

IRTE INTERNATIONAL HEAVY VEHICLE SEMINAR

HEAVY TRUCK SUSPENSION SYSTEMS

PRESENTED BY: BOB CADDEN

HENDRICKSON AUSTRALIA

NEW ZEALAND AUGUST 1989

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HENDRICKSON AUSTRALIA PTY LTD

THIS PAPER EXAMINES THE BASIC HARDWARE REQUIREMENTS OF A HEAVY TRUCK TANDEM AXLE SUSPENSION, THE CHALLENGES & DILEMMA FACING THE DESIGNER WITH A CLEAN SHEET OF PAPER.

EXAMPLES OF SPECIFIC SUSPENSION TYPES WILL BE GIVEN WITH PARTICULAR EMPHASIS TO THOSE IN CURRENT USE IN BOTH AUSTRALIA & NEW ZEALAND.

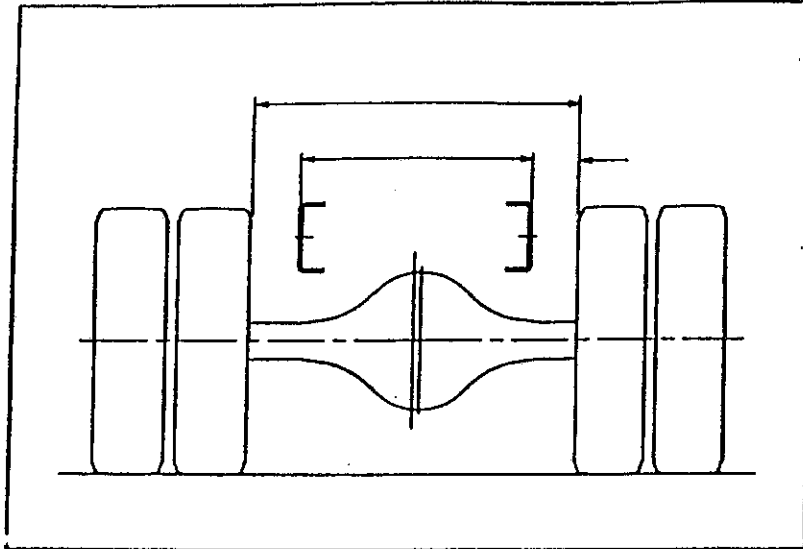
THE AREAS WHICH HAVE TO BE CONSIDERED CAN BE GROUPED AS FOLLOWS:

- PACKAGING...THE SUSPENSION MUST FIT TO THE VEHICLE
- SPRINGING...TO ABSORB SHOCK LOADS & PROVIDE DAMPING
- LOAD SHARING...FOR PROTECTION OF VEHICLE, ROADS & BRIDGES
- POWER CONTROL...OF BOTH DRIVING & BRAKING TORQUES
- LATERAL LOAD RESTRAINT...FOR CORNERING & CAMBER FORCES
- ROLL STABILITY...ESPECIALLY FOR HIGH C OF G LOADS.
- RIDE COMFORT...FOR DRIVER, CARGO & VEHICLE.
- DURABILITY...FOR ECONOMIC WHOLE LIFE COST.
- WEIGHT...FOR MINIMUM TARE & MAXIMUM PAYLOAD.
- COST... TO BE COMPETITIVE.
- LEGISLATION...RELATED TO ROAD & BRIDGE DAMAGE & SAFETY.

MOST OF THE REQUIREMENTS LISTED APPLY IN PART TO SINGLE DRIVE AXLE SUSPENSIONS & ALSO TO TRAILER SUSPENSIONS WITH 1, 2 OR 3 AXLES & SOME MENTION WILL BE MADE OF THESE WHERE APPLICABLE.

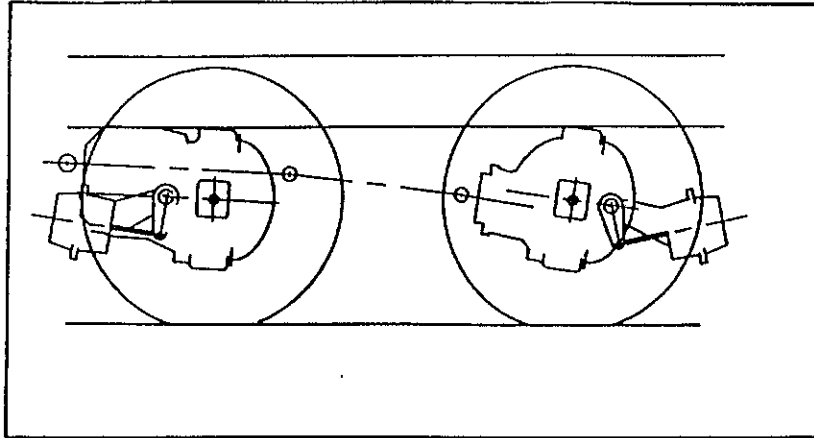
PACKAGING:

CONSIDERING THE TYPICAL TANDEM DRIVE AXLE SUSPENSION, WE ARE IMMEDIATELY PRESENTED WITH CERTAIN CONSTRAINTS.



A CHASSIS COMPRISING 2 CHANNEL SECTIONS, OF PREDETERMINED WIDTH ACROSS & A SET DISTANCE FROM THE GROUND. THE WIDTH ACROSS CAN BE FROM 794 mm (31.25") FOR EUROPEAN TRUCKS, AROUND 864 mm (34") FOR MOST USA TRUCKS . 965 mm (38") FOR THE OLDER ATKINSONS & 1016 mm (40") ON THE EARLIER ERF TRUCKS..

DUAL TYRES GENERALLY HAVE A WIDTH BETWEEN THE WALLS OF AROUND 1220 mm (48") LEAVING A GAP BETWEEN THE TYRES & CHASSIS WHICH CAN VARY BETWEEN 212 mm (8.26") & 100 mm ( 4") SO, ANY SPRING MUCH WIDER THAN 76 mm (3") WILL PROBABLY HAVE TO BE MOUNTED UNDER THE CHASSIS SIDE RAILS IF IT IS TO HAVE UNIVERSAL APPLICATION.



DRIVE AXLES ARE GENERALLY SQUARE (OR CLOSE TO) ALTHOUGH QUITE A FEW ARE WERE ROUND IN SECTION.

BRAKES ARE GENERALLY AIR / MECHANICAL & THE S-CAM OR WEDGE TYPE COMPONENTS TOGETHER WITH THE AIR/SPRING CHAMBERS ARE FREQUENTLY MOUNTED WITH LITTLE REGARD FOR ANY SUSPENSION ATTACHMENTS. NO DOUBT THE SUPPLIERS OF BRAKE EQUIPMENT CONSIDER THAT SUSPENSIONS ARE POSITIONED WITH LITTLE REGARD FOR BRAKES.

#### SPRINGING

SPRINGING IS REQUIRED ON THE MAJORITY OF TRUCKS TO ABSORB OR CUSHION ROAD SHOCKS & FOR SPRINGING WE HAVE A CHOICE OF ELASTIC MATERIALS, ALL OF WHICH ARE UTILISED EITHER SEPARATELY OR IN COMBINATION WITH ANOTHER MEDIUM.

SOME DEGREE OF DAMPING IS REQUIRED & THIS MAY BE MERELY THE INTERLEAF FRICTION OF STEEL LEAF SPRINGS OR THE USE OF HYDRAULIC SHOCKABSORBERS.

#### STEEL

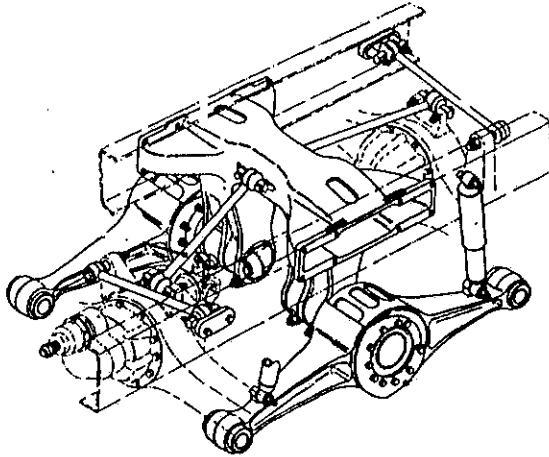
UNDOUBTABLY, STEEL IS STILL THE MOST COMMON SPRINGING MATERIAL USED IN THE SUSPENSION OF HEAVY TRUCKS. THE TENSILE PROPERTY, AS USED IN THE BENDING OF STEEL LEAF SPRINGS STILL MAKES GOOD COMMERCIAL & TECHNICAL SENSE FOR A WIDE RANGE OF APPLICATIONS & OPERATORS. AND, WE TEND TO BE A CONSERVATIVE INDUSTRY.

