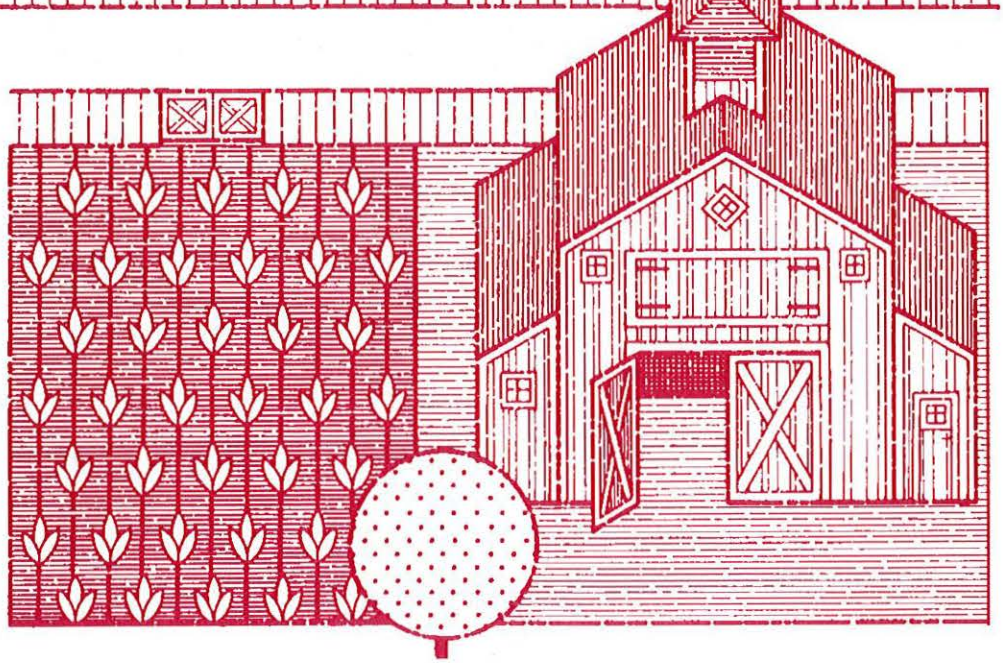
Improving Farmstead Accessibility



This material is based on work supported by the U.S. Department of Education/Rehabilitation Services Administration Grant No. H128A01027 and Extension Service, U.S. Department of Agriculture, Project No. 91-EDFA-1-0001

Improving Farmstead Accessibility

A resource guide for rehabilitation professionals providing services to farmers and ranchers with physical disabilities.

July 1994

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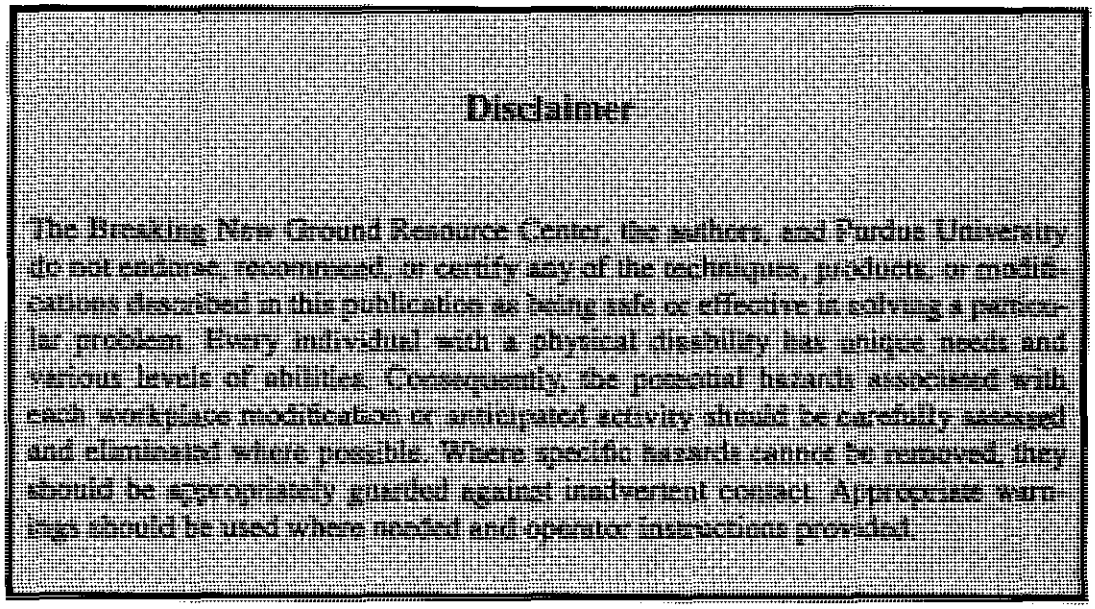
Purpose

The authors believe that everyone benefits when accessibility is improved around the farmstead, including family members, parents, relatives and neighbors with disabilities. Making accessibility improvements also increases the convenience, comfort, and safety for all family members, with or without a disability.

