuel, oil and grease costs are high, the observation made in connexion with the two other groups of road trains on the importance of drivers' wages and tucker boxes as an important cost, also applies to this group. For petrol vehicles this item represents 22.4% of the total operational costs, compared with 13.9% and 23.6% for the large and medium diesels respectively.

COMPARISON OF THE AVERAGE OPERATIONAL COSTS.

A study of the three road train groups shows that, in 1958-59, the large diesels and the medium diesels both had similar costs per unit, approximately 40 s. per bullock per 100 miles. Table No. 8, from which two high cost vehicles were excluded, nevertheless illustrates the superiority of large diesels, if the following causes of inefficiency were eliminated:

(a) High depot and administration costs - In the case of three road trains this charge was excessive, being 50% higher on the average than for the other three trains.

(b) High repairs and maintenance costs - Because of a series of unfortunate breakdowns due to structural faults, two vehicles had maintenance costs double those of the next highest vehicle. The technical problems involved have been overcome.

(c) Low annual mileage - Western Australian large diesel vehicles [11] requiring two drivers averaged approximately 36,000 miles in the year of the survey. In the Northern Territory the large diesels averaged approximately 18,500 miles during 1958-59. Because of this relatively low annual mileage they have not exploited possible economies of scale.

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(11) The Economics of Road Transport. op cit.

Table No. 10

Cost of Transporting Cattle by Road Train : Petrol Vehicles

(Average of 8 Road Trains)

Item	Cost per			Cost as per cent of total
	Road train per 100 miles loaded	Bullock per 100 miles(b)	Ton-mile (b)	
	£	Shillings	Pence	%
Cash Costs				
Fuel, oil and grease	8.38	7.98	1.92	14.6
Diesel tax	-	-	-	-
Tyres and tubes	8.88	8.46	2.03	15.5
Drivers' wages (a)	12.06	11.48	2.76	21.1
Tucker boxes	.75	.72	.17	1.3
Registration and 3rd Party Insurance(a)	.67	.64	.15	1.1
Other insurance (a)	1.20	1.14	.27	2.1
Repairs and maintenance of vehicles				
Repairs by (Materials	1.28	1.22	.29	2.2
Owners (Wages (a)	2.93	2.79	.67	5.1
Garage repairs	7.75	7.38	1.77	13.5
Depot and administration costs				
Supervision (a)	2.70	2.57	.62	4.7
Office charges (a)	2.26	2.15	.52	4.0
Total	48.86	46.53	11.17	85.2
Depreciation				
Prime movers and trailers	5.41	5.15	1.24	9.5
Depot plant and vehicles (a)	.75	.72	.17	1.3
Total	6.16	5.87	1.41	10.8
TOTAL CASH COSTS AND DEPRECIATION	55.02	52.40	12.58	96.0
Interest at 6%				
Prime movers and trailers (a)	1.83	1.74	.42	3.2
Depot plant and vehicles (a)	.51	.48	.11	.8
Total	2.34	2.22	.53	4.0
TOTAL COSTS	57.36	54.62	13.11	100.0
TOTAL VARIABLE COSTS	32.45	30.91	7.42	56.6
TOTAL FIXED COSTS	24.91	23.71	5.69	43.4

(a) Fixed costs which must be met regardless of mileage.

(b) Average capacity of road train = 21 bullocks (approx. 10.5 tons). Average annual mileage = 15,000.

However, comparison cannot be taken too far. Although the road trains have been put into groups, within these groups there is still a large variation in type of vehicles, performances, and mileage travelled. The variability in cost items is apparent in the itemized costs for individual road trains, but these of course cannot be shown in a work intended for publication.

A comparison of the operational costs and the types of trains operating in the Northern Territory, shows that the large units with diesel prime movers of 170 b.h.p. and 250 b.h.p. respectively, each carrying 80 bullocks, have the lowest per unit costs of operation.

From details supplied by two hauliers in the Territory, a cost model for a road train powered by 170 b.h.p. prime mover, pulling two trailers, has been constructed. In establishing the model set out in Table No. 11 the following assumptions were made :

(i) That the total capacity of the train is 60 bullocks. This is the number needed to fill three cattle vans, and permits a reasonable brake-horsepower to total laden weight ratio.

(ii) That the road train completes an annual mileage of 40,000 miles.

(iii) That this road train provides employment for two drivers and one full-time mechanic who is also the entrepreneur. The wage allocated to each driver is £1,300 per annum (this includes any bonuses), while the wage of the mechanic/entrepreneur has been set at £2,080 per annum, of which £780 is allocated to supervision and £1,300 to wages under the heading "repairs and maintenance of vehicles".

(iv) That there is no backloading. The vehicle therefore travels 20,000 miles per year loaded.

(v) That the vehicle is operating under conditions at present existing in the Alice Springs District.

(vi) That the value of the prime mover be £12,280, and that £3,230 be the value for each of two trailers (these figures are exclusive of the value of tyres and tubes, but include the delivery cost for the prime movers and trailers). This high value for the unit includes sales tax. It has also been assumed that the train is in its first year of operation, and hence interest at 6% has been charged on the total value of the unit.

Total cash costs in the model (20.28 s.) are similar to those in the Western Australian survey [12] where the average for four road hauliers was 19.23 s. per bullock per 100 miles. Depreciation and interest charges are somewhat higher than the 4.6s. per bullock per 100 miles for these four trains, due to the assumption that the model is in its first year of operation and also to its higher capital cost. When these factors are considered, the total cost of 26.3s. per bullock per 100 miles compares not unfavourably with 23.8 s. per bullock per 100 miles for Western Australian trains.

The operational cost of petrol vehicles compares unfavourably with that of diesels. The most important factor is the generally higher cash costs, particularly items such as drivers' wages, tyres and tubes, and fuel, oil and grease.

To sum up, it may be said that large diesels with prime movers of 150 to 200 b.h.p. are the most suitable for cattle transport in the Alice Springs area. These units could very likely operate at a cost of approximately 27 s. per bullock per 100 miles, provided the assumptions previously mentioned are realized.

The achievement of results approaching those shown in the model will depend on the elimination of high-cost competitors, so that the turn-off is distributed between fewer transporters but handled more expeditiously. With the provision of an adequate road system necessary for this development, the standard of service to the pastoralist should not be jeopardised by the reduction in transport numbers.

EFFECT OF MILEAGE.

As previously mentioned, annual mileage registered by road trains in the Northern Territory varies considerably. During the year 1958-59 the annual mileage of the 19 road trains studied ranged from 4,500 miles to 31,000 miles, the average being 16,600 miles. This low mileage stemmed from the fact that a large number of road trains were available to transport a limited number of cattle. In view of their low annual mileage, the average cost of the trains in the three groups were recalculated for annual mileages of 20,000, 30,000 and 40,000 miles. The results expressed as the cost in shillings per bullock per 100 miles were as follows:

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(12) The Economics of Road Transport. op.cit.

Table No. 11.

Cost Model for a Road Train Powered by a 170 B.H.P. Prime Mover.

(Annual Mileage 40,000)

Item	Cost per			Cost as per cent of total
	Road train per 100 miles loaded	Bullock per 100 miles(b)	Ton-mile (b)	
	£	Shillings	Pence	%
Cash Costs				
Fuel, oil and grease	7.57	2.52	.61	9.6
Diesel tax	2.22	.74	.18	2.8
Tyres and tubes	16.39	5.47	1.31	20.5
Drivers' wages (a)	13.00	4.33	1.04	16.3
Tucker boxes	2.68	.89	.22	3.4
Registration and 3rd Party Insurance(a)	1.03	.34	.08	1.3
Other Insurance (a)	.25	.08	.02	.3
Repairs and maintenance of vehicles				
Repairs by (Materials	9.30	3.10	.74	11.6
Owners (Wages (a)	6.50	2.17	.52	8.1
Garage repairs	-	-	-	
Depot and administration costs				
Supervision (a)	.39	.13	.03	.5
Office charges (a)	1.52	.51	.12	1.9
Total	60.85	20.28	4.87	76.3
Depreciation				
Prime movers and trailers	12.11	4.04	.96	15.0
Depot plant and vehicles (a)	.58	.19	.04	.7
Total	12.69	4.23	1.00	15.7
TOTAL CASH COSTS AND DEPRECIATION	73.54	24.51	5.87	92.0
Interest (at 6%)				
Prime movers and trailers (a)	5.62	1.87	.45	7.1
Depot plant and vehicles (a)	.70	.24	.06	.9
Total	6.32	2.11	.51	8.0
TOTAL COSTS	79.86	26.62(c)	6.38	100.0
TOTAL VARIABLE COSTS	50.27	16.76	4.02	63.0
TOTAL FIXED COSTS	29.59	9.86	2.36	37.0

(a) Fixed costs which must be met regardless of mileage.

(b) Capacity of road train = 60 bullocks (approx. 30 tons).

(c) With the assumptions embodied in the above model the cost per bullock per 100 miles for annual mileages of 25,000, 30,000 and 35,000 inches would be 32.80s., 29.85s., and 28.03s. respectively.

—	Actual Average	20,000 miles	30,000 miles	40,000 miles
Large diesels	40.07	39.20	33.04	29.96
Large diesels - excluding 2 trains (a)	36.82	29.23	25.86	24.17
Medium diesels	39.87	37.88	32.77	30.22
Petrol vehicles	54.62	47.90	42.55	39.84

(a) These are the two road trains excluded from the large diesels in the previous discussions.

Note : Drivers' wages have not been increased at the 40,000 miles level for medium diesels and petrol vehicles. It is likely that at some point between 30,000 and 40,000 miles it would be necessary to employ two drivers instead of the present one. Large diesels require two drivers regardless of their level of operation.

The average cost per bullock per 100 miles for the large diesels at the 30,000 and 40,000 mile level is lower than for the cost model, due to the inclusion of a lessee-operated vehicle with a very low brake horsepower to total laden weight ratio. It is unlikely that this 170 b.h.p. prime mover could effectively haul 80 bullocks per load under commercial conditions with a high annual mileage. This fact, however, in no way invalidates the argument regarding the effect of mileage on costs.

When comparing the cost of road trains in Western Australia and the Northern Territory, the average cost of medium diesels was calculated for an annual mileage of 35,000 miles (the approximate average annual mileage of road trains in Western Australia). The comparison is set out in Table No. 12.

Table No. 12.

Comparison of Operational Costs.

Average of medium diesels in the Northern Territory compared with a Leyland Beaver 125 b.h.p. diesel operating in Western Australia. (a)

(cost per bullock per 100 miles)

Item	Average of 5 medium diesels average capacity = 22 bullocks	Leyland Beaver capacity = 23 bullocks
	shillings	shillings
Fuel, oil and grease (incl. diesel tax)	5.14	4.64
Tyres and tubes	5.43	4.42
Drivers' wages and tucker boxes	10.46	10.47
Repairs and maintenance	7.85	4.17
Depreciation	3.68	2.92
Interest	1.04	.84
Other costs	2.94	4.37
Total	36.54	31.83

(a) The Economics of Road Transport, op. cit.

The lower repairs and maintenance costs, and tyres and tubes costs, in the case of the Western Australian vehicle, were due among other things to more satisfactory maintenance, careful driving and better road conditions. Also, the fact that the medium diesels average 12 tyres and the Leyland Beaver 10, cannot be overlooked. In this comparison, wages have been calculated for two drivers per vehicle in the case of the Northern Territory to permit a comparison with the Western Australian vehicle. The greater age of the Western Australian vehicle and associated equipment is reflected in its lower depreciation and interest charges.

CAPITAL INVESTMENT

Initial capital required for road transport enterprises may vary considerably. Total capital investment in road trains included in the survey and the associated equipment represented by the depreciated value at 1 July 1958 was £229,000 - of which £169,000 was invested in the large diesel group, £24,500 in the medium diesel group and £35,500 in the petrol vehicles group. Details of the average capital investment in four groups is given in Table No. 13.

Table No. 13

Capital Investment in Rolling Stock and Depot Equipment.

Item	Large diesels average of 6 trains	Large diesels average of 4 trains(a)	Medium diesels average of 5 trains	Petrol vehicles average of 8 trains
	£	£	£	£
Prime movers	8,190	7,250	2,180	1,690
Trailers	3,990	2,930	980	1,050
Tyres	2,350	2,340	750	880
Investment in rolling stock	14,530	12,520	3,910	3,620
Investment in depot equipment	13,650	2,340	1,000	830
Average investment per road train	28,180	14,860	4,910	4,450

(a) The two road trains excluded from the large diesels are the same trains previously excluded.

Note:

(a) Some hauliers used all or portion of their road trains for general cartage. This has been taken into account for the cost analysis, although the full depreciated value of rolling stock is given in this Table.

(b) Investment in depot equipment for medium diesel and petrol vehicles has been estimated.

The second group in the Table - large diesels, average of 4 trains - was inserted to overcome the effect of two trains with abnormal investment in depot equipment. The Table shows clearly that capital investment for large diesels is very much greater than for medium diesels and petrol vehicles. This partly explains why there are few large units operating commercially in the Territory.

The average capital investment for medium diesels and petrol vehicles is approximately the same, the main reason for this being that the medium diesels are on the average older than the petrol vehicles and hence the depreciated value of the former approaches that of the latter. The relatively small amount of capital needed to become a cattle haulier in the petrol vehicle class, together with convenient hire purchase arrangements, has been partly responsible for many new entries to this business during recent years.

A comparison of returns for vehicles operating in the Northern Territory shows that large and medium diesels have a return to capital invested of 12%, while petrol vehicles have a return to capital of minus 10%. In calculating returns to capital for each group, the average charge for commercial hauliers has been used. This return has been established by subtracting from gross returns, operational costs (exclusive of interest charges) and expressing the result as a percentage of capital invested in the beef cattle haulage enterprise.

When factors such as risk and location are taken into account, even the returns to large and medium diesels are unsatisfactory, reflecting once again low annual mileage travelled and poor road conditions. This low return is further emphasized when the high charges to pastoralists are considered - these average £2 5s. 0d. per bullock per 100 miles - although in some cases, concessions were made when back loading was available. On the other hand, charges were made in some cases for dead running, for example, from Alice Springs to Finke. In the remote areas of Western Australia the average charge per bullock per 100 miles was approximately £1 10s. 0d.

The above suggests that some hauliers with low returns to capital, unless sufficient cattle become available to increase profitability, will be forced out of the business when faced with the problem of vehicle replacement.

EFFECT OF BITUMEN ROADS.

There are 1,360 miles of sealed roads in the Territory. For the hauliers in this survey, approximately 50% of their total mileage was completed on sealed roads. This figure however is an average and varies between 30% and close to 100%. The main costs to be affected by the presence of sealed roads would be:

(a) fuel, oil and grease;
(b) tyre and tube replacements;
(c) repairs and maintenance; and
(d) depreciation.

The effect of reducing these costs will be discussed with reference to the cost model shown in Table No.11.

Western Australian hauliers [13] suggested that on sealed roads, fuel, oil and grease costs could be cut by as much as 40%. However, in the Territory, with many hauliers already operating on bitumen, a saving of about 15% would be reasonable. Some hauliers in the Territory stated that there was no difference in fuel consumption on sealed roads as against unsealed roads of a reasonable standard. It may be assumed that there will also be a 15% decrease in lubrication costs due to less dust and vibration. A 15% decrease in fuel and lubrication costs will reduce these charges by approximately £227 per year in the model.

Hauliers working predominantly on bitumen, estimate the life of tyres at about 30,000 miles, although most hauliers in the Territory estimate tyre life at approximately 25,000 miles. However, tyre life is not only dependent on roads, as other factors such as the skill of drivers and the speed of the vehicles play an important part. An increase of 20% for the life of tyres would decrease the annual costs for tyres and tubes by approximately £550 in the case of the 170 b.h.p. model train.

It was assumed in the calculation of operational costs that most tyres would not be suitable for recaps, but tyres used on bitumen could be recapped, and this would be quite economical particularly with larger tyres, even when freight charges are considered. It is estimated that recapping of tyres would result in a saving of £360 per year on this item.

A reduction of up to 20% in the cost of repairs and maintenance might be expected; this would represent a further saving of £372 per annum.

Although it might be assumed that vehicles on bitumen roads would have a longer life owing to such factors as smoother running, nevertheless it appears that after five years the obsolescence factor included in depreciation becomes increasingly important. The economic life of the model train could possibly be extended by 10%, to give it a life of approximately 264,000 miles for prime movers and 440,000 miles for trailers. This would mean a reduction of approximately £220 per annum for this cost item.

If all the roads used were sealed, the annual operating cost of this road train could be reduced by the following amounts:

	£
Fuel, oil and grease	227
Tyres and tubes	910
Repairs and maintenance	372
Depreciation	220
Total	£1,729

This reduction in costs would represent the following savings:

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(13) The Economics of Road Transport. op. cit.

	£ s. d.
Per road train per 100 miles loaded	8. 12. 11
Per bullock per 100 miles	2. 11
Per ton-mile	0.7

Apart from the savings in variable costs considered above, sealed roads could also lead to another important saving, namely the possibility of spreading fixed costs over a greater annual mileage, provided sufficient additional cattle were available for transport to enable hauliers to take advantage of improved turn-around times. However, some fixed costs could increase with mileage, for example drivers' wages.

BACKLOADING.

The assumption that cattle transports carry no backloading may not be entirely correct, as some hauliers do carry small quantities of stores and equipment to stations, but this is more the exception than the rule. It is often inconvenient, as stations are widely separated and probably not on the same route. Also, these vehicles, especially the larger transports, are not entirely satisfactory for transport of station stores.

Hauliers in the Alice Springs District must keep to schedules largely dictated by railway time-tables, which preclude them from visiting stations other than those from which cattle are to be transported. Most backloading of stock consists of imports of cattle, mainly bulls but also some horses, wich are road transported from the railhead. It will be seen from Part I of this report, that the extent of such backloading is small. Lessee hauliers do carry station stores and equipment as backloading to their properties, but again it is relatively small. Some hauliers included in this study were also general carriers, but this was a separate enterprise.

Hence it may be safely assumed that backloading with station stores and livestock is not important since it is often inconvenient, and stores are mainly carried by well established general carriers. Although costs have been slightly overstated by this assumption of no backloading, it has also been assumed that there is no "dead" running due to such causes as breakdowns and bogging. Sufficient evidence does not exist for a full consideration of this factor, but it is known that on occasions dead running does occur, and to this extent costs have been understated. It is assumed therefore that one is balanced by the other.

EFFECT OF SALES TAX AND TAX ON DIESEL FUEL.

Sales Tax.

Sales tax is levied on prime movers, trailers and component parts at the rate of $16\frac{2}{3}\%$. and on tyres at the rate of $12\frac{1}{2}\%$. As the tax is levied on the wholesale price, the proportion it represents of the price paid by the operator (since this includes a margin of profit for the retailer) is slightly less. The effect of sales tax on the operational costs of the diesel cost model previously described is shown in Table No. 14.

Table No. 14.

Effect of Sales Tax on Replacement Cost of a Model Road Train.

Item	Prime mover		Trailers		Train
	Chassis & cab	Tyres	Trailers	Tyres	Total
	£	£	£	£	£
Price excluding sales tax	10,790	760	5,530	1,210	18,290
Sales tax	1,490	90	930	150	2,660
Total	12,280	850	6,460	1,360	20,950

Sales tax therefore represents an additional 14.5% on the price of this particular road train. From Table No. 11 it will be noted that depreciation per train per 100 miles loaded, based on the value of trains less tyres, is £12.11. Of this, £1.77 may be regarded as depreciation on that part of the value represented by sales tax. Similarly, the interest cost per train per 100 miles loaded of £5.62 contains an amount of £0.80, which may be regarded as interest on the sales tax portion of the purchase price.

Diesel Tax.

A tax of 1s per gallon was imposed on diesel fuel as from 13 September 1957. It has caused the average cost of road train operation to rise by 2.8% and represents an increase of 31.6% in the price of fuel.

Combined Effect of Taxes.

Table No. 15 shows the combined effect of sales tax and the tax on diesel fuel on the annual operating costs of the cost model diesel which has been described above. The figures show that sales tax and diesel tax together represent 9.2% of operational costs.

Table No. 15

Effect of Sales Tax and Fuel Tax on Operating Costs.

Item	Per road train per 100 miles loaded	Per bullock per 100 miles	Per ton - mile
	£	shillings	pence
Total costs, including depreciation and interest	79.86	26.62	6.38
Effect of sales tax -			
(a) on purchase of road train	2.57	0.86	0.21
(b) on purchase of tyres	1.92	0.64	0.15
Total	4.49	1.50	0.36
Effect of fuel tax	2.22	0.74	0.18
Total effect of taxes	6.71	2.24	0.54
Net costs (total costs less effect of taxes)	73.15	24.38	5.84
Effect as % of net costs	9.2%	9.2%	9.2%

PART III: THE SUITABILITY OF VEHICLES.

TYPE OF VEHICLE REQUIRED.

Part II of this report supports the findings in the Western Australian Survey [1] that the larger diesel vehicles have considerable economies of operation. Furthermore, it shows that the smaller diesel vehicles have a considerable cost advantage over petrol powered prime movers with the same carrying capacity, due largely to their better fuel consumption and lower maintenance costs.

Road transport in the Alice Springs District is particularly inefficient both as regards the type of vehicles operating and the annual mileages travelled. Although operational problems, due largely to unsuitable roads, are chiefly responsible for the inefficient types of vehicles used, it is quite apparent that lack of capital on the part of many persons entering the transport business has also had a distinct effect. If pastoralists here are to receive the benefit of an efficient road transport service, roads must be improved sufficiently to allow the satisfactory operation of large,efficient vehicles and so act as an incentive to those with sufficient capital to invest.

The most satisfactory vehicle for use on earth formed roads still appears to be the conventional-type diesel powered by an engine of approximately 200 b.h.p. pulling two trailers, with a total capacity of about 60 head of large bullocks. On the bitumen, larger vehicles are operating satisfactorily. Two custom-built road trains powered by 250 b.h.p. Rolls Royce engines have been operating on the Stuart and Barkly Highways between Helen Springs and the railheads at Larrimah and Mt. Isa,for the past two seasons. These 150 feet-long trains, with a capacity of approximately 80 head of large bullocks, have operated quite satisfactorily except for some initial transmission problems. Although these road trains each cost £25,000 (and not £40,000 as published in at least one newspaper at the time of their purchase) their capital cost per beast capacity is no greater than for small vehicles.

Certain interests have pointed out that a vehicle requires a reasonable brake horsepower to total weight ratio if optimum performance is to be achieved. This improves turn-around times, minimizes wear and tear especially to transmission and assists in ensuring a smooth ride for stock being carried, as well as providing additional power for the supply of compressed air for the power operated steering unit and gear shifting mechanism. Brake horsepower to total weight ratios are given hereunder for the large diesel group. It will be noticed that one major train has a very low ratio, and it is thought that in areas of undulating country, especially when operating on earth formed roads, this could become uneconomic.

Vehicles	Brake horsepower	Total laden weight	b.h.p./tons
		(tons)	
1	170	71.1	2.4
2	225	75.5	3.0
3	250	78.5	3.2
4	250	78.5	3.2
5	170	43.1	3.9
6	200	40	5.0
Average for six trains	211	64.5	3.3

PRACTICAL LIMITATIONS ON SIZE.

Under present operating conditions, any increase in the size of road trains is limited by the following considerations :-

(a) with existing design, the greater the length of the train the greater is the possibility of bruising cattle. This was so in Western Australia, but there appears no reason why bruising should be greatly increased on a number of the roads in the Alice Springs District, if trains with at least double the present capacity are used, provided normal precautions are taken. These larger trains operate at lower speeds than the small units and this should actually tend to reduce bruising, for it is well known that because of the speed and manoeuvrability of these small units careless drivers can cause considerable bruising to stock. However, at least one train operating in the Alice Springs District is approximately 150 feet long, and it is possible that the use of trains of this length on dirt roads in undulating country might pose a problem of bruising;

(1) The Economics of Road Transport of Beef Cattle - Western Australian Pastoral Areas, 1958. Bureau of Agricultural Economics, Canberra.

