Recommend Design Process for Residential Garage Floor Joists

The use of wood members to support a garage floor is a common practice for sloping lots. This creates additional space under the garage that may be used for occupancy. Building codes provide minimum standards to support garage applications and should be followed. For more information on garage floor design, see iLevel Technical Bulletin #105 at http://www.ilevel.com/literature/TB-105.pdf

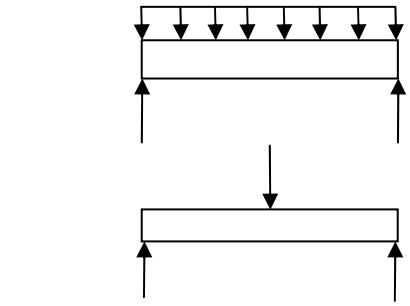
Per the 2009 IBC - Notes to Table 1607.1

a. Floors in garages or portions of buildings used for the storage of motor vehicles shall be designed for the uniformly distributed live loads of Table 1607.1 or the following concentrated loads: (1) for garages restricted to vehicles accommodating not more than nine passengers, 3,000 pounds acting on an area of 4.5 inches by 4.5 inches; (2) for mechanical parking structures without slab or deck which are used for storing passenger vehicles only, 2,250 pounds per wheel.

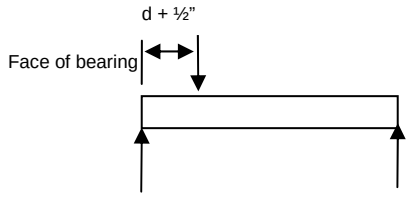
Consider 4 load cases for a simple span garage floor to determine member. Whichever load case produces the greater load effect shall be used to size the supporting member.

Case 1: Uniform live load (40 psf) + Uniform dead load

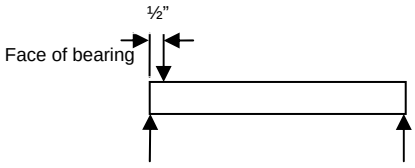
Case 2: Uniform dead load + 3000 pounds live load located at mid-span (Design professional may design reinforced concrete, and determine some load sharing for this case)



Case 3: Uniform dead load + 3000 pounds live load located the depth of the joist + ½" *from face* of bearing. (no load sharing this case)



Case 4: Bearing Length/Hanger Check- Uniform dead load + 3000 pounds live load located ½" *from face* of bearing



Creep Deflection Check:

Both the IRC and IBC require garage floors to be a non-combustible surface and facilitate the movement of liquids to drain towards the garage doors. The most common use of material to achieve this requirement is concrete. In this application the dead load is often more than the live load, so creep should be considered and checked in garage floor design. Creep deflection could cause cracking in the concrete floor and/or ponding in the middle of the garage floor. To check the creep deflection using Forte®, use Case 1 and calculate the dead load deflection by taking the total deflection minus the live load deflection. Increase the dead load deflection by a factor of 1.5. Verify that the total of new dead load deflection and live load deflection will meet code deflection limits and customers expectation. The 1.5 factor comes from the National Design Specification for Wood Construction (NDS) 2005. If the total load deflection, including the creep deflection check, does not meet L/240 deflection criteria, the design professional shall make adjustments accordingly.

Hanger Considerations:

If connection details require hangers to sit on a treated plate on top of the foundation or connect to a treated ledger other than TimberStrand® StrandGuard® LSL, additional corrosion resistance may be required for the hangers. Hangers in contact with ACQ, CA-B, or CBA-A plate or ledger will require Zmax (G185) or Hot Dipped Galvanized (HDG) from Simpson Strong-Tie and Triple Zinc (TZ) or Hot Dipped Galvanized (HDG) from USP. Nails also have to match the treatment of the hanger. Find additional information in Simpson Strong-Tie and USP catalog's in the corrosion information section.

For the hanger design, load case 4 will control. This will result in a heavier gauge hanger to support the load. Typically, an "H" series for face mount hangers and a "B" or "W" series for top flange hangers should be considered.

TJI® joists in garage floors

It is very uncommon to use TJI® joists to support garage floors for many reasons. First, the reaction capacity of more commonly used TJI® joists are only approximately 900-1500 lbs depending on bearing length. If resisting a 3000 lbs jack load near bearing (case 3), at a minimum you may need three TJI® joists to support this at each on center spacing. It may be more economical to use a solid section such as TimberStrand® LSL or Microllam® LVL. Load sharing between joists for case 3 loading is difficult to achieve. In addition, there is a requirement for a TJI® joist supporting a point load from above in excess of 1500 lbs within the span to have a web stiffener at that location per ESR-1153, Table 4, footnote 4. Since the wheel load and jack load could occur anywhere along the joist, it is not feasible to install web filler the entire length of the joist.

General Notes:

- 40 psf live load comes from the IBC, Table 1607.1

- Most garage floors will have a minimum of 3" of concrete on low end and 5" on the high end. The dead load break down for such a floor is as follows:

5" regular weight concrete (worse case)….	60 psf	(12.0 psf / in thickness)
¾" Plywood sheathing.....	2.3 psf	
Joists at 16" on center.....	5.0 psf	
Insulation.....	0.4 psf	
$^5/_8$" gypsum board ceiling(code required)...	2.8 psf	
Miscellaneous	1.0 psf	
Total	71.5 psf	(round up to 72 psf)

- Design using 1¾" 1.55E TimberStrand® LSL joists or better (as required).

- iLevel products are intended for dry use applications. Proper detailing and moisture barriers are required to ensure the dry use condition is maintained

- Multi-span joists require further analysis and if more than 1 vehicle could rest on the joist.