SKILL GUIDE · ACCESS & FUNCTIONAL NEEDS

# DIY Assistive Equipment Fabrication

The Access & Functional Needs chapter's Tier 3 Assistive Technology Fabrication item calls this a real skill, best learned by working with an occupational therapist or assistive-tech specialist rather than improvised from scratch. This guide covers where that line actually falls: the real organizations that already build and give away assistive devices, simple builds reasonable to make yourself, and what genuinely needs a professional.

## Where DIY stops and professional help starts

Occupational therapists and assistive-technology professionals draw a fairly consistent line: customizing or adapting an already-selected, low-risk aid is reasonable to do yourself, while anything load-bearing, structural, or involving custom seating or positioning needs a professional. A grab bar that isn't anchored into a wall stud, or a mobility device modification that changes how weight is distributed, isn't a place to improvise.

WARNING

**Never DIY these**

Anything load-bearing or structural (wheelchair frame modifications, custom seating, ramps meant to support a wheelchair's full weight) and anything that replaces a properly fitted medical device should go through a professional. Standard PVC pipe, in particular, is not rated as load-bearing and is not food-safe; treat it as a shaping and mounting material only, never a structural or ingestible-contact one.

## Real organizations already doing this

| Organization | What it does |
|---|---|
| e-NABLE | A volunteer network of roughly 200 chapters and 10,000+ members who 3D-print free upper-limb devices for people with partial hand or limb differences. Material cost typically runs $25-50 per device, print time 12-16 hours. e-NABLE explicitly recommends working with a medical professional before and after fitting a device. |
| Makers Making Change (Neil Squire Society) | 215+ open-source assistive device designs, with an estimated 30,000+ devices built by volunteer makers since the program launched in 2016. |
| AT3 Center / ATAP | The national umbrella organizations for assistive-technology reuse and state AT programs; a good starting point for finding a local device-lending or reuse program instead of building from scratch. |

Thingiverse's assistive technology design groups are worth browsing too, but they're unmoderated and less vetted than e-NABLE or Makers Making Change; treat designs there with more scrutiny before printing and using one.

## Simple builds reasonable to DIY

PVC pipe and fittings are the most common material for low-risk, non-structural adaptive builds, cheap, easy to cut and assemble with basic hand tools, and easy to reconfigure.

1. **Reachers and grabbers:** use 1/2-inch PVC pipe, 2 to 3 feet long, as the shaft. Cut two identical jaw pieces from thin plywood or thick cardboard and mount them to cross like scissors at a fixed pivot point (a bolt through both pieces works as the fulcrum) near the shaft's business end. Run a non-stretching cord (paracord or strong string) from the jaws' non-gripping ends back down the shaft to a pull-handle; pulling the cord rotates the jaws closed. A rubber band stretched across the gripping ends provides the opposite tension, holding the jaws open by default so they close only when you actually pull.
2. **Walker or wheelchair trays:** a flat panel mounted to a PVC frame that clips onto a walker or wheelchair for carrying items hands-free. Size the frame's tubing to slide snugly over or clamp around the walker/wheelchair's own frame tubing (measure its outer diameter first), and secure the connection with hose clamps sized to that diameter rather than PVC cement, so the tray can be removed later.
3. **Switch mounts:** a PVC arm or frame that positions an adaptive switch (for a communication device or powered equipment) within reach of a specific range of motion.

