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A Study On Tyre Specification And Tyre Pattern Prevalent In Sagar District Of Madhya Pradesh (India)

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Abstract: This study has been undertaken to determine the Tyre length, Tyre width, Aspect Ratio and Rim diameter along with that Tyre mark pattern characteristics and what type of Tyre will suit in what type of vehicle. In this study 50 standard Indian tyres 6 international tyresw and 4 locals made tyres measurement has taken place along with that proper pattern analysis of that all tyres done to find out unique characteristics of tyres

I. INTRODUCTION

TYREMARKS

Tyre marks are those left by the thread design of a tyre of vehicle after they pass over a surface.In other words, Tyre marks are impression in surface upon which a vehicle has driven on. However depending on the surface and type of tyre that are involved it can be determined the type of print that is made. Some tyres and surface will not leave a print. Surfaces that are softer such as snow or mud will leave an imprint under the weight of the vehicle. On the hard surfaces tyre marks are only made if the dust or dirt is present.[Pam, 2004]

Tyre marks is two-dimensional or three dimensional marks that reflect the tread design and dimensional features of the individual tyre on a vehicle 2-D tyre marks occur when the tread surface acquires various residues on or off the road and then deposit toes onto a 2-D surface like a piece of paper, clothing skin or the road itself 3-D tyre marks occur when the tread surface is pressed into a substance like mud or snow.[Baker, 2001]

The present study is undertaken on a total six (06) models of tyres which is used in four wheeler vehicle which are prevalent in Sagar (Madhya Pradesh) districts of India. A survey was conducted from different showrooms of Sagar district of Madhya Pradesh.

Purposive data was collected from different showrooms related with Make & Model of different tyres of different brands and photographs were taken for further analysis.

A total of 5 different brands of tyres and their 10 model, 1 International brand of tyre and their 6 model and 4 local or duplicate tyres were taken and each were studied so a total of 60 samples were studied.

3.1 PRELIMINARY STUDY FOR SELECTION OF DIFFERENT TYRE COMPANY:

India tyre industry is booming, especially in the last decade of so a number of tyre companies have started operating in the Indian tyre company market.

In India there are about more than 15 brands in tyre market which include- MRF, APOLLO, CEAT, BRIDGESTONE, JK TYRE, MICHELIN, TVS, GOODYEAR, YOKOHAMA, BKT etc. MRF is selected as Benchmark tyre because of an estimate that MRF having 70% of the market share with different tyre models, having thousands of patterns and specifications.

3.1.1 MRF Tyre Ltd:-

Madras Rubber Factory was created in 1946, and is a multi-national company and the largest manufacturer of Tyre Company in India. The company is advanced in terms oftechnology with its world-class facilities. For the 12^{th} time in the last 16 years, it has been ranked as India no 1 tyre manufacturer in the customer satisfaction in the JD power Asia Pacific 2016 India original tyre satisfaction study for passenger's cars for SUVs and passenger cars.

3.1.2. APOLLO Tyres:-

Established in 1972 Apollo is one of the biggest companies in India having a market share of 62.6 %(tyre share revenue) in India. The company robust and quality portfolio ensured that it leads the market with over 25% market share. This year the company introduced XT-7 Gold HD, a new bias truck tyre with improved durability for moderate to high load applications. It has 4,900 dealers approx. across India.

3.1.3 CEAT Tyres:-

Established in 1958, and a flagship company of RPG Enterprises. It is one of the India leading tyre makers with a capacity of rolling out more than 95,000 tyres per day. Its major share is in the light truck and truck tyre market segment.

3.1.4. JK TYRES

Based in Delhi, it was found in 1974, and soon established itself as the market leader in Truck/Bus radial tyre segment in India and is the only tyre manufacturer offering the entire range of 4 wheeler radial for truck, buses and cars. JK tyres state itself as "TheBad shah of radial tyres on India roads" with more than 3-million truck and bus radial tyres on Indian roads. It is also India's no 1 truck and bus radial tyres manufacturer .It has been awarded as a super brand for the year 2013-2014. The group also received the "Brand of the year". Award in 2015 at world Branding awards held in London.

3.1.5.GOODYEAR TYRE LIMITED

Parent organisation Goodyear tyre and rubber company (global names) was founded in 1898, with headquarter at Ohio (USA) , they went on achieving heights in tyre manufacturing claiming world's first detectable tyre and the Mass-produced car i.e. the model T-ford. They are also engaged in manufacturing o0f tyres for different products such as Automobiles, trucks, Racing cars, airplanes, farm equipment and heavy earth-mover machinery.

3.2. SELECTION OF TYRE BRANDS FOR PRESENT STUDY:

For the present study, a total of 5 different brands of tyres and their 10 model, 1 International brand of tyre and their 6 model and 4 local or duplicate tyres were taken and each were studied so a total of 60 samples were studied.

Following brands were selected for present study:

- Apollo company
- CEAT Company
- MRF Company
- Bridgestone Company
- JK Tyre

3.3. PROCEDURE OF DATA COLLECTION

For the present study primary data was collected from various showrooms and shops of tyre of different and few selected brands of tyre available in and Sagar district of Madhya Pradesh of India.

Different manuals were collected from the dealers and primary data was also collected from them and subsequently photographs of different tyres were taken especially of the Tread Area and Rim for further analysis and evaluation.

Step 1: The Tyremark pattern was photographed from the brand new tyre of four wheeler vehicle to get a high resolution photograph for data analysis.

Step 2: Tyre specification and tread pattern characteristics of four wheeler vehicles was collected from their respective Book manual and also by visiting showrooms of Ranchi city of Jharkhand and Sagar district of Madhya Pradesh to look out for all details.

The primary data of different tread pattern of tyre obtained from the various tyre showrooms and the shops of different and few selected brands of tyre available in Sagar (Madhya Pradesh) was analysed manually.

Following tools and techniques used for present study:

- Measuring Tapes
- L-shaped scale
- Realme 64 MP

Following measurement and tread characteristics of tyre were taken:

3.3.1. TYRE WIDTH-Tyre width refers to the measurement from one sidewall to another, width is in millimetres.

3.2.2. ASPECT RATIO-It is the ratio of the sidewall height to the cross section width. It is measured in per cent.

3.2.3. RIM DIAMETER-The diameter of the wheels that the tyre is designed to fit. It is measured in inches.

3.2.4. GROOVES-Circumferential channels between the tread ribs of the tyre. It reduces hydroplaning for improved wet performance and maximize grip.

3.2.5.RIBS-The rubber elements at the tyre tread which contact the ground, oriented in a generally circumferential direction. It provides good stability and steering responses.

3.2.6. TREAD-the tread of the tyre refers to the rubber on its circumference that makes contact with the road. It allows for a great balance of performance capabilities under varying road condition and weather requirement and optimizes pitch sequence variation to reduce tyre road noise.

3.2.7. TYRE SHOULDER- Tire shoulder is the portion of the tread between the tread centre and the tire sidewall. Tire shoulder may have blocks, plain rounded or angular shoulder. It offers support, rigidity and protection to both the sidewall and the tread.

The present study is undertaken on a total of six (06) of tyres of four wheeler which are prevalent in Sagar (Madhya Pradesh). A survey was conducted from different showrooms of Sagar district of Madhya Pradesh.

TABLE2. TYRE SPECIFICATION OF APOLLO COMPANY

S.NO	TYRE MODEL	TYRE WIDTH (in mm)	ASPECT RATIO (in %)	RIM DIAMETER (in inches)	CONSTRUCTION TYPES
1	Amazer 4G life	205	65	15	Radial
2	Amazer 4G life	155	65	14	Radial
3	Aspire 4G	235	55	17	Radial
	Apterra HT2	215	75	15	Radial

4					
5	Apterra HT	215	75	15	Radial
6	Apterra HLS	205	65	16	Radial
7	Alnac 4GS	195	65	15	Radial
8	Amazer 3G	135	70	12	Radial
9	Amazer XL	145	70	13	Radial
10	Aspire 4G	215	55	16	Radial

The above table Illustrates the Tyre specification of Apollo company which representsthe TyreWidth, Aspect Ratio, Rim Diameter and Construction types and it was observed that Amazer 4G have highest tyre width of 205mm and Amazer XL has smallest tyre width of 145mm inches.Aperra HT2 has the highest aspect ratio of 75 percent and the aspect ratio of Aspire 4G is smallest of 55 percent. Rim diameter of Aspire 4G is highest of 17 inches and Amazer 3G having lowest of 12 inches and nearly all models are of Radial Construction types.It was also observed that tyre having same model but its width, and rim diameter may vary and aspect ratio maynearly be the same. Amazer 4G have tyre width of 205mm and 155mm and rim diameter is of 15 and 14 inch whereas in Aspire 4G the tyre width is of 235mm and 215mm and rim diameter is 17 and 16 inch and aspect ratio is have same value of 55 percent.