(b) the accident risk would be heightened unless roads were considerably improved. This is largely true of the Alice Springs District where most roads require widening, straightening and forming, and would certainly be true of some roads in the other survey areas where, as yet, large scale road transport of cattle has not been established;

(c) where cattle are delivered to railheads the numbers carried need to be related to the capacity of the railway wagons. Cattle trucks of the "bogie" type used in the Northern Territory have a capacity of some 20 bullocks, while the 8 wheeled "K" wagons in operation in Queensland carry about 18 bullocks. This supports the contention that off-bitumen trains carrying 60 head would be suited to the requirements of the Alice Springs District. Most stations would, without great difficulty, be able to muster sufficient fat bullocks to fill such a unit;

(d) if hauliers decide to use vehicles of a type and size not readily available from manufacturers, price considerations might offset any economic advantage, although if sufficient demand existed manufacturers might be willing to modify existing designs to suit local conditions;

(e) any large increase in the size of road trains, besides making driving more hazardous and difficult and to a degree more specialized, means a loss of flexibility. Owing to high capital costs, vehicles must be worked at, or near, full capacity, and the size of the train could make this difficult in some areas. This could be true of large diesel electric "cross country" trains attempting to operate in areas where stations depend on turning off a small number of fats as they become available; and

(f) long road trains, with a capacity much in excess of the previously mentioned desirable maximum, increase the dangers to other road users. They reduce average speed and increase the work load of the driver and co-driver.

TRAFFIC REGULATIONS AND VEHICLE SIZE.

The Northern Territory Control of Roads Ordinance 1953-1958, fixes maximum dimensions for prime movers and trailers operating in the Territory, while in Queensland these are determined under The Traffic Acts 1949-1953 and Traffic Regulations 1959. Those limitations, which may apply to vehicles used for the road transport of cattle in the areas of the present investigation, are shown below.

The Administrator of the Northern Territory is empowered under the Ordinance to permit the operation of trains with three self-tracking trailers. In Queensland only one self-tracking trailer is allowed on main roads, but permission may be given by the Queensland Department of Main Roads after consideration of the likely effect on road safety and the road surface, for the operation of larger trains. It has already been mentioned that two road trains, each 145 feet long, are operating from the Northern Territory to Mt. Isa in Queensland. Although the Northern Territory Administration has granted permission for the operation of trains pulling three trailers each with a length of 45 feet, it is doubtful if these would be permitted to operate in Queensland, other than on the Barkly Highway.

Table No. 16:

Limitations on the Size of Vehicles: Northern Territory and Queensland.

Dimension	Vehicle	Maximum permitted	
		Northern Territory	Queensland
		feet	feet
Length	Prime mover	40	31
"	Prime mover and semi-trailer (articulated)	45	45
"	Self-tracking and independently braking trailer	55	45
"	Non-self-tracking trailer	31	-
"	Two or three trailers each	45	-
"	Prime mover and one trailer	100	-
"	Prime mover and two or three trailers	145	-
Height	All vehicles	14.5	12.5
Width	All vehicles	8	8
Gross weight	All vehicles	18,000 lb. per axle load and 36,000 lb. on tandem axles	18,000 lb. per axle load and 36,000 lb. on tandem axles

All road trains encountered in Queensland and the Northern Territory had the maximum permissible width of 8 feet. With side-loaded vehicles it is unlikely that a much greater width would be of any advantage. However, should road trains be designed so that stock stand in a fore and aft position, the problem of width might become important.

The height limitation of 12 feet 6 inches is unlikely to affect vehicles being currently used; but should the transporting of weaner-type stores on two decks ever be successfully attempted, height may become a limiting factor in Queensland. Although this procedure has been suggested as possible, there are problems associated with its adoption which would appear to make it impracticable on other than very straight, flat roads.

Prescribed maximum axle loadings are unlikely to be exceeded on conventional vehicles, especially as cattle have a relatively low ratio of weight to area occupied.

Within limits, therefore, legislation governing the size of vehicles is unlikely to hinder the growth of an efficient road transport fleet for use in the marketing of cattle. Especially in the Northern Territory, the restrictions may be regarded as being not ungenerous.

SUGGESTED MODIFICATIONS.

Hauliers were asked to suggest modifications to vehicles that might improve road train performances. Answers forthcoming were generally disappointing as most hauliers appeared satisfied with the units they were operating.

One pastoral company, however, suggested that if transports could be fitted with a moveable roof of some light material made in the form of louvres to enable them to be opened or shut as required, it would be of benefit to travelling stock. These louvres would provide shade and could be opened to allow the circulation of air, and so keep cattle cool. They would be specially advantageous if the turn-off season were extended. The actual design and construction would need to be carefully considered.

Methods of reducing sway have been given attention in some quarters. Bruising caused by excessive sway is often a feature of concern where two or more large self-tracking trailers are used. Sway has been reduced in some cases by a shortening of the distance between the towing hitch and the rear axle of the prime mover and trailer.

In the Western Australian [(2)] report it was suggested that a prime mover using an underfloor-type engine unit of about 230 b.h.p., and hauling a single large trailer, might eliminate much of the sway. It was envisaged that both the prime mover and trailer would be fitted with crates of equal size carrying a total of approximately 50 large bullocks. The length of this unit would be 96 feet compared with a length of 105 feet for a unit consisting of a prime mover and two trailers, each 30 feet long, with similar capacity. In addition to reducing sway it was claimed that the unit would have a better performance due to more efficient tracking and some decrease in total weight. Apparently the production of a unit of this type is being undertaken in Western Australia, and it appears that if successful from the point of view of both performance and cost, it might offer advantages in the Alice Springs District if road conditions are improved there.

The elimination of bruising of cattle in transit, due to jolting caused by corrugations and other road deficiencies, is still a problem. Much hip bruising can be prevented if cattle loaded into a crate are of uniform size and packed sufficiently tightly to prevent freedom of movement without detriment to their comfort, while both hip and buttock bruising can be reduced by careful driving at speeds suitable to the road conditions and by avoiding sudden speed changes associated with careless braking and gear changing. Dehorning of cattle would also assist. Padding of crates will reduce buttock bruising, but the only effective way of doing this at present is by using rather expensive sponge rubber, and it still remains for the future to produce a relatively cheap and effective padding. Perhaps the use of foam plastic with a tough, impermeable surface would have something to offer.

It has been suggested that improvements in vehicle suspension might reduce bruising. The use of air suspension assisted units and hydraulic shock absorbers, in conjunction with existing types of springing, would improve the ride. However, the economics of carrying out this modification are not known, and a consideration of the technical factors involved is outside the scope of this report.

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(2) The Economics of Road Transport. op. cit.

An estimated reduction of about 20% might be achieved in the weight of cattle crates by the use of aluminium alloys instead of the conventional wood and steel structure. This would have the effect of improving fuel consumption, reducing tyre and vehicle wear, and improving acceleration and braking.

Station stock on road trains become very restless when the vehicles are not in motion, especially if any disturbing features are visible to them, and an amount of bruising results from milling around. Because of this, crates enclosed with timber, utilizing boards of about 8 inches in width and of adequate thickness, with perhaps 2 inches between boards, appear to be preferable to crates enclosed with steel mesh.

It was noticeable that many hauliers in the Alice Springs District used welded metal non-slip lattices made of iron piping on the floor of their vehicles instead of the wooden lattice used so widely in Western Australia. These were in sections and secured to the floor by a number of holding bolts. The sections were easily removable by one man and permitted easy cleaning of the crates. Light self-cleaning grates of pressed metal sheeting suitably ridged are being successfully used in crates by one haulier in Western Australia.

CONCLUSION.

It appears that the most satisfactory vehicle on earth formed roads is a prime mover with approximately 200 b.h.p. pulling two trailers, with a total capacity of 60 bullocks. This gives the vehicle a satisfactory ratio of brake horsepower to total laden weight. On bitumen roads in the Northern Territory larger trains have been operating successfully.

The size of conventional-type vehicles, except on bitumen roads in Queensland, is influenced by practical considerations such as the condition of roads, the size of railway cattle wagons and capital cost, rather than by traffic regulations.

The major development in road transport has taken place in the Alice Springs District. However, vehicles being used there are relatively small and inefficient due largely to capital restrictions and the condition of roads.

Before an efficient cattle transport service can be instituted in the survey areas, considerable improvement in the standard of roads will be required. On bitumen roads, larger trains can be successfully operated, and prime movers of 250 b.h.p. are being currently used. Further experimentation with suspension is required to provide a more comfortable ride for cattle, and the use of air suspension assisted units has been suggested.

PART IV: SUITABILITY OF ROADS.

The planning and development of roads in the Northern Territory are under the control of the Department of Territories, while the actual construction and maintenance of such roads are carried out by the Commonwealth Department of Works. The Queensland State Department of Main Roads is responsible for road development and maintenance in the Channel Country of Queensland. This part of the report, therefore, will not be directly concerned with the economics of road construction and maintenance. It will, however, consider in the light of information available from those interested, the suitability of existing roads for the transport of cattle, bearing in mind the major reasons for which road transport might be introduced in the areas under consideration. It will also discuss the roads which appear of major importance, in view of such factors as the present and potential cattle numbers available for transport, market considerations and expected development.

NORTHERN TERRITORY.

With the exception of the Stuart Highway (954 miles) linking Alice Springs and Darwin, and the Barkly Highway (406 miles) linking the Stuart Highway with Mt. Isa, all roads in the Northern Territory are unsealed. Figures released by the Department of Territories show that at 30 June 1958 there were 12,451 miles of road in the Territory of which 85% were graded and bush tracks, 11% were sealed roads and highways, and the remainder were formed earth roads some of which had gravelled surfaces.

The two sealed highways, constructed for the wartime movement of troops and supplies, have a 16 feet sealed surface. They are maintained by the Commonwealth at an annual cost of approximately £500,000, which includes the cost of road patrols, periodical reseals and reconstruction at the rate of 2% per annum.

Generally speaking, earth formed roads and tracks in the Northern Territory are very poorly maintained owing, it is claimed, to insufficient funds. Because of this and the large mileage requiring development it is unlikely that roads in the Northern Territory will reach a reasonable standard of efficiency in the near future. A scheme of gradual development, which should ensure the improvement of a number of major roads, is being currently undertaken.

The classifications which are set out below have been suggested by the Department of Territories as satisfactory for road development in the Northern Territory. They also form a convenient basis for discussions in this report.

(i) Class A roads:- All-weather except for flood periods. Clearing 40 feet wide, formation 26 feet wide, pavement 18 feet wide with 12 feet bitumen strip in centre, low level bridges and concrete causeways.

(ii) Class B roads:- Near all-weather roads, clearing 40 feet wide, formation 26 feet wide, pavement 18 feet wide, gravelled or stabilized throughout, with low level bridges and concrete causeways.

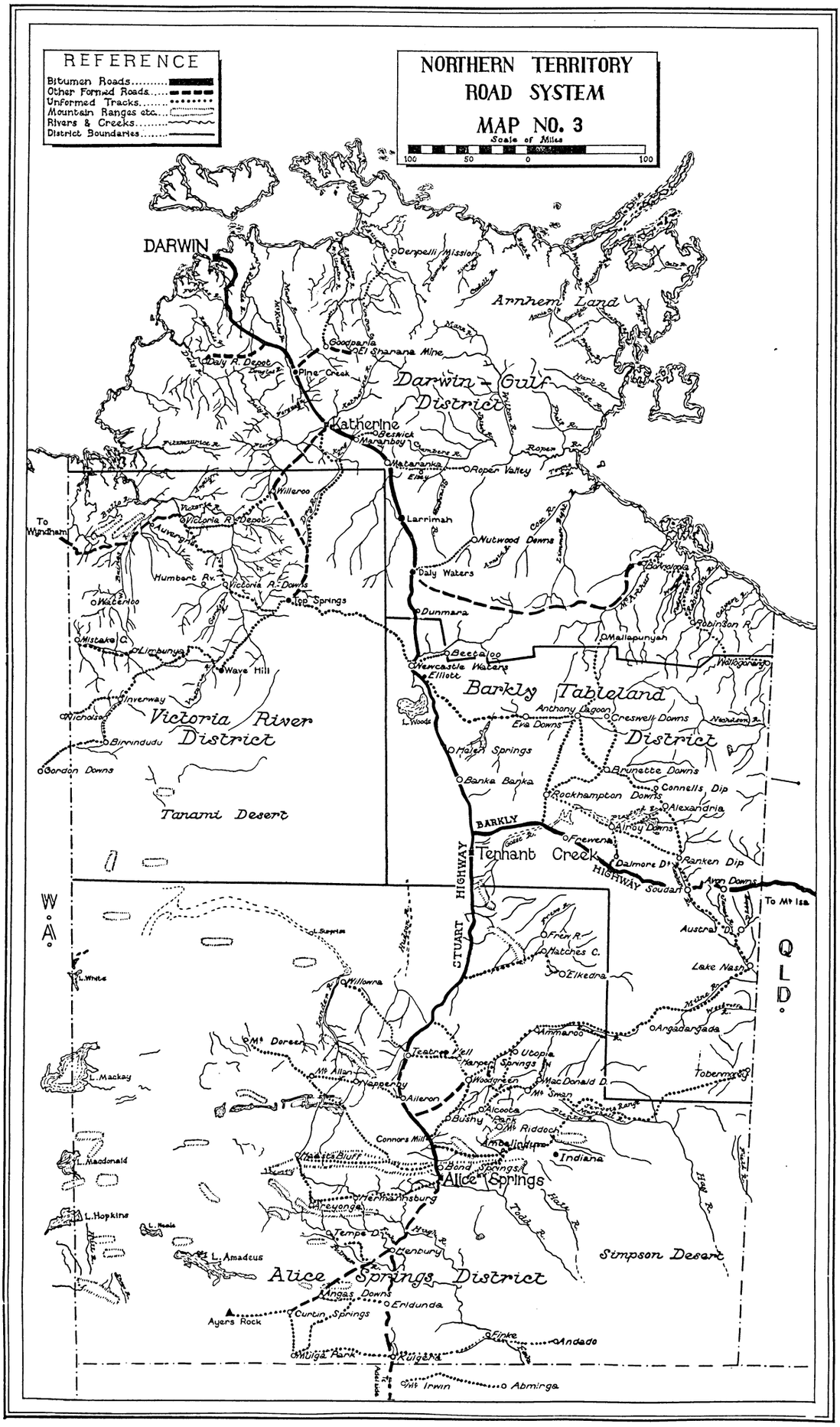
(iii) Class C roads:- Dry weather roads, clearing 40 feet wide, formation 26 feet wide, gravelled in weak spots as necessary. Stone and gravel stream-bed crossings, with graded approaches.

(iv) Graded earth tracks:- Dry weather tracks with an average width of 18 feet.

Map No. 3 classifies Northern Territory roads into three categories, namely bitumen roads, other formed roads and unformed tracks. The suitability of existing roads for the transport of cattle, and road requirements in each of the areas visited in the course of the survey, are now considered.

Alice Springs District.

Because of the low annual rainfall of this District and the fact that much of the terrain consists of flat, sandy country, hauliers have been able to operate with a degree of success on roads which in other areas would have been completely unsuitable for the transport of cattle. Roads flat graded to a width of 18-20 feet which come within the Northern Territory classification of graded earth tracks, predominate in the District, although there are a number which are considerably narrower and a small number which are wider and satisfactorily formed. Roads have been considerably widened in recent years, for when the transporting of cattle commenced in the late forties, most were only 12 feet wide.


REFERENCE
Bitumen Roads
Other Formed Roads
Unformed Tracks
Mountain Ranges etc.
Rivers & Creeks
District Boundaries
NORTHERN TERRITORY
ROAD SYSTEM
MAP NO. 3
Scale of Miles
100 50 0 100
DARWIN
Darwin - Gulf District
Katherine
Annhem Land
Victoria River District
Barkly Tableland
District
Tanami Desert
Tennant Creek
STUART HIGHWAY
BARKLY HIGHWAY
Alice Springs
Alice Springs District
Simpson Desert
Ayers Rock
To Wyndham
To Mt Isa
W.A.
N.T.
QLD.

The major deficiencies mentioned by hauliers are listed below.

(i) Narrowness of roads. Roads or sections of roads are often too narrow to allow vehicles to pass without being forced off the road proper. This is undesirable as staking of tyres may occur or vehicles may become bogged. Hauliers state that in some low lying areas falls of 50 points of rain are sufficient to cause bogging. The net result is that cattle deliveries are held up, cattle become restless which causes bruising particularly in the case of fat stock, and hauliers' operational costs are increased.

(ii) Roads are not sufficiently straight. Many roads follow old bush tracks and are therefore very winding. Not only does this slow down the speed of travel and increase turn-around times, but also causes bruising of stock and wear and tear to vehicles.

(iii) Unsatisfactory creek crossings and approaches. Numerous gullies and stream crossings need attention. Many of these have sandy bottoms which cause bogging. In some cases the approaches are too steep to be successfully negotiated by road trains without causing bruising and discomfort to stock.

(iv) Dust hazard. Areas of bull dust occur on some roads owing to the breakdown of the soil into a fine powdery dust which, although probably having no lasting ill effects on stock being transported, reduces visibility, thus increasing accident risk and making driving decidedly uncomfortable. Furthermore, owing to the hard sub-soil which generally underlies this dust, considerable jolting may occur, causing increased bruising of stock and wear and tear to vehicles. As a large proportion of cattle transported in the Alice Springs District in normal seasons is fat stock, elimination of bruising is a consideration of the greatest importance.

(v) Bogging in some areas. Hauliers state that in many low lying areas bogging occurs if falls of from 50 points to 100 points are recorded. They consider that, where roads are properly formed, the water is shed and the risk of bogging is therefore greatly reduced. Table No. 17 sets out the probability of receiving: (1) more than 1" of rain; (2) more than 2" of rain; and (3) more than 4" of rain, in any month; and is based on figures collected at Alice Springs over a period of 50 years. Although monthly rainfall will often be received from several falls some time apart, and there will be cases where such falls will not cause bogging, the Table does indicate the likelihood of delays.

Table No. 17.

Probability of Receiving Specified Amounts of Rain: Alice Springs District.

Month	Probability of receiving		
	more than 1"	more than 2"	More than4"
January	1 in 2.4	1 in 4.2	1 in 12.5
February	1 in 2.5	1 in 3.1	1 in 5.5
March	1 in 2.3	1 in 3.5	1 in 12.5
April	1 in 5.5	1 in 12.5	negligible
May	1 in 5.5	1 in 16.7	1 in 50
June	1 in 3.9	1 in 8.3	negligible
July	1 in 7.1	1 in 25	negligible
August	1 in 7.1	1 in 16.7	negligible
September	1 in 10	1 in 50	negligible
October	1 in 3.9	1 in 10	negligible
November	1 in 2.1	1 in 6.2	negligible
December	1 in 2.1	1 in 3.3	1 in 12.5

As will be seen, the chances of more than 4 inches of rain falling in any month other than February are rather remote. On the other hand, falls of more than 2 inches may be expected every 3 or 4 years in December, January, February and March, while falls totalling 1 inch are likely every 2 or 3 years in November, December, January, February and March. In the main "fat" turn-off period during April, May and June, there is a better than even chance of more than one inch of rain in at least one of the months concerned. The figures support the hauliers' contention that bogging is likely to occur with consequent delays and bruising of stock.

Details of the roads in the Alice Springs District mainly used for the road transport of cattle are given below, with an estimate of the percentage of total cattle transported over each.

(i) Connor's Mill - Woodgreen - Utopia - Ammaroo Road (150 miles). A large part of this road is wide, earth formed and roughly equivalent to a "Class C" road as defined previously, but no sections are gravelled. This road, which links the north-east cattle areas with the Stuart Highway 60 miles north of Alice Springs, was brought up to its present standard some years ago to facilitate the road transport of cattle. It carries approximately 20% of the cattle road-trained to Alice Springs, and is regarded by hauliers as probably the best earth road in the District. An extension connects Ammaroo with Argadargada and Lake Nash near the Queensland border. Reconstruction of the unformed portion of the road will commence in the financial year 1960-61.

(ii) The Jervois Road (325 miles). This links Tobermory near the Queensland border with the Stuart Highway some 40 miles north of Alice Springs and carries approximately 15% of the cattle traffic to this centre. This road traverses some rather hilly country, especially in the vicinity of the Strangway and Harts Ranges, and is reputed to be very winding and not satisfactory for the transport of cattle. Hauliers claimed that there is a risk of bogging throughout its length particularly in a number of sandy creek beds. Part of the road, from the Stuart Highway to the Plenty River, is in the course of reconstruction. To Jervois Creek the road will be "Class B" standard. The remainder of the reconstruction will be "Class C". This should be satisfactory for the road transport of cattle.

(iii) North-West Road (300 miles). The most important section of this road for cattle transport is the 220 miles linking Mt. Doreen with the Stuart Highway 12 miles north of Alice Springs. It is flat graded to a width of some 20 feet and generally not subject to washouts; reconstruction as an earth formed road is due to be undertaken during 1960-61. An estimated 20% of cattle road-trained to Alice Springs pass over this road.

(iv) North-South Road to Kulgera (176 miles). This is a new wide earth formed road. However, it is far from satisfactory for the road transport of cattle, being badly corrugated in parts, especially in the hills. At the time of the survey there were extensive areas of bull dust, and some creek crossings needed attention. This road which carried about 5% of the cattle road-trained to Alice Springs is a section of the road to Adelaide, and it is understood that reconstruction as a wide earth formed road to the South Australian border is scheduled for 1960-61. The section of road from Alice Springs to Kulgera, traversed during the investigation, will need a considerable amount of gravelling and attention before it can be regarded as adequate.

(v) Stuart Highway. As is to be expected from its position, this sealed road is a particularly important one for cattle transport. It is a main artery which is joined by all outlet roads north of Alice Springs. At the time of the survey it appeared to be in quite good condition except for some washouts in the McDonnell Ranges. It is understood that this section has now been repaired.

(vi) Roads to Finke Railhead. These roads are generally very poor, being often no better than tracks. For example, the 130 miles of road from Kulgera to Finke is unformed, winding and narrow. It has extensive areas of bull dust and several unsatisfactory creek crossings, and on occasions transports have been held up for several hours due to bogging. At the time of the visit an estimated 5,000 head of cattle were expected to be transported over this road in the 1959 season.

(vii) Other roads. It has been suggested that the following two roads should be brought up to a standard satisfactory for the road transport of cattle.

(a) Indiana to Deep Well (180 miles). At present this is no better than a bush track passable by Landrover. It was expected at the time of the survey that approximately 10,000 head of cattle would pass over the stock route from this area to Deep Well during 1958-59. Many of these cattle would be road transported if a suitable road were available.

(b) Ambalindum to Alice Springs (90 miles). This would call for the improvement of about 60 miles of road through some very hilly country. Because of the rather difficult terrain cattle on the stock route become very footsore. The annual turn-off from here would be from 2,000 to 3,000 head.

(viii) Access Roads. In this report, access roads are defined as those which link stations, or small groups of stations, to major roads. In the Alice Springs District, properties are generally situated close to major roads or on access roads which are also maintained by the Commonwealth Department of Works. Criticisms similar to those above also apply here. In many cases feeder roads are little more than narrow winding bush tracks which have been graded but require considerable further development for the satisfactory transport of cattle.

All major roads used by cattle transports should be at least brought up to "Class C" standard. This would permit cattle to be transported under reasonably favourable conditions, and would reduce bogging and the bruising of cattle, while turn-around times would be considerably improved. Perhaps the greatest benefits from the hauliers' point of view would be reduced operating costs and improved driving conditions.

The road systems discussed above include approximately 1,150 miles of earth roads. It has been estimated by the Department of Territories that a cost of approximately £2,000 a mile, or a total cost of £2,300,000, will be incurred if the roads are to be brought up to the standard suggested. The annual savings to the cattle industry, resulting from such causes as reduced weight losses and mortalities associated with droving, decreased drought losses and reduced age of turn-off, would be considerable. This would be particularly so if the District developed as expected by the Northern Territory Administration to the stage where an annual turn-off of 100,000 head would be effected. The extent of such savings is difficult to assess and no attempt will be made to do so. However, Part V of the report will consider in detail the nature of savings accruing from the use of road transport.

The above is not intended as a complete coverage of road requirements in the Alice Springs District, for this would be outside the scope of the investigation. As mentioned earlier the intention has been merely to consider in the light of information available, including information obtained from hauliers and others interested, the suitability of roads for cattle transport.

Top End and Victoria River District.

As many of the roads in the Top End and Victoria River District are common to both areas they may be considered together. Roads in these areas, especially in the Top End, have achieved notoriety. With the exception of the Stuart Highway, the majority are little better than tracks, often following stock routes. In recent years some road development has been undertaken, and there are stretches of quite good earth formed roads, including a large section of the road from Katherine to Top Springs and the road from Victoria River depot to Auvergne. Even these formed roads suffer from lack of maintenance, and a number of creek crossings are unsatisfactory. In general terms it may be said that roads here are completely unacceptable for the road transport of cattle. They are narrow, very winding in parts, with deep gullies and steep "jumpups", and portions of some roads are too rough to grade. Sections of excessive bull dust are common to many roads including those newly formed. In the higher rainfall areas it was not uncommon during the survey to find rough rocky river crossings with several inches of water still flowing over them, five to six months after the finish of the monsoon. In other areas some creeks have soft, sandy bottoms which would cause bogging of transports, while many creek banks would crumble under the impact of a heavy vehicle.

