

Complexity of including Light Truck and ‘C-Type’ tyres in the GTR for Tyres

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Background:

There is a group of tyres that generally have higher load capacities and/or higher inflation pressures than passenger car tyres, and at the same time generally have lower load capacities and lower inflation pressures than truck/bus tyres. These tyres are typically standardized in specific sections of the three major tyre standards Year Books:

- **US Tire and Rim Association (TRA)** – Light Truck section,
- **Japan Automobile Tyre Manufacturers Association (JATMA)** – Light Truck Section,
- **European Tyre and Rim Technical Organization (ETRTO)** – ‘C-Type’ tyres within the Commercial Vehicle Tyre section.

For TRA and JATMA, these tyres typically have either a LT prefix or suffix within the size nomenclature. ETRTO generally uses the ‘C’ suffix in the size nomenclature to identify these tyres.

Worldwide, a great majority of these tyres have a metric size designation, but still specify a rim diameter code. Most, but not all, use an ‘integer’ rim code. Rim codes with decimal (xx.5) are less common.

There is a group of tyres commonly referred to as high flotation tyres that have a three part size designation (Nominal Overall Diameter(in.) x Nominal Section Width(in.) x Rim Diameter Code), where each term is code designated, not metric. This group of tyres is not as common as metric tyres, but is still prevalent in the marketplace.

A third group of tyres use an older designation such as 7.00R15 or 7.50R16. These tyres are far less common today in North America and Europe, but can be found in other regions of the world.

For consideration within the compendium of tests for the GTR for these LT/C tyres, there are two major regulations: Regulation 54 for signatories of the 58 Agreement and FMVSS 139 for North America. In Europe, sound emission (noise) is being regulated and Wet Grip is in development, pending the establishment of suitable reference tyres. FMVSS 139 specifies high speed, plunger energy, and tubeless tyre bead unseat in addition to an endurance (lab durability) requirement.

Complexity Issues:

The discussion above in the Background section can be considered as a current status of test harmonization. However, it is not necessarily the most significant issue to be considered. In fact, the Tyre Industry feels there is a greater factor that needs to be resolved before we can make progress on test harmonization.

The US regulation segregates tyres by load range, using an alphabetic character typically ranging from C to F for this class of LT/C tyres. Specifically, test requirements (loads, inflations and/or speeds) may be adjusted based on the tyre load range. Additionally, the US regulation requires that the load range be marked on the tyre.

Regulation 54 however, does not acknowledge load range. The numeric load index (directly associated with the tyre maximum load) along with the speed symbol (the two terms that comprise the service description) generally determine which test prescription must be followed.

Therefore, the dominant factor, and the principal subject of the rest of this document, will be a discussion concerning the difference between load range and load index. In fact, there is virtually no correlation between these two terms. Without a prescription to equate these two terms, the industry will be severely hampered to propose a credible testing scheme for LT/C tyres.

The load index value which is specified within the ETRTO Standards Manual for each tyre size at a given reference pressure is the simplest to understand. The load index code directly relates to the tyre load capacity. There are several publications where the relationship between load index and maximum load capacity can be verified. Regulation 54 test specifications are generally based on a percentage of the tyre load index.

FMVSS 139 stipulates different test procedures and/or requirements based on the tyre load range. However, the US code does not specify how a tyre manufacturer is to select or mark a tyre with an appropriate load range.

The most widely recognized source of information to establish the relevant load range is found in the US TRA publication, Engineering Design Information (EDI). TRA established a maximum inflation pressure for each load range, dependant on the nominal section width of the tyre. The following table, edited from TRA EDI p. 2-10 provides illustrations:

**Inflation Pressure Selection Table
For MAXIMUM LOAD For Each Load Range**

Pressure for Max Load		LOAD RANGE INCREMENTS	
<u>kPa</u>	<u>PSI</u>	≤ 295 SN	305-395 SN
250	35	--	C
350	50	C	D
450	65	D	E
550	80	E	F
650	95	F	G

TRA Load Range Selection
ref: EDI p. 2-10 (edited)

The inflation pressure associated with load range D is generally 450 kPa. However, this is only true if the nominal section width is less than 305mm. For section widths between 305 and 395 mm, the reference pressure for load range D tyres is 350 kPa! Tyre experts who are familiar with TRA guidelines have no trouble understanding this concept and assigning the correct load range for a given tyre, but for those who are not as well versed; this can be a source of significant confusion.

