TYRE MANAGEMENT PLAN

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SYNOPSIS

The Paper reviews the major options available to an operator to reduce his tyre costs and looks at the cost structure from a different perspective than usual.

Some of the questions that are asked include:-

What position suits what tyre/retread?
How often should you retread?
Is my tyre supplier keeping up to date?

By following the principles laid down in the Paper the answers to these and other similar questions relating to your particular operation become apparent. By using the answers a practical plan can be formulated which will minimize your tyre costs and maximise vehicle utilization.

INTRODUCTION

WHAT ARE THE MAJOR FACTORS AFFECTING YOUR TYRE COSTS?

1) Operating Conditions -
   e.g. Speed, Distance, On or Off Road, Position

2) Number of Tread Lives -
   e.g. In their first life, First Retread ...., etc.

3) Reason they were Scrapped -
   e.g. Damaged, Failed, Old Age

4) Percent Worn When Scrapped -
   e.g. 25%, 50%, Worn Out

5) Relative Costs -
   e.g. New tyre price Vs Retread price

6) Driver Ability -
   e.g. Heavy foot, Conscientious, etc.

7) Type of Vehicle -
   e.g. Horsepower, Tandem Drive, Load, etc.

8) Type of Tyre -
   e.g. Radial vs Bias, Standard vs Premium

This paper will concentrate on the first five of these factors which must be controlled on a continuing basis if your tyre costs are to be kept to a minimum.

A careful review of each of them will provide information as to:-

a) The best tyres for your operation.
b) Where to position them on the vehicle.
c) How often they should be retreaded.
d) When they should be removed.

which can then be used to provide the lowest cost/km.

CONSIDER EACH FACTOR IN DETAIL:-

1) OPERATING CONDITIONS:

The more severe the service the greater the stress on the tyre - long distance, high speeds, heavy loads, and high horsepower are harder on your tyres and reduce the overall life expectancy of the carcass.

2) NUMBER OF TREAD LIVES:

Do those that have given the most retreads have the lowest cost? Are tyres failing early because you have placed them under too much stress for their age?

3) REASON THEY WERE SCRAPPED:

Analysis of tyres scrapped will identify:-

Poor maintenance
Use of wrong size/type
Poor quality new tyres
Poor quality retreads
Running tyres too far.

4) PERCENT WORN WHEN SCRAPPED:

Only a tyre that is scrapped at the very end of its tread life has given you the best value it is capable of providing.

5) RELATIVE COST:

The difference in cost between a retread and a new tyre will affect the overall savings and final cost/km. It does not however affect any of the principles under discussion.

COST STRUCTURE

To obtain the lowest cost/km it is necessary to understand the cost structure of new tyres and retreads and the effect on cost when a tyre is discarded. Let us assume the following:-

Cost of a new radial truck tyre is $500
Cost of a pre-cured retread is $200
Distance travelled per tread life is 50,000 Kms

And use the data in the following examples to illustrate in practical terms their effect on cost.

A) THE EFFECT OF MULTIPLE RETREADING ON COST/KM

TABLE "A"

TYRE TYPE	TYRE COST	CUMULATIVE COST	CUMULATIVE DISTANCE	COST PER KM	SAVINGS COST/KM	CUMULATIVE SAVINGS COST/KM	CUMULATIVE SAVINGS %
NEW	$500	$ 500	50,000Ks	1.00c	-	-	-
1st R/T	$200	$ 700	100,000Ks	0.70c	0.30c	0.30c	30%
2nd R/T	$200	$ 900	150,000Ks	0.60c	0.10c	0.40c	40%
3rd R/T	$200	$1100	200,000Ks	0.55c	0.05c	0.45c	45%
4th R/T	$200	$1300	250,000Ks	0.52c	0.02c	0.47c	48%

B) THE EFFECT ON COST IF ACTUAL NUMBER OF RETREADS PER CASING (i.e. NUMBER OF LIVES) IS LESS THAN BUDGETED (USING DATA FROM TABLE "A").

