

HANDBOOK

Accessibility and Tool Adaptations
for Disabled Workers
in Post-Conflict and Developing Countries

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Rehabilitation Engineer

International Labour Office
Geneva

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Foreword

The International Labour Organization (ILO) has been active in a number of countries emerging from armed conflict, assisting with the rehabilitation and reintegration of ex-combatants and other affected persons. This assistance emphasizes vocational skills training, the creation of self-employment opportunities through small enterprise development, and employment-intensive public works programmes. Among the participants and beneficiaries of these activities are persons with disabilities.

In a project in Cambodia, it was found that for physically disabled persons to work in the public works projects, adaptations to tools and equipment were necessary, and an ILO consultant, Mr. David Dilli, a Rehabilitation Engineer, was sent to provide technical guidance. This Manual is a product of his consultancy. Additional designs have been added to broaden the range of work activities that can be performed by physically disabled workers in developing countries.

The Cambodia and other ILO projects have demonstrated that many persons with disabilities can be effectively integrated in ordinary vocational training, small enterprise development, employment-intensive works and other employment creation programmes in post-conflict countries, with a little adaptation of worksites, tools and equipment. The benefits are significant for the disabled workers, as special programmes are often few, lead to segregation, and rarely result in meaningful employment.

The ILO would welcome hearing about the practical experiences in the use of this Manual by individuals and organizations, particularly in post-conflict situations. Other related ILO publications available include: *How to Start a Small Business: A Manual for Community Workers Assisting Persons with Disabilities*, and *Challenging Disability: A Guide for Frontline Social Workers in Africa*.

Willi Momm
Chief
Vocational Rehabilitation Branch

1. Introduction

Typically, most countries emerging from armed conflict have a higher than average percentage of their labor force who are disabled due to the war or inadequate access to medical care. These individuals, women and men, generally have a difficult time becoming economically self-reliant due to economic conditions and the limitations of their impairments. These difficulties can be exacerbated if their homes, public buildings and proposed places of employment in their communities not accessible. This handbook provides examples of the types of tool and facility accessibility adaptations that can be made with materials and resources that are usually available in developing countries. These adaptations make it easier for individuals with a variety of disabilities to be more productive when working in agricultural, road construction and certain manual jobs.

Section 1 describes a number of adaptations that can be performed to tools that are commonly used in agricultural, road construction and other work. The intended use of each tool adaptation is initially described. Directions for the fabrication of each adaptation are then provided, followed by instructions on how to use the tool. In some cases several fabrication methods are provided for the same adaptation - depending upon the materials, tools and skills of the fabricator. In all cases, proposed dimensions of the adaptations are provided. These dimensions should be considered a starting point for the adaptation, but most adaptations will

be more effective if the dimensions are modified according to the needs of the user.

Tools and required materials to fabricate these adaptations are limited to basic hand tools - hand and hacksaw, screwdriver, wrenches, hammer, etc. - and a welder. Materials are steel, leather and wood.

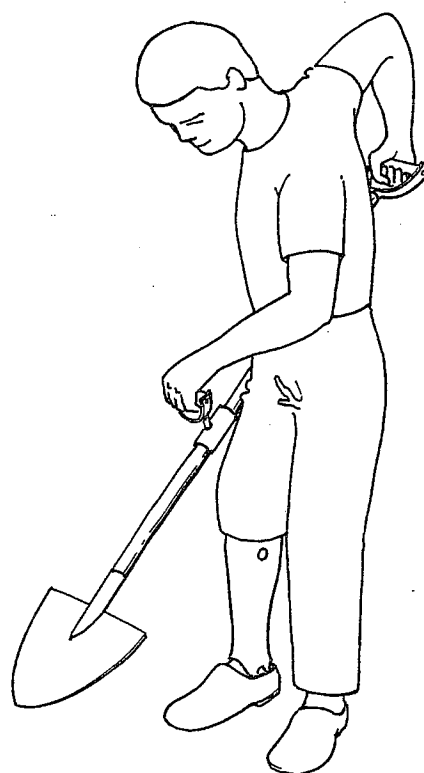
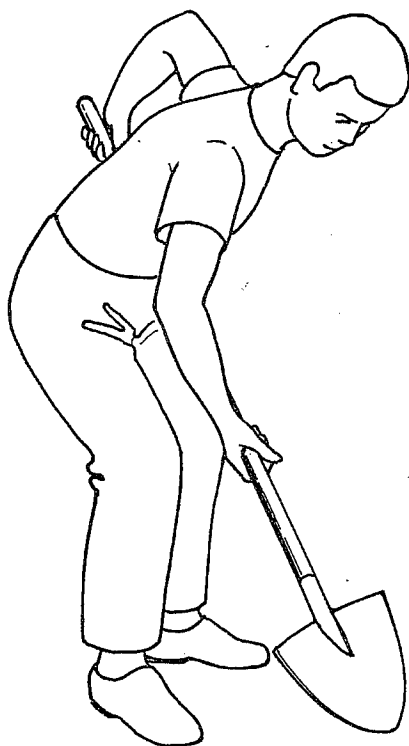
Section 2 describes a number of accessibility guidelines that should be considered during new construction or renovation of buildings. These accessibility recommendations usually include a series of adaptations that can be provided depending upon the resources available and the severity of individual disabilities. It is assumed that resources to make these adaptations are extremely limited, and that individuals with disabilities have little access to wheelchairs and other assistive devices. The accessibility guidelines have been developed for individuals who generally have some mobility, and who have some vision.

The scope of this book does not allow for a comprehensive description of all the possible types of tool adaptations available. It is expected that the readers will use the information in this handbook as a starting point when making adaptations for these and other tools. Modifications to these adaptations to meet the specific needs of the users are encouraged.

2. Agricultural, Road Construction and Other Tools

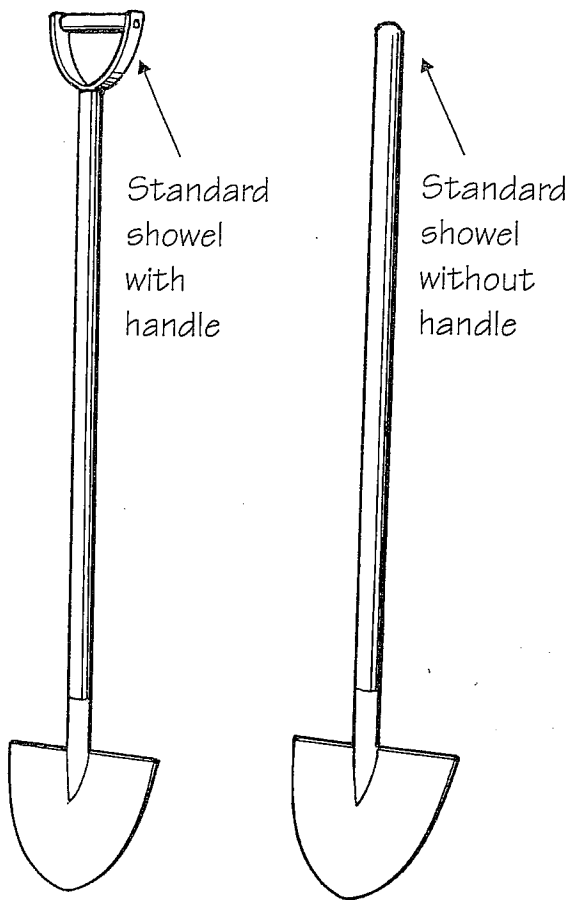
2.a Shovel Adaptations

The following shovel adaptation is designed for individuals who have difficulty bending over. Typically these individuals may have one limb that has been amputated below the knee, or a back or hand injury.



This shovel adaptation makes it easier for individuals to shovel without bending over as much as they do when using a standard shovel. The directions for the manufacturing of this adaptation are on the following pages.

If possible, the shovel should be purchased with a handle at the end for easier use. It is easier for individuals with a variety of disabilities to use a shovel with this type of handle on the end.



If it is not possible to purchase a shovel with a handle on the end, a handle can be fabricated as follows.

- Step 1.** Cut the end of the shovel flat
- Step 2.** Bend a flat piece of steel into a half circle.
- Step 3.** Weld a piece of tube between the ends of the flat plate for a handle. A round piece of wood can also be inserted between the two plates and bolted in place if desired.

Typical users:

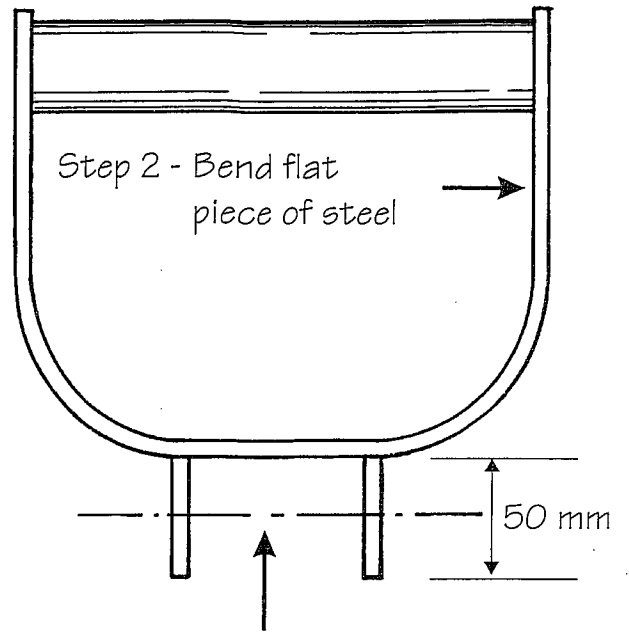
- back pain
- disfigured hands and fingers
- amputated leg above knee with prosthesis

Purchase a shovel that has a handle on the end of it if possible.

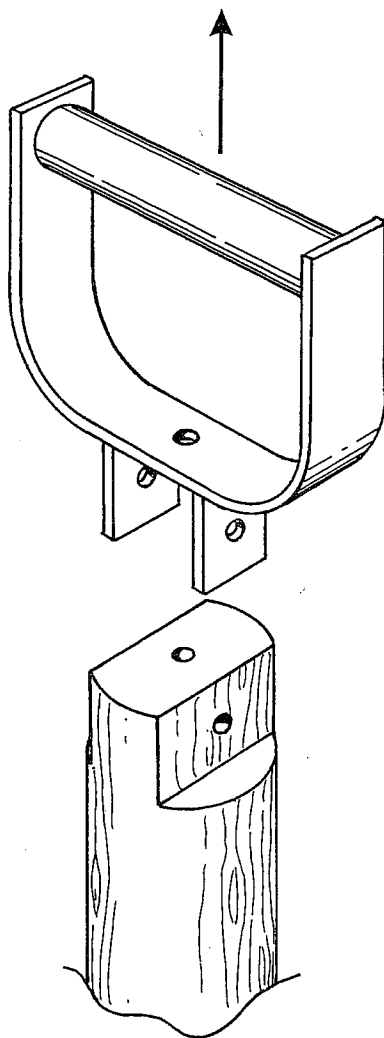
Follow these directions to fabricate this handle only if purchase is not possible.

Step 4. Weld two plates and drill holes to mount to shovel.

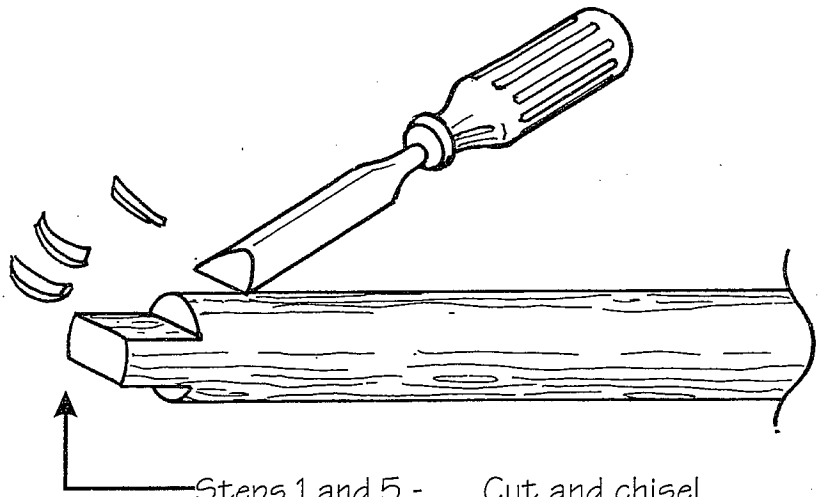
Step 5. Chisel the shovel to fit between the two plates tightly, drill a hole for the bolt, and attach to the shovel.



Step 3 - Weld tube or attach wooden dowel



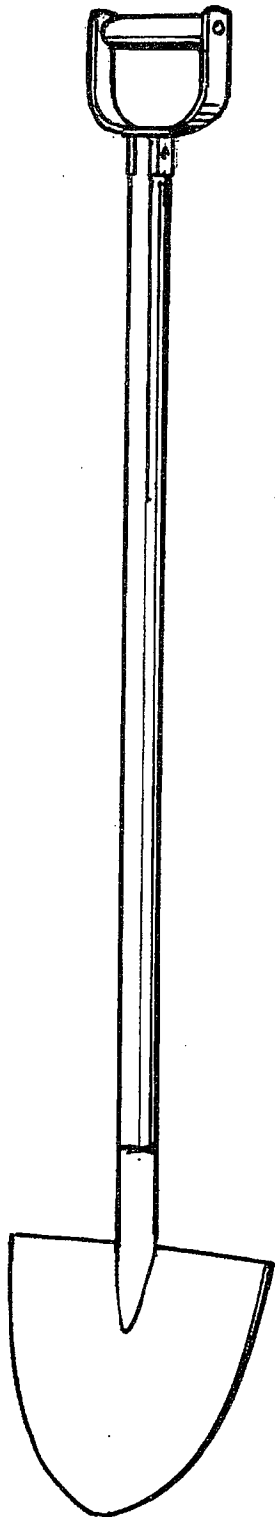
Step 4 - Weld plates and drill holes



Steps 1 and 5 - Cut and chisel end of shovel

Fabricate this shovel handle only if it is not possible to purchase a shovel with a handle like this.

This is what the finished shovel handle looks like, and a typical user using the shovel. This handle makes it easier for any individual to use the shovel - whether that individual has a disability or not.



Typical users:

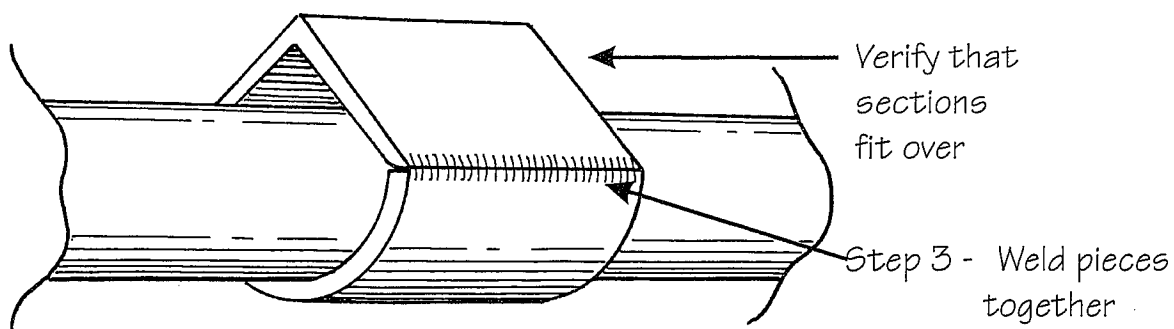
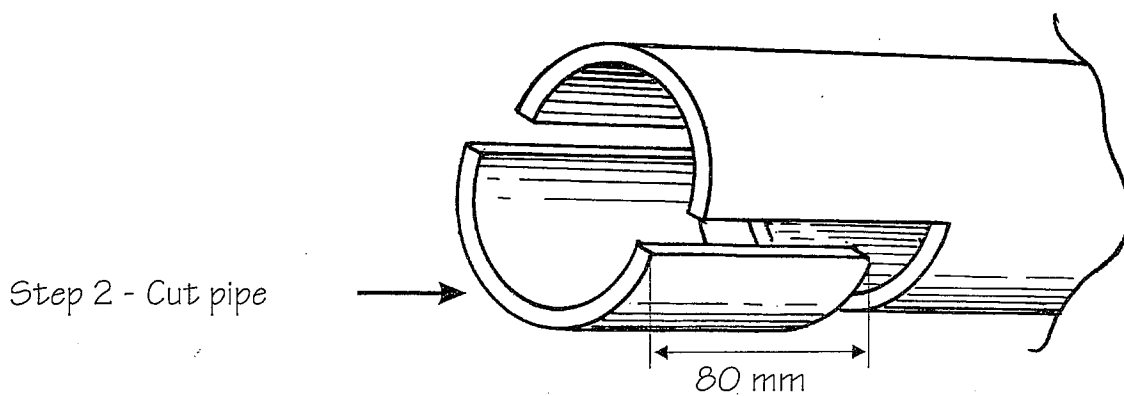
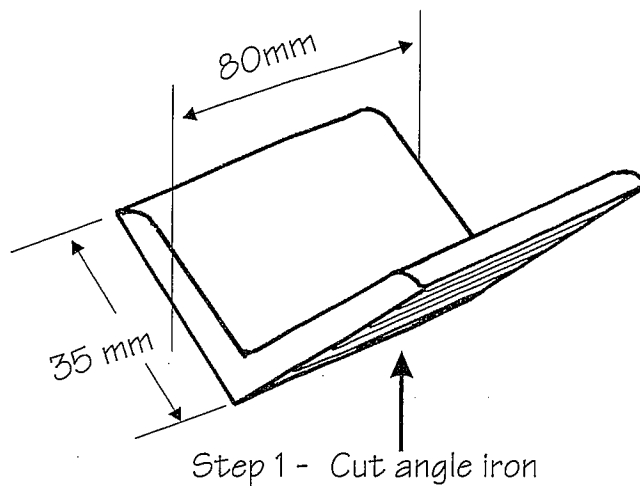
- back pain
- disfigured hands and fingers
- amputated leg above knee with prosthesis

2.b. Handle Attachment Bracket

It may be necessary to fabricate a *Handle Attachment Bracket*. This bracket is used to attach a number of different types of handles to shovels, hoes and picks.

Step 1. Cut a piece of angle iron 3 inches long. The angle iron should have about 1 1/2" legs.

