

Tire Selection

Selecting the proper tire size, load range and design is very important to insure satisfactory performance. The best guide is to follow past experience and use the advice of professionals who are familiar with the types of tires used in service conditions similar to yours. Goodyear representatives are trained to aid you in this important decision. The following will provide basic guidelines for proper tire selection.

*Information courtesy of The Maintenance Council (TMC)

— Recommended Practices Book

TIRE SELECTION PROCESS

Purpose

This Recommended Practice is intended to make the tire purchaser, fleet operator, or maintenance manager aware of major items for consideration, and to provide a step-by-step thought process for selecting the best type of tire for the application. The following sections provide a brief explanation of the various tire selection criteria that must be addressed. A summary of considerations is also listed to enable the decision-maker to identify advantages and disadvantages of each of the selection criterion.

If higher steer tire pressures are required, this may mean you'll be using different inflation pressures for drive and trailer tires.

While the considerations may not be all-encompassing, they point out the major issues that should be dealt with before selecting a tire. Because of the pace of technology change in the tire industry, certain considerations may become less important while new ones may arise from time to time.

Introduction

The process of determining which tire to select for a particular job or operation may sometimes seem difficult or complex. Indeed, the proper selection involves a myriad of decisions concerning the size, the type, and the tread design of the tire based upon the intended application. Other considerations are the manufacturer of the tire, the tire dealer, price, availability, and the warranty coverage which comes with the product. However, there is a logical method for selecting which kind of tire would be most appropriate depending upon an assessment of the many considerations surrounding the fleet operation.

Be aware that all tire use selections will have advantages and disadvantages depending upon vehicle design and vocation. Make certain your choices are in line with your perceived fleet needs and contact your tire suppliers for expert assistance in making your selection.

Tire Clearance Restrictions

New Equipment — When specifying a new vehicle, the prospective owner can be quite imaginative in creating a vehicle that meets specific needs. Tires, however, may be the limiting factor to this creativity since they must be capable of carrying the expected load and be made to certain minimum dimensions. The fleet owner can choose from several types of tires that can carry the anticipated load, but may be forced to redesign a vehicle's overall dimensions if the tires that can carry the load are larger than originally desired.

Existing Equipment — When changing the type or size of tires used on existing equipment, space restrictions are more inflexible. Not only must a tire be selected that can carry the load, it must fit in an existing space. In addition, when changing tire sizes on an existing power unit, consideration must be given to the effects the new size tire will have on

the gear ratio. Some change may require a different rim (width, pressure limits).

Tire Clearances — In order to select a new tire size for a given application, the dimensional clearance of the tire must be acceptable. The following define those areas that must be checked:

1. **Vertical Clearance** is the distance between the top of the tire tread and the vehicle immediately above it. This clearance varies as the axles operate. The vertical movements of the whole axle in relation to the chassis are normally limited by an axle stop. To determine vertical clearance, subtract the axle stop clearance from the total clearance above the tire at rest.
2. **Front Tire Clearances** are the distances between the front tires (on both steering lock positions) and the vehicle. Clearances of front wheels must be checked by turning the wheels from full left lock to full right lock, since the minimum clearance might occur at some intermediate point.
3. **Overall Width** — When fitting larger or wider tires to an existing vehicle, the overall width across the dual tires is increased by half of the increase in the section width of each outside tire and the increase in offset of each outside wheel. The overall width across the tires is measured at the twelve o'clock position and not at the lower side (six o'clock position) where the tires deflect due to load.

When using tire chains, a minimum of two inches more clearance is needed to provide clearance between the dual assembly.

Rims And Wheels

The selection of rims or disc wheels goes hand-in-hand with the selection of tires. When ordering new equipment, specifying the recommended rim for the tire size selected will ensure optimum performance.

Rims are identified by a diameter and width and, in the case of tube-type rims, also with a type code. The type code designations are used on tube-type products to help identify rings and rims for interchangeability. For example, a 20 x 7.5 FL rim would have a nominal diameter of 20 inches, a width between the flanges of approximately 7.5 inches, and be a FL type rim. Other typical type codes are: CR, 5°, LB, and LW. It is important that the rim size be approved for the tire being used. This assures proper fit and performance of the tire and rim. The tire or rim/wheel manufacturer's data book or *Tire & Rim Association Yearbook* (or equivalent), and www.goodyear.com/truck specify approved rims for each tire size.