CASE I

BUDGETED PERFORMANCE
Two Lives - New tyre plus one retread. Cost/Km 0.70 cents

ACTUAL PERFORMANCE
One Life - New tyre only. Cost/Km 1.00 cents

EFFECT ON COST

Budgeted Cost/Km	Actual Cost/Km	Extra Cost/Km	X	Distance Run	=	Total Extra Cost
0.70c	1.00c	0.30c		50,000 Kms		$150.00

CASE II

BUDGETED PERFORMANCE

Three Lives - New tyre plus two retreads. Cost/Km 0.60 cents

ACTUAL PERFORMANCE

A) Two Lives - New Tyre plus one retread. Cost/Km 0.70 cents
B) One Life - New Tyre only. Cost/Km 1.00 cents

EFFECT ON COST

Budgeted Cost/Km	Actual Cost/Km	Extra Cost/Km	X	Distance Run	=	Total Extra Cost
A) 0.60c	0.70c	0.10c		100,000 Kms		$100.00
B) 0.60c	1.00c	0.40c		50,000 Kms		$200.00

CASE III

BUDGETED PERFORMANCE

Four Lives - New tyre plus three retreads. Cost/Km 0.55 cents

ACTUAL PERFORMANCE

A) Three Lives - New tyre plus two retreads. Cost/Km 0.60 cents
B) Two Lives - New tyre plus one retread. Cost/Km 0.70 cents
C) One Life - New tyre only. Cost/Km 1.00 cents

EFFECT ON COST

Budgeted Cost/Km	Actual Cost/Km	Extra Cost/Km	X	Distance Run	=	Total Extra Cost
A) 0.55c	0.60c	0.05c		150,000 Kms		$ 75.00
B) 0.55c	0.70c	0.15c		100,000 Kms		$150.00
C) 0.55c	1.00c	0.45c		50,000 Kms		$225.00

CASE IV

BUDGETED PERFORMANCE

Five Lives - New tyre plus four retreads. Cost/Km 0.52 cents

ACTUAL PERFORMANCE

A) Four Lives - New tyre plus three retreads. Cost/Km 0.55 cents
B) Three Lives - New tyre plus two retreads. Cost/Km 0.60 cents
C) Two Lives - New tyre plus one retread. Cost/Km 0.70 cents
D) One Life - New tyre only. Cost/Km 1.00 cents

EFFECT ON COST

Budgeted Cost/Km	Actual Cost/Km	Extra Cost/Km	X	Distance Run	=	Total Extra Cost
A) 0.52c	0.55c	0.03c		200,000 Km		$ 60.00
B) 0.52c	0.60c	0.08c		150,000 Km		$120.00
C) 0.52c	0.70c	0.18c		100,000 Km		$180.00
D) 0.52c	1.00c	0.48c		50,000 Km		$240.00

C) THE EFFECT ON COST IF THE FULL TREAD LIFE IS NOT RECEIVED.

Each time a new or retreaded tyre is put into service the operator incurs a significant capital cost - the benefits of which are only realized as the tyre wears. Because of this when a carcass is retreaded it must run for a calculable distance before the cumulative cost/km starts to show a savings over the actual cost/km achieved at the end of the previous tread life. The more often a carcass is retreaded the greater the percentage of wear that must be achieved before any additional savings eventuate.

This is better illustrated graphically as shown in Annex 1.

D) THE EFFECT ON COST OF EARLY REMOVAL OF TYRES TO ENSURE THEY ARE RETREADABLE.

The major reason for tyres being classified as "NWR" (Not Worth Retreading) is because they have been worn too far for the particular service conditions applicable to their operation. The effect on the carcass is to allow it to be damaged by stones, rock and other miscellaneous foreign material.

This type of damage can be minimised, and the carcass saved for retreading by removing it from service earlier, i.e. with more skid remaining.

Obviously there is a short term cost penalty in doing so but in the longer term there can be a far greater cost penalty if tyres are not removed early enough to ensure their retreadability.