STEEL CAN BE USED IN TORSION BUT WITH ONE EXCEPTION IS NOT USED FOR HEAVY TRUCKS ALTHOUGH THERE ARE MANY EXAMPLES OF TORSION BAR SPRINGING IN PASSENGER & LIGHT COMMERCIAL VEHICLES.

COIL SPRINGS ARE NOT USED IN HEAVY TRUCK SUSPENSIONS, MAINLY BECAUSE OF THE PACKAGING CONSTRAINTS REFERRED TO EARLIER.

## RUBBER

RUBBER CAN BE COMPRESSED OR PUT IN SHEAR OR A COMBINATION OF THE TWO. ONE SUSPENSION USED BY THE WHITE COMPANY FOR SOME TIME USED LARGE BUSHES WHICH PUT THE RUBBER IN TORSION.



Torilastic Rubber Suspension

ALMOST ALL SUSPENSIONS USE RUBBER BUSHINGS IN LINKS & CONTROL ARMS & THESE ADD A LEVEL OF COMPLIANCE IN BOTH COMPRESSION & TORSIONAL MODES. IN TENSION, RUBBER HAS LIMITATIONS WHICH DO NOT SUIT SUSPENSION APPLICATIONS.

## COMPOSITES

GLASS REINFORCED PLASTICS, KEVLAR & OTHER EXOTIC MATERIALS ARE MOVING INTO OUR INDUSTRY AS A COMPETITOR FOR STEEL LEAF SPRINGS IN SOME APPLICATIONS. THEY OFFER SUBSTANTIAL WEIGHT SAVINGS BUT CURRENTLY HAVE A PRICE PENALTY & ARE NOT THE SORT OF ITEM EASILY REPAIRED IN THE OUTBACK .

THEY WILL HOWEVER GAIN MARKET SHARE, CERTAINLY IN TRAILER RATHER THAN DRIVE AXLE APPLICATIONS ALTHOUGH EVEN THERE THEY WILL MAKE INROADS.

## AIR

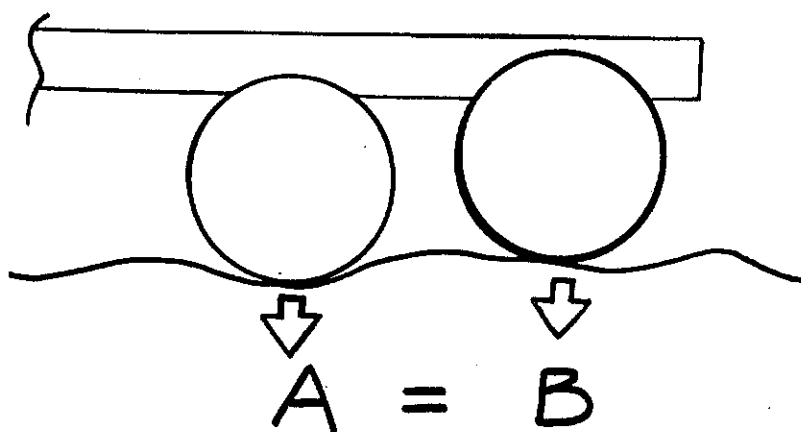
AIR SPRINGS HAVE COME & GONE MORE THAN ONCE ON TRUCK SUSPENSIONS BUT WE ARE NOW SEEING A RETURN OF AIR WITH NEW SUSPENSION DESIGNS THAT ARE TAKING OFF IN THE MARKET LIKE NEVER BEFORE.

THE DEVELOPMENTS MADE IN THE BUS INDUSTRY OVER THE PAST FEW YEARS HAVE CONTRIBUTED GREATLY TO THE CURRENT TECHNOLOGY BEING APPLIED TO HEAVY TRUCKS & TRAILERS.

SUMMARISING SPRING MATERIALS, WE HAVE THE FOLLOWING:

STEEL	INDIVIDUALLY
RUBBER	OR
COMPOSITES	COMBINED
AIR	

LOAD SHARING

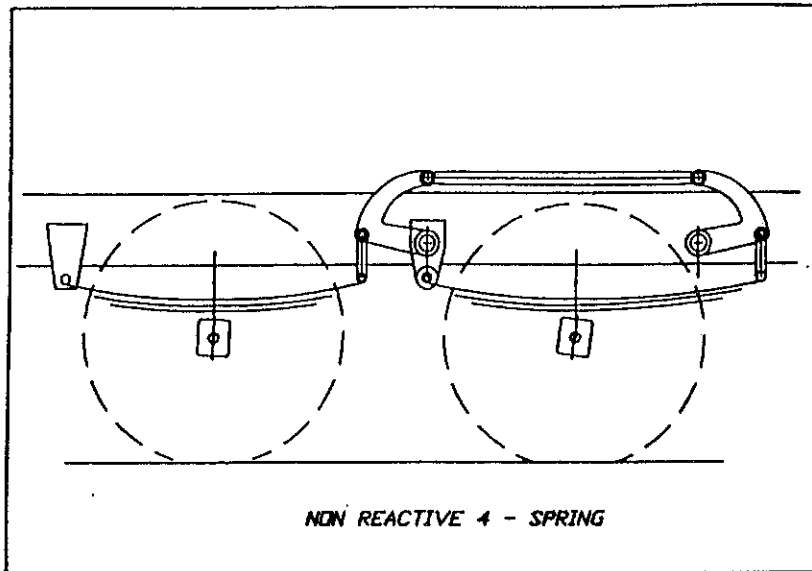


LOAD SHARING IS NOT ONLY DESIRABLE BUT IT IS A LEGAL REQUIREMENT IN MOST COUNTRIES THAT TANDEM SUSPENSIONS SHARE THE IMPOSED LOADS EQUALLY (OR CLOSE TO EQUALLY) BETWEEN THE AXLES.

STATIC LOAD SHARING IS ACHIEVED WITHOUT MUCH DIFFICULTY USING A VARIETY OF MECHANISMS.

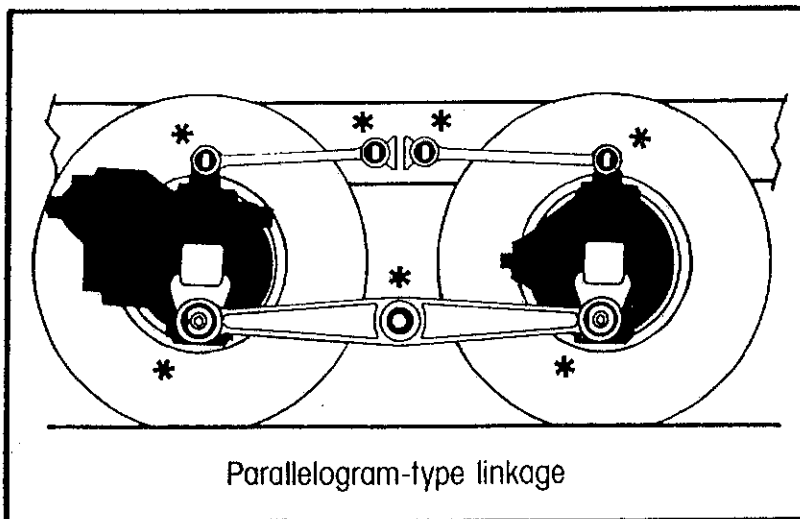
DYNAMIC LOAD SHARING WILL DEPEND ON THE EFFICIENCY OF THE MECHANISM, ON HOW REACTIVE THE SUSPENSION IS & THE DYNAMICS OF THE UNSPRUNG MASS

FOR SOME APPLICATIONS, IE 6X2 LAZY AXLES UNITS, A DEGREE OF LOAD TRANSFER BIAS TO THE DRIVE AXLE DURING ACCELERATION IS AN ADVANTAGE. THIS SUBJECT DEALT WITH IN THE ARRB PAPER PRESENTED TO THE IRTE NZ LAST YEAR BY JAN TSO.



