THE INSTITUTE OF ROAD TRANSPORT ENGINEERS OF NEW ZEALAND

THIRD INTERNATIONAL HEAVY VEHICLE SEMINAR

A REVIEW OF THE LAST 15 YEARS OF MAJOR HEAVY HAULAGE ACTIVITIES IN NEW ZEALAND

by

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1.0 INTRODUCTION

Conventional heavy vehicles are broadly described as having a gross weight between 2.5 and 44 tonnes. Heavy Haulage, on the other hand, is the use of unconventional heavy vehicles - low loaders, dollies, hydraulic trailers etc. - to transport payloads between 20 and (on the basis of existing capacity) 1250 tonnes.

The last 15 years have seen a dramatic increase in heavy haulage activities and the implementation of a wide range of new equipment to service the major project construction activity and to ensure transportability of larger and heavy civil and building construction equipment.

This paper provides an overview of the recent history of the heavy haulage industry and the relationship with the controlling authorities with special attention afforded the movement of large and heavy loads utilising varying types of transport equipment.

The paper closes with a brief review of future trends and opportunities.

2.0 THE OVERVIEW

2.1 Pre 1974 History

The early growth in post-war Heavy Haulage was allied to the buildup in New Zealand's power generation capacity. George Dale & Sons were foremost in the industry and had 10 year Heavy Haulage contracts with State Hydro/N.Z.E.D. which were renewed until the late 1970's when, due to corporatisation, transport of individual loads was competitively tendered. Limitations in cranage capacity restricted the transportable weight of a number of components but items which could be self loaded and unloaded (e.g. mobile plant) and jacked/skated from the transporter (e.g. transformers) continued to increase in size and weight.

The first major composite transport system to cater for these increasing weights was the "Big George" unit fabricated in 1957 for the 80 tonne Kinleith Paper Roller. The original 5 axle system was added to during the late 60's and early 70's to form a 200 tonne capacity beam set/trailer configuration, which was used in the successful transport of 150 to 190 tonne loads to major power and pulp/paper plants.

Up until the early 1970's the largest composite wheel group was three closely spaced axles of eight tyres.

The 1960's also saw the joining of George Dale & Sons to Allied Freightways to form Dales Freightways who remain the predominant Heavy Haulage carrier in New Zealand.

The growth in the number of operators servicing the Heavy Haulage industry resulted in the (1964) formation of the Heavy Haulage Association. Over the last 25 years this Association has gone from strength to strength and now has a national committee - representing approximately 90 operators - to ensure a unified approach to the ever changing transport environment.

2.2 The Controlling Authorities

Heavy Haulage activities utilise State and local body facilities. Overweight and overdimension aspects require review and approval by a large number of controlling agencies including the National Roads Board, Works Department, New Zealand Rail, Telecom, Ministry of Transport, Local Body Traffic and Streetworks, Power Boards etc. It is acknowledged that use of the facilities is a privilege, not a right, and the fact that a particular load was previously successfully moved down a defined route is no precedent for continued approval.

The predominant controlling authority is the National Roads Board (N.R.B.) who are the agents of the N.Z. Government in the ownership and use of the roads and bridges on the state highways. The N.R.B. Overweight Policy introduced in 1974 is a comprehensive set of guidelines and procedures defining Heavy Haulage activities and the limitations for varying equipment types. The philosophy of the policy is to safeguard the State's investment in pavements and bridges and to ensure maximum consideration is afforded other road users. This is demonstrated in the area of "Divisibility" which states that, where possible, payloads must be subdivided until gross vehicle weights of less than 39 (or 44) tonnes are achieved.

The Overweight Policy is administered by the Ministry of Works & Development (Works). Central to any approval is a correctly completed permit application form which depicts proposed equipment, load description, axle spacings and loadings to the road or bridge. This is then checked on computer for the proposed route against each bridge structure. The establishment of this review system requires systematic checking and numbering of each bridge structure in the country and is considered one of the most comprehensive in the world.

The Ministry of Transport has a major input into the actual load movements, ensuring that the equipment is certified, load security and stability aspects correctly interpreted and the safety of other road users is maximised. Regulations and guidelines are contained in an Overdimensional Policy which was first introduced in 1978. The M.O.T. transport engineers are currently reviewing procedures that will apply to companies proposing to move extremely large and heavy loads.

2.3 The Introduction of the Platform Trailer

The increasing controlling authority requirements and the proposed heavy component weights for the Huntly Power Project resulted in the Dales Freightways 1976 acquisition of 13 axles of Series 1 hydraulic platform trailers from Cometto (Italy). This was a dramatic move away from composite dolly trailers - exemplified by various combinations of the "Big George" concept - to a simpler, safer and more efficient means of distributing heavy loads to pavements and bridges.

This Series I trailer comprised three modules - 3, 4, 6 axle - with the principal structural member being a central longitudinal box beam of mild steel fabrication.

The platform trailer enables the configuration of hydraulic geometry to be varied for different payloads and incorporates the option of manual or drawbar steering to increase manoeuverability. Central to the statically determinate load transfer to the pavement is the three point hydraulic suspension and 600mm stroke rams which cater for a variety of road profiles.

Gooseneck attachments can be bolted to the front of the trailer structure but ballasted prime movers are required for the majority of platform trailer movements. This was contrary to the N.R.B. policy and considerable debate occurred before the concept of ballasted prime movers was accepted. To this day each application is only approved on merit.

Contemporary developments were also occurring with low loaders with 4 and 5 axle units being fabricated for a variety of transport and civil engineering companies corresponding to the demands of the increased equipment weights and capacities of hydraulic/lattice boom cranes.

Ocean freight capacities also increased with the introduction of Heavy Lift ship's equipment with 500 tonne derricks.

2.4 The Major Project Period

The Major Project period of 1981 through 1985 involved vast amounts of capital expenditure on imported and locally fabricated components which all required transportation in their most efficient form. Transport feasibility became an important factor in the constructability of plants. Differing prime contractors had varying views on construction methods and programming which were also markedly influenced by labour availability (and capability) and site union constraints.

Where possible, the decision was made to optimise offsite prefabrication in the form of modular construction. This concept was epitomised on the Gas to Gasoline Project in Taranaki and resulted in one of the largest Heavy Haul operations through city streets and public highways ever undertaken in the world.

The number of proposed Heavy Hauls necessitated the importation of extra equipment: Dales Freightways purchased 52 axle lines of Cometto Series 5 trailer to cater for their prime haulage contract work on the Ammonia Urea, Petralgas, NZ Steel, Marsden Point Refinery projects and their haulage subcontract on the giant G.T.G. Project.

The Heavy Haul contract for the G.T.G. Project was combined with the on-site erection and was awarded to a joint venture of Rigging International (California) and Mogal Corporation (Auckland). The joint venture partners temporarily imported 68 axle lines of Goldhofer trailers which augmented the Dales fleet of 33 Cometto axle lines and the combined 101 axle lines were used by Dales for their Public Road Haulage subcontract over an 18 month period.

Major improvements in trailer fabrication were obviously required for payloads now ranging up to weights of 800 tonnes. Single wide trailers could now be bolted in paired combinations; the yield strength of the main structural members had increased threefold and module connection bolts were capable of developing the full moment of adjoining members.

The successful completion of approximately 400 major heavy hauls during the 81 - 85 boom period was testimony to the growing professionalism of the Heavy Haul industry.

2.5 The Post Major Project Period

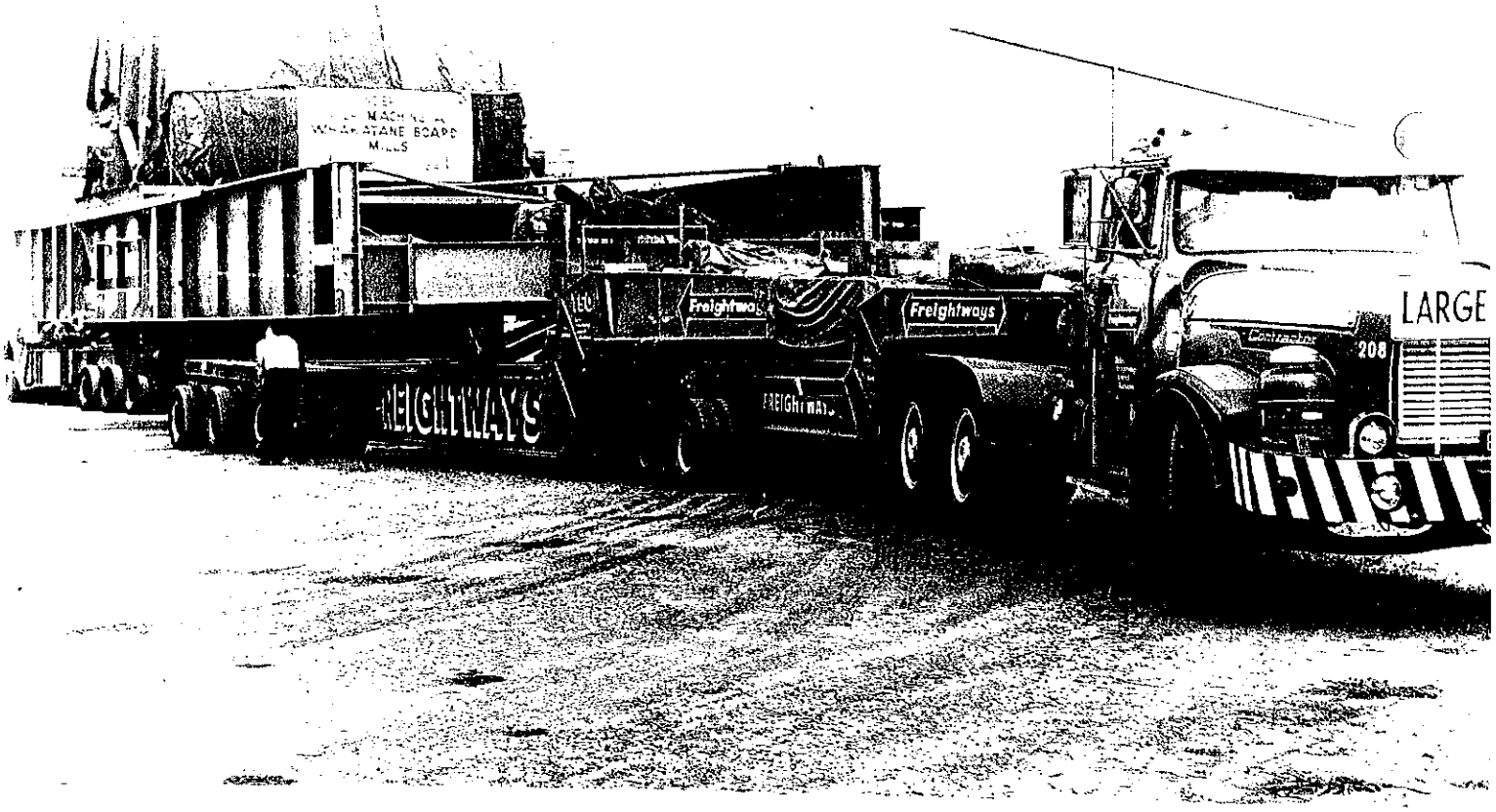
The successful completion of the modular based major projects was proof of the reduction in risk and cost from maximising off-site prefabrication. Increases in fabricated component weights would ensure continued growth in Heavy Haulage and the modular message was subsequently marketed strongly in N.Z. and overseas.