Take the following example:-

COST PER MILLIMETRE OF TYRE SKID -

1.	New tyre -	Skid depth new	15mm
		Skid depth at removal	2mm
		Usable skid depth	13mm
		Total cost	$500.00
		Cost/mm skid	$ 38.50
2.	Retread -	Skid depth new	16mm
		Skid depth at removal	2mm
		Usable skid depth	14mm
		Total cost	$200.00
		Cost/mm skid	$ 14.50

Compare these figures with those from Clause "B" which shows that the dollar loss if a new tyre is not retreadable varies between $150.00 and $240.00 and for a retread the loss varies between $60.00 and $180.00.

Clearly it is better to leave an extra millimetre or two on the tyres when they are removed than to lose the carcasses for retreading.

E) THE EFFECT ON COST OF PLACING TYRES INTO SERVICE THEY ARE NOT CAPABLE OF HANDLING.

For best performance the age and condition of a tyre must be considered so they are not overstressed. To do this effectively it is necessary to have your retreads graded by the retreader along the following lines:-

GRADE	METHOD OF GRADING	PROPOSED USAGE
A	1st R/T, no repairs	All positions, all types of service
B	1st or 2nd R/T, no repairs but protector ply may have been removed.	Long haul drive wheel or trailer
C	3rd R/T and up to two repairs	Long haul trailer Short haul drive wheel
D	More than 3 R/T's and/or more than two repairs	Short haul trailer Within city drive wheel

N.B.: The grading method must remain constant however, the "Proposed Usage" can be tailored to suit individual operations.

Failure to follow this principle will undoubtedly lead to tyres having to be removed from service earlier than need be. The extra cost so incurred is impossible to quantify except in specific instances.

DATA ACQUISITION

To successfully "manage" your tyres and take advantage of the cost factors just examined it is necessary to start by:-

1. Carrying out a fleet tyre inspection
2. Initiate a comprehensive survey of every tyre that is discarded.

The information obtained from these surveys should be analysed in such a manner that you can compare it with the five basic effects on cost previously discussed.

Your tyre supplier should have the expertise to examine both your fleet and your discarded tyres, fill out the necessary forms and do the analysis for you. Attached are fairly standard forms (Annexes 2, 3, 4 and 5) that can be used for this purpose. To provide an example of what you can expect the forms in Annexes 4 and 5 have been completed in a typical manner. Looking at this data you can quickly see that:-

1. Although three tyres were on their fourth retread average retreads per tyre was only 2.00.

2. Only three tyres could be considered as worn out when they were scrapped.

3. Of the eight retreads scrapped only four were worn past the point where additional savings accumulate.

4. A 1st up retread was NWR because it was worn too far (poor maintenance).

5. Tyres on 3rd and 4th retreads fitted to drive wheels failed (overstressed).

6. A new tyre fitted to trailer failing from a puncture (poor selection).

Most fleet inspections would highlight similar areas of concern - particularly those relating to poor maintenance (pressure), mismatching and wrong positioning.

THE PLAN

Like most good plans it is simple.

1) Buy from a reputable tyre specialist and follow his advice.

2) Carry out a fleet inspection at least once a year.

3) Inspect every tyre that is discarded and analyse the results monthly.

4) Have all your retreads graded and specify where each grade is to be used.

5) Based on analysis of discarded tyres:-

   a) Decide how often you should attempt to retread your tyres.
   b) Decide how much remaining skid you should leave on your tyres when they are removed for retreading.

6) Keep your tyre supplier on his toes by running a programme of comparative testing of new designs and competitors' products - but be sure any such testing is carried out in such a way that the results are meaningful. (A suitable test form and related explanation is included in Annexes 6 and 7).

   Such testing should account for some 10% of your total tyres.