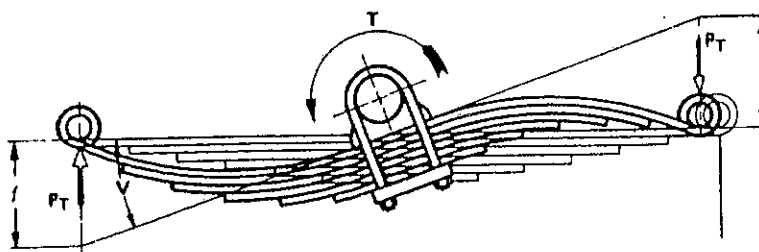
SUSPENSIONS WHICH ARE NON REACTIVE GENERALLY USE ADDITIONAL CONNECTING LINKS LIKE THE SET SHOWN ABOVE.

POWER TRANSMISSION



A DRIVE AXLE SUSPENSION HAS TO CONTROL AXLE DRIVING & BRAKING TORQUES & THIS CAN BE VIA UPPER & LOWER CONTROL ARMS (TORQUE RODS) OR BY SPRING ATTACHMENTS OR A COMBINATION OF THE TWO.

IF THE SPRING ALONE IS USED, CONSIDERATION HAS TO BE GIVEN TO THE AMOUNT OF SPRING WIND UP THAT MAY OCCUR & HOW MUCH CAN BE TOLERATED BY THE SPRINGS..

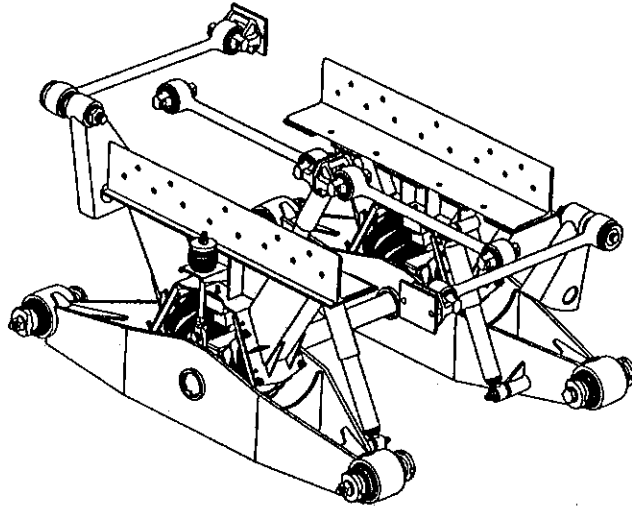


## LATERAL LOADS:

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SIDE LOADING FROM CORNERING & ROAD CAMBERS ARE OFTEN RESTRAINED BY THE SPRINGS BUSHES & FRAME HANGERS ALONE. FOR SOME APPLICATIONS TRANSVERSE RODS, PANHARD ROD OR AN UPPER WISHBONE IS USED.

## **HENDRICKSON** HN Series Premium Rubber



TRANSVERSE RODS ARE AN OPTIONAL ADDITION TO SOME SUSPENSIONS, SUCH AS THE HENDRICKSON RT - SERIES WHERE SIGNIFICANT IMPROVEMENT IN RUBBER CENTRE BUSH LIFE IS GAINED. ON OTHER SUSPENSION TYPES LIKE THE HENDRICKSON HN - 460 OR HA - SERIES AIR SUSPENSIONS THE TRANSVERSE ROD IS A STANDARD FEATURE.

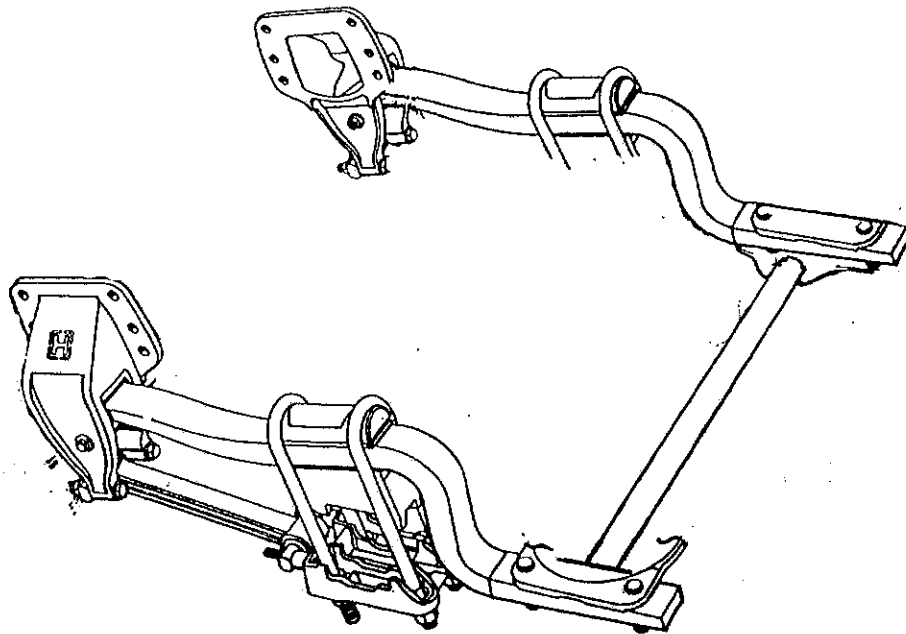
## COMFORT & ROLL STABILITY

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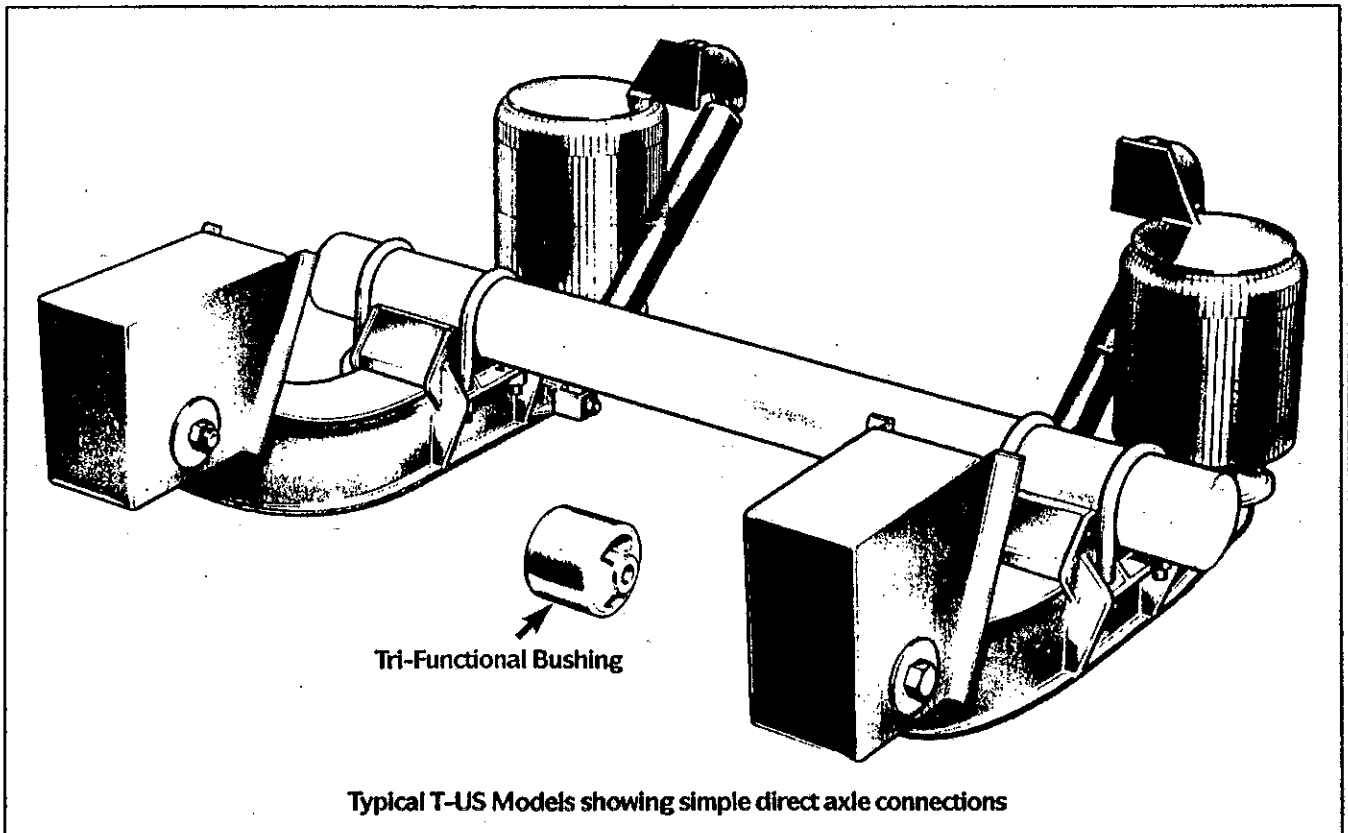
SUSPENSIONS WITH RELATIVELY STIFF SPRINGS WHICH ARE PINNED AT ONE END, GENERALLY HAVE SUFFICIENT BUILT IN ROLL RESISTANCE.