The success of this concept in a dwindling marketplace depended on the interpretation of the Divisibility restrictions contained in the N.R.B. Overweight Policy. Several major hauls were completed only after lengthy reviews of the 'divisibility' versus 'commercial' aspects of the payload.

Investment in transport equipment continued after the major project period. Dales maintained their Cometto allegiance by acquiring an 8 axle widening scallop trailer with particular application to horizontal vessel transport. Mogal Corporation confirmed their intention of staying in the market by purchasing a 4 axle Drake low loader from Queensland and forming a heavy haulage company called Mogal Heavy Haul. This company has actively marketed their haulage abilities and the majority of clients welcomed the resultant competition. However, for public road hauls in excess of 80 tonnes Dales is still the only company with N.Z. based equipment for the work. Furthermore, its huge investment in heavy transport equipment is purposely orientated to the specific requirements of N.Z. conditions: trailers have wide axle spacings and are extremely light. The importation of heavier close axle spaced trailers is only feasible in off highway or purposely modified highways.

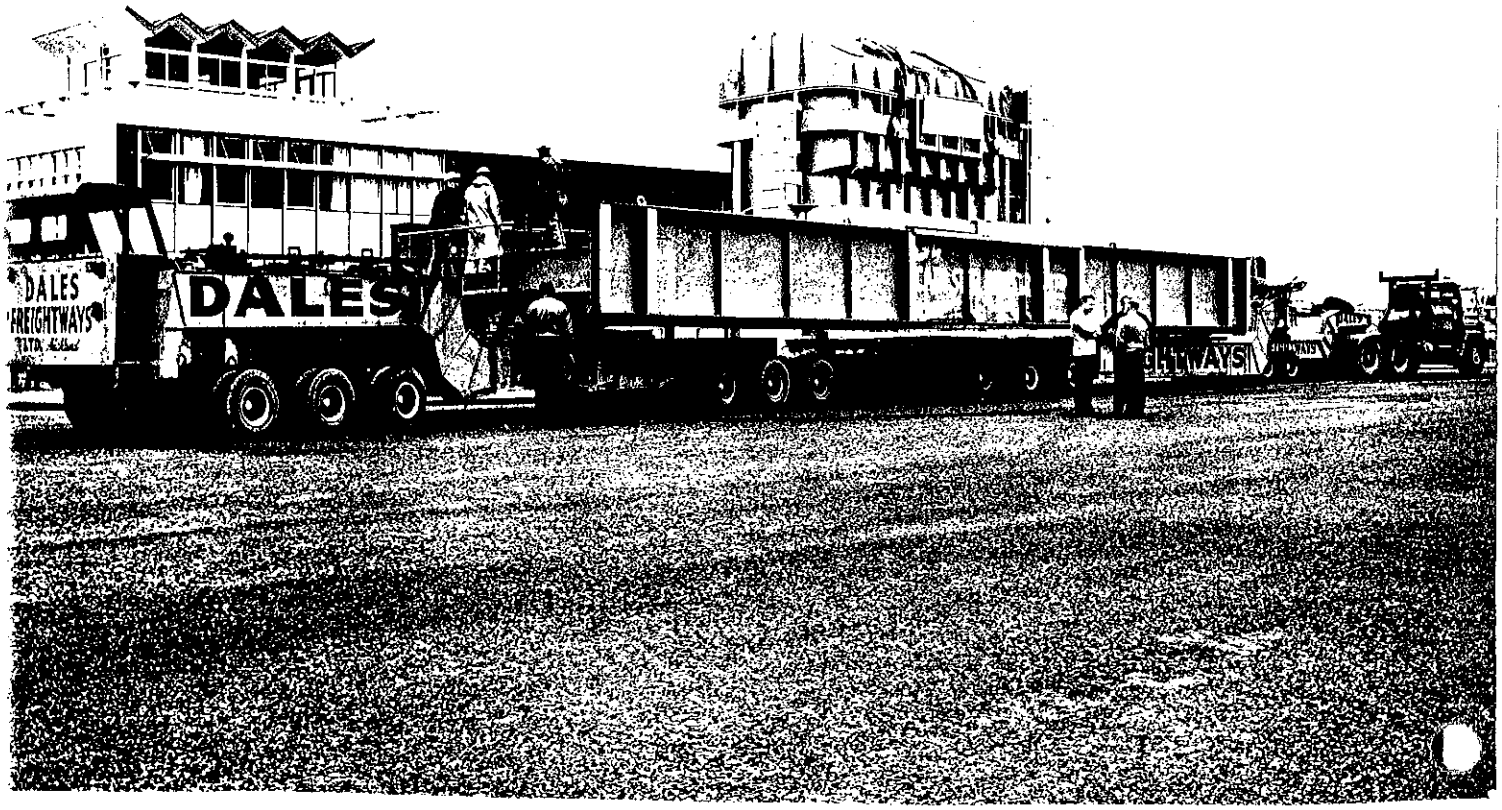
Following on from the very lean years of the mid 1980's the industry is again looking at buoyant times with proposed capital works in the pulp and paper, oil and defence industries. Section 4.0 contains a brief review of the trends and opportunities associated with the future.

Section 3.0 is a pictorial review of the Heavy Haulage activities over the past 15 years.



PHOTOGRAPH 1 <u>BIG GEORGE TRANSPORTER</u> (1975)

128 tonne Paper Machine transported from Mt Maunganui to Whakatane Board Mills



PHOTOGRAPH 2 <u>BIG GEORGE TRANSPORTER</u> (1964)

150 tonne Transformer for Marsden 'A' Power Station

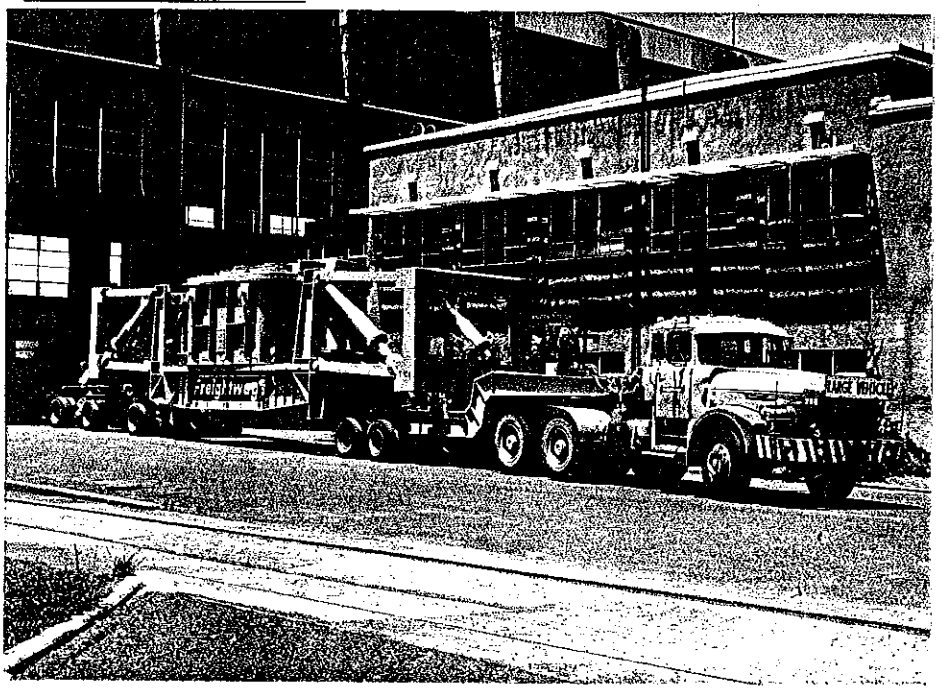
3.0 THE BIG GEORGE TRANSPORTER

3.1 The original Big George - aptly named after George Dale - comprised a 3 axle steerable dolly with cab attachment and beam structure connection to a front 2 axle or 3 axle dolly, as shown in Photograph 2.

This system was augmented with additional beams and dollies to ensure sufficient load distribution to the pavement. The main bolster beams are still in use today as is the front 2 axle load divider.

Tractive effort was provided by a 300 H.P. Scammell Contractor with an AEV1100 engine and semi automatic transmission. Pusher tractors were also used on grades.