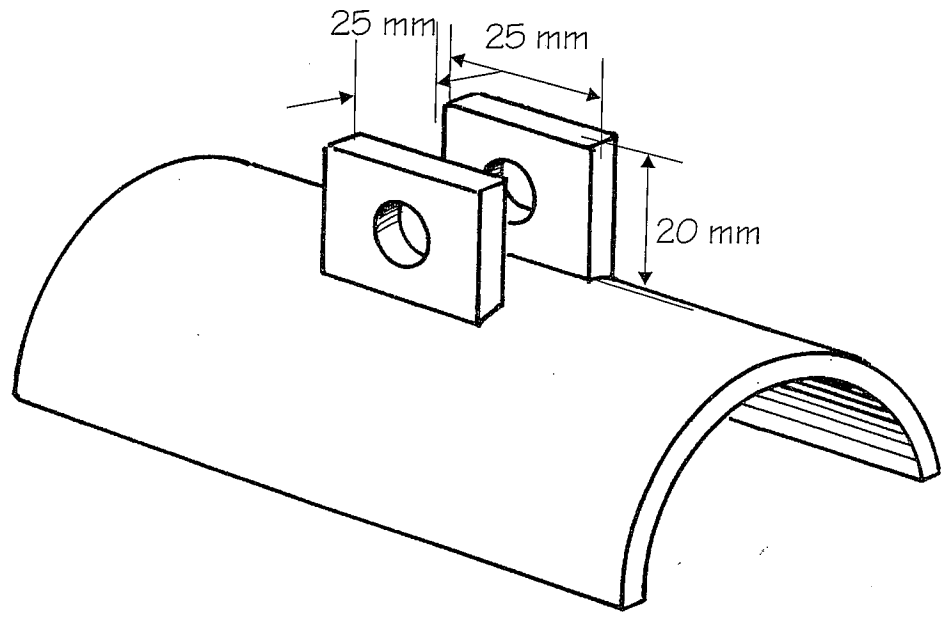
Step 2 Cut a piece of pipe 3" long. Cut the pipe lengthwise to provide a semi circle.



Step 2. Verify that the pipe and angle iron create a large enough opening so they will slide over the shovel or hoe handle, and still touch on the sides.

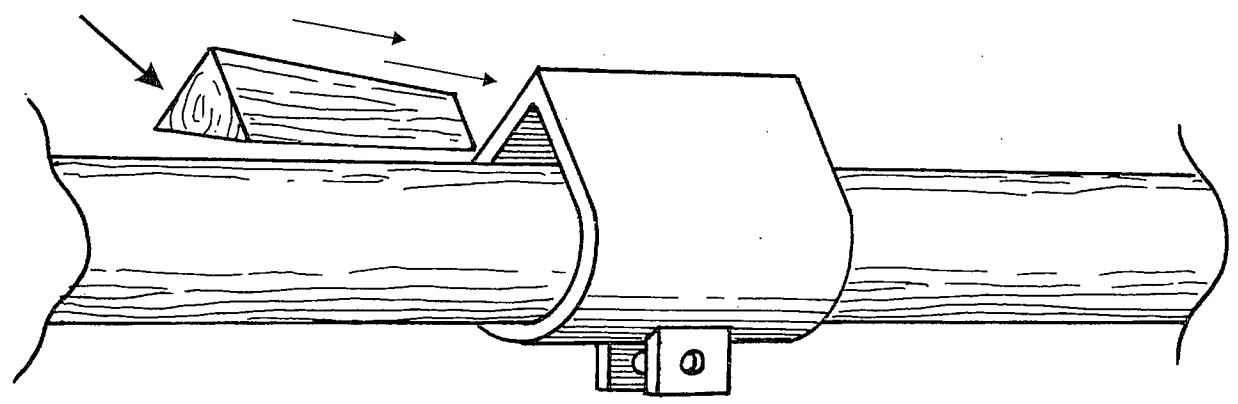
Step 3. Weld the two pieces together.

Step 4. Weld two plates with 7/16" diameter holes to the pipe section of the bracket.

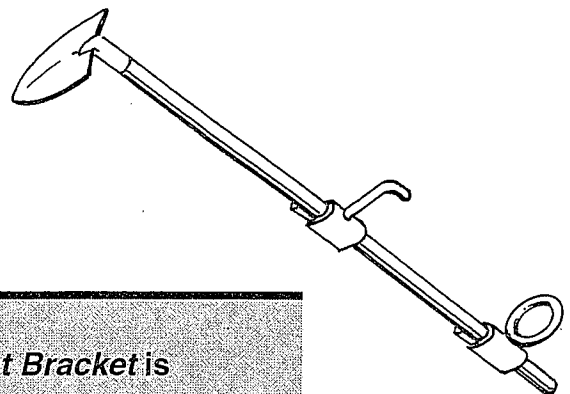
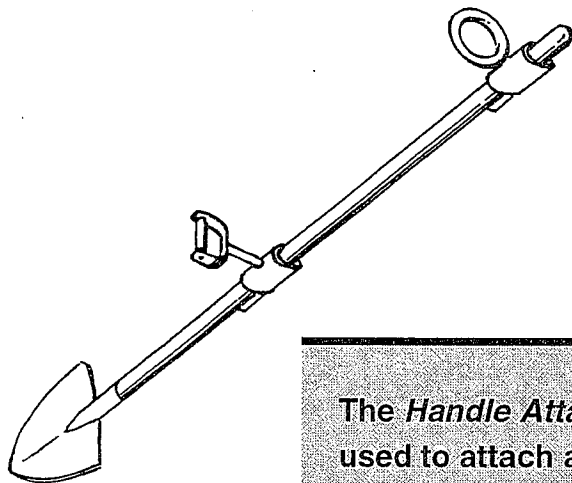
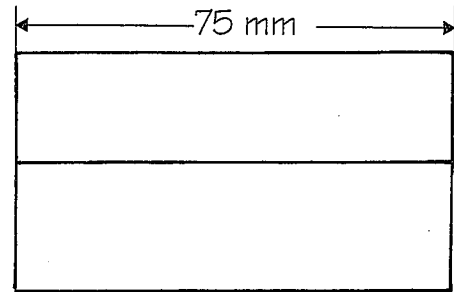
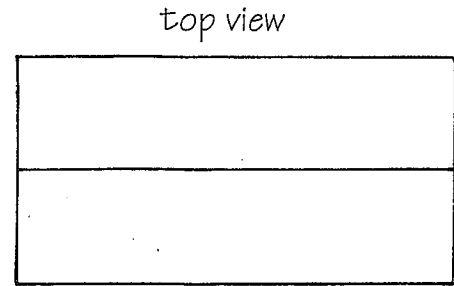
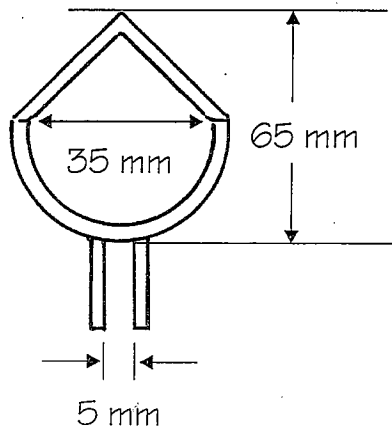
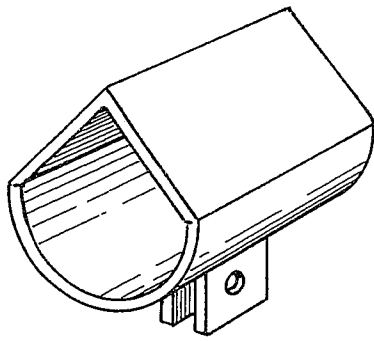


Step 5. Slide the assembled bracket over the shovel handle, and into the desired location. Cut a piece of wood into a wedge shape, and pound the wedge into the corner of the angle iron. This firmly attaches the bracket to the shovel or hoe handle, yet is still removable if needed.

Pound wood wedge into bracket to secure to handle



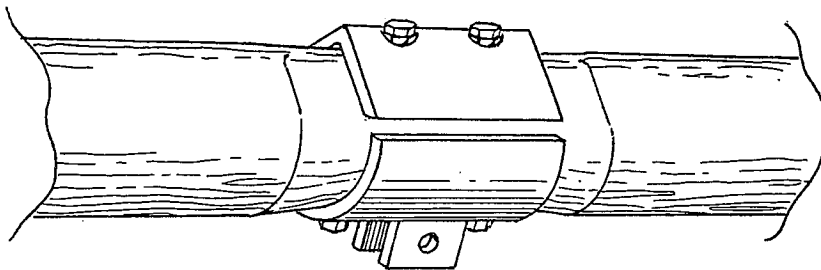
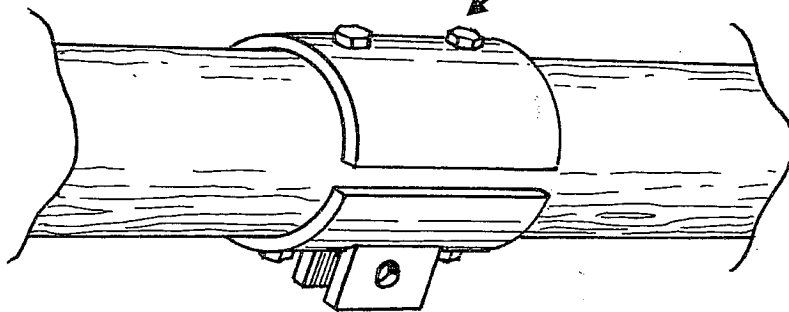
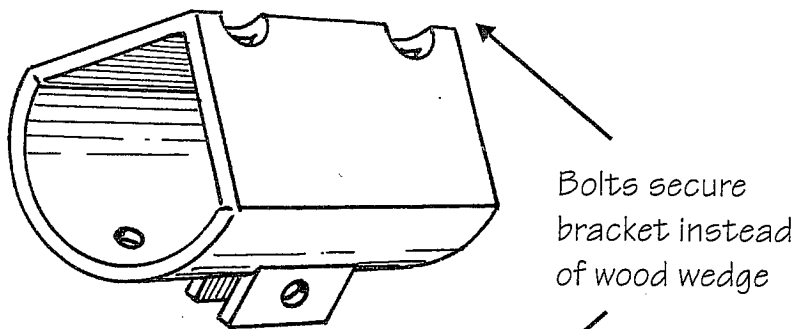
The completed *Handle Attachment Bracket* is securely attached to a shovel or hoe handle, and allows a number of alternative attachments to be fabricated to go onto the tool.



The *Handle Attachment Bracket* is used to attach a number of adaptations to shovels, hoes and other agricultural implements.

**2.c. Alternate designs
of the Handle
Attachment Bracket**

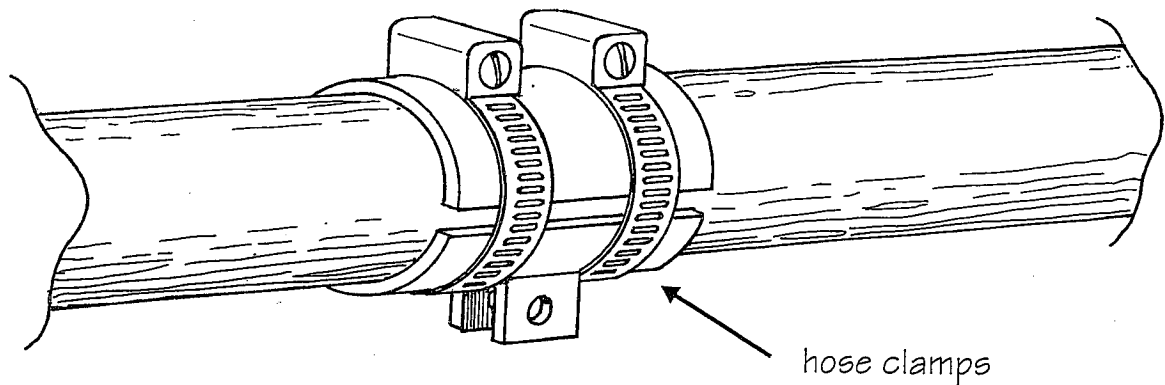
The bracket can be attached with bolts if desired. This creates a more permanent attachment, but may weaken the tool handle.



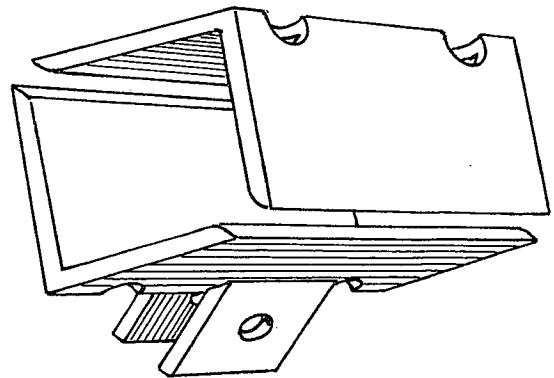
The Handle Attachment Bracket can be attached by drilling holes and chiseling the shovel if desired. This attachment method is more permanent than using a wooden wedge, but may weaken the shovel.

The Handle Attachment Bracket is used to attach adaptations to shovels, hoes and other agricultural implements. This page illustrates several alternative designs for this bracket.

Additionally, hose clamps can be used to temporarily attach the bracket to the handle. If the exact location of the bracket on the handle is in question, hose clamps allow for easy movement of the bracket until the location can be determined.



It is also possible to fabricate the *Handle Attachment Bracket* by using two sections of angle iron. This requires two wooden wedges, or bolts, to securely fasten the bracket to the shovel or hoe handle.



2. d. Adapted Shovel Handle

The handle portion of the second handle on the shovel is fabricated identically to the first shovel handle (see page 4).

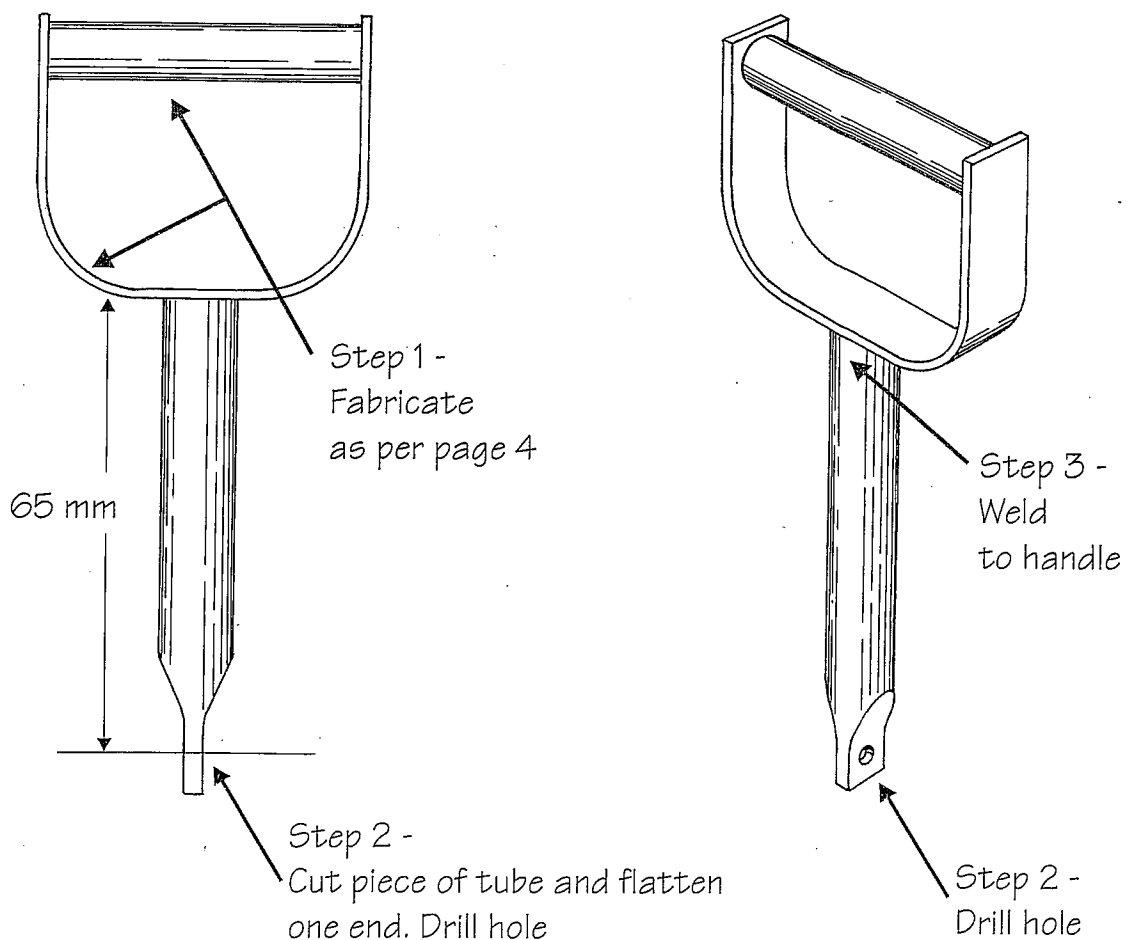
Step 1. Follow steps 2 and 3 on page 4.

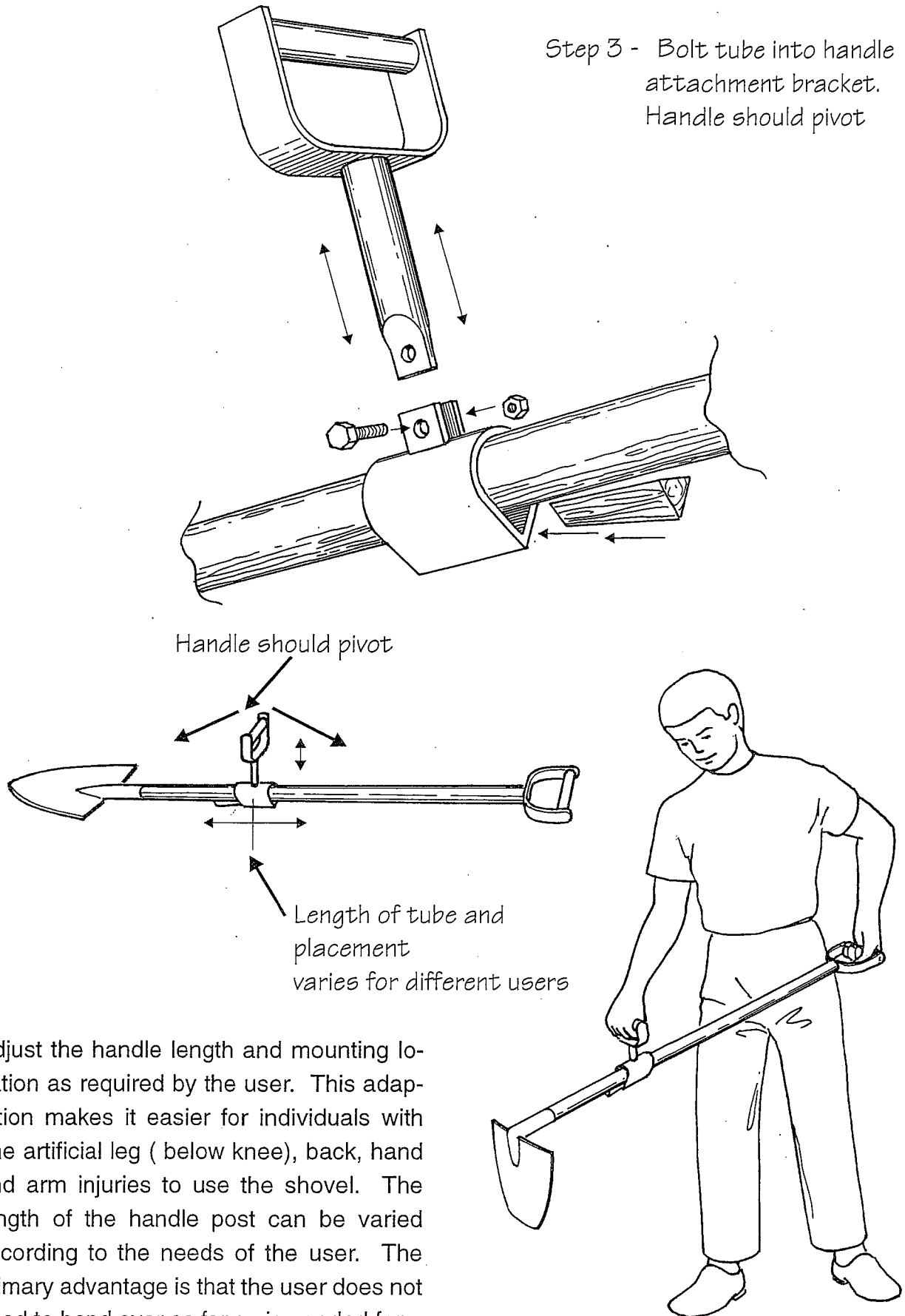
Step 2. Cut a piece of tube, flatten one end and drill a hole.