When selecting the correct wheel or rim type, it is important to determine the operating conditions to which the wheel or rim will be subjected. Conditions to consider are loads, speeds, road surfaces, use of bias or radial tires, tire pressure, tire size, and the use of tube-type or tubeless tires.

Caution is necessary in selecting wheel/rim offsets to ensure proper tire spacing, body and chassis clearance, and overall track width. If dual tires are used, dual spacing and tire clearance must be considered.

Take precautions to ensure that the rim and wheel not only have the approved contour, but also have the load and inflation ratings sufficient for the tire in the intended application.

For more detail in selecting the correct wheel/rim, refer to TMC RP211A, *Rim and Wheel Selection and Maintenance*.

Radial and Bias Tire Construction

There are two basic types of tire construction — radial and bias — that must be considered when choosing either a replacement tire for certain applications or when specifying new tires on an original equipment vehicle **Figure 2.1**.

Bias ply tires are constructed of overlapping crossed layers of cord material and are typically made with nylon, polyester, or other materials. The crossed plies run on a diagonal from tire bead to tire bead and comprise a generally stiff sidewall area. Sometimes, extra crossed plies or breakers are used under the tread area to further stiffen the crown area and provide better wear resistance or other performance parameters (such as puncture resistance, etc.).

Radial ply tires are made with the cord material running in a radial or direct line from bead (at 90 degrees to the centerline of the tire), and are

typically made with one steel body ply or multiple body plies of other materials. Under the tread area, the radial tire usually has three or four crossed plies or belts made of steel cord to stabilize the crown area and offer better puncture resistance. The radial sidewall area is generally less stiff than the bias ply sidewall, though the tread area is normally much stiffer.

Bias ply tires have been designed over the years to perform in many different types of applications from all-highway to on-off road, to all off-road service conditions. With the advent of the radial tire and some of its inherent advantages, the bias tire is now used much less frequently in long haul over-the-road applications. Radial tires typically are used in applications where heat build-up with bias ply tires is a problem. With the many improvements to radial tire construction made in recent years, the radial tire is now used in virtually all types of service conditions.

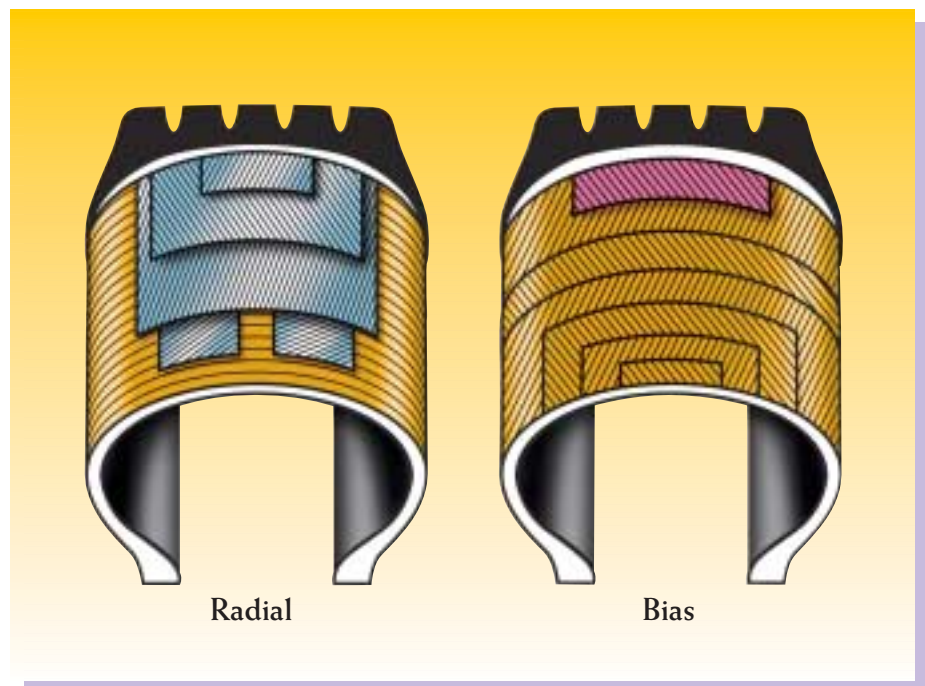


Figure 2.1

Bias Ply Tire Considerations

- stiffer sidewalls give better driver handling/feel
- lower susceptibility to sidewall snags/hazards/rusting
- lower initial tire purchase price