THE MOVE TO SOFTER SUSPENSIONS, PARTICULARLY WITH AIR SPRINGING HAS MEANT THAT ROLL CONTROL HAS TO BE DESIGNED INTO THE MECHANISM. THIS CAN BE AS PART OF THE SUSPENSION STRUCTURE OR AS A SEPARATELY ADDED ANTI ROLL BAR, SUCH AS ARE USED ON COMMONLY ON STEER AXLES.





WITH THE HENDRICKSON HA SERIES DRIVE AXLE SUSPENSION, THE CROSS TUBE CONNECTING THE MAIN SUPPORT MEMBERS AT THE REAR COMBINED WITH AXLE ATTACHMENTS, PROVIDE SUFFICIENT DEGREE OF ROLL STIFFNESS WHILST PERMITTING ADEQUATE CROSS ARTICULATION OF THE AXLES.



ANOTHER METHOD OF ACHIEVING THE SAME THING IS SEEN IN THE HENDRICKSON TRAILER AXLE AIR SUSPENSION, THE HT SERIES. HERE THE TRAILING ARMS ARE RIDGID MEMBERS & ARE RIDGIDLY ATTACHED TO THE TRAILER AXLE TUBE. COMPLIANCE FOR THE CROSS AXLE ARTICULATION IS PROVIDED BY DEFLECTION WITHIN THE RUBBER OF THE TRI FUNCTIONAL PIVOT BUSH.

## LIGHTWEIGHT, DURABILITY & SERVICEABILITY

IDEALLY, A SUSPENSION SHOULD HAVE A MINIMUM OF MOVING PARTS WHIST PERFORMING ALL THE REQUIRED MOVEMENT FUNCTIONS . GREASING & MAINTENANCE REQUIREMENTS SHOULD BE KEPT TO A MINIMUM.

REPLACING WORN PARTS SHOULD BE POSSIBLE WITH A REASONABLY EQUIPPED WORKSHOP & REPLACEMENT PARTS SHOULD BE QUICKLY & ECONOMICALLY AVAILABLE THROUGHOUT THE REGION IN WHICH THE TRUCK IS OPERATING.

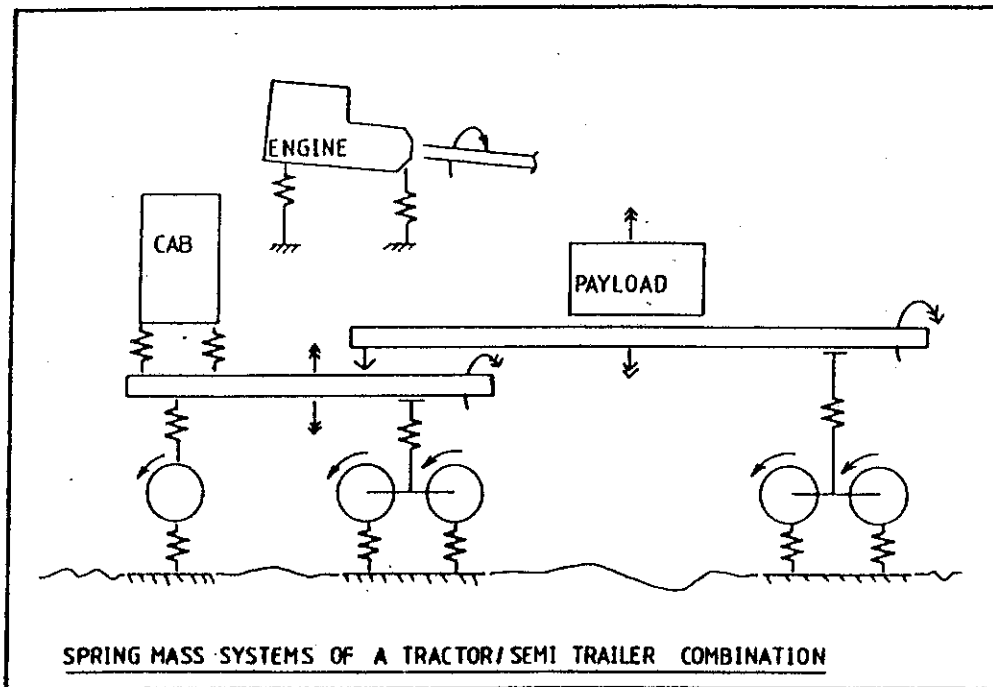
FOR MAXIMUM PAYLOAD THE SUSPENSION SHOULD BE AS LIGHT AS POSSIBLE, WHILST PERFORMING THE REQUIRED FUNCTIONS OF THE APPLICATION.

## ON RIDE GENERALLY

ON RIDE COMFORT LEVELS, MUCH HAS BEEN WRITTEN & THE TENDENCY IS TO ASSUME THAT SOFTER SPRINGING, PARTICULARLY THE USE OF AIR SUSPENSIONS WILL RESOLVE ALL PROBLEMS RELATED TO A HARSH RIDE.

RIDE NOISE, VIBRATION & HARSHNESS CAN RANGE FROM MINOR IRRITATIONS TO THE DRIVER THROUGH TO MAJOR DISTURBANCES WHICH MAY INJURE DRIVERS, DAMAGE FREIGHT & SHAKE THE TRUCK TO PIECES.

WHILST RIDE COMFORT OBVIOUSLY WILL BE RELATED TO SUSPENSION CHARACTERISTICS, THERE ARE A NUMBER OF OTHER INDEPENDANT & RELATED FACTORS WHICH HAVE INPUT.



THE TRUCK CHASSIS, BEING OF NECESSITY A FLEXIBLE BEAM, WILL DEFLECT UNDER LOAD & IS THEREFORE ITSELF A SPRING. CHASSIS BEAMING IS A COMMON CAUSE OF CAB PITCHING.

THE DRIVERS CAB & SLEEPER BOX IS MOUNTED TO THE CHASSIS WITH VARIOUS LEVELS OF SPRINGING, ACCORDING THE THE TRUCK MANUFACTURERS IDEAS ON THE SUBJECT.

THE ENGINE/TRANSMISSION MASS IS SUSPENDED WITHIN THE CHASSIS, HAS UNBALANCED DYNAMICS OF ITS OWN & CAN BE TRANSMITTING 450 OR MORE HP, THROUGH THE AXLES & WITH A LITTLE SUPPORT FROM THE SUSPENSION, ON TO THE ROAD

TYRES DEFLECT UNDER LOAD & HAVE A NATURAL FREQUENCY WHICH CAN INTERACT WITH THE SUSPENSION.

THE STEER AXLE SUSPENSION, BEING CLOSEST TO THE DRIVERS BODY AND CONNECTED TO THE FIRST SET OF WHEELS WILL BE FIRST IN THE FIRING LINE FOR ALL ROAD DISTURBANCES & WILL INTERACT WITH THE REAR SUSPENSION.