Farmers with disabilities are aware of the importance of accessibility. A recent survey of farmers with spinal cord injuries conducted by the Breaking New Ground Resource Center, sponsored by the Paralyzed Veterans Association, found that improving overall mobility or accessibility around the farm was a very important issue. Improving farmstead mobility ranked a close second to safety in accessing and operating equipment when farmers were asked to prioritize their goals concerning worksite accessibility.

The purpose of *Improving Farmstead Accessibility* is to help rural rehabilitation service providers identify accessibility concerns around the farmstead and in the home. This information will enable professionals to better assist farm or ranch families in identifying farmstead accessibility problems and in developing solutions to those problems.



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Disclaimer

The Breaking New Ground Resource Center, the authors, and Purdue University do not endorse, recommend, or certify any of the techniques, products, or modifications described in this publication as being safe or effective in solving a particular problem. Every individual with a physical disability has unique needs and various levels of abilities. Consequently, the potential hazards associated with each workplace modification or anticipated activity should be carefully assessed and eliminated where possible. Where specific hazards cannot be removed, they should be appropriately guarded against individual contact. Appropriate warnings should be used where needed and operator instructions provided.

Acknowledgements

This resource is based on work supported by the United States Department of Education Rehabilitation Services Administration, Grant No. H128A01027, and by the United States Department of Agriculture, Project No. 91-EDFA-1-0001. We thank them for the opportunity to prepare and publish this resource.

Thanks to all the authors for their wonderful contributions. We also recognize Ed Sheldon, Deb Felix, and especially Scott Whitman for their skills with the artwork. Special thanks to Denise Heath for typing endless revisions, incorporating several format changes, and not once raising her voice or threatening to quit her job! We have been fortunate to have Dallas Dinger and Ed Kirkpatrick's expertise in proofreading and page layout.

To everyone who assisted in the creation of this resource, thank you for sharing your talents.

Dean A. Brusnighan	Mary H. Yearns	William E.Field	Steven A. Freeman
Editor	Editor	Editor	Editor
Purdue University	Iowa State University	Purdue University	Purdue University

Use of Chapter Checklists

To make this resource as practical as possible, an Accessibility Checklist is included at the end of each chapter. Each chapter's checklist identifies potential problems that may be encountered (relevant to the chapter topic) and possible solutions for eliminating those problems.

Feel free to make copies of any of the checklists to meet your needs or the needs of the rural family with which you are working.

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Chapter Page

Introduction

Joe's family has lived on this farm for four generations. His great-grandfather farmed with mules. Joe can't imagine being anything other than a farmer.

Now, six months after an automobile accident left him with paraplegia, Joe still can't imagine living and working anywhere but on the farm.

Like Joe, many farmers decide to continue farming after a disabling injury or disease. One of the first issues that farmers need to address following a disabling incident is accessibility to the house, barn, shop, machinery storage, garden and other sites around the farmstead. Are the facilities and worksites where the farmer lives and works still usable?

Accessibility is an individual notion, but it generally means the ability (1) to gain entry to a building or facility and travel within it, or (2) to make use of a site. Increasing accessibility involves removing physical barriers when possible and modifying existing facilities or making use of assistive aids and devices when called for.

For agricultural environments, one good way to determine the level of accessibility is to visit the farmstead and perform an agricultural worksite assessment. This is an on-site inspection of the farm or ranch to identify barriers that would hinder a person's involvement in any aspect of the operations. Several agricultural worksite assessment tools have been developed to assist you in performing this task. These are contained in the Breaking New Ground publication, "Conducting Agricultural Worksite Assessments," (1991). The contents of this publication also provide information that may assist you in assessing a farmstead's accessibility.

Any farmstead assessment should include talking at length with the farmer and the family to gain an understanding of their needs, wishes, goals, hobbies, work activities, etc., all of which will have an impact on the accessibility assessment as well as any potential improvements to be suggested later.

After an assessment is made with the needs of the farmer and family included, work can begin on improving accessibility. Priorities will typically need to be set for the order in which improvements are to be made. In some cases, accessibility will be improved simply by clearing clutter from aisles or organizing tools on a tool rack. In other situations, structural modifications will need to be made to make the site or facility accessible. If costs of modifications are prohibitive, tasks once performed by the farmer may need to be reassigned.