Step 3. Weld this tube to the shovel handle. Insert the flattened portion between the plates on the *Handle Attachment Bracket*, and attach with a bolt. The handle should be able to pivot between the two plates.

Typical users:

- below knee amputation
- hand or arm injury
- back injury
- individuals who have difficulties bending over



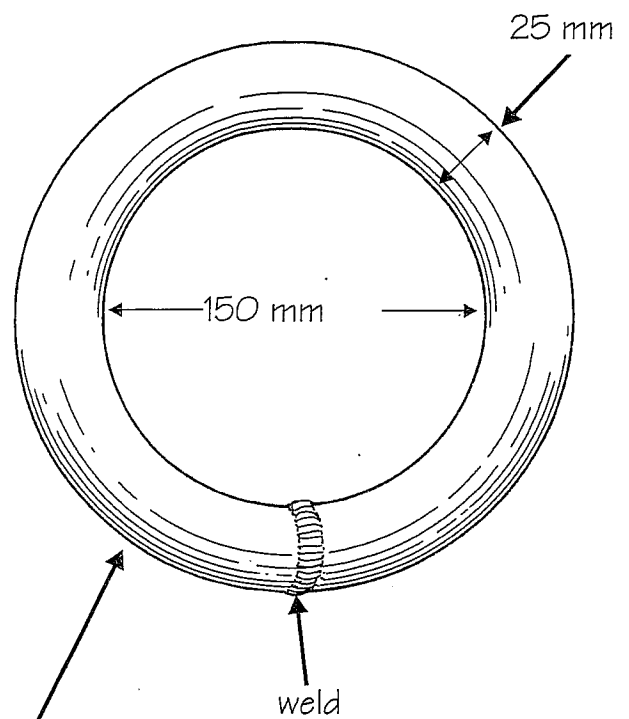


Adjust the handle length and mounting location as required by the user. This adaptation makes it easier for individuals with one artificial leg (below knee), back, hand and arm injuries to use the shovel. The length of the handle post can be varied according to the needs of the user. The primary advantage is that the user does not need to bend over as far as is needed for a standard shovel.

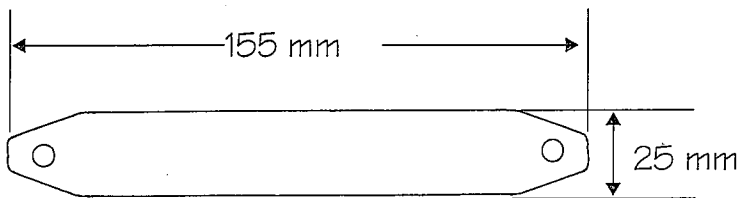
2. e. Additional Adapted Shovel

The previous adaptation cannot easily be used by individuals who have an arm amputated below the elbow. The following adaptation will facilitate the use of a shovel for individuals with this disability.

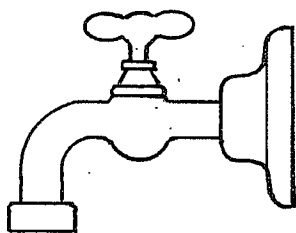
- Step 1.** Bend a tube into as round a shape as possible.
- Step 2.** Cut a piece of leather into the shape in the drawing.
- Step 3.** Dip the leather piece into water so that it will shrink when it dries.



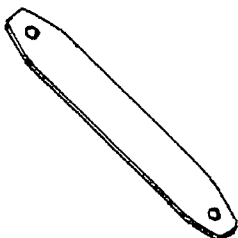
Step 1 - Bend a tube into as round a shape as possible



Step 2 - Cut leather - use very thick leather



Step 3 - Dip into water



Typical User:

- below elbow amputation

and could additionally have

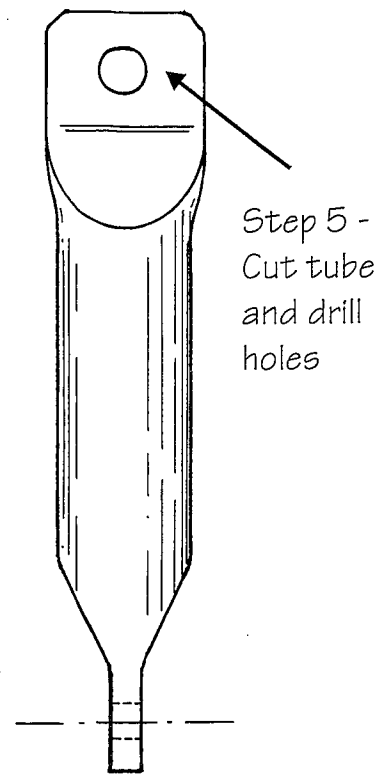
- below knee amputation with prosthesis
- injured back
- injured hand

Step 4. Wrap the leather tightly around the tube, and sew it as closely to the tube as possible.

Step 5. Cut a piece of tube, and flatten each end at 90 degrees from each other. (see drawing). Drill a hole into each flat portion.

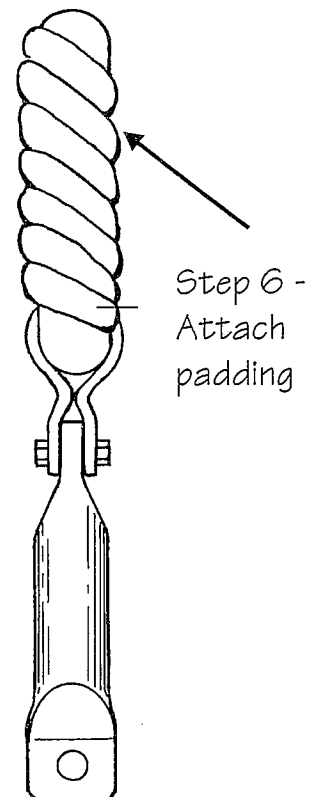
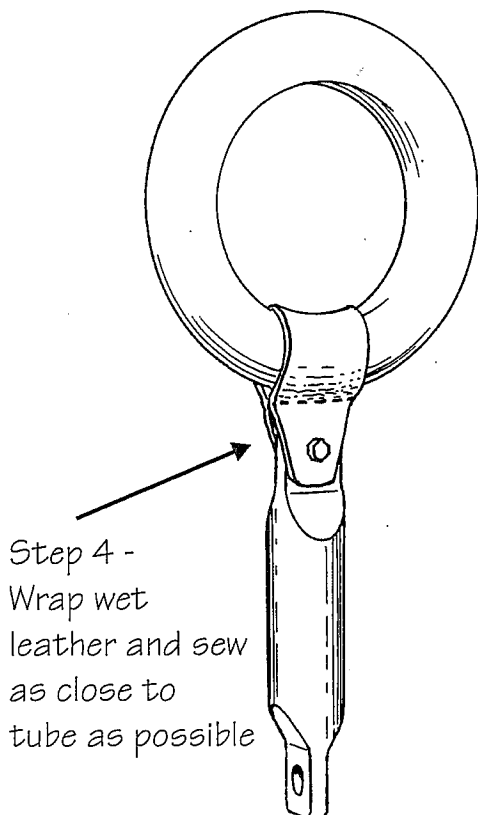
Step 6. Attach padding around the circle. This padding can be cloth, leather or any other soft material.

The leather is required because the circle portion of the handle must be free to rotate while in use. For best results, the leather should be sewn as closely as possible to the tube to prevent it from slipping. Glue can also be applied between the leather and the round tube if needed.

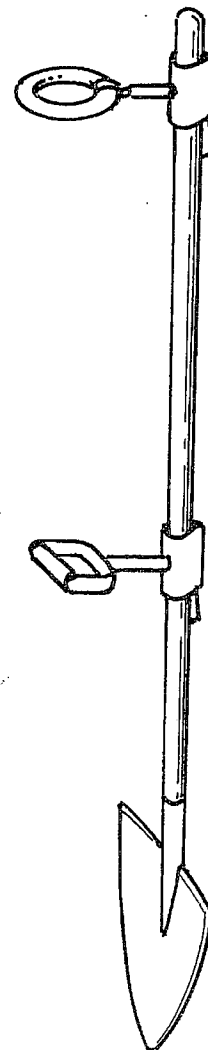
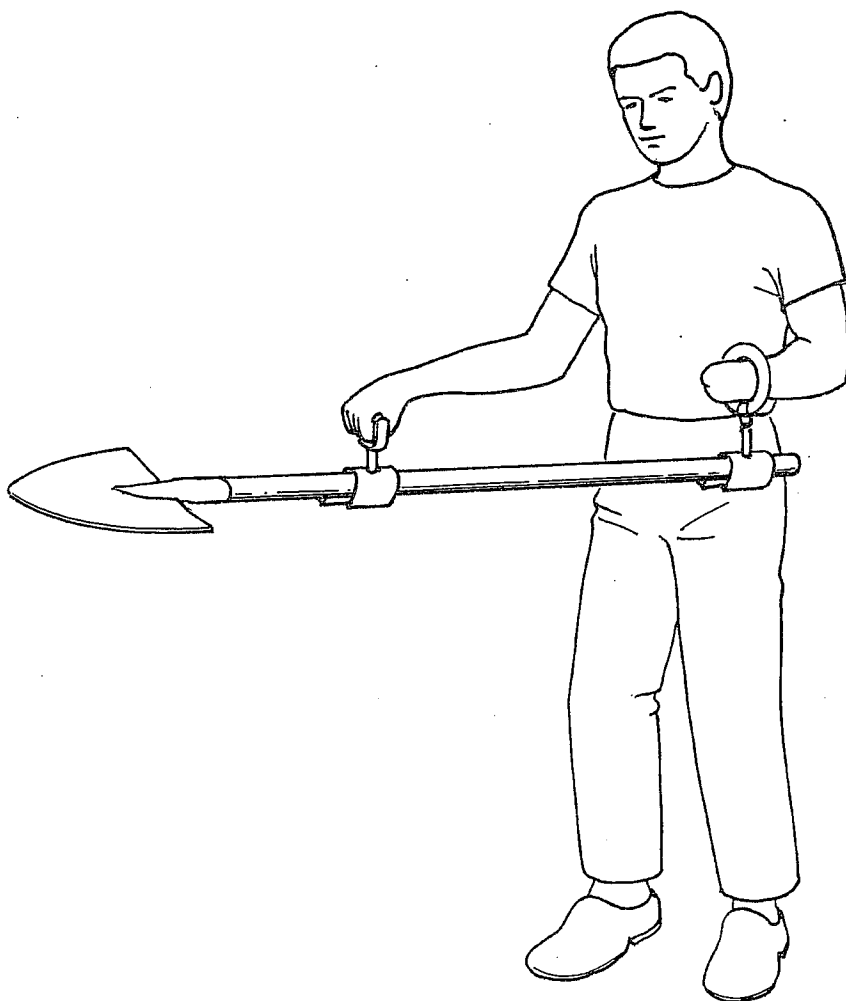


front view

side view



This adaptation generally works best in combination with the second shovel handle - described previously. The second handle is required to prevent the shovel from rotating during use. It is usually necessary to change the length of the tube and the attachment point of the handles in order to accommodate the capabilities of the individual user. This adaptation will work with individuals who have an arm that has been amputated below the elbow. The individual could also have a leg amputated below the knee, a back or hand injury.



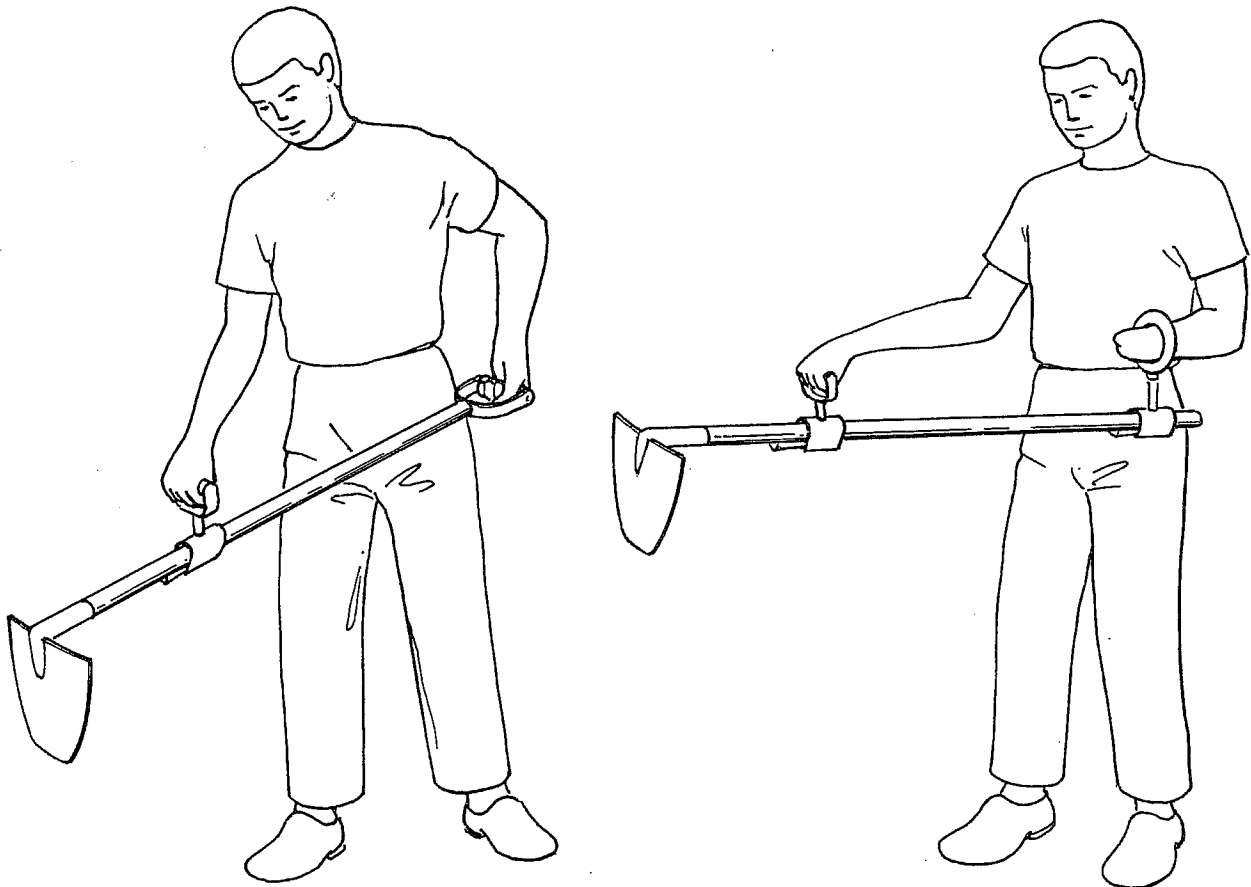
The *Additional Shovel Handle* helps individuals with a below elbow amputation to use a shovel. This adaptation also helps if the individual has a below elbow amputation in addition to another disability that makes it difficult to bend over.

2. f. Adaptations for Hoes

The two previous adaptations will also work with most standard hoes. Because the movements with hoes are different than those for using shovels, it is necessary to mount the adaptations in different locations. The best location is generally determined based upon the users height and disability. Trial and error will help to ensure it is mounted in the most appropriate location. It is best to perform the trial and error using hose clamps, as described previously. After the location has been determined, the attachments can be permanently attached in a manner similar to those described on pages 8 and 9.

Typical Users:

- below knee amputation with artificial limb
- hand or arm injury
- back injury
- individuals who have difficulties bending over



2. g. Additional Adapted Hoe

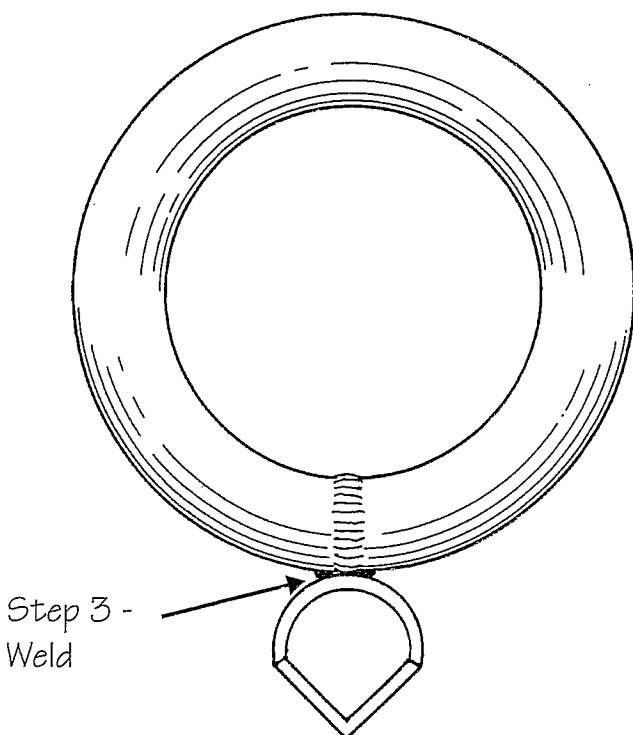
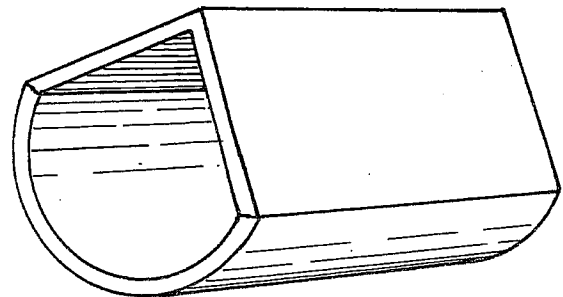
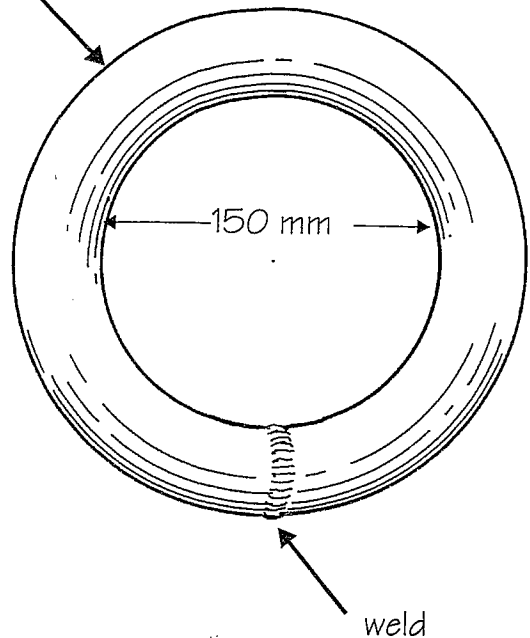
It is also possible to adapt a hoe so that it can be used by individuals with one arm that has been amputated either above or below the elbow.