TABLE3. TYRE SPECEFICATION OF MRF COMPANY

S.NO	TYRE MODEL	TYRE WIDTH (in mm)	ASPECT RATIO (in %)	RIM DIAMETER (in inches)	CONSTRUCTION TYPES
1	ZLX	145	80	12	Radial
2	ZV2K	175	60	14	Radial
3	ZVTS	155	70	13	Radial
4	ZTX A1	155	80	13	Radial
5	ZVTV	175	65	14	Radial
6	ZGP	215	75	15	Radial
7	ZTX A1	205	65	16	Radial
8	ZVTV	165	70	14	Radial
9	Wanderer A/T	235	65	17	Radial
10	ZLX	165	65	14	Radial

The above table Illustrates the Tyre specification of MRF company which represents the tyre width, aspect ratio, rim diameter and construction types and it was observed that Wanderer A/T have highest tyre width of 205mm and ZLX has smallest tyre width of 145mm inches.ZLX and ZTX A1 has the highest aspect ratio of 80 percent and the aspect ratio of ZV2K is smallest of 60 percent. Rim diameter of Wanderer A/T is highest of 17 inches and ZLXhaving lowest of 12 inches and nearly all models are of radial Construction types.It was also observed that Tyre having same model but its width, and rim diameter may vary and sometimes aspect ratio may also vary. ZLX have tyre width of 145mm and 165mm aspect ratio is of 80 and 65 percent and rim diameter is of 12 and 14 inch and in ZVTV the tyre width is of 175mm and 165mm aspect ratio is of 65 and 70 percent and rim diameter is same with 14 inches Whereas in ZTX A1 have tyre width of 155 and 205 and aspect ratio is of 80 and 65 percent and rim diameter is of 13 and 16 inches.

TABLE4. TYRE SPECEFICATION OF CEAT COMPANY

S.NO	TYRE MODEL	TYRE WIDTH (in mm)	ASPECT RATIO (in %)	RIM DIAMETER (in inches)	CONSTRUCTION TYPES
1	Milaze X3	205	65	15	Radial
2	Fuelsmarrt	165	80	14	Radial
3	Milaze X3	155	70	13	Radial
4	CZAR Sport	215	60	16	Radial
5	Milaze X3	145	70	12	Radial
6	CZAR A/T	235	65	17	Radial
7	Fuelssmartt	175	65	14	Radial
8	Milaze X3	145	80	12	Radial
9	Formula I	215	75	15	Radial
10	Milaze X3	155	65	13	Radial

The above table Illustrates the Tyre specification of CEATCompany which represents the Tyre Width, Aspect Ratio, Rim Diameter and Construction Types and it was observed that CZAR A/T have highest tyre width of 235 mm and MILAZE X3 has smallest tyre width of 145mm inches.FUELSSMARTT and MILAZE X3 has the highest aspect ratio of 80 percent and the aspect ratio of CZAR SPORT is smallest of 60 percent. Rim diameter of CZAR A/Tis highest of 17 inches and MILAZE X3 having lowest of 12 inches and nearly all models are of Radial construction types.It was also observed that Tyre having same model but its width, and Rim diameter may vary and sometimes aspect ratio may also vary. MILAZE X3have tyre width of 205mm, 155mm, 145mm, 145mm and 155mm. Aspect ratio is of 65, 70, 70, 80 and 65 percent and Rim diameter is of 15, 13, 12, 12 and 13 inch and in Fuelssmartt the tyre width is of 165mm and 175mm aspect ratio is of 80 and 65 percent and rim diameter is same with 14 inches

TABLE5. TYRE SPECEFICATION OF JK TYRE COMPANY

S.NO	TYRE MODEL	TYRE WIDTH (in mm	ASPECT RATIO (in %)	RIM DIAMETER (in inches)	CONSTRUCTION TYPES
1	Ultima Sport	195	60	14	Radial
2	Ranger H/T	235	65	17	Radial
3	Elanzo NXT	235	65	17	Radial
4	UXI Royale	175	65	14	Radial
5	Vectra	185	60	15	Radial
6	Elanzo NXT	235	65	17	Radial
7	Vectra	205	60	16	Radial
8	Ultima NXT	145	70	12	Radial
9		165	65	13	Radial

	Ultima Sport				
10	Vectra	185	65	15	Radial

The above table Illustrates the Tyre specification of JK TYRE company which represents the Tyre Width, Aspect Ratio, Rim Diameter and Construction Types and it was observed that ELANZO NXT and Ranger H/T have highest tyre width of 235mm and ULTIMA NXT has smallest tyre width of 145mm inches.ULTIMA NXT has the highest aspect ratio of 70 percent and the aspect ratio of ULTIMA SPORT and VECTRA is smallest of 60 percent. Rim diameter of RANGER H/T and ELANZO NXT is highest of 17 inches and ULTIMA NXT having lowest of 12 inches and nearly all models are of Radial construction types.It was also observed that tyre having same model but its width, and rim diameter may vary and sometimes aspect ratio may also vary. ULTIMA SPORT have tyre width of 195mm and 165mm aspect ratio is of 60 and 65 percent and rim diameter is of 14 and 13 inch and in VECTRA the tyre width of both are same i.e. 185mm aspect ratio is of 60 and 65 percent and rim diameter is same with 15 inches

TABLE6. TYRE SPECEFICATION OF BRIDGESTONE COMPANY

S.NO	TYRE MODEL	TYRE WIDTH (in mm)	ASPECT RATIO (in %)	RIM DIAMETER (in inches)	CONSTRUCTION TYPES
1	B290	165	65	13	Radial
2	B250	185	65	14	Radial
3	S322	155	65	13	Radial
4	AR20	145	70	13	Radial
5	B290	155	65	13	Radial
6	S248	145	80	12	Radial
	S322 77T	165	65	13	Radial

7					
8	Turanza ER-601	145	80	12	Radial
9	AR20	155	80	13	Radial
10	B250	175	70	14	Radial

The above table Illustrates the Tyre specification of BRIDGESTONE company which represents the Tyre Width, Aspect Ratio, Rim Diameter and Construction Types and it was observed that B250 have highest tyre width of 185mm and AR20 and S248 has smallest tyre width of 145mm inches.S248, TURANZA ER-601, AR20 has the highest aspect ratio of 80 percent and the aspect ratio of B290, B250, S322, B290 is smallest of 65 percent. Rim diameter of B250 and B250 is highest of 14 inches and S248 having lowest of 12 inches and nearly all models are of Radial construction types.It was also observed that tyre having same model but its width, and rim diameter may vary and sometimes aspect ratio may also vary.B290 have same tyre width of 165mm and 155mm aspect ratio is same with 65 percent and rim diameter same with 13 inch and in B250 the tyre width is 185 mm and 175 mm aspect ratio is of 65 and 70 percent and rim diameter is same with 14 inches

TABLE7. TYRE SPECEFICATION OF INTERNATIONAL COMPANY

S.NO	TYRE MODEL	TYRE WIDTH (in mm)	ASPECT RATIO (in %)	RIM DIAMETER (in inches)	CONSTRUCTION TYPES
1	Eagle F1	225	50	18	Radial
2	Efficient grip	225	65	17	Radial
3	Efficient grip Moe	205	55	16	Radial

4	Dura plus	175	70	14	Radial
5	Wrangler triplemax	215	75	15	Radial
6	Eagle NCTS FP	205	55	16	Radial

The above table Illustrates the Tyre specification of INTERNATIONAL TYRE company which represents the Tyre Width, Aspect Ratio, Rim Diameter and Construction Types and it was observed that EAGLE F1 and Efficient grip have highest tyre width of 225mm and Dura plus has smallest tyre width of 175mm inches.WRANGLER TRIPLEMAX has the highest aspect ratio of 75 percent and the aspect ratio of Eagle F1 is smallest of 60 percent. Rim diameter of Eagle F1 is highest of 18 inches and Duraplus having lowest of 12 inches and nearly all models are of Radial construction types.