It is apparent from discussions that if road transport is to develop here, those roads which will bear the major traffic must be brought up to the standard of "Class C" roads, with gradual development up to "Class B" standard, to obtain full advantage of road transport. Stream crossings are a problem, and relatively small falls of rain make many of these impassable. If road transport is to be used to turn off stores just before the onset of the major wet in early December, or even immediately after the wet in March, for the proposed agricultural development at Katherine, or if the turn-off season for "fats" is to commence earlier as might be required with the establishment of a modern abattoir at Darwin, problems with creek crossings will surely be encountered as will problems of bogging on extensive sections of some roads. This is supported by Table No. 18 which shows the probability of receiving specified amounts of rain in each month at both Victoria River Downs and Katherine. Rainfall figures used in the calculation of the Table have been collected over a 50 year period at both of these recording centres.

Table No. 18.

Probability of Receiving Specified Amounts of Rain: Victoria River Downs and Katherine.

Month	Probability of receiving					
	more than 1"		more than 2"		more than 4"	
	V.R.D.	Katherine	V.R.D.	Katherine	V.R.D.	Katherine
January	1 in 1.0	1 in 1.0	1 in 1.1	1 in 1.0	1 in 1.8	1 in 1.1
February	1 in 1.0	1 in 1.0	1 in 1.2	1 in 1.0	1 in 1.7	1 in 1.2
March	1 in 1.3	1 in 1.0	1 in 1.7	1 in 1.3	1 in 3.6	1 in 1.5
April	1 in 4.5	1 in 3.1	1 in 10	1 in 8.3	1 in 50	1 in 50
May	1 in 16.7	1 in 16.7	1 in 50	1 in 50	negligible	negligible
June	1 in 50	1 in 50	negligible	1 in 50	"	"
July	1 in 50	negligible	"	negligible	"	"
August	1 in 50	"	"	"	"	"
September	1 in 50	1 in 10.0	1 in 50	"	"	"
October	1 in 4.2	1 in 2.8	1 in 16.7	1 in 3.8	"	1 in 25
November	1 in 1.2	1 in 1.5	1 in 1.8	1 in 1.8	1 in 8.3	1 in 4.2
December	1 in 1.0	1 in 1.0	1 in 1.2	1 in 1.0	1 in 1.9	1 in 1.1

The probability of substantial falls in March and November is high, and if the expected development in the Territory is realized, road transports will be operating during these months. It is doubtful if gravelling of crossings in the high rainfall areas is economic, as the gravel apparently washes out in spite of concrete retaining walls, and does not overcome the problems of eroding banks. In some instances it is possible to relocate roads on higher ground, and so reduce the number of crossings and low lying sections. However, it does appear that most crossings will require satisfactory concreted culverts, and in some cases low level bridges will be necessary. Furthermore, the sections that will need gravelling initially are likely to be extensive.

The Department of Territories estimates that the cost of bringing a road up to the required standard, excluding low level bridges, might be £3,500 per mile, while the cost of providing a 10 feet high bridge suitable for a crossing over the Alligator or Mary Rivers might be in the vicinity of £7,000. It is obvious that the construction of roads satisfactory for the transport of cattle in the Top End is a costly procedure, and any suggestion that feeder roads to those railheads supplying Darwin should be sealed is unrealistic in view of the limited number of cattle likely to pass over them in the immediate future. The cost of complete gravelling and sealing of roads improved to the standard mentioned above would be in the vicinity of £4,000 - £5,000 per mile. If roads are brought up to the minimum standard required to transport cattle for the major portion of the year, further development can then be undertaken as the economic justification arises.

A description of the major beef roads is given below. It does not consider internal roads required for any envisaged agricultural development plan, as these must be decided in the initial stages of formulating any such scheme.

(i) Katherine - Willeroo - Top Springs Road. This will be a major road for the turn-off of stores for proposed land development schemes further north. It is mainly on high ground, and has been chosen as it avoids location problems associated with the more direct route from Katherine to Top Springs via Dry River. The road is in the process of being reconstructed, and most of it is now a wide, formed earth road roughly equivalent to "Class C" standard. Major construction work will be completed during the current financial year. Continuations of this road from Top Springs to Wave Hill (101 miles) and from Wave Hill to Nicholson in Western Australia (180 miles) have been suggested. Although probably desirable from the point of view of national development and no doubt with some potential as a beef road, the latter proposed extension does not have the same claim to development as the first. The heaviest concentration of cattle in the Victoria River District is in the central eastern section and roughly includes Wave Hill, Sandford, Humbert River, Victoria River Downs and the Top Springs area, so that the Wave Hill-Top Springs road could become quite important if road transport develops. Cattle from further west could be we walked to Wave Hill for loading on transports if required. Some 70%-80% of the cattle being turned off from the Victoria River District come from stations within reasonable walking distance of the Katherine-Willeroo-Top Springs-Wave Hill road.

The section of the road from Top Springs to Wave Hill and Limbunya, the limit travelled on this road during the survey, is little better than a bush track. Narrow and winding, it has stony creek crossings, rough steep ridges or "jumpups", while in many places stony outcrops occur. In the vicinity of Wave Hill much of the country is low lying and subject to flooding.

(ii) Katherine-Auvergne Road (241 miles). This, the second road requiring development if, in the future, cattle are to be transported for fattening on properties around Katherine or to the Katherine railhead, is now being reconstructed, and completion is planned for 1960-61. A continuation of this road from Auvergne joins the Wyndham-Nicholson road 73 miles south of Wyndham. At the time of the survey the section from Auvergne to Timber Creek (40 miles) had been reconstructed and was roughly equivalent to a "Class C" standard road. Some washouts from the previous wet season still needed attention, and it was apparent that at least one crossing would need a low level bridge if the road was to be satisfactory for cattle transports. From Timber Creek the road became little better than a flat graded track, with the usual steep gullies and rock protrusions. Considerable areas of bull dust suggested that large sections of the road would have to be gravelled and a satisfactory crossing constructed over the Victoria River, if it is to be used extensively for the road transport of cattle. Reconstruction had also been carried out between Willeroo and Katherine (89 miles) but again, the existence of large areas of bull dust and unsatisfactory culverted gullies suggest the need for considerable improvement, if it is proposed to use cattle transports on this road during the major portion of the year.

The road would serve stations turning off some 20% of cattle from the Victoria River District. Not only would it enable cattle to be road trained to Katherine but would open the way for the transport of cattle to the Wyndham works.

(iii) Top Springs to Stuart Highway Road. The proposed road links up with the bitumen 11 miles south of Dunmarra (104 miles). It could be used as an outlet for drought-affected cattle from the Victoria River District, or for the normal transport of stores if road transport became economic and acceptable to pastoralists. As previously mentioned, one company whose interests include extensive holdings in this District, already has its own transports operating between Helen Springs and Camooweal. The proposed road would reduce by some 30 miles the length of the present track which follows the Murranji stock route. The latter traverses some very rough country near Top Springs, and towards Newcastle Waters there is an area apparently subject to flooding.

From the point of view of stations in the south of the District, including Wave Hill and Limbunya, a direct route from Wave Hill to Helen Springs would be more desirable, reducing the length of this journey by about 100 miles. There is an old track not visited by the survey party, which crosses the semi-desert and meets the bitumen in the vicinity of Muckety Bore. Without knowing the problems involved, an alternative road from Wave Hill to Newcastle Waters, or preferably Attack Creek, suggests itself. This would be some 160 miles shorter than the proposed route to Helen Springs via Dunmarra and would also link up with the Barkly stock route. Either of these last two roads could conveniently serve the area of greatest concentration of cattle numbers. On the other hand, dipping facilities have been provided at Top Springs. It is some 200 miles from Top Springs to Larrimah railhead via Dunmarra, and this road could be an alternative outlet for cattle going to Katherine. The fact that this would add more than 100 miles to the journey makes it a doubtful advantage.

(iv) Daly Waters - Borroloola Road (230 miles). It is planned to construct this road during the financial years 1959-60 and 1960-61. In some quarters the road is regarded as very important for the development of the Top End. It will tap a supply of stores in the McArthur River and Robinson River area, making them available if required in connexion with future development at Katherine, and will bring the Darwin market within reach of any fat cattle turn-off. Some 40,000 square miles of country carrying about 50,000 head of cattle are held under grazing licence in this area, and it is suggested the number could be trebled if an incentive for development were provided. Up to date there has been a very restricted market for such cattle.

This area was not visited during the survey, but it appears that problems to be met in road construction will be similar to those on the roads previously mentioned.

(v) Other Roads.

(a) Stuart Highway- Mainoru -Bullman:- It is planned to commence the reconstruction of this road as a "Class C" road to Mainoru, to serve at present inaccessible pastoral country. Funds to be provided will allow for some work on this road in 1960/61.

(b) Mataranka-Elsey-Roper Valley:- It is planned to reconstruct this road to "Class C" standard on high ground above flood level. Survey work on the road will commence during 1960. This will service an area providing cattle for the export trade through Darwin.

(vi) Access Roads. - Most of these roads, except in the rare instances where they are maintained by station plant, are in very poor condition. The 30 miles of road linking Elsey Station with the Stuart Highway is fairly typical. It is a narrow winding road with rocky outcrops and difficult creek crossings subject to flooding after relatively small falls of rain. Sections of the road at the time of the survey were covered with deep bull dust. The importance of these roads is considerably reduced where central trucking points can be used. Also as mentioned, an appreciable number of properties are within easy walking distance of railheads.

Even with the construction of satisfactory roads the acceptance of road transport as a normal means of moving store cattle will depend on the availability of sufficient satisfactory transports, the comparative merits of droving and road transport, and the attitude of pastoralists. Even if conditions are favourable its general acceptance might be slow.

Loading Facilities. For the above mentioned roads to service the area adequately, loading facilities and perhaps dips will have to be provided at strategic points. In the Victoria River District, Pussy-cat Dip (Top Springs) is an obvious loading point, while loading facilities at Wave Hill and Auvergne also suggest themselves. It should be possible to situate loading points so that very few if any cattle walk more than 100 miles to a loading centre. The number and situation of such facilities will be largely determined by the future pattern and degree of development of the road transport of cattle. In all probability many pastoralists would wish to provide their own loading and perhaps dipping facilities, if the use of road transport were to become popular.

Barkly Tableland District.

Because of the nature of the country, road making on the Barkly Tableland presents few difficulties. Most of the country is flat and generally free from steep gullies, stony outcrops and the various other obstacles to road making existing further north. The so-called "black soils", the predominant soil type on the Tableland, are reported to make particularly good dry weather roads, if formed, rolled when wet and allowed to settle down. Even roads that have been flat graded make good dry weather roads, but it is stated that a fall of 1 inch of rain will cause bogging on these roads, while 3 to 4 inch falls will make them impassable for a matter of weeks. The sandy "desert" country such as that adjacent to the Barkly Highway is also reported to be good road-making country, but here again substantial falls of rain such as mentioned above make flat graded roads impassable. The probability of receiving specified amounts of rainfall in each month of the year is shown in Table No. 19, and is based on rainfall figures recorded at Brunette Downs over a period of 50 years.

Table No. 19.

Probability of Receiving Specified Amounts of Rain: Brunette Downs.

Month	Probability of receiving		
	more than 1"	more than 2"	more than 4"
January	1 in 1.2	1 in 1.5	1 in 2.8
February	1 in 1.2	1 in 1.8	1 in 2.5
March	1 in 1.9	1 in 3.3	1 in 7.1
April	1 in 8.3	1 in 12.5	1 in 50
May	1 in 12.5	1 in 50	negligible
June	1 in 8.3	1 in 2.5	1 in 50
July	1 in 16.7	1 in 50	negligible
August	1 in 50	negligible	negligible
September	1 in 12.5	negligible	negligible
October	1 in 5.0	1 in 16.7	negligible
November	1 in 2.5	1 in 6.2	1 in 25
December	1 in 1.4	1 in 1.9	1 in 5.0

This suggests that there is a high risk of receiving more than 1 inch of rain in November, December, January, February and March, while in December, January, February and March there is a high probability of receiving between 2 inches and 4 inches of rain. Falls of more than 4 inches are apparently not infrequent during January and February. Thus, even formed roads would be impassable for extended periods in one year out of two during January and February, while delays due to bogging would be likely to occur during March, November and December. Also there is the possibility of unseasonal falls of rain affecting roads during the normally dry months, for example, there is a 20% chance of getting more than one inch of rain during October, while there is a 12% chance of getting a similar amount during April and June. This is supported by information received from pastoralists. To keep roads open for the major portion of the year they would have to be brought up to "Class C" standard, although further improvements to some sections of the more important roads would be necessary if road transport is to be extensively used.

It was suggested during the survey that bitumen-surfaced roads should be constructed from proposed loading facilities at No. 7 South Barkly (Frewena) and Ranken Dip, to the Barkly Highway. However, enquiries revealed that should road transport become firmly established, loading yards at the former point would probably only be used by Rockhampton Downs station. Pastoralists prefer to move cattle eastwards, thus reducing the distance of travel to markets, and in some cases bullock paddocks have been constructed in the eastern sections of stations. Most pastoralists would not, therefore, be interested in walking cattle to a loading point some distance to the west of their properties. But Ranken Dip is centrally situated for quite a number of stations and could be used for loading cattle from as far north as Anthony Lagoon, a distance of approximately 150 miles. If cattle transporting shows promise of developing, there appears good reason to consider the building of loading facilities at Ranken Dip and the provision of an all-weather road that is, a "Class B" road, which would then be progressively sealed for the 40 miles to the bitumen. Connell's Dip, some 57 miles north-west of Ranken Dip, is centrally situated in what is probably the area of greatest cattle concentration on the Barkly Tableland. The area turns off about 25,000 head a year, a large proportion of which could be turned off as fats, but as will be seen from later sections of this report the potential exists for doubling this number under certain conditions. Also, Connell's Dip could serve as a trucking point for stock walked down from the McArthur River and Robinson River areas during favourable seasons. It is estimated that more than 50% of these cattle could be marketed as fats. Some pastoralists indicated that they would probably install their own loading facilities, if they decide to use road transport. However, transports carrying cattle from these stations will have to use that section of the road from Connell's Dip to the Barkly Highway.

If road transport becomes generally accepted as a means of marketing stock from the Barkly Tableland, the provision of loading facilities at Connell's Dip and the extension of the suggested all-weather road from Ranken Dip to Connell's Dip should have many advantages. The standard of any such road extension will, however, have to be determined in the light of future developments and requirements of road transport. Insufficient information is available at present to estimate the extent to which such a road would be used, or to gauge its effect on national income. Figures available from the Commonwealth Department of Works suggest that the cost of building a "Class B" road in this District could be more than £3,000 per mile, while the additional cost of improving and sealing the road to a width of 16 feet might be approximately £3,000 per mile.

Some comments on the major roads which would be used in the event of the development of road transport are given below.

(i) Barkly Highway (406 miles). - To facilitate the construction of this highway it was located largely on hard "desert" country well to the south of the main cattle concentration, and therefore it is not centrally situated with regard to cattle turn-off from a large area of the Barkly Tableland. This somewhat reduces its effectiveness for the road transport of cattle. It is, on the other hand, conveniently situated for those stations adjacent to the Stuart Highway south of Newcastle Waters, which send stock to Queensland, and also serves a number of stations in the South Barkly area. Some 125 miles of this highway lies in Queensland but is maintained by the Commonwealth. The cost of maintaining the Stuart and Barkly Highways has already been discussed. All cattle transported to Queensland during 1958-59 passed over sections of this road; the numbers transported are given in Table No. 4.

(ii) Elliott-Anthony Lagoon-Ranken River-Barkly Highway. - This road follows the Barkly stock route and is consequently a winding flat graded road, though considerably wider and more satisfactory than similar roads in the Top End. Most of this road is through "black soils" country, but it traverses "desert" country in the vicinity of Anthony Lagoon and again between Ranken River and the Barkly Highway. At the time of the survey, a section of this road between Brunette Downs and Alexandria Downs had been reconstructed as a wide, straight, earth formed

road, but obviously would take a considerable time to settle down. Except for this section, the road is completely unformed, and for the reasons previously mentioned is inadequate for the road transport of cattle. The road traverses the major cattle producing country on the Tableland, and the potential of certain sections for the transport of beef cattle has been discussed earlier. Of less potential but still important is the section of the road from Anthony Lagoon to Connell's Dip.

If young store cattle of the desired type are to be turned off by road transport from the Barkly Tableland to the Channel Country, their logical outlet is through Lake Nash via the Anthony Lagoon-Ranken River road. Thus an extension of the above road through Lake Nash to the Queensland border would be desirable, if road transport of stores becomes popular. A large scale turn-off of stores would probably require the provision of loading facilities at Anthony Lagoon. The distance from Anthony Lagoon to the Queensland border would be a little more than 350 miles. The time of turn-off of stores is not particularly critical, and the problem of bruising not as important as with fat cattle turn-off. In view of this, therefore, it is thought that a road of "Class C" standard, except for the sections previously mentioned, would be adequate. However, roads here as elsewhere in the Territory, would need more adequate maintenance than they receive at present.

The section of road from the Stuart Highway to Anthony Lagoon (176 miles) is not particularly important from the point of view of road transporting cattle, as stock would be within easy walking distance of Anthony Lagoon and Elliott, both of which would be convenient points for the establishment of loading facilities. In an emergency caused by a drought it would be possible to transport cattle over the unformed black soil road.

During the investigation it was suggested that the development of a road from Anthony Lagoon to Dalmore Downs on the Barkly Highway would serve a number of properties including Anthony Lagoon, Brunette Downs, Alexandria and Alroy Downs. However, with the exception of Rockhampton Downs, this road would only serve stations with access to the Anthony Lagoon - Lake Nash road. In comparison with the latter road it has two disadvantages: (a) cattle from some stations would have to be moved in a westerly direction, and (b) it increases the distance to Camooweal or Lake Nash.

(iii) Access Roads. - Access roads both to the Barkly Highway and the suggested road from Anthony Lagoon to Lake Nash, although much more satisfactory than those in the Top End, need considerable improvement, particularly straightening and forming, if they are to be used for the road transport of cattle through the major portion of the year. However, with the provision of the loading facilities already suggested very few access roads would be really essential other than in drought seasons.

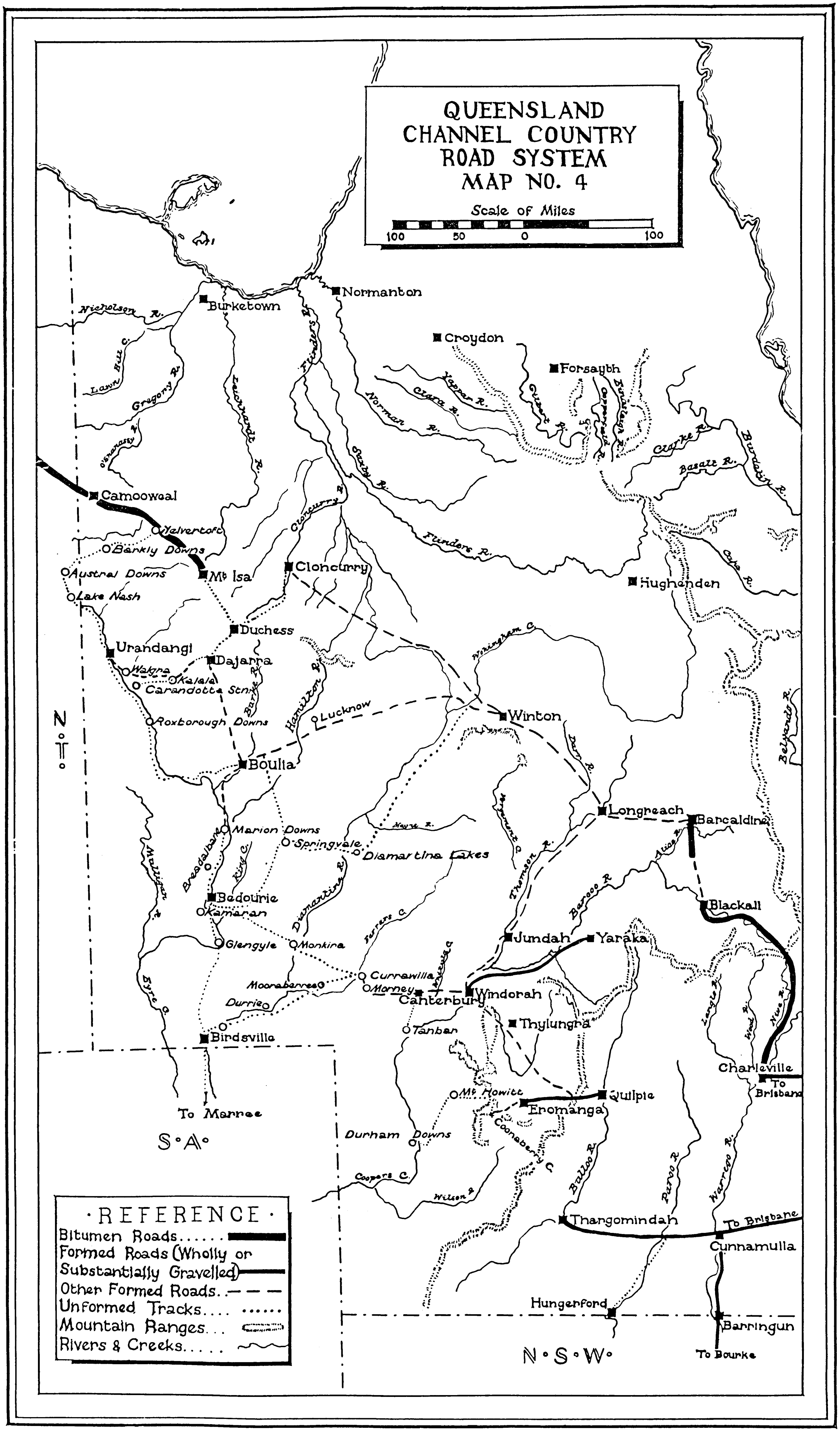
CHANNEL COUNTRY OF QUEENSLAND.

Roads in the Channel Country of Queensland may, for the purposes of this study, be conveniently divided into two categories:-

(a) those which might be used for the transport of store cattle from the Barkly Tableland to the Channel Country; and

(b) those which might be used for the marketing of fat cattle or the transport of drought-affected cattle to agistment. These roads connect the Channel Country to railheads or the inland abattoir at Bourke.

Roads required for the marketing of fat cattle are likely to be of a much higher standard than those required for the turn-off of store cattle. There are several reasons for this, including the fact that turn-off time for fats is somewhat critical and may require an extension of the marketing season into those months when substantial falls of rain are likely, the effect of delays and hold-ups on marketing costs, and the problem of bruising. With store stock, minor bruising is of little consequence but with fat stock it leads to down-grading and waste. Prime cattle from the Channel Country are soft and very subject to bruising. Until recent years cattle turned off have been mature beasts of five years of age and upwards. That the combined factors of excessive weight and unsatisfactory roads can lead to considerable bruising, has been the unfortunate experience of one pastoral company pioneering the road transport of cattle in this area some years ago. Downgradings of carcasses for bruising were as high as 45%, and averaged about 20%. Other


QUEENSLAND
CHANNEL COUNTRY
ROAD SYSTEM
MAP NO. 4
Scale of Miles
100 50 0 100
Normanton
Burketown
Croydon
Forsayth
Camooweal
Yelvertoft
Barkly Downs
Austral Downs
Lake Nash
Mt Isa
Cloncurry
Hughenden
Duchess
Urandangi
Dajarra
Carandotta Stn.
Roxborough Downs
Lucknow
Winton
Boulia
Longreach
Barcaldine
Marion Downs
Springvale
Diamantina Lakes
Blackall
Bedourie
Glengyle
Monkira
Jundah
Yaraka
Currawilla
Morney
Canterbury
Windorah
Thylungra
Durrie
Birdsville
Tanbar
Charleville
To Brisbane
Quilpie
Eromanga
To Marree
S.A.
Durham Downs
Thargomindah
To Brisbane
Cunnamulla
Hungerford
Barringun
To Bourke
N.S.W.
N
Nicholson R.
Gregory R.
Flinders R.
Norman R.
Gilbert R.
Clarke R.
Basalt R.
Burdekin R.
Cape R.
Thomson R.
Barcoo R.
Diamantina R.
Hamilton R.
Mulligan R.
Eyre C.
Coopers C.
Wilson R.
Bulloo R.
Paroo R.
Warrego R.
Langlo R.
Ward R.
Nive R.
Belyando R.
·REFERENCE·
Bitumen Roads......
Formed Roads (Wholly or Substantially Gravelled)
Other Formed Roads
Unformed Tracks....
Mountain Ranges...
Rivers & Creeks.....

factors such as inexperienced or unsuitable transport drivers contributed to the bruising, but the effect of the two factors mentioned above can hardly be over-emphasized.