CONCLUSION

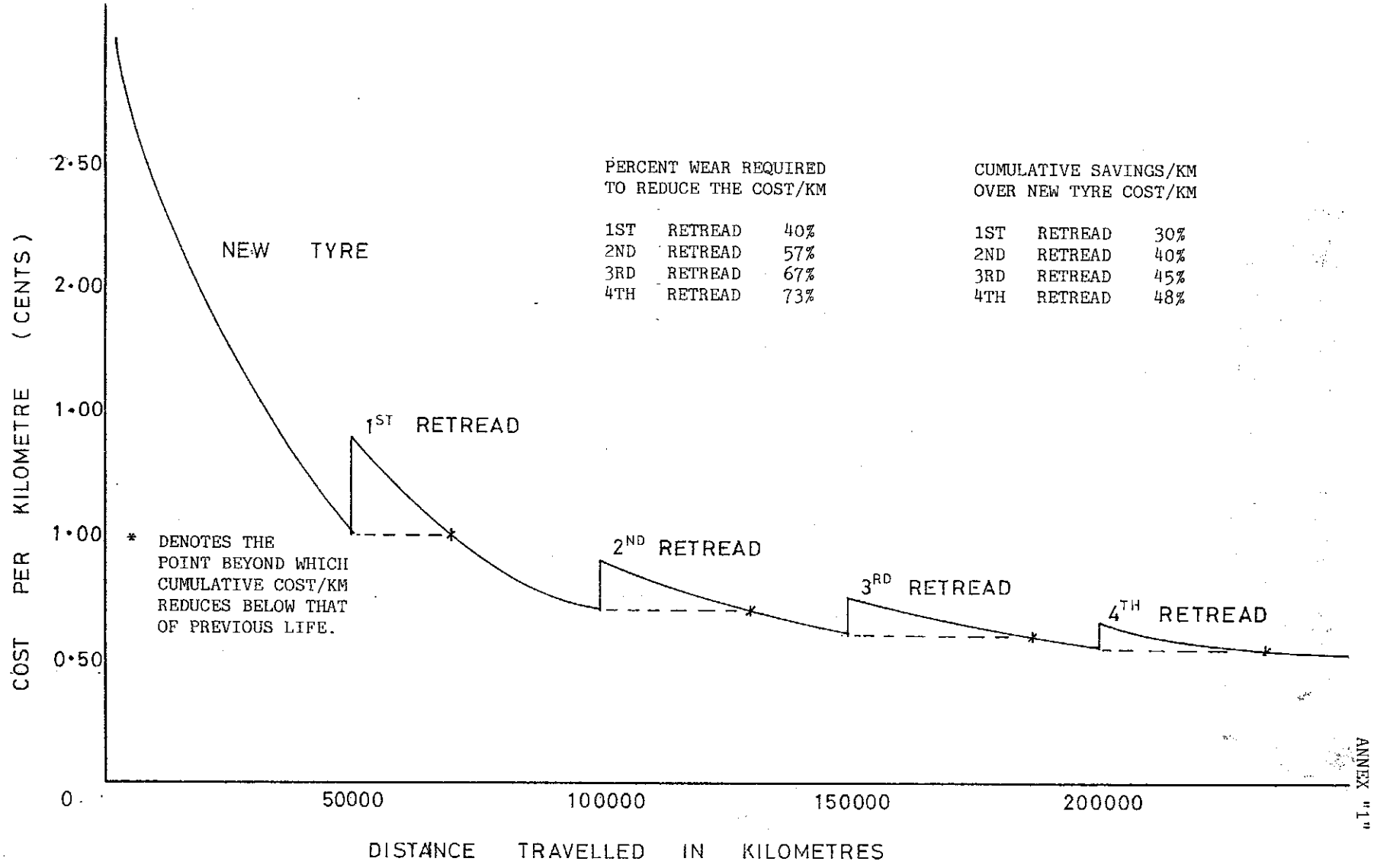
Much has been written on the use of individual tyre and/or vehicle records together with a suitable computer programme which will give you immediate access to up to the minute information on your tyre costs, analysed in any form you desire. Unfortunately such systems, which require a tremendous amount of input on a daily basis, do exactly what they say they do - namely provide up to the minute information on tyre costs - whereas what is needed is a plan to control and minimise your tyre costs.

By following the principles laid out in this paper and implementing the necessary regular inspections, together with a testing programme, you will have in place an effective **"Tyre Management Plan"** that will give you the ability to reduce your cost/Km down to the lowest level for your particular operation with the minimum amount of paperwork. It is a far more rewarding exercise than being able to quote the latest cost/Km figures.

R.N. Tillman

GRAPH SHOWING PERCENT WEAR THAT HAS TO BE ACHIEVED AFTER EACH RETREAD BEFORE CUMULATIVE COST/KM REDUCES BELOW THAT OF PREVIOUS LIFE.