BEHIND THE TRACTOR UNIT MAY BE A TRAILER WITH ITS OWN FLEXIBLE CHASSIS, DEFLECTING BOTH AS A BEAM & TORSIONALLY & AT ITS BACK END IT WILL HAVE ANOTHER SUSPENSION & AXLE SYSTEM.

SO THE WHOLE VEHICLE CAN BE CONSIDERED AS A NUMBER OF SPRING MASS SYSTEMS & SUBSTANTIAL ROTATING MASSES WITH QUESTIONABLE BALANCE & CONCENTRICITY. ADD TO THIS A RANDOM VERTICAL INPUT FROM THE ROAD SURFACE & A DRIVER TRAVELLING TOO FAST .

#### MECHANISMS & SPECIFIC SUSPENSION TYPES:

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THE MAJOR TRUCK MANUFACTURERS REPRESENTED IN THE AUSTRALIAN & NEW ZEALAND MARKETS GENERALLY USE ONE OF THE FOLLOWING SUSPENSION TYPES WITH A COUPLE OF EXCEPTIONS WHICH WILL BE MENTIONED:

4 SPRING	STEEL LEAF SPRING
WALKING BEAM	ALL SPRING TYPES
6 ROD	STEEL SPRING
TRAILING ARM	AIR

## 4 SPRINGS:

WITH THE MAJORITY OF 4 SPRING DESIGNS, THE SPRINGS ON EACH AXLE ACT WITH A CENTRAL EQUALISER BEAM TO SHARE THE LOAD & PROVIDE AXLE ARTICULATION.

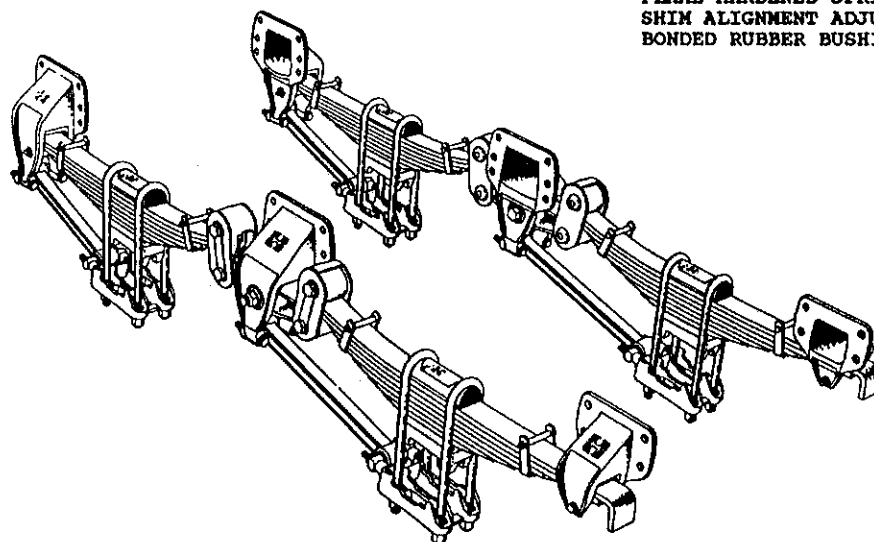
WHILST MOST TRAILER SUSPENSIONS HAVE THE SPRING END RUBBING AGAINST A PAD ON THE EQUALISER, LATER DRIVE AXLE 4 SPRING SUSPENSIONS USE A SHACKLE SYSTEM WHICH REDUCES WEARING PARTS IN THIS AREA.

**HENDRICKSON**  
Suspension

A Dan Company

### FEATURES

BAR PIN TYPE TORQUE ROD ENDS  
FLAME HARDENED SPRING HANGERS  
SHIM ALIGNMENT ADJUSTMENT  
BONDED RUBBER BUSHINGS



### BENEFITS

LIGHTWEIGHT 410 kg  
LOW MAINTENANCE  
GOOD RIDE

**H E4 SERIES**  
Four Spring

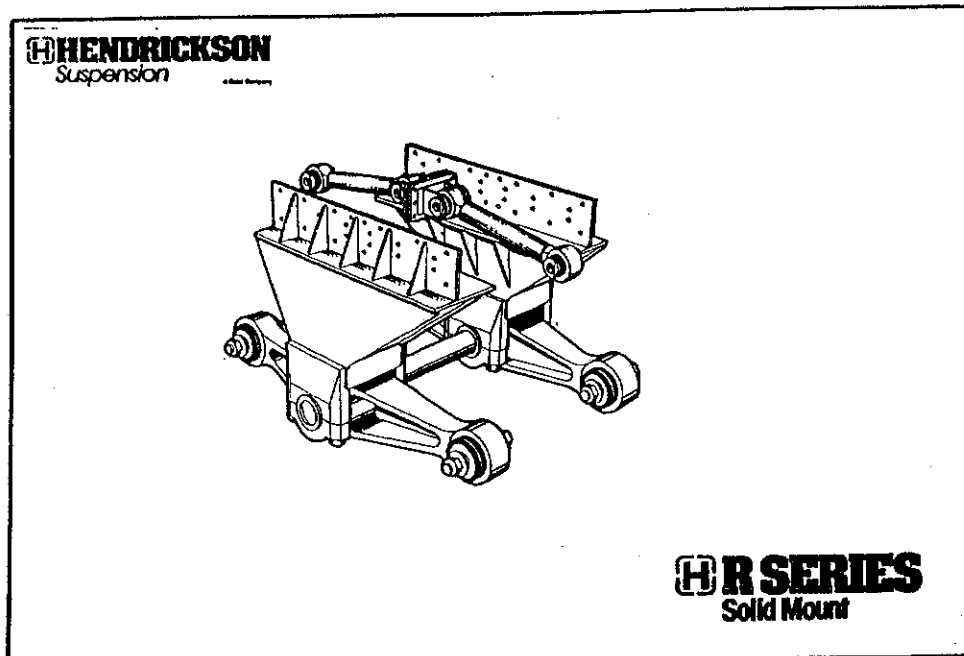
## WALKING BEAM SUSPENSIONS:

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HENDRICKSON HAVE USED THE ONE BASIC WALKING BEAM DESIGN WITH ALL OF THE SPRING TYPES MENTIONED WITH THE EXCEPTION OF COMPOSITE MATERIALS.

### R - SERIES

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THE R - SERIES SOLID MOUNT HAS NO SPRINGS AT ALL . IT HAS BEAMS WHICH PROVIDE FULL LOAD SHARING & ARTICULATION. THE R - SERIES IS AVAILABLE IN ALMOST UNLIMITED CAPACITIES & IS STILL WIDELY USED FOR HEAVY DUTY CRANE CARRIERS WHERE MAXIMUM ROLL STABILITY IS AN ESSENTIAL REQUIREMENT & SUFFICIENT SPRINGING IS PROVIDED BY THE PNEUMATIC TYRES..

### RT - SERIES

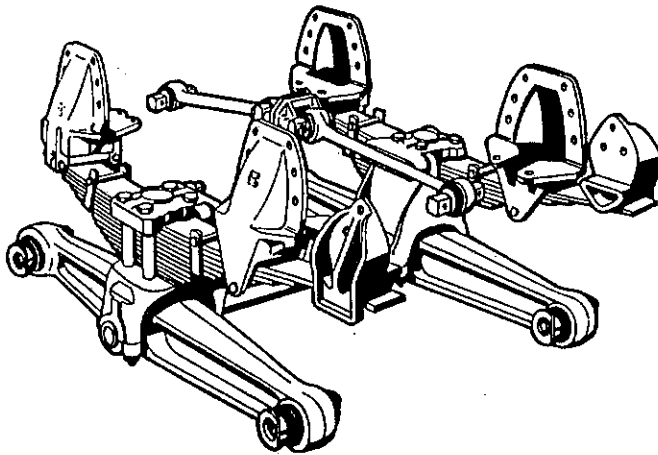
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WITH FEW EXCEPTIONS THE MOST WIDELY KNOWN & SUCCESSFUL WALKING BEAM SUSPENSION IS THE HENDRICKSON AS TYPIFIED BY THE RT - 380 . IN VARIOUS FORMS THE RT - SERIES HAS BEEN AROUND SINCE ITS INCEPTION IN 1926 . THE BASIC PRINCIPLE THAT MADE IT GOOD THEN STILL APPLIES, IN SOME WAYS IT IS GOING TO BE AS HARD TO COMPLETELY REPLACE AS THE WHEEL.