As yet there has been no large scale transportation of stores to the Channel Country, and the possibility of doing this economically by bringing in weaner stores has only recently been considered. There are still many pastoralists who, while admitting the desirability of eliminating the long walk, consider that the road transport of stores is unlikely to be economic. In view of this, it might be expected that roads with a potential for the transport of store cattle would at present be unsatisfactory for this purpose. Although this is largely true, the construction of a considerable mileage of wide earth formation has been lately undertaken.

The problem of transporting fat cattle in the Channel Country has received considerable attention during the last few years. In 1949, consideration was given to the construction of roads to assist in the movement of cattle to railheads, and resulted in the provision of the "beef" roads from (a) Yaraka via Retreat and Windorah to Currawilla, (b) Quilpie via Eromanga to Coonaberry Creek and (c) Thargomindah via Cunnamulla to Barringun. To the end of June 1958 some £1,160,000 had been advanced to Queensland by the Commonwealth for the provision of these roads under the State Grants (Encouragement of Meat Production) Act 1949. Although these are wide earth formed roads, substantially gravelled with low sections and drop sections bituminized, they have certain deficiencies which will be further considered in the more detailed discussion below.

In addition to the above, the Queensland Main Roads Department has constructed a considerable mileage of wide earth formed roads, but further extensions are required, and in some cases present formation is unsatisfactory for the road transport of cattle. Pastoralists stress the following problems associated with roads in the area.

(i) Impassability of major rivers and creeks for extended periods. - Many of the major river and creek crossings have been concreted and are satisfactory for use in the dry season. However, after floods it is found that they are impassable for a considerable period after the surrounding low lying country has dried out. Low level bridges would overcome the problem, but because of cost only a limited number have been constructed.

(ii) Bogging would occur on many low lying areas. - It was suggested that falls of 1 inch of rain not necessarily in the immediate vicinity, may cause creeks to rise sufficiently to flood low areas, resulting in time-consuming delays. Because of the flatness of the country, flood water tends to undermine any built-up sections of earth formed roads. On some roads the problem has been overcome by stoning and concreting or bituminizing low areas and drop sections. It was suggested that many of the approaches to the main channels need sealing, while many of the minor streams need culverting or concreting. In some cases it is understood that the problem can be overcome or minimized by the relocation of sections of certain roads.

(iii) Clayey sections of earth formation become slippery when wet.- It was stated that after relatively small amounts of rain some sections of earth formation are impassable for the above reasons, and it has been suggested that these should be fully gravelled.

(iv) Areas of bull dust make driving a hazard. - Areas of bull dust are prevalent in some types of country, and these would be accentuated by the constant grading of earth formed roads during the dry season. This is necessary for satisfactory transport of cattle; and gravelling of such areas would be essential.

(v) Roads insufficiently maintained. - At present the degree of maintenance is largely dictated by the availability of machinery, the season and the type of soil used in the earth formation. It is most unlikely, therefore, that purely earth formed roads can be maintained in a condition suitable for the transport of fat stock.

(vi) With earth formed roads period of turn-off confined to dry season. - Owing to droving problems, the main turn-off period is limited to May-September. Market prices for cattle suggest that an expansion of the season to December might be desirable and could be facilitated by the use of road transport. Any extension, however, would be difficult on earth formed roads, owing to possibility of rain. The probability of receiving specified amounts of rain in each month of the year, based on rainfall figures recorded at Monkira station over a period of 56 years, is shown in Table No. 20.

Table No. 20.

Probability of Receiving Specified Amounts of Rain: Monkira.

Month	Probability of receiving		
	more than 1"	more than 2"	more than 4"
January	1 in 2.3	1 in 4.0	1 in 8.0
February	1 in 2.5	1 in 4.0	1 in 8.0
March	1 in 3.7	1 in 5.1	1 in 8.0
April	1 in 6.2	1 in 14.0	1 in 50
May	1 in 3.5	1 in 11.0	1 in 50
June	1 in 4.0	1 in 11.0	negligible
July	1 in 14.0	1 in 50.	negligible
August	1 in 11.0	1 in 28.0	negligible
September	1 in 9.2	1 in 19.0	negligible
October	1 in 8.0	1 in 50.	negligible
November	1 in 3.5	1 in 8.0	1 in 19.0
December	1 in 2.9	1 in 6.2	1 in 19.0

It is apparent that although heavy falls of rain are rather exceptional, in January, February, March, May, November and December, falls of 1 - 2 inches are not unlikely. This suggests that unless roads are brought up the "Class B" standard previously mentioned, with proper attention to stream crossings and approaches, delays will occur during the turn-off season.

(vii) Some roads become very corrugated. - Although gravelled surfaces are unlikely to be affected by the weight factor, they are, in common with black soil roads, subject to corrugations. The main problems connected with corrugations are :-

(a) cattle are adversely affected and become very fatigued. Some animals may fall in the transports and be trampled by others. Moreover, fatigued cattle on leaving the transports tend to rest rather than feed or drink. With fat cattle the degree of bruising is increased; and

(b) wear and tear of vehicles is increased, drivers become fatigued, concentration suffers and accidents could result.

It has been suggested both in the Alice Springs District and Western Australia, that higher speeds tend to eliminate the discomfort caused by corrugations, i.e. cattle have a more comfortable trip over these roads at 35 m.p.h. than at 20 m.p.h. Although this seems logical there is need for further verification.

This problem as well as many others could be solved by the construction of sealed roads. However, these are largely ruled out by economic considerations and State priorities connected with the sealing of roads. This is further discussed in the section on the Currawilla-Quilpie road, the major "beef" road in the area.

From the foregoing it could be concluded that, while a road equivalent in status to the Northern Territory "Class C" road is likely to be suitable for the road transport of store stock, the minimum requirement for the road transport of fat cattle in the Channel Country is a road equivalent to "Class B" standard with proper attention to stream crossings and approaches as demanded by local conditions and requirements.

Details of the major roads needed, and their requirements, are given below.

(i) Roads required for the transport of stores into the Channel Country. - The Barkly Highway continuation from Camooweal to Mt. Isa (120 miles) has already been mentioned. If desired, store cattle could be road trained to Mt. Isa, railed to Dajarra and road trained or walked to the Channel Country. However, the road next mentioned is a much more direct route and therefore more likely to be used.

(a) Lake Nash-Urandangi - Dajarra (220 miles). - This road which would link up with the suggested road from Anthony Lagoon in the Northern Territory to Lake Nash would require loading facilities at the latter place. Untrucking yards are available at Dajarra.

From Lake Nash to Urandangi (61 miles) the road is an unformed winding track, very rough in parts with rough stony hills and sharp gullies. But from Urandangi to within 20 miles of Dajarra there is a 35 feet wide earth formed road mainly through flat plain country. Although there are patches of natural gravel on this road, other sections would need gravelling to prevent both the formation of bull dust and bogging due to unseasonal rains. There are very few difficult creeks. The last 20 miles into Dajarra is through rough hilly country and the road deteriorates to a 12 feet wide track, very stony and rough with sharp bends, and completely unsuitable for cattle transport. Even formed sections of this road are below the standard suggested for the transport of stores.

(b) Dajarra-Boulia (98 miles). - This is a wide earth formed road, well maintained in the Boulia Shire where areas of bull dust are being progressively gravelled, and necessary culverting and improvement of low areas is in progress. To reach the standard suggested for the transport of store cattle, it would require further improvement especially in the Cloncurry Shire, where several difficult gullies need attention and some areas need to be gravelled.

Boulia seems to be the natural untrucking point for many store cattle coming into the Channel Country, and would therefore need to be equipped with unloading facilities.

(c) Boulia-Bedourie (172 miles). - The first 20 miles of this road is a continuation of the improved Dajarra-Boulia road. A large part of the remainder of the road is unformed and much of it is located in country subject to flooding, but certain sections could be relocated on higher ground. Even on some formed sections the need for gravelling is apparent. There are a number of difficult gullies on this road, and two low level bridges might be required between Marion Downs and Breadalbane.

Although this road has a potential for the transport of stores, it has been pointed out that cattle coming into the area could be walked in from Boulia down the Georgina River. In dry seasons when this route is difficult there would be small demand for stores in the Bedourie area. A continuation of the road from Bedourie to Birdsville (124 miles) does not appear to have much potential for the transport of stores.

(ii) Roads required for transport of fat cattle or drought-affected stock to railheads.

(a) Bedourie-Monkira-Windorah-Quilpie. - Quilpie is a major railhead for the export of cattle from the Channel Country. In normal years 50,000 head, mainly from the Channel Country, are consigned from here and this number could be increased, given the necessary conditions for development in the area. Because of its location, this road could be the main supply route to Quilpie and is therefore of major significance. The relative importance of sections of this road will be apparent from the following.

The road from Bedourie to Currawilla (170 miles) is flat graded and would need forming, straightening and in many sections relocating on higher ground. There are three major crossings in need of bridging - over Eyre's Creek and King's Creek near Bedourie and the Diamantina near Monkira. These have been concreted, but are too steep for satisfactory negotiation by loaded transports and are subject to prolonged flooding. Also, there are many minor creek crossings and areas subject to flooding which would need special attention, such as Farrar's Creek near Currawilla which consists of a number of channels separated by several miles of low flood country. The actual road might dry out in three to four days, but the channels might take 10 to 14 days to subside sufficiently to allow vehicles to pass. Interested parties consider that main channels would probably need to be bridged, minor channels culverted and the low lying areas bituminized or concreted. Because of the small number of cattle likely to be transported between Bedourie and Monkira, little argument exists for the development of this section of the road for the road transport of cattle. The road from Monkira to Currawilla would need to be "Class B" standard, as it would be used primarily for the transport of fat cattle.

Except for a few sandhills and some gently undulating country west of Canterbury, the road from Currawilla to Windorah (105 miles) is through flat country which, apart from some red sandy loam in the vicinity of Windorah, consists of brown silty clays impassable after rain. This is a wide earth formed road, a section of the Currawilla-Yaraka road , one of the three roads constructed under the State Grants (Encouragement of Meat Production) Act 1949.

Although sections have been gravelled and a wooden bridge built over the Whitula Creek, there are some very low sections which need attention, and the road is still far below the "Class B" standard suggested for the transport of fat cattle.

The section of road from Windorah to Quilpie (158 miles) is now a formed earth road, with areas of natural gravel, and joins the Quilpie-Eromanga road some 27 miles west of Quilpie. Much is through low lying areas subject to flooding, and there are a number of gullies which require attention. Pastoralists maintained that delays of 36 hours have occurred due to the flooding of creeks even though no rain had fallen in the immediate vicinity; some sections of the road have been gravelled. During 1958-59, 29 miles near Thylungra were straightened, formed and properly drained, and the gravelling of six miles of road south of Thylungra was undertaken. A large part still requires gravelling, and considerable improvements to the road surface, low lying areas and stream crossings will be necessary if the road is to be brought up to the minimum standard required.

If this road is developed for the transport of cattle, loading facilities should be established at convenient points throughout its length. This would enable cattle to be walked in from adjacent stations up to a distance of 80-100 miles, and it would largely eliminate the need for hauliers to operate on inferior feeder roads, which must adversely affect both costs and efficiency of operation.

Suggested loading points and the percentage of the total numbers that might be available for transporting from each to Quilpie railhead, are shown below. The total number available for transport from areas adjacent to this road is likely to be about 65,000. This figure is based on an estimate made by the Meat Production Development Committee in 1949, and takes into consideration the effect of improvement in stock routes and the development of road transport for the turn-off of fat cattle. It is supported by information collected during the survey. If road trained, the majority of these cattle would go to Quilpie. A limited number, perhaps 20% to 25%, would go to Winton railhead, but few if any would go to Yaraka, as the only cattle going to this railhead have been a small number produced in the immediate vicinity.

Loading Point	No. cattle
Bedourie	10%
Morney Plains)	48%
Canterbury)	
Windorah	33%

The remaining 9% would come from stations between Windorah and Quilpie and would probably be loaded at station facilities if road trained.

Currawilla would be an alternative site for the suggested facilities at Morney Plains. However, it is understood that a site has already been selected on high ground on the Currawilla side of Morney Plains. Canterbury would be a convenient centre for some stations which would otherwise have to use the Morney Plains or Windorah facilities.

A large proportion of the cattle shown as available for loading at Bedourie and Morney Plains are now walked to railheads other than Quilpie, mainly to Dajarra and Winton, while a proportion of those shown as coming into Windorah probably go south to Bourke. It is difficult to estimate how many would be road transported as this would depend, among other things, on the price of road transport and the nature of the seasons.

If the above development takes place, a feeder road would be required to link Betoota and Mooraberree (44 miles). This would need to be of "Class C" standard, with additional attention to low sections and gullies, and would provide an alternative outlet for those cattle in the Birdsville area which normally go to the Adelaide market. A loading yard would be required at Betoota. Because of the short distance, the relatively small number of cattle involved and the fact that much of the area around Durrie is subject to flood, there appear to be very limited reasons for extending the road from Betoota further towards Birdsville.

Because of the high potential for the road transport of cattle here, a sealed road from Currawilla to Quilpie (226 miles) has been suggested. At an estimated charge of £4,000 per mile to bring the road up to "Class B" standard and subsequently seal, the total cost would be about £1,064,000. Against this must be offset the estimated accruing benefits. Survey results suggest that without considering the effect of road-trained stores from the Barkly Tableland on the age of turn-off, there might be an increase greater than 25,000 head, if road transport were generally accepted. The Meat Development Production Committee in 1949 suggested that with the use of transport an average weight saving of 30 lb. per beast might be achieved; and this contention is supported by survey information. However, the weight of turn-off will be decreased with the use of road transport as stock will be turned off a year earlier on breeding properties, while on store fattening properties the age of a portion of the turn-off will also be decreased. Based on 1958 prices at Cannon Hill, the increase in the annual value of turn-off due to the use of road transport would be more than £1,000,000, assuming all stock except those within easy walking distance of the railhead were road transported. To arrive at the estimated value of added production, the purchase price of some 15,000 stores required to achieve the additional turn-off should be subtracted from the increased value of turn-off, while to arrive at the added return accruing to pastoralists, an allowance would need to be made for additional marketing charges due to the use of road transport. There is of course no guarantee that all stock would be road transported even allowing a reasonable period for transport to develop and, furthermore, it is impossible to estimate what additional numbers might be carried on a bitumen road. The section of road appearing to have the greatest claim to improvement to this standard would be that for Windorah to Quilpie, which as well as carrying the bulk of any cattle traffic that might develop, also carries a large amount of wool traffic to the Quilpie railhead.

(b) Coonaberry Creek-Eromanga-Quilpie (110 miles). - This is the second of the three roads which were developed under the State Grants (Encouragement of Meat Production) Act 1949. It is a wide, formed road gravelled from Quilpie to Eromanga (65 miles), with drop sections and low areas bituminized. Sections from Eromanga to Coonaberry Creek have been gravelled. Although the first 22 miles from Eromanga is through gently undulating country comprised largely of brown clay loams with low gravel ridges, the next 20 miles is through rougher stony country which finally changes to gently rolling downs with brown silty clay soils. From the nature of the country it will be apparent that there are many areas subject to flooding, and these need further attention, while much of the road through the hills is too rough for cattle transport. The latter half of the road will need considerable improvement to bring it up to the standard required for the transport of fat cattle. At the time of the survey, areas of the road were very corrugated, and maintenance appeared to be well in arrears.

A feeder road, constructed to link Coonaberry Creek with a point between Mount Howitt and Durham Downs, a distance of approximately 40 miles, has been suggested. This would bring all stations likely to forward cattle to Quilpie via this road, to within 100 miles of transport facilities. Any extension of the road would need to be of good quality, initially not less than "Class C" standard, with additional attention to culverting and low areas, required to suit climatic conditions. Loading facilities, one of the eight approved by the Commonwealth in connection with the three "beef" roads, are available at Coonaberry Creek, and it is understood that a private facility in poor condition is available at Eromanga. A further loading centre would be required if the above extension were adopted. The loading yard at Coonaberry Creek was constructed to hold 250 head of cattle, but the forcing pen appears smaller and the loading ramp shorter than that suggested by pastoralists and hauliers for the loading of appreciable numbers of cattle.

It is estimated that some 15,000 head of cattle are currently being turned off annually from properties adjacent to this road.

(c) Thargomindah-Cunnamulla-Barringun (190 miles). - This is the third road constructed under State Grants (Encouragement of Meat Production) Act 1949. The road was not inspected during the recent investigation, but it is understood that it is a wide earth road largely gravelled. An estimated 9,000 head of cattle go to the railhead at Cunnamulla annually, while probably more than 10,000 go via Hungerford to the meat works at Bourke or to properties elsewhere in New South Wales. A considerable number of these should be available for road transport, if it develops.

(d) Birdsville-Marree (314 miles). - This road was not traversed during the survey, but some observations based on available information are made here for the sake of completeness.

The problems of making a satisfactory road to Marree for the transport of cattle are summed up in the following comments prepared by Kelly[1] after his visit to the area in 1950.

"There is the certainty rather than the possibility of drifting sand making road construction, maintenance and transport difficult. Sandhills and drifting sand on the Birdsville-Kopperamanna route are well known. Beyond Kopperamanna to Marree I believe the conditions are good....."

"..... to construct an all weather road would mean crossing the Diamantina at Birdsville and proceeding down the river, following the high ground and skirting the flood-out where it spreads over Goyder's Lagoon".

Adelaide is the logical outlet for a number of stations in the Birdsville area. This is illustrated by the fact that the distance from Birdsville to Brisbane via Quilpie is approximately 1,040 miles. The disparity of distances is even greater for properties further down the Birdsville Track. Also, in past years the incentive to send to the Adelaide market has been influenced by the higher prices ruling there. In recent years, however, prices at Cannon Hill have been higher than at Gepp's Cross market.

The number of cattle going to Marree have been given in Table No. 5, and Quilpie is an alternative outlet (in time of drought) for some 50% of these. This means that the actual number of cattle requiring transport to Marree in time of drought is likely to be relatively small, and the costs of road construction likely to be high. However, further information is required on costs and benefits before a firm decision can be made on the economics of improving this road to the standard required for the transport of cattle.

(e) Winton-Boulia (250 miles). - This is a State highway equal in status to the main road from Dajarra to Boulia. Most of the road is formed and part has been relocated on higher ground. Construction of major creek crossings and improvement of areas subject to flooding is proceeding. When complete, this road should be suitable for cattle transport during the drier months. However, if as is understood, this road is to be an ungravelled earth formation, it will be impassable to transports during the wet season. Although situated to the north of the Channel Country proper, it would be a most important road for those Channel Country properties marketing cattle through Winton.

(f) Other roads. -The construction of two further roads in this area was suggested during the survey.

(i) Coorabulka-Winton/Boulia Highway (approximately 95 miles).-This would meet the Winton-Boulia Highway at Lucknow Homestead and would be an outlet for probably 14,000 head of cattle turned off annually from the northern section of the Channel Country. Although many of these cattle could use the alternative route from Bedourie to Quilpie, it was pointed out that this outlet through Winton would enable cattle to be railed to Townsville, Rockhampton, Gladstone or Cairns. Location would also influence many pastoralists to send through Winton, for example, Springvale station is about 200 miles from Winton which in turn is about 390 miles from Townsville. The distance to Brisbane via Quilpie would be considerably more than 1,000 miles.

There is no road in existence here, and because of the nature of the country a road equivalent to "Class B" standard would be required if cattle are to be transported for most of the year. Fortunately there are no major water-courses on the suggested roads. Loading facilities would be required at Coorabulka.

The percentage of turn-off which might be transported over such a road would depend on factors previously mentioned, including availability of suitable transport, season and degree of acceptance of road transport by pastoralists.

(ii) Mayne Pub - Winton (160 miles). -Formation has been completed on 60 to 80 miles of this road which traverses excellent road making country, flat and free of major creeks. The suggestion has been made that properties close to this road would be disinclined to walk

(1) J.H. Kelly, Bureau of Agricultural Economics, unpublished data.

cattle westward to loading facilities at Coorabulka,as this would increase the distance to railhead by some seventy miles. Nevertheless this proposed road must be regarded as to some extent duplicating the Coorabulka to Winton road. In times of drought it would serve as a convenient outlet for a number of properties which would otherwise have to walk fat cattle considerable distances to other loading points. One pastoralist in the area has estimated the annual turn-off of cattle from properties adjacent to the road at from 15,000 to 20,000. The road would need to be brought up to "Class B" standard, and satisfactory paddocks and loading facilities provided at Mayne Pub.

(g) Access Roads. - Access roads at their best are flat graded roads passable for heavy motor vehicles only during dry weather. They suffer from problems mentioned in connexion with other roads, including susceptibility to flooding. The cost of making these roads passable to road transports during the major portion of the year is likely to be high, but the need for this has been largely overcome by suggesting a pattern of roads which bring most properties within easy walking distance of loading facilities.

CONCLUSION.

Observations made during the investigation and information received from hauliers and pastoralists largely support the conclusion contained in the report on the "Economics of Road Transport of Beef Cattle - Western Australian Pastoral Areas" (2) that cattle can be transported satisfactorily on earth formed roads under certain conditions. To minimize the risk of bruising cattle and wear and tear on vehicles, it is desirable that roads be:

(a) sufficiently broad to prevent the wheels of vehicles following the same tracks continually;

(b) sufficiently straight to prevent bruising from jolting and sway;

(c) not subject to flooding during the trucking season;

(d) of reasonable grades;

(e) maintained constantly to prevent the development of corrugation; and

(f) provided with satisfactory crossings over creeks and gullies.

These features indicate that generally speaking the roads need to be wide, formed, gravelled where necessary, with satisfactory stream and river crossings, and low lying areas brought up to the standard required to avoid bogging during the trucking season. Based on this assumption and information available from those concerned, minimum road standards have been set down earlier in this part of the report for each area. These standards vary considerably from area to area depending on the nature of the country, climatic conditions, length of the turn-off season and the type of cattle transported. Road hauliers in both the Alice Springs District and Channel Country of Queensland are operating under adverse conditions, for few if any earth roads either in the Northern Territory or Queensland Channel Country come up to the minimum standard suggested. Some are basically unsuitable, others although satisfactorily formed need further improvements, such as gravelling, bituminizing of low sections, and attention to stream or channel approaches and crossings. Maintenance of roads, in the areas surveyed, was in arrears.

On some roads, including black soils and gravel surfaced roads, it is difficult if not impossible to eliminate corrugations completely, which suggests that fat cattle travelling over such roads will always receive a small degree of bruising even though the road may be adequately maintained.

In view of this and other factors previously mentioned,the bituminizing of one major road in the Channel Country has been suggested. However, any decision on this matter is likely to be influenced not only by economic factors including the weighing of costs against direct and indirect benefits, but also by State planning priorities and certain non-economic factors, consideration of which are outside the scope of this report.

In all regions earth formed roads will be subject to the dust problem but this can be considerably reduced by gravelling areas of bull dust.

Access roads were generally of a standard less than that required for the successful transporting of cattle. The need for improving these can be overcome to a large degree by the establishment of a system of roads located so that most stations are within easy walking distance of them, and by the provision of central trucking facilities at strategic points.

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(2) Bureau of Agricultural Economics, Canberra. Economics of Road Transport of Beef Cattle-Western Australian Pastoral Area, 1958.

Road transport is unlikely to develop to its maximum or to develop efficiently in these areas unless suitable road systems of the standard suggested are provided. Not only would such systems reduce operational costs which, it is hoped, would be passed back to pastoralists in the form of reduced charges, but would improve turn-around times, reduce bruising and encourage the use of larger and more efficient vehicles than are being generally used in the Alice Springs District at present.