Not only does FMVSS 139 make no reference to a procedure for assigning load range, it is also silent on the specification of the tyre reference inflation pressure. These two factors make it virtually impossible to consistently assign a load range to an ETRTO metric tyre. The following table provides an illustration:

ETRTO		TRA		Load Range	
<i>kPa</i>	<i>(PSI)</i>	<i>kPa</i>	<i>(PSI)</i>	<i>SW ≤ 295mm</i>	<i>SW between 305 -395 mm</i>
-	-	250	(35/36)	B	C
325	(47)				
350	(51)	350	(50/51)	C	D
375	(54)				
400	(58)				
450	(65)	450	(65)	D	E
475	(69)				
525	(76)				
-	-	550	(80)	E	F
575	(83)				
-	-	650	(95)	F	G

It should be clear from this table, that if an ETRTO tyre has a reference pressure of any value other than 350 or 450 kPa, there is no absolute prescription to assign an appropriate load range. Additionally, the FMVSS specified test pressures would not correspond to the tyre reference pressure. This lack of precision is not appropriate for regulatory purposes.

Tyre manufacturers are faced with this dilemma today for most tyre sizes that are standardized outside of TRA. It is not known what basis or procedures any given manufacturer may use to assign a load rating. Similarly, there is no direction provided to ensure that the tyre reference pressure relates to any FMVSS 139 specified test pressure.

Could the situation be any more confusing? Unfortunately, yes! The load range has no absolute correlation to the load index code. The load index (or maximum load) is a function of the tyre size and reference inflation pressure. There can be, and in fact exists today, significant overlap in load index values across load ranges. The following table, based on a review of the 2008 TRA Year Book, provides an illustration:

TRA Load Index (LI) Range				
<i>Load Range</i>	C	D	E	F
Minimum LI	88	99	98	119
Maximum LI	123	127	127	128

To further confuse the issue, ETRTO generally only specifies the ‘C’ suffix for tyres with load index values up to 121 (two exceptions are noted for the 285/65R16 with LI of 125 and 128 based on reference pressures of 475 and 525 kPa).

There is no good methodology on how to use the current systems to provide a reasonable scope for LT/C tyres; no maximum load index value, no upper load range.

C tyres (Reg 54) would not exceed load index values of 121; LT load range E (FMVSS 139) tyres could have load index values up to 128 (higher load index value tyres, load index 130 for both Load Range D and E , have recently been approved for the 2009 TRA Year Book).

This rather limited initial analysis of load range and load index discrepancies in LT/C tyres suggest that including currently standardized products will prove to be very challenging. New classes or products could be harmonized to more closely align with the prescriptions of a GTR, but that does not address the vast array of today’s pre-existing products.

Summary and Future Action Plan:

Because this class of tyres, LT/C, has not seen the same global commerce exposure as passenger car tyres, more of these tyres have regional service exposure instead of being global tyres. While this is not an absolute rule, it has been a general practice. The impact of this regionalism is that the Tyre Industry has less experience with these tyres in global trade, than the industry had with passenger car tyres. With all the experience the Tyre Industry has with passenger car tyres in the global marketplace, it has taken over two years of intense effort to try to reach consensus on a harmonized high speed test. The point to be made is not that the industry cannot propose harmonized test prescriptions for LT/C tyres, but rather, that there is significantly less factual test data available today for LT/C tyres than existed for passenger car tyres at the start of the GTR.

The Tyre Industry is committed to completing the GTR, including both radial passenger tyres and LT/C tyres. However, since we are so close to finalizing the requirements for radial passenger tyres, the Tyre Industry strongly recommends finishing the work on radial passenger tyres first, and then beginning work on the LT/C portion of the GTR.

In considering the complexity issues previously mentioned and the time necessary to develop a plan to resolve these issues towards harmonization, the Tyre Industry is committed to developing a proposal and plan forward for LT/C tyres by the first quarter of 2009.

Addendum regarding the term ‘Ply Rating’:

The term “ply rating” is a historical term that has limited usage today. It is found in some standards manuals for some limited tyre categories. The TRA Year Book (introductory section, page XVII) shows a table of Load Range – Ply Rating Equivalencies. It is reproduced for reference:

Load Range	Ply Rating		Load Range	Ply Rating
A	2		G	14
B	4		H	16
C	6		J	18
D	8		L	20
E	10		M	22
F	12		N	24

In practical terms, the ply rating designation provides minimal value. From a historical perspective, a review of TRA Year Books shows the following definition of ply rating as published in the 1947-48 Year Book:

DEFINITION OF TERM “PLY RATING”

The term “Ply Rating” is used to identify a given tire with its maximum recommended load when used in a specific type of service. It is an index of tire strength and does not necessarily represent the number of cord plies in the tire.

The general recollection of several long-time industry members was that the origin of the ply rating term was based on the usage of cotton cord as a tyre ply.

There may not be any value in continuing to use or preserve this terminology within the context of the GTR.