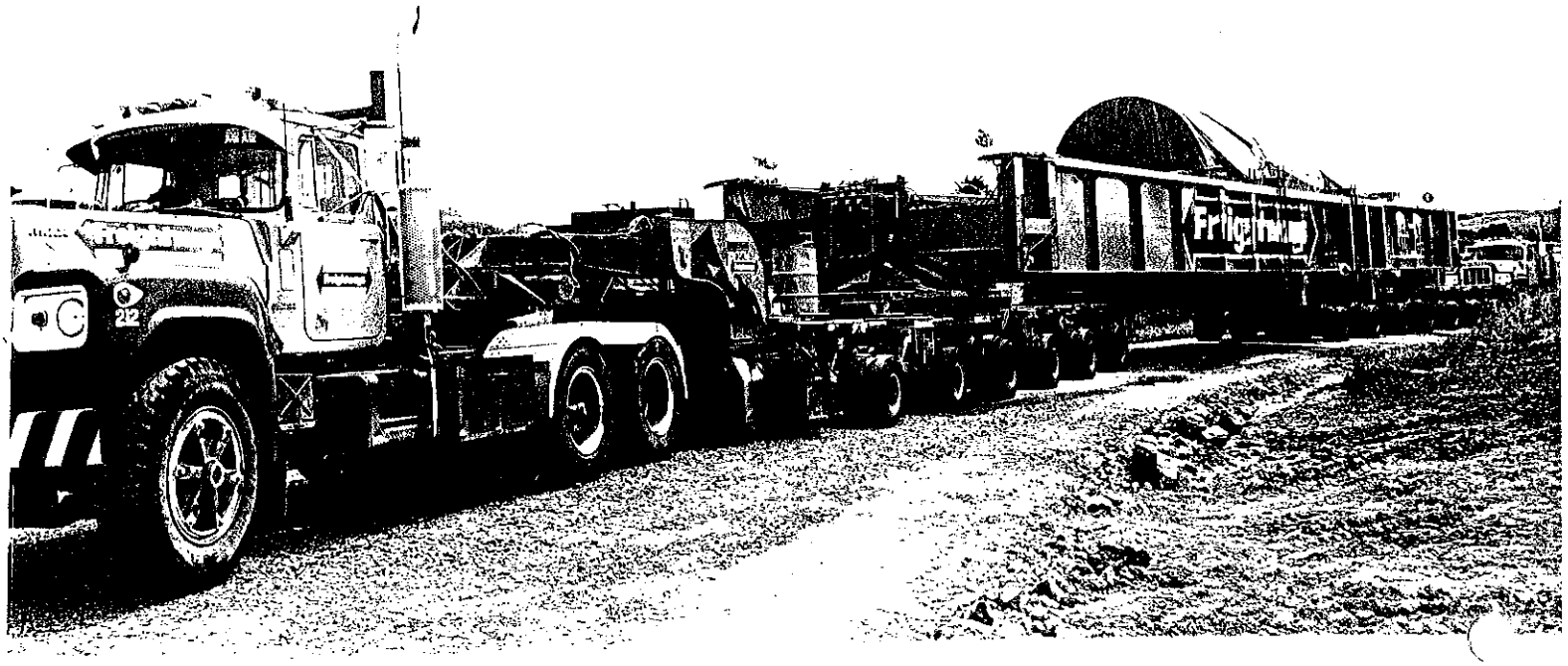
3.2 Transformer Trailer



PHOTOGRAPH 3 TRANSFORMER TRAILER (1975)
65 tonne Transformer en route from Auckland Wharf to Wiri Substation.

This 70 tonne capacity system comprised hydraulic rams to assist in the self loading and offloading due to the low capacity of cranage. Substation transformer pads were designed to accommodate this rig which became redundant and obsolete under the N.R.B. Overweight Policy restrictions and has now been scrapped.

3.3 THE SERIES I COMETTO TRAILER



PHOTOGRAPH 4 THE SERIES I COMETTO (1978)

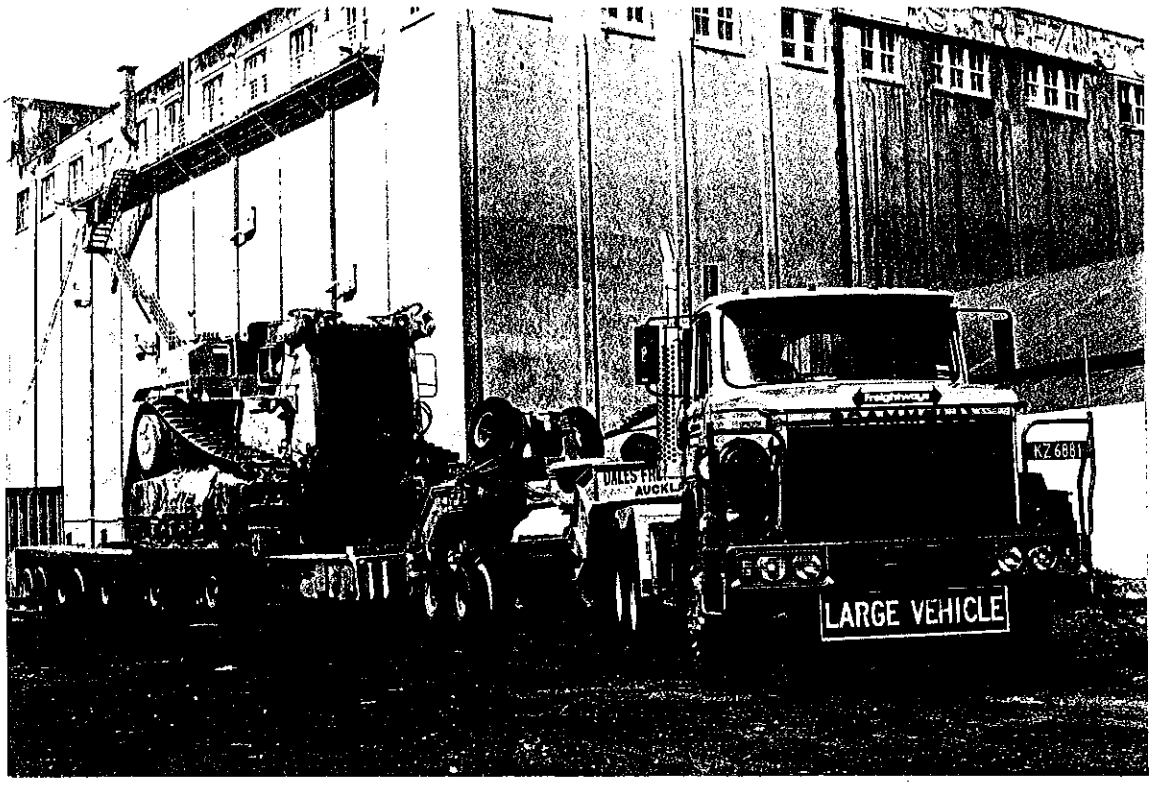
152 tonne Stator transported from the Otara Dockway to Huntly Power Project.

The introduction of the hydraulic platform trailers heralded a new era in N.Z. Heavy Haulage. Loads up to 200 tonnes were transported with the 13 axle bolstered system to the Huntly Power Project 70 kilometres from Auckland. Where possible, the gooseneck attachment was used but ballasted prime movers predominated.

Tractive effort is provided by 2 Mack 350 Hp prime movers which were the mainstay of the fleet until the introduction of the Scammel S24 in 1983.

The Series I trailer was sold by Dales in 1985 to an Australian fabricator.

3.4 THE 5 AXLE HYDRAWIDE TRAILER

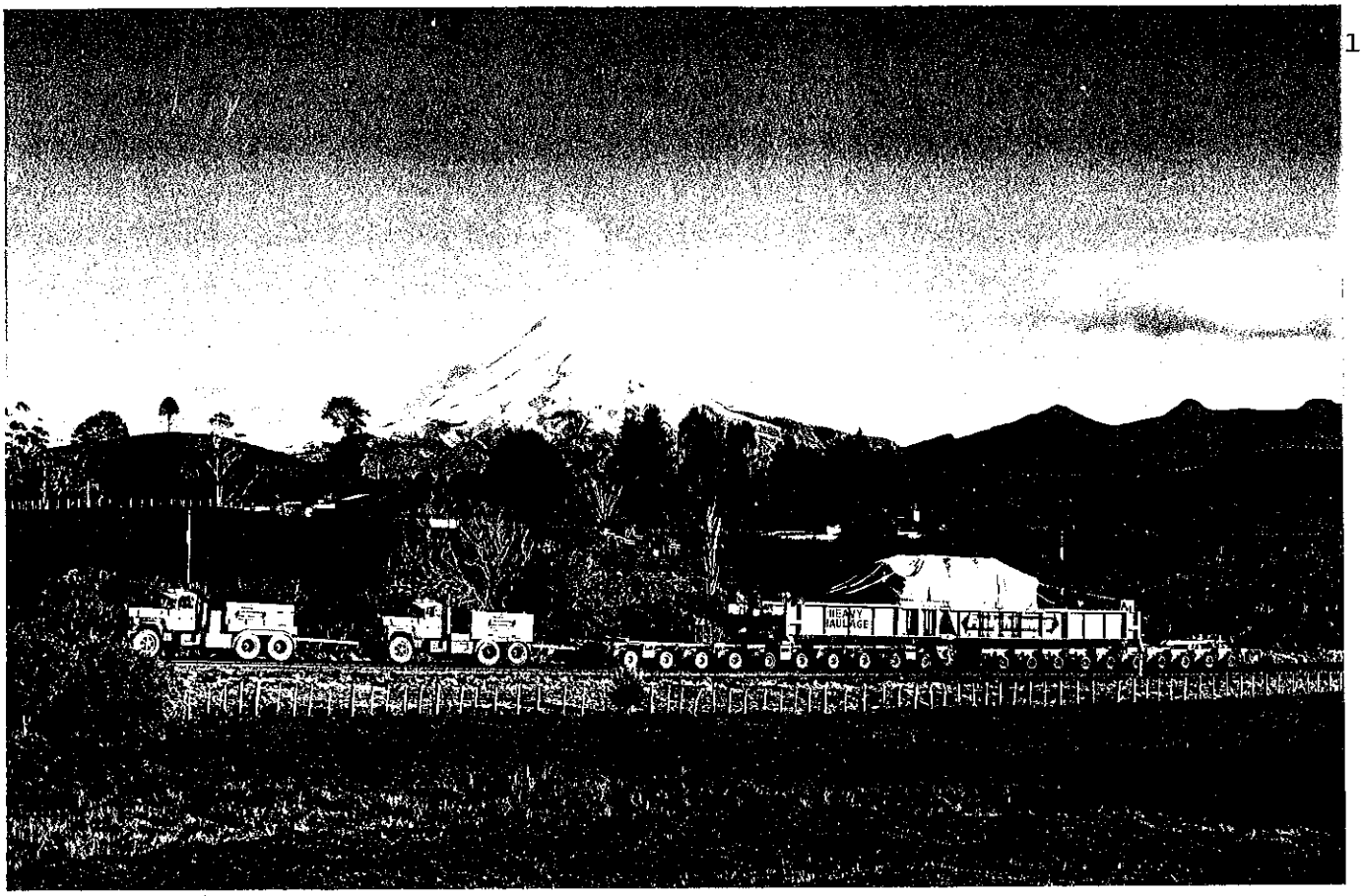


PHOTOGRAPH 5 HYDRAWIDE TRAILER (1984)
Caterpillar D10 Bulldozer at Auckland Wharf

This trailer was fabricated by Tidd/Ross Todd in 1977 and to cater for the demands of increasing payload weights and erection crane capacities.