Step 1. Bend a tube into as round a shape as possible.

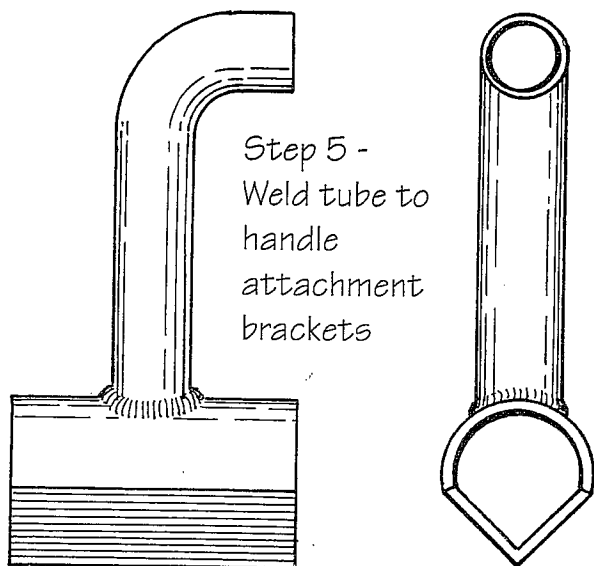
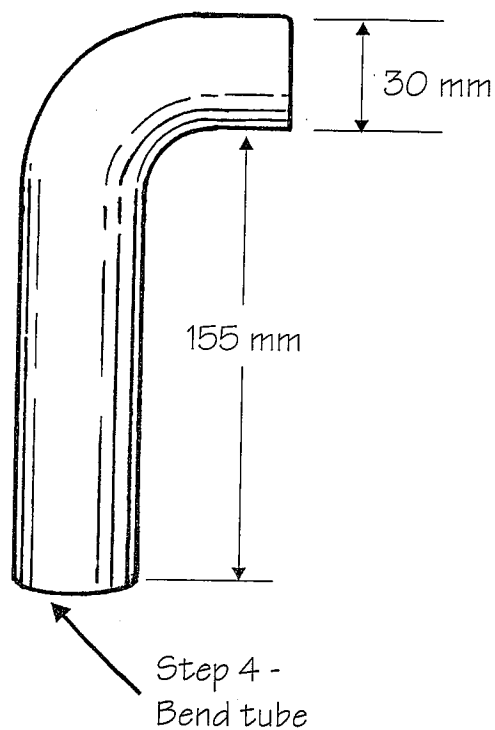
Step 2. Fabricate two *Handle Attachment Brackets* as described in steps 1, 2 and 3, page 6. Do not attach the vertical plates in step 4, page 7.

Step 3. Weld the hoop to the *Handle Attachment Bracket*, so that it will be perpendicular to the hoe handle.

Step 1 - Bend tube

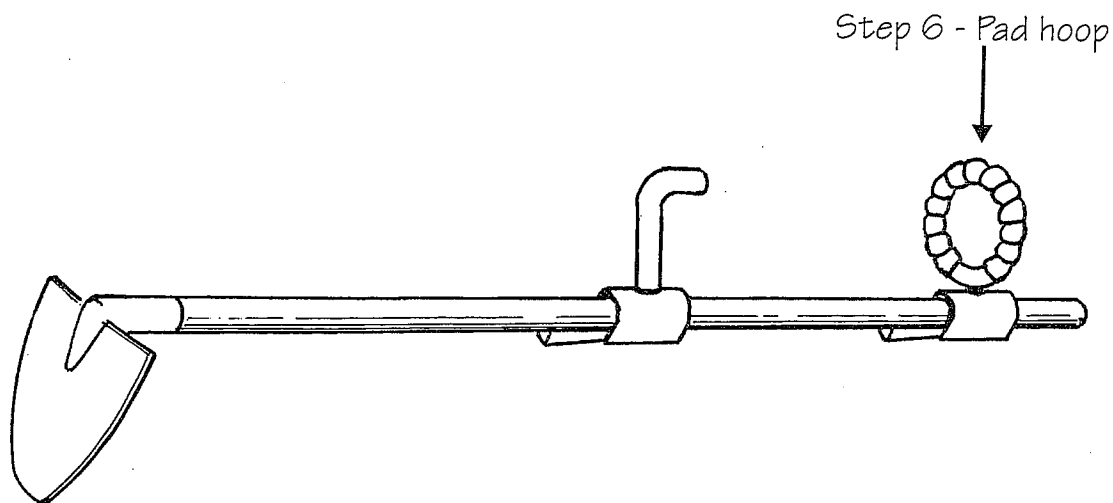


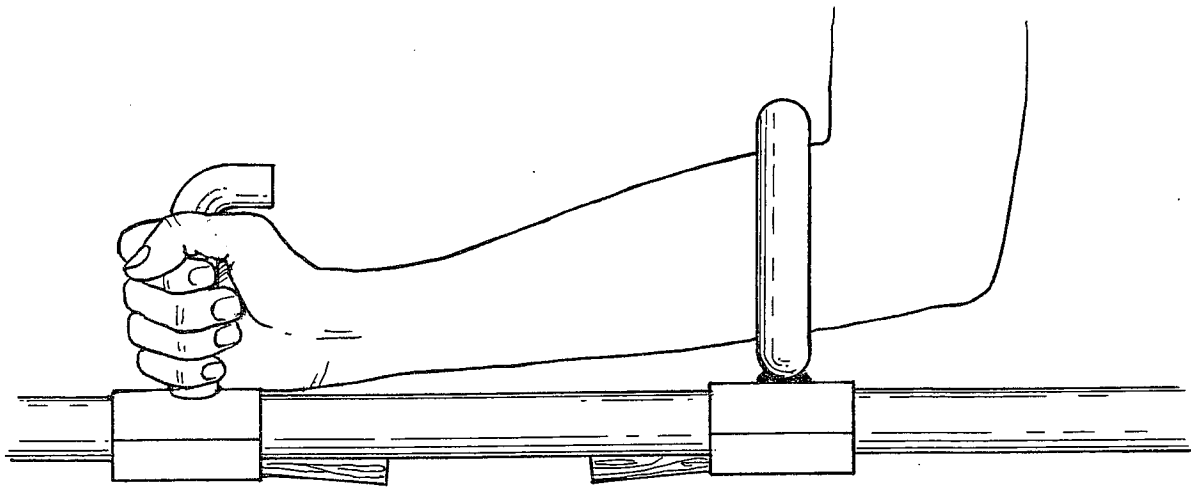
- Step 4.** Make a 90 degree bend in a section of pipe.
- Step 5.** Weld this section of pipe to one of the *Handle Attachment Brackets*.
- Step 6.** Pad the hoop portion of the adaptation with foam, leather or cloth.
- Step 6.** Attach the two *Handle Attachment Brackets* to the hoe.



Typical User:

- one arm that has been amputated either above or below the elbow.





This adaptation allows individuals who have an arm that has been amputated either above or below the elbow to use a hoe. Care should be taken when mounting the brackets to the hoe to ensure they are in the appropriate location for the user's height and skill level. The padding on the hoop is critical to reduce abrasions on the skin due to the use of the tool.



2. h. Peg Holder for Survey Crew

One task required in the rebuilding of roads is to survey the path of the road or irrigation ditch and to set stakes in the appropriate locations. The surveying can usually be performed by individuals who have a higher level of disability than individuals who are able to dig or level the road. One task that can be made easier on the survey crew is the setting of stakes - or pegs.

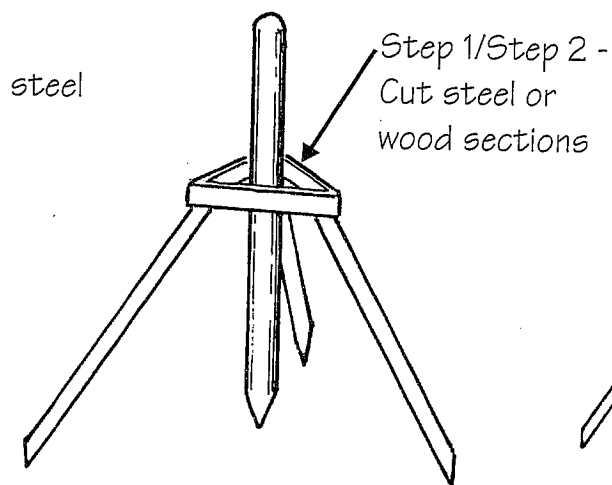
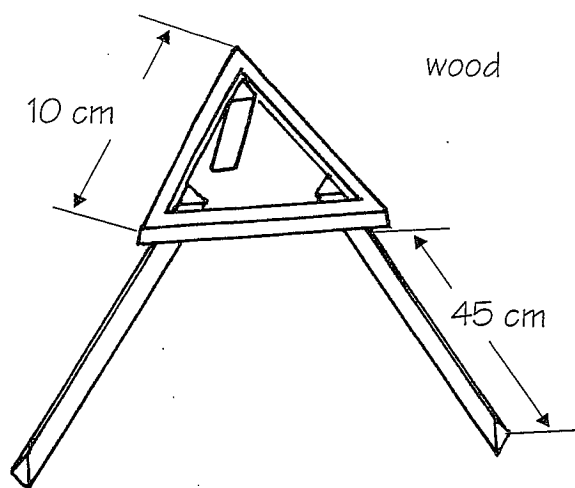
Step 1. Cut 3 pieces of steel or wood 6 mm X 3 mm into 10 cm long pieces.

Step 2. Cut 3 sections of 18 mm X 3 mm steel into 45 cm long sections. Sharpen one end of each of these sections.

Step 3. Attach the pieces into a pyramid shape - as per the drawing. If the material is wood - glue and nail the pieces together. If the material is steel, weld the pieces together.

Typical Users:

- *Arm amputation* - one side above or below the elbow.
- *Leg amputation*, one side above or below the knee.

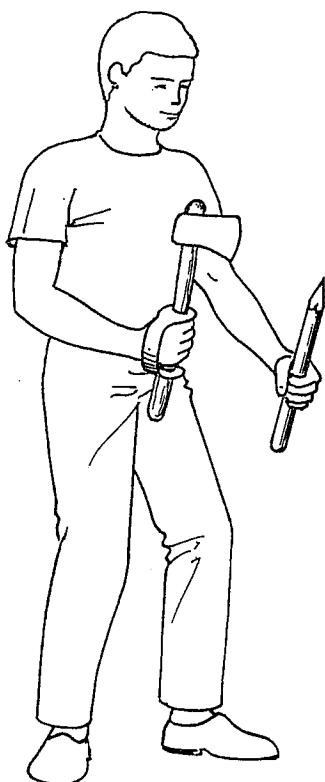


2. i. Peg Fabrication

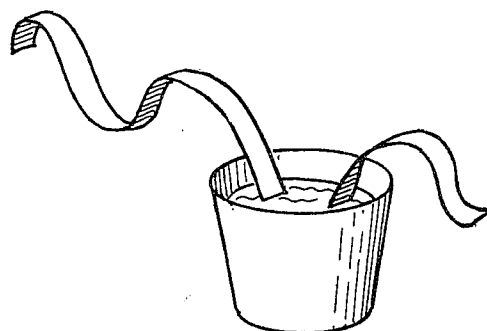
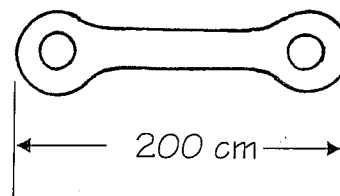
The task of fabricating pegs can usually be provided to individuals with more severe levels of disabilities. These individuals can gather the wood required, and cut the wood into pegs the proper size. In some cases, it is useful to modify an ax in order to make it easier to hold.

Step 1. Cut a section of leather into the shape in the drawing. This strap will go around the wrist and help the fingers hold onto the ax.

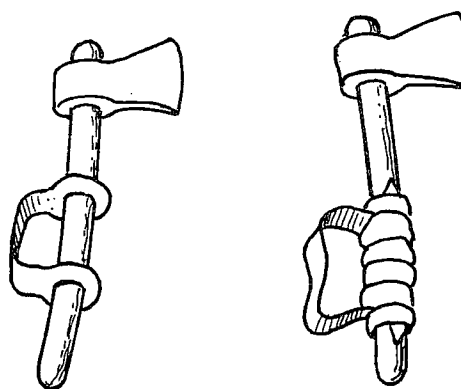
Step 2. Soak a strip of leather in water. Wrap the leather around the ax handle to make it larger and easier to hold. The leather should be wet when wrapped. When it dries, it will shrink and attach more firmly to the ax handle.



Step 1 - Cut leather shape.
Holes should be large enough
to slip over ax handle



Step 2 - Soak leather and
wrap around handle



This leather makes a larger, more textured surface that is easier to hold onto for individuals with grip difficulties.

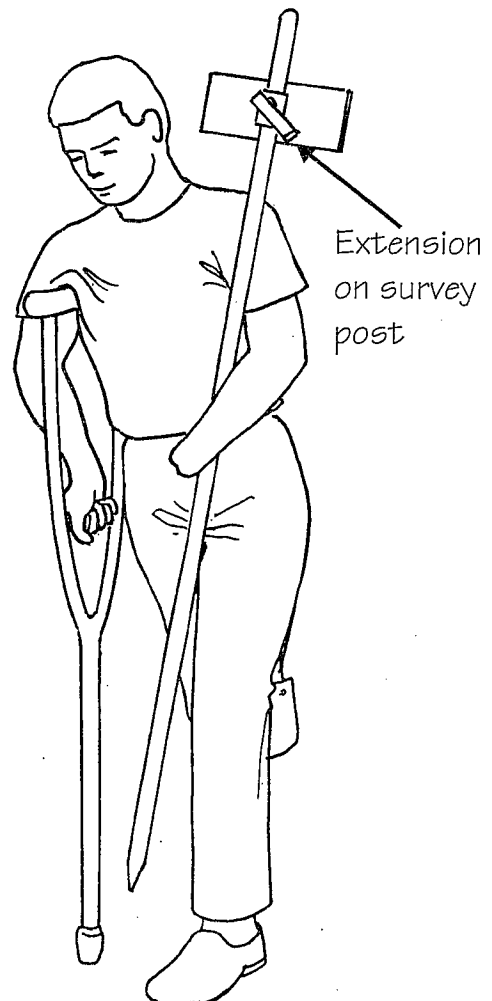
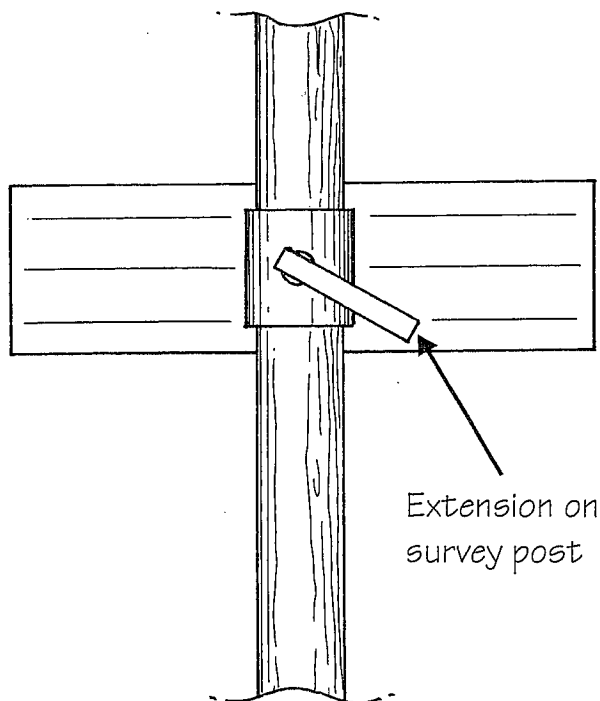
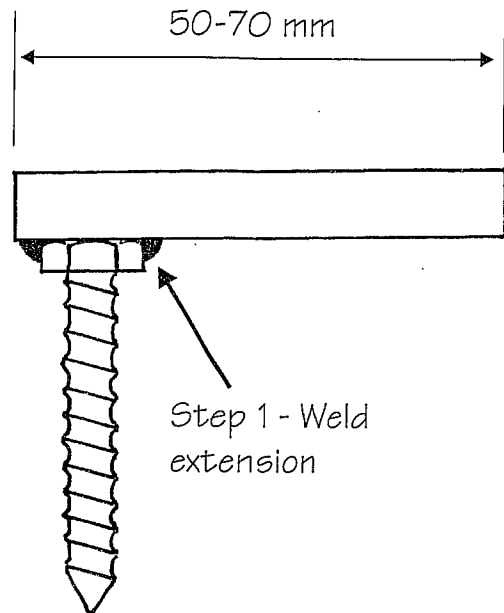
Typical Users

- hand and wrist deformity, pain or weakness

2. j. Survey Crew

The individuals who perform surveying work can have more severe levels of disabilities than some of the other individuals. Generally the individuals working on the survey crew need to be able to walk with the survey instruments. Most instruments require the user to tighten a bolt that attaches the horizontal marker to the vertical post. These markers usually have a thumb screw that should be turned in order to hold the marker in place. This thumb screw can be adapted to make it easier to turn.