TABLE8. TYRE SPECEFICATION OF LOCAL/DUPLICATE TYRE

S.NO	TYRE MODEL	TYRE WIDTH (in mm)	ASPECT RATIO (in %)	RIM DIAMETER	CONSTRUCTION TYPES
1	Czzar	230	60	16	Radial
2	Amaazzer	145	65	14	Radial
3	ZZX	165	70	12	Radial
4	B2S0	180	70	15	Radial

The above table Illustrates the Tyre specification of LOCAL/DUPLICATE company which represents the Tyre Width, Aspect Ratio, Rim Diameter and Construction Types and it was observed that Czzar have highest tyre width of 220mm and ZZX has smallest tyre width of 165mm inches.B2SO has the highest aspect ratio of 70 percent and the smallest aspect ratio of CZZAR is 60. Rim diameter of CZZAR is highest of 16 inches and ZZX Having lowest of 12 inches and nearly all models are of Radial construction types.

TABLE9. COMAPARISION OF LOCAL/DUPLICATE AND COMPANY MADE TYRE

	TYRE MODEL	TYRE WIDTH (in mm)	ASPECT RATIO (in %)	RIM DIAMETER (in inches)	CONSTRUCTION TYPES
COMPANY	CZAR A/T	235	65	17	Radial
LOCAL	CZZAR	230	60	16	Radial
COMPANY	AMAZER 4G	155	65	14	Radial
LOCAL	AMAAZZER	145	65	14	Radial
COMPANY	ZLX	165	80	12	Radial
LOCAL	ZZX	165	70	12	Radial
COMPANY	B25O	185	65	14	Radial
LOCAL	B2SO	180	70	15	Radial

The above table illustrates th comparison of company and local made/duplicate tyre which further represent the tyre width, aspect ratio, rim diameter and construction types. Local made tyres and company made tyres have variation only in tyre width, aspect ratio, rim diameter. Like majority of company made tyre local made tyre also have Radial construction types.

CZAR A/T (company made) and CZZAR(local made) have the tyre width of 235 mm and 230 mm. Aspect ratio of CZAR A/T is 65 percent and CZZAR is 60 percent. Rim diameter of CZZAR A/T and CZZAR is 17 AND 16 inches respectively. AMAZER 4G (company made) and AMAAZZER(local made) have the tyre width of 155 mm and 145 mm. Aspect ratio of AMAZER 4G Aand AMAAZZER is same with 65 percent. Rim diameter of AMAZER 4G and AMAAZZER is same with 14 inches respectively. ZLX (company made) and ZZX (local made) have same tyre width of 165mm. Aspect ratio of ZLX is 80 percent and ZZX is 70 percent. Rim diameter of ZLX and ZZX is 12 inches respectively. B250 (company made) and B2SO(local

made) have the tyre width of 185 mm and 180 mm respectively. Aspect ratio of B250 is 65 percent and B2SO is 70 percent. Rim diameter of B250 and B2SO is 14and 15 inches respectively.

TABLE10. TYREMARK PATTERN CHARACTERISTICS OF APOLLO COMPANY

TYRE MODEL	TYRE TREAD PATTERN	GROOVE	RIB		SHOULDER
			PATTERN	NUMBER	
Amazer 4G life	Symmetry	Wide longitudinal and lateral	Block-design with notches, No sips	4	Wide, closed, inward and outward facing block
Amazer 4G Life	Symmetry	Wide longitudinal and lateral	Block-design with notches, No sips	4	Wide, closed, inward and outward facing block
Aspire 4G	Asymmetry	Wide and thin longitudinal and lateral	Block-design Continuous Rib with dot notches, No sip	5	Wide, closed inward and outward facing block
Apterra HT2	Symmetry	Wide and Aggressive Longitudnial and lateral	Continuous rib at centre witrh parallel sips and Block-design with Zig-Zag sips	5	Wide, open Inward and Outward facing Block
Apterra HT	Symmetry	Wide and Thin aggressive longitudinal and lateral	Lugs-design with hook like sips and continuous S-shaped design	5	Wide, open Lugs pattern
Apterra HLS	Symmetry	Longitudnial Curvilinear and lateral	Continuous rib at centre and block-design with	5	Wide, open Inwards and

			notchesand curves sips		Outward facing block
Alnac 4GS	Symmetry	Wide longitudnial and lateral	Block-design with curved sips and notches	5	Wide, Closed Inward and Outward facing block
Amazer 3G	Symmetry	Wide longitudnial and lateral	Continuous lug design with parallel sips	4	Wide, open inward and outward facing block
Amazer XL	Symmetry	Longitudinal and lateral	Block-design with S-shaped groove and Circle	6	Open, Inward and outward facing block
Aspire 4G	Asymmetry	Wide, longitudinal and lateral	Block-design Continus Rib with notches,	5	Wide, closed, inward and outward facing block

The above table illustrate the Tyremark pattern characteristics of APOLLO company which represent the tyre thread pattern, grooves, rib pattern, rib number and shoulder with further studies it was observed that AMZER 4G LIFE has symmetry tyre tread pattern and groove is wide longitudinal and lateral. Rib pattern is block-design with notches, No sips and rib is 4 in number.Shoulder is wide, closed inward and outward facing block. ASPIRE 4G is asymmetry pattern and groove is wide and thin longitudinal and lateral. Rib pattern is block design with continuous rib with dot-notches with no sip and rib is 5 in number. Shoulder is wide, closed inward and outward facing block. APTERRA HT2 has symmetry tyre tread pattern and groove is wide and aggressive longitudinal and lateral. Rib pattern is continuous rib at centre with parallel sips and Block design with zig-zag sips and rib is 5 in number. Shoulder is wide, open inward and outward facing block. APTERRA HT has symmetry tyre tread pattern and groove is wide and thin aggressive longitudinal and lateral. Rib pattern is Lugs-design with hook like sips and continuous s-shaped design and rib is 5 in number. Shoulder is wide, open and has lugs-pattern.APTERRA HLS has symmetry tyre tread pattern and groove is longitudnial curvilinear and lateral. Rib pattern is continuous rib at centre and block-design with notches and curved sips and rib is 5 in number. Shoulder is wide, open inward and outward facing block.ALNAC 4GS has symmetry tyre tread pattern and groove is wide and longitudinal and lateral. Rib pattern is block-design with curved sips and notches and rib is 5 in number. Shoulder is wide, open inward and outward facing block.AMAZER 3G has symmetry tyre tread pattern and groove is wide longitudinal and lateral. Rib pattern is continuous lugs-design with parallel sips and rib is 4 in number. Shoulder is openinward and outward facing block. AMAZER XL has symmetry tyre tread pattern and groove is longitudinal and lateral. Rib pattern block design with s-shaped groove and circle and rib is 6 in number. Shoulder is open inward and outward facing block.