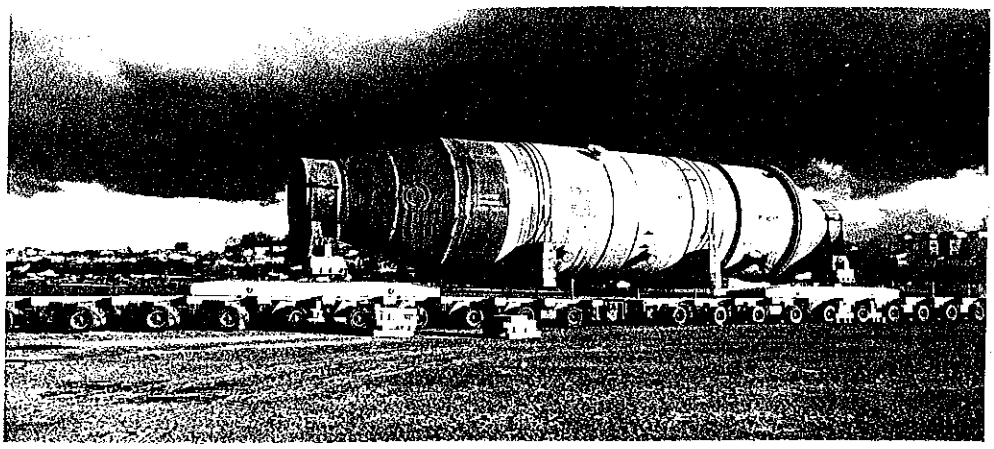
The trailer incorporated a number of features including:
- use of Wel-Ten High Tensile Steels
- 120 tonne frame strength capacity over 5m spacing
- Rear 2 axles steerable
- Rear 2 axles capable of being removed to form 3 axle lowloader
- Hydraulic compensation through the 5m wheel

With 2 axle load divider the trailer was capable of transporting 90 tonnes at a P.L.R. of 1.3 which is within N.R.B. and local body criteria.



PHOTOGRAPH 6 <u>SERIES I/SERIES 5 COMETTO BOLSTER SYSTEM</u> (1981)

<u>136 tonne Engine en route to Kapuni from New Plymouth Wharf</u>



PHOTOGRAPH 7 <u>SERIES 5 COMETTO WITH SCHNABEL LOAD SUPPORT</u> (1982)

A 310 tonne Methanol Converter at New Plymouth Wharf for transport to Waitara Methanol Plant

3.6 The Cometto Series 5 Trailer

The pending Major Project commitments resulted in Dales purchasing 52 axle lines of Series 5 trailer, 20 of 2.0 metres spaced axles in 1981 and 32 lines of 1.8 metre spaced in 1983. The trailers were 25% lighter than the Series 1 units with high strength steel frames and full moment connecting bolted joints. The trailers are unique to New Zealand with their open-spaced skeletal frame and large axle spacing.

The difficulties of transporting heavy loads on the rugged and bridge strewn terrain of N.Z. is exemplified in Photographs 6 and 7.

The Kapuni engine transport required considerable feasibility and engineering study of the critical bridges en route; the 20 axle lines are capable of transporting 480 tonnes and are thus at only 30% of capacity due to the bridge loading and pavement restrictions.

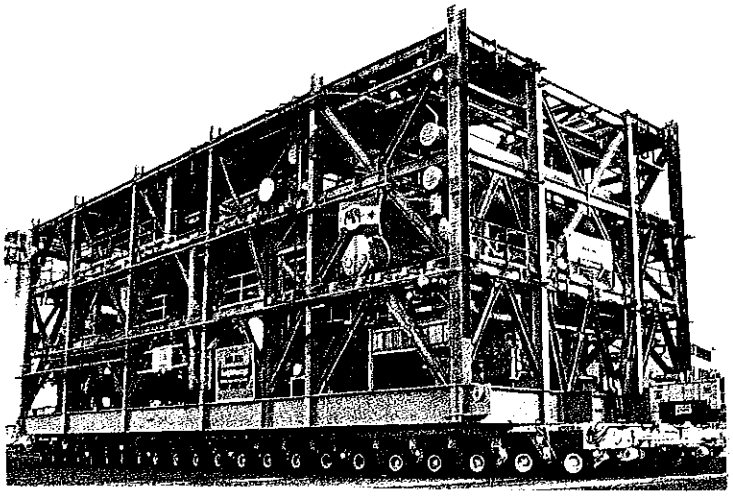
Similar restrictions resulted in the bolting of Schnabel end sections to the 310 tonne Methanol Converter to ensure sufficient length to interface with the 20 axle Cometto trailers. It is not uncommon for large amounts of temporary steel to be used in the transportation of large and heavy loads.

It is interesting to note that the platform trailers enabled a 50% time saving - depot to depot - on the periods required for the old "Big George" transport system.

PHOTOGRAPH 8 **TWENTY TWO AXLE PAIRED GOLDHOFER TRAILER**
1983

A 600 tonne module 30m (L) x 12m (W) x 12m (H) on the Waitara Bypass Bridge en route to the Gas to Gasoline Plant.

PHOTOGRAPH 9
SIDE VIEW OF GOLDHOFER TRAILER



3.7 The Goldhofer Trailer - G.T.G. Project

The Dales Cometto trailers are lightweight with high axle spacings to suit the N.Z. public highway, pavement and bridge restrictions. The increased capacity of the G.T.G. haul route and the module weights resulted in the importation of 68 axle lines of Goldhofer trailer from the U.S.A. These trailers with their dense heavy structure and close axle spacing were ideal for the long modules as shown in Photographs 8 & 9. However, the lighter modules - 60% of the total number - were hauled on Dales' Cometto trailers. Tractive effort was provided by 3 No. Michigan TD 380 "Modified" front end loaders, 2 No. Oshkosh M911 heavy duty prime movers and 2 No. Dales Mack prime movers. For the major grades 4 prime movers - in series - were required.

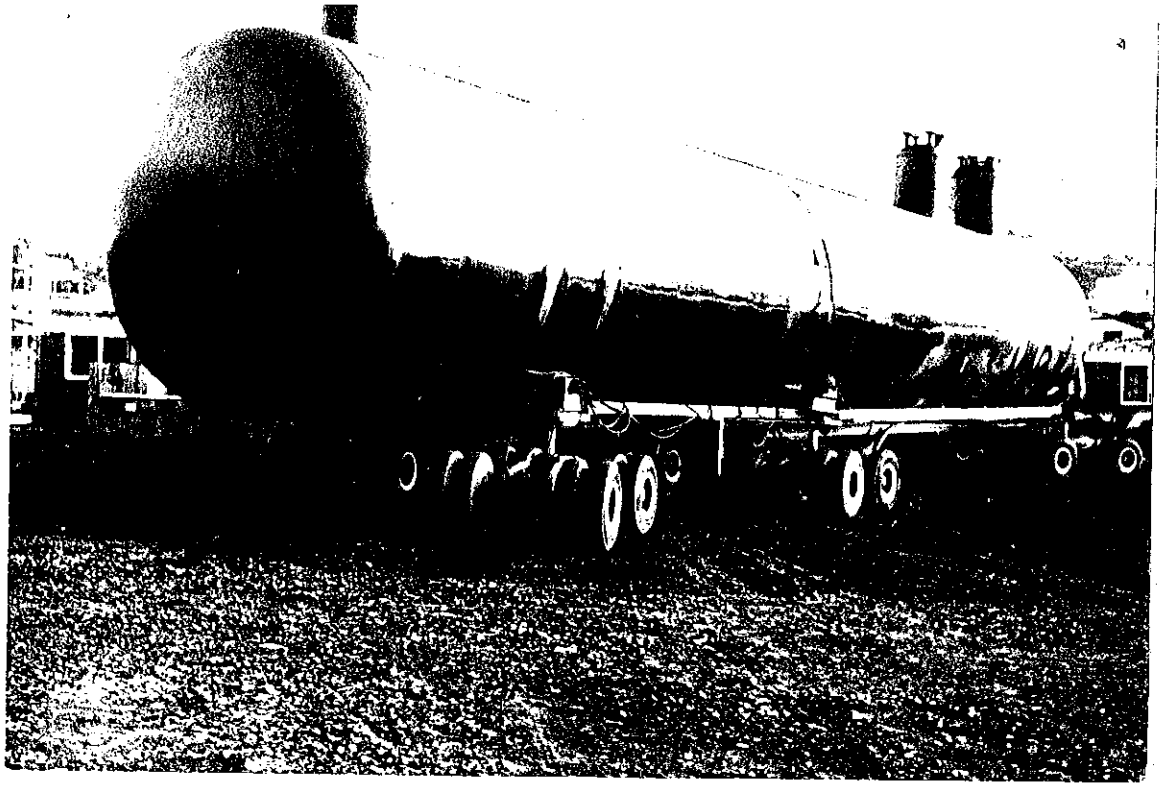
The G.T.G. Heavy Haul Project involved the transport of 187 prefabricated modules with a total weight of 27320 tonnes. Eighty seven of the modules were preassemblies fabricated by one company - Hitachi Zosen - in Japan.

The Dales haulage contract was completed over an 18 month period with the majority of modules transported in an 8 month period from spring 1983 to autumn 1984.

Travel along the city streets and public highways necessitated a huge controlling authority input from Head Office and local agencies. It is estimated that audit, supervision and permit review costs exceeded $600,000 for the overall project.

Public interest in the haulage work was intense with 20,000 people observing some of the larger hauls. Police and traffic officers not only had to supervise the haulage contractors work but also concern themselves with the crowds that congregated around the loads.