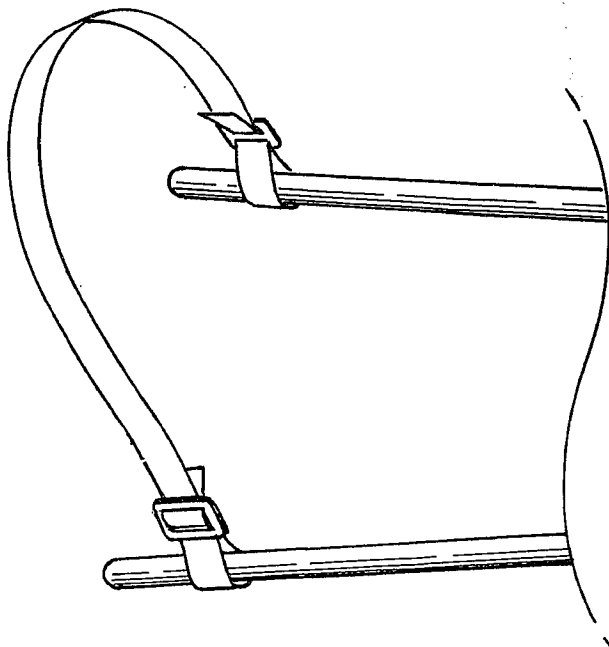
Step 1. Weld a 50 - 75 cm extension to the thumb screw as per the drawing.



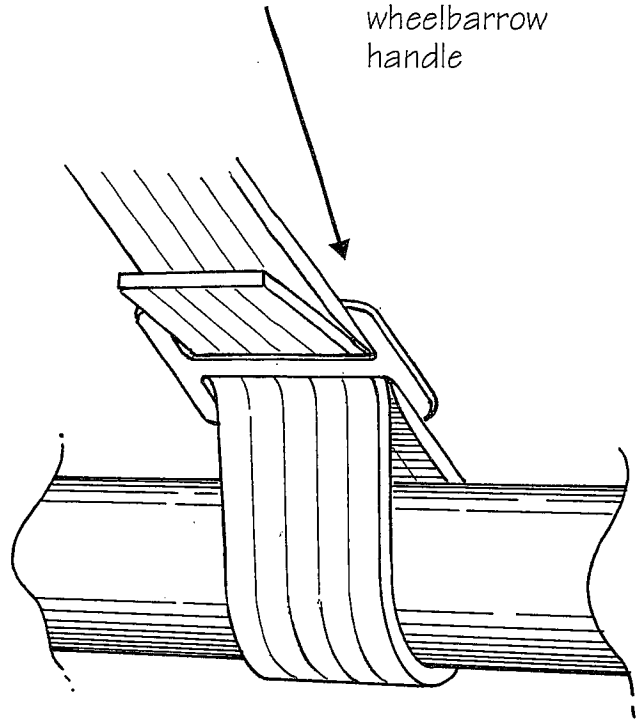
2. k. Wheelbarrow Attachment

It is possible to modify a wheelbarrow so that it is easier for individuals with one amputated arm, or one amputated leg to push it. The following modification will make it easier for certain individuals to use a wheelbarrow, but for best results the wheelbarrow should be pushed on fairly level ground and with not too heavy of a load.

Step 1. Attach a 50 cm wide leather strap to each handle of the wheelbarrow. This strap should be long enough to be able to rest on the shoulders of the user. If possible, place an adjustable buckle on one side of the leather strap, and make the strap longer than needed.



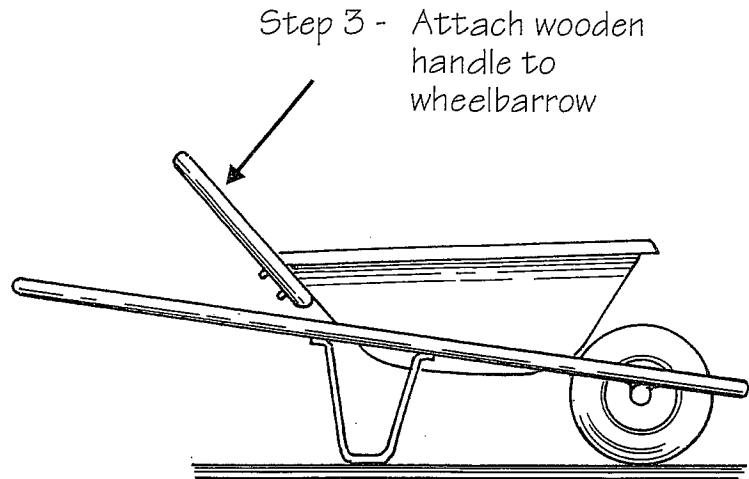
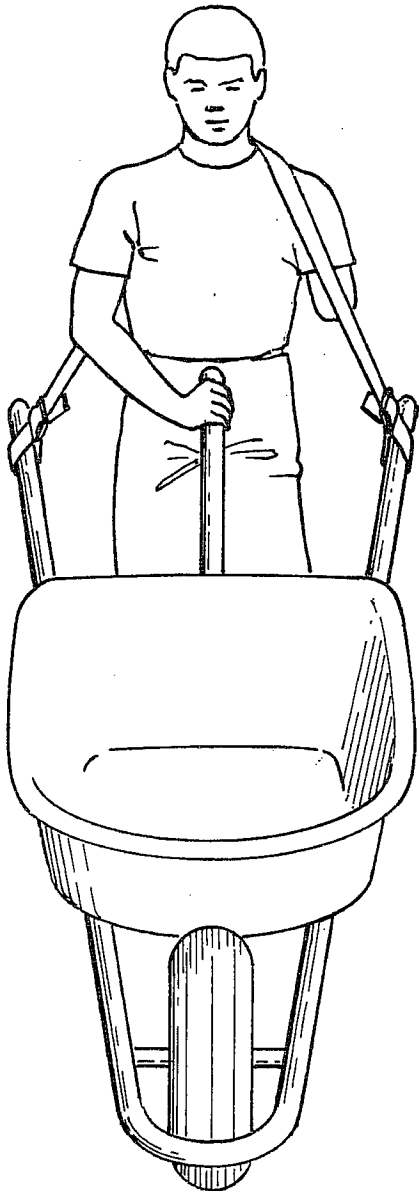
Step 1 - Attach a strap to the wheelbarrow handle



Step 2. Wrap some type of padding material around the leather where the shoulders will rest. This padding would ideally be foam, but if that is not available, cloth, rags or other material is acceptable.

This adaptation works for relatively light loads and fairly level terrain only.

Step 3. Attach a wooden handle to the wheelbarrow as shown. This handle provides something for the user to stabilize and push the wheelbarrow with.



Typical users:

- one leg amputated below the knee
- one arm amputated above or below the elbow

2. I. Hinges that widen the clearance of a door by about 40 mm

In many instances the door into a room or building is not wide enough for an individual who uses a wheelchair. In some cases, the door frame itself is wide enough for the wheelchair, but when the door is in the open position, a standard hinge reduces the width of the door opening by about 40 - 50 mm. The following adaptation to the door hinges will allow the door to swing completely free from the door opening, allowing for a slightly wider passage. It is possible to purchase special "swing free" hinges that have already been modified to provide this additional clearance. If not available, the following steps will modify a standard hinge to provide this additional clearance.

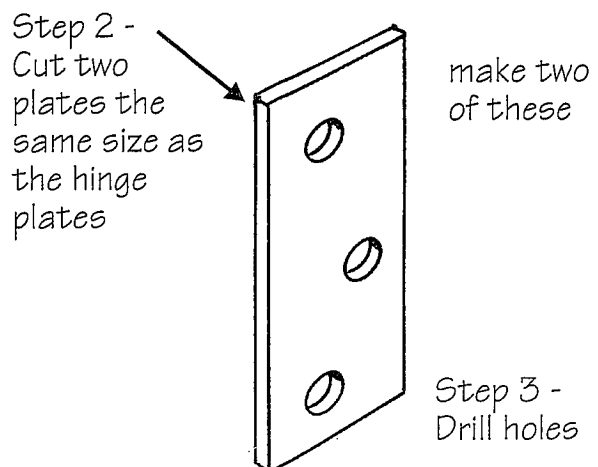
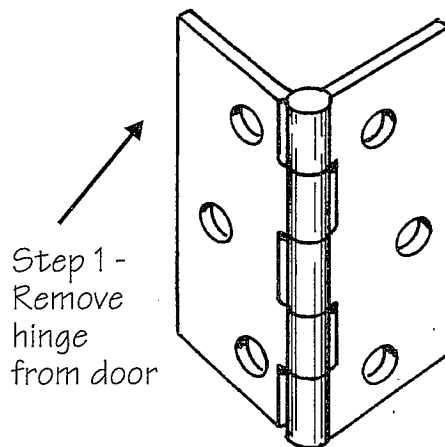
Step 1. Remove the standard hinges from the door frame and door jam.

Step 2. Cut two pieces of steel plate about the same size as the size of the plates on the hinge.

Step 3. Drill holes in each plate to match the holes in each hinge.

These hinges will make the overall width of a door when open about 40 - 50 mm larger than with standard hinges. This additional width can make it easier for some individuals in wheelchairs to pass through the door.

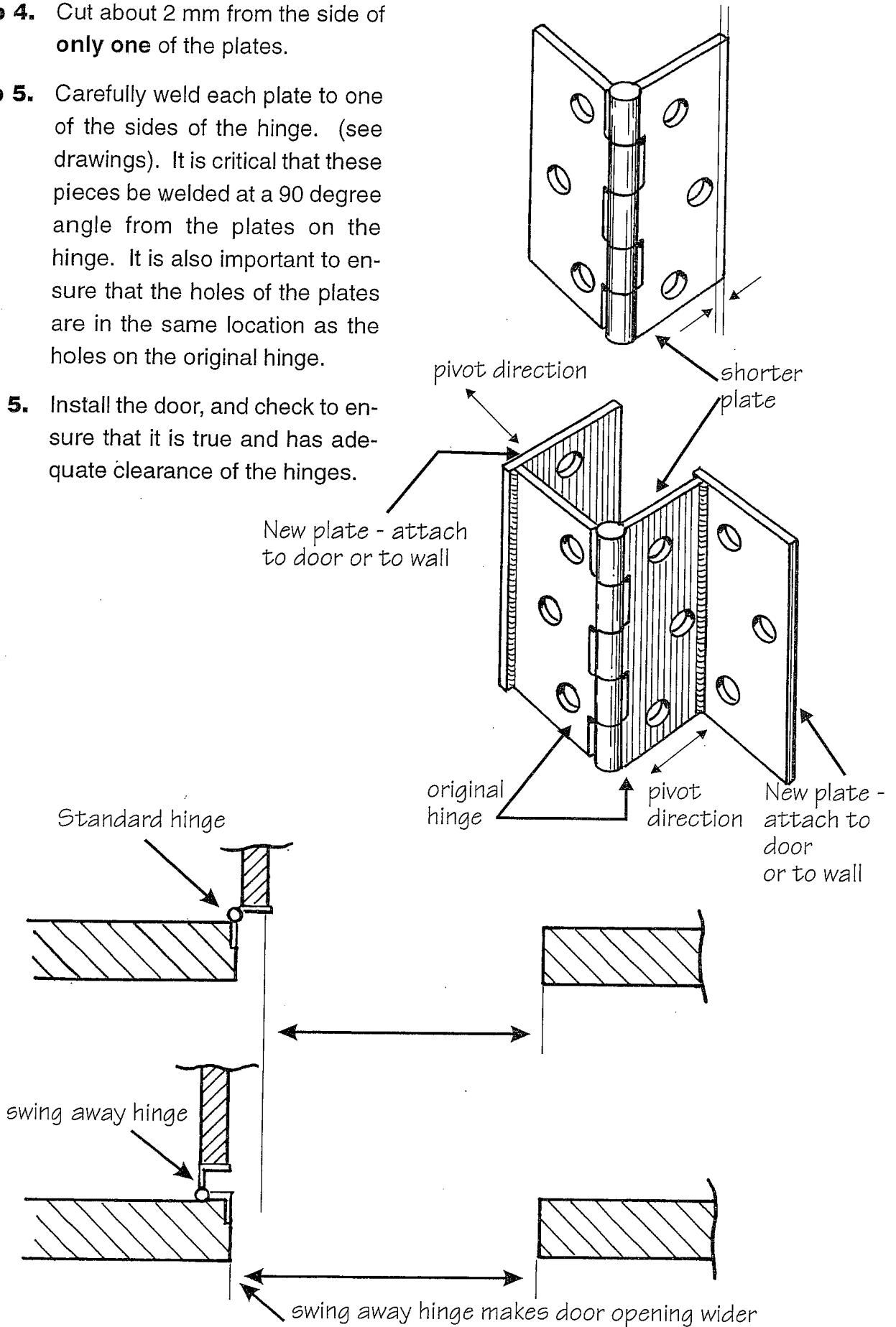
Standard hinge before modification



Step 4. Cut about 2 mm from the side of **only one** of the plates.

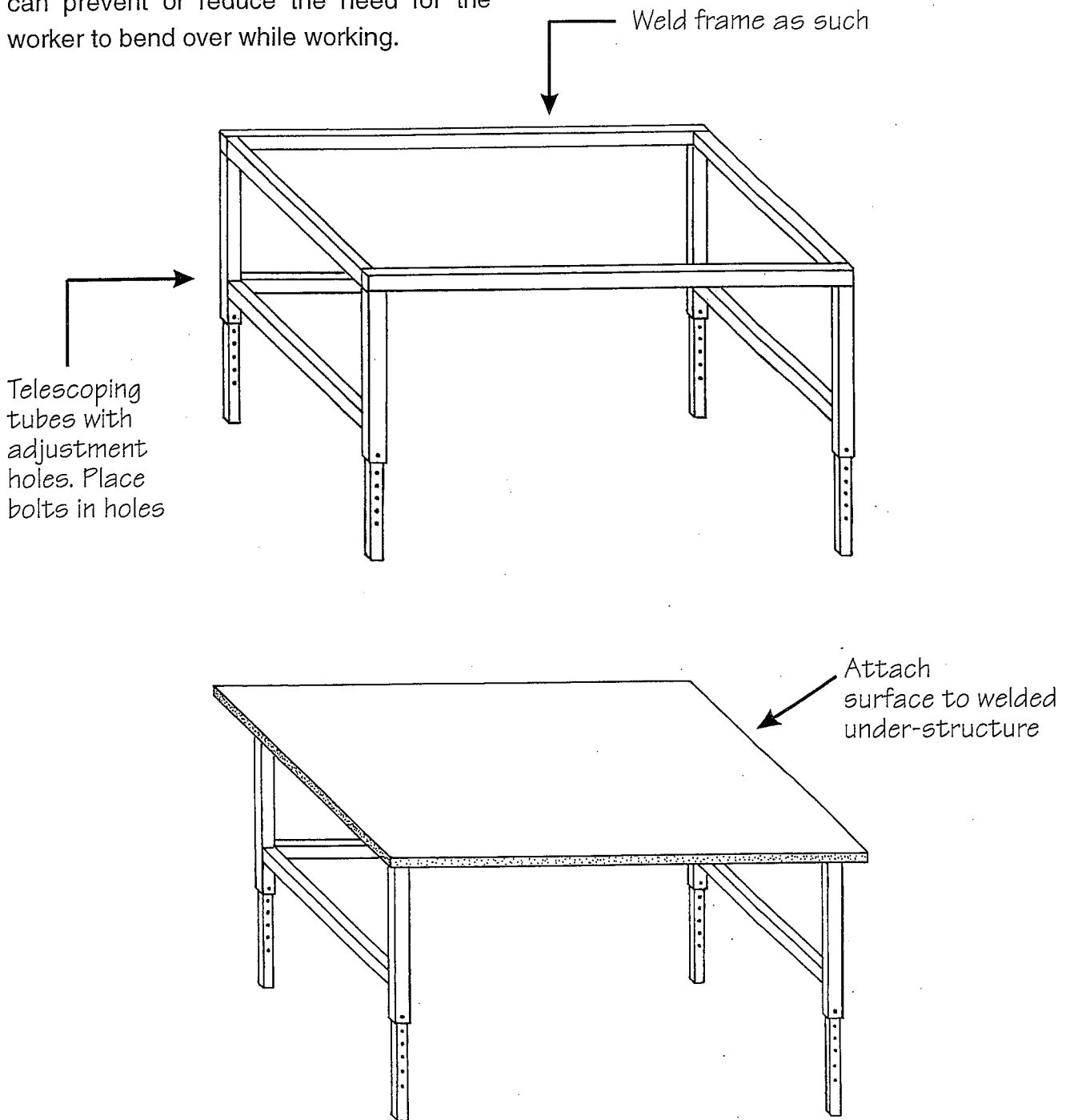
Step 5. Carefully weld each plate to one of the sides of the hinge. (see drawings). It is critical that these pieces be welded at a 90 degree angle from the plates on the hinge. It is also important to ensure that the holes of the plates are in the same location as the holes on the original hinge.

Step 5. Install the door, and check to ensure that it is true and has adequate clearance of the hinges.



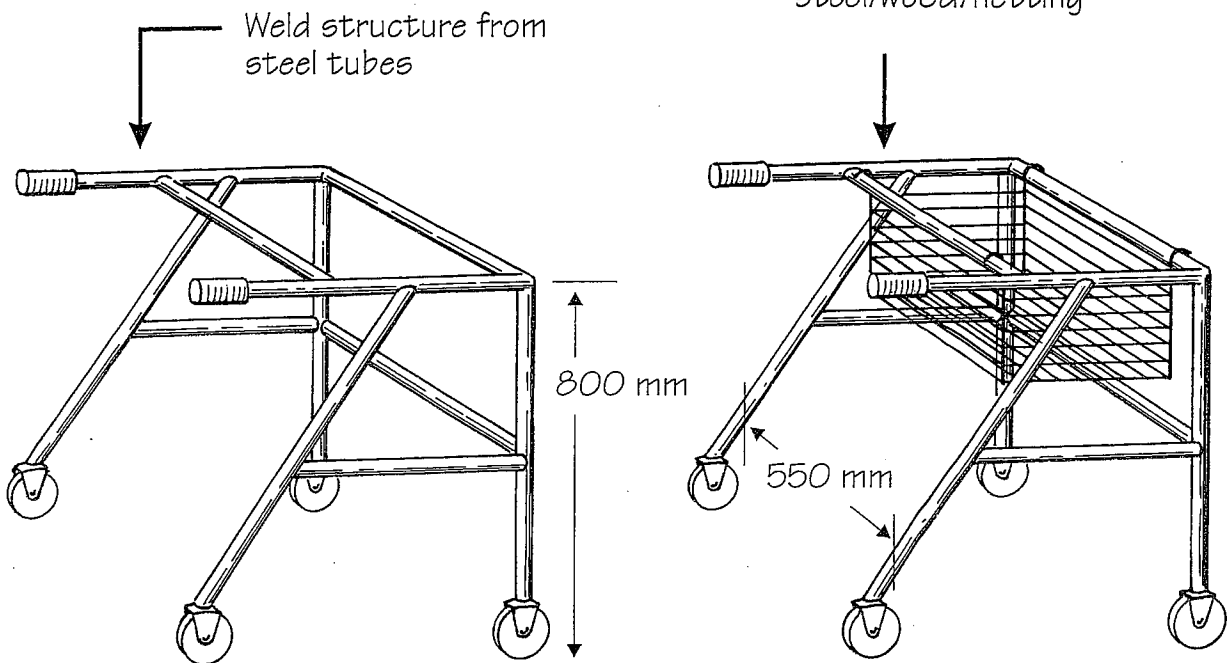
2. m. Accessible Table

The following table provides the adjustability and clearance for individuals with a wide variety of disabilities. This table can be used for any task that requires the worker to use a flat surface. The table adjustments can prevent or reduce the need for the worker to bend over while working.