Radial Tire Considerations

- better treadwear performance
- higher potential for retreading
- more fuel efficient
- lower susceptibility to tread punctures
- better traction characteristics

Tubeless And Tube-Type Tires

The tubeless tire is similar in construction to a tube-type tire, except that a thin layer of air and moisture-resistant rubber is used on the inside of the tubeless tire from bead to bead to obtain an internal seal of the casing. This eliminates the need for a tube and flap. The two types of tires require different rim configurations: the tubeless tire uses a single-piece wheel; and the tube-type tire requires a multi-piece wheel assembly **Figure 2.2**. Both tires, in equivalent sizes, can carry the same load at the same inflation pressure. However, tubeless tires generally offer more benefits than tube-type tires in line-haul operations.

Tubeless Tire Characteristics

vs. Tube-type:

- less complicated mounting process due to use of a single-piece wheel
- decreased weight with lighter tire/wheel assembly
- less maintenance of parts and reduced parts inventory
- improved bead durability potential from less brake drum heat resulting from higher wheel clearance
- improved crown and sidewall durability potential from cooler running tubeless casing
- better lateral stability from lower section height
- reduced downtime from punctures

TABLE 1		
Conventional vs. Low Profile Tire Comparison		
	11R22.5	295/75R22.5 (Low Profile)
Diameter	41.5"	40.0"
Section Width	11.0"	11.2"
Nonskid	19/32"	18/32"
Rim	8.25"	8.25"
SLR	19.4"	18.7"
RPM	501	514

Table 1

Low Profile Tires

Low aspect ratio tires are a category of radial tubeless tires which feature section widths wider than their section height. The ratio of tire section height to section width for these low aspect ratio tires generally fall between 80% to 70%.

Low aspect ratio tires have shorter sidewall heights and wider tread widths than their "conventional" aspect ratio tire counterparts.

These differences lead to the following tire characteristics:

- improved treadwear (less irregular wear) on steer and trail axles
- lighter weight and less federal excise tax
- better trailer cube potential due to smaller tire diameter on new equipment
- improved stability and handling from higher lateral spring rate
- greater susceptibility to sidewall curb damage

As fleet experience with low profile tires increases, other considerations (such as vehicle geometry, alignment maintenance, and brake wear) may need to be addressed depending on the applications and service requirements of the operation.

Drivetrain/gearing must be taken into account when converting to low profile tires, either at the original equipment or replacement level. These involve engine RPM, transmission, drive axle gear ratio, and tire RPM. The objective is to obtain the most fuel efficient engine RPM/ground speed relationship consistent with service condition requirements.

The effect on road speed at the same engine RPM using a 55 mph base depends upon which conventional aspect ratio and low profile tires are involved. Generally, if the percent change in the tire RPM is 3% or less, a gearing change is not required **Table 1**.

Wide-Base (Super Single) Tires

A wide-base tire is simply a larger tire with a lower profile by nature. Currently, the primary application in North America is on vehicles whose front axle loads exceed the capacity of standard tires. Construction vehicles such as cement mixers and refuse haulers are prime examples. In addition to increased load capacity, these larger tires provide improved flotation versus conventional size tires.

The common wide-base sizes include: 385/65R22.5, 425/65R22.5, 445/65R22.5, 435/50R22.5, and 445/50R22.5.

The pros and cons of wide base singles versus duals in many performance categories are dependent on specific vehicle configuration and operations. Some key considerations and potential benefits are discussed in the following paragraphs.

Potential advantages for wide base singles include: increased payload weight and volume due to lower tire/wheel weight/volume, ease of maintenance (no mismatched tires, etc.), reduced inventory, improved fuel economy, and sometimes more uniform wear in free-rolling trailer applications. Possible legal restrictions of nonsteer axle application of wide base singles should be thoroughly investigated before finalizing size selection.

Original equipment fitment of wide base singles offers the potential for lowering the center-of-gravity and thus improving the stability of vehicles such as tankers. In retrofit applications, care must be taken to properly select wheel/rim offsets to maintain a tracking width for acceptable stability. A common way to

take full advantage of the wide base single concept is to use a 77.5 inch wide axle in place of the standard 71.5 inch.

Inherent advantages of duals versus wide base singles include standardization of tires/wheels, reduced road service due to tire problems through "limp" capability to get to repair facility, and improved vehicle stability/control during tire air loss.

