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STRUCTURFLEX

NEW ZEALAND

THE EXPANDING POTENTIAL FOR INDUSTRIAL
FABRICS IN THE TRANSPORT ENVIRONMENT

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THE EXPANDING POTENTIAL FOR INDUSTRIAL

FABRICS IN THE TRANSPORT ENVIRONMENT

INTRODUCTION

The next decade may well be the Fabric Age.

Fabrics are performing a silent revolution in many fields of industry but nowhere more prevalent than in the transport environment. Transport engineers in general are only slowly becoming aware of this potential medium as a tool of their profession. Part of the blame for this is that the principal technologies involved encompass mechanical, fabric and chemical engineering which are not combined in a formal tertiary education system in New Zealand. Even the transport engineering section of N.Z.C.E. has little if any reference to fabrics.

Without education or experience in the field how can the transport engineer be expected to specify an appropriate fabric let alone a fabrication system to accommodate a particular requirement?

Aluminium and steel have well known and documented parameters which can be readily located in charts or computer programmes, consequently making these materials convenient to use.

Fabrics are not measured by the same standards, in fact a plethora of different standards are used for measurements of characteristics. Test data in a coherent form can be difficult to obtain. A great deal of reliance is placed on the fabricator to provide the experience as well as the technical support to back it up.

The advances in tension membrane technology for architectural applications have generated a quantum leap forward in determining the stress-related behaviour of coated fabric. Too often, fabrics are treated as weather protection membranes instead of an engineering medium in their own right. While weather protection is an important element in fabric application it is only one of many.

Engineering fabric applications will herald a new era in the transport environment.

The most common forms of industrial fabric applications in road transport are canopies, tarpaulins and curtainsiders.

CANOPIES AND TARPAULINS

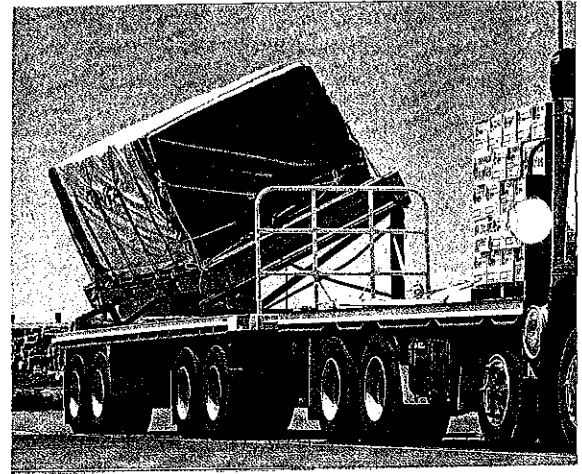
While this system of covering loads has been around for generations it has recently undergone a transformation with new fabric construction, fibres, weaves, coatings, advanced fabrication technology, new fastening and attachment systems. The development of the one tonne reef lug multiplied previous attachment strength standards by a factor of 2.5. Carbon black impregnated polyethylene rope increased durability by a factor of 1.5.

The advent of the load restraint regulations witnessed the development of the load restraint tarpaulin to meet this criteria with built in webb straps of up to 2 tonne capacity.

These gains were achieved by ignoring previous canvas fabrication methods and developing new systems based on coated fabrics welding technology.

Army canopies have progressed from the R L Bedford one piece canvas version to the five piece versatile PVC Unimog system used today.

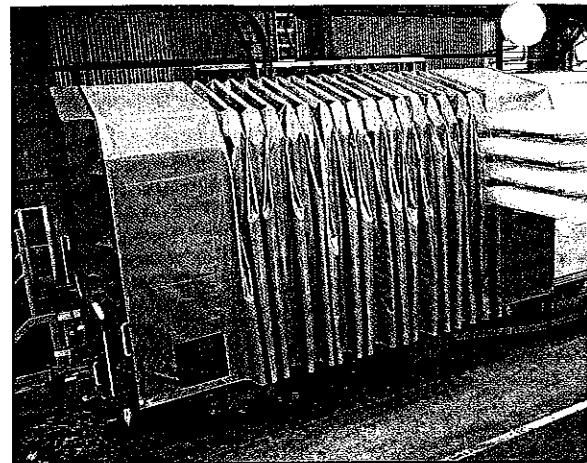
Meanwhile another system has emerged in which N.Z. Railways has been at the forefront of development. An example of necessity being the mother of innovation. Although the first prototype concertina wagon canopy was successfully trialed four years ago, with modifications and alterations it is only now in limited production. This system has also been adapted for road transport and is particularly suitable where overhead loading facilities are used. With removable end pillars the whole canopy can be demounted onto slave rails to leave a flat bed semi for general cargo.



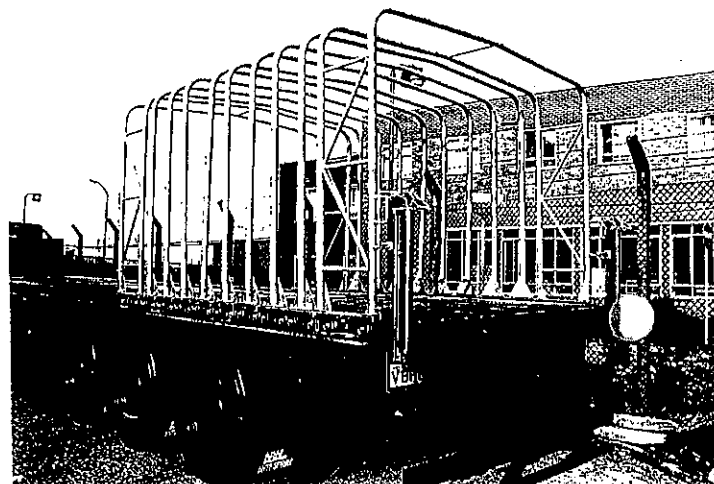
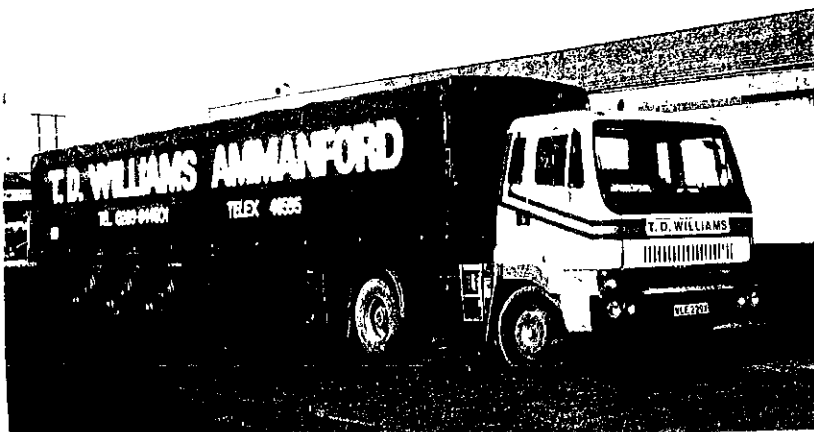
LOAD RESTRAINT TARP