TABLE 11. TYREMARK PATTERN CHARACTERISTICS OF MRF COMPANY

TYRE MODEL	TYRE TREAD PATTERN	GROOVE	RIB		SHOULDER
			PATTERN	NUMBER	
ZLX	Symmetry	Thin longitudinal and lateral	Continuous rib with inward and outward direction grooves, curved sips	4	Wide, open inward and outward facing block
ZV2K	Symmetry	Thin longitudinal and wide lateral	Continuous rib at centre with holes, Block design like sip	5	Wide, open inward and outward facing block
ZVTS	Symmetry	Thin longitudinal and wide lateral	Continuous rib at centre with holes,s-shaped block design	5	Open, inward and outward facing block with parallel sips
ZTX A1	Symmetry	Thin longitudinal and lateral	Block-design with sips and dotted line grooves	4	Wide continuous shoulder
ZVTV	Asymmetry	wide longitudinal, lateral and angular grooves	Continuous rib at centre with ;lateral grooves, block design with curved sips	5	Wide open inwards and closing outward facing block
ZGP	Symmetry with puzzle pattern	Zig-zag lugs grooves	Zig-zag with puzzle design	-	-
ZTX A1	Symmetry	Thin longitudinal and lateral	Block-design with sips and dotted line grooves	4	Wide continuous shoulder

ZVTV	Asymmetry	Wide longitudinal and lateral	Continuous rib at centre with lateral grooves.block-design with sips	5	Wide open inward and close outward facing block
Wanderer A/T	Symmetry	Aggressive longitudinal and lateral	S-shaped block design with curvilinear sips	4	Wide, open inward and closed outward facing block
ZLX	Symmetry	Deep longitudinal, lateral and curvilinear	Continuous rib with curvilinear groove and curved sips	4	Wide open, inward and close outward facing block

The above table illustrate the Tyremark pattern characteristics of MRF company which represent the tyre thread pattern, grooves, rib pattern, rib number and shoulder with further studies it was observed that ZLX has symmetry tyre tread pattern and groove is thin longitudinal and lateral. Rib pattern is continuous rib with inward and outward direction groove and, curved sips and rib is 4 in number.Shoulder is open, closed inward and outward facing block. ZV2K issymmetry pattern and groove is thin longitudinal and wide lateral. Rib pattern is continuous rib at centre with holes, block-design stich like sips and rib is 5 in number. Shoulder is wide, open inward and outward facing block. ZVTS has symmetry tyre tread pattern and groove is thin longitudinal and wide lateral. Rib pattern is continuous rib at centre with holes, s-shaped block design and rib is 5 in number. Shoulder is open inward and outward facing block. ZTX A1 has symmetry tyre tread pattern and groove is thin longitudinal and lateral. Rib pattern is block-design with sips and dotted line groovs and rib is 4 in number. Shoulder is wide continuous shoulder. ZVTV has asymmetry tyre tread pattern and groove is widelongitudniallateral and angular groove. Rib pattern is continuous rib at centre with lateral grooves, block-design with curved sips and rib is 5 in number. Shoulder is wide, open inward and closed outward facing block.ZGP has symmetry with puzzle-pattern tyre tread pattern and groove is zig-zag lugs grooves. Rib pattern is zig-zag with puzzle design. Wanderer A/T has symmetry tyre tread pattern and groove is aggressive longitudinal and lateral and groove is s-shaped block design with curvilinear sips and rib is 4 in number. Shoulder iswide open inward and close outward facing block. ZLX has symmetry tyre tread pattern and groove is deep, longitudinal, lateral and curvilinear. Rib pattern is continuous rib with curvilinear groove and curved sips and rib is 4 in number. Shoulder is wide open, inward and outward facing block.

TABLE12. TYREMARK PATTERN CHARACTERISTICS OF CEAT COMPANY

TYRE MODEL	TYRE TREAD PATTERN	GROOVE	RIB		SHOULDER

			PATTERN	NUMBER	
Milaze X3	Symmetry	Wide and Thin longitudinal and lateral	Continuous rib at centre with curved sips, Block-design with notches	5	Wide open block shoulder
Fuelssmart	Symmetry	Wide longitudinal and lateral	Continuous rib with Half block design with notches, sips	4	Wide open block shoulder
Milaze X3	Symmetry	Wide longitudinal and lateral	Block-design with notchesbnband line sips	4	Wide closed block shoulder
CZAR Sport	Asymmetry	Wide longitudinal lateral, zig-zag angular	Continuous with zig zag sip, Block design with notches	4	Wide open block shoulder
Milaze X3	Symmetry	Wide longitudinal and lateral	Block-design with notches and Line sips	4	Wide closed blocked shoulder
CZAR A/T	Asymmetry	Aggressive and wide longitudinal and lateral	Block-design and distorted block design with notche,sips	4	Wide open block and distorted shoulder
FuelSmarrt	Symmetry	Wide longitudinal and wide lateral grooves	Hexagonal block design and half Rectangular block With Notches and line sips	4	Open wide block shoulder
Milaze X3	Symmetry	Deep longitudinal and Wide lateral grooves	Inward and Outward Block design with Notches and line sips	4	Wide closed Block shoulder with sip
Formula I	Symmetry with block design	Longitudnial and lateral zig zag grooves	z-Shaped Block-design, no sip	5	Open Block shoulder

Milaze X3	Symmetry	Longitudinal and lateral grooves	Continuous rib at Centre and block design with sip	5	Open Inward and Outward facing block

The above table illustrate the Tyremark pattern characteristics of CEAT company which represent the tyre thread pattern, grooves, rib pattern, rib number and shoulder with further studies it was observed that MILAZE X3 has symmetry tyre tread pattern and groove is wide and thin longitudinal and lateral. Rib pattern is continuous rib at centre with curved sips, block-design with notches and rib is 5 in number.Shoulder is wide opeb lock shoulder. FUELSMARRT is symmetry pattern and groove is wide longitudinal and lateral. Rib pattern is continuous rib with half-block design with notches, no sips and rib is 4 in number. Shoulder is wide open block shoulder. MILAZE X3 has symmetry tyre tread pattern and groove is wide longitudinal and lateral. Rib pattern is block-design with notches and line sips and rib is 4 in number. Shoulderis wide closed block. CZAR SPORT has asymmetry tyre tread pattern and groove is wide longitudinal, lateral, zig-zag angular . Rib pattern is continuous with zig zag sips, block design with notches and rib is 4 in number. Shoulder is wide open block shoulder. MILAZE X3 has symmetry tyre tread pattern and groove is wide longitudnial and lateral. Rib pattern is block design with notches and line sips and rib is 4 in number. Shoulder is wide closed block shoulder. CZAR A/T has asymmetry tyre tread pattern and groove is aggressive and wide longitudinal and lateral. Rib pattern is block-design and distorted block-design with notches, no sips and rib is 4 in number. Shoulder is wide, open block and distorted block. FUELSSMARRT has symmetry tyre tread pattern and groove is wide longitudinal and thinlateral grooves. Rib pattern is hexagonal block design and half rectangular block with notches, no sips and rib is 4 in number. Shoulder is open wide block shoulder. MILAZE X3 has symmetry tyre tread pattern and deep longitudinal and wide lateral grooves. Rib pattern is inward and outward block design with notches and line sips and rib is 4 in number. Shoulder is wide closed block shoulder with sips. FORMULA I has symmetry with block design pattern and longitudinal and lateral zig-zag groove. Rib pattern is z-shaped block design with no sip and rib is 5 in number . Shoulder is open block. MILAZE X3 has symmetry tyre tread patten with longitudinal and lateral groove . rib pattern is continuous rib at centre and block design with sip and rib are 5 in number . Shoulder is open inward and outward facing block.

TABLE13.TYREMARK PATTERN CHARACTERISTICS OF BRIDGESTONE COMPANY

TYRE MODEL	TYRE TREAD PATTERN	GROOVE	RIB		SHOULDER
			PATTERN	NUMBER	
B290	Symmetry	Longitudnial and Lateral	Continuous rib at centre and Block design with line sips	5	Open Block shoulder with slightly S-shape sips
B250	Symmetry	Deep longitudinal and lateral	Continuous rib with block-design	4	Wide open with circumferential grooves
S322	Symmetry	Longitudnial and lateral	Block design with line sips	5	Open Block shoulder
AR20	Symmetry	Longitudnial lateral and diagonal	Continuous rib at centre and Block design	5	Closed block with sips
B290	Symmetry	Longitudinal and lateral	Continuous rib at centre and Block-design with line -sips	5	Open Block shoulder with slightly S-shaped sips
S248	Symmetry	Longitudnial lateral and dotted line	Block design with diagonal sips	5	Open Block shoulder
S322 77T	Symmetry	Longitudinal and lateral	Block design with line sips	5	Open Block shoulder