Matching Tires For Speed And Axle Weights

As mentioned earlier, there are drive train/gearing considerations which must be made at the original equipment or replacement level when utilizing low profile tires. These involve engine RPM, transmission, drive axle gear ratio and tire RPM. The objective is to obtain the most fuel efficient engine RPM/ground speed relationship consistent with service condition requirements.

The effect on road speed at the same engine RPM, using a 55 mph base, depends upon which conventional sizes and which low profile diameters are involved. Generally, if the percent

change in the tire RPM is 3 percent or less, a gearing change is not required.

In a tire selection process, it is mandatory that consideration be given to selecting a tire size and load range which at least equals the maximum load requirements by axle position (steer, drive, or trailer). All highway truck tires have load limits established for tires used in normal highway service. Therefore, when selecting a tire for service, both the carrying capacity and speed implications must be considered.

For example, when selecting tires for a tractor-trailer combination with a gross combination weight (GCW) of 80,000 lbs. and an axle weight distribution of 12,000 lbs. on the steer, 34,000 lbs. on the tandem drive, and 34,000 lbs. on the tandem trailer axles, common conventional tire sizes used are 295/75R22.5 (275/80R22.5), 285/75R24.5 (275/80R24.5), 11R22.5 and 11R24.5 Load Range G. The load and inflation tables (from the Engineering Data Book for Over-the-Road Truck Tires or www.goodyear.com/truck) for these sizes are shown in Table 2.

Table 2

TABLE 2										
Tire Load Limits (lbs.) At Various Cold Inflation Pressures (The Pressure is Minimum for the Load, Maximum Speed of 60 MPH)										
Size	Usage	Inflation Pressure (psi)								
		70	75	80	85	90	95	100	105	110
11R22.5	Dual	4380	4580	4760	4950	5205(F)	5415	5625	5840(G)	5895
	Single	4530	4770	4990	5220	5510(F)	5730	5950	6175(G)	6320
11R24.5	Dual	4660	4870	5070	5260	5510(F)	5675	5840	6005(G)	6205
	Single	4820	5070	5310	5550	5840(F)	6095	6350	6610(G)	6790
295/75R22.5	Dual	4500	4690	4885	5070(F)	5260	5440	5675(G)	5800	6005(H)
	Single	4500	4725	4945	5155	5370	5510(F)	5780	5980	6175(G)
285/75R24.5	Dual	4540	4740	4930	5205(F)	5310	5495	5675(G)	5860	6175(H)
	Single	4545	4770	4990	5210	5420	5675(F)	5835	6040	6175(G)

(F) = Load Range F

(G) = Load Range G

(H) = Load Range H

Therefore, with conventional tire sizes, it would require at least an 11R22.5 tire with a carrying capacity of 6,175 lbs. at 105 psi on the steer axle (which would be the most critical for load and single application). The 11R22.5 would be more than adequate for drive and trailer axle applications. In low profile sizes, the 285/75R24.5 at 105 psi would have the adequate carrying capacity for the steer as well as the drive and trailer axle loads.

The Tire and Rim Association has established inflation pressures for load limits at various speeds for truck tires used on improved surfaces. Consult the Tire and Rim Association table or individual tire manufacturer for specific recommendations to meet your operating condition. You can contact The Tire and Rim Association at 330-666-8121 or www.us-tra.org.

Tread Design Selection

The selection of the proper tread design for an intended application is very important to the fleet that wishes to obtain the maximum potential from tires and thereby lower tire expenses. Selection of the proper tread design

is not an exact science, but there are certain general rules and guidelines which, if followed, can lead to selecting a tread design that will give the maximum desired performance for the service application in a particular fleet. In order to help select the right tread design, refer to Technology & Maintenance Council RP (Recommended Practice) 220, *Tire Tread Design Selection*.

Fleet Operation Considerations

When evaluating the many tire options available for any given vehicle application, there are numerous management considerations in addition to the mechanical considerations already covered. While these considerations apply most directly when specifying out new equipment, they also can be used to reevaluate tire selection prior to tire replacement.