4. **Key turners:** drill a hole through a short length of PVC or a wood dowel sized to hold a bolt, sandwich the key's head between the two halves (or a slotted holder cut to the key's thickness), and secure it with a bolt, nut, and washer rather than epoxy, so the turner can be swapped between keys. The added leverage from the handle length is what does the actual work for someone with reduced grip strength, not the fastening method.

| Material | Use |
|---|---|
| PVC pipe and fittings | 1/2-inch for shafts and handles (reachers, key turners); 3/4 to 1-inch for load-spreading frames like a walker tray. Cut with a PVC cutter or hacksaw and deburr the cut edge with sandpaper before use, a rough edge is uncomfortable to grip and can catch on clothing. Use PVC cement only for permanent joints; leave a friction-fit or clamped joint uncemented anywhere you'll need to adjust or disassemble it later. |
| Foam pipe insulation | Slip over a handle or grip point to build up diameter for easier grasping |
| Non-slip drawer liner | Wrap or line a grip surface, or place under an item to keep it from sliding |
| Stud finder | Critical before mounting anything to a wall, including a grab bar; never rely on drywall anchors alone for load-bearing hardware |
| Basic hand tools (PVC cutter or hacksaw, screwdriver, drill) | All that's needed for the builds above |
| FDM 3D printer (optional) | Opens up e-NABLE and Makers Making Change's open-source device library directly |

**A useful reference ceiling, even for improvised builds**

The ADA's 1:12 maximum slope standard for wheelchair ramps (one inch of rise for every twelve inches of ramp length) is a reasonable benchmark to check any improvised ramp against, even outside a context where ADA compliance is legally required.

TIP

**Sealant-filled inner tubes prevent the flat that strands a wheelchair user**

For a wheelchair with pneumatic (air-filled) tires, a puncture is a mobility emergency, not just an inconvenience. A tire sealant made for this (injected through the valve after removing the valve core, then the tire fully inflated) seeks out and seals small punctures as they happen, before the tire even

goes flat. It's a preventive product, not a fabrication project, but it's cheap, doesn't require replacing the tire, and closes a real gap this guide's builds don't otherwise address.

## Sources


- e-NABLE network size, device cost, and print time: e-NABLE
- Makers Making Change design library and device count: Makers Making Change
- National AT reuse infrastructure: AT3 Center; Association of Assistive Technology Act Programs (ATAP)
- PVC-based adaptive equipment builds: Equip2Adapt project documentation
- DIY-versus-professional scope of practice: American Occupational Therapy Association (AOTA) scope-of-practice guidance; RESNA wheelchair service provision guidelines
- ADA ramp slope standard: ADA.gov, 2010 ADA Standards for Accessible Design, §405
- DIY reacher/grabber cord-and-jaw mechanism: Engineer Fix; The Tech Interactive
- DIY key turner attachment approach: Thingiverse, Open Assistive Technology
- Tire sealant use in wheelchair pneumatic tires: Adventure Wheels

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# Home Accessibility Modifications

The Access & Functional Needs chapter names temporary ramps, wider doorways, and grab bars as practical modifications worth making, without covering how. This guide covers the real slope ratio a ramp needs to be usable, why a grab bar has to go into a stud and nothing else, and the cheap fix that solves most doorway-width problems before anyone reaches for a saw.

## Building a temporary ramp

Slope is the number that actually matters, and it's expressed as a ratio of rise to length: 1 inch of vertical rise for every 12 inches of ramp length (a 1:12 slope) is the standard accessible ratio. A gentler 1:16 slope is easier to push a manual wheelchair up; 1:20 takes even less effort but needs more length and material to cover the same rise. A short, steep plywood ramp that technically bridges a single step but doesn't meet something close to 1:12 is usable by an able-bodied person carrying groceries and not much use to anyone who actually needs it.

| Component | Typical spec | Note |
|---|---|---|
| Ramp surface | 3/4" plywood | Full width of the ramp, edges secured with screws, not just nails |
| Stringers (side supports) | 2x8 pressure-treated lumber | Cut to the exact slope angle; the ramp's actual skeleton |
| Cross joists | Every ~16 inches | Joist hangers and screws, not just nails, for real load-bearing strength |
| Handrail height | 34–38 inches above ramp surface | Support posts no more than 6 ft apart, bolted (not just screwed) in place |

Slope isn't the only spec that determines whether a ramp actually works. Build it at least 36 inches of clear width, narrower than that and a wheelchair's own width leaves no margin for error. Include a level landing at least as wide as the ramp and 60 inches long in the direction of travel at both the top and the bottom, and anywhere the ramp turns; a ramp that dumps straight onto a step or an uneven transition at the door creates exactly the hazard the ramp was built to remove. Add a curb or raised edge at least 2 inches high along both open sides wherever the drop-off exceeds about half an inch, without it a wheel can slide off the side, especially in the corner of a turn.