4.8 Use of Dollies



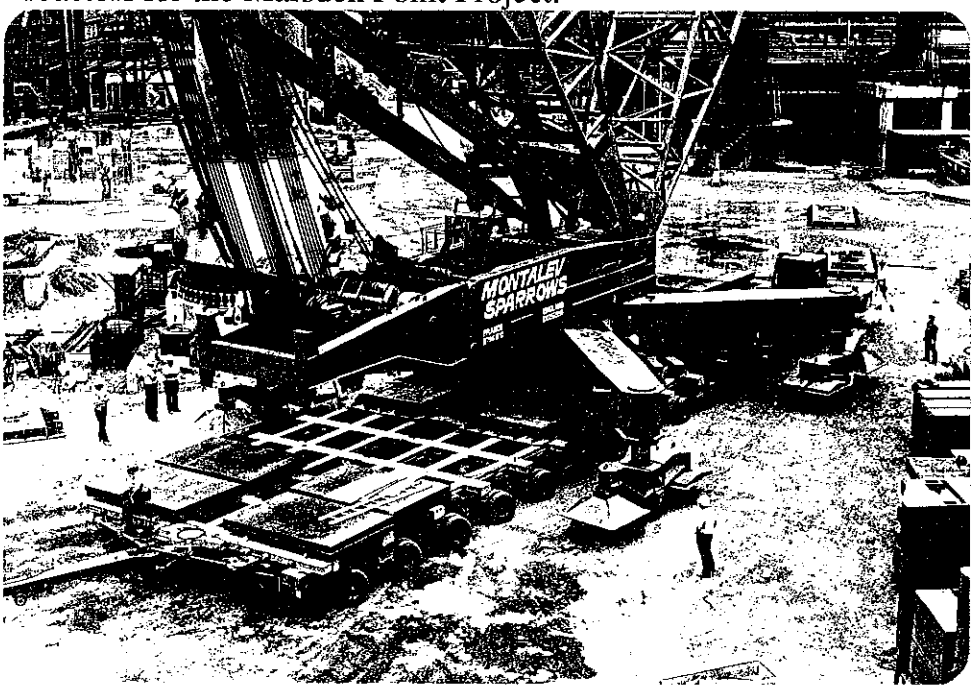
PHOTOGRAPH 10 **LIQUIGAS LPG STORAGE VESSELS (1983)**

6 sets of 40 tonne capacity dollies are assembled to haul a 45 tonne LPG cylinder in New Plymouth.

The expansion of the N.Z. LPG network resulted in major haulage activity in Dunedin, Christchurch, Wellington, New Plymouth and Auckland. The contract was awarded to Wellington based company, Groundwork, who utilised 8 tyred dollies configured to suit the geometry and pavement/bridge restrictions en route. Unfortunately, problems beset the company and the contract was completed by Dales Freightways.

PHOTOGRAPH 11 **Reactor Transport on C16 Trailer (1983)**

Dales presented 32 axle lines of Cometto trailer and 2 torque converted high capacity Scammell prime movers for the transport of 4 No. 750 tonne reactors for the Marsden Point Project.



PHOTOGRAPH 12 **ON SITE TRANSFER OF 1000 TONNE CRANE (1983)**

This 1000 tonne Sparrow's (UK) Gottwald Crane was transported on-site at Marsden Point in preparation for more lifts using the same trailer that hauled the reactors.

3.9 The Marsden Point Project

The largest haulage contract undertaken by a New Zealand company at the Marsden Point Refinery Project involved not only the haulage of 4 No. 750 tonne Hydrocracker reactors but also all the heavy and general cartage from the Marsden Point and Auckland wharves.

It was necessary to import additional equipment for the work. After extensive enquiries in New Zealand and overseas the decision was made to purchase 32 axle lines of Cometto and 2 No. Scammell prime movers. This equipment adequately serviced the client's needs over an intensive 2 year period.

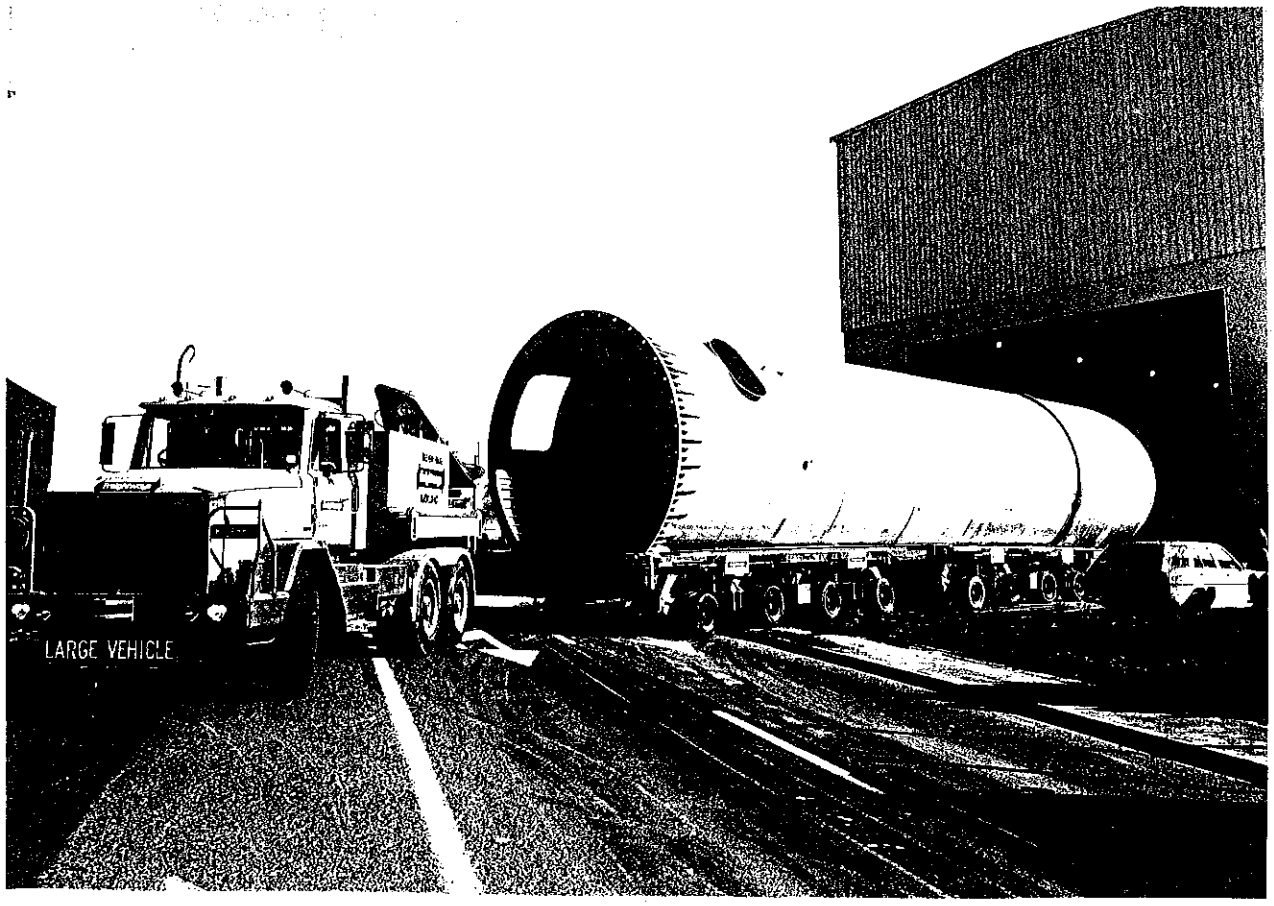
3.10 The Post Major Project Period

3.10.1 Investment in New Equipment

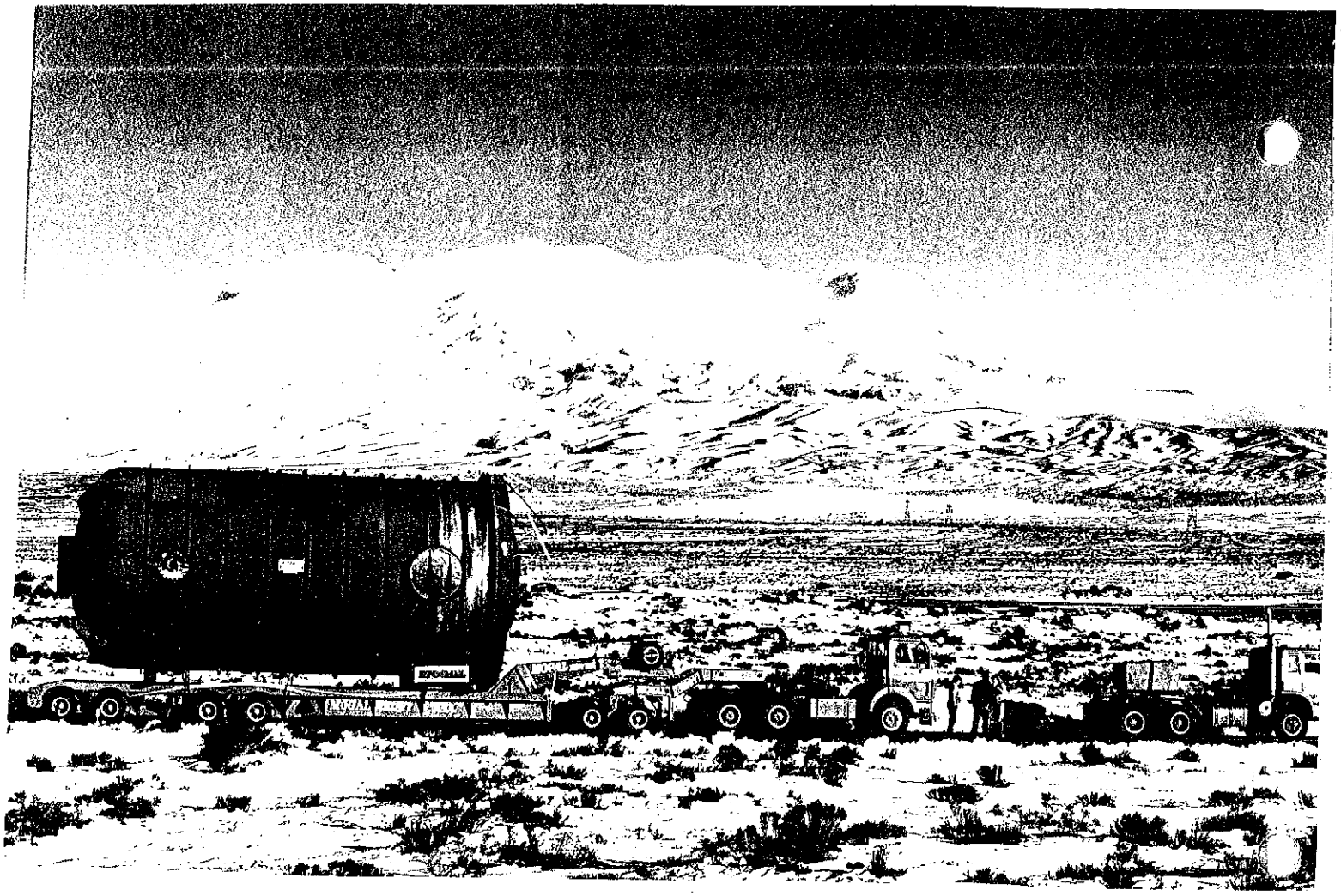
Dales continued their major capital expenditure programme by purchasing a gooseneck attachment and 8 axle widening Scallop trailer from Cometto. The gooseneck is shown on Photograph 13 hauling the 85 tonne major carbody and upper works of the Carlton Demag crane. This 600 tonne crane was the largest available in N.Z. prior to its overseas sale in late 1988.