Fleet Operation Considerations

- availability of various products and service maintenance
- tire purchase price vs. performance (cost-per-mile)
- financial inventory investment and space requirements

- maintenance training for personnel
- retreadability/repairability costs and servicing
- warranty and adjustment servicing
- leading edge or "experimental" product availability
- effects of non-standardization
- effects of tire down-sizing on vehicle gearing and braking
- timing for phase-in or changeover programs
- legal or contractual requirements

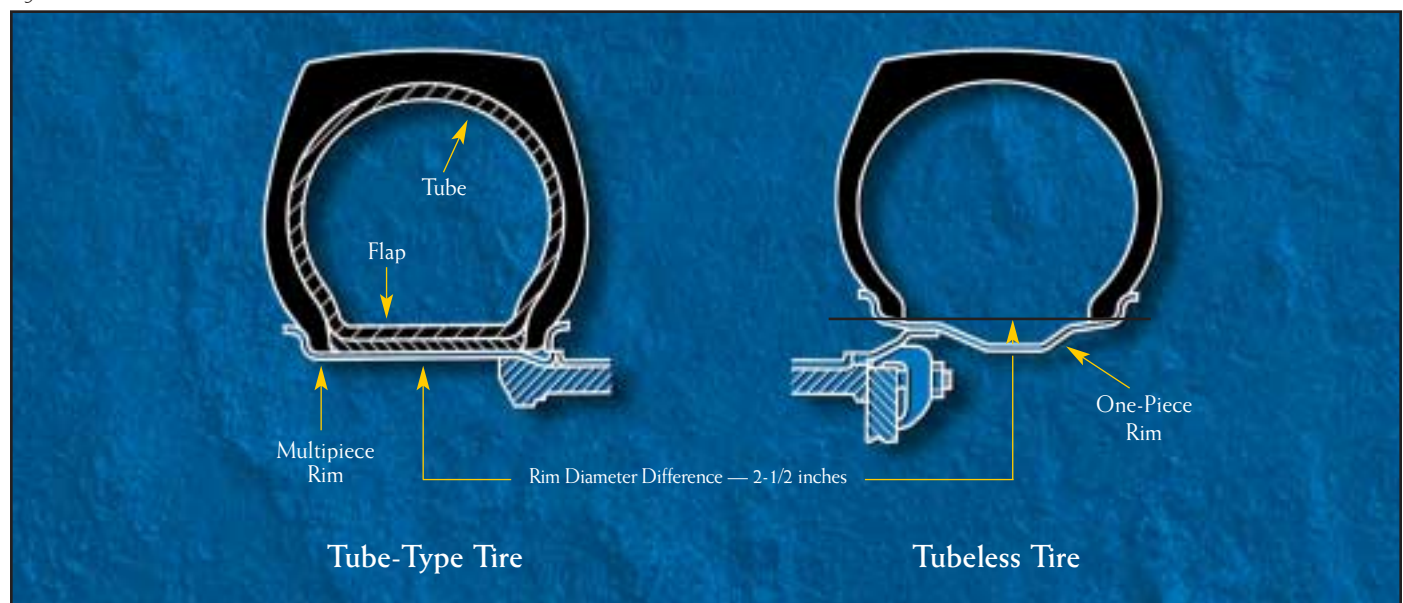
Retreadable Tires

Retreading your worn tires or purchasing retreads from a dealer can provide new tire service and performance at a fraction of the cost of a new tire. When selecting new tires, purchase those that are designed to be retreadable. To insure retreadability, follow prescribed maintenance and avoid regrooving which may damage the valuable casing.

Retreaded Tire Considerations

- provide equivalent service and performance
- reduce overall cost-per-mile
- conserve natural resources
- tread designs available for all applications