Check local permit requirements before building anything permanent; many jurisdictions allow a temporary plywood ramp without a permit but require one for a fixed structure, and the line between the two isn't always obvious.

## Grab bars: the one rule that isn't optional

A grab bar has to be mounted into a wall stud, or into blocking installed behind the wall specifically for this purpose, never into drywall alone and never relying on drywall anchors or toggle bolts as the primary support. A properly stud-mounted bar needs to support real force, up to 250 pounds applied at any single point along the bar or its mounting hardware, and a bar backed only by drywall simply can't meet that even briefly, which turns a fall-prevention device into the cause of a fall the moment someone actually leans on it under real weight.

Standard mounting height is 33 to 36 inches from the finished floor to the top of the bar, at the toilet, in the shower, and at the tub; a vertical bar at a shower entry mounts with its bottom edge between 39 and 41 inches up. Buy a bar with a 1.25 to 1.5 inch diameter grip, thin enough that an average hand can actually wrap fully around it, and mount it with 1.5 inches of clearance from the wall so fingers have real room behind the bar rather than getting pinched against the tile. Use a stud finder before drilling, and if a stud doesn't land where the bar needs to go, install a section of solid blocking (a piece of lumber screwed between two studs) behind the wall first rather than compromising on anchor type.

**WARNING**

**A grab bar in drywall is worse than no grab bar**

Someone reaching for an installed grab bar assumes it will hold their full weight during a fall, exactly the moment a drywall-only mount fails. A missing grab bar at least doesn't create false confidence; a failed one can turn a stumble into a fall with someone already off-balance and reaching for support that isn't there.

## Widening a doorway: try the cheap fix first

Standard doorways clear 32 inches with the door open, and many household wheelchairs fit through that, but tighter. Before cutting into a frame, try offset (also called swing-clear or Z-style) hinges: they shift the door's pivot point so the door swings completely clear of the opening instead of eating into it, typically gaining about an inch or two of usable clearance for a relatively small, inexpensive hardware swap that most people can install themselves. Removing the door entirely, or just removing its trim, is the next-cheapest option and can gain meaningful clearance without any structural work at all. Actually widening the frame is

a real carpentry project, worth doing for a permanent Tier 3-style modification, but not the first thing to reach for when the goal is a working fix now.

## Quick Reference

| Modification | Key number | Cheapest fix first |
|---|---|---|
| Ramp | 1:12 slope minimum; 36" min. clear width; 60" landings | Plywood + pressure-treated stringers |
| Grab bar | 33–36" height, 1.25–1.5" grip diameter; stud-mounted, rated to 250+ lb | Stud finder + blocking if needed, never drywall alone |
| Doorway | 32" minimum clear width | Offset hinges before frame-widening |

**Full checklist:**

- Ramp slope measured and built to at least 1:12, not just "close enough"
- Ramp surface and stringers rated for real, repeated load, not a one-time-use fix
- Every grab bar located over a stud (or blocking) with a stud finder before drilling
- Grab bar height confirmed against the 33-36" (or 39-41" vertical) standard
- Offset hinges tried before committing to frame-widening carpentry
- Local permit rules checked before any permanent structural modification

## Sources


- Ramp slope ratios and construction: Family Handyman; BraunAbility
- Grab bar height, stud mounting, and weight rating: GrabBars.com; AccessibilityChecker.org
- Doorway width and offset hinges: Karman Healthcare; Age Fearless Academy
- Ramp minimum width, landing size, and edge protection: U.S. Access Board; AccessibilityChecker.org
- Grab bar grip diameter and wall clearance: GrabBars.com