**HENDRICKSON**  
Suspension  
A B&W Company

**FEATURES:**

4 POINT FRAME MOUNTING  
TWIN CLAMP SPRING HANGER  
RANGE OF SPRING OPTIONS  
HEAVY DUTY BEAM END CONNECTION  
FORGED STEEL BEAM

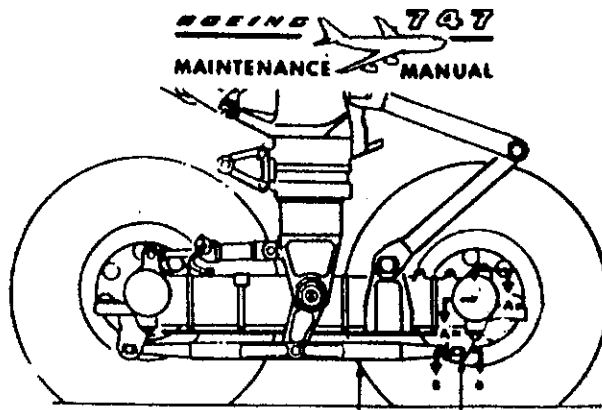


**BENEFITS:**

MEDIUM WEIGHT (550kg)  
LOW MAINTENANCE  
FULL ARTICULATION  
WIDE INDUSTRY ACCEPTANCE  
APPLICATIONS - GENERAL PURPOSE ON/OFF HIGHWAY

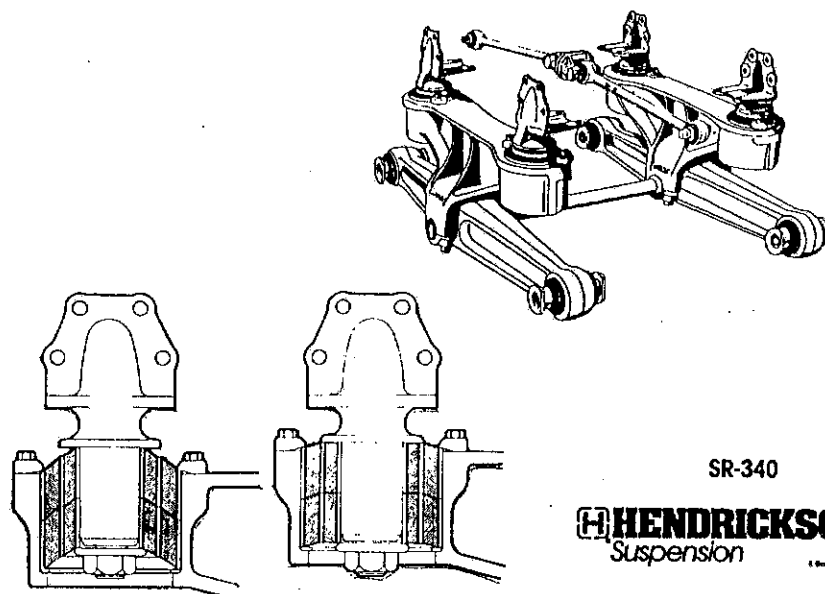
**RT - RTE SERIES**  
Heavy Duty Steel Leaf

THE CURRENT HENDRICKSON RT - 380 SUSPENSION FEATURES ARE OUTLINED ABOVE.



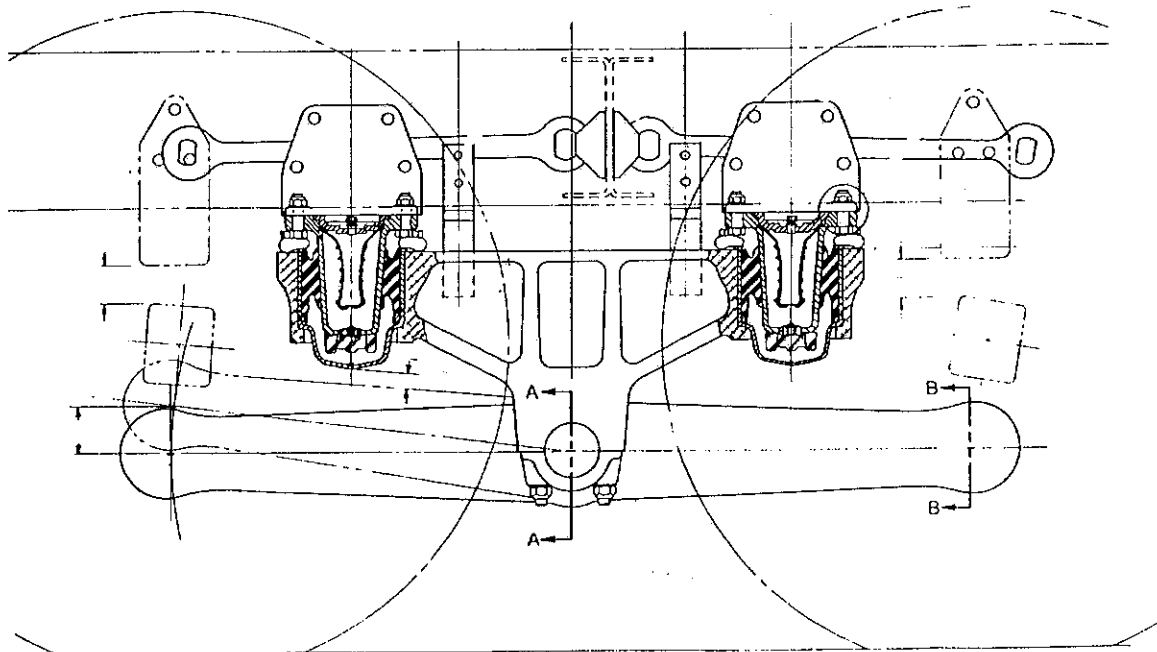
FOR THOSE WHO MAY CONSIDER THE WALKING BEAM PRINCIPLE HAS HAD ITS DAY, CONSIDER THE LANDING GEAR OF THE B 747 AIRCRAFT. IT USES BEAMS FOR LOAD SHARING & ARTICULATION WHEN IT PUTS DOWN 286 TONNES THROUGH 18 TYRES AT 320 KM/HR.

SHEAR RIDE SR - SERIES



RUBBER IN SHEAR WAS USED IN THE SR ( SHEAR RIDE ) SUSPENSION SHOWN HERE .

RUBBER/AIR V4 - SERIES

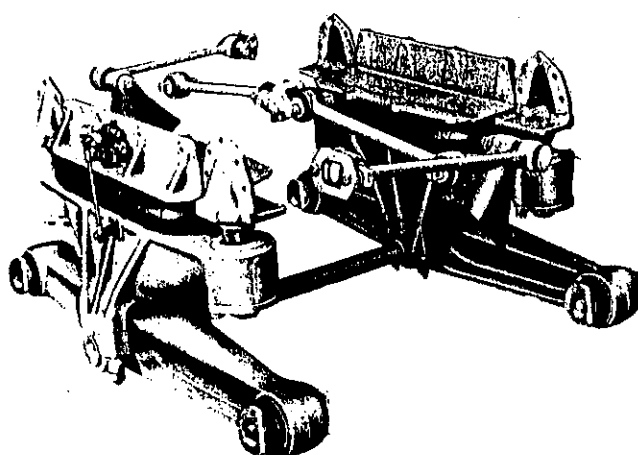


A STILL AVAILABLE & LIGHTWEIGHT HIGHWAY DEVELOPMENT OF THE SR IS THE V4 - 380 SUSPENSION WHICH USES RUBBER IN SHEAR TOGETHER WITH AIR FOR SPRINGING. FLUID SURROUNDING THE AIR SACK IS TRANSFERRED BETWEEN TWO CHAMBERS DURING DEFLECTION OF THE SPRING MODULE WHICH GIVES BUILT IN HYDRAULIC SHOCK ABSORBING.