PERCENT WEAR REQUIRED TO REDUCE THE COST/KM			CUMULATIVE SAVINGS/KM OVER NEW TYRE COST/KM		
1ST	RETREAD	40%	1ST	RETREAD	30%
2ND	RETREAD	57%	2ND	RETREAD	40%
3RD	RETREAD	67%	3RD	RETREAD	45%
4TH	RETREAD	73%	4TH	RETREAD	48%



ANNEX "1"

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FLEET TYRE INSPECTION

COMPANY _____ DATE _____

VEHICLE MAKE _____ FLEET No. _____

REGISTRATION No. _____ SPEEDO AND/OR HUB _____

TYRE SIZE FRONT _____

REAR _____

TRUCK

Tread .....
Code .....
.....
kPa
mm

CODES

1. Missing Valve Cap
2. Leaking Valve Core
3. Mismatched Duals
4. Misalignment
5. Irregular Wear
6. Remove for Retreading
7. Remove for Repair
8. Replace — Worn Out

A. New Tyre
B. Mold Cure
C. Pre Cure

RECOMMENDATIONS: .....

.....

.....

NAME: ..... STORE: .....

SPARE

Firestone
FLEET TYRE INSPECTION

COMPANY ____________________ DATE ____________________

VEHICLE MAKE ____________________ FLEET No. ____________________

REGISTRATION No. ____________________ SPEEDO AND/OR HUB ____________________

TYRE SIZE ______________________________

____

TRAILER

CODES

1. Missing Valve Cap
2. Leaking Valve Core
3. Mismatched Duals
4. Misalignment
5. Irregular Wear
6. Remove for Retreading
7. Remove for Repair
8. Replace — Worn Out

A. New Tyre
B. Mold-Cure
C. Pre-Cure

Tread .... | kPa / mm | kPa / mm | Tread ....
Code .... | | | Code ....
.... | | | ....

Tread .... | kPa / mm | kPa / mm | Tread ....
Code .... | | | Code ....
.... | | | ....

Tread .... | kPa / mm | kPa / mm | Tread ....
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Tread .... | kPa / mm | kPa / mm | Tread ....
Code .... | | | Code ....
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RECOMMENDATIONS: ....

....

....

SPARE

kPa / mm | Tread ....
Code ....
....

NAME: .... STORE: ....

Firestone
SCRAP TYRE REPORT

Prepared for ..XYZ TRANSPORT.....
..SPECIALIZING IN.....
..REFRIDGERATED CARGO.....

Prepared by: ....J.D. FRANK.....
Store: .....DUNEDIN..... Date: .....

Tyre/ Vehicle No.	Tyre Brand	Size	Bias/ Radial	Reason for Rejection	Possible Cause	% Worn	New Tyre/ Retread	No. R/Ts	Vehicle Position ~~Remarks~~
	WAT2000	11R 22.5	R	IMPACT BREAK	-	70	NEW	-	RF
	T315 T-R-T	11R 22.5	R	SEPARATION	CASING FAILURE	50	R/T	3	DRIVE
	UT T-R-T	11R 22.5	R	CUT	DAMAGE	65	R/T	1	TRAILER
	UT T-R-T	11R 22.5	R	REP FAILURE	-	85	R/T	4	TRAILER
	T315 T-R-T	11R 22.5	R	REP FAILURE	3 REPS IN TYRE	40	R/T	2	DRIVE
	UT T-R-T	11R 22.5	R	WORN TOO FAR		95	R/T	4	TRAILER
	T315 T-R-T	11R 22.5	R	SEPARATION	CASING FAILURE	35	R/T	1	DRIVE
	UT T-R-T	11R 22.5	R	SEPARATION	CASING FAILURE	60	R/T	4	TRAILER
	UT2000	11R 22.5	R	RUN FLAT	PUNCTURE	20	NEW	-	TRAILER
	T315 T-R-T	11R 22.5	R	NWR	EXCESSIVE CUTTING	100	R/T	1	DRIVE

ANNEX "4"

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SCRAP TYRE ANALYSIS

Prepared for: XYZ TRANSPORT SPECIALIZING IN REFRIDGERATED CARGO Date: .....