UNIMOG

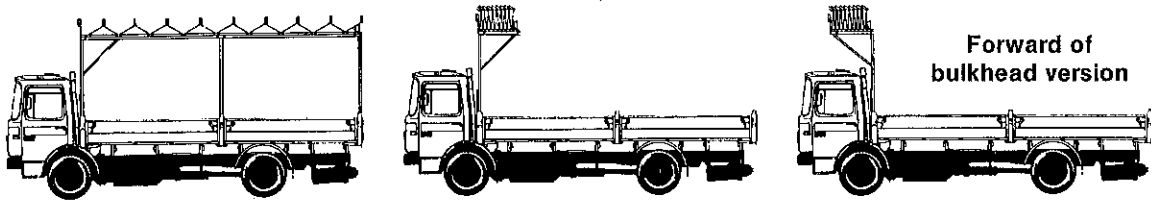


CONCERTINA WAGON



SLIDAFLEX CONCERTINA TRUCK CANOPY

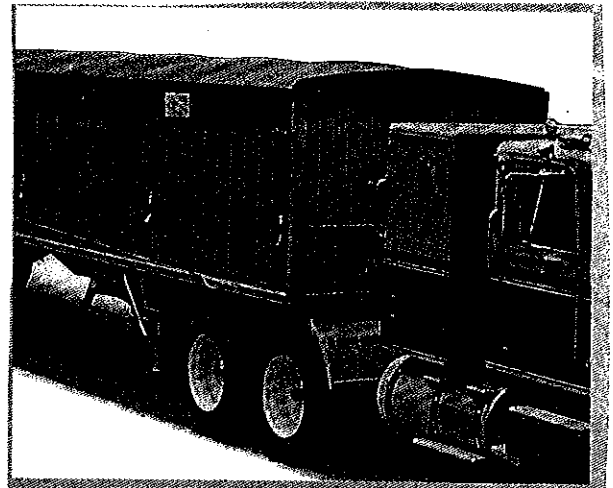
Another version for smaller vehicle applications utilises a folding canopy on top of a framework which can be demounted to achieve maximum side, top and end access.



A sliding system using folding plastic hinge plates built onto the fabric to concertina the canopy is used in Europe. Conventional loading is from the rear but by sliding the canopy and removing the rafters of the framework, overhead loading can take place. The dismantled framework is then reassembled after loading.

Roll-top tarps would appear to be a basic waterproofing system for bulk carriers. However, in places like Canada and USA where these are a necessity, not just to keep the product inside, but to protect from rain and snow, sophisticated systems have been developed to make these simple and quicker to operate.

One particular system is operated by an electric motor which can be opened and closed by a switch in the cab without the operator having to leave his driving position.



ROLL-TOP TARP

CURTAINSIDED MAXIMUM ACCESS VEHICLES

To the uninitiated observer all tensioned curtainsided systems probably look much the same. This belies a great deal of engineering detail incorporated into each individual system to optimise it for its chosen task. A plethora of brand names identify the different types of system.

While the generic term is curtainsider many people use the brand name Tautliner to encompass all forms of curtain as it was the first tensioned fabric curtain system to come into operation back about 1970.



TAUTLINER/FLEXISIDER

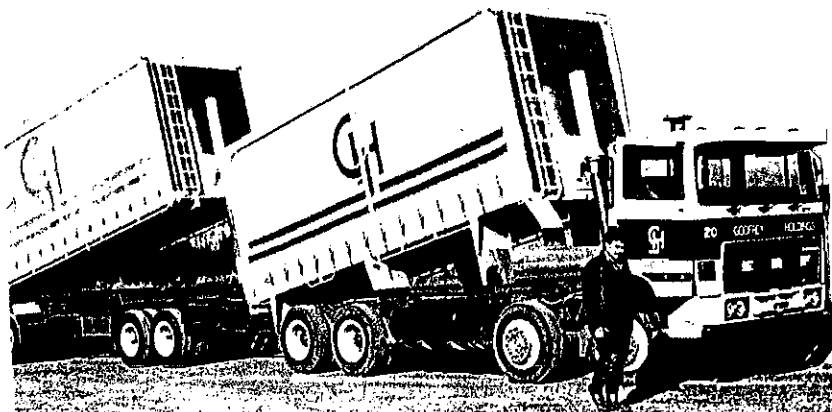
The most versatile and commonly used system incorporates a pipe or luff groove pole front and rear, either, or both of which are tensioned by rotating the curtain on the pole. The Tautliner method places the pole in a channel and rotates the channel. The Structurflex method rotates an alloy pole with a built in luff groove which captivates a nylon rod welded in the edge of the curtain. Both systems are subject to patents. The standard curtainsider method incorporates a steel pole riveted into pockets in the ends of the curtain. Horizontal tension is achieved with various forms of ratchet type tensioners. The advantage of the first two methods is that lighter poles can be used.