Single Application Only

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LI = Load Index
LR = Load Range

Tire Size	LT or C	Inflation Pressure	ETRTO			JATMA			TRA		
			LI	LR	Load	LI	LR	Load	LI	LR	Load
215/80R15	LT	350				109		1030			
	LT	450				112		1120	107	D	975
	C	475	111		1090						
215/85R16	LT	350							103	C	880
	LT	450				114		1180	110	D	1060
	C	475	110	D ?	1060						
	LT	550							115	E	1215
	C	575	115	E ?	1215						
	LT	600				120		1400			
	LT	650							119	F	1360
225/75R16	LT	350							103	C	880
	LT	450							110	D	1060
	C	475	116		1250						
	C	525	118		1320						
	LT	550							115	E	1215
	C	575	121		1450						
	LT	600				118		1320			
	LT	650							119	F	1360
235/85R16	LT	350							108	C	1000
	C	375	112		1120						
	LT	450				118		1320	114	D	1190
	C	475	114	D ?	1180						
	LT	550							120	E	1380
	C	575	120	E ?	1400						
	LT	650							123	F	1150
255/70R15	LT	350				112		1120	107	C	975
	C	375	112		1120						
	LT	450							113	D	1150

155R12	C & LT	350	83	487	6-ply	C ?	485			
	C & LT	450	88	560	8-ply	D ?	560			
155R13	C & LT	350	85	515	6-ply	C ?	510			
	LT	450			8-ply	D ?	595			
165R13	LT	350			6-ply	C ?	585			
	C	375	91	615						
	LT	450			8-ply	D ?	670			
165R14	LT	350			6-ply	C ?	615			
	C	375	93	650						
	C & LT	450	97	730	8-ply	D ?	715			
175/75R14	LT	350						88	C	560
	C	475	99	775						
175R14	LT	350			6-ply	C ?	665			
	C	375	96	710						
	C & LT	450	99	775	8-ply	D ?	775			
185/75R14	LT	350						91	C	615
	C	475	102	850						
185R14	LT	350			6-ply	C ?	725			
	C	375	99	775						
	C & LT	450	102	850	8-ply	D ?	840			
195/65R16	C	375	100	800						
	C	475	104	900						
	LT	600					106			950
195/70R15	C	325	98	750						
	C	375	100	800						
	C	450	104	900						
	LT	600					106			950
195/75R14	LT	350						93	C	650

	C	375	102	850				
	LT	450				99	D	775
	C	475	106	950				
195/75R15	LT	350				95	C	690
	LT	600			109			1030
195R14	LT	350			6-ply	C ?		805
	C	375	102	850				
	C & LT	450	106	950	8-ply	D ?		935
205/65R15	C	375	102	850				
	LT	600			107			975
205/65R16	C	325	99	775				
	C	375	103	875				
	C	475	107	975				
	LT	600			109			1030
205/70R14	LT	350				94	C	670
	C	375	102	850				
	LT	450				100	D	800
	LT	550				105	E	925
215/65R15	C	375	104	900				
	LT	600			110			1060
215/70R14	LT	350				97	C	730
	C	375	106	950				
215/70R15	C	375	106	950				
	C & LT	450	109	1030	107			975
	C	475	109	1030				
	C	525	113	1150				
215/70R16	LT	350				100	C	800
	C	375	108	1000				
215/75R14	LT	350				98	C	750

	LT	450				104	D	900
	C	475	112	1120				
215/75R15	LT	350				100	C	800
	LT	450				106	D	950
	LT	600			115	1215		
215/75R16	C	475	113	1150				
	C	525	116	1250				
	LT	600			116	1250		
225/70R16	LT	350				102	C	850
	LT	600	117	115				
225/75R15	LT	350				120	C	850
	C	375	110	1060				
	LT	450				108	D	1000
235/60R17	C	525	117	1285				
		550				112	E	1120
245/70R16	LT	350				106	C	950
	C	375	111	1090				
	LT	450				113	D	1150
245/75R15	LT	350				107	C	975
	C	375	109	1030				
255/75R15	C	325	110	1060				
	LT	350				109	C	1030
	C	375	118	1320				
255/85R16	LT	350				112	C	1120
	LT	450				119	D	1360
	C	475	119	D ? 1360				
	LT	550				123	E	1550
265/70R16	LT	350				110	C	1060
	C	375	113	1150				

	LT	450					117	D	1285	
265/75R16	LT	350					112	C	1120	
	C	375	113	1150						
	LT	450					119	D	1360	
	LT	550					123	E	1550	
6.50R16	LT	350					97	C	730	
	LT	450					103	D	875	
	LT	475			8-ply	D ?	920			
	LT	550			10-ply	E ?	1010	107	E	975
	LT	625			12-ply	F ?	1090			
7.00R15	LT	350					99	C	775	
	LT	450			8-ply	D ?	980	105	D	925
	LT	525			10-ply	E ?	1080			
	LT	550						110	E	1060
	LT	600			12-ply	F ?	1180			
7.50R16	LT	350					105	C	925	
	LT	450					112	D	1120	
	LT	475			8-ply	D ?	1175			
	LT	550						116	E	1250
	LT	575			10-ply	E ?	1330			
	LT	650			12-ply	F ?	1440			
	LT	700			14-ply	G ?	1510			