Total New Tyres Scrapped .....2.....= 20 %

Total Retreads Scrapped .....8.....= 80 %

Total Tyres Scrapped .....10.....=100 %

Average No. of Retreads per tyre = 2.00

CAUSE OF FAILURE SUMMARY

CONDITION	New Tyres		Mold Cure		Pre Cure	
	No.	%	No.	%	No.	%
Run Underinflated/Overloaded (flexbreak)	1					
Ply Separation						
Impact Break	1				1	
Cut or Damaged Beyond Repair Limits					1	
Repair Failure					2	
Worn Too Far	1				1	
Rim Damage					1	
Tread Separation (Heat)						
Tread Separation (Other)					2	

BRAND RETREADABILITY SUMMARY

CASING BRAND	CROSSPLY			RADIAL		
	No. of Tyres	No. of Caps	Ave Caps Per Tyre	No. of Tyres	No. of Caps	Ave Caps Per Tyre

Report Prepared by: .....

Firestone

TYRE COMPARISON RECORD

	PAIR 'A'		PAIR 'B'	
FIRM	POSITION	POSITION	POSITION	POSITION
TRUCK #	MAKE	MAKE	MAKE	MAKE
No. DRIVE AXLES	DESIGN	DESIGN	DESIGN	DESIGN
TYPE SERVICE	SERIAL No.	SERIAL No.	SERIAL No.	SERIAL No.
TIRE SIZE	CROWN RADIUS	CROWN RADIUS	CROWN RADIUS	CROWN RADIUS
PLY RATING	CROWN WIDTH	CROWN WIDTH	CROWN WIDTH	CROWN WIDTH
TYPE	OVERALL DIA.	OVERALL DIA.	OVERALL DIA.	OVERALL DIA.
RIM WIDTH	HARDNESS	HARDNESS	HARDNESS	HARDNESS
COMMENTS	DATE MOUNTED	DATE MOUNTED	DATE MOUNTED	DATE MOUNTED
	SPEEDO READING	SPEEDO READING	SPEEDO READING	SPEEDO READING
	REMOVAL REASON	REMOVAL REASON	REMOVAL REASON	REMOVAL REASON
	No. PUNCTURES	No. PUNCTURES	No. PUNCTURES	No. PUNCTURES
	RETREADABLE	RETREADABLE	RETREADABLE	RETREADABLE

DATE	SPEEDO	CUM KMS	SKID DEPTH 1	2	3	4	C R	PRESS	AV SKID	SKID DEPTH 1	2	3	4	C R	PRESS	AV SKID	2 TYRE AV	SKID DEPTH 1	2	3	4	C R	PRESS	AV SKID	SKID DEPTH 1	2	3	4	C R	PRESS	AV SKID	2 TYRE AV

ANNEX "6"

B4

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TRUCK TYRE TESTING PROCEDURE AND RECORD

APPLES AND APPLES

Comparative testing of different types and designs of truck tyres must be carried out so as to eliminate as many variables as possible. Ignoring even one can mean you are testing apples against oranges instead of apples against apples. By working to the following procedures you will eliminate these variables and end up with meaningful results.

Tread Design

Different tread designs have widely different wear characteristics. Always test comparable designs i.e.:—

Running Tread	Vs	Running Tread
Cross Rib	Vs	Cross Rib
Semi-Traction	Vs	Semi-Traction

Tyre Construction

Tyres must be of the same basic construction i.e. both bias or both radial. They should also be of the same ply rating and use the same material in the carcass.

Type of Service
a) Driver & Vehicle

It is imperative that the effect of both driver & vehicle be eliminated. This can be achieved in two ways:—

1) Run test over such a large number of trucks (25 to 30) that such variable is not significant.
2) Run separate test on individual trucks use both tyres you wish to compare on each truck.

Method 1) is not practical in most New Zealand operations.

Position

The position of the tyre on the truck affects the wear and must be overcome by regular rotation every 5000 to 10000kms.