This system utilises over centre buckles attached to high strength low stretch webb and steel coaming rail hooks. The buckles are usually stainless steel for durability and trigger activated for speed of handling. Apart from the obvious advantage of access to the full length of the vehicle deck the curtain can wrap around irregular and protruding loads yet still be disengaged by pulling the curtain out from the load when the tension is released.

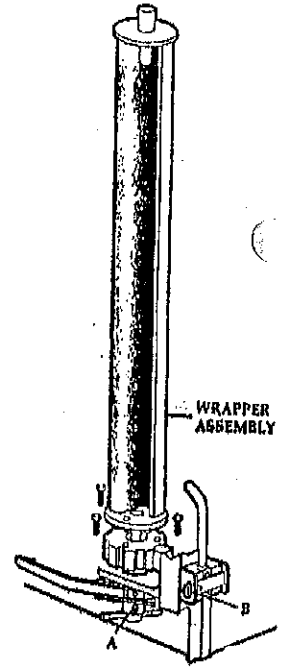
Many variations have been developed using the basic system to achieve diverse end uses.

CHIPSIDER

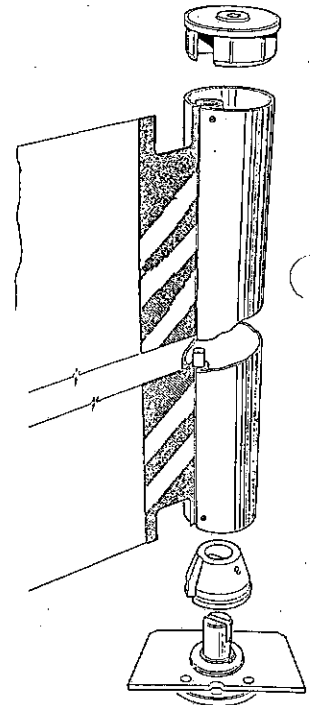
This system has been engineered to carry wood chips and shavings in bulk by utilising narrower webb spacings, two plies of the same fabric or a heavier, denser, base fabric coated to 1400gsm. The two ply or heavier fabric is necessary due to the constant load being applied to the curtain and to contain stretch inside the vehicle width's limitations. A consideration in the design is the free flow of chips from the rear of the vehicle when tipping which precludes the usual pole channel construction, at the rear end.



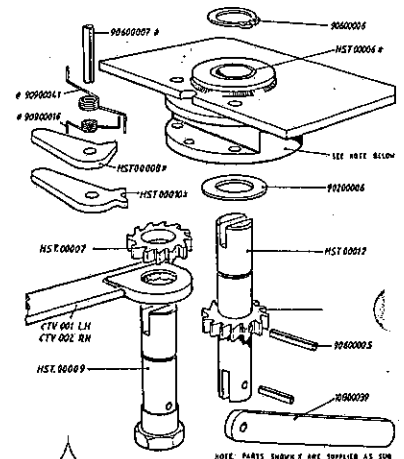
CHIPSIDER



TAUTLINER



FLEXISIDER

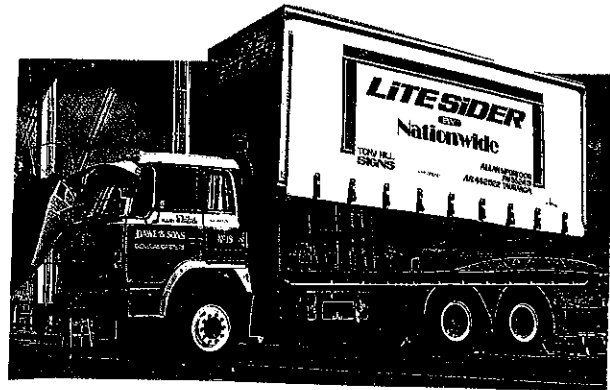


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RATCHET TENSIONER

DEMOUNTABLE

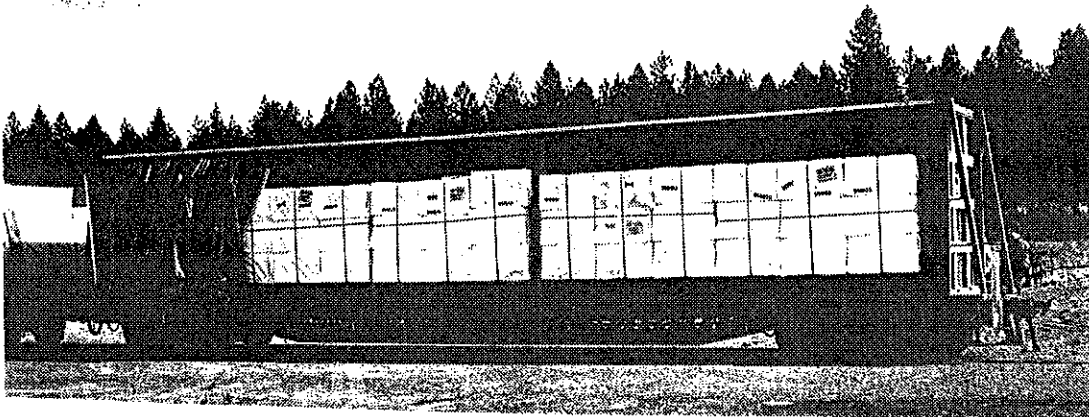
In this version the body is separate from the truck or trailer deck and attaches with the use of container twist locks. Removable diagonal bracing is necessary for stability when handling. When adequately engineered demountables can be utilised for all commodities including wood chips.



CONTAINERSIDES

Structurally self supporting, these units incorporate a base so that they can be utilised in both stationary and mobile modes. Applications vary from 20ft. I.S.O. container to 15.0m purpose built units for rail transport.