Failure in the past for cattle transport to develop, on roads constructed primarily for that purpose, has been due to many and varied causes. At the outset it was necessary for road transport to be proved successful before it was accepted by the majority of pastoralists. In areas where pastoral companies had been able to attract good droving plants there was often an anti-road transport attitude. Until recently margins out of which to pay for transport charges were often low. In the Channel Country the unfavourable experience of pioneers in the field of cattle transport left an impression which persisted until it was accepted that younger fat cattle could be successfully transported, given satisfactory roads. Furthermore, organizational problems and poor roads resulted in an apparent disinclination on the part of hauliers to enter the field. In fact pastoralists often commented that transports were not available in the numbers required to move their turn-off. Recent increases in the number of transports available both in the Northern Territory and Channel Country suggest this problem will be resolved. The development of roads with a low potential instead of roads with a high potential, and the construction of roads to a standard less than that required to permit the uninterrupted transport of cattle during the marketing season, have also had their effect.

PART V : THE DEVELOPMENT OF ROAD TRANSPORT.

Contract road transporting of cattle was first undertaken in the Alice Springs District in 1946 by K. Johannsen using a Diamond "T" 201 b.h.p. prime mover pulling three trailers. In the following years he increased the number of trains to three. These vehicles each hauled the equivalent of 8 railway vans or 74 head of bullocks, but this was later reduced to 7 vans. The venture was not wholly successful owing to heavy costs including the high cost of tyre replacement caused by staking on the narrow roads. Drivers employed knew very little about the factors influencing the road transport of cattle, and roads were very narrow and winding. These factors were largely responsible for the initial price of 17s. 0d. per head per 100 miles rising to £2.10s.0d. per head per 100 miles in 1950. Mortalities and bruising were considerable, partly owing to operating conditions and partly to the fact that turn-off in those days was largely of full grown bullocks, many of them weighing from 700 lb. to 800 lb. dressed weight. Today the average age of fat bullocks turned off in the Alice Springs District is from two to three years with a dressed weight of from 450 lb. to 600 lb.

The Australian Meat Board carried out road transport trials in the latter half of 1948 with 239 head of stock road trained from Anthony Lagoon to Alice Springs railhead for immediate slaughter in Adelaide, and with 607 head of stock from Helen Springs to Mt. Isa for slaughter in Rockhampton. Cattle were transported on Johannsen's vehicles. The consignment from Anthony Lagoon travelled 527 miles of which 391 miles were on a bitumen-surfaced road. The first consignment of 74 bullocks to Adelaide weighed approximately 450 lb. to 950 lb. dressed weight on the property, with an average of about 720 lb. Some 24% of quarters was rejected for export due to bruising, and although the origin of this was not determined, possibly much occurred during railage. At the time of the trials, under existing market demand, the Meat Board considered that only transport of mature bullocks would be economic, as 2 - 2½ year-old steers would not give a sufficient return, taking into account the high road and rail costs to Adelaide. However, with increasing demand for younger stock in recent years, the above situation has changed.

Cattle on arrival at Alice Springs showed little deterioration in condition and general appearance as a result of the trip or the double dipping to which they had been subjected. The Board considered that, "provided a satisfactory alternative to present veterinary restrictions (intended to prevent the spread of tick and pleuro-pneumonia) can be found, there are definite commercial prospects under certain conditions for the movement of cattle (by road transport) even for distances of up to 500 miles."

In 1948 some 2,200 head of fat cattle were moved to Alice Springs by road transport. In 1949, with three units in operation, the number was 8,000 head while in the summer of 1949-1950, when most of the Alice Springs District was affected by drought, some 6,800 head were transported. Faced with rising costs and the need to replace vehicles and undertake major repairs, in 1950 the operator increased his price to £2 10s. 0d. per bullock per 100 miles, which resulted in the virtual cessation of cattle transport for some years. In 1956-57 some 2,925 head were transported in the Alice Springs District, and in 1957-58 the number rose to 13,750 fats or 38% of total turn-off. By 1958-59 the number had risen to 10,056 fats and 18,950 stores, an increase of 111% on the previous year. It is interesting to note the effective use being made of road transport at this time to turn off drought-affected stock. In 1956-57, five transports were operating in the Alice Springs District, and by 1958-59 this number had increased to about eight major haulage contractors operating 15 vehicles, and some five pastoralists operating their own transport.

The gazettal of the Central Australia Protected Area for Pleuro-Pneumonia, although it temporarily restricted the movement of cattle from some Barkly Tableland properties to the Alice Springs District, has assisted road transport, for with the completion of duplicate handling facilities, cattle for immediate slaughter from the pleuro areas must be road transported to abattoirs or railheads in the protected areas. Stores from Alice Springs can moreover now be marketed freely in the pleuro-free areas of the south. Not only has this opened new markets for store cattle from the "centre", but has also facilitated an outlet for drought-affected stock, a large proportion of which must be road transported to railheads, owing to the state of stock routes.

The numbers road transported to railheads in the Top End have not increased to any great extent. In 1958-59 perhaps 3% of the cattle going to Darwin were road transported. This, as has been seen, was partly due to the state of the roads and to the fact that some properties using the Darwin outlet are not far from railheads. However, there has also been the absence of satisfactory markets which has inhibited management and prevented serious consideration of the advantages of road transport. A major pastoral company has successfully experimented with the road transport of cattle from Helen Springs to Darwin, but it is unlikely that this procedure, except in an emergency, would ever compete with rail transport; nor is it desirable that this should happen. Rather, as will be seen, the joint use of the two systems is indicated.

In the Victoria River District, except for a few cattle going to Darwin, road transport has not been used other than to bring in bulls and horses. On the Barkly Tableland approximately 19% of cattle turned off during 1959 were transported. This was largely accounted for by one company which, during the last 18 months, has road transported some 19,000 head of stock from Helen Springs to properties near the Queensland border. In the same year 1,270 fats were road transported to Mt. Isa butchers, and 2,500 drought cattle were brought from the Tableland to Mt. Isa for transfer to agistment properties.

Road transport had not been used to any great extent in the Channel Country of Queensland until 1959 when upward of 7,000 head were transported by this means. A large proportion of these movements must be attributed to drought conditions in the region, although the use of road transport for the movement of fats to Quilpie butchers appears to be developing on a permanent basis.

An understanding of the factors influencing the development of beef cattle transport in the Alice Springs District, and a consideration of whether the experience of cattlemen in that District might not have a bearing on the development of road transport of cattle in other areas, is a necessary procedure before considering the future of cattle transport throughout the Northern Territory, and in the Channel Country of Queensland.

FACTORS FAVOURING THE DEVELOPMENT OF ROAD TRANSPORT IN THE ALICE SPRINGS DISTRICT

Although road transport has only been used on a large scale over the last three years, lessees have become increasingly aware of the many advantages it has to offer. These advantages are set out below.

(i) Enables the turn-off of small numbers of fats in prime condition. - Properties here are much smaller than in more northern areas and nearly all are operated by resident lessees. These have an incentive to maximize their net return and they can accomplish this by using road transport to exploit their close proximity to railheads. With road transport these stations can turn off fat cattle in lots of 50 head or less as they become available. Contract drovers would not accept mobs of this size and it would hardly be economic to use station plants.

(ii) Assists in the better control of stock. - When cattle are walked in, it is necessary to undertake a general muster and many bullocks may be missed, to be turned off later as aged stock. With road transport enabling the marketing of stock during most of the year, this is largely avoided and a more uniform age of turn-off of the type of cattle required by the trade can be achieved. Conversely, if full advantage is to be taken of road transport, lessees must initiate satisfactory stock control. The age of turn-off in the Alice Springs District has been reduced considerably in recent years, and although this has been largely due to the demand by fatteners in the south and south-east of South Australia for young stores from Central Australia, it has no doubt been assisted by the development of road transport. This has enabled more breeders to be carried with a consequent increase in turn-off.

(iii) Enables the marketing of drought-affected stock. - The 1959 season has made pastoralists in this District aware of the advantages which road transport offers in this respect. Approximately 19,000 stores were road transported to railheads, mostly from badly drought-affected areas. A large percentage of these, too weak to walk, would have died if left on the stations. Many authentic cases were encountered during the survey in which road transport had been responsible for reducing drought losses by 40%-50%.

(iv) Makes possible the speedy delivery of stock and avoids weight losses. - Road trained cattle may reach the Adelaide market three to four days after leaving their property of origin in the Alice Springs District without loss of weight or bloom, and it is unlikely that stock need to be held in hand on properties for more than four to five days before being railed to Adelaide. Pastoralists estimated that, with the exception of properties close to railheads, road transported bullocks probably make an additional £5 at market if they have been turned off prime, even if stock routes are in fair condition. In periods of adverse seasonal conditions the saving might be £7 to £8, or more if stock are unable to traverse the stock route without supplementary feeding. Even then, numbers of footsore cattle would have to be dropped. Records show that from 1925 to 1959, a period of 35 years, some 30% were drought years, while in another 20%, rainfall was considerably below average. Although the intensity of droughts varies considerably, the figures indicate that in many years drought conditions do exist in areas of this District, and therefore sections of stock routes will be drought-affected in many years.

(v) Permits the marketing of weaner-type stores. - These soft young cattle could not be walked in more than 100 miles in many seasons when areas along stock routes are bare. If necessary these cattle can be "weaned" onto transports at the time of turn-off, which could act as an effective counter to seasonal growth checks. As will be seen from Appendix A the monsoonal climate prevailing in many of the survey areas dictates a short season of effective pasture growth followed by a long dry period.

(vi) Overcomes losses associated with droving. - Most pastoralists complained that good drovers are becoming scarce, and that the incidence of heavy droving losses due to "rushes" is increasing. Even if losses are in the vicinity of 2% it means the loss of 30 bullocks in a turn-off of 1,500, with an average price of about £30.

(vii) To some extent enable advantage to be taken of market prices. - As previously mentioned, Adelaide prices for fats in August and September are, over a period of years, some 11% above the annual average market price. Traditionally, fats are turned off in April, May and June, largely because the body of feed is at its best in January, February and March, and if held later than the months indicated there is every chance that weight losses will occur due to eaten-out stock routes. As cattle walking-in some 200 miles take a month to arrive in the Adelaide market, they miss the period of highest price.

(viii) Permits the release of station droving plants for pressing station work. - Distances travelled by stock in the Alice Springs District are not as great as in Western Australian pastoral areas, and this advantage of road transport is therefore not nearly so important. However, even the saving of a few weeks, in the period before the summer heat commences, must be advantageous.

(ix) Enables the turn-off season to be extended. - With road transport it is possible to extend the period of turn-off. This is important in most areas, for if rains are late, numbers of cattle may not be prime until climatic conditions make it difficult to walk them out.

Some or all of the above advantages would apply to pastoralists in other areas. However, some have special application in certain areas, and some may be peculiar to individual areas. For the sake of completeness these are discussed below.

The need for road transport in the Victoria River District, in order to avoid weight losses in, and improve the quality of, fat cattle going to Wyndham, will be apparent from discussions in Part I of this report. For obvious reasons it is difficult to arrive at a fair estimate of weight losses, and it has been suggested that perhaps losses of the order of 40 lb. dressed weight would be more realistic than the 60 lb. dressed weight indicated by the survey properties. However, with present available droving facilities, and the outlook for these in the future, it may be that the 60 lb. is not altogether excessive. Perhaps more important than the saving of weight losses would be the decrease in the age of turn-off (three year-old bullocks could be marketed), the improved gradings of beef obtainable, maintenance of bloom, the speed with which the cattle could be marketed and the fact that old cull cows which could not possibly walk in could be marketed. In one instance quoted, two mobs of allegedly similar quality cattle turned off together from the same station and delivered by different droving plants, had export gradings which varied by as much as 20%. This supports the contention that droving problems exist here and that road transport would have a lot to offer in improving quality of turn-off. Consideration was given in Part IV of this report to the building of a more direct road from Wave Hill to the bitumen to enable the road transport of drought-affected stock both from the Victoria River District and the border areas of Western Australia. Drought statistics for this District reveal that although the incidence of severe drought[1] is much less than in the Alice Springs District the area has not been drought-free, and there have been numerous instances where rainfall has been well below normal. Losses of up to 30% of the total herd in periods of severe drought were quoted by pastoralists in the survey. An outlet such as suggested above could also be used for the turn-off of stores by road transport in normal seasons under certain conditions, and it is possible that a major pastoral company in the area with its own transport would use such a road to take store cattle to Helen Springs.

Cattle coming in from the East Kimberleys may be susceptable to red water fever. Losses are also likely when cattle are walked from tick-free through tick-infested areas. Road transport could virtually eliminate this problem.

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(1) Commonwealth Bureau of Meteorology, Bulletin No. 43, Droughts in Australia.

In the case of the development of the Katherine area for cattle fattening it would be necessary to use road transport to bring in store stock from the Victoria River District, if the intention were to have them on fattening properties just prior to the beginning of the wet (December). Stock routes would be eaten out at this time of the year, and it would be difficult to work stock in the intense heat. This would also apply to young stores coming in from the North Barklys to Katherine. As far as the turn-off of fat stock from Katherine is concerned, the distance to railhead would be very small, probably not more than 50 miles, and it should be possible to walk stock in for most of the year.

On the Barkly Tableland there is the need for the development of road transport to move fat cattle quickly from station properties to local abattoirs or railheads. Details of weight losses and mortalities in travelling cattle were discussed in Part I of this report. Not only could considerable reductions in the above be affected by the use of road transport, but cattle would arrive in much better condition at meat works. Weight losses from the Queensland border to Dajarra have not been inconsiderable.

Pastoralists generally commended the advantages of extending the Mt. Isa and Dajarra railways to "softer" country and further pointed out that the extension of the rail to the areas of production in the Northern Territory, and the provision of adequate holding paddocks there, could be of great assistance. However, in the absence of further rail construction it is thought that properly organized road transport facilties could contribute much. A comparison of marketing times for Helen Springs cattle with road transport and droving is of interest.

	Road train	Droving
	hours	days
Helen Springs to Mt. Isa	17	65 (including 20 days on the very poor route from Camooweal to Mt. Isa)
Time on rail to Rockhampton	55	2.3
Rest at Saline	24	1.0
Total	96 (4 days)	68.3 days

Another problem facing the Barkly Tableland is that of supplying good young stores of weaner age to properties in the fattening areas. The droving trip from the Tableland to fattening properties in the Channel Country takes 12 - 16 weeks, and pastoralists consider that young stock are definitely adversely affected by the walk. As has been pointed out, this delays the age of turn-off, with its consequent effect on weight and quality. The risk of problems associated with seasonal fluctuations would be reduced if stock could be turned off the fattening property in the following season rather than be kept for an additional season, as is necessary with droving. This would produce a considerable saving, as it has been estimated that the cost of keeping one beast for one year in the Channel Country would be in the vicinity of £2, (although some pastoralists estimate it to be as high as £3). It should also assist decision-making on these properties.

The Barkly Tableland suffers from periodic droughts. Statistics show that in 20% of the years from 1925 to 1959 rainfall was less than half the long term annual average, and losses from these droughts have sometimes been very severe. In February 1952 it was reported that thousands of cattle had died in the worst drought for 50 years. (2) Breeding cattle were thought to have decreased by 20% - 40%, while losses in new born calves were from 40% - 80%, and the export of cattle was reduced to half that of the previous year. In 1958 some properties suffered heavy losses; in extreme cases, breeding stock mortalities were as high as 50% and reductions in brandings 70%. Because of the size and geographical situation of the region the effects of droughts in many years may be localized, and therefore stock savings could be effected by the use of road transport. It is not suggested that road transport should be regarded as a cure for all management ills, including the inadequate supply of waters. However, it will be apparent that some method of alleviating drought losses is desirable in the interests of both the pastoral industry and the nation, and if an extension of railways is not envisaged, road transport offers a reasonable alternative.

(2) Commonwealth Bureau of Meteorology Bulletin No. 43, Droughts in Australia.

In the Channel Country the major uses of road transport would be to:

(a) transport fat stock to railheads without loss of weight when sections of stock routes are impassable owing to adverse seasonal conditions. As drought problems are at times confined to localized areas, one section of the region may be suffering severe drought losses while others have fat cattle to market. In many years weight losses of up to 100 lb., in fat stock coming into Quilpie railhead from properties in the western areas, have been registered. At times it has resulted in stock being diverted from one railhead or market to another. Road transport could also assist in the turning off of young stock which at present could not endure a long walk without considerable loss of weight; and

(b) enable drought-affected stock to be transported to agistment. Rainfall figures in this region over the period from 1925 to 1959 indicate that a deficiency in rainfall sufficient to produce drought conditions may occur every four to five years. Perhaps equally important as rainfall failure is the failure of the major rivers in the area to flood. An analysis has been made by the Queensland Bureau of Investigation (3) of the Cooper River floods for a period of 57 years. Although the behaviour of the Cooper is not exactly the same as for other rivers in the Channel Country, it is sufficient to provide a useful guide. The Bureau reached the conclusion that during the above period there were good floods in 46% of years, fair floods in 16% of years, useful floods in 9% of years and droughts in 29% of years. The history of the Channel Country as reflected in the statistics of livestock numbers of the region is one of severe drought losses followed by periods of gradual recovery. Figures published by the Commonwealth Bureau of Census and Statistics show "deaths" as representing an annual loss of 7% of total cattle numbers in this area. With the development of adequate transport, Quilpie in particular could be the railhead for the movement of many thousands of cattle to south eastern areas in times of crisis.

Because of the nature of this investigation, the advantages which might be expected to be derived by pastoralists from the development of road transport have been discussed at length. However, benefits would not be limited to this group. For instance, it might be anticipated that rural workers would benefit through reduced freight rates, while increased activity in the small country centres affected would lead to improvements in facilities such as schools. If road transport, through its effect on stock mortalities and age of turn-off, increases the annual turn-off of stores, it could at least partially satisfy the unfilled demand for stores in southern fattening areas. At the national level benefits could be reflected in increased national income, and increased export earnings.

PROBLEMS ASSOCIATED WITH THE USE OF ROAD TRANSPORT.

Although pastoralists are becoming increasingly road transport minded they are also becoming increasingly aware of the problems associated with its use. Besides certain objections usually put forward by lessees not favouring the use of road transport, there are real problems associated with its efficient development and organization as well as certain limitations to its use.

(i) Objections Raised by Pastoralists to the Use of Road Transport.

(a) That it causes excessive bruising of stock. - In most cases where considerable bruising of fat stock has occurred it has been impossible to separate that due to road trains from that suffered while in transit in railway stock trains. The experience of a Rockhampton meatworks is that cattle road trained to Mt. Isa and railed to Rockhampton do not generally show excessive bruising. Evidence in this survey supports the contention in the Western Australian report that where undue bruising does occur it is often the fault of roads, the way cattle are treated during loading (including the use of physical violence), unsatisfactory loading facilities and wildness in cattle. Ideal cattle for road transporting are docile stock which have been well rested before loading. Pastoralists have mentioned cases both in the Alice Springs District and the Channel Country where bruising has been occasioned by faulty driving. It is important that road transport drivers be conscientious and have sufficient knowledge of stock to realize the consequences of their own actions.

(b) That earth roads are unsuitable. - As concluded in the Western Australian report, cattle can be transported on earth formed roads suitably maintained. It will be apparent from earlier considerations, however, that because of geographical situation and climatic factors it is not possible to suitably maintain earth roads in some areas to permit an uninterrupted extension of the turn-off period into those months when storms and local floodings occur, although this may be desirable. The net result in these circumstances is that, while not preventing the use of road transport, earth roads do limit its effectiveness.

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(3) Queensland Bureau of Investigation - unpublished data.

(c) Transport is too costly. - This is a very real obstacle to the full development of road transport in some areas. Most pastoralists in the Alice Springs District did not consider it uneconomic to pay from £2 5s. 0d. to £2 10s. 0d. per head per 100 miles for the road transport of fat bullocks. However, they all maintained that a charge of 36s. per head per 100 miles for store stock was far too high. The following figures give a comparison of droving and road transport costs, incurred in the marketing of 750 fat and 750 store cattle, the annual turn-off from a property 200 miles from Alice Springs railhead. They exclude incidental droving expenses such as the cost of watering stock at Government bores.

Table No. 21.

Comparison of Droving and Road Transport Costs.

—	Droving		Road Transport	
	Fats	Stores	Fats	Stores
	£	£	£	£
(a) Droving charges	1,125	750	-	-
(b) Road transport charges	-	-	3,375	2,550
(c) Mortality 2%	550	390	-	-
(d) Conservative value of weight loss, loss of bloom etc. *	2,800	-	-	-
Total Cost	4,475	1,140	3,375	2,550

* Based on an estimated saving of 50 lb. dressed weight per head at Adelaide at 1.5s.per lb., accruing from the use of road transport.

The above assumes there will be no further reduction in the age of turn-off due to road transport, and takes into account the fact that with road transport small numbers of prime bullocks will be turned off. These figures indicate why pastoralists in the Alice Springs District have stated that when seasons improve they will walk store cattle to the railhead. Even in worse than average years, one pastoralist said it paid him to walk store stock in, and supplementary feed during the trip. Eventually the problem is likely to be solved by the introduction of larger and more efficient transports by operators willing to reduce prices.

On the Barkly Tableland charges must be considerably reduced if store cattle are to be road transported. Survey properties indicated they would be willing to pay from 10s. to £1 per head per 100 miles, depending on the distance involved. A consideration of the cost of droving and the value accruing from the use of road transport is given below for stock travelling 500 miles.

Item	Charge per head per 100 miles (shillings)
Droving	5.0
Mortality in excess R/T mortality (3%)	3.0
Cost of holding 50% of stock for an additional season to fatten *	6.0
Incidental (additional dippings, watering at Government bores etc.)	1.5
Price at which it would be economic to use R/T	15.5

* Based on the assumption that it costs £3 per head per annum to hold stock on stations in the Channel Country.

The above assumes that road transport will reduce the fattening period by a season in the case of 50% of stock. Indications are that the percentage might be much greater. This suggests that economic road transport prices for stores would be between 15s. 6d. and 21s. 6d. per head per 100 miles, depending on the percentage of stock walked in, which must be held for an additional season before being turned off. No allowance has been made for the beneficial effect that road transport might have on planning or on the quality of beef finally turned off, due to age reduction and the minimizing of some factors causing growth set-back.

The obvious method of reducing unit costs of transport is to reduce the age of turn-off. Road hauliers suggest that they can carry 50% more yearlings (12-18 months of age) and 65% more weaners up to 12 months of age than grown male cattle. At 36s. per head per 100 miles for male stores the comparative price for weaners would be 22s. Cost figures given in Part II make it clear that with efficient types of transports and improved roads the price of road transporting weaners could be reduced to a level attractive to pastoralists. The turning off of weaner-type stores would have beneficial effects, especially in reducing the percentage of drought mortality in breeders and increasing the number of breeders that can be carried. As breeders are commonly regarded as being more vulnerable to drought than other classes of stock, the total losses in a herd containing a great proportion of breeders will be higher. Nevertheless such increased losses should be offset to a considerable degree by the greater enterprise flexibility obtained by turning off weaners. Furthermore, this procedure would diminish growth checks which adversely affect carcass quality. The successful implementation of this scheme would, however, call for the adoption of some improved management practices such as controlled breeding and weaning.

It is clear that fatteners would benefit substantially from receiving younger stores. Any change over to a weaner enterprise by breeders, might be expected, therefore, to largely depend on the willingness of fatterners to pay a price premium for good quality young cattle. Information available suggests that at the present time fatterners, especially in southern areas, are willing to pay attractive prices for such stock.

(ii) Organizational Problems.

(a) Lack of transports in the numbers required. - It was pointed out by interests both on the Barkly Tableland and in the Channel Country that if there had been a general demand for road transport to move drought stock in these areas in recent dry years, sufficient transports would not have been available to deal with the problem effectively. The major haulier in the Channel country, who also serves the Barkly Tableland, has a fleet of seven vehicles with a total capacity of 300 head. There are also a number of small transporters but their operations are generally very localized. The one area free of this problem is the Alice Springs District, where there are sufficient small transports to deal with the problem even if somewhat inefficiently. Until suitable roads and loading facilities are available, and there is a more general acceptance of road transport especially on the Barkly Tableland, there is little likelihood of road transport expanding rapidly. Potential haulage companies are unlikely to invest large capital sums in road transport unless they have guaranteed loadings each year. On the other hand pastoralists are unlikely to accept road transport fully unless hauliers can guarantee the efficiency of their business and offer transport at attractive prices.

(b) Lack of suitable loading facilities. - Another problem is the provision of suitable loading facilities at central trucking points. The location of a number of these facilities has been considered in the previous section. In the Northern Territory these are to be provided at the more centrally situated dips, while it has been suggested that in the Channel Country they should be situated at strategic points along the major "beef" roads. Loading yards would have to accomodate a train load of cattle. Loading races attached to yards need to be sufficiently long to eliminate any excessive slope up to the deck of the transport, and a length of five, eight foot panels has been suggested, while forcing pens should hold the equivalent of a trailer load of beasts. This enables cattle to "run" freely during loading. It has also been suggested that small paddocks, about two square miles in size, well watered and shaded, should be attached to these yards. Large paddocks are not envisaged, as cattle would only be held at such trucking points for a short period, probably overnight, and would be hand-fed. Even if quite large paddocks were supplied they would be soon eaten out if substantial numbers of stock were being transported.