The scallop trailer is shown in Photograph 14 with a 30 tonne stainless steel brewery tank fabricated by Protech Engineering. The "scalloped" shape of the trailer and high stroke rams enable large diameter vessels to be transported 300mm above the ground. The subsequent savings in overhead authority costs can amount to thousands of dollars.

PHOTOGRAPH 13 **COMETTO GOOSENECK ATTACHMENT (1984)**

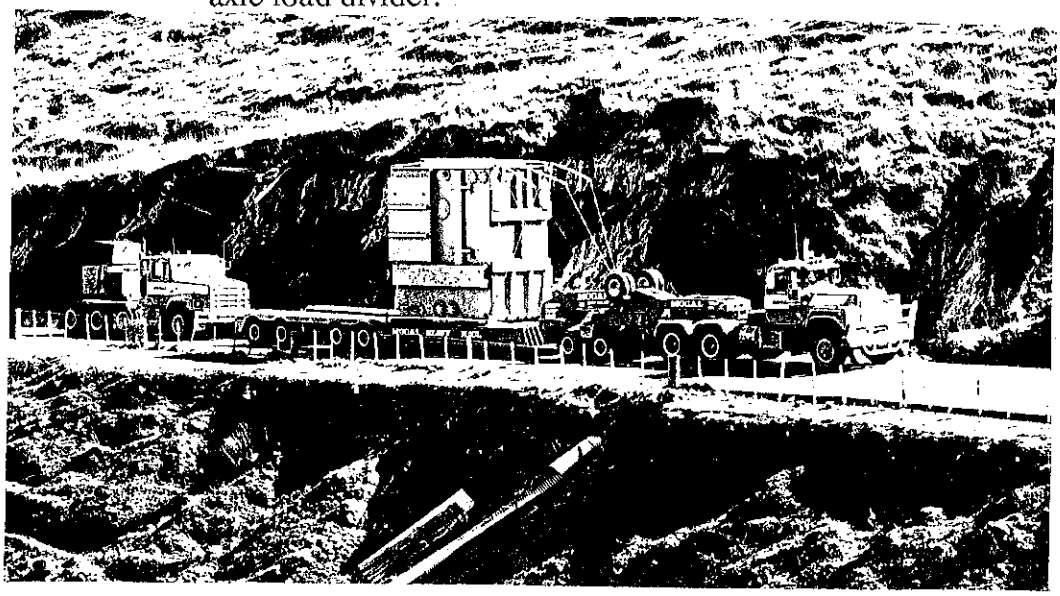


PHOTOGRAPH 14 **8 AXLE SCALLOP TRAILER (1984)**



PHOTOGRAPH 15 MOGAL DRAKE TRAILER (1985)

This magnificent photograph shows a 70 tonne evaporator en route to the Kinleith Pulp Mill aboard Mogal's 4 axle Drake trailer and 2 axle load divider.



PHOTOGRAPH 16 MOGAL DRAKE TRAILER

A transformer over the Evans Pass en route to the Clyde Power Station.

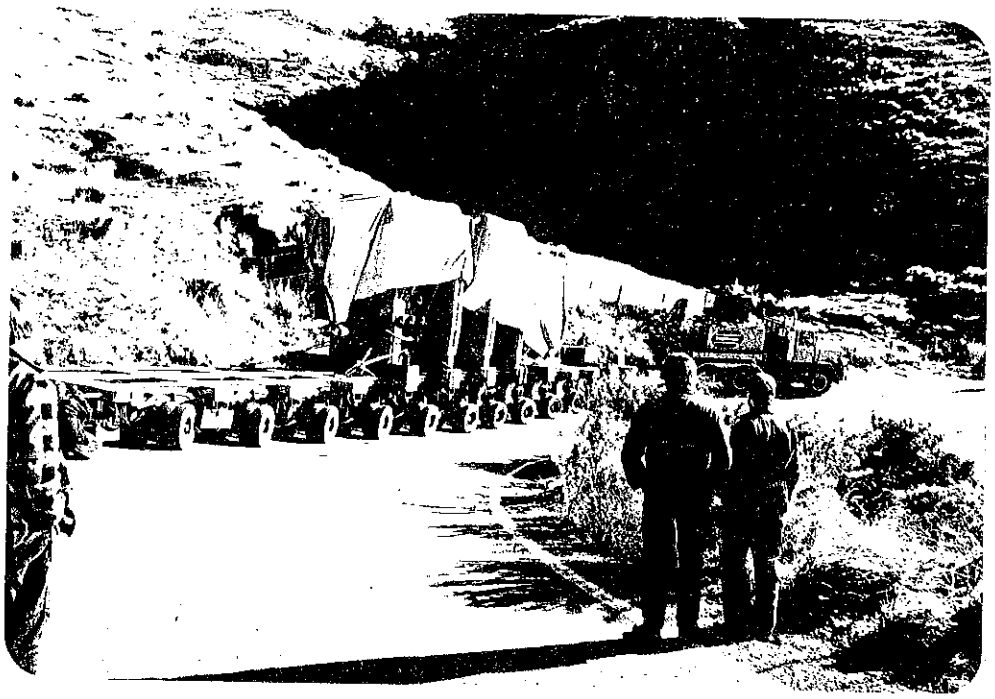
Mogal continued their push into heavy haulage activities by purchasing a number of ex groundwork low loaders and - the pride of the fleet - a 4 axle Drake low loader. Fabricated in Brisbane of high strength T1 steel the trailer has an off-highway capacity of 130 tonnes and with the addition of the 2 axle load divider an on-highway rating of 85 tonnes. The trailer is widening to 4.8 metres and has extensions for lighter long loads and is possibly the best low loader available in the country for loads up to 80 tonne and 7 metres long, but has constraints due to short stroke suspension rams.

3.10.2 Divisibility & Use of Alternative Modes

It was important to remember in the post G.T.G. euphoria that the N.R.B. policy was still in force in respect of proposed "modular" movements for clients whose payloads did not rank highly in "national importance."

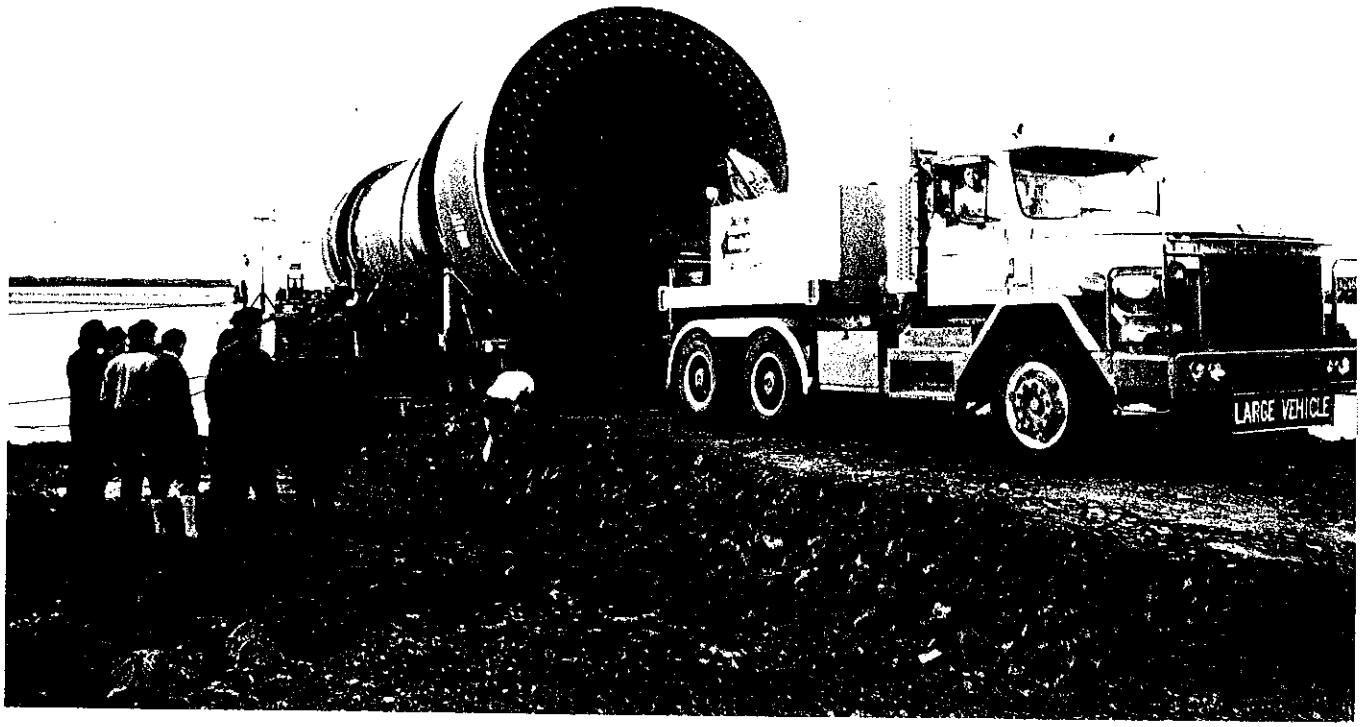
Photograph 17 depicts a 100 tonne wool press on a 12 axle trailer being hauled over Evans Pass en route to Timaru. Five of these wool presses were fabricated by Ash Engineering in Auckland with the first unit requiring transport to Wellington via State Highway 1. The N.R.B. reviewed aspects of the haul long and hard over a 6 month period and required proof that the press could not be easily subdivided into lighter payloads. It would not be an understatement to say that the haul was technically more demanding than the much heavier modules moved to the G.T.G. project.

Similar N.R.B. reviews were required for this 93 tonne drum, as shown in Photograph 18, built in Auckland for the Northern Pulp MIll in Kaitaia. Heavy Haul permit applicants must give due consideration to alternative modes of travel - sea, rail. Whilst it was feasible to move the payload by road the final haul mode was joint road/barge with purpose-built ramps required at the Kaitaia end.



PHOTOGRAPH 17 **100 TONNE WOOL PRESS (1986)**

The divisibility aspects of the press haul were fully explored prior to receiving a permit. Note the relative extensions of the trailer rams to accommodate severe superelevation.