DEMOUNTABLE



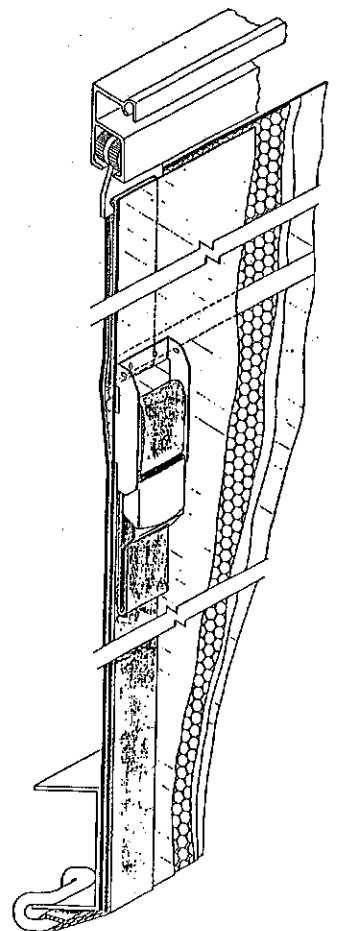
CONTAINERSIDER

INSULATED

Basically an infill between an outside skin (the structural load bearing curtain) and an inside membrane of PVC coated fabric. The degree of effectiveness depends on the nature and type of infill material, size of air gap, thickness of inner skin and most importantly, minimising transmittance due to air movement at the curtain boundaries.

Tests carried out by BRANZ in conjunction with Structurflex and the Kiwifruit Authority have gleaned a great deal of information on this subject which could be the topic of a separate paper. Suffice to say that the higher the speed and the lower the transmittance the more effective the insulation.

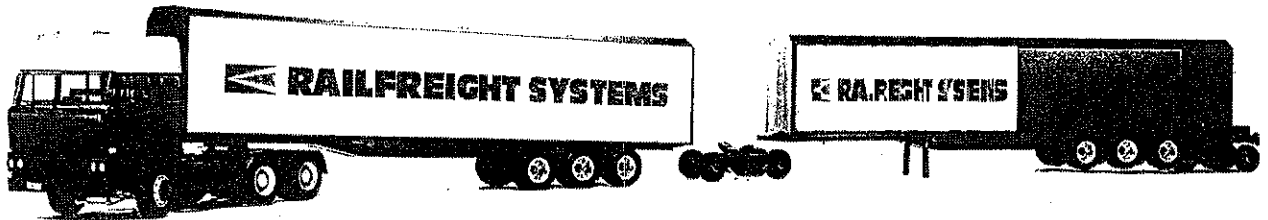
The requirement for conserving thermal energy in space has led to the development of new, lightweight, efficient insulation fabrics yet to be utilised in industry. Greater thermal efficiency at lower cost with maximum access is the means by which curtainsiders may gradually replace other forms of refrigerated vehicles.



INSULATED CURTAIN

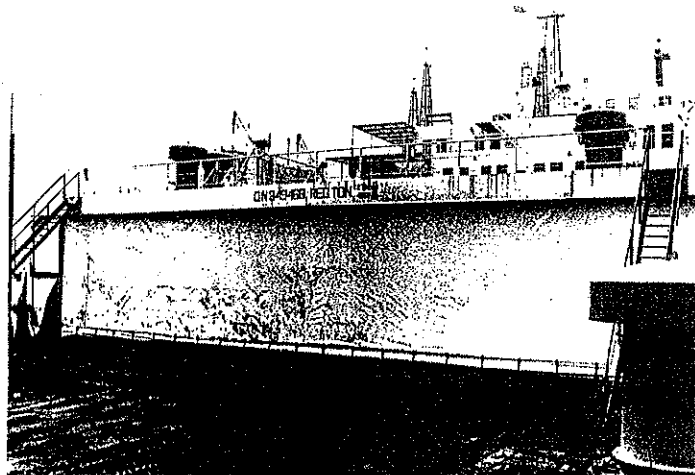
ROADRAILER

This exciting innovation in intermodal transport has launched NZ Railways to the forefront of world development with the first curtainsided Road-railer. The necessity of catching up after generations of regulated environment has mothered the adoption of this system by the first country outside the USA. A 43ft semi-trailer spans two rail bogeys for rail transport and then converts to road mode.



SHIPSIDER

A recent development has been the use of this curtain system to close off a bridgedeck space for transportation of motor vehicles across the Tasman. Primarily a water proofing medium, the magnitude of size (25.0m x 5.5m) gives a new dimension to load bearing, in this case wind load. 1500 sq. ft. is a pretty large spinnaker. Both trans-Tasman ferries have now been fitted with these flexisider curtains.



INDUSTRIAL APPLICATIONS

Derivations of this system are used for numerous applications. The temporary storage of tropical fruit in a chilled environment of 8°C between arrival and distribution to fruit and vegetable markets.

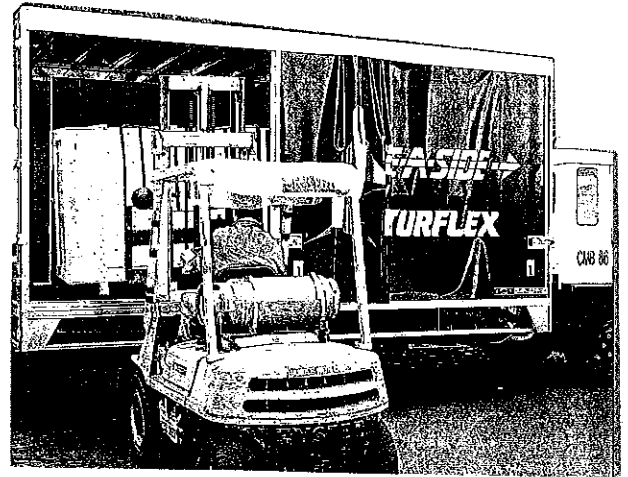
Hot air drying of timber at 40°C providing an easily removed thermal barrier with maximum width access for fork lift placement and retrieval.

MAXIMUM SPEED AND ACCESS

The demand for faster access with the user of curtainsiders in multiple drop off delivery situations produced the SLIDE-A-SIDE or LOCALINER variation. With a single overcentre catch on a rigid panel at each end providing horizontal tension and the top roller connected to a coaming rail hook or glide via an alloy pole or batten this system can be fully opened or closed within 5 seconds. Bias strips built into the curtain or attached to the poles assist the curtain to fold as it is contracted.