Suitable resting paddocks at clearing dips for cattle coming into Queensland from the Northern Territory seem essential. As previously pointed out, tick-infested store cattle going to "clean" areas in Queensland may be held up for some time if they are not tick-free on arrival. From the point of view of road transport, the provision of satisfactory holding paddocks, equipped with loading facilities (of a size to be determined) at Camooweal, both for the spelling and for the holding of cattle is desirable.

A problem closely related to loading facilities is that of unloading facilities. At many railway sidings road transports are forced to use races constructed for the loading of railway waggons. This involves road trains backing across railway lines with the consequent bruising of cattle, and wear and tear to tyres and vehicles. Furthermore, such races are not satisfactory for the unloading of stock which tend to baulk, slip or become jammed in them, with consequent bruising. Unloading ramps such as the one provided at the quarantine yards at Alice Springs completely eliminate these problems and speed up unloading.

Many railway loading yards which serve the Channel Country have been built too close to towns and in some cases are situated close to railway shunting yards. The unfamiliar noise of traffic, and shunting trains, is alleged to have an unsettling effect on station cattle, and it has been suggested that yards should be established a reasonable distance away from towns.

(c) Co-ordination of road and rail. - For pastoralists to obtain the maximum advantage from combined rail and road services in marketing stock, not only must road services be free of delays due to breakdowns, bogging etc., but the railways must provide fast stock trains.

Although stock trains both from Alice Springs and from railheads in the Channel Country have been speeded up in recent years, pastoralists, stock firms and authorities interested in the transport of cattle suggest that there is still room for considerable improvement. It is alleged that not only are stock trains slow but undue delays take place; those occurring from Alice Springs to Adelaide have already been mentioned. Complaints by Queensland pastoralists that hold-ups are often caused by priority given to passenger trains, are confirmed by train drovers. Furthermore, it is stated that delays of up to two months in the supply of stock waggons makes planning difficult.

Should the cattle industry in the Top End of the Northern Territory begin to realize its development potential it is unlikely that the railways in that area could copy efficiently with the increased turn-off. At present the Darwin-Larrimah line can handle a maximum of 1,000 head a week.

(iii) Limitations of Road Transport.

The limitations of road transport were fully discussed in the Western Australian report. They are reconsidered here partly for completeness and partly in the light of conditions existing in the Northern Territory and Channel Country at the time of the investigation.

(a) There is an optimum distance over which cattle may be transported. - This is largely governed by two factors - cattle fatigue and costs. Hauliers in the Alice Springs District generally do not haul cattle for the maximum distance. However, they estimate that the maximum desirable distance that stock should be transported without resting would be about 400-500 miles on earth formed roads similar to those at Alice Springs. This would involve a travelling time of 16-18 hours. After this, they become very fatigued and lose appetite; fat cattle especially are likely to fall and be trampled. On bitumen roads the distance might be considerably increased. Cattle transported from Helen Springs to Camooweal, a distance of some 400 miles, arrive in very fresh condition and it is thought that such stock might be successfully carried to Mt. Isa, a total distance of 520 miles. This suggests that the maximum length of travel on bitumen might be 16-18 hours, and it appears then, that where conditions of travel are satisfactory, time rather than distance will determine rest periods.

Hauls in the Alice Springs District mostly do not exceed 200 miles and are very convenient in that they permit a round trip to be made each day, and maintenance and loading to be carried out in daylight.

The fact that cattle can be transported over quite long distances in a single stage, combined with the economic aspects of road transport, largely overcomes the need for resting paddocks and facilities. Most stock going to Queensland would arrive at Camooweal in one haul. As cattle must be dipped at Camooweal, owing to tick control regulations, this would be a compulsory resting centre. The majority of cattle going from the border to the Channel Country would not travel more than 400 miles. Similarly, cattle coming into the Alice Springs District from the South Barkly area must be dipped before entering the tick-free area. This would constitute a compulsory rest for stock, which would then be taken to Alice Springs in a single stage.

The prices ruling for livestock determine the maximum price that can be paid for road transport or, as a corollary, the distance stock can be transported at a given charge. Pastoralists at Alice Springs estimate that they must receive £16 per head at the station for two year-old store stock, or £18 to £20 per head for fat stock, to cover full operating costs. These figures are rough but they do serve as a guide. The maximum that a pastoralist might be expected to pay for road transport in reasonable seasons then, would be the difference between his net selling price per head at railhead or local abattoirs and his full operational cost per head. This is not, however, the figure that all pastoralists would be willing to pay for transport, for this would be governed, among other things, by the availability and price of contract drovers. If road transport causes costs to rise steeply, even in areas where it has been accepted such as the Alice Springs District, there would be, where possible, a reversion to the use of station plants to walk cattle in if contract drovers were not available.

The mileages at which road transport at the rate of £2 5.s. 0d. per fat bullock per 100 miles or £1 16s. 0d. per store bullock per 100 miles (the average charge by road hauliers in the survey) would become completely uneconomic to pastoralists in the Alice Springs District in reasonable seasons, are shown in Table No. 22 for a range of prices. It should be borne in mind, however, that in very poor seasons, pastoralists might consider it worthwhile to pay relatively high transport charges for part or all of their turn-off to avoid total loss.

Table No. 22

Distances at which Road Transport becomes Uneconomic

Net price at railhead or local abattoirs		Distance at which road transport becomes uneconomic
Stores	Fat cattle	
£	£	Miles
20	25	222
21	26	267
22	27	311
23	28	356
24	29	400
25	30	444
30	35	666

Thus, on an average net price of approximately £30 received at Alice Springs railhead in 1958-59 for fat cattle, the maximum economic haul would have been 444 miles. On the average net price of approximately £20 for store cattle at Alice Springs railhead for the same season, the total distance that could be justified, would be 222 miles. On the Barkly Tableland a large number of stores are sold on the property or merely transferred to associated stations. However, on the basis of an estimated 1958-59 price of £20 for a two year-old store steer on rail Mt. Isa, and a charge of £12 - £14 per head for operational costs, the distance such a beast could have been economically transported would have been 333 miles.

The use of road transport for very short hauls is generally regarded as uneconomic. Up to a distance of 100 miles, cattle including two to three year-old stock can be walked in if conditions on the stock routes are satisfactory, without station plants being absent for a long period. However, even where the distances involved are relatively short, road transport permits the marketing of small drafts for which it would be uneconomic to use station plants. As previously mentioned, pastoralists in the Alice Springs District often wish to market small numbers of fat bullocks in numbers of perhaps not more than 50 to 100.

(b) Roads may be unsatisfactory. - This has been dealt with in previous sections. To reiterate, transports can be successfully used only where roads are of a high standard. There are many roads in the areas covered by the investigation which are not suitably constructed for use by cattle transports. In some areas it will be impossible due to climatic and geographical factors to maintain earth formed roads in a satisfactory condition, if the length of the turn-off season is to be extended to any degree.

(c) There is a minimum price that hauliers can afford to charge for road transport. - This is a function of the cost of operation and profit expectation. The former will be governed by efficiency and will depend on suitable vehicles, better roads, the availability of off-season work, back-loading, etc. As previously mentioned, a considerable reduction in operating costs is possible, especially if suitable vehicles are used. The willingness of hauliers to accept reduced profit margins would depend largely on competition within the business, and on the ability and willingness of the pastoral industry to pay present charges.

(d) Problems of breakdowns. - Another factor which either limits the efficiency of road trains or cancels out their advantages is that of breakdowns, which result in the disorganization of schedules and increased costs. These may result partly from poor roads, though they are often entirely due to insufficient vehicle maintenance. This contention is substantiated by the disproportionate number of breakdowns suffered by some hauliers.

Difficulties associated with the development of road transport, including present high costs, the attitude of some pastoralists, problems connected with the co-ordination of road and rail transport, and organizational problems, can be regarded as little more than teething troubles to be overcome in the first few years of development. The major need for the efficient development of cattle transport is without doubt the provision of satisfactory road systems of the necessary standard, and suitably equipped loading facilities. These will also act as an inducement to hauliers to enter this field. The standards of roads suggested in the report are minimum requirements, and the sealing of major roads as transport develops will be desirable and probably essential.

PART VI: SCOPE FOR THE INCREASED USE OF ROAD TRANSPORT.

In Part V the advantages of using road transport were discussed, and it was suggested that its development would depend on a number of factors. Here, the influences which are likely to determine the scope of this development in the Northern Territory and Channel Country of Queensland are discussed.

(i) Wider Acceptance of Road Transport.

Interested authorities confidently expect that, before long, some 90% of fat cattle railed from the Alice Springs District will be road trained to railheads, provided that the present price premiums for road transported "fats" remain. In favourable seasons the fat turn-off from here, under the present conditions of development, might be from 35,000 to 40,000, of which more than 30,000 could be road transported. The numbers of store cattle road transported from the Alice Springs District will depend on seasonal conditions and the willingness of hauliers to reduce prices.

A proportion of stock going to Darwin and the Philippines would be road trained to railheads. In the Top End, shippers at Darwin need assurance that cattle will be available when required so that unnecessary delays to sailing schedules are avoided. Road transport, if available at a reasonable price, could go far to providing this guarantee. However, at the 1958-59 export price to Hong Kong and Manila of 5½d. per lb. liveweight, or a little more than 80s. per 100 lb. dressed weight, there is little margin with which to pay road transport charges. In 1958-59, cattle to the Philippines averaged £21 per head while cattle to Hong Kong averaged £14 per head, at Darwin. Under these conditions weight savings alone may not make it economic for pastoralists to use road transport, and shippers will probably have to offer some inducement such as increased prices for quality and condition of cattle.

The total annual turn-off from the Top End at present is only about 25,000 head, and it would be unwise to forecast the number that might be road transported. The development of satisfactory roads would draw some stock from the McArthur River and Robinson River areas. Most properties in this area are relatively small and depend on station droving plants to market their stock. Station plants may be absent for 11-12 weeks, and this has its effect on development. Because of this, some properties are said to be very interested in using road transport. Cattle numbers in the area are estimated at roughly 50,000 head, so that turn-off, which may be less than 10% of total numbers, is relatively small. An alternative route would be to walk cattle to Anthony Lagoon or Creswell Downs and road train from there, but stock coming down would be completely dependent on surface water which may be inadequate in some seasons.

It has been suggested that cattle from here might be shipped from Vanderlin Island, three miles off-shore. This, if possible, would certainly save stock a long walk, and provided shipping and markets continued to be available, might have much to recommend it. The scheme envisaged the construction of a railway to link the island with the mainland. However, this might mean an unjustified capital outlay and it might be necessary to consider other means of transport. The question would need much more investigation before a decision could be made.

In the Victoria River District the development of road transport would be hindered by the traditional practice of some pastoralists of walking cattle across to Queensland properties for fattening. Owing to the distance involved it is unlikely that the road transport of stores from, say Victoria River Downs to Queensland, could ever be economic. If fat cattle or cattle suitable for the boner-type beef trade could be turned off to markets in close proximity to this area, it could create an annual demand for road transport for 8,000 to 10,000 head. The turn-off from many stations here is composed of cattle of very mixed ages, many being old, and this in turn leads to a lack of uniformity in size. Because of this and the fact that the temperament of these animals is anything but docile, they are not ideal for transport by road.

It has been pointed out that at least one major pastoral company here might use road trains to transport stores to their Barkly Tableland property. Also, a number of the smaller properties intimated at the time of the investigation that they would be willing to supply stores to fatteners in the proposed agricultural areas of the Northern Territory, if these areas were developed. The numbers involved in the latter movements would be small, probably not more than 6,000 head a year. The annual turn-off of fats from this District to the meatworks at Wyndham amounts to approximately 9,000 to 10,000 head. Some 6,000 head of this turn-off in 1958-59 walked in distances well in excess of 100 miles, although the maximum distance walked was not much more than 300 miles. This suggests that perhaps 70% of the turn-off to Wyndham comes from properties ideally situated for the use of road transport. From a consideration of available figures, it appears that the maximum number available for road transport in this District would be approximately 64% of the annual turn-off, but the actual number that would be road transported, given suitable roads and the necessary transport, would be something less than this.

The difficulties faced in road transporting mature stores from the Barkly Tableland has already been discussed. However, the possibility of road transporting weaner-type stores does exist, and the development of this procedure will have to await the successful results of some large pastoral company willing to pioneer this field. The potential for the use of road transport here cannot be disputed, especially in view of the fact that in many years some 60,000 head of store cattle cross into Queensland.

Of all the areas discussed, it is the Channel Country that probably offers the greatest scope for the use of road transport. This area has an annual average turn-off of approximately 50,000 to 60,000 head of fat cattle, and some 85% of these would be within easy walking distance of loading facilities suggested earlier.

(ii) Increased Turn-off.

Increased turn-off in the Northern Territory will depend on a number of factors, not least of which will be the continuance of a high level of prosperity within the industry to provide the necessary capital for development, especially in the case of owner-operated properties. Managerial ability is a very vital factor influencing future development, and although the level of management varies between districts, overall it is apparent that on company properties the possible lack of managers of the necessary calibre may be restrictive, while in the case of some properties, especially in the Top End, a change in ownership will be required before production potential can be realized.

Table No. 23 shows the average number of cattle in each district for each four-year period, from 1945 to 1959. Figures for the period 1931-1940 have been included for purposes of comparison. Unfortunately no figures are available for the period 1940-1945. The upward trend in cattle numbers in the Alice Springs District during the whole of this period is evident from Graph I. Cattle numbers in this District showed an increase of 370% between 1937 and 1958, largely due to the level of management on these lessee-operated properties and the existence of the rail link with Adelaide. Because of the close proximity of many properties to railheads, road transport has much to offer and pastoralists have taken advantage of it. An estimate by the Animal Industry Branch of the Northern Territory Administration that the annual turn-off in the District could increase to 100,000, or 80% more than the present turn-off, is supported by evidence collected during the survey. It would seem that the increase is not so much likely to come from increases in total numbers carried, as from decreased age of turn-off, reduced mortality due to better husbandry practices and the provision of additional waters. Road transport can play a major role in achieving this development by providing a speedy and efficient means of marketing livestock.

Table No. 23.

Cattle Numbers in the Northern Territory by Districts

1931 to 1959.

Period (a)	Darwin & Gulf	Victoria River	Barkly Tablelands	Alice Springs	Total
1931-40 (10 yrs)	189,300	359,500	247,200	330,100	868,000
1941-44 (4 yrs)	-	-	-	-	-
1945-48 (4 yrs)	143,400	339,400	331,900	182,300	997,000
1949-52 (4 yrs)	166,600	310,300	315,600	222,800	1,015,000
1953-55 (3 yrs)	158,400	266,400	288,100	274,600	988,000
1957-59 (3 yrs)	183,400	349,100	347,300	308,800	1,189,000

(a) Prior to 1957 the count was taken on the 31 December each year. Since 1957 it has been taken on the 30 June.

In the Darwin and Gulf District the trend in cattle numbers over the 21 year period has been in a downward direction. The failure of this District to develop is among other things a reflection on management, although the effect of the lack of suitable markets both on incentive and the financial ability of lessees to carry out capital development cannot be disregarded. With the recent development of the live cattle trade with Asia and Queensland, conditions have changed, and the Northern Territory Administration

considers that if this incentive remains during the next few years, turn-off might be expected to increase from the present 12,000 head per annum to nearly 50,000 head per annum. This may appear somewhat optimistic in view of the statement by Kelly[1] that this is the poorest cattle country with the lowest production potential of the occupied areas in the Northern Territory. However, there is little doubt that a considerable increase in output could occur as a result of the greater availability of capital, particularly if this were accompanied by an improvement in the level of management. Output would further be stimulated if the proposed fattening of store cattle on pasture and crops in the Katherine/Darwin area developed.

A downward trend in cattle numbers over the 21 year period is also apparent in the Victoria River District, where management has in many cases been unsatisfactory. Here, as in the Top End, the ratio of turn-off to total herd numbers is often much lower than that advocated by the Northern Territory Administration. This District has also suffered from the lack of satisfactory markets. Under new leases currently issued in the Northern Territory, lessees are obliged to undertake certain improvements, including those to waters and fences, for the better control of herds. This should have a beneficial effect both here and on the Barkly Tableland. Figures available from the stock inspector in the area suggest that with the provision of satisfactory markets an increase in turn-off of 110% in 15 years time, from properties already established in the area, is possible. This is provided that certain development works are carried out on some properties, and that the level of management on other properties is improved.

Figures collected from 13 properties on the Barkly Tableland show an expected increase in turn-off of 40% within the next 10 years, provided that certain improvements to waters and fencing are carried out for better herd control, and there is some improvement in husbandry practices. The turn-off weaner-type stores would mean a considerable increase in the total annual turn-off due to the additional breeding stock that could be carried. This would result in a decrease of nearly 50% in the time stores are held on breeding properties, and it might be expected that sufficient additional breeders could be carried to increase annual turn-off by 50%.

Estimates made by the Committee of Investigation on Beef Production[2] suggest that, with the development of satisfactory road systems and the establishment of road transport, the annual turn-off in the Channel Country might be expected to increase or double the present turn-off. This excludes any consideration of the likely increase in turn-off, if weaner-aged stores are brought in by road trains from the Northern Territory. As previously pointed out, road transport would appear to have much to offer here, and so should have an excellent chance of operating successfully if given satisfactory working conditions. Furthermore, it is known that many pastoralists are favourably disposed towards this means of marketing stock.

(iii) Integration of Breeding and Fattening Areas.

Sufficient has been said in the body of the report to indicate the scope for the use of road transport for the transfer of stores from the Barkly Tableland to fattening properties in Queensland, especially in the Channel Country. However, owing to an increasing demand by southern fattening properties for stores from the Alice Springs District and a proposal to establish fattening properties in the Katherine area, some further consideration should be given to the degree of integration between breeding and fattening areas that might be expected to result from these influences, and the part road transport might play in achieving this. These matters are discussed below.

Alice Springs District and Southern Fattening Areas - It is reported that the increasing demand for Central Australian store cattle in the fattening areas of South Australia, New South Wales and Victoria, appears likely to exceed the supply. This suggests that pastoralists in the Alice Springs District could concentrate on supplying young stores of the type required by the southern States, rather than on the fattening of stock in this area of low and unreliable rainfall. The prices for fat cattle have been extremely high, and this may possibly influence the nature of turn-off. On the basis of the average prices ruling at Gepp's Cross market during 1958, a price of approximately £34 would have been received for a three year-old beast from the Alice Springs District dressing out at 520 lb., while a four year-old beast with a dressed weight of 600 lb. might have brought £40. Good quality two year-old store cattle brought £20 on trucks at Alice Springs or approximately £27 at Adelaide, while 12-18 month-old stores sold at from £15-£18. Thus, on a return per year-held-basis there is only a slight margin in favour of store cattle. However, their big advantage is in the shorter time they are held before sale which, in turn, leads to the carrying of an increased number of breeders, while decreasing the probability of severe weight losses in fat stock due to seasonal conditions. Furthermore, it could reduce the risk of mortalities in steers, although with the

(1) J.H. Kelly: Report on the Beef Cattle Industry in Northern Australia, Bureau of Agricultural Economics, 1952.

(2) Meat Production Development Committee, unpublished data 1949.

careful use of road transport these should already be relatively small. The above is particularly true of young 12-18 month-old stores which, because of their size, cause a reduction in per head road and rail freights. There is, then, a very strong argument in favour of concentrating on the turn-off of young store steers, and there is no doubt that given the necessary conditions this practice will become more widespread, although in many cases the number of stores turned off will still continue to be dictated largely by the nature of the season. To assist this integration and ensure its smooth development in spite of seasonal conditions, an efficient transport service at reasonable prices will be necessary, and this requires some improvement in the present transport facilities.

Top End breeding areas and suggested fattening areas - Initial work is proceeding in determining the possibilities for agricultural development on the Tipperary Land System at Katherine and on the black soils of the sub-coastal plain. Actual development plans have not been formulated for these two areas, but it has been proposed that the fattening of livestock should constitute one enterprise. Tentative figures suggest that if this development occurred, it could create an annual demand for 50,000 to 60,000 stores which would be drawn from the Darwin and Gulf and Victoria River Districts and the North Barkly Tableland area. The construction of an abattoir at Darwin to treat the bulk of the turn-off would be necessary, as it could not be handled by the present live cattle export trade.

From the point of view of the pastoral industry in the areas mentioned above, the successful implementation of any such development schemes should have a very beneficial effect. Not only would it provide a more convenient market for many pastoralists but it would, by engendering a feeling of confidence in the future of the cattle industry in the Top End, create the atmosphere necessary if capital development on these properties is to be undertaken. It could also act as a brake on the wasteful habit of walking stock excessive distances from the Victoria River District to Queensland, and could save at least a proportion of the annual loss in income due to mortalities, excessive weight losses and deterioration in quality. Furthermore, it could increase carrying capacity by permitting a younger age of turn-off of stores. At present a major problem facing any such development is the lack of stores. The total annual turn-off from the Top End is only 25,000 head, and the additional numbers expected from the North Barkly Tableland area, and properties in the Victoria River District, are unlikely to be sufficient. Such a scheme is, therefore, dependent for its success on a high level of station development in the areas of supply taking place concurrently with the development of the fattening areas.

The desirability of using road transport to move stores to these areas has already been mentioned. Young stores could be transported to the fattening areas at those times when there is very little feed on stock routes, or during the period when early storms create droving problems. An efficient road transport service would appear to be a desirable adjunct to any such development.

(iv) Road Development.

Although even under present conditions large numbers of cattle are available for road transport, the number that will be available must necessarily remain limited until satisfactory road systems have been established in the areas being considered. At present the number of roads suitable is very small, and it is unlikely that hauliers using large, efficient vehicles will be induced to operate in areas where the wear and tear to costly capital equipment is sure to be high. Furthermore, pastoralists are not generally willing to risk extensive bruising of fat stock on poor roads. There is little doubt, then, that the development of road transport to anywhere near its full potential will require the development of satisfactory road systems.

(v) Effect of Marketing Younger Stock.

Should pastoralists take advantage of road transport to market younger stock, greater numbers of breeders may be carried, or in the case of overstocked properties the same number of breeders may be carried with a reduced risk. The effect of age on the volume of turn-off is adequately reflected in the following Table based on information given by East Kimberley pastoralists to the Advisory Panel on Air Beef Transport.[3]

(3) Report by Commonwealth Advisory Panel on Air Transport of Cattle or Beef, 1955.

Table No. 24

Herd Composition Turning Off Cattle at Different Ages.

Turn-off at 5 years		Turn-off at 3 years	
Breeder cows	5,000	Breeder cows	6,000
Bulls etc.	300	Bulls, etc.	350
Yearlings (M)	1,500	Yearlings (M)	1,800
Yearlings (F)	1,500	Yearlings (F)	1,800
2 year heifers	1,400	2 year heifers	1,700
2 year steers	1,400	2 year steers	1,700
3 year steers	1,350	3 year bullocks	1,650
4 year steers	1,300		
5 year bullocks	1,250		
Total	15,000	Total	15,000
Turn-Off = 1,250 bullocks, 250 cows or 10% of herd numbers.		Turn-off = 1,650 bullocks, 300 cows or 13% of herd numbers.	

The figures refer to the possible composition of a herd turning off five year-old bullocks under open range conditions, and the composition which might be expected under similar conditions if three year-old stock were marketed. It will be seen that turn-off has been increased by 30%. These figures in their present form relate to the turn-off of both the East Kimberley region and Victoria River District. Similar tables could be constructed for the other Districts, but this appears unnecessary for the present study, as the above figures clearly indicate the fact that, as the average age of turn-off is reduced, the greater the number of cattle and aggreate liveweight which will become available for road transport.

(vi) Market Requirements.

The use of road transport by pastoralists for marketing cattle is dependent to a large extent on the maintenance of prosperity within the industry, and therefore the growth of road transport will be influenced by the condition of cattle and beef markets.