2. n. Parts dolly / walker

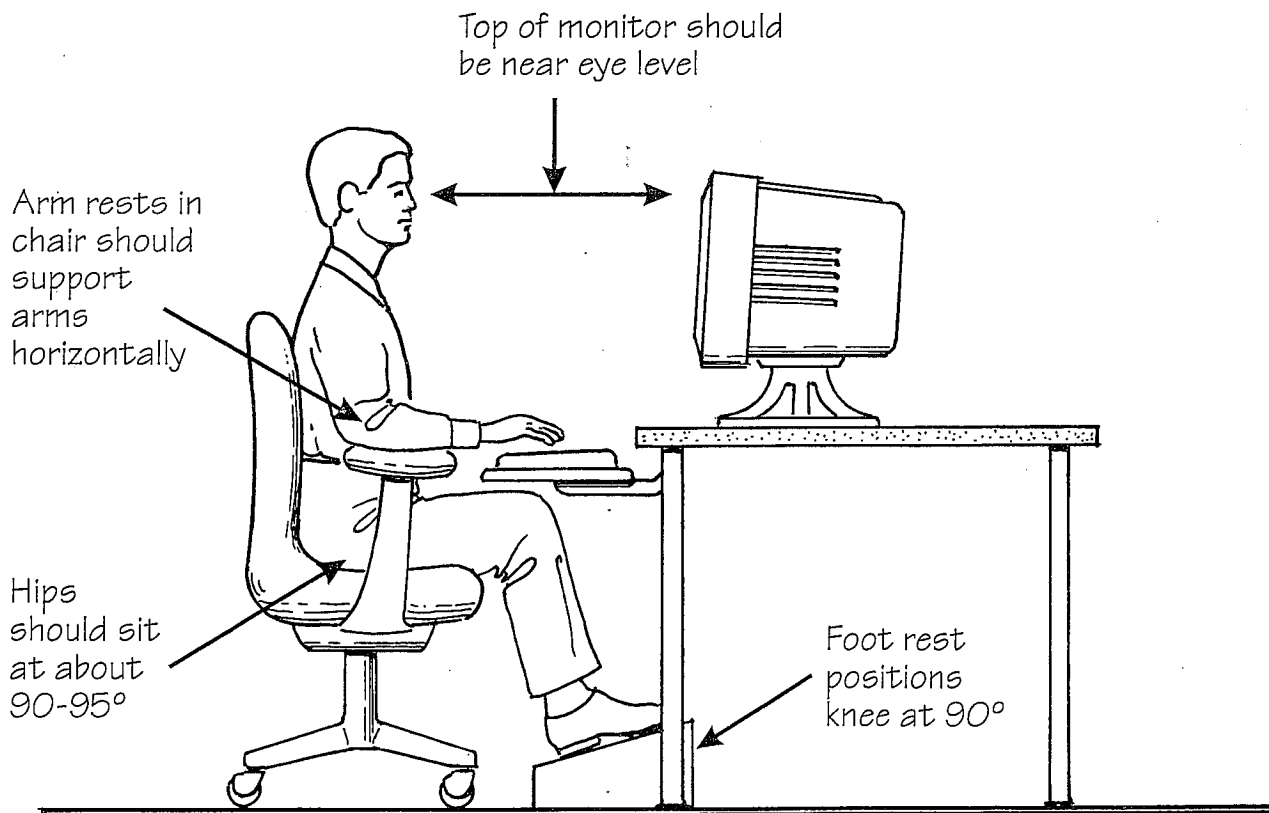
One of the most difficult tasks for many individuals with disabilities is to carry parts from one location to another. This is particularly important in an automobile mechanics shop. The drawing below demonstrates an acceptable walker/ parts dolly that can be fabricated. The material should be as strong as possible to allow for heavy parts to be moved. Care should be taken to ensure the basket is large enough to hold the part required, but not so deep that it is difficult to remove the parts.



2. o. Computer Adaptations

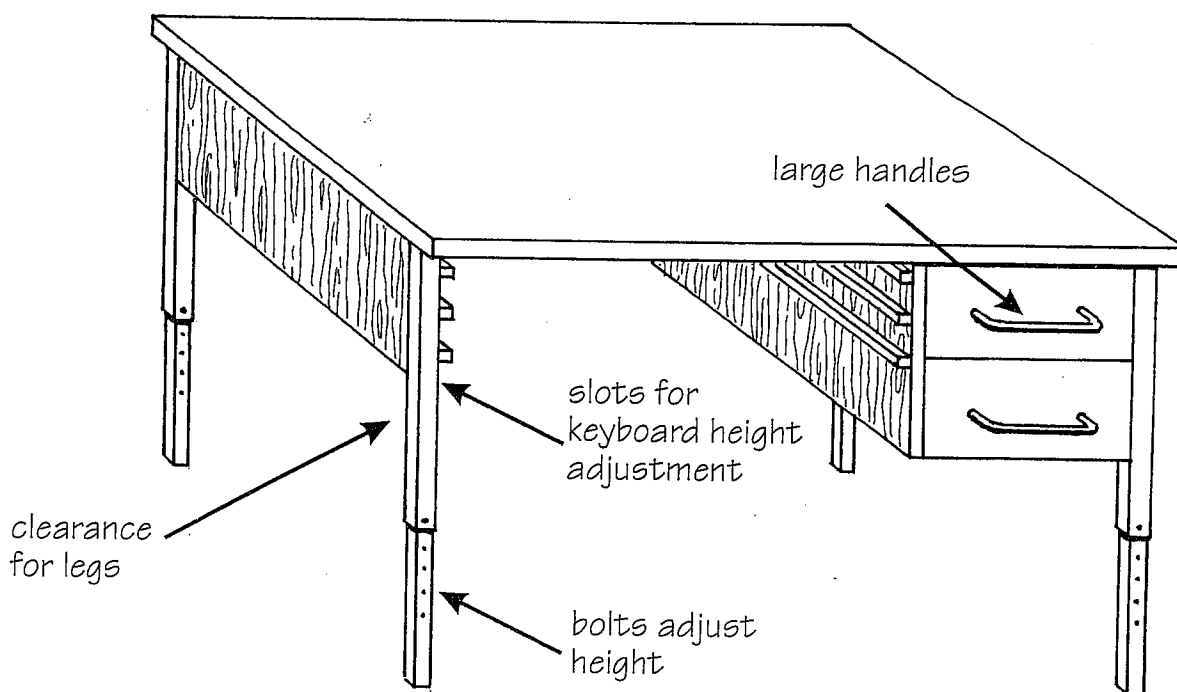
A number of adaptations can be made to help individuals with disabilities use a computer better. The individual should sit in a chair that provides supportive back and arm rests. The keyboard tray should be positioned so the arms project at nearly a horizontal angle and sit on the arm rests. The feet should be supported so that the hips sit at an angle of approximately 90 degrees, either with footrests or on the floor. The top of the monitor should be positioned at about eye level. If the computer is either IBM or Macintosh compatible, software designed to help individuals with disabilities is available at **no cost** from the manufacturer.

The posture of an individual when using a computer is critical for individuals with mild to moderate disabilities.



2. p. Accessible Computer Table

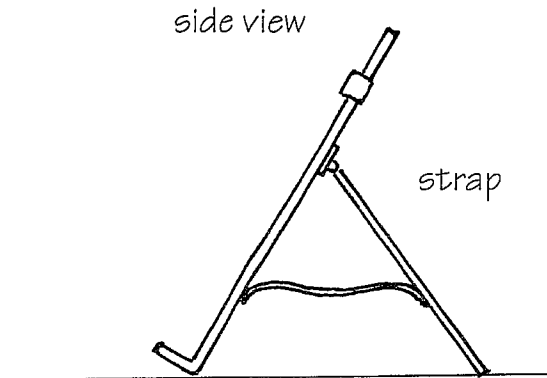
An accessible computer table is critical to achieving the posture described on page 30. A accessible computer table should have sufficient leg room, a keyboard that can be adjusted to the appropriate height, and the ability to mount the monitor at an acceptable height. The diagram shows an accessible computer desk that is relatively easy to manufacture. The overall table height is adjusted in the same manner as the table on page 28, and the keyboard tray fits into 1 of 3 slots at different heights. The monitor height can be adjusted with books when it sits on the accessible computer table.



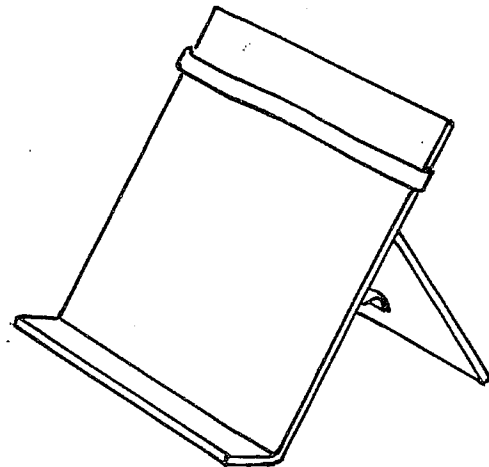
2. q. Other Computer Accessories

The following few adaptations can make it easier for individuals with certain disabilities to use a computer.

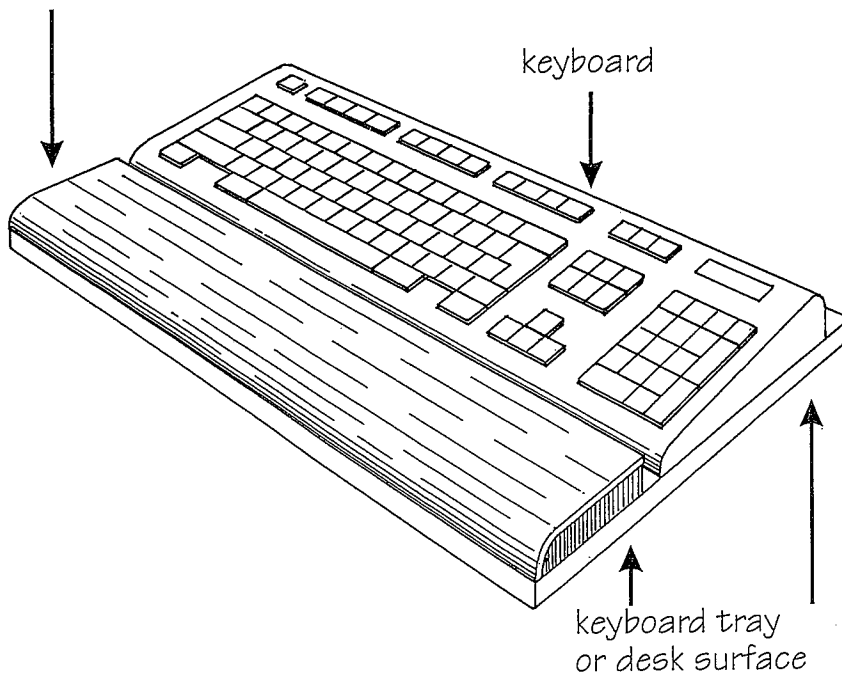
This clip board mount will hold paper in a location that is higher and easier for the user to see. This is particularly useful when the individual is typing information from a sheet of paper into the computer.



large rubber band or clip

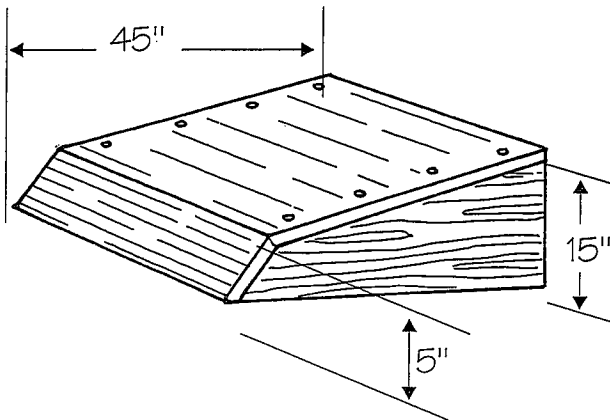
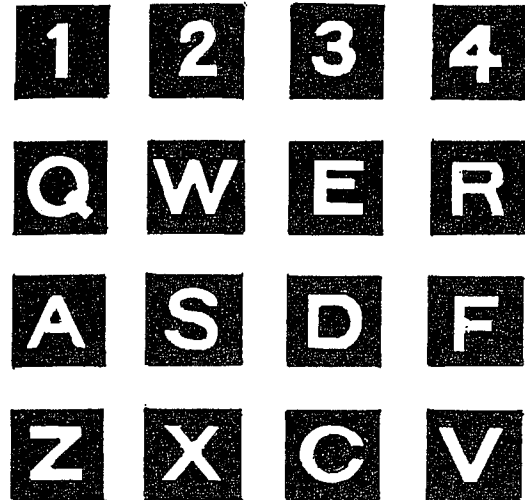


wrist rest



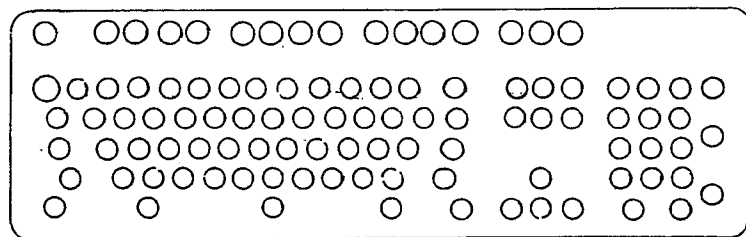
This simple wrist rest is made from wood and covered with a smooth cloth to reduce friction. The height should be closely matched to the height of the keyboard.

It can be helpful to blacken the keys on the keyboard and write each letter on each key with white paint. This may help an individual with a visual impairments see the keys. Stick on letters are available in some areas.



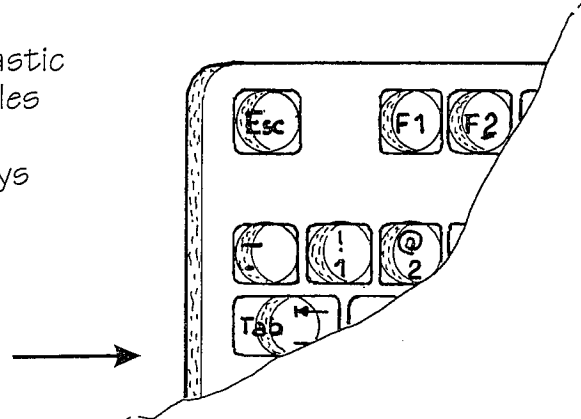
The height of the feet can be adjusted by moving the foot rest closer or farther away from the body.

Clear rigid plastic overlays can be firmly mounted to the top of



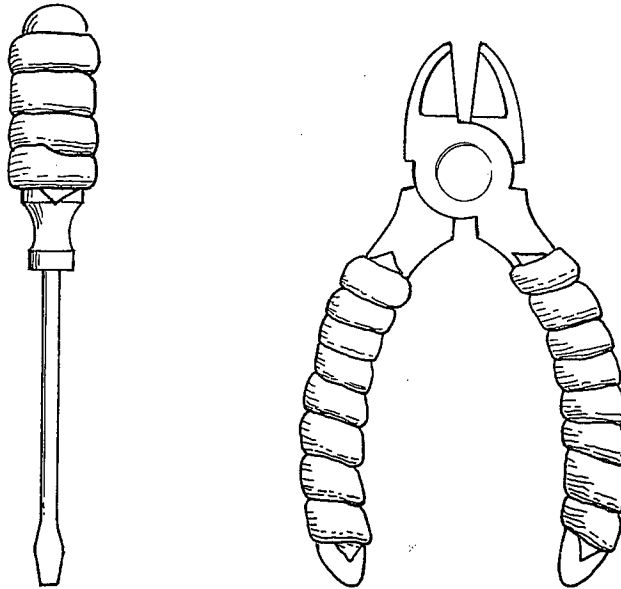
Rigid clear plastic sheet with holes that match location of keys

Placed over a keyboard

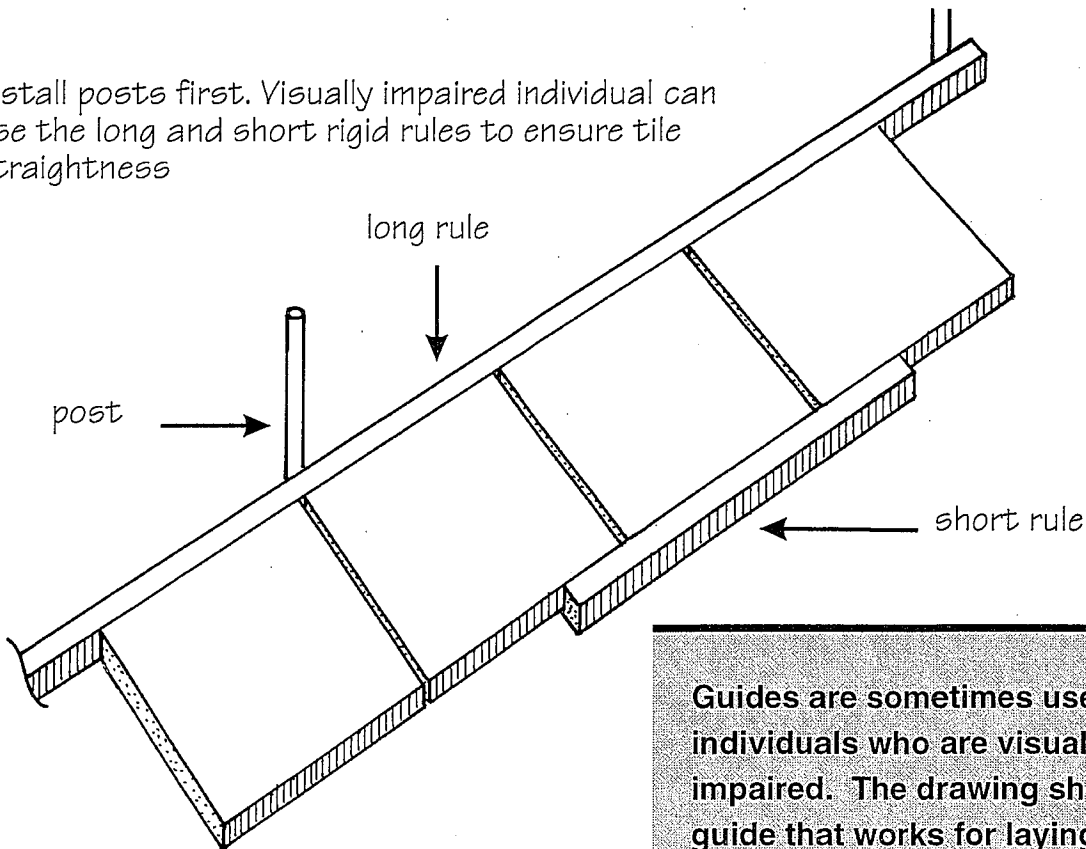


2. r. Other Adaptations

Many small tools are difficult for weak or deformed fingers to grasp. Wrapping the handles with leather or other material makes gripping easier.