Figure 2.2: Tire Construction



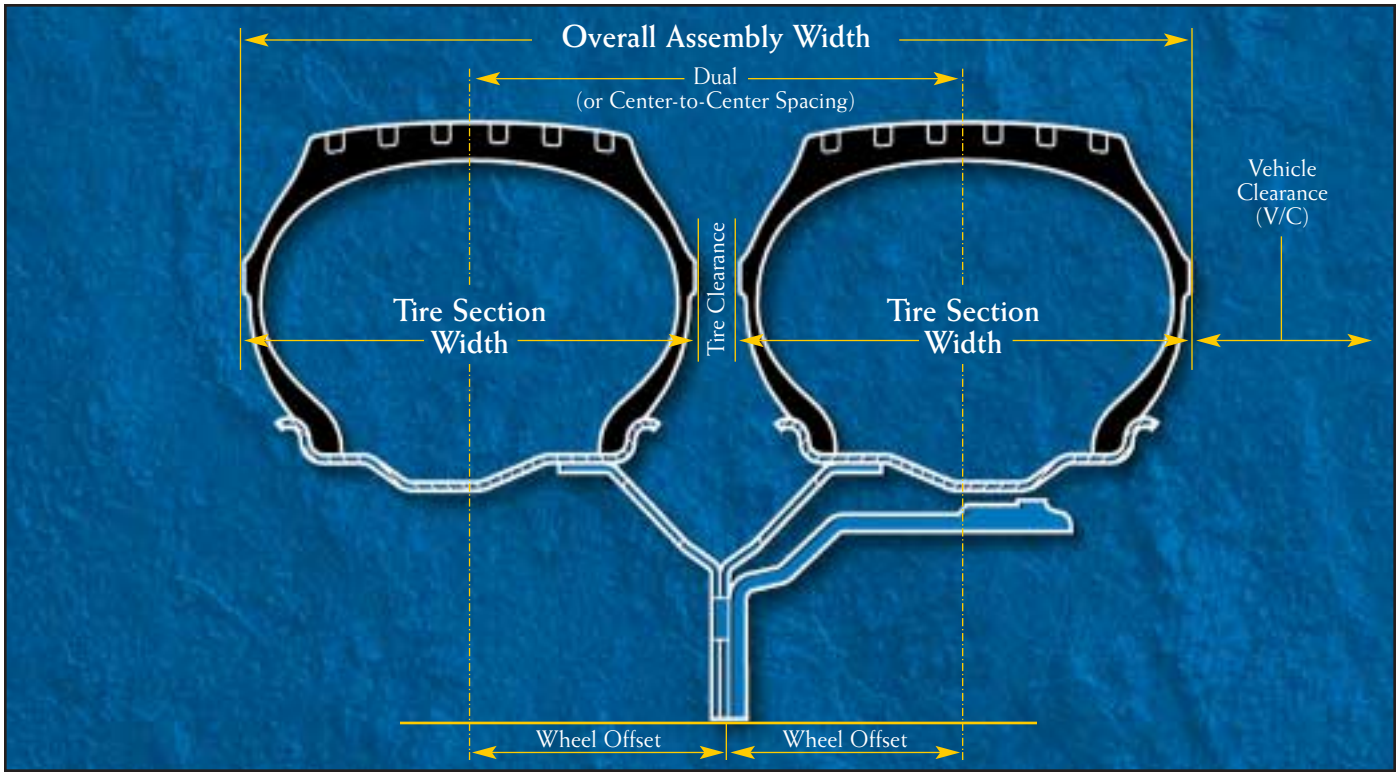


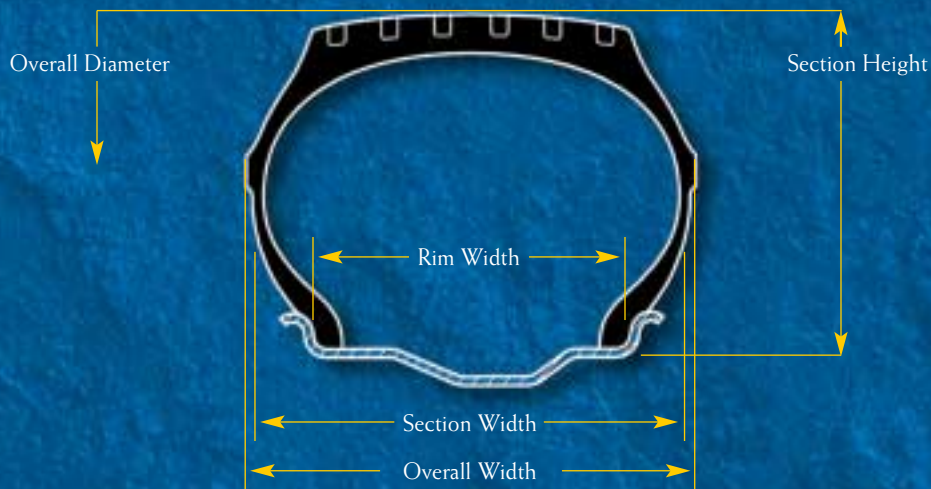
Figure 2.3: Overall Width, Dual Tires

Common aspect ratio categories of medium truck tires are as follows:

- 98 Tube-type conventional sizes (10.00R20)
- 88 Drop center tubeless (11R22.5)
- 70-75-80 Low profile (295/75R22.5, 255/70R22.5)
- 65 Wide-base singles (18R22.5, 445/65R22.5)

$$\frac{\text{Section Height}}{\text{Section Width}} = .75 \text{ Aspect Ratio}$$

New Tire Dimensions



"Aspect Ratio" is defined as the percent of the section height to the section width of the tire.