Owing to the expected growth in population during the next few years, an increasing proportion of the Australian turn-off of fat cattle will be required for home consumption. Recent population projections made by Borrie and Rodgers[4] suggest that by 1970 Australia's population might be 12,836,098, assuming an annual migrant intake of 100,000. This is a 29% increase over the Australian population at 31 December 1958. Approximately 78.7% of the Australian population is regarded as urban[5], so that by 1970 there will be some 10,102,000 city dwellers. On the basis of a per capita beef consumption of 120.8 lb., the Australian average consumption figure for 1957-58, there is likely to be an annual increase in the demand for beef for the Australian local market of about 122,000 tons by 1970, of which some 108,000 tons will be required by the Australian population other than in Western Australia and Tasmania.

The above increase in demand will affect the Northern Territory through the increased requirements of store stock by fatteners in South Australia, Victoria, New South Wales and Queensland. The Channel Country of Queensland will also be affected, accounting as it does for some 10% of the total turn-off of fat cattle in that State, a large part of which supplies the Brisbane metropolitan market.

The development of the Northern Territory's live cattle trade with Queensland depends largely on the continuation of the demand by the United States for Australian boner-type beef. The lifting in October 1958 of restrictions on the export of manufacturing-type beef imposed under the Fifteen Year Meat Agreement with the United Kingdom, coincided with a cyclical slump in American beef production, and a reduction in Argentine beef exports brought about largely by the overslaughtering of breeding stock. Australian exporters, therefore, have been able to take advantage of the increased demand for manufacturing-type beef by the United States (with resulting high prices) due to the shortage caused by the above factors. Meat exports to the United States rose from 4,952 tons in 1957-58 to 51,748 tons in 1958-59, while in the three months ended September 1959 some 32,538 tons were exported to this market. Only 2,123 tons were exported in the first four months of the financial year 1958-59, so that more than 81,000 tons were exported

(4) W.B. Borrie and Ruth M. Rodgers. The Next Fifteen Years - A Study of Australia's Changing Population Structure, in course of publication.

(5) Commonwealth Bureau of Census and Statistics, Demography. 1958.

between November 1958 and September 1959.

The maintenance of this trade will depend on the requirements by the expanding population of the United States of manufacturing-type beef for the preparation of hamburgers and other meat loaf dishes so popular in their meat diet. The demand is expected to grow, and as there has been a decline in percentage of lower grades of beef produced locally in the United States, it is probable that imports will be necessary if supplies are to be adequate. The level of these imports, however, may vary substantially with the cyclical rise or fall in local production. The short-run outlook for this trade would therefore appear to be quite satisfactory.

In the United Kingdom, the main market for Australian beef, domestic production of beef has increased by more than one-third since 1939, due largely to the operation of a price guarantee system. Moreover, the Government has recently called upon industry to produce more beef of the quality required by the market. However, in the foreseeable future domestic production will still have to be supplemented by substantial quantities of imports if consumer demand is to be fully satisfied. The quantities available from the Argentine, the main source of supply, will depend upon the success of the measures being taken to encourage the recovery of the industry. Substantially larger exports may not occur in the short term. The United Kingdom, therefore, should remain favourable for Australian exports of beef and veal, especially as the guaranteed minimum prices under the Fifteen Year Meat Agreement provide a buffer against any temporary recession that may occur.

The Philippine market for live cattle exports appears to be somewhat unstable. Hong Kong seems, however, to be a much more satisfactory market, and some sources quote its potential demand as approximately 20,000 head annually. The continuance and development of this market will largely depend on the maintenance of the status quo in Hong Kong. It would appear that, with the successful development of fattening areas in the Northern Territory and the provision of an abattoir at Darwin, the need for much of this live cattle trade might diminish.

In view of the above, the short term outlook for the beef cattle industry is very bright, and this should create a climate favourable to the development of road transport. The level of its development, however, will be determined by factors previously discussed in Part VI, and by the long term outlook for the industry which cannot be accurately gauged at the present time.

APPENDIX A.

DESCRIPTION OF REGIONS.

Northern Territory.[1]

The Northern Territory covers a land area of 523,620 square miles, consisting of that part of the Australian continent north of latitude 26 degrees South and between longitude 129 degrees East and 138 degrees East, together with some adjacent islands which were not considered in the report. The extreme points of the Territory lie about 1,000 miles apart from north to south, and 580 miles from east to west. The greater portion of the Territory, comprising 426,320 square miles, lies within the Torrid Zone, and the balance of 97,300 square miles is in the Temperate Zone.

Away from the coast the land gradually rises to an altitude of about 1,200 feet in the vicinity of 17^{o} to 18^{o}S, where a broken plateau forms the watershed between the inland and coastal rivers. The inland rivers are generally dry, merely being channels which carry water during the wet season. In the southern part of the Territory - Central Australia - the land rises again to a general level of over 2,000 feet, culminating in the Macdonnell Ranges which extend east and west in parallel ridges over an area approximately 150 miles long and 20 to 50 miles wide, with an altitude in places of over 4,000 feet. In the south-west, isolated outcrops rising to nearly 3,000 feet occur, but south of the Macdonnell Ranges, especially to the south-east in the Simpson Desert area, the general altitude declines.

The Territory is sparsely populated, and the majority of the estimated non-aboriginal population of 21,242 live in Darwin, Alice Springs, Tennant Creek or Katherine. The aboriginal population of approximately 16,800 is scattered throughout the Territory, the greatest numbers being in the northern area. The population of Darwin, the capital of the Territory, is approximately 10,000 excluding aborigines, while the population of Alice Springs, some 954 miles to the south, is about 3,000 excluding aborigines.

A brief description of the climate, vegetation and soils, of each of the four administrative districts in the Northern Territory, is given hereunder.

The Darwin and Gulf District. The northern section of the Territory, extending from approximately 133^{o} E to the Queensland border, is occupied by the Darwin and Gulf District which extends from the northern seaboard to almost as far south as Newcastle Waters and occupies an area of some 124,000 square miles. A section of the District lying adjacent to the Gulf of Carpentaria has been discussed for convenience with the Barkly Tableland District.

In common with the Victoria River District, this District has a monsoonal climate with a short wet season and a long dry season. Rainfall is the dominating climatic feature affecting plant growth, and it exerts a very definite limiting influence on production in that, apart from specially favoured seepage and flooded areas, growth is restricted to a short wet season. Total annual rainfall varies from 35 inches in the south-east to 60 inches in the north and north-west. Annual rainfall is reasonably reliable and drought years rarely occur, but the time of commencement and duration of the wet season are both variable. The estimated growing season for crop species varies from 18 to 24 weeks in the Top End [2].

In a total area of some 124,000 square miles, some 31,200 square miles of this District are occupied by the Arnhem Land aboriginal reserve.

Descriptions by C.S.I.R.O.[3] of pasture groups and vegetation show that, in the higher rainfall upland country, annual sorghum and other tall grasses occupy some 40,700 square miles. These occur on flat to undulating country not subject to flooding, with light-textured soils, where the mean annual rainfall is greater than 30 inches. Vegetation is mostly tall (30 to 70 feet) open forest characterized by numerous Eucalyptus spp., of which stringybark (E. tetrodonta) and woollybutt (E. miniata) are most common. There is a lower (10 to 30 feet) tree storey which is extremely variable in composition and density, but of which palm and deciduous broad-leaved species form a conspicuous part. The understorey consists mainly of tall (5 to 10 feet) plants, most common of which is annual sorghum (sorghum intrans and S. Stipoideum), but

(1) General description from The Northern Territory - Annual Report 1st July 1955 to 30th June, 1956.

(2) R.O. Slatyer Agricultural Climatology of the Katherine Area N.T. C.S.I.R.O. Division L.R.R.S. Technical Paper No. 6. (1960)

(3) C.S.I.R.O. unpublished data.

numerous tall perennial species occur throughout and many assume dominance in some areas. These include giant spear grass (Heteropogon triticeus), perennial sorghum (Sorghum plumosum) and beard grass (Chrysopogon latifolius). Numerous medium height (2 to 5 feet) and short (less than 2 feet) grasses and forbs occur, but these are of low density. Wet season pasture is regarded as poor, while the dry season pasture is regarded as very poor.

A further 6,000 square miles of higher rainfall upland country is classified as kangaroo grass-perennial sorghum, and consists mainly of flat to generally undulating country with red earth and yellow podzolic soils. The mean average rainfall varies from about 25 to 50 inches, and the vegetation is woodland (or low open forest) characterized by eucalypts 20 to 30 feet high. The understorey is of perennial drought-evading tussock grasses about 3 feet high, most common of which are kangaroo grass (Themeda australis) and perennial sorghum (sorghum plumosum). Interspaces are bare or with sparse ephemerals including native couch grass (Brachyachne convergens), several other short grasses and a number of forbs particularly legumes. Approximately 50% of the area is occupied by inaccessible rocky outcrops carrying tall grasses, by creeks, rivers and associated frontages, by areas of lateritic soils carrying tall grasses, and by small areas of heavy clay soils with mainly tall bluegrass pastures. After effective rains in November and December the perennial grasses grow rapidly and cattle fatten. During the dry season pastures are of low nutritive value and stock lose weight. Where rainfall exceeds 30 inches arable agriculture is possible on some soils.

The sub-coastal plains consisting of heavy clay soils, or peaty soils on alluvium, account for some 4,300 square miles. Many streams rising in the much dissected watersheds of the central or south-eastern sections, and flowing to the west and north coasts, break their banks during the wet season. This area is therefore flooded deeply for six to eight months each year. As a result of this annual flooding many portions of the regions, including some of the river levees, are inaccessible by road transport for several months each year. This handicaps the establishment of extensive permanent roads, and also causes difficulties in the management of large properties. It has been a major influence deterring general development. The area is mainly treeless, but has a dense growth of tall (3 to 6 feet) perennial drought-evading plants including reeds (Eleocharis spp.) and wild rice(Oryza sativa). The drier parts carry Ischaemum arundinaceum and blady grass (Imperata cylindrica). When the flood recedes, pastures are good for several months. The area has an average stocking rate of less than five cattle per square mile. However, much of it is not stocked, or occupied only by buffaloes. In view of the problems associated with handling stock during the wet, and stock movements during the dry, the potential would appear to be more in mechanized rice production than in cattle grazing.

Some 5,800 square miles of coastal country consist of bare salt flats, samphire flats and dunes. Rice grass (Xerochloa imberbis) and salt couch grass (Sporobolus virginicus) produce useful fodder in some parts. These areas are mainly unstocked because of inaccessibility and the lack of fresh water.

In the north of the Darwin and Gulf District, kangaroo grass (Eriachne spp.) pastures occur on some 2,400 square miles, mainly on flat to gently sloping alluvial plains, in the middle and upper sections of the Adelaide, Margaret, McKinlay, Mary, Finniss and South Alligator Rivers. The mean annual rainfall is 50 to 60 inches, and the plains are liable to flooding each wet season for periods of three to four months, during which they are inaccessible to cattle. These plains are mostly treeless, although in some places there is a low parkland characterized by eucalypts and low Melaleuca spp. At the beginning of the wet season perennial grasses make rapid growth, but by the time the flood water recedes grasses are already near maturity. From then on, the plains and most of the flats dry rapidly, and pastures quickly deteriorate. Minor areas consist of water courses, low stony rises, isolated hills and ridges.

Some 4,500 square miles of inferior Mitchell grass and other perennial grasses occur mainly north of latitude 18° S (approximately Newcastle Waters). This pasture is restricted to heavy clay soils where the rainfall is greater than 25 inches. The topography is flat to undulating, and there are generally scattered trees particularly coolibah (Eucalyptus microtheca), although some areas occur as treeless grasslands. The pasture consists of tall (3 to 6 feet) and dense stands of perennial drought-evading tussock grasses. The common species are bull Mitchell (Astrebla squarrosa), blue grasses, native panics (Panicum spp.), beard grass (Chrysopogon fallax), feathertop (Aristida latifolia) and brown top (Eulalia fulva). Minor areas are steep stony hillslopes, drainage channels and frontages.

Some 10,000 square miles between latitude 15° S and 18° S are composed of semi-arid upland country, flat to undulating, with light to medium-textured soils often shallow or gravelly. The vegetation, consisting mainly of trees 15 to 30 feet high, is eucalypt woodland in which bloodwood (Eucalyptus dichromophloia) is the commonest. The rather sparse pastures are characterized by three-awned spear grass

(Aristida pruinosa), a perennial tussock grass generally 2 to 3 feet high with tussocks 3 to 6 inches in diameter. Several other perennials, including kangaroo grass (Themeda australis), white grass (Sehima nervosum), beard grass (Chrysopogon pallidus) and citronella grass (Cymbopogon bombycinus), occur infrequently. Soft spinifex (Plectrachne pungens) occurs at a variable but generally low density. Between the perennial tussocks numerous species of short grasses, particularly Aristida spp. and forbs, provide a sparse cover. Occasional top-feed species such as supplejack (Ventilago viminalis) occur, and there are minor areas of lancewood (Acacia shirleyi) forest country sparsely grassed. Although the quality of wet season pasture is poor, the pastures nevertheless respond quickly to rain and provide considerable quantities of feed in the early part of the wet season. During the dry season, when both annual and perennial components are mature and dry, the pasturage is of very poor quality. Some 50,000 square miles of this District consist of rugged and otherwise inaccessible country useless for grazing.

Although the major portion of the District is nominally occupied, it is largely undeveloped. Adverse factors including the relatively short growing season, problems relating to stock handling during the wet and stock movements during the dry, absence of any prospects for extensive irrigation, lack of communications during the wet season and the general lack of communications internally and externally, floods, marketing problems, lack of adequate and suitable labour, and the fact that to date settlement in this District has offered no advantage in competition with more congenial localities in other parts of Australia, as well as the absence of a population adequate for its development, have all had their effect in retarding development.

Victoria River District. This District includes a substantial part of the Ord-Victoria region as defined by C.S.I.R.O.(4) and lies approximately between the latitudes of 15° S and 20° S. It borders Western Australia to the west and the Barkly Tableland District to the east. Its approximate area is 91,200 square miles.

A predominantly semi-arid District, it experiences a warm dry monsoonal climate characterized by a short rainy season of four to five months and a long dry period of very little if any rainfall for the remainder of the year. Total annual rainfall ranges from 15 inches to 40 inches, with rainfall slowly increasing from south to north. The bulk of the area receives an annual rainfall of less than 30 inches, which is almost completely confined to the period from November to March. Rainfall is characterized by a low to moderate variability, and the length of the growing season for pastures ranges from 21 weeks in the north to less than ten weeks in the south.

In the south of the District soft spinifex plains occur as part of a belt stretching across the Northern Territory between latitude 18°S and 21°S (Newcastle Waters to Tennant Creek). Approximately 40,000 square miles are to be found in the Victoria River District, where it occurs on plains or low hills, mostly on sandy red earths. This country is largely undeveloped, but has a low but stable stocking rate even during droughts. A further 11,300 square miles in the south of the District is accounted for by spinifex dune fields.

Sparse, perennial, drought-evading tussock grasses of medium height, the most common of which is three-awned spear grass (Aristida pruinosa), interspaced with sparse ephemerals, occupy some 7,100 square miles of semi-arid upland country. Fodder here in wet seasons is poor and in the dry season very poor. Many areas are unstocked. The vegetative cover is a eucalypt woodland 15 to 30 feet high.

Approximately 5,000 square miles of mainly undulating country, with stony, heavy clay soils, predominantly carry barley Mitchall grass (Astrebla pectinata) and other perennial grasses including native panics (Panicum spp.) bluegrass (Dichanthium fecundum) and feathertop (Aristida latifolia). Drought-evading ephemerals are common and varied. Nearly half this area consists of steep, stony hills, drainage channels and frontages, and red soils with kangaroo grasses (Themeda spp.). Some 3,500 square miles of mainly undulating country with heavy clay soils are occupied by inferior Mitchell grass and other perennials.

On some 3,200 square miles of higher rainfall upland country, red earths or yellow podzols have developed, with a cover of eucalypt woodland having an understorey of perennial, drought-evading tussock grasses, most common of which are kangaroo grass (Themeda australis) and perennial sorghum (Sorghum plumosum). During the "wet", cattle gain weight on these pastures, but during the "dry" they are of low nutritive value and cattle lose condition. Minor areas consist of rocky outcrops, rivers and frontages, and lateritic soils. Another 4,500 square miles of higher rainfall upland country comprise light-textured soils with a vegetative cover of tall eucalypt open forest and a variable low tree layer. The understorey is

(4) C.S.I.R.O. unpublished data.

variable normally consisting of dense tall and drought-evading plants of which annual sorghum is most common. There are also several species of perennials and a low density of medium and short grasses and forbs. Wet season pasture is regarded as poor while dry season pasture is very poor. An area classified as kangaroo grass, on lowlands mixed with hilly country, accounts for some 6,900 square miles. Inaccessible hills constitute more than half the area. However, significant areas of lowland with mainly red soils occur, and carry pastures similar to those mentioned directly above.

Short grass-forb country occuring in scattered areas occupies some 2,400 square miles. Features of this group will be described when the Alice Springs District is being considered. In this District the top-feed species of vegetation characteristic of the short grass-forb country in the Alice Springs District are replaced by low Eucalyptus spp. The remainder of the District is accounted for by minor areas of other pasture species, and rugged country.

Alice Springs District[5]. This part of the Northern Territory adjoins the South Australian border and is bounded on the north and north-east by the Victoria River and Barkly Tableland Districts. Its western and eastern boundaries are Western Australia and Queensland. It extends roughly 200 miles north and south of Alice Springs and occupies an area of some 211,800 square miles.

The District lies between the 5 inch and 13 inch rainfall isohyets, with rainfall largely confined to the summer months. Although rainfall variability here is not as high as in the Channel Country of Queensland or northern South Australia, nevertheless coupled with the low annual precipitation, it is sufficiently significant to cause prolonged dry periods which have been responsible for heavy stock losses.

Short grass-forb country accounts for some 47,000 square miles. On the plains (22,700 square miles) consisting largely of red earths or calcareous earths, vegetation is mostly low woodlands or drought-resisting edible Acacia spp. with an understorey of drought-evading ephemerals. Grasses e.g. kerosene grass (Aristida arenaria) and oat grass (Enneapogon spp), are more common after summer rains while forbs such as white daisy (Helipterum floribundum) flourish after winter rain. The country fattens cattle after summer rains, and during extended dry periods when the ground is bare stock are maintained by top-feed. There are minor areas of woollybutt (Eragrostis eriopoda) pastures, creeks and frontages, stony hills and spinifex sandplains. Floodplains and outwash plains, carrying short grasses and forbs, cover some 10,900 square miles. These consist of alluvial plains with sparse, low woodland of drought-resisting edible trees and an understorey of drought-evading ephemerals somewhat taller and denser than those previously mentioned. Top-feed here is available in lesser quantities than in the area previously mentioned. This country also fattens cattle after summer rain. There are minor areas of creeks and frontages, Mitchell grass plains, blue bush "swamps", old man saltbush and spinifex sandplains. Short grasses and forbs on lowlands mixed with hilly country, account for some 13,400 square miles of the region. Hills occupying a large part of this area vary from rugged, high, (1,000 feet) linear ridges to low rounded, rocky rises, and are all useless for grazing. Stock are, however, run where the area of lowland available is sufficient. In the north of the District the belt of soft spinifex plains previously mentioned occupy an area of some 10,000 square miles.

Hard spinifex sandplains on poor sandy soils cover some 48,400 square miles. The vegetative cover is grassland with scattered shrubs and low trees. Hard spinifex (Triodia basedowii) is a drought-resisting perennial, coarse and unpalatable to stock, with little or no grazing value. This area is mainly unstocked. There are minor areas of isolated hills, sand dunes, drainage lines and salt pans.

Spinifex dune fields consisting of regular and irregular systems of dunes and swales, stabilized by various types of spinifex, occupy about 77,700 square miles. The area is almost unstocked.

The remainder of the District comprises minor areas of other pasture species, probably including 400 square miles of barley Mitchell grass country, and rugged country.

Barkly Tableland District. As described by the C.S.I.R.O.[6] the Barkly region includes the area popularly known as the Barkly Tableland, a contiguous portion of the Georgina River Basin and the inland "desert", and the country extending to the Gulf of Carpentaria. In all, it covers an area of 120,000 square miles. The Barkly Tableland District excludes the section of the region extending into Queensland and an area adjacent to the Gulf of Carpentaria which is part of the Darwin and Gulf District. It comprises an area of about 94,000 square miles.

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(5) Description taken from C.S.I.R.O. unpublished papers.

(6) C.S.I.R.O. Survey of Barkly Region 1947-48. Land Research Series No. 3.

This District has a dry monsoonal climate, with an average annual rainfall ranging from 10 inches in the south to 30 inches near the coast, which falls mainly during the period November to March. Although rainfall on the Tableland proper is regarded as regular, periods of drought and heavy drought losses of cattle are not uncommon. The estimated average periods of useful pasture growth are 19 weeks near the coast and seven weeks inland.

The more extensive soils in the region are lateritic soils of various kinds, grey and brown soils of heavy texture, and podsolic soils. Plant communities are of wide variety including treeless grasslands dominated by Mitchell grass (Astrebla spp.) on heavy soils, low shrub or sparse tree communities in which mallee eucalypts, Acacia spp. and spinifex (Triodia spp.) are prominent in the low rainfall areas, and a wide range of woodland and open forest communities in many of which Eucalyptus spp. are dominant. Forests of lancewood (Acacia shirleyi) cover large areas of lateritic country.

Mitchell grass country, consisting almost entirely of broad plains of unbroken pastures, accounts for some 24,000 square miles of the District, and covers a large part of the area popularly known as the Barkly Tableland. Inferior Mitchell grass country, similar to that described in the Darwin and Gulf District, accounts for some 11,100 square miles. Hilly country, extending in a wide arc north-west from Dajarra, occupies some 29,000 square miles of the Barkly region. Of this, some 6,500 square miles are in the Barkly Tableland District.

In the southern part of the District the so-called desert country occurs. It is gently undulating to undulating, and consists of light-textured soils and low scrub or woodland vegetation. Soft spinifex plains similar to those described in the Alice Springs District account for 23,000 square miles, while hard spinifex sandplains cover some 9,800 square miles. Short grass-forb country, previously described, covers an area of some 7,000 square miles, and dune fields a relatively small area of 700 square miles. Bluebush swamp country occurs in scattered small areas and probably totals 1,400 square miles. These swamps are distributory areas of inland streams, and may be flooded for several months of the year. They are mostly surrounded by areas of Mitchell grass and are easily accessible to stock. The bluebush pastures, of which there are many variants, provide good stock-fattening feed as swamp waters recede. In "drybog" country, which accounts for 2,200 square miles, the soil profile cracks deeply and the deep cracks and uneven surface discourage stock movements. A considerable part of the remainder, 6,700 square miles, consists of the three-awned spear grass country previously described.

The Barkly Tableland proper has very few permanent natural waters. Cattle are therefore for the greater part of the year on bore water supplies. This lack of permanent water supply and lack of complementary grazing due to uniformity of pasture species, and lack of top-feed, renders this area very vulnerable in time of drought.

Queensland Channel Country.

The inland river system of western Queensland is characterized by streams which in their lower courses spread into a network of shallow channels. Fed by tributaries having their sources in zones of relatively high monsoonal rainfall, these rivers periodically flood, causing a widespread distribution of slow-moving water in the channels and inter-channel areas. The area of country adjacent to the major rivers in this region, namely the Georgina, Diamantina and Bulloo Rivers, and Cooper's Creek, has been estimated[7] to be at least 10,000,000 acres.

The climate of this area is typically one of hot summers and mild winters, low humidity throughout the year and a low, unreliable rainfall. Evaporation is very high, being more than 90 inches a year, so that the amount of water required for plant growth is only available for relatively short periods immediately following rain or floods.

The 10 inch isohyet runs from north-west to south-east, forming the approximate border of the area. Rainfall decreases rapidly towards the south-west, and at Birdsville the annual average is less than 6 inches. The greater proportion of the annual total falls in the six months October to March. This summer maximum is more marked in the north of the area, Urandangi, Boulia and Diamantina Lakes receiving over 75 per cent of their rain in this period, Birdsville and Windorah receiving about 65 per cent, and Onepah and Thargomindah receiving 60 per cent in these six months.

(7) Queensland Bureau of Investigation: The Channel Country of South West Queensland.

Variability of the rainfall, expressed as the mean deviation from the mean, is very high, ranging from 42 per cent at Windorah to 51 per cent at Boulia and 59 per cent at Birdsville. About two years in three receive totals below the average, but occasionally totals of 10 to 15 inches above average are received.

There is a long, hot summer, the six months October to March having mean maxima above 90°F. Temperatures above 100°F. may occur almost continuously in December, January and February, and temperatures of 115°F. and above have been recorded. The winters are mild, but there is a brief frost season which is longer and more severe in the south-west of the area than elsewhere.

