

during takeoffs or landings. For dynamic rollover to occur, some factor must first cause the helicopter to roll or pivot around a skid or landing gear wheel, until its critical rollover angle is reached. The angle at which dynamic rollover occurs will vary based on helicopter type. Then, beyond this point, main rotor thrust continues the roll and recovery is impossible. After this angle is achieved, the cyclic does not have sufficient range of control to eliminate the thrust component and convert it to lift. If the critical rollover angle is exceeded, the helicopter rolls on its side regardless of the cyclic corrections made.

Dynamic rollover begins when the helicopter starts to pivot laterally around its skid or wheel. For dynamic rollover to occur the following three factors must be present:

1. A rolling moment
2. A pivot point other than the helicopter's normal CG
3. Thrust greater than weight

This can occur for a variety of reasons, including the failure to remove a tie down or skid-securing device, or if the skid or wheel contacts a fixed object while hovering sideward, or if the gear is stuck in ice, soft asphalt, or mud. Dynamic rollover may also occur if you use an improper landing or takeoff technique or while performing slope operations. Whatever the cause, dynamic rollover is possible if not using the proper corrective technique.

Once started, dynamic rollover cannot be stopped by application of opposite cyclic control alone. For example, the right skid contacts an object and becomes the pivot point while the helicopter starts rolling to the right. Even with full left cyclic applied, the main rotor thrust vector and its moment follows the aircraft as it continues rolling to the right. Quickly reducing collective pitch is the most effective way to stop dynamic rollover from developing. Dynamic rollover can occur with any type of landing gear and all types of rotor disks.

It is important to remember rotor blades have a limited range of movement. If the tilt or roll of the helicopter exceeds that range ($5\text{--}8^\circ$), the controls (cyclic) can no longer command a vertical lift component and the thrust or lift becomes a lateral force that rolls the helicopter over. When limited rotor blade movement is coupled with the fact that most of a helicopter's weight is high in the airframe, another element of risk is added to an already slightly unstable center of gravity. Pilots must remember that in order to remove thrust, the collective must be lowered as this is the only recovery technique available.

Critical Conditions

Certain conditions reduce the critical rollover angle, thus increasing the possibility for dynamic rollover and reducing

the chance for recovery. The rate of rolling motion is also a consideration because, as the roll rate increases, there is a reduction of the critical rollover angle at which recovery is still possible. Other critical conditions include operating at high gross weights with thrust (lift) approximately equal to the weight.

Refer to *Figure 11-5*. The following conditions are most critical for helicopters with counterclockwise rotor rotation:

1. Right side skid or landing wheel down, since translating tendency adds to the rollover force.
2. Right lateral center of gravity (CG).
3. Crosswinds from the left.
4. Left yaw inputs.

For helicopters with clockwise rotor rotation, the opposite conditions would be true.

Cyclic Trim

When maneuvering with one skid or wheel on the ground, care must be taken to keep the helicopter cyclic control carefully adjusted. For example, if a slow takeoff is attempted and the cyclic is not positioned and adjusted to account for translating tendency, the critical recovery angle may be exceeded in less than two seconds. Control can be maintained if the pilot maintains proper cyclic position and does not allow the helicopter's roll and pitch rates to become too great. Fly the helicopter into the air smoothly while keeping movements of pitch, roll, and yaw small; do not allow any abrupt cyclic pressures.

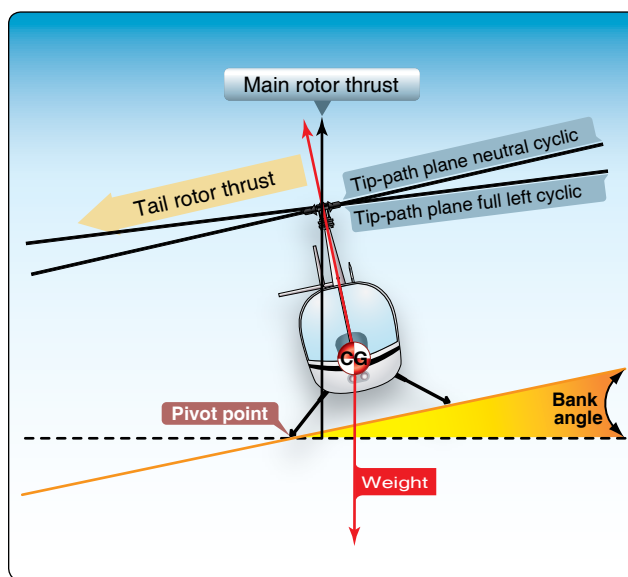


Figure 11-5. Forces acting on a helicopter with right skid on the ground.