Air Pressure

The same pressures must be kept. Even a 35kpa (5psi) difference will affect the result.

TESTING PROCEDURES

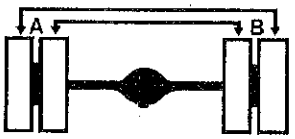
Now that the variables have been discussed and the methods to be followed to eliminate them we can carry on with the actual test procedures.

Mounting

Tyres should be mounted and inflated, then left for 24hrs before adjusting air pressure and measuring and recording the data as itemised in the tyre comparison section on the back. The skid depth measurement should be taken at two places 180 ° apart in each of the two major grooves adjacent to the centreline. This gives four readings which should be averaged as shown and further averaged over each pair. The diameters of the tyres must be within 6mm (20mm circumference).

Installing

Tyres should be fitted as matched pairs (if being run as duals) shown as 'A' and 'B' on diagram below and rotated as shown.



When running tests on a twin drive unit a special method of rotation can be used to give an eight position average. However this is more difficult to control and we strongly recommend twin drive units be considered as two separate tests; one on each axle.

Records

Every 5000/10000kms inspect the tyres and measure and record the relevant information in the spaces provided. At the same time rotate the tyres.

Removal

Tyres should be run until at least 75% worn or preferably ready for retreading. Discontinue test the moment any one tyre has to be removed.

TEST ANALYSIS

A running comparison of the tyre performance on each axle can readily be obtained by plotting remaining skid against cumulative kilometres on the chart below.

For each inspection there will be two groove depth points (One for each of the pairs on the axle). Use a different symbol for each and plot all data from original groove depth down to when tyres were removed.

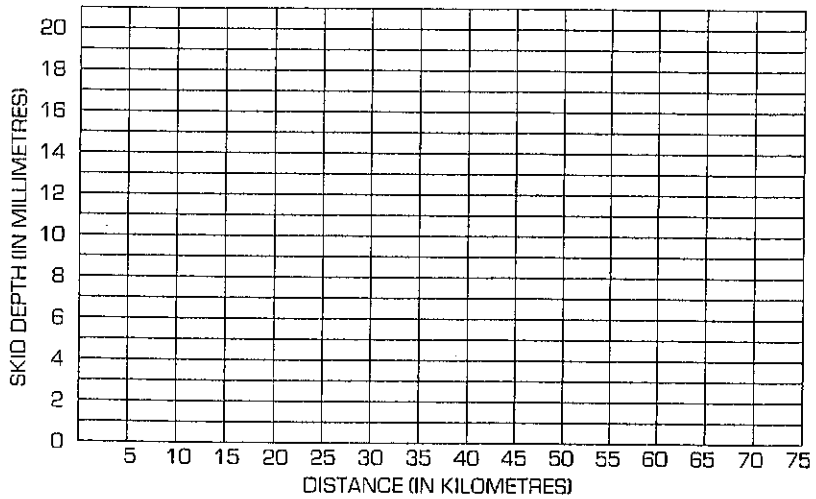
Wear during the initial 5000 to 10000 kms is often high so when extrapolating line down to the 1½mm skid, it is best to ignore this part of the graph. The graph can now be used to calculate:—

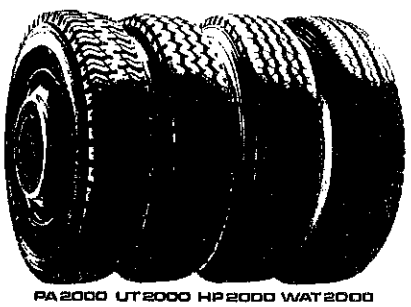
Kilometres per millimetre of skid
Kilometres to wear out
Cost per kilometre

Where tests of the same nature are run on more than one axle or on more than one vehicle then the figures obtained from each separate test can be averaged and an overall comparison made. The form also allows for information on punctures and retreadability of the casings to be recorded.

CONCLUSION

If the preceding have been faithfully adhered to then you now have in your possession accurate information on the relative merits of various makes and designs of tyres which you can use with confidence to help you decide which type and make of tyre is best for your particular type of operation.





PA2000 UT2000 HP2000 WAT2000