While considerably faster than the basic curtainsider it is less versatile in that the curtain is captive top and bottom and consequently will only slide if clear of the load.

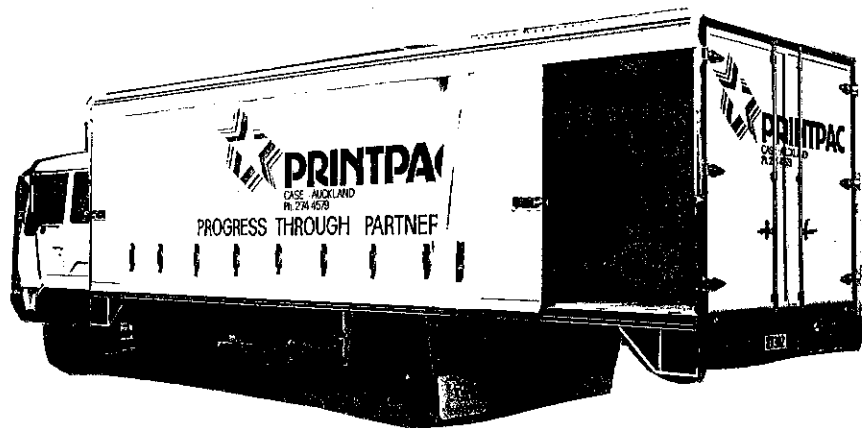
The uninterrupted wrinkle-free surface gives the appearance of a rigid panel body and provides a great billboard space with this system.



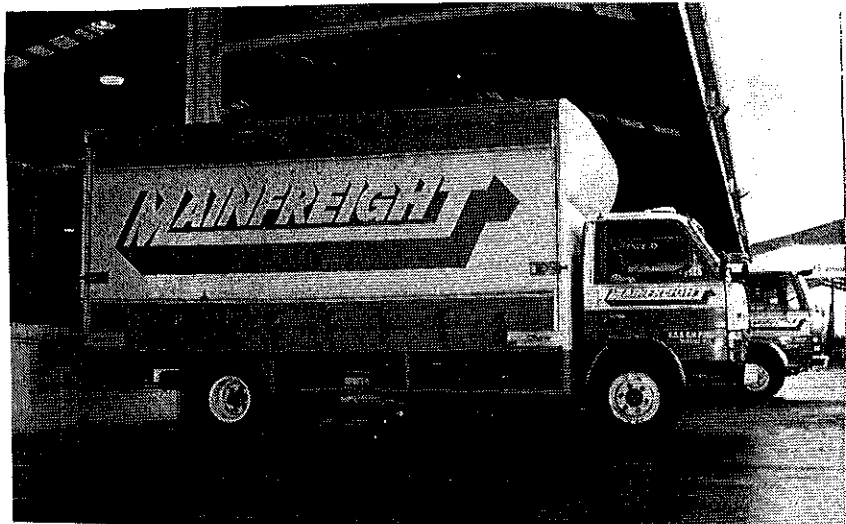
SLIDE-A-SIDE

COMPROMISE

The demand for speed of operation plus the requirement for flexibility of load containment meant the inevitable development of a compromise between the traditional curtainsider and the SLIDE-A-SIDE system. Roadrunner produced the first in the theme, METROVAN followed shortly after by CITYSIDER from STRUCTURFLEX. These two systems incorporate the buckle and strap, load restraining mechanism with overcentre catches on rigid end panels. This provides the flexibility of hugging the load while at the same time supplying fast access to either end. Rapidly gaining ground as an alternative system for round town delivery vehicles and container sides.



METROVAN

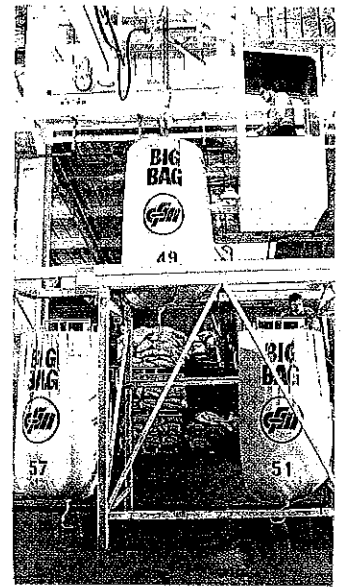


CITYSIDER

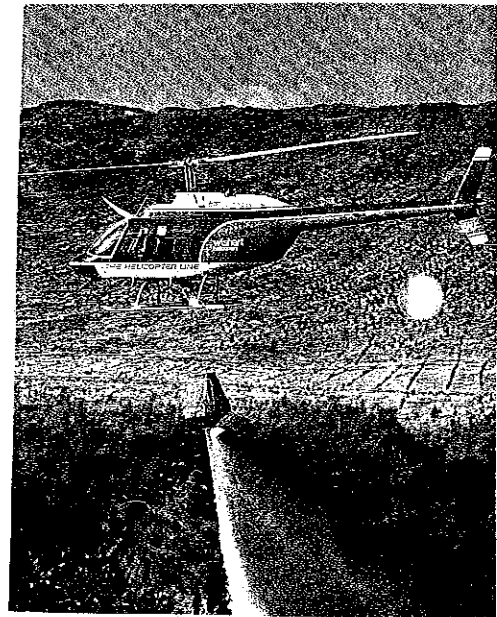
FLEXIBLE REUSABLE CONTAINER SYSTEMS

Many forms of liquids and flowable solids are transported today in flexible containers. The one trip polypropylene bag is the basic form but the reusable systems like BIG BAG have been known to do in excess of 200 round trips sometimes spanning 10 years before replacement is necessary. These containers vary in capacity from 800 kgs to 3 tonnes and occupy minimum storage or transportation space when empty. Variations in diameter, base shape, inlet and outlet chutes or fully opening bottoms allow for a great variety of flowable solids such as salt, soda ash, soap chips, lamb skin pelts, rubber filings, sand, soup powder to name but a few.