The outstanding feature of the area is the natural system of reticulated irrigation that is provided by the channels or de-tributaries that break off from the main channels of the rivers(8). These channels become shallower as they get further from the main channel, and continue to branch and form additional off-channels. Some disperse fully while others may eventually rejoin the main channel.

The extent of flood-water dispersal depends upon the height of the flood in the main river. A small flood in the river will result in a dispersal of water into the minor channels, while increased height of the flood will result in further dispersal of waters into the "swamps" and finally over the flood plains. Flood waters recede from the flood plains after a period of inundation which may vary from a few days to a couple of weeks. The water recedes from the channels more slowly and in the "swampy" areas may not disappear for a month or more.

A channel may disperse over a wide area of low-lying "swampy" country that, when flooded, will form an inland "lake". Such a lake would be "ponded" by low sandhills, and may be as large as 100 square miles in extent; Lake Machattie on the Georgina watershed is an example of this formation.

The soils of the channels and "swampy" areas are of heavy, grey clay and contract greatly during dry periods between floods, forming very extensive cracks. These soils are very fertile, and there is comparatively little leaching of plant nutrients to depths beyond the reach of plant roots. The surfaces are extremely rough and almost impossible to negotiate by motor vehicle.

Typical of the channels and swampy areas is the domination by bluebush (Chenopodium auricomum) and lignum (Muehlenbeckia cunninghamii). The limits of bluebush almost coincide with the flood water distribution of "channel floods", and demarcate that area of so-called swampy country in which the only feed produced is in response to flooding. Local rains produce no feed in the channels. The lignum stands are in those parts of the channels in which the water may lie on the ground for a considerable time.

Bluebush has some feed value but lignum is inferior as a stock feed. The valuable fattening feed of the channels consists of the so-called native sorghum (Echinochloa turneriana), neverfail (Eragrotis setifolia), pepper grass (Panicum whitei), channel blue grass, some Flinders grass (Iseilema membranacea) and a variety of good herbage. In the Georgina channels, "clover" (Trigonella suavissima) and native sorghum are the dominant channel feeds, but no clover whatever grows in the Diamantina channels. A coarse canegrass (Eragrostis australasica) of the channels grows with the lignum-sorghum communities, but it is of little feed value.

The native sorghum is the outstanding grass of the channel country and is a summer-growing annual. It comes away quickly after flood waters recede, and grows vigorously to a height of 5 to 6 feet. It is of greatest value in the green stages, cattle showing decreasing liking for this grass as it dries off. Extensive flats, commonly 2 to 3 miles across, in good flood seasons are a vast sorghum field. In the earlier days, sorghum hay was made and stacked for hand-feeding to stud cattle. The sorghum matures in a few months and seeds very heavily, the seeds finding shelter in the deep cracks that begin to open in the grey clay as the season dries out.

With summer floods, the feed response is more marked with scrghum and the other grasses, whereas in later floods, March or April, the herbage response is much greater and more extensive than with summer floods. This is particularly the case with the clover of the Georgina.

The dominating timbers are coolibah (Eucalyptus coolibah) and gidgee (Acacia cambagei), which occur mainly as thin, fringing belts along the channels.

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(8) Description of channels, soils and vegetation from publication by J.C.J. Maunder, Queensland Department of Agriculture and Stock, The Beef Cattle Industry in the Far West.

Merging with and beyond the limits of the heavier "swampy" channel country which carries the lignum, bluebush, sorghum and clover, extend the level flood plains over which the flood waters disperse from the channels. Normally these plains are only submerged for a few days, which is sufficient time to soak the ground thoroughly, and flooding is followed by a good feed response. These flood plains vary from a mile or two up to several miles across, and the limits are in most cases marked by sandhills or low sand ridges.

The soil of the flood plains generally is a reddish-grey loam, sometimes lightly covered with gravel and pebbles. Fine silt deposits occur from the periodical floodings. In the upper reaches of the Georgina and the Diamantina, these flood plains are not very extensive and quickly give way to the gravelly and pebbly downs, and stony ridges. In lower reaches they are much more extensive, and as they get further from the main river channels, gradually merge into the non-flooded gravelly downs and sandhill country.

Unlike that of the heavier channel and "swampy" country, the vegetation of the flood plains will respond well to local rains as well as to flooding. Button grass (Dactyloctenium radulans) and Flinders grass are the dominant species, and constitute very valuable fattening feeds. Neverfail is also an important grass of the flood plain. A wide variety of herbage comes away with winter rains, forming excellent feed. There is no clover or native sorghum on these plains, nor is there any timber.

Beyond the limits of the flooded country extend the gravelly and pebbly downs that constitute the bulk of the country between the two rivers. The extent of these non-flooded downs would exceed the combined areas of channel country and flood plains. Between the upper reaches of the two rivers the gravelly and pebbly downs are more extensive than in the lower reaches, where they are intermingled with sandhill formations.

The soils of the gravelly downs consist of yellowish-brown to light-red clay, with which is associated a covering of gravel or pebbles. These may vary from a coarse gravel to large pebbles, up to stones as big as a man's head. Generally speaking, these downs are more stony between the Georgina and Mulligan Rivers than between the Georgina and Diamantina, where the smaller pebbles and finer gravelly downs predominate.

Bare claypans do occur, though not frequently, nor as a rule are they extensive. The soils of these claypans are usually silty in nature, almost impervious to water, and present a smooth almost polished surface.

The most important vegetation of the gravelly downs is undoubtedly Flinders grass and button grass, which, even in the dry state when it forms a mere powdery lick-up feed, will still fatten cattle. On some parts of the gravelly downs, between the upper reaches of the Georgina and Diamantina, there are remnants of Mitchell grass tussocks, which indicate some deterioration of the country. There is a light cover of neverfail, and with winter rains a profuse growth of edible herbage is stimulated. The gravelly downs are practically devoid of timber. The area between the Georgina and Diamantina immediately south-east of Boulia comprises approximately 6,000 square miles of gravelly downs country, with practically no channel or flooded country.

The sandhill country forming the eastern fringe of the Simpson Desert is an outstanding feature of lower reaches of the Georgina and Diamantina, and of the areas between these rivers here. This country occurs in an area roughly bounded by Mooraberree, Monkira, Cluny and Bedourie. A few miles west of Bedourie the sandhills gradually give way to the harder pebbly downs and stony ridges.

The sandhills vary in height from low sand ridges, with very little loose sand at their summit, to imposing sandhills up to 100 feet in height, composed of loose sand, and the summits of which are entirely bare of vegetation. The sandhill formations generally have a direction from south to north and one "range" may run for several miles without a break. The distance between one "range" or line of sandhills and the next varies from half a mile up to several miles.

In the heart of the best sandhill country, the area really comprises a series of flooded flats half to one mile in extent, divided from each other by lines of sandhills. These flats may flood from creeks which meander through the sandhill country, fed by local rains, and may also flood from typical channels which are the final de-tributaries from the main river channels.

As the sandhill ranges extend beyond the limit of channel floods they are separated from each other by wider stretches of downs country several miles in extent. Here, within a few hundred yards of the base, there is a light cover of sand drift, blown from the summits. The lower sandhill ridges are covered right up to the summit with vegetation consisting mainly of spinifex clumps and canegrass.

The higher sandhills carry an interesting gradation of vegetation. A flood plain may extend right to the foot of the slopes, carrying the usual cover of Flinders and button grass. On the slopes themselves, scattered stunted trees of mulga and gidgee are to be seen. There is a considerable growth of herbage, including tahvine and a plant which resembles a giant pigweed. Generally speaking, the herbage is of less value as a stock feed than that found on the gravelly downs and flood plains. Spinifex (Triodia basedowii) and canegrass (Spinifex paradoxus) dominate the vegetative cover as the summit is approached. There is no doubt that stock can be maintained on the slopes of these sandhills in drought times, when all feed is exhausted on the flood and plain country.

Beyond the limits of the flooded country, there is sometimes a considerable cover of timber and excellent feed right to the base of the sandhills. The timber is generally a mixture of somewhat stunted mulga (Acacia aneura) and gidgee, while whitewood (Atalaya hemiglauca) and bauhinia (Bauhinia carronii) are fairly common.

APPENDIX B.

TURN-OFF OF CATTLE --- NORTHERN TERRITORY

1947-48 to 1958-59.

Year	Number of Each Destination					Total
	Queensland	Sth. Aust.	West. Aust.	Philippines	Hong Kong	
1947-48	58,953	41,225	13,003	-	-	113,181
1948-49	66,929	34,160	11,317	-	-	112,406
1949-50	83,465	48,977	9,366	-	-	141,808
1950-51	98,711	40,835	6,092	-	-	145,638
1951-52	35,463	38,459	6,000	-	-	79,922
1952-53	32,568	42,150	6,650	-	-	81,368
1953-54	72,058	46,951	7,116	-	-	126,125
1954-55	21,513	43,786	10,370	1,783	-	77,452
1955-56	58,918	64,243	7,986	586	-	131,733
1956-57	76,528	55,808	3,652	-	-	135,988
1957-58	82,113	36,085	9,083	1,888	-	129,169
1958-59	66,183	81,968	9,294	3,928	3,451	164,824
Annual Average	62,784	47,887	8,327			119,968

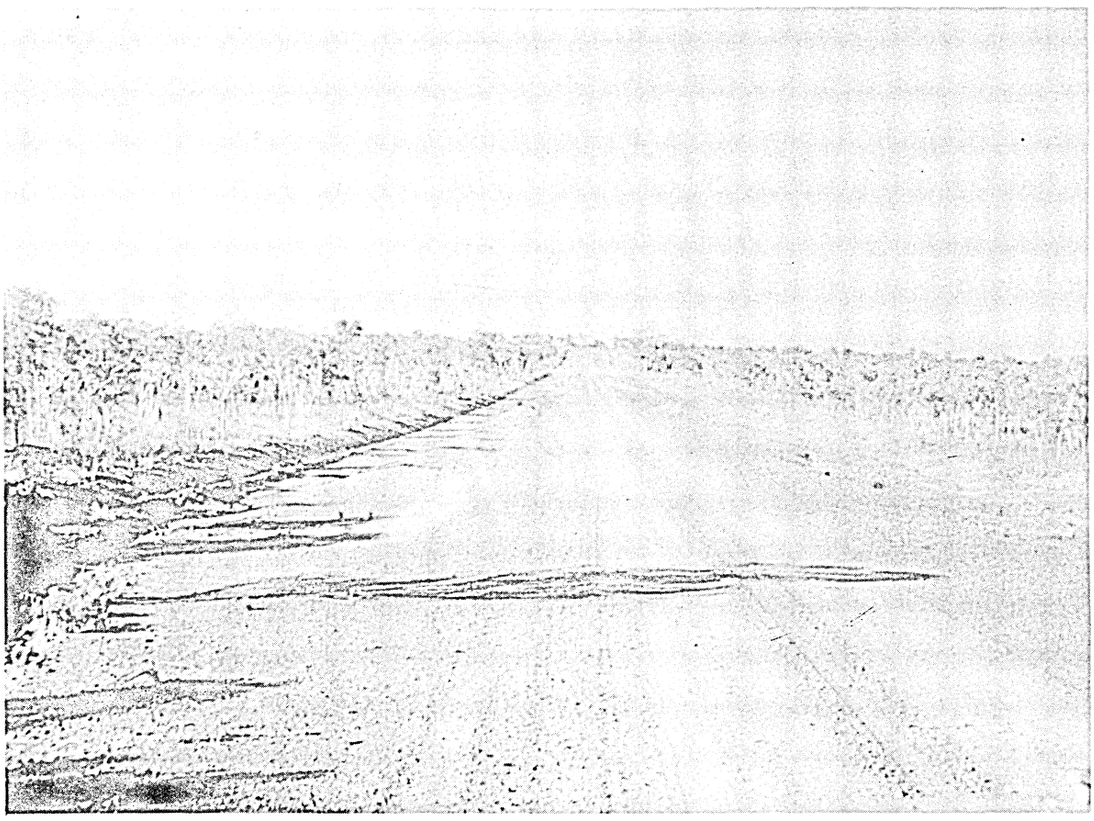

Plate No.1 Part of the road between Auvergne and Timber Creek. This is a wide formed road with gravelled sections regarded as satisfactory for the road transport of cattle in the " Top End ".

Plate No.2 A section of the road between Top Springs and Wave Hill Station showing limestone outcrops. Many roads in the area are little better than tracks.

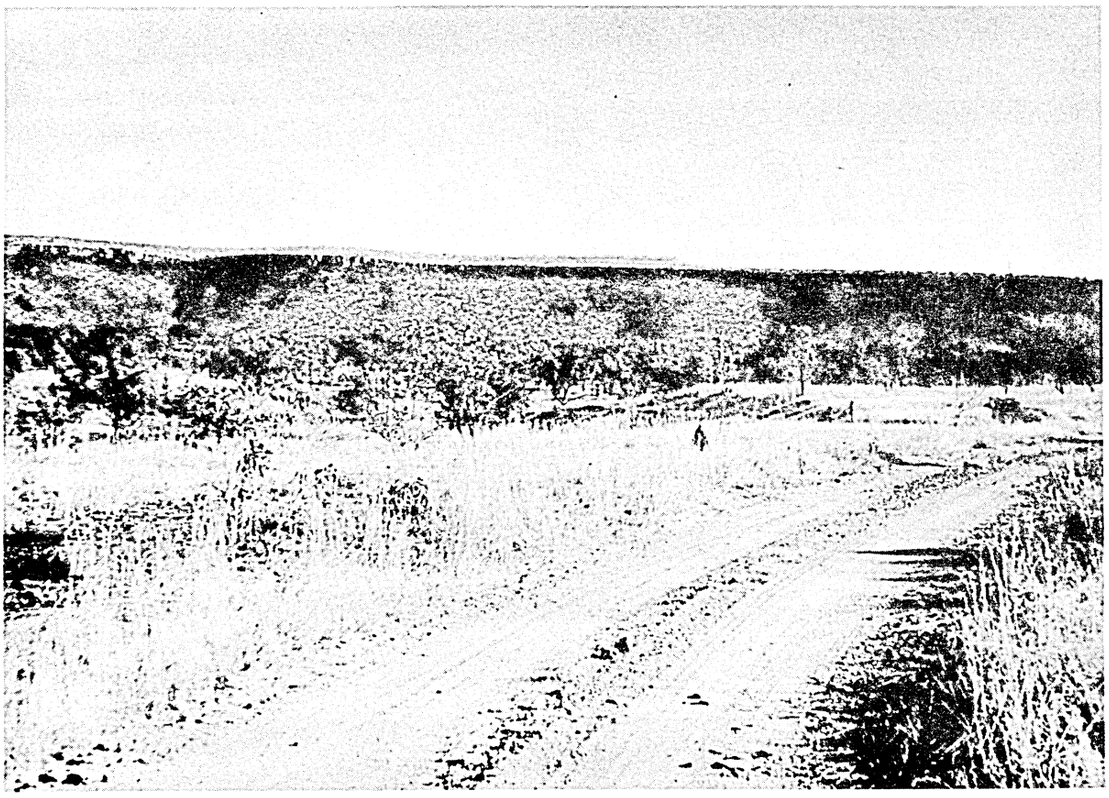

Plate No.3 Part of the road between Coolibah Station and Katherine in the Northern Territory. The rugged country in the background is typical of much of the country in the "Top End".

Plate No.4 A sandy crossing near Roxborough Downs in Far Western Queensland. It is typical of many crossings encountered in the lower rainfall areas.

Plate No.5 Yards and loading ramp at Marion Downs (Queensland Channel Country). This solidly constructed ramp consists of several panels and is regarded as ideal for loading cattle onto road trains.

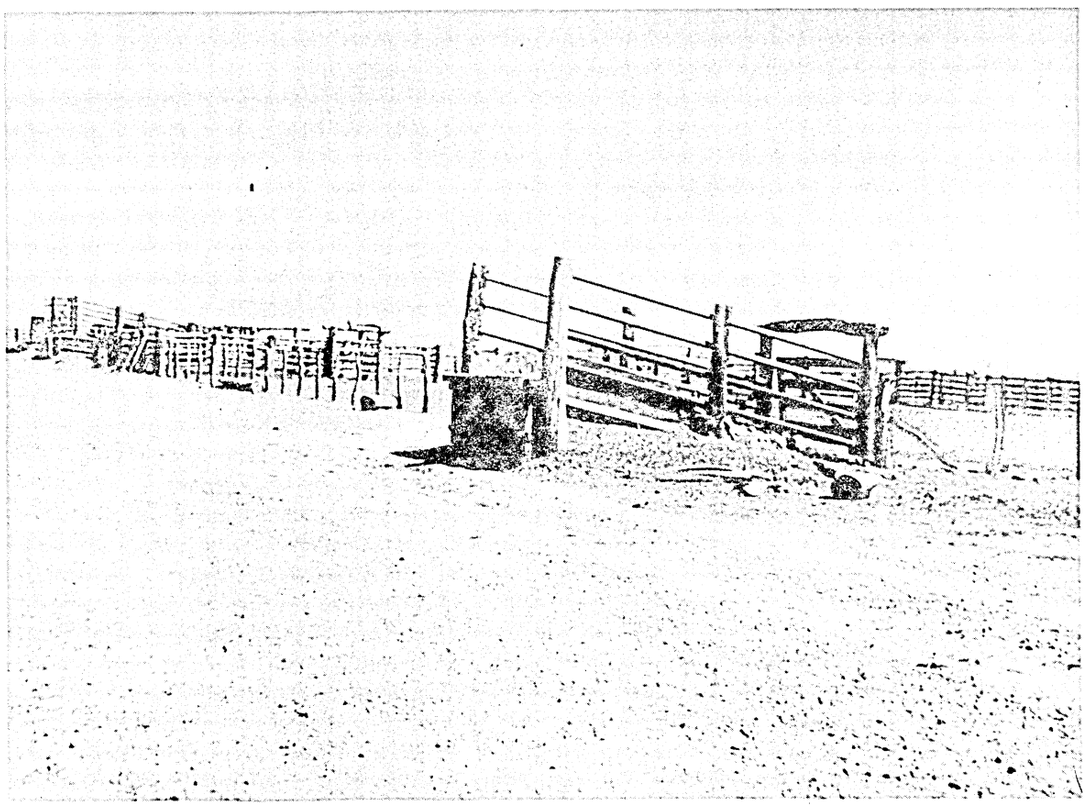

Plate No.6 In contrast to the above this temporary loading ramp consisting of two panels is not regarded as particularly satisfactory for loading cattle.

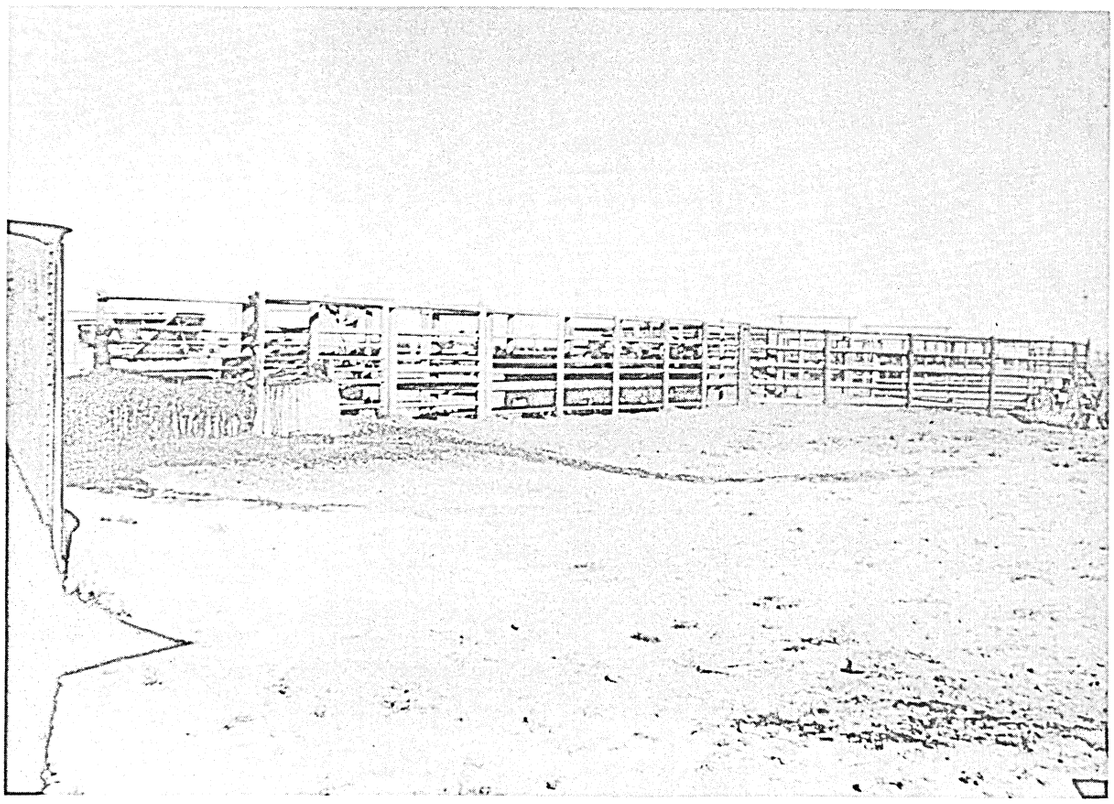

Plate No.7 Dipping facilities at Connell's Dip (Barkly Tableland,N.T.). These yards are typical of those constructed at strategic dipping points on Northern Territory Stock Routes.

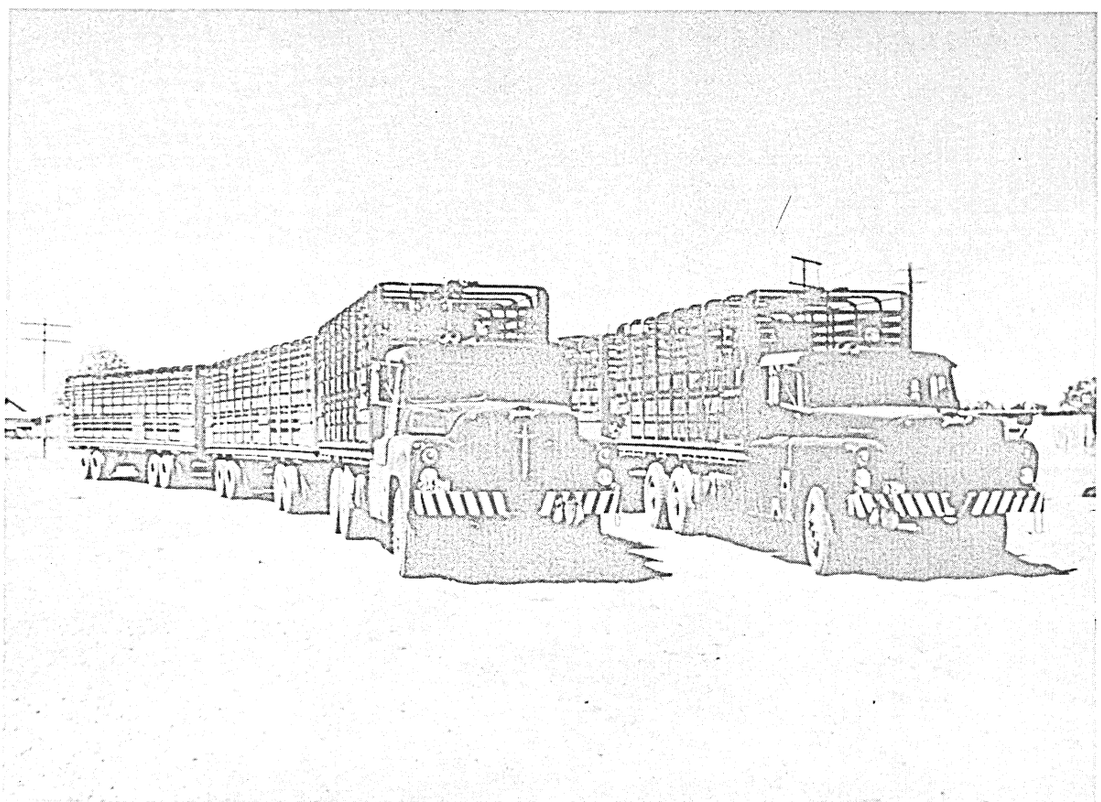

Plate No.8 Two large road trains powered by 250 b.h.p. Rolls Royce Viscount engines, capable of carrying a total of approximately eighty head of fat cattle. These vehicles are operating on the bitumen mainly between Helen Springs in the Northern Territory and Mt.Isa in Queensland.