Turanza ER-601	Symmetry	Deep longitudinal and lateral	Continuous rib at centre with inward and outward facing Block-design	5	Open block shoulder
AR20	Asymmetry	Thin longitudinal and lateral	Continuous rib with V-shaped grooves and Block-design	4	Thin continuous shoulder
B250	Symmetry	Longitudnial and lateral	Continuous with block design and diagonal sips	4	Open and closed with dortted lines

The above table illustrate the Tyremark pattern characteristics of BRIDGSETONEcompany which represent the tyre thread pattern, grooves, rib pattern, rib number and shoulder with further studies it was observed that B290 has symmetry tyre tread pattern and groove is longitudinal and lateral. Rib pattern is continuous rib at centre and block-design with line sips and rib is 5 in number.Shoulder is open block with slightly s-shaped sips.B250 is symmetry pattern and groove is deep longitudinal and lateral. Rib pattern is continuous rib with block design and rib is 4 in number. Shoulder is wide open with circumferential groove. S322 has symmetry tyre tread pattern and groove is longitudinal and lateral. Rib pattern is block-design with line sips and rib is 5 in number. Shoulder is open block. AR20 has symmetry tyre tread pattern and groove is longitudinal, lateral and diagonal. Rib pattern is continuous rib at centre and block design and rib is 5 in number. Shoulder is close block with sips. S248 has symmetry tyre tread pattern and groove is longitudniallateral and dotted line. Rib pattern is block design with diagonal sips and rib is 5 in number. Shoulder is open block shoulder. S322 77 T has symmetry tyre tread pattern and groove is longitudinal and lateral. Rib pattern is block-design with line sips and rib is 5 in number. Shoulder is open block .TURANZA ER-601 has symmetry tyre tread pattern and groove is deep longitudinal and lateral. Rib pattern is continuous rib at centre with inward and outward facing blck-design and rib is 5 in number. Shoulder is open block shoulder. AR20 has Asymmetry tyre tread pattern and groove is thin longitudinal and lateral. Rib pattern is continuous rib with v-shaped grooves and block design and rib is 4 in number. Shoulder is thin continuous. B250 has symmetry pattern and groove is longitudinal and lateral. Rib pattern is continuous with block design and diagonal sips and rib is 4 in number . Shoulder is open and closed with dotted lines.

TABLE14.TYREMARK PATTERN CHARACTERISTICS OF JK TYRE COMPANY

TYRE MODEL	TYRE TREAD PATTERN	GROOVE	RIB		SHOULDER
			PATTERN	NUMBER	
Ultima Sport	Aymmetry	Longitudinal and lateral	Continuopus rib with lateral groove and line sips	5	Closed shoulder
Ranger H/T	Symmetry	Longitudnial and lateral	Continuous rib at centre and Block, design withj sips	5	Open shoulder
Elanzo NXT	Asymmetry	Longitudnial and lateral	Continuous rib with lateral groove anmd line sips	5	Closed shoulder
UXI Royale	Asymmetry	Longitudinal and lateral	Continuous rib with lateral groove and line sips	5	Closed shoulder
Vectra	Asymmetry	Longitudnial and lateral	Continuous rib with lateral groove and line sips	5	Close shoulder
Elanzo NXT	Lugs-design	Circumferential and Angular groove	Continuous rib at centre	3	Wide inward and outward facing block
Vectra	Symmetry	Longitudnial and lateral	Continuous rib at centre and Block-design with Stich-like sips	5	Open Block shoulder

Ultima NXT	Asymmetry	Longitudinal and lateral	Continuous rib at centre, angular block,Block-design with Y-shaped sips	5	Open Block shoulder
Ultima Sport	Symmetry	Longitudnial and lateral	Continuous rib with lateral grooves and line sips	5	Closed Shoulder
Vectra	Symmetry	Longitudnial and lateral	Continuous rib at centre and Block-design with stich like sips	5	Open Block shoulder

The above table illustrate the Tyremark pattern characteristics of JK TYRE company which represent the tyre thread pattern, grooves, rib pattern, rib number and shoulder with further studies it was observed that ULTIMA SPORT has asymmetry tyre tread pattern and groove is longitudinal and lateral. Rib pattern is continuous rib with lateral grooves and line sips and rib is 5 in number.Shoulder is closed. RANGER H/T is symmetry pattern and groove is longitudinal and lateral. Rib pattern is continuous rib at centre and block-design with line sips and rib is 5 in number. Shoulder is open .ELANZO NXT has asymmetry tyre tread pattern and groove is longitudinal and lateral. Rib pattern is continuous rib with lateral grooves and line sips and rib is 5 in number. Shoulder is closed.UXI ROYALE has asymmetry tyre tread pattern and groove is longitudinal and lateral . Rib pattern is continuous rib with lateral grooves and line sips and rib is 5 in number. Shoulder is closed .VECTRA has asymmetry tyre tread pattern and groove is longitudnial and lateral. Rib pattern is Continuous rib with lateral grooves and line sips and rib is 5 in number. Shoulder is closed. ELANZO NXT has lugs-design pattern and groove is circumferential and angular. Rib pattern is continuous rib at centre and rib is 3 in number. Shoulder is wide, inward and outward facing block. VECTRA has symmetry tyre tread pattern and groove is longitudinal and lateral grooves. Rib pattern is Continuousrib at centre and block design with stich-like sips and rib is 5 in number. Shoulder is open. ULTIMA NXT has asymmetry tyre tread pattern groove is longitudinal and lateral. Rib pattern is continuous rib at centre, angular block-design with Y-shaped sips and rib is 5 in number. Shoulder is open block.ULTIMA SPORT has symmetry pattern with longitudinal and lateral groove and rib pattern is continuous rib with lateral grooves and line sips and rib is 4 in number and closed shoulder. VECTRA has symmetry tyre tread patten with longitudinal and lateral groove . rib pattern is continuous rib at centre and block design withstich-like sips and rib are 5 in number . Shoulder is open block.

TABLE15.TYREMARK PATTERN CHARACTERISTICS OF INTERNATIONAL TYRE COMPANY

TYRE MODEL	TYRE TREAD PATTERN	GROOVE	RIB		SHOULDER
			PATTERN	NUMBER	
Eagle F1	Aymmetric	Wide longitudinal and lateral	Continuous rib with lateral groove and block-design with lateral grooves	5	Wide open block shoulder
Efficient grip	Asymmetric	Longitudnial and lateral	Continuous rib design with block dsign with no notches	5	Open block shoulder
Efficient grip Moe	Asymmetric	Aggressive wide longitudinal groove	Continuous lateral groove with notches, no sips	5	Wide, open inward and close outward facing block.
Dura plus	Symmetry	Wide longitudinal and lateral	Continuous rib at centre with lateral groove	4	Close shoulder

Wrangler triplemax	Symmetry	Wide longitudinal and lateral	Lateral groove and block design with angular groove	5	Close shoulder
Eagle NCTS FP	Asymmetry	Wide longitudinal and lateral	Block design with notches	4	Wide open block shoulder

The above table illustrate the Tyremark pattern characteristics of INTERNATIONAL TYRE company which represent the tyre thread pattern, grooves, rib pattern, rib number and shoulder with further studies it was observed that EAGLE F1 has asymmetry tyre tread pattern and groove is wide longitudinal and lateral. Rib pattern is continuous rib with lateral grooves and block design with lateral grooves and rib is 5 in number.Shoulder is wide open block shoulder .EFFICIENT GRIPis asymmetry tyre tread pattern and groove is longitudinal and lateral. Rib pattern is continuous rib with block design with no notches and rib is 5 in number. Shoulder is open block .EFFICIENT GRIP Moehas asymmetry tyre tread pattern and groove is aggressive and wide longitudinal groove. Rib pattern is continuous lateral grooves with notches, no sips and rib is 5 in number. Shoulder is wide open inward and close outward facing block. DURAPLUS has symmetry pattern and groove is wide longitudinal and lateral. Rib pattern is continuous rib at centre with lateral grooves and rib is 4 in number. Shoulder is closed .WRANGLER TRIPLEMAX has symmetry tyre tread pattern and groove is widelongitudnial and lateral. Rib pattern is lateral groove and block-design with angular grooves and rib is 5 in number. Shoulder is closed. EAGLE NCTS FP has asymmetric pattern and groove is wide longitudinal and lateral . Rib pattern is block-design with notches and rib is 4 in number. Shoulder is wide open block.