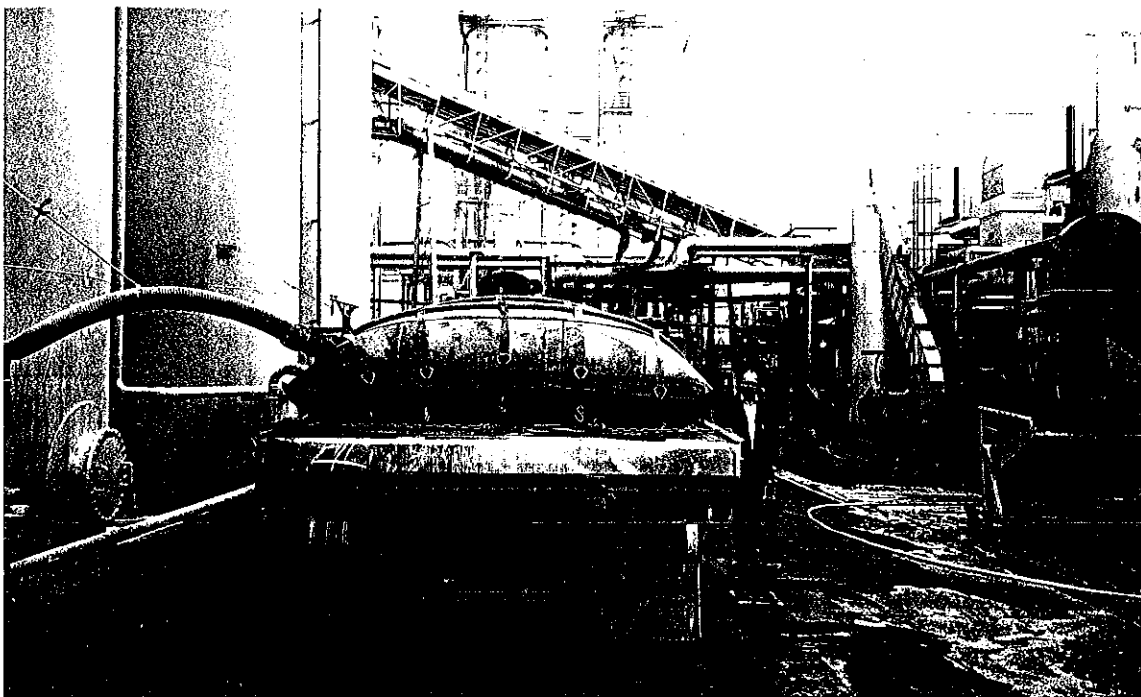
Liquid containers come in different forms from wheel type for aviation fuels to tear drop for forest fires. However, the predominant type in road transport and storage is the pillow tank. While in the past these have largely been of rubberised fabrics with a high cost and weight the advent of new plastics, Alcryn and TPU (thermo plastic urethane) has made it possible to store and transport many fluids not feasible with PVC. Liquid commodities such as ink, glue, fruit juice, wine, fertiliser and water are but a few of those regularly transported in these containers. With the small returnable volume and weight of a rolled up flexible tank the cost benefits of this mode of transport have yet to be fully appreciated in New Zealand. Many liquids are still imported and handled internally inside drums with the resultant redundancy problem when empty. Generally, it is not economic to return empty drums. The potential for converting flat decks into water tanks for fire fighting and dust control alone cannot be over-estimated.



BIG BAG I.B.C.

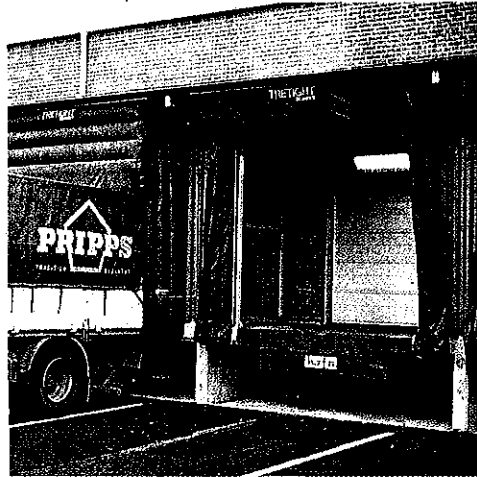


HELIBUCKET



ENVIRONMENT CONTROL

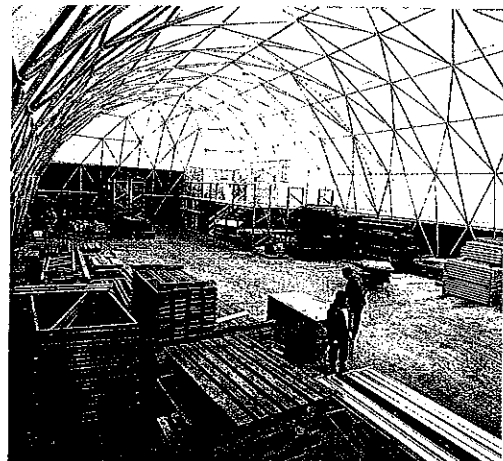
An important consideration for various forms of transport is the loading or unloading environment. Here also fabric is playing an ever increasing role. Frozen meat needs to be handled at a tightly controlled temperature. Inflatable buffers and load out flaps are used to seal the environment to maintain low temperatures in the dock space adjacent to the vehicle, container or rail wagon. After loading the air is extracted to release the seal and retract the buffer allowing the vehicle to depart.



Another system of dock seal utilises a PVC coated fabric over expanded foam plastic against which a truck reverses, depressing the foam to seal the loading space on three sides.