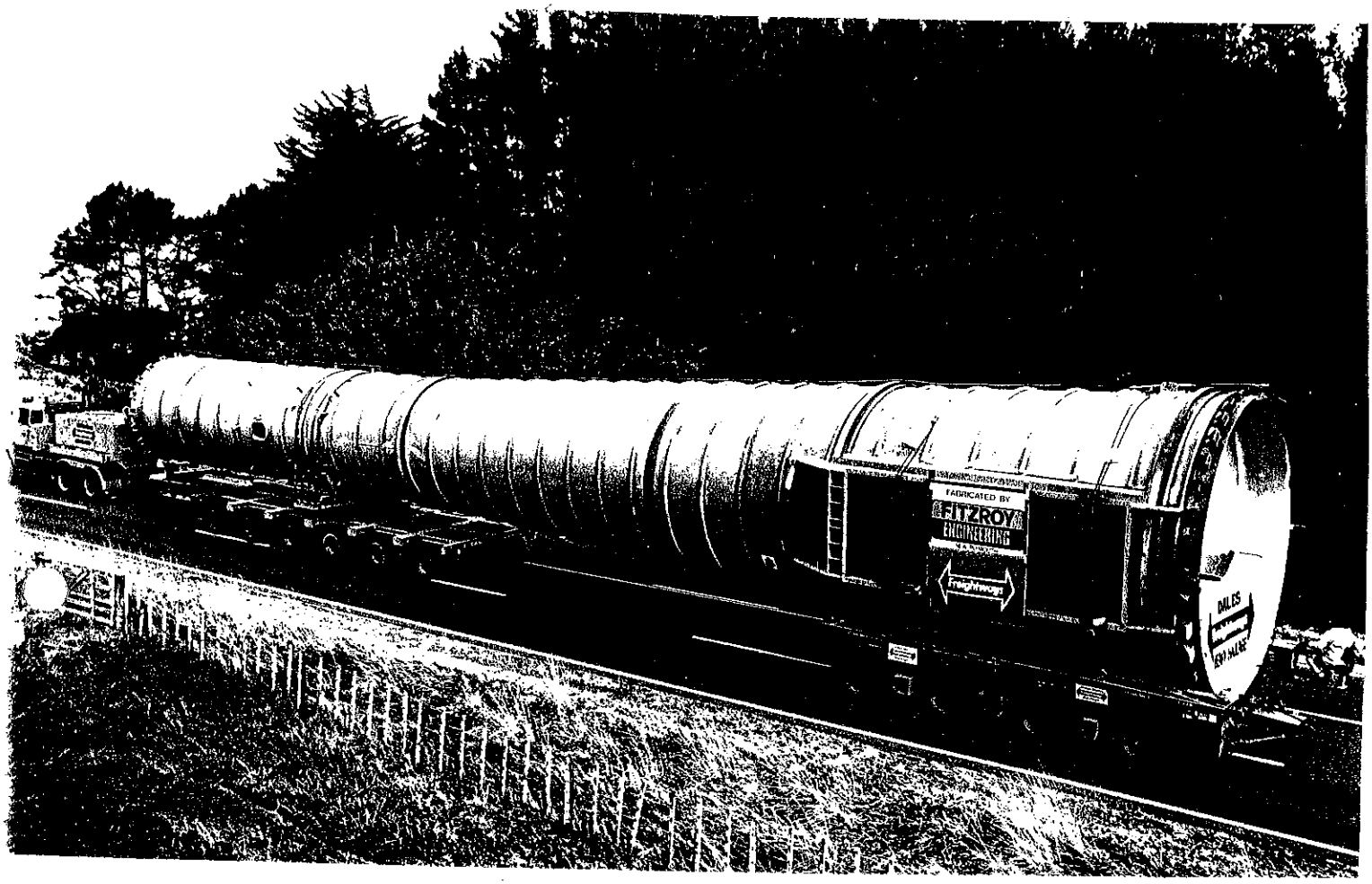


PHOTOGRAPH 18 **93 TONNE WOOD DRUM (1986)**

A joint road/sea exercise was used to transport this item exemplifying the "alternative" mode criteria of the N.R.B. Overweight Policy.

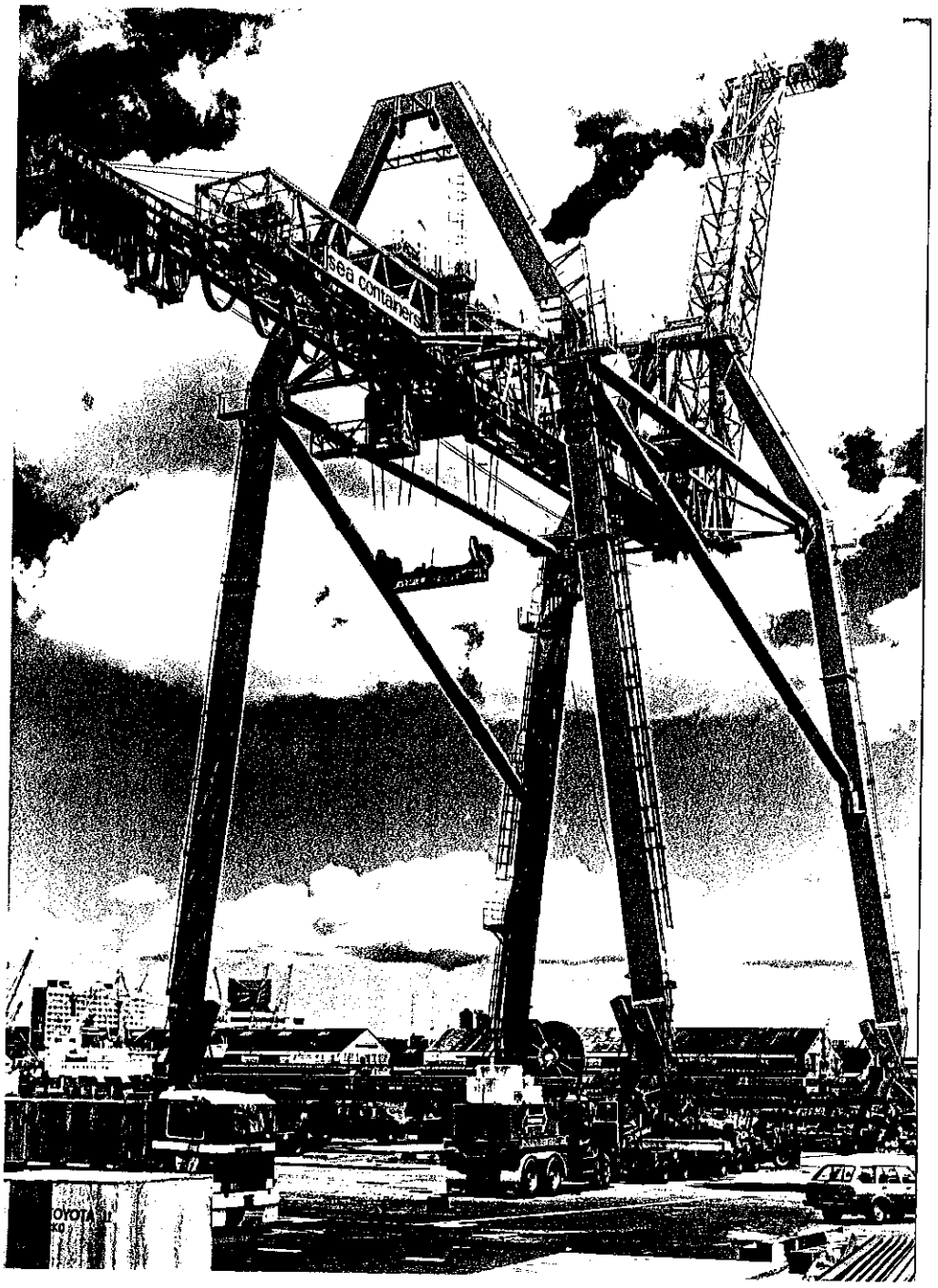
3.10.3 Range of Difficult Hauls

The following photographs and narrative describe some of the more difficult hauls undertaken in the past three years.



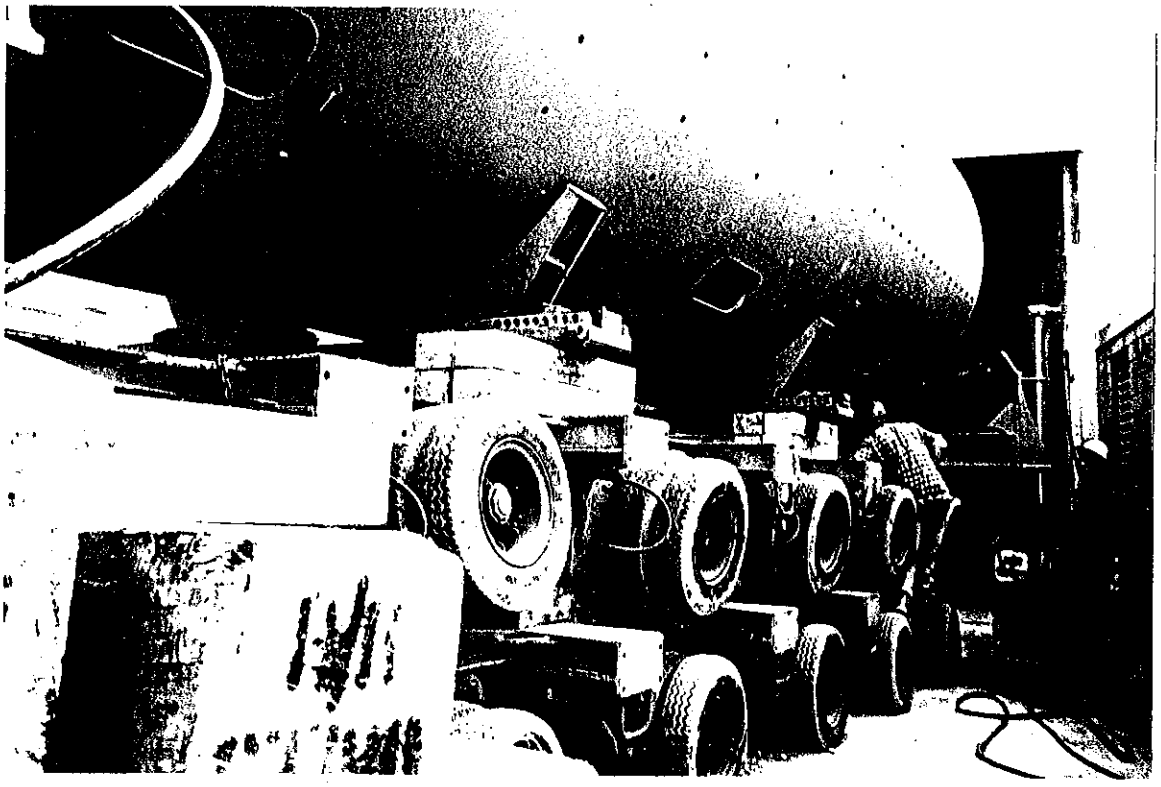
PHOTOGRAPH 19 **KINLEITH FLUE STACK (1986)**

This 74 tonne, 34 metre long x 5.5 metre diameter stack was fabricated in New Plymouth by Fitzroy Engineering and required hauling to the Kinleith Pulp Mill via S.H. 3 (to Bulls) and S.H. 1. The large base diameter necessitated the use of the 4 axle Scallop trailer with a trailer operator on the haul for the full duration ensuring that the trailer and payload remained parallel.