Install posts first. Visually impaired individual can use the long and short rigid rules to ensure tile straightness



Guides are sometimes useful for individuals who are visually impaired. The drawing shows a guide that works for laying tile, but the same concept will work for brick and shingle laying.

3. Accessibility Guidelines

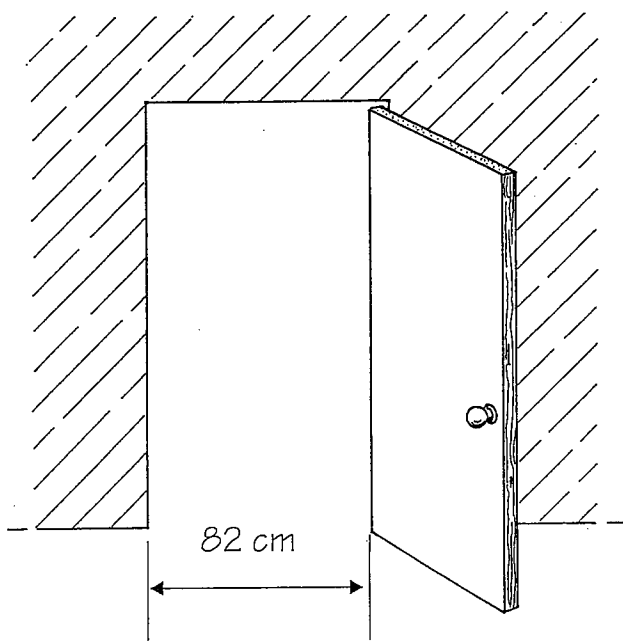
3. a. Introduction

The following guidelines provide general parameters to be considered when attempting to make facilities more accessible for individuals with disabilities. These parameters have been developed primarily for use in regions that have extremely limited resources and facilities that have not been designed to consider the needs of individuals with disabilities. Since the severity and types of disabilities vary greatly in different regions, guidelines that are specific to certain disabilities have been identified as such. Additionally, since the access to wheelchairs varies in different regions, certain guidelines that apply primarily to individuals who use wheelchairs have also been identified as such. This additional information should make it easier for regions that have limited resources to prioritize the modifications according to the specific needs of the region.

These recommendations do not meet the requirements of the Americans with Disabilities Act in the United States, or similar standards in other countries. It is not necessarily appropriate to apply standards from those countries in regions emerging from armed conflict because of dissimilarities between the available resources, severity of disabilities, and access to technology for individuals with disabilities. For this reason, these guidelines were developed to highlight only the most pertinent accessibility issues for individuals who are likely to be mobile enough in developing countries to require access into local facilities.

3. b. Accessibility Survey

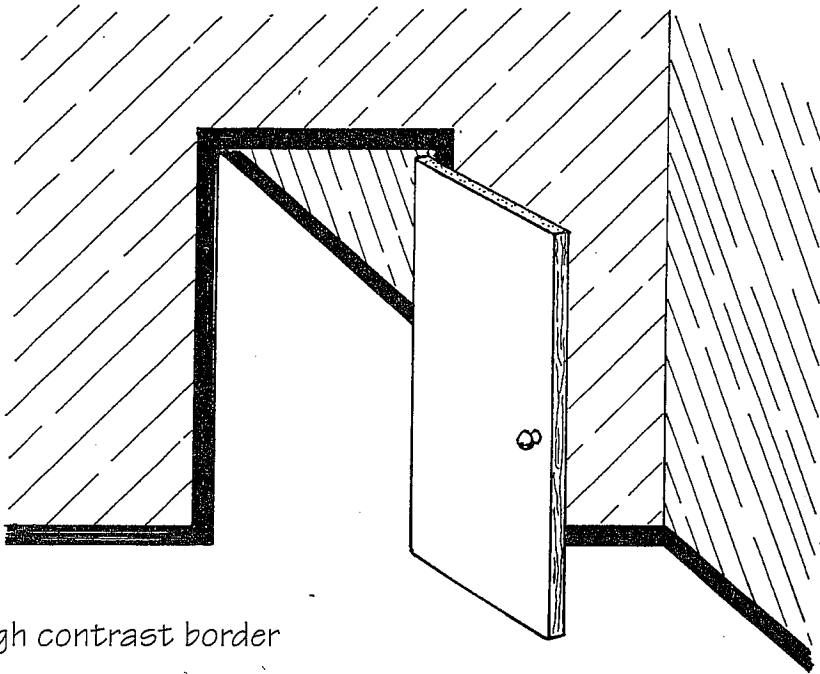
The first step in determining what modifications should be made to a facility in order to make it more accessible is to perform an accessibility survey. An accessibility survey is made by walking through the entire facility and determining which areas of the facility require access by individuals with disabilities, and what pathways will be taken by those individuals. The pathways taken are then identified as "accessible pathways". It is not always necessary to make all rooms and all pathways accessible. It is usually prudent to prioritize the rooms and areas that should be available for individuals with disabilities based upon the anticipated use of the rooms. Each accessible room must have at least one pathway that is accessible (an "accessible pathway"), but it is not always necessary for each pathway that leads to an accessible area to be accessible.



3. c. Doors

1. Doors in accessible pathways should be equipped with lever handles instead of round handles. See page 37 for a description of how to fabricate a lever handle if purchase is not possible.
2. Doors in accessible pathways should provide a minimum of 82 cm of clearance (or 90 cm for facilities with many wheelchair users) when the door is in the fully open position. See pages 26 and 27 for a description of how to fabricate a hinge that will increase the opening width by approximately 40 mm.
3. Doors on accessible pathways should open with less than 5 pounds of force.
4. Visually impaired individuals require a high degree of contrast between a door opening and the adjacent wall in order to see the door. Additionally, a contrasting border along the bottom of a wall in an accessible pathway increases the ability of individuals with visual impairments to navigate. This need is particularly acute in low light areas.

Doors in accessible pathways should have at least 82 cm of clearance when opened.

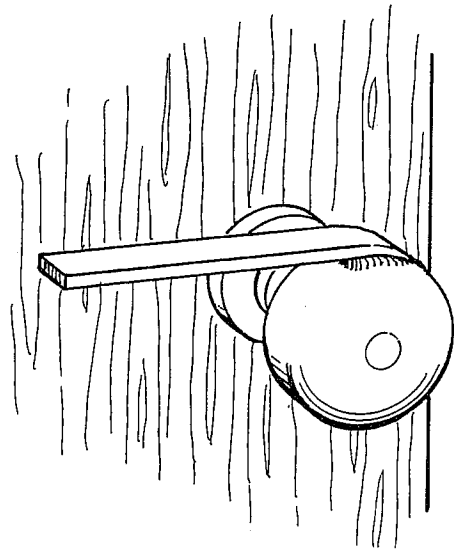
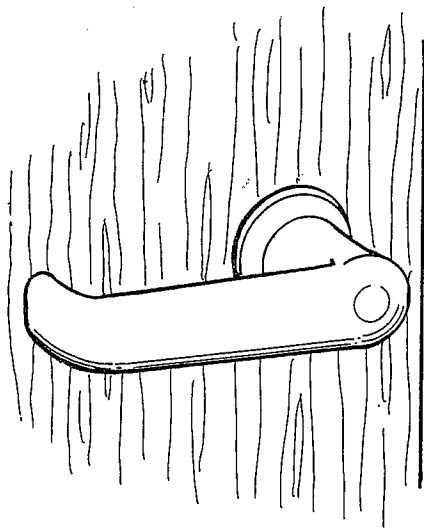


high contrast border

High contrast borders between doors and their openings help individuals with visual impairments. Additionally, high contrast markings on the floor are helpful.

commercial lever door handle

Weld a plate to a round door knob to convert to a lever

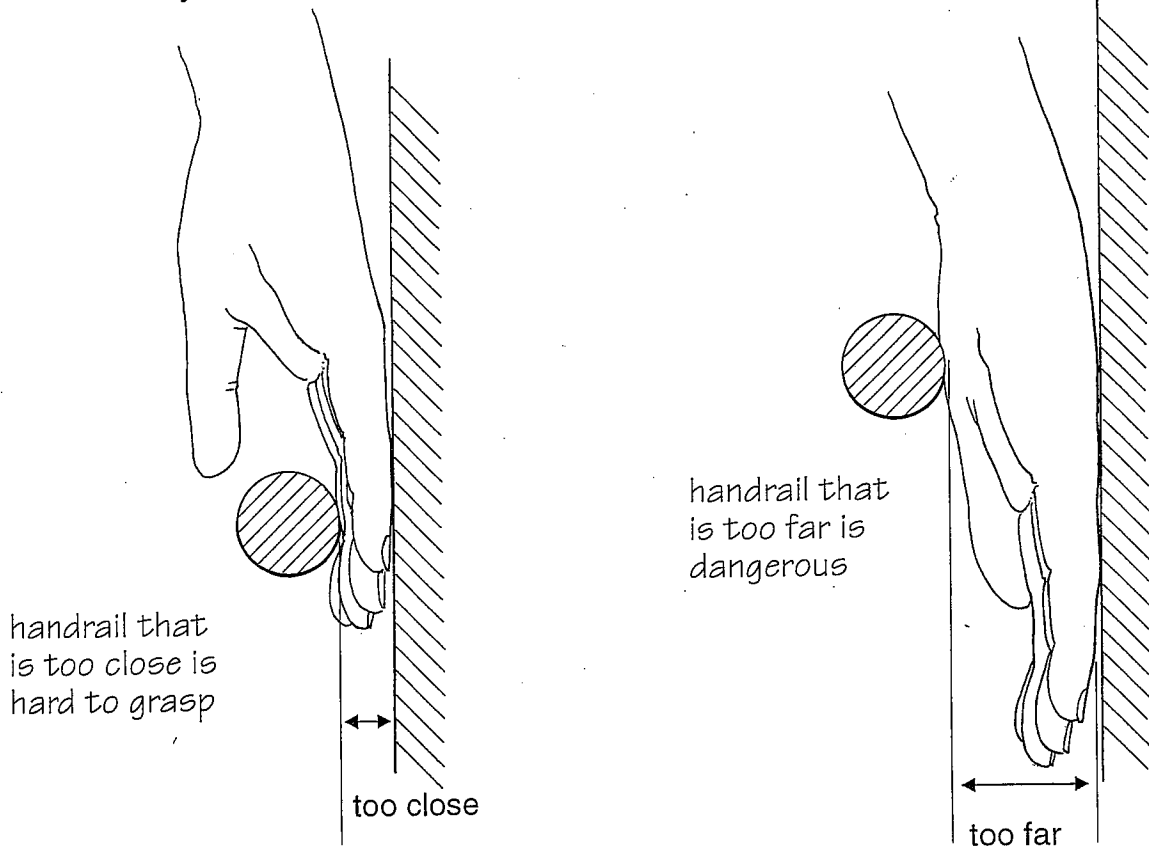


Lever door handles are easier to open than round door knobs. A round door knob can be converted to a lever door handle by welding a plate as shown.

3.d. Stairs

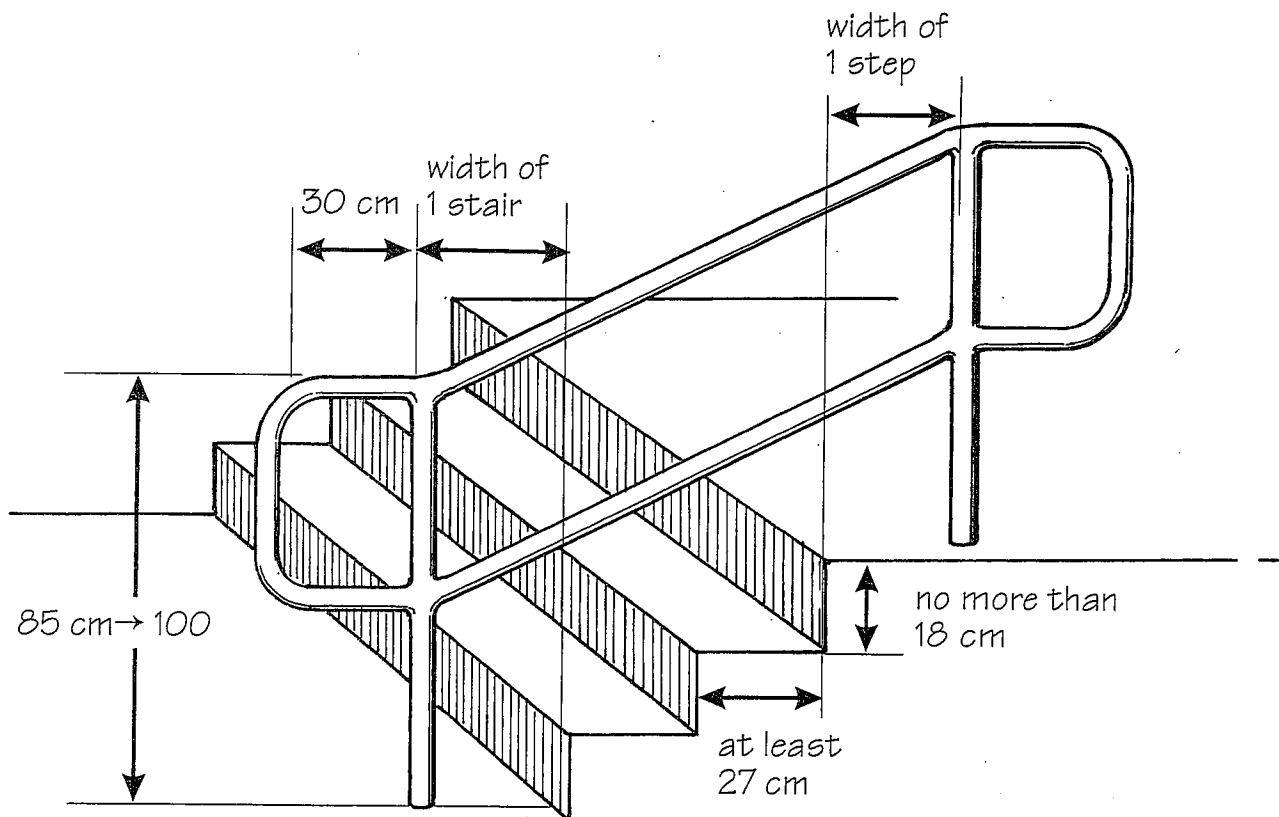
1. Stairs that are in an accessible pathway with an overall rise of more than 30 cm. should have a handrail - preferably on each side. Handrails should be approximately 3.75 cm. away from the wall (if attached to a wall) and between 3.2 and 3.8 cm. in diameter. It is important for the handrail to be securely attached to the studs of the

wall, and for it to be not too close or too far away from the wall. A handrail that is mounted too far away from the wall is dangerous because individuals with disabilities may lose their grip and catch their hand between the wall and the handrail and possibly break a wrist or hand.



Handrails should be mounted approximately 3.75 cm away from the wall. It is difficult to hold a rail that is mounted closer to the wall. If it is mounted farther from the wall, the hand may slip and injure the individual.

2. Each step should have a flat surface for stepping that is at least 27 cm. long, with a rise of no more than 18 cm.
3. Handrails should be between 86 and 96 cm. high. They should extend horizontally for at least 30 cm. past the top stair, and 30 cm. plus the width of one stair past the bottom stair.
4. Handrails should be continuous along the inside of the stairs that have a switchback between flights (i.e.: a flight of stairs that has a landing should have a continuous inside handrail that goes from the bottom of the ground floor to the top of the highest floor).
5. Handrails should not rotate within their fittings.



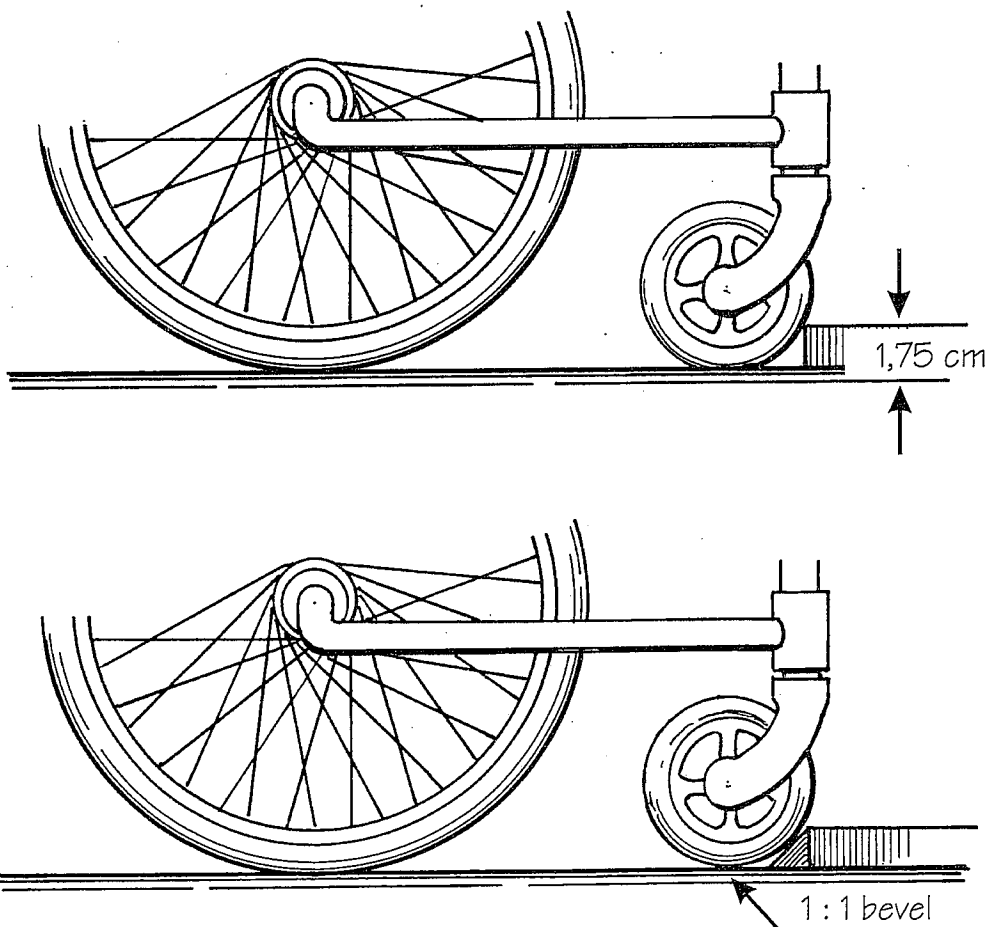
Typical accessible handrail mounted near stairs.