STORAGE AND DISPERSAL

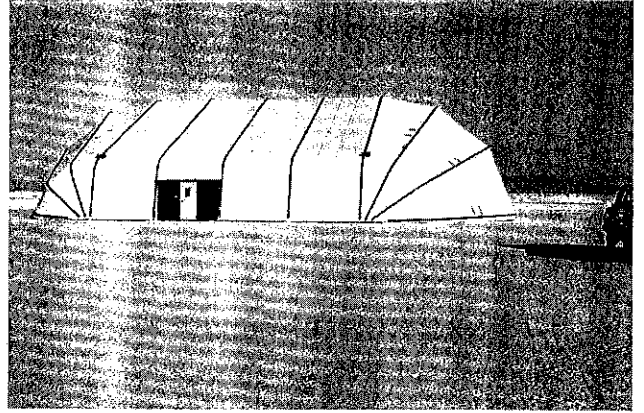
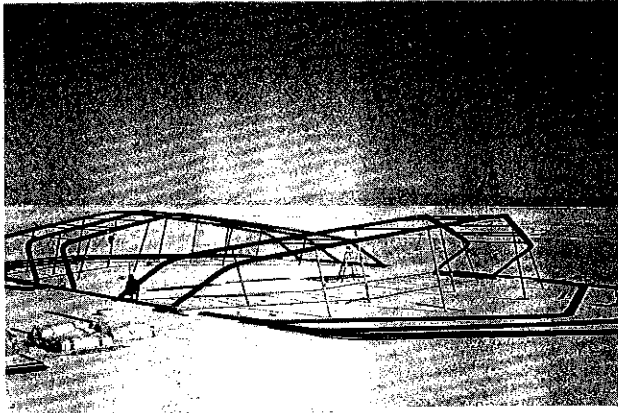
Chilled fruit is best handled in a covered environment and here architectural grade fabric can be used to keep out the weather, yet being translucent allows a high degree of daylight maintaining good visibility without artificial lights.



For this and economic reasons translucent fabric covered warehouses are becoming more common. Other reasons for their acceptance are their speed of erection and transportability from location to location. A geodesic framed Elitunnel can be erected in a matter of weeks with the fabric component manufactured offsite in a fabrication facility and transported to the site where it can be installed in a matter of a few days.

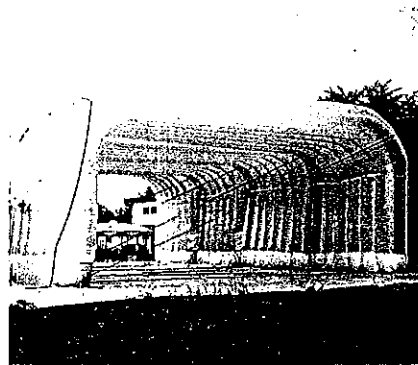
FLEXIBILITY AND PORTABILITY

The Clamshelter system is made up of jointed alloy framework assembled on site to the required dimensions and then prefabricated panels slid into the frames and erected or dismantled in a matter of days. Its transportability and speed of erection and dismantling makes it eminently suitable for short periods of high seasonal use.



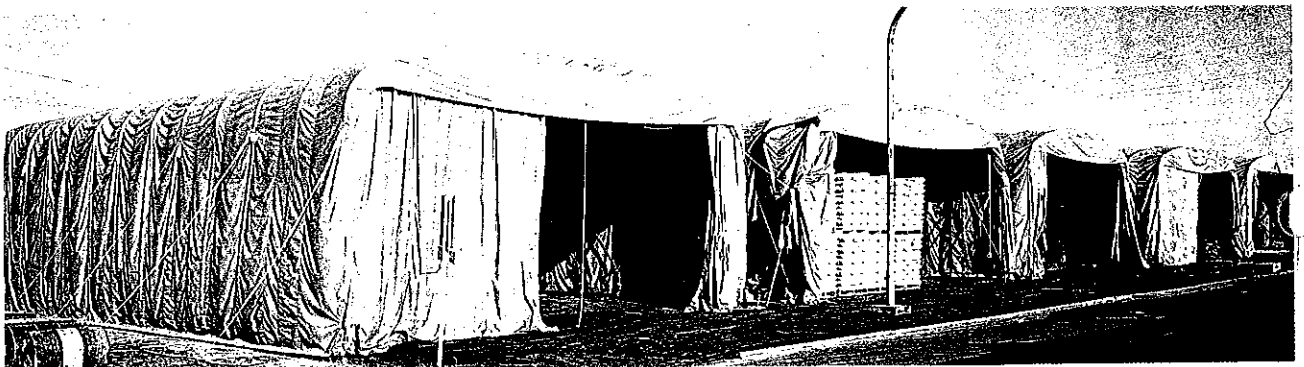
CLAMSHELTER

Air Beam shelters provide an instantly erected temporary work area for a multitude of uses, sometimes custom designed for a specific purpose.



AIR BEAM SHELTERS

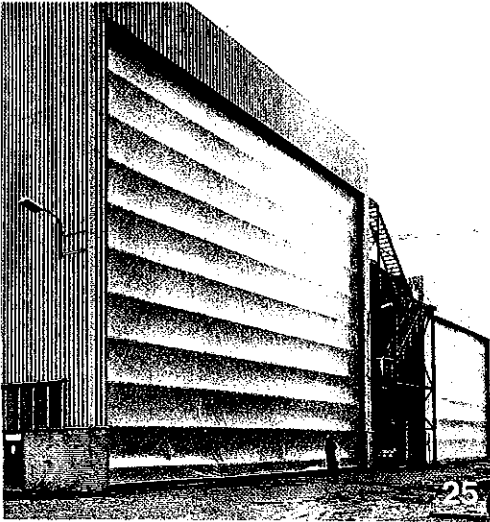
The Jabara House utilises the concertina principle in a static location simplifying access.



