EXTRACTS FROM "THE MANUFACTURE, LIFE AND MAINTENANCE OF TRAMWAY CAR TYRES" by Arthur Norton A.M.Inst C.E. A.M.I. Mech.E.

MAINTENANCE OF FLANGES:

In considering the question of tyre wear, it is important to remember that the wheel flanges play a very significant part in steering the car thru points, crossings and curves. Also if the correct profile is maintained, the amount of side-play is reduced - an important consideration when one takes into account the increased wear to both tyre and rail which is bound to take place when too much laterial movement is allowed.

It is therefore advisable to send the wheels into the shop for re-turning or grinding when the flanges can be re-formed with the least possible loss of metal on the tread, or:-

1. When the tyres on one pair of wheels have worn to different diameter.
2. When the inside of the flange becomes approx. at right angles to the thread thus forming a definite corner on the tyre.
3. When the flange becomes more than 3/16" above or below the standard section of flange of the original tyre.
4. When the flange at its base is less than 7/8".
5. When the tread of the tyre is worn with a considerable hollow.

REASONS FOR EXCESSIVE TYRE WEAR:

1. Systems which operate in very hilly districts.
2. Systems which operate in narrow streets, and where very sharp curves obtain.
3. Single tracks with loops.
4. Worn conditionsof tracks.
5. Maintenance of car frames.
6. Motors running against each other.

MAINTENANCE OF CAR FRAMES:

The maintenance of the car frames, with special reference to the squaring of them, together with the wear of the axle-box guides, has a very considerable bearing on the question of tyre wear, as owing to the flexibility of a car

frame, and the difficulties of really efficient staying, the frames are very liable to get out of square, and are often helped in this direction by the too sudden application of the brake. The immediate result of this defection is to cause both excessive and uneven wear in the flanges and diameters of the tyres, which latter eventually causes the tyres to slip.

TYRES RUN THROUGH THEIR LIFE WITHOUT RE-TURNING:

The mileage obtained from these two sets was 73,106 in the first case and 84,070 in the other, or, taking the worst-worn tyre in each set, you get 4,873 miles per 1/8" wear in the first case and 5,604 in the second.

LIMIT OF WEAR.

The life of a tyre is generally concluded when its thickness is reduced to 3/4" to 7/8" although there are cases on record where that limit is exceeded. e.g. a pony wheel was run until it had practically worn thru, the thickness being about 1/8" to 3/16" but the flanges were very well maintained.

There can be little doubt that the maintenance of the tyre sections, flanges, and diameters should receive more frequent attention during their life than at present appears to be the case. Admitting it may be necessary to cut away a little more material from the tread to re-form the flanges, with the consequent charges for labour, loss of material, etc. the other side of the account would be more than balanced by the reduction of rail wear, current consumption, and a helping hand to our old friend - "Rail Corrugation".

This is further emphasised when the following table is studied:

	1st. Period.		2nd. Period.	
	Mileage run	Mileage per 1/8" radial wear.	Mileage run	Mileage per 1/8" radial wear.
Ref. 25 -	27,823	7320	25,336	4606
26 -	28,493	7934	22,699	5269
27 -	27,256	7314	no further information	
38 -	27,277	6994	" "	"

The above four sets of tyres show a mileage result per 1/8" radial wear of 7,400 miles per 1/8", whereas for the

second period a reduction in wear of over 35% has taken place, but it must be pointed out that whilst the tyres were paired after the first period run, the flanges were left in their worn state, and showed a very much reduced thickness from the original section. This reduction in the width of the flanges is reflected in the reduced mileage results obtained for the second period.

Another set of tyres made from the same cast ran 12,061 miles andgave a mileage result of 9210 miles per 1/8" radial wear or an increase of nearly 20% over the four sets mentioned above. They were then returned and paired. The flanges being reformed to their original section, the slight wear that had taken place required the removal of much less material in comparison with what would have been required to re-form the tyres of the other four sets, and the consequent saving in the wear of the rails etc. must be kept in mind.

IMPORTANCE OF RETURNING TYRES AT FREQUENT INTERVALS:

In this connection it may be pointed out that the wear to rails must be considered in conjunction with the wear to tyres. As rails are much more expensive to replace than tyres and poor tyres have a very great bearing on Track wear. Allowance for shrink fit of tyres not to exceed 1/1000 of the diameter of the wheel centre. The smallerthe nip you can put on tyres the better.

Also cooling down tyres with water was a primitive method and was asking for trouble. (Cooling in atmosphere is the best method.)

With regard to the matter of heating tyres for SHRINKING drinking, he again agreed very fully with the remarks of the author, and mentioned that as a result of experiment and experience the temperature was in most cases kept below 400°F. with good results.

FLATS ON PONY WHEELS:

Coming to his remarks re flats on pony wheels, Mr. Mozley states that the flats are always on the smaller wheel. The obvious thing is to keep them paired. Surely the explanation of

flats is that the smaller wheel cannot cover the same distance as the larger by rolling motion only and must therefore skid, and once skidding has worn a flat the tendency will be for the flat surface to enlarge, though under special circumstances a second or third skidding plane may be formed before the first is very fully developed.

RE - UNEQUAL WEAR OF TYRES FITTED TO THE SAME AXLE:

A great many troubles were primarily brought about owing to the wheels on the same axle being of different diameters, notably the excessive side rock and boxing of four-wheel cars. This can be cured by returning the wheels to equal diameters. This uneven wear is largely caused by the frames of the truck being out of square, in the first instance, and once one wheel becomes larger than the other, the flange of the larger wheel is bound to get laid up against the check of the rail.

Refer diag. No. 3.

At the top of the diagram the tyres of original section as put into service are shown in relative position to each other on the original section of rail. The difference between the wheel gauge and the rail gauge allows 1/4" lateral movement.

The tyres as plotted on the two sets of diagram below illustrate them in their two extremes and show a lateral movement of 3/4" and 7/8", which amount of movement is a serious factor in relation to wear, not only as regards the tyre, but also the rail.

It must be pointed out, however, that these tyres had run 37,651 miles before being examined, and the worn state of the flanges of Nos. 1. and 3. clearly indicate that during an intervening period in their life one tyre has been running with a larger diameter than its fellow in each pair of wheels, as the outside of the flange is badly worn away, having been in contact with the check of the rail, whilst the inside of the flange of its fellow in each case is badly worn. A point comes in this process of attrition when the smaller tyre begins to react on the larger tyre, and when this point is reached a decided concavity in the tread of the larger tyre is formed.

It may be pointed out that when a tyre is shrunk on to a wheel centre of the "umbrella" shape the wheel centre closes up slightly. To compensate for this springing action the wheel centres should be pressed on to their axle, so that the distance between the rims of the wheel centres is <u>less</u> than the standard gauge by 1/16th. of an inch.