3. e. General Wheelchair Accessibility Guidelines

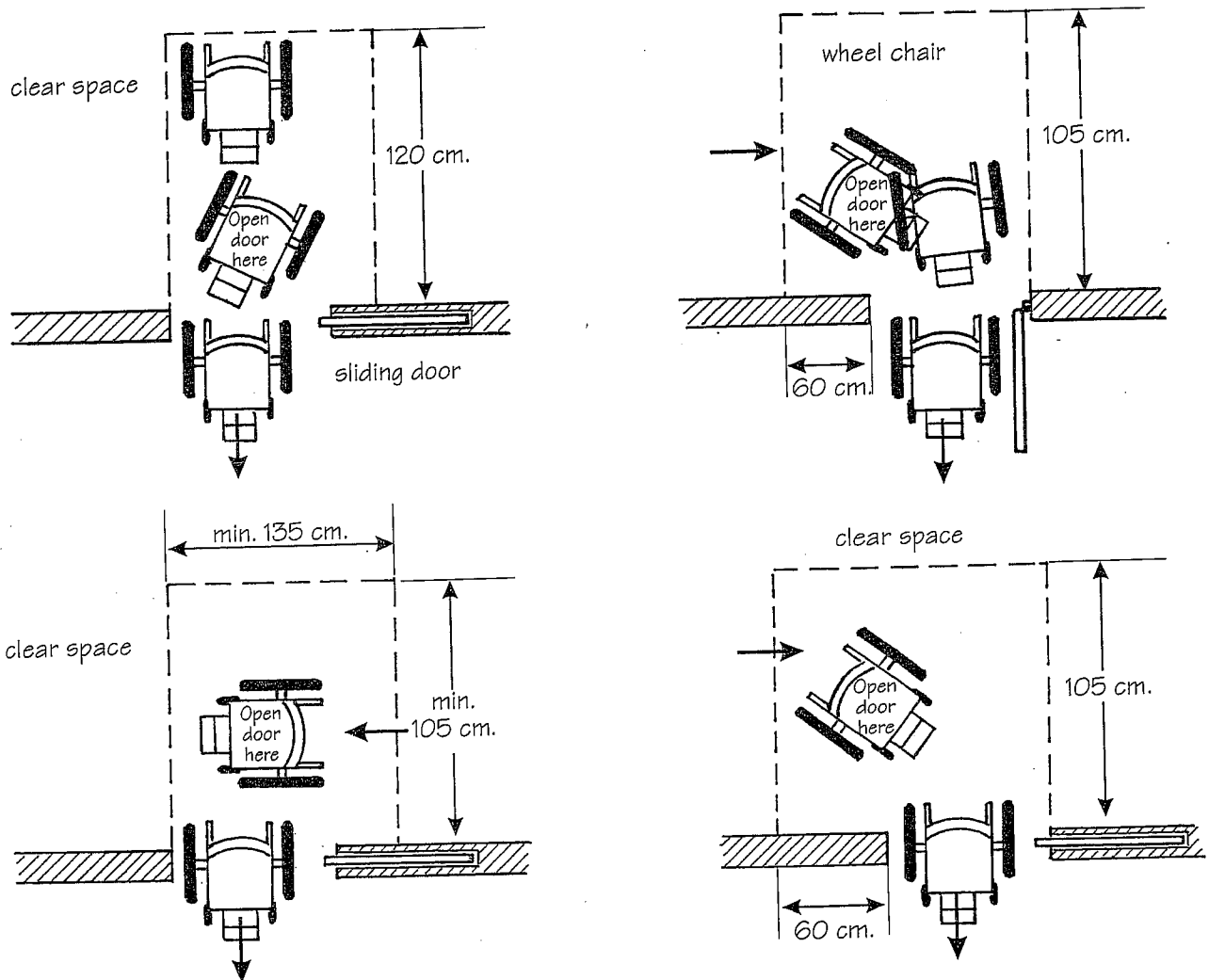
1. Wheelchairs require a minimum clear space for turning of 152 cm radius - preferably 160 cm.
2. It is generally not possible for a wheelchair user to push over an abrupt change in the surface of a sidewalk that is higher than 1.75 cm. A bevel, with a slope of approximately 1:1 will facilitate a wheelchair user's ability to go over these small discontinuities.
3. It is necessary for wheelchair users to have a clear space next to a door in order to be able to open and shut the door without having to back up while

holding the door when opening. The spaces required for the door opening depend upon which direction the door opens and which direction the user must move both before and after they go through the door. See pages 41 and 42 for examples of door openings, and recommended clearances depending upon the direction of travel.

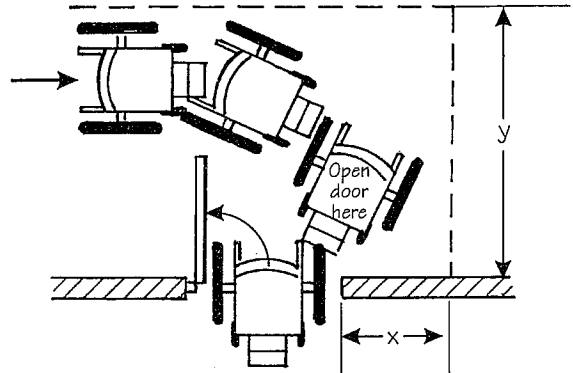
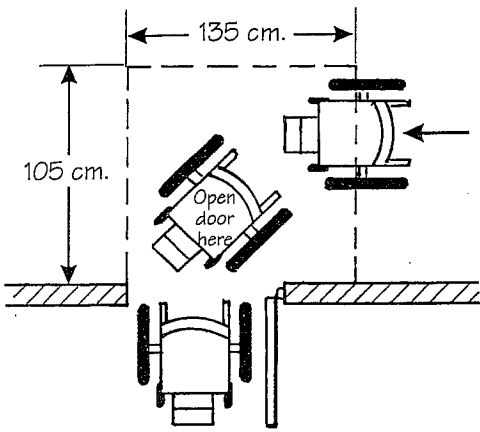
A typical user in a wheelchair will not be able to push the chair over an abrupt discontinuity of more than 1.75 cm. A bevel with a slope of 1:1 will facilitate wheelchair travel over the bump.



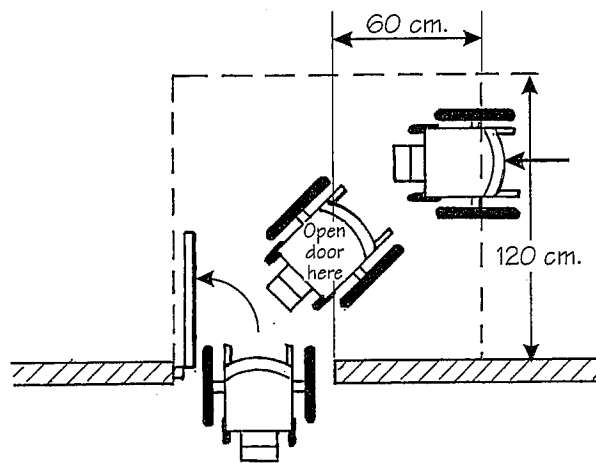
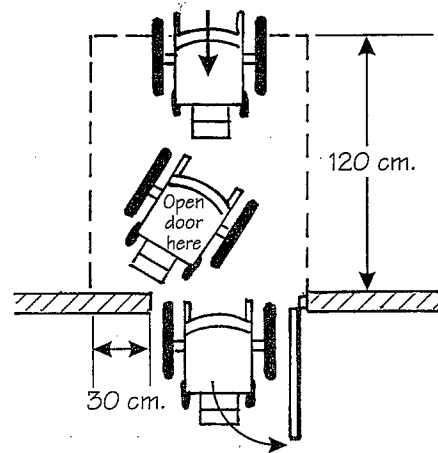
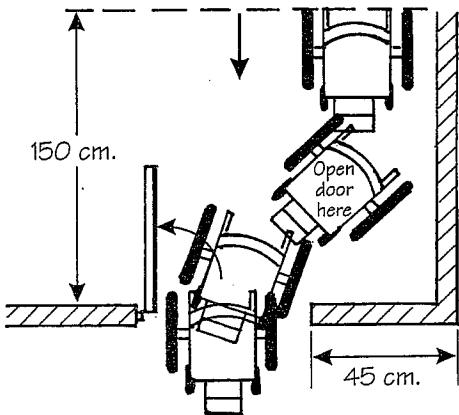
The following diagrams demonstrate recommended spaces near doors to allow individuals with wheelchairs to easily pass through the doors. These spaces are required in order to allow the wheelchair user to grab hold of the door handle, and open the door without having to back up the wheelchair to clear the door.



Additional clearances required for wheelchair users.

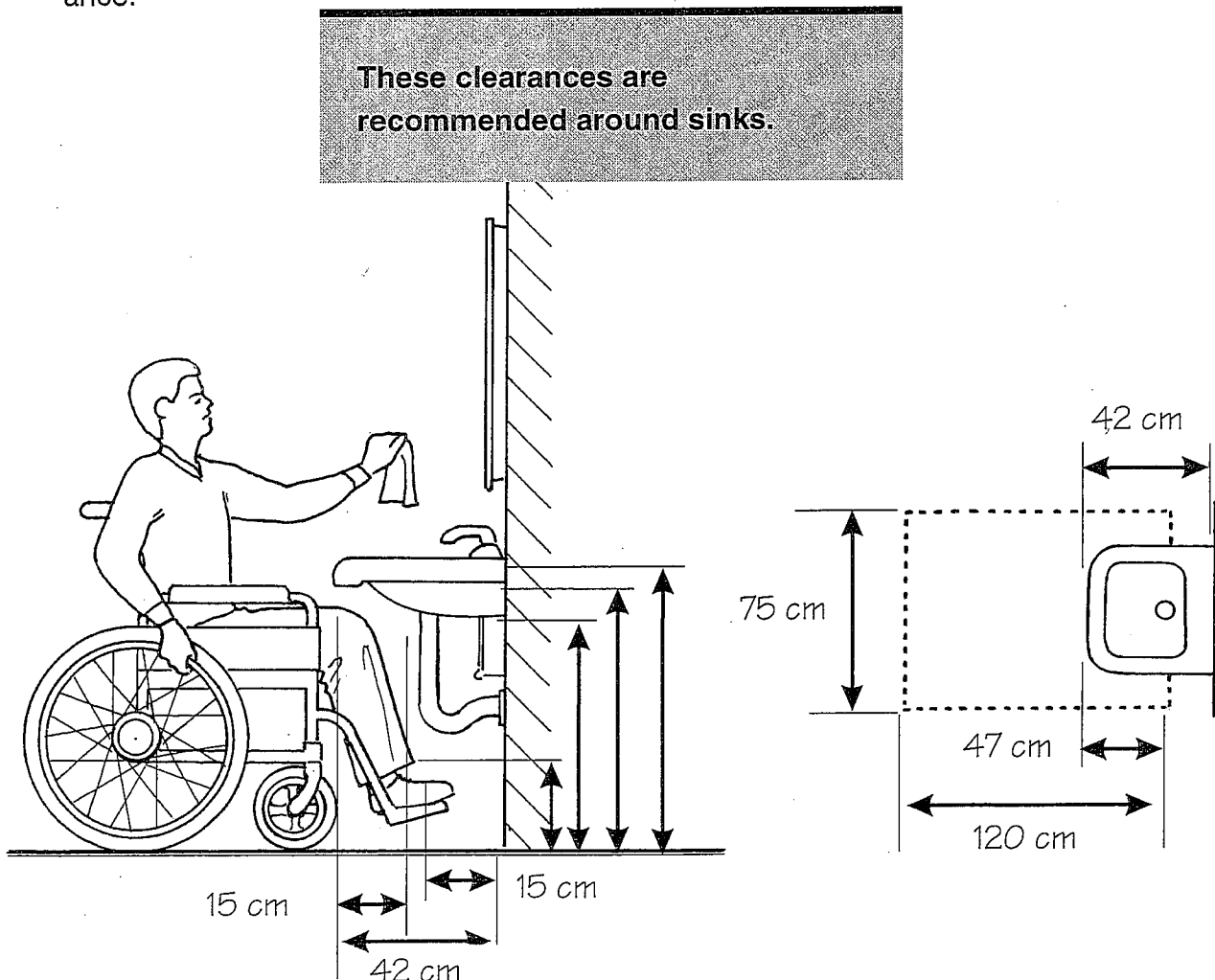


$x = 90 \text{ cm. minimum if } y = 150 \text{ cm.}$
 $x = 105 \text{ cm. minimum if } y = 130 \text{ cm.}$



3.f. Sinks

1. Wall mounted sinks are more accessible than pedestal or counter mounted sinks because they provide more clearance under the sink for leg room. Pedestal sinks are more accessible than counter sinks, unless the counter sink has a large space underneath it for leg clearance. See below for recommended clearances under and around sinks for wheelchair users.
2. Install lever activated faucet handles on faucets. The spout should be as high above the sink as possible in order to provide an additional clearance.
3. Any sink that has an exposed drain pipe underneath (typical wall mounted sinks) should have the pipe insulated. This insulation protects the skin of the wheelchair user from burning when hot water is run through the sink. This is especially critical for individuals who have experienced a spinal cord injury because they may not be able to feel the hot pipe.



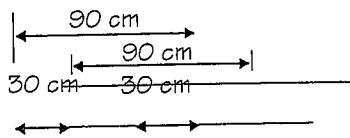
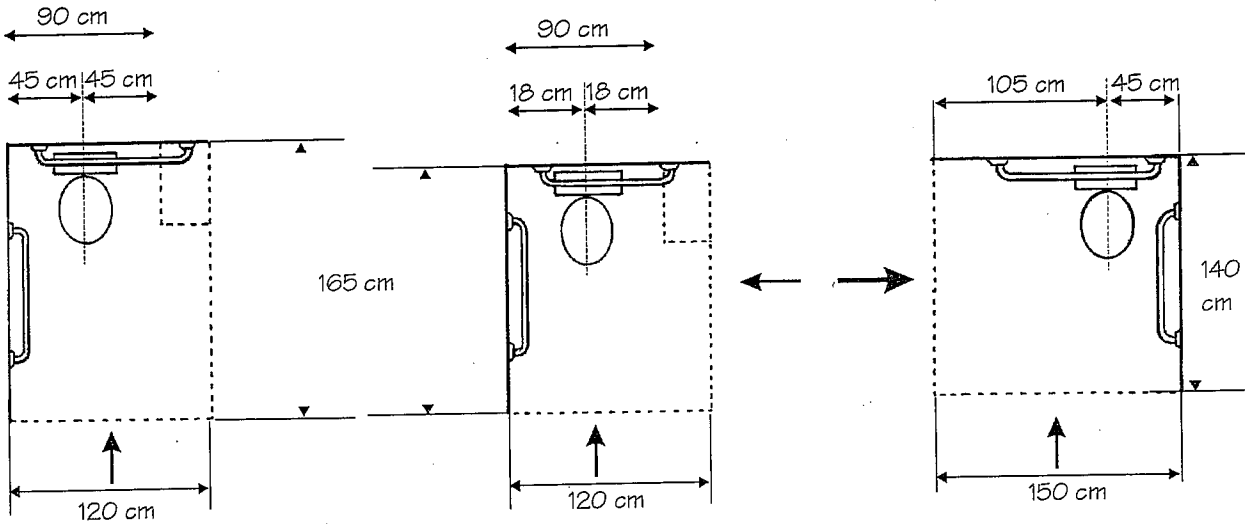
3.g. Toilet Rooms

It is not necessary for all toilet rooms in a facility to be accessible. It is necessary for any toilet rooms that are accessible to be on an accessible pathway.

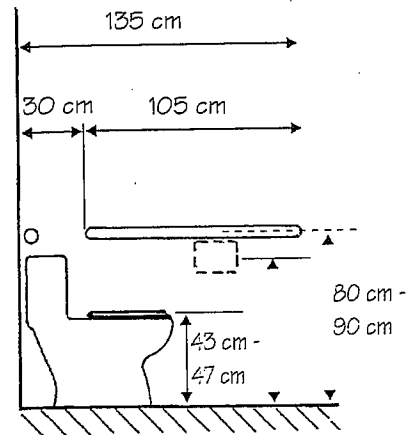
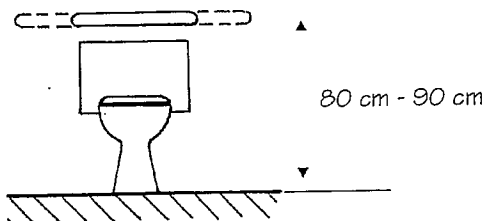
1. Accessible toilet rooms should have the required turning radius for a wheelchair. The spaces and clearance room in the toilet room depends upon the location of the door, toilet and sink. See below for recommended clear-

ance spaces in toilet rooms with different configurations. It is critical to determine the path required for a wheelchair to both go in and out of the room.

2. Follow all guidelines in the stair section for the mounting and dimensions of the handrails. It is critical that all handrails be mounted securely into studs in the wall.



Recommended clearances for toilet rooms.



3.h. Ramps

Most individuals who use crutches can either use a ramp or stairs, but find the ramp to be easier and safer. All individuals who use walkers and wheelchairs require the use of a ramp. Many individuals who use a walker can negotiate a steeper ramp than wheelchairs can utilize. Because of the variety of terrains and types and severities of disabilities, the acceptable ramp slopes can vary widely. The following table provides a minimum and preferable slopes for ramps. It should be understood that the minimum slopes may be acceptable for individuals with crutches and possibly walkers, but many wheelchair users will find the slope too steep to easily negotiate. The minimum slopes should only be used when terrain and available resources require the minimum slopes. Accessible stairs or ramps are not necessary in all instances - only if they are on a designated accessible pathway.

1. Individuals are able to negotiate slightly steeper ramps for ramps that are shorter than for longer ramps. For this reason, the recommended slopes below are related to the total rise of the ramp.

Rise of less than:	Minimum Slope	Preferred Slope
1.75 cm.	1:1	1:2
5 cm.	1:4	1:6
10 cm.	1:7	1:12
20 cm.	1:8	1:12
30 cm. and above	1:10	1:12

2. Ramps should have a level area of a minimum of 120 cm, but preferably 150 cm before any obstruction or turn at the bottom of the ramp. This level, obstruction free area should be at least 100 cm at the top of the ramp.
3. Ramps should be at least 92 cm wide.
4. Ramps should have handrails on one or both sides. See the stairs section on pages 38 and 39 for specifics on the handrails.
5. The cross slope on any ramp should be less than 1:50 in order to prevent wheelchair users from rolling off the ramp.

An example of an accessible ramp.