TABLE16.TYREMARK PATTERNCHARACTERISTICS OF LOCAL/DUPLICATE TYRE

TYRE MODEL	TYRE TREAD PATTERN	GROOVE	RIB		SHOULDER
			PATTERN	**NUMBER**	
Czzar	Asymmetry	Wide longitudinal and lateral zig-zag	Block design with notches	4	Open block shoulder
Amaazzer	Asymmetry	Wide longitudinal and lateral groove	Block design with notches, No sips	4	Open block shoulder

ZZX	Symmetry	Thin longitudinal and lateral	Dotted line groove and block design with sips	5	Wide continuous shoulder
B2SO	Symmetry	Longitudnial and lateral	Continuous with block design and diagonal sips	4	Open and close with dotted lines

The above table illustrate the Tyremark pattern characteristics of LOCAL/DUPLICATE tyre company which represent the tyre thread pattern, grooves, rib pattern, rib number and shoulder with further studies it was observed that CZZAR has asymmetry tyre tread pattern and groove is wide longitudinal and lateral zig-zag. Rib pattern is block design with notches and rib is 4 in number.Shoulder is open block.ZZX hassymmetry tyre tread pattern and groove is thin longitudinal and lateral. Rib pattern is dotted line groove and block with design sips and rib is 4 in number. Shoulder is wide continuous .B2S0 has symmetry pattern and groove is longitudinal and lateral . Rib pattern is continuous with block-design and diagonal sips and rib is 4 in number. Shoulder is open and closed with dotted lines .

TABLE17. TYRE MODEL OF APOLLO AND VEHICLE IN WHICH IT CAN BE EMPLOYED

TYRE MODEL	VEHICLE BRAND	VEHICLE MODEL
Amazer 4G life	Toyota, chevrolet, Mahindra	Chevrolet tavera, Quanto, RhinoRx, Camry old
Amazer 4G life	Maruti Suzuki	Wagon-R,WagonR-Sting ray
Aspire 4G	Audi, BMW	A8,X3 Series
Apterra HT2	Mahindra, Tata,Force Motors	Bolero invader, vecta, sumo, TUV 300, Sieraa
Apterra HT	Mahindra, Tata, Force Motors	Bolero DX/LX,Marshal, Xylo,Sumo Gold,CR4,GX
Apterra HLS	Hyundai, Nissan	Creta, Taena230JMV6
Alnac 4GS	Ford,Honda, Hyudai, Maruti Suzuki,Skoda	Sonata, SX4, Octavia, Octavia VRS, MBC Class
Amazer 3G	TATA	Nano
Amazer XL	Daewoo, Maruti Suzuki	Matiz,WagonR-old,Zen Estilo,Zen

Aspire 4G	Audi, BMW	A8,X3 Series

The above table illustrates the tyre models of Apollo company, the brands of vehicle and the models of the vehicle in which it can be employed.it was observed that AMAZER 4G LIFE tyre can be fitted with toyota, chevroletmahindra, rhino brands of innova 2.5,tavera, quanta, camry old, xylo-02 model of vehicle respectively. AMAZER 4G life tyre can be fitted with marutisuzuki brands of wagon-r, wagon-r stingray model of vehicle respectively. ASPIRE 4G tyre can be fitted with audi, bmw brand and A8,A3 series model of vehicle respectively. APTERRA HT2 can be fitted with mahindra, tata , force motors brand and bolero invader, bolero DX/LX, sumo,vecta,sierra model of vehicle respectively. APTERRA HT can be fitted withmahindra, tata, force motor brand andtuv 300 marshal bolero invader, traveller crv16model of vehicle respectively.APTERRA HLS can be fitted with hyundai, nissan motor brand andcreta, teanna 230jmv6model of vehicle respectively. ALNAC 4GS can be fitted with ford, honda, hyundai, maruti Suzuki motor brands and eco sport 1.5, sonata,sx4 octaviamodel of vehicle respectively. AMAZER 3G can be fitted with tata brand and nano model of vehicle respectively. AMAZER XL can be fitted daewoo, maruti Suzuki brand andmatiz, wagonR-old, zen estilo,zen series model of vehicle respectively. ASPIRE 4Gcan be fitted withaudi,bmw brand and A8,X3 series model of vehicle respectively.

TABLE18. TYRE MODEL OF MRF AND VEHICLES IN WHICH IT CAN BE EMPLOYED

TYRE MODEL	VEHICLE BRAND	VEHICLE BRAND
ZLX	Maruti Suzuki, Hyundai	Alto, Alto 800, Eon
ZV2K	Tata, Honda, Hyundai, Ford	Bolt XMS, Indica Vista Terra, Aqua,Indigo Ls,Lx,Sx
ZVTS	Datsun, Hyundai	Go, Santro
ZTX A1	Datsun, Daewoo, Hyundai, Tata, Ford	Redi Go, Cielo, Indica ev2, Ikon
ZVTV	Honda,Ford, Fiat	City, Ikon, Fiesta, Figo,Brio, Amaze,Palie, Sienaa
ZGP	Mahindra	Bolero, Marshal, Scorpio, TUV 300, Xylo
ZTX A1	Hyundai, Rhino	Creta, Rhino Rx
ZVTV	Maruti Suzuki, Renault	Celerio, Pulse

Wanderer A/T	Maruti Suzuki, Tata, Chevrolet, Tata, Volvo	Alto K10, Chevrolet captiva, Scorpio, Aria, Land Rover
ZLX	Tata, Hyundai	Indigo, i10

The above table illustrates the tyre models of MRF company, the brands of vehicle and the models of the vehicle in which it can be employed.it was observed that ZLX tyre can be fitted with marutisuzuki, hyundai brands of Alto, Alto 800, eon model of vehicle respectively. ZV2K tyre can be fitted with tata, honda, hyundai, ford brands of bolt xms, geyz prime, brio, city, fiesta model of vehicle respectively. ZVTS tyre can be fitted with datsun, hyundai brand and go, santro model of vehicle respectively. ZTX A1 can be fitted with datsun, daewoo, hyundai,tata brand and redigo,cielo,ikon, indica ev2 model of vehicle respectively. ZVTV can be fitted with honda, ford, fiat brand and city,ikon, fiesta, petra, amaze model of vehicle respectively.ZGP can be fitted with mahindrabrand and bolero,marshal,scorpio, xylomodel of vehicle respectively. ZTX A1 can be fitted with hyundai, rhino motor brands and creta, rhino rx model of vehicle respectively. ZVTV can be fitted with marutisuzuki brand and celerio, pulse model of vehicle respectively. WANDERER A/T can be fitted with marutisuzuki, tata, chevrolet, mahindra, volvo brand and alto k10, chevroletcaptiva, land rover, scorpio, aria, xc90 model of vehicle respectively. ZLX can be fitted with tata, hyundai brand and indigo, i10 series model of vehicle respectively

TABLE19. TYRE MODEL OF CEAT AND VEHICLE IN WHICH IT CAN BE EMPLOYED

TYRE MODEL	VEHICLE BRAND	VEHICLE MODEL
Milaze X3	Toyota	Innova
Fuelsmarrt	Maruti Suzuki	Swift Lxi/Vxi
Milaze X3	Hyundai,TATA,Maruti Suzuki	Spark, Santro, Wagon R, Indica
CZAR Sport	Hyundai, Nissan, Renault, Audi	Tucson, Terrano, Duster, Q3
Milaze X3	Maruti Suzuki	Maruti 800
CZAR A/T	Audi, Mahindra	Q3,Q5,XUV 500,

Fuelsmarrt	Honda, Maruti Suzuki	Amaze, Brio, City, Celerio
Milaze X3	Maruti Suzuki	Alto, Zen
Formula I	Mahindra	Bolero, Xylo
Milaze X3	TATA	Nano

The above table illustrates the tyre models of ceat company, the brands of vehicle and the models of the vehicle in which it can be employed.it was observed that MILAZE X3 tyre can be fitted with toyota brands of innova model of vehicle respectively. FUELSSMARTT tyre can be fitted with marutisuzuki brands of swift Lxi/vxi model of vehicle respectively.MILAZE X3 tyre can be fitted with hyundai,tata, marutisuzuki brand and spark, santro, wagon-r, indica series model of vehicle respectively. CZAR SPORT can be fitted with hyundai,nissan, renault brand and tucson, terrano, duster q3 model of vehicle respectively. MILAZE X3 can be fitted with marutisuzukibrand andmaruti 800 model of vehicle respectively.CZAR A/T can be fitted with audi,mahindra brand and q3, q5, xuv 500 model ofvehicle respectively. FUELSMARTT can be fitted with honda, maruti Suzuki brands and alto, zen model of vehicle respectively. MILAZE X3 can be fitted with marutisuzuki brand and alto, zen model of vehicle respectively.FORMULA I can be fitted mahindra brand and bolero, xylo series model of vehicle respectively. Milaze X3 can be fitted with tata brand and nano series model of vehicle respectively.