Figure 2.4: Aspect Ratio

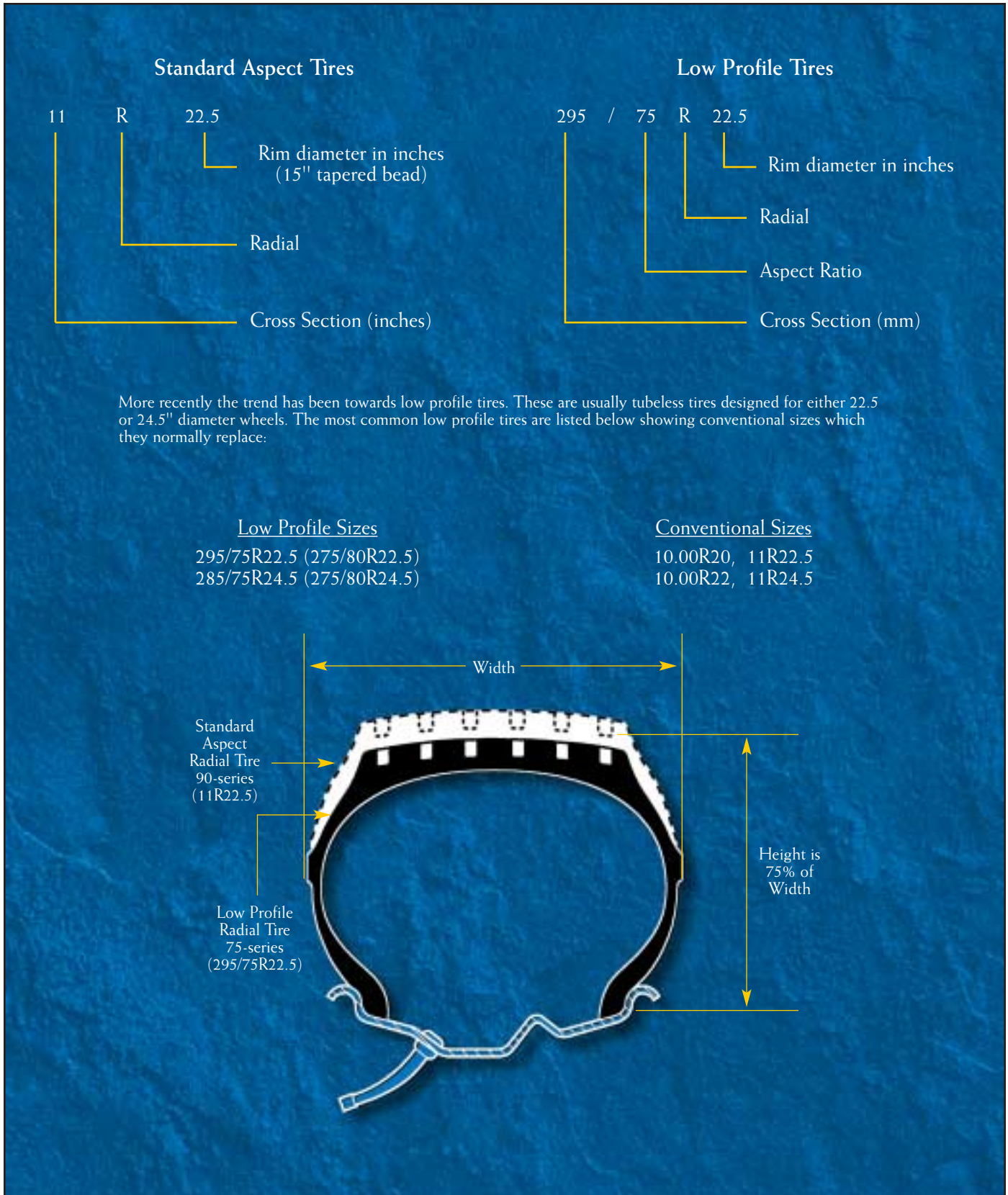


Figure 2.5: Sizing Definition

*Information courtesy of The Maintenance Council (TMC) — Recommended Practices Book

TIRE SELECTION PROCESS WORK SHEET

STEP 1

Record maximum axle weights expected during vehicle operation.