AIR AR - SERIES  
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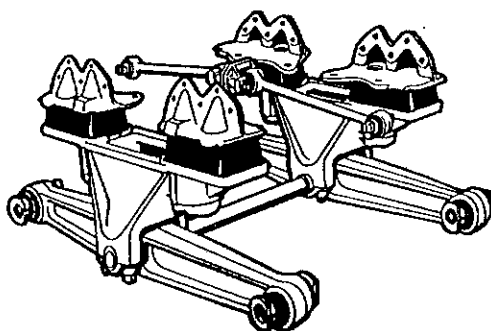
### Hendrickson "Air-Ride"

- Maintains constant height—at all load conditions.
- Drive line angles are constant
- Cushioned ride—loaded, partial, or empty
- Light weight—no lubrication



THE HENDRICKSON AR - SERIES WHILST ENJOYING A GOOD MARKET SHARE SOME YEARS AGO IN THE USA WAS NOT INTRODUCED INTO THE AUSTRALIAN MARKET MAINLY BECAUSE OF THE LONG RUNNING SUCCESS OF THE RT - SERIES & IT IS NOW REPLACED BY THE HA - SERIES.

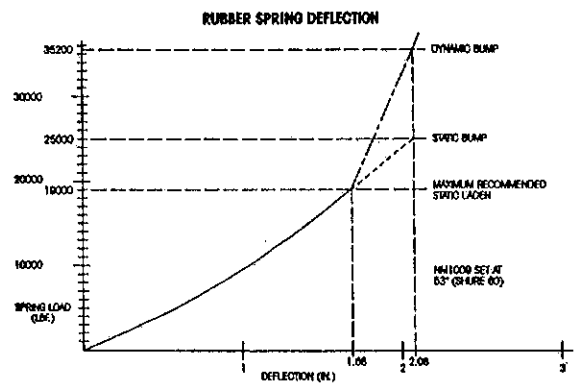
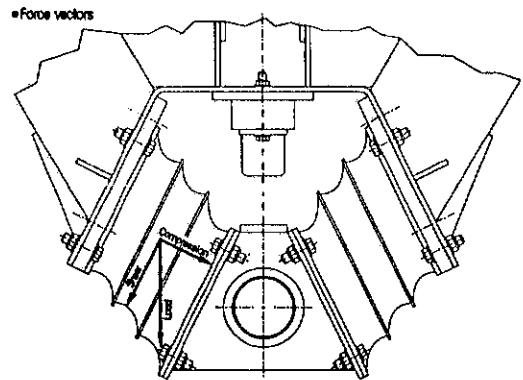
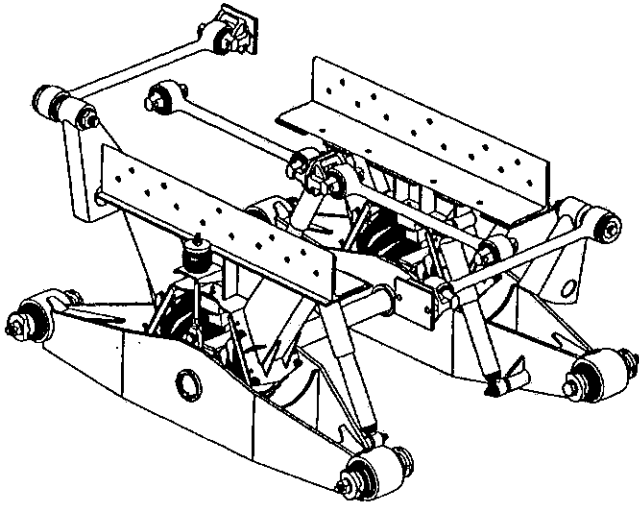
RUBBER IN COMPRESSION RS - SERIES  
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THE RS - SERIES IN ITS 450 VERSION STILL HAS A PLACE IN THE MARKET WITH ITS LIGHT WEIGHT & HIGH DURABILITY. THE RUBBER IN COMPRESSION PROVIDES GOOD ROLL STABILITY & A ROBUST SPRINGING MEDIUM.



**HENDRICKSON**  
HN Series Premium Rubber



THE HN - 460 SUSPENSION TAKES ADVANTAGE OF THE COMBINED PROPERTIES OF RUBBER IN BOTH COMPRESSION & SHEAR. ITS FEATURES & BENEFITS ARE SHOWN ON ABOVE. THE HN - 460 IS RAPIDLY BECOMING AN INDUSTRY STANDARD SUSPENSION FOR WASTE COMPACTORS IN THE USA & EUROPE & MORE AUSTRALIAN OPERATORS ARE MOVING IN THE SAME DIRECTION.

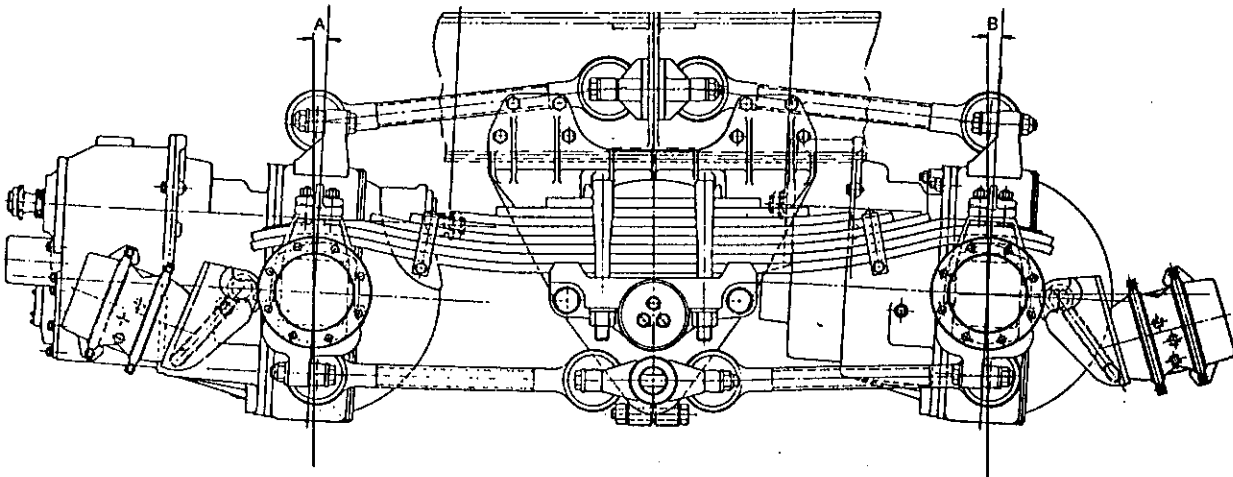
**TORSION BARS**

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THE ONLY HEAVY TRUCK SUSPENSION WITH TORSION BAR SPRINGING IS PRODUCED BY KENWORTH & USED EXCLUSIVELY ON THEIR OWN TRUCKS.

## SIX ROD OR TRUNION MOUNT SUSPENSIONS

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MANY TRUCK MANUFACTURERS PRODUCE A SIX ROD SUSPENSION FOR THEIR OWN USE. THE MOST WELL KNOWN NON PROPRIETARY 6 - ROD AVAILABLE IS PRODUCED BY ROCKWELL IN A RANGE OF CAPACITIES FOR DIFFERENT APPLICATIONS.

## MACK CAMEL BACK

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MACK HAVE A SUSPENSION, KNOWN AS THE CAMEL BACK, BECAUSE OF THE SPRING SHAPE. IT IS SIMILAR TO A 6 ROD EXCEPT THAT THE AXLE IS ATTACHED TO THE SPRING ENDS TO PROVIDE LONGITUDINAL LOCATION & THIS DOES AWAY WITH THE LOWER 4 RODS AS USED ON A 6 ROD.