TABLE20.TYRE MODEL OF JK TYRE AND VEHICLE IN WHICH IT CAN BE EMPLOYED

TYRE MODEL	VEHICLE BRAND	VEHICLE MODEL
Ultima Sport	Hyundai, Maruti Suzuki, Tata, Ford	Getz, verna, Baleno, Versa, Indica, Indigo, Fiesta
Ranger H/T	Mahindra, Audi, Volvo, Land Rover	Accord, Rhino, Tavera, Xylo, Innova,Camry
Elanzo NXT	Volvo, Audi, Land Rover, Tata, Mahindra, Chevrolet, Mercedes	Discovery, Freelander,XC60,Q5,Aria
UXI Royale	Tata, Ford, Honda, Toyota, Nissan	Fiestaa, Figo, Ikon, Brio, City, Indica Vista
Vectra	Hyundai, Skoda, Toyota, Volkswagen, Tata	Elite i20,Rapid,Etios,Cross, Polo
Elanzo NXT	Land Rover,Volvo,Audi,Mahindra,	Discovery,XC60, Freelander, Captiva, Scorpio, M class

Vectra	Ford, Hyundai, Volvo, Chevrolet,Skoda, Renault, Mini	Ecosport,Elantraa,SX4,Cruze, Fluence,V40
Ultima NXT	Maruti Suzuki	800, Alto 800
Ultima Sport	Tata	Indica
Vectra	Toyota, Honda, Ford, Hyundai, Tata, Fiat, Renault	Etios,Etios liva,Amaze, Figo, Fiestaa, Fiestaa indica, Ertiga

The above table illustrates the tyre models of JK tyre company, the brands of vehicle and the models of the vehicle in which it can be employed.it was observed that ULTIMA SPORT can be fitted with hyundai, marutisuzuki, tata brands of getz, verna, baleno, versa, indica, indigo model of vehicle respectively. RANGER H/Tcan be fitted with mahindra, volvo,audi brands of accord, rhino, tavera, xylo, innova model of vehicle respectively. ELANZONXT tyre can be fitted with land rover, mahindra, honda, mercedes brands of discovery, freelander, xc 60, scorpio, M class series model of vehicle respectively. UXI ROYALEcan be fitted with tata , ford, honda, nissan brand and fiesta, figo, ikon, indica vista, indigo ecs, indigo xl model of vehicle respectively. VECTRA can be fitted with hyundai,skoda, toyota, volkswagen brand and elite i20, rapid, etios, polo, zest model of vehicle respectively. ELANZO NXT can be fitted with land rover, volvo, audi, tata,mercedes brand and discover, xc60, freelander, scorpio, M class model of vehicle respectively. VECTRA can be fitted with ford, hyundai, marutisuzuki, volvo, Chevrolet motor brands and ecosport, elantra, sx4,cruze, v40 model of vehicle respectively. ULTIMA NXT can be fitted with marutisuzuki brand and 800, alto 800 model of vehicle respectively. ULTIMA SPORT can be fitted tata brand and indica model of vehicle respectively. VECTRAA can be fitted with honda, ford, toyota, tata, fiat, renault brand and etios, amaze, figo, fiesta, etiosliva series model of vehicle respectively.

TABLE21.TYRE MODEL OF BRIDGESTONE COMPANY AND VEHICLE IN WHICH IT CAN BE EMPLOYED

TYRE MODEL	VEHICLE BRAND	VEHICLE BRAND
B290	Hyundai, Chevrolet, Fiat, Maruti Suzuki,Tata, Honda	Eon, Santro,Spark, Indigo Reva, Wagon-R, City, Punto
B250	Chevrolet, Hyundai, Volkswagen, Renault,Maruti Suzuki	Aveo, Optera, verna,Optera i20, Swift Dzire, Vento
S322	Maruti Suzuki	Alto K10,Wagon R, Zen, Eeco, Estilo
AR20	Maruti Suzuki, Daewoo, Mahindra	Zen, Alto,Zen estilo, Reva, Wagon-R, Matiz
B290	Maruti Suzuki	Alto K10, Wagon-R, Zen, Eeco

S248	Maruti Suzuki, Hyundai	Alto, Alto 800, Omni,Zen, Eon
S322 77T	Chevrolet, Hyundai, Mahindra, Tata, Honda, Fiat	Eon, Santro, Spark, Indigo, Wagon-R,Indica, Indica V2
Turanza ER-601	Maruti Suzuki, Hyundai	Omni,Zen Eon, Alto
AR20	Maruti Suzuki, Chevrolet, Tata, Nissan, Hyundai	Indica V2, Celerio, Eeco,Aveo, Accent A star
B250	Ford, Hyundai, Fiat, Maruti Suzuki, Volkswagen, Renault, Daewoo	Verna, i20,Polo, Figo, Sienaa, Accent, Amaze

The above table illustrates the tyre models of BRIDGESTONE company, the brands of vehicle and the models of the vehicle in which it can be employed it was observed that B290 tyre can be fitted withchevrolet, mahindra, hyundai, fiat, marutisuzuki brands of eon, santro, spark, indigo, reva, indica, wagon R, punto model of vehicle respectively. B250 tyre can be fitted with chevrolet,mahindra,hyundai, renault, volkswagen brands of aveo, optera, verna, baleno, swift dzire model of vehicle respectively.S322 tyre can be fitted with marutisuzuki brand and alto k10, wagon-R, Zen series model of vehicle respectively. AR 20 can be fitted with marutisuzuki,mahindra motors brand and zen, alto, matiz, wagon-R model of vehicle respectively.B290 can be fitted with marutisuzuki brand and alto k10, zen, eeco,estilo model of vehicle respectively.S248 can be fitted with hyundai, marutisuzuki motor brand and omni, zen, eon model of vehicle respectively. S322 77T can be fitted with chevrolet, hyundai, marutisuzuki, fiat, Tata motor brands and eon,santro,spark, indigo model of vehicle respectively.turanza ER-601 can be fitted with marutisuzuki,hyundai brand and Alto,Alto 800,omni model of vehicle respectively. AR20 can be fitted marutisuzuki, chevrolet, nissan, tata brand and Indica v2, celerio, Eeco, versa, indica, aveo model of vehicle respectively. B250 can be fitted with ford, hyundai, fiat, honda, marutisuzukidaewoo, volkswagen brand and verna, i20, vento, polo, figo,city, brio, amaze, accent model of vehicle respectively.

TABLE22.TYRE MODEL OF INTERNATIONAL COMPANY AND VEHICLE IN WHICH IT CAN BE EMPLOYED

TYRE MODEL	VEHICLE BRAND	VEHICLE MODEL
Eagle F1	Chevrolet, Ford, Fiat	Ford Ecosport, Ford figo, Audi A3
Efficient Grip	Force Motors, SUV	Forc one, Ford endeavour
Efficient Grip Moe	Mercedes Benz	Mercedes Benz-cl-class,S-class,v-class
Dura Plus	Maruti, Honda	Maruti celerio, Honda jazz, Maruti swift, Dzire

Wrangler Triplemax	Tata, Toyota	XUV,Sumo, Fortuner
Eagle NCTS FP	Toyota, Honda	Honda accord, BMW series

The above table illustrates the tyre models of INTERNATIONALcompany, the brands of vehicle and the models of the vehicle in which it can be employed it was observed that EAGLE F1 tyre can be fitted with chevrolet,ford, fiat, brands of ford ecosport, ford figo, audi a3 of vehicle respectively.EFFICIENT GRIP tyre can be fitted with force moptors, suv brands of force one, ford endeavour model of vehicle respectively. EFFICIENT GRIP MOE tyrecan be fitted with Mercedes benzbrand Mercedes benz-cl-class, s-class, v-class series model of vehicle respectively. DURAPLUS can be fitted maruti, Honda brand and maruticelerio, Honda jazz, marutiswift,dziremodel of vehicle respectively. WRANGLER TRIPLEMAXcan be fitted with tata, toyota brand and xuv, sumo, fortuner model of vehicle respectively.EAGLE NCTS-FP can be fitted with Toyota, honda brand and Honda accord, bmw series model of vehicle respectively.