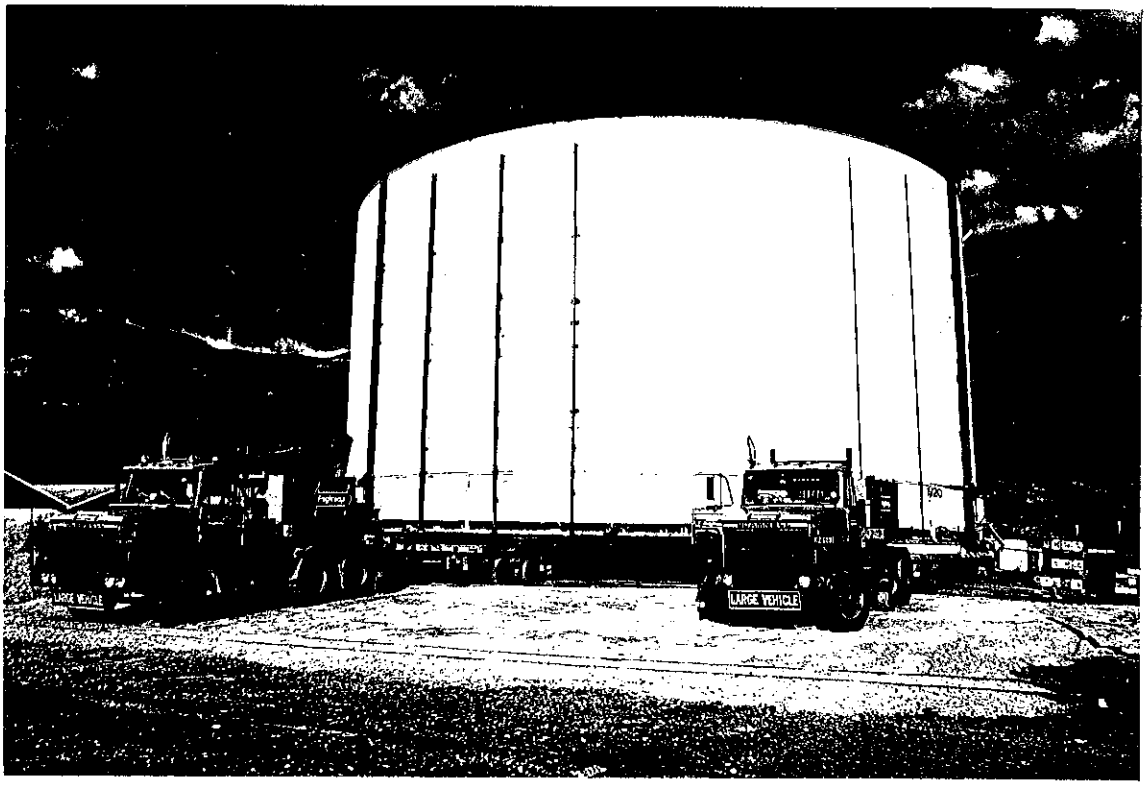
PHOTOGRAPH 20 <u>SEA CONTAINERS 450 TONNE CRANE (1986)</u>

This crane which was temporarily used in Lyttelton following the container crane mishap, was purchased by the Auckland Harbour Board and skidded off the heavy lift ship and stored. The final relocation of the 450 tonne unit required the placement of 4 modular trailers under each leg and temporary steel struts between the crane column.



PHOTOGRAPH 21 **PORTLAND CEMENT MILL INSTALLATION (1988)**

A total of 1200mm of jacking height was obtained by placing one trailer atop the other to aid in the installation of this 65 tonne cement mill.

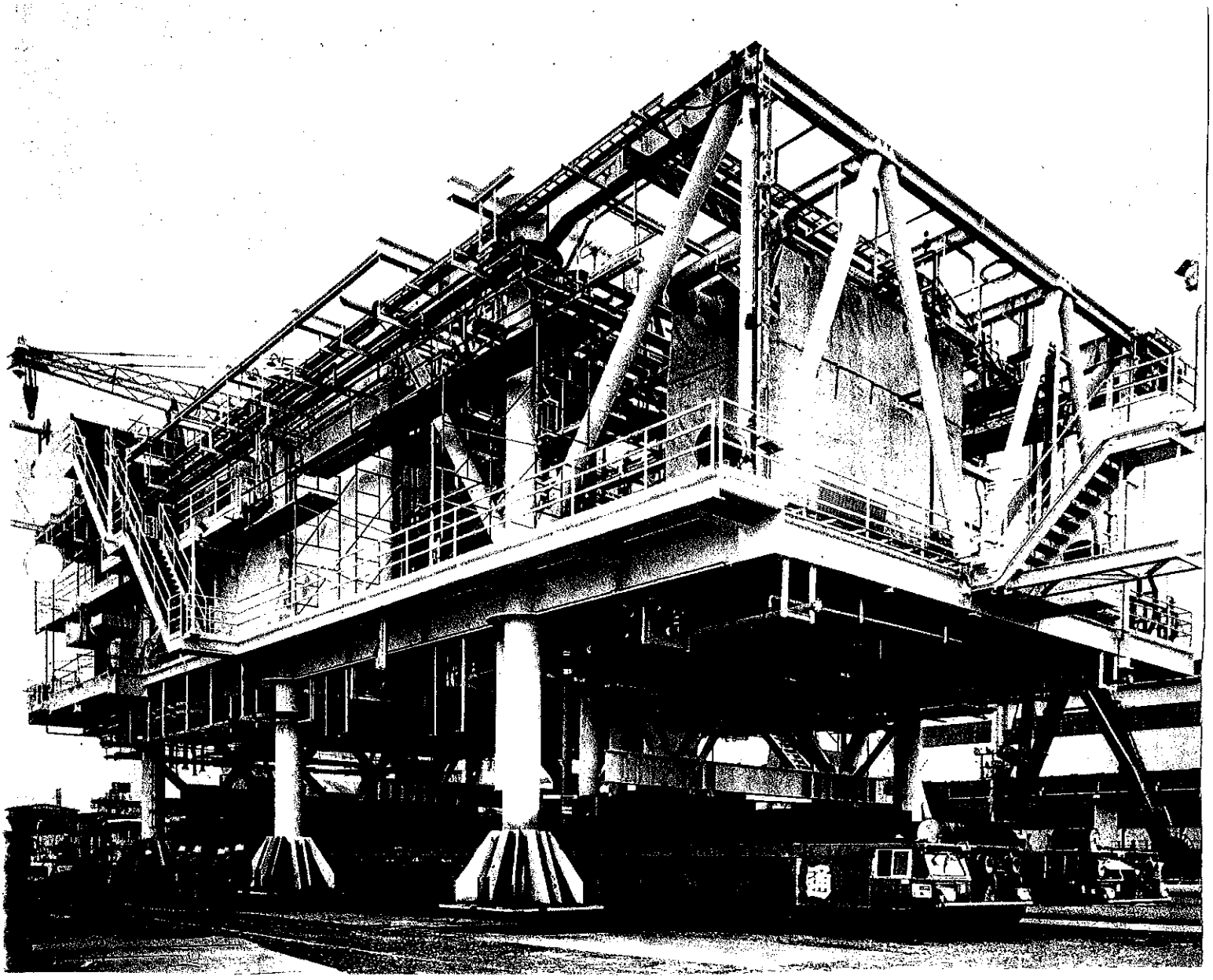


PHOTOGRAPH 22 **BP TANK (SEAVIEW) (1988)**

This 160 tonne 25 metre diameter is the largest load ever shifted on N.Z. public roads. The tanks were jacked for loading prior to a 2 kilometre trip. Clearances at one location were less than 50 millimetres.

PHOTOGRAPH 23 **BLOW TANK TO TASMAN (1989)**

Extensive use has been made of off-site prefabrication and haulage to the Tasman Pulp & Paper Mill Expansion in Kawerau. This Blow Tank section was hauled form Murapara to Kawerau on Timberlands/Tasman Forestry private roads and measured 10 metres high x 8 metres in diameter and weight 55 tonnes.



PHOTOGRAPH 24 **OFFSHORE MODULE LOADOUT**

The ultimate advancement in trailers - the self proprelled platforms. These trailers have hydraulically driven front axles and 90 degree steering orientation. Computers mounted in the cabin continually monitor centre of gravity location.

4.0 THE FUTURE

At the time of writing this paper, final preparations are in hand for one of the largest and most difficult heavy hauls undertaken in New Zealand. The Tasman Continuous Digester is a 500 tonne 54 metre long vessel which is to be transported in late July from Murapara to Kawerau. The digester is the largest bolstered load to date in N.Z. and involves one of the longest haul routes encountered.

An excellent 25 year comparison of the developments in equipment, load weight and controlling authority impositions is evidenced in the proposed transformer(s) haul to Haywards, Lower Hutt in 1990. In 1964, 80 tonne transformers were transported on the 5 axle Big George Rig. In 1990 the 212 tonne will be supported by a 34 metre long beam set atop 26 axle lines of trailer necessary to achieve the pavement load spread. A quick calculation will confirm that whilst heavier loads are possible a huge array - and investment - is required to meet the restrictions in pavement and bridge loadings. Given this situation, it is unlikely that the next 15 years will see the degree of investment experienced over the last 15 years.

This observation may be influenced by the possibility of the larger contracting companies (Fletchers, McConnell Dowell etc.) investing in equipment or the requirement for extra axles to load out the 2500 tonne Maui "B" module. This work could open the door for the introduction of the self propelled trailers as shown in Photograph 24. Only time will tell!

Acknowlegdements

The writer wishes to thank Trevor Jones of Dales Freightways and Richard Hyde of Mogal Heavy Haul for their comments and photographs.