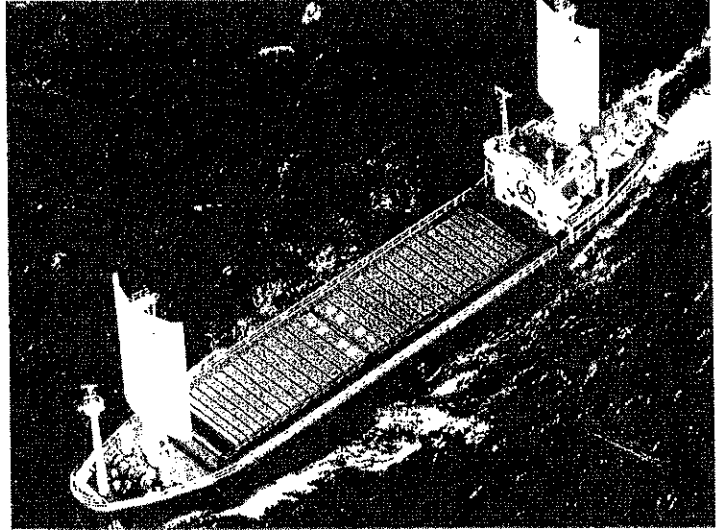
JABARA HOUSE

FABRIC SOLUTIONS

Another permanent fabric use is for large span doorways where rigid panels are expensive, bulky and difficult to retract. Lifting fabric doorways are light enough to be electrically controlled, yet strong enough to handle intermittent heavy wind loads. These can also be made with double membranes providing an air space between to act as a thermal barrier.



FABRIC DOOR

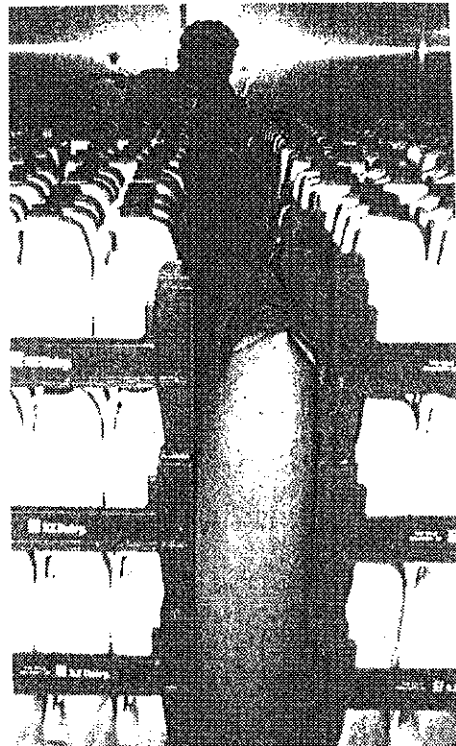


CARGO SAILS

Advanced design fabric membrane "sails" augment diesel power on cargo vessels and oil rigs to save fuel and shorten passage times.

LOAD SECURITY

Air bolsters are another innovative use of coated fabric. These air cushions are used as longitudinal gap fillers to prevent load movement created by spaces between palletised loads. Air bolsters are inserted in the space and inflated maintaining a pressure between cargoes or between cargo and bulkhead. Being flexible, the bolster takes up any irregularities of contour and provides a pressure cushion during acceleration or deceleration.



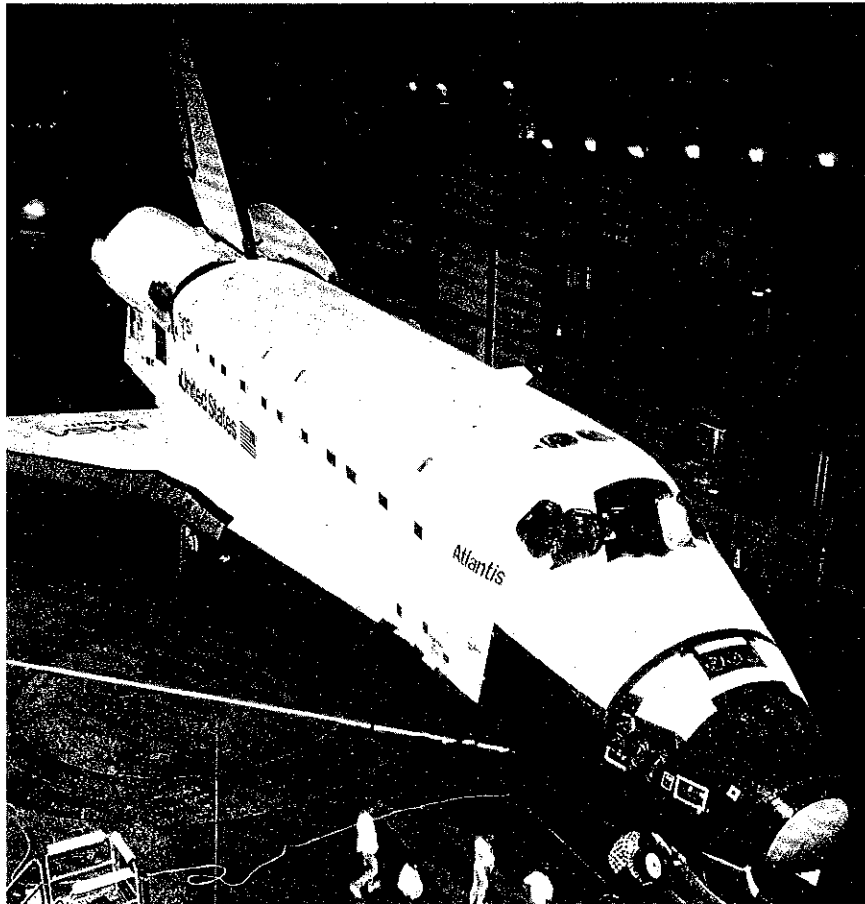
AIR BOLSTER

SPACE - THE FUTURE ENVIRONMENT

The space shuttle has become the first "truck" in a new environment. Industrial fabrics form one of the major ingredients in each shuttle mission. From the pressured suits worn by the astronauts, to covers that secure cargo and small objects during liftoff and weightlessness, from the insulation blanket and shields that protect the ship from the heat of rockets and atmospheric re-entry to the lightweight composites that form the structural members of the spacecraft itself and the list goes on.

Indeed, industrial fabrics are every bit as important to the space programme as are electronics, astrophysics and metallurgy.

Where will it all lead? The range and potential of future fabric applications seems only to be limited by the imagination.



Thermal blankets cover large areas of the exterior upper body and upper wing surface, in this case on the orbiter Atlantis.

GLOSSARY OF TERMS

GSM	-	Grams per square metre
P.V.C.	-	Poly Vinyl Chloride
I.B.C.	-	Intermediate bulk container