TABLE23.TYRE MODEL OF LOCAL/DUPLICATE COMPANY AND VEHICLE IN WHICH IT CAN BE EMPLOYED

TYRE MODEL	VEHICLE BRAND	VEHICLE MODEL
CZZAR	Nissan, Hyundai	Tucson, Duster
AMAZZER	Toyota, Mahindra	Chevrolet, Tavera, Xylo-02
ZZX	Hyundai	Alto Series
B2SO	Volkswagen, Renault, Hyundai	Elite i20, Swift Dzire, verna

The above table illustrates the tyre models of LOCAL/DUPLICATE company, the brands of vehicle and the models of the vehicle in which it can be employed it was observed that CZZAR tyre can be fitted with Nissan, Hyundai brands of ntucson, duster of vehicle respectively.AMAAZZER tyre can be fitted with Toyota, Mahindra brands of Chevrolet, xylo-02 model of vehicle respectively. ZZX tyre can be fitted with Hyundai brand alto series model of vehicle respectively. B2SO can be fitted with Volkswagen, renault, hyundai brand and elite i20, swift dzire verna model of vehicle respectively.

The present study deals with the class characteristics of tyre including tyre its manufacture models, pattern

characterisstics, vehicle manufacturer and its model. This section present the result to the above observations. The observation was made by examining the thoroughly examining the tyre specefications and pattern characteristics of the tyre of five company namely APOLLO,MRF,CEAT,JK TYRE and BRIDGESTONE

along with their ten model of each respectively. These brand have strong dominance of Indians leading tyre manufactures today.

The Result were in line with theoretical expectations and were seen that Different companies of tyre having different tyremarks pattern , Different models of tyre of same company as well as the different company have different tyremarks pattern respectively and Different vehicles tyre followed by its model and brands have different tyremarks pattern. The result is based on the unique pattern founds in tyre tread of tyre.

The result are supported in the form of databank of class characteristics of various tyre tread pattern from the mentioned tables . with the help of this preliminary and predictive database it will be more efficient for the investigators of forensic tyre impression to analyze crime scene and narrow down the investigation by comparison with the recovered tyrepattern of tyre of vehicle at crime scene because just like fingerprint and shoeprint, tyremark pattern is unique and is of great importance in forensic science because each tyre on the street is great importance and each different brands of tyre and its models have different tread patterns, different class and individual characteristics and also have different patterns caused by damage or destruction of the tread and save times. It also helps in reconstruction of events. The investigation officer does not have to search the vehicle every time for a case in which vehicles used in commission of crime

Table 2 to 9 demonstrates the Tyre specefications of Apollo,MRF,CEAT, JK tyre and Bridgestone company followed by ten models of each and 6 models of internatonal company and 4 local/duplicate tyre respectively. From the above study of table it can be concluded that every tyre company available in India made with the same have different and unique pattern because of principle of forensic science that Every objects,natural or man-made has a individuality which is not duplicated in any other objects . it has also seen that two tyres of the same brand, models and sizes will have identical tread design and dimensions but have slight different in length due to imperfections in the molds during manufacturing. From the above observation table of specefications of tyre it can also be seen that the rim diameter available for all brands followed by its models of tyre comes in Size ranges from 12 inches to 17 inches for four wheeler vehicle.

The given tyre size is the original equyipment which is useful in the new car this tyre should be same for the delivery in every country.

Table 10 to 16 illustrates the Tyremark pattern characteristics of Apollo,MRF,Ceat, Jk tyre and Bridgestone company, international and local/duplicate tyre which includes tyre tread pattern, grooves, ribs, number of ribs and shoulder of the tyre. These pattern on the tyre tread are made depending on the crediability and also some models on which he tyre will fit. Also on basis of water dispersion and wet performance flexibility, stability and many more taken into consideration. Now a days mostly the tyre made are of Radial construction. From the above table, it can be concluded that mainly all the tyres in the tyremarket have symmetric type of tyre tread pattern in four wheeler vehicle as compared to asymmetric and directional type. Tyre tread can also have lugs pattern. But lugs pattern mostly seen in two wheeler vehicles . The pattern of tyre tread grooves have longitudinal or circumferential which varies from thick to thin , wider to deeper and transverse or lateral grooves which varies from parallel to s-shaped . Ribs pattern of tyre tread feature block-design , in lugs with notches and without notches and with sips and without sips. The shape of sips in four wheeler vehicle vehicle feature in line pattern ,parallel pattern and in curved shaped and s-shaped . shoulder is the portion of the tyre

tread between the tread between the tread centre and sidewall of tyre. Shoulder of tyre tread have wide closed shoulder, open shoulder, open block shoulder, thin continuous shoulder and wide closed shoulder. The extending part of the shoulder of tyre is varies from thin to wide. The most common passenger tyre should be feature 5-rib design and 4 rib design separated by circumferential grooves.

These are the pattern characteristics of tyre tread and wear and tear of tread records as a evidence for use in legal procedings to help to prove the identities of person at crime scene.

Table 17 to 23 represents the tyre model of Apollo,MRF, JK tyre and Bridgestone company and vehicle in which it can be employed, from the above table it can be concluded that in one vehicle two different brands of tyre can be employed and even the same sized tyre is used in same type of vehicle irrespective of different company. It is also seen that a tyre belong to same company having the same brand name but slightly change in measurement ofd the tyre result in that tyre will fit in other vehicle and this also proves a law of forensic is that Every objecs, natural or man-made has a individuality which is not duplicated in any other objects.

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DISCUSSION

The current study was conducted on "A STUDY ON TYRE SPECEFICATION AND TYRE PATTERN AND CREATION OF DATABANK PREVELANT IN SAGAR DISTRICT OF M.P INDIA. The Tyre specification can be studied on the basis of Tyre width, Aspect Ratio , Rim Diameter and construction types and and Tyre pattern can be studied on tyre tread pattern, Grooves, Rib pattern , Rib number and shoulder of tyres and also on the vehicle in which it can be employed. The present study is undertaken on a total of six (06) of tyres of four wheeler which are prevalent in Sagar (Madhya Pradesh). A survey was conducted from different showrooms of Sagar district of Madhya Pradesh.

In the study Conducted by Ying-wei wang (2005) presented a database which includes tire manufactures, vehicle type/model and tire specification and it encompasses a tire manufacturing function and it can be more conviently used to identify the tyre pattern and catch tire-treads by inputting actal widths of light and heavy streaks on the tire-marks. From this studies we can find out the probably involved tyre size and vehicle geometric properties and infer from them with the front/reast track and wheelbase to determine the tire-marks belongings. .

In the study conducted by Vidas Zuraulis (2015) which deals with the problem of a vehicle speed prediction from tyre yaw marks and objective is for analysis of tyre yaw marks when speed is too great to maintain the proposed cicular path and the error caused by Yaw marks trajectory measures could have influence on choice of calculatiom methodology for an obtained results.

Kumar A 2018 worked on the topic Tyre marks identification for crime scene investigation using image processing techniques and study employs to design and develop an android application for identifying tyre marks by applying image processing techniques and image of tyre marks is fed as an input to the server. In the server image analysis is done so as to extract various features. The extracted features are compared with the database and a comparison is performed. If a match is found then an SMS with the information corresponding tyre manufactures and vehicle class of the tyre is sent to the user mobile.