## AIR SUSPENSIONS

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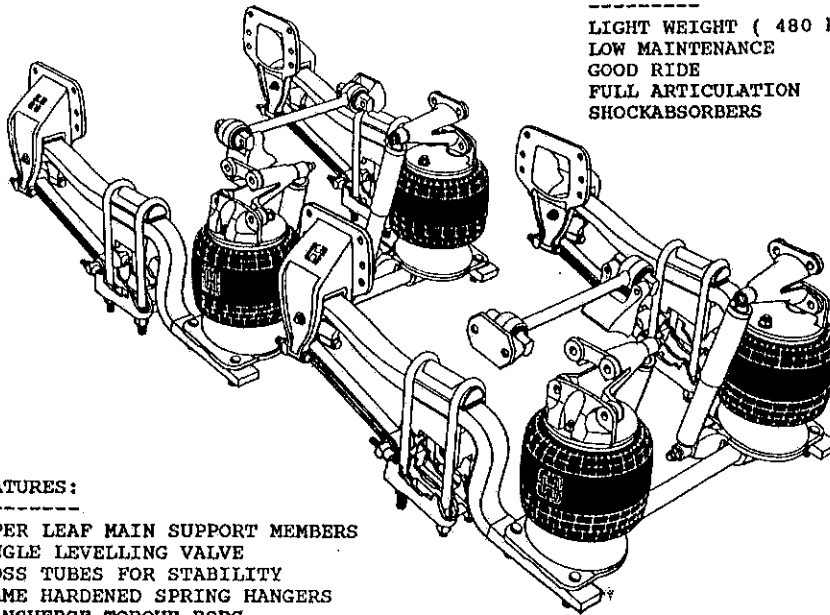
EXCLUDING THE HENDRICKSON AIR WALKING BEAM AIR SUSPENSION REFERRED TO EARLIER, THE MAJORITY OF CURRENT AIR SUSPENSION DESIGNS USE A TRAILING ARM OF ONE TYPE OR ANOTHER AS THE MAIN SUPPORT MEMBER CONNECTING THE AXLES TO THE CHASSIS.

**HENDRICKSON**  
Suspension  
A Bocar Company

**HA SERIES**  
Air Ride

**BENEFITS:**

LIGHT WEIGHT ( 480 kg ) INCLUDING SHOCKABSORBERS  
LOW MAINTENANCE  
GOOD RIDE  
FULL ARTICULATION  
SHOCKABSORBERS



**FEATURES:**

TAPER LEAF MAIN SUPPORT MEMBERS  
SINGLE LEVELLING VALVE  
CROSS TUBES FOR STABILITY  
FLAME HARDENED SPRING HANGERS  
TRANSVERSE TORQUE RODS  
SHOCKABSORBERS

THE HA - SERIES AIR SUSPENSION IS DESIGNED FOR OPTIMUM PERFORMANCE FOR HIGHWAY OPERATIONS WHERE RIDE IS A PRIME REQUIREMENT.

THE MAIN SUPPORT MEMBERS ARE FORMED AS A TAPER LEAF SPRING. THEY PROVIDE A SECONDARY SPRINGING FUNCTION & ACT AS THE MAIN STRUCTURAL MEMBER OF THE SUSPENSION FROM THE FRAME HANGER AT THE FRONT TO THE AIR SPRING LOWER ATTACHMENT AT THE REAR. THE MAIN SUPPORT MEMBERS IN CONJUNCTION WITH THE CROSS TUBES ALSO PROVIDE THE ROLL STABILITY WHILST HAVING SUFFICIENT COMPLIANCE FOR AXLE CROSS ARTICULATION.

ALL CASTINGS ARE HIGH GRADE NODULAR IRON FOR MAXIMUM STRENGTH & MINIMUM WEIGHT & THE CAM & LEG SURFACES OF THE FORWARD SPRING HANGER BRACKETS ARE SURFACE HARDENED TO REDUCE WEAR.

SHOCK ABSORBERS ARE STANDARD ON THE HA - SERIES AS ARE TRANSVERSE RODS, THESE NOT ONLY RESTRAIN LATERAL FORCE BUT RAISE THE EFFECTIVE ROLL CENTRE OF THE SUSPENSION & THEREFORE CONTRIBUTE TO ROLL STABILITY..

LONGITUDINAL TORQUE OR RADIUS RODS HAVE SHIMS AT EACH END WHICH PROVIDE THE FACILITY FOR EASY AXLE ALIGNMENT AT EACH WHEEL.

A MAJOR APPLICATION FEATURE OF THE HA - SUSPENSION IS THAT IT CAN BE A SINGLE AXLE SUSPENSION OR OF COURSE IN ANY MULTIPLE OF AXLES.

THE FIRST HA - INSTALLATIONS IN THE SOUTHERN HEMISPHERE WERE CARRIED OUT BY OUR AUCKLAND DISTRIBUTOR, TRANSCOM ENGINEERING & AN HA - 400 SUSPENSION IS DISPLAYED HERE BY TRANSCOM FOR YOUR INSPECTION.

## HORSES FOR COURSES

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BECAUSE OF THE WIDE RANGE OF APPLICATIONS, CONDITIONS & THE PREFERENCES OF SOME MANUFACTURERS & USERS, NO ONE SUSPENSION TYPE WILL BE IDEAL FOR EVERYTHING. A LIGHTWEIGHT 4 SPRING MAY BE IDEAL FOR A HIGHWAY TRACTOR HAULING A FUEL TANK ON HIGHWAY WITH LEGAL LOADS WHILST AN 8 WHEELER WITH A GARBAGE COMPACTOR WILL REQUIRE SOMETHING MORE ROBUST & PROBABLY HEAVIER TO SURVIVE. SOME OPERATORS WANT A VERSATILE SPECIFICATION TO SUIT A VARIED OPERATIONS & A MORE GENERAL PURPOSE SUSPENSION SUCH AS THE HENDRICKSON RT - 380 WILL THEN FIT THE BILL.

WE ARE GOVERNED BY REGULATION, WITH ISSUES RELATING TO ROAD DAMAGE, THE ENVIRONMENT & ABOVE ALL ROAD SAFETY. SOME BRIDGES HAVE LOWER THAN NORMAL LOAD LIMITATIONS WHICH IF IGNORED CAN HAVE CATASTROPHIC RESULTS.

SUSPENSIONS ARE AN ITEM OFTEN IGNORED BY OPERATORS AS OUT OF SIGHT & MIND.

CRISIS MAINTENANCE & THE USE OF LOOKALIKE REPLACEMENT PARTS INSTEAD OF GENUINE IS FORTUNATELY RARE WITH RESPONSIBLE OPERATORS & FLEETS BUT MANY WILL STILL TAKE RISKS TO SAVE A BUCK.

## THE FUTURE

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THERE WILL UNDOUBTABLY BE MORE USE OF EXOTIC MATERIALS, NOT ONLY COMPOSITES BUT WITH ALLOY STEELS COMBINED WITH THE LATEST IN DESIGN & PRODUCTION TECHNOLOGY. HENDRICKSON IS NOW PRODUCING TAPER LEAF SPRINGS IN HIGH GRADE STEELS WHICH BREAK NEW GROUND IN PERFORMANCE TO WEIGHT RATIOS.

WITH SOME NOTABLE EXCEPTIONS, SHOCK ABSORBERS HAVE LARGELY BEEN IGNORED ON TANDEM DRIVE AXLE SETS BUT THIS WILL CHANGE. SOME SPIN OFF FROM PASSENGER CAR TECHNOLOGY MAY OCCUR IN THIS AREA BUT THERE WILL BE LIMITS TO THIS. WE SHOULD ALL RECALL THE RISE & FALL OF DISC BRAKES ON TRUCKS SOME YEARS AGO. THEY MAY WELL RETURN BUT WE TEND TO BE A CONSERVATIVE INDUSTRY.

I PREDICT THAT THERE WILL BE 4 - SPRINGS, WALKING BEAMS, 6 - RODS WITH A VARIETY OF SPRINGING MATERIALS, PLUS AIR SUSPENSIONS FOR SOME YEARS TO COME.

THE HENDRICKSON COMPANY WITH OPERATIONS SPREAD ACCROSS THE WORLD IS COMMITTED TO LONG TERM EXCELLANCE IN THE DESIGN & PRODUCTION OF HEAVY TRUCK SUSPENSIONS.

I HOPE THAT THE BRIEF OVERVIEW GIVEN HAS BEEN OF INTEREST. IF IT ONLY PROMOTES QUESTIONS, DISCUSSION & INTERCHANGE OF IDEAS, THEN ONE OF THE OBJECTS OF THIS SEMINAR WILL HAVE BEEN ACHIEVED.