

### Helical Gear Geometry

Figure 12-2 shows the geometry of a basic helical rack. The teeth form the helix angle  $\psi$  with the “axis” of the rack. The teeth are cut at this angle and the tooth form is then in the **normal plane**. The **normal pitch**  $p_n$  and the **normal pressure angle**  $\phi_n$  are measured in this plane. The **transverse pitch**  $p_t$  and the **transverse pressure angle**  $\phi_t$  are measured in the **transverse plane**. These dimensions are related to one another by the helix angle. The transverse pitch is the hypotenuse of the right triangle  $ABC$ .

$$p_t = p_n / \cos \psi \quad (12.1a)$$

An axial pitch  $p_x$  can also be defined as the hypotenuse of the right triangle  $BCD$ .

$$p_x = p_n / \sin \psi \quad (12.1b)$$

$P_t$  corresponds to circular pitch  $P_c$ , measured in the pitch plane of a circular gear. Diametral pitch is more commonly used to define tooth size and is related to circular pitch by

$$p_d = \frac{N}{d} = \frac{\pi}{p_c} = \frac{\pi}{p_t} \quad (12.1c)$$

where  $N$  is number of teeth and  $d$  is pitch diameter.

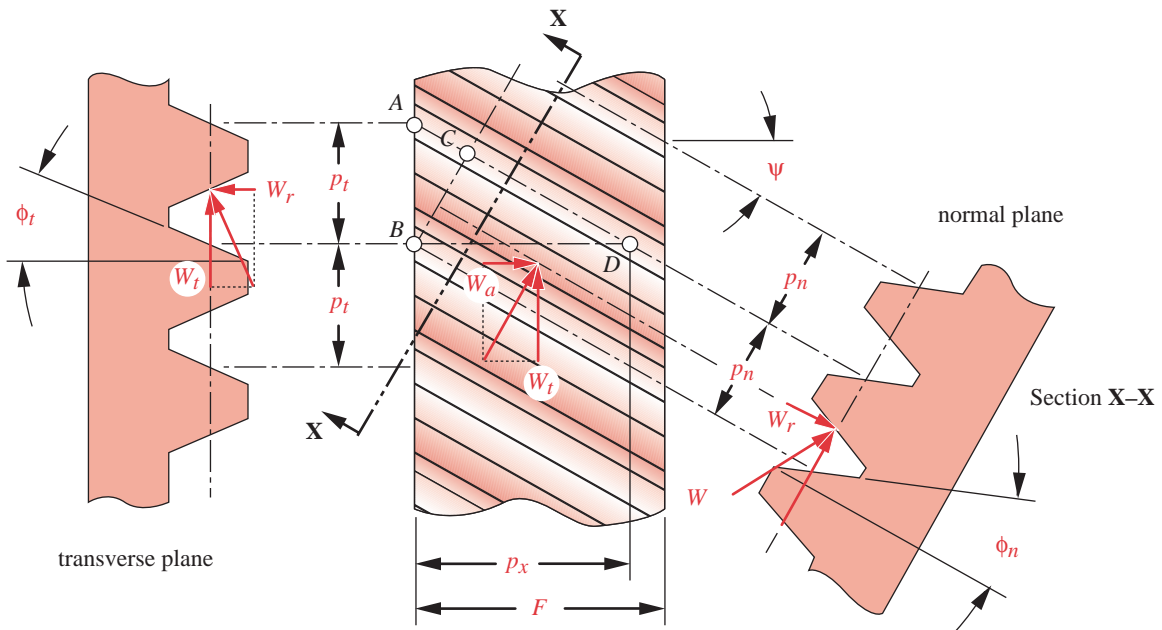


FIGURE 12-2

Basic Helical Rack Showing Normal and Transverse Planes and Resolution of Forces