Axle Weights Steer Drive Drive/Trail Trail Trail

STEP 2

Check types of service

- Line Haul — Travel on interstate and normal highway roads at maximum speeds with runs over 250 miles.
Local — Most travel between and around city areas, with runs generally less than 250 miles.
On-Off-Road — Travel on some highway and secondary roads with possible travel on gravel/dirt roads.
Off-Road — Travel on mostly secondary and gravel/dirt roads with a potential for tread cutting due to rocks, debris, etc.

STEP 3

Determine size restrictions

- 1. If spec'ing for new equipment, provide for adequate tire clearance and brake compatibility.
a. Minimum tire diameter due to brake restrictions
b. Maximum tire diameter desired
2. If retrofitting tires on existing equipment, will rim size change?
a. [] No (State Rim Size)
b. [] Yes (Select new rim size in Step 10)

If wheel size becomes larger (change from dual tires to wide-base tires or to larger dual tires), determine present tire clearances:

- (1) Vertical Tire Clearance
(2) Front Wheel Clearance
(3) Overall Width of Present Tire
(4) Overall Diameter of Present Tire
(5) Current Wheel Offset
(6) Overall Width Across the Tires

STEP 4

Write in type of tires to be used — Duals or Wide-Base

STEP 5

Write in type of construction to be used — Radial or Bias

STEP 6

Write in type of air retention construction — Tube-type or Tubeless (This will be determined by the type of rims to be used.)

STEP 7

Write in aspect ratio to be used
(This step may be incorporated into Step 8.)

STEP 8

Select tire size from Tire and Rim Association tables or tire manufacturers' data books using the tire described in Steps 4 through 7. Do this by cross checking the axle weights and speed restrictions to be sure the tires can carry the maximum axle load recorded in Step 1 at operational speeds.

Tire Size _____ Dual Load _____ Single Load _____ at _____ psi

If maximum loads cannot be attained with the initial tire desired, a change in either Steps 3(1), 4, or 5 must be made. Repeat Step 8 until a tire size with the necessary carrying capacity is selected.

STEP 9

Write in selected tire's dimensions from Tire and Rim Association tables or tire manufacturers' data books.

Overall Diameter _____

Overall Width _____

Revolutions per Mile _____

1. If specifying new equipment, redesign space restrictions if adequate clearance and brake compatibility are not afforded, or return to Step 8 and select another size tire.
2. If retrofitting tires on existing equipment and larger size tires than presently used are selected, determine clearances:

a. Vertical Clearances:

Vertical Tire Clearance of Present Tire _____

Overall Diameter of Present Tire + _____

= _____ (Subtotal)

Overall Diameter of Selected Tire - _____

Vertical Tire Clearance = _____

(Consult the vehicle or suspension manufacturer for minimum clearance required.)

Overall Vehicle Height _____

b. Front Tire Clearance:

Clearance of Present Tire	_____	
Overall Diameter of Present Tire	+ _____	
	= _____	(Subtotal)
Overall Diameter of Selected Tire	- _____	
Front Tire Clearance (Must be a positive number.)	= _____	

c. Overall Width:

Overall Width Across the Present Tire	_____	
Overall Width of one current outside tire	- _____	
	= _____	(Subtotal)
Overall Width of one selected outside tire	+ _____	
	= _____	(Subtotal)
Offset of both current outside wheels	- _____	
	= _____	(Subtotal)
Offset of both selected outside wheels	+ _____	
Overall Width (Must be 102" or less.)	_____	

If all clearances are not suitable, return to Step 8 and select a smaller size tire.

STEP 10

Select wheel/rim from Tire and Rim Association tables or wheel/rim manufacturers' catalogs. Check to see that load and inflation pressure ratings are adequate (compare with Single Load and Pressure in Step 8).

Wheel Size _____ Load Rating _____ at _____ psi

STEP 11

Select tread designs for steer, drive, and trailer positions using Technology & Maintenance Council Recommended Practice 220, *Tire Tread Design Selection*. Call 800-ATA-Line to order.

STEP 12

Incorporate fleet operation considerations at this point. Compute gear ratio changes if appropriate.