Experiment with simple low-cost solutions, using materials already around the house or farm before purchasing expensive equipment or making major structural changes.

Some needed improvements will be evident — such as the need for a ramp. Other barriers will not have such obvious potential solutions. In these instances, be sure to talk with the farmer and the family members about their ideas for potential solutions. Living with a disability, or living with someone who has a disability can provide keen insight into how to solve an accessibility problem.

When disabling injuries occur to farmers and ranchers, many decide to continue their chosen occupation. This creates a need for information that can assist in diagnosing and removing accessibility barriers around the farmstead. *Improving Farmstead Accessibility* is designed to fill this need.

In addition to this publication, four other resources may be of assistance when developing solutions to farmstead accessibility problems. They are as follows:

RESOURCES

Agricultural Tools, Equipment, Machinery & Buildings for Farmers & Ranchers with Physical Disabilities, Volume I, 1986. Breaking New Ground Resource Center, Purdue University, Agricultural Engineering Department, West Lafayette, IN.

Agricultural Tools, Equipment, Machinery & Buildings for Farmers & Ranchers with Physical Disabilities, Volume II, 1991. Breaking New Ground Resource Center, Purdue University, Agricultural Engineering Department, West Lafayette, IN.

Identifying, Selecting, and Implementing Assistive Technology in the Agricultural Workplace, 1992. Breaking New Ground Resource Center, Purdue University, Agricultural Engineering Department, West Lafayette, IN.

Linville, B.G., Brusnighan, D.A., and Field, W.E. (1990). Improving Worksite Mobility for Farmers with Physical Disabilities, *Plowshares #9; A Special Breaking New Ground Technical Report.* West Lafayette, IN.

1. Farmstead Layout For Efficiency And Accessibility[1]

A BACKGROUND FOR PLANNING

In developing a farmstead plan to improve accessibility for the people who work there, the first requirement is that the scheme be effective and workable from an operational and performance standpoint. Production and processing systems that work well are safer, more efficient, and potentially more profitable.

Facilities and equipment systems on many well-managed farm operations are not well organized. This is due often to the lack of a well defined long range plan to guide changes and additions. Long range planning is difficult because the typical farm building has a life of 20 to 25 years, whereas the planning horizon for most operators is at best three to five years ahead. However, the treatment of new building and equipment additions is absolutely essential to the development of a more efficient long range layout. If new additions are not wise choices, positioned in a manner that enhance efficiency, problems may be created faster than they are being solved!

One method to effectively increase the planning horizon might be called "Double and Detail." It works like this: 1) estimate system needs three to five years ahead and detail the plan; 2) double the three to five year plan and detail the layout and equipment changes required; 3) finally, scale down the doubled plan to fit current needs and pocketbook but work diligently to keep space and layout options open to permit the expanded facility.

The "Double and Detail" process works because it forces planning at twice what is believed to be needed (It is also done comfortably — farmers/ranchers think they will NEVER build anything that big!) Experience in system planning indicates that most well-designed layouts can be doubled in volume without serious compromise. If one accepts this latter judgment, then the three to five year plan becomes a six to ten year plan when it is doubled and detailed. If this plan can now be doubled without serious compromise in performance, even though it was not spelled out at this larger scale, then the 6-10 year plan is potentially a twelve to twenty year model. The planning horizon is now reasonably close to the 20-25 year expected life of grain bins, silos and shelter structures.

Two other thoughts: 1) Planning the farm operations center on most family farms involves planning for both the family living and farm enterprise needs. The facilities frequently involve

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[1] Information contained in this section is based primarily on concepts and materials developed and practiced in AGEN 321 - Farmstead System Planning taught at Purdue University by Bruce A. McKenzie for over 20 years. Professor McKenzie and Don D. Jones team-taught the course for a number of years in the early 1980s. The course is a part of the Agricultural Systems Management curriculum at Purdue University.

livestock in addition to grain and other field and horticultural crops. The finished plan must address both the quality-of-life or aesthetic values desired by the farm family, while at the same time facilitating the production, processing and materials handling needs of the farm enterprises; 2) A useful concept in system planning for farm operations centers is to think of the farmstead or headquarters site as the focal point of the flow. Flow in this sense involves products, supplies, materials, equipment, animals and vehicles. Virtually everything used in and produced from the farm enterprises must travel into, be warehoused on, and travel out of the headquarters site. This flow of materials and objects through and about the farmstead area should be a key factor guiding the organization and layout of facilities.

OPPORTUNITIES FOR INCREASED ACCESSIBILITY — A GENERAL OVERVIEW

Reduce/Eliminate Mud and Drainage Problems

Many farmsteads present serious mud and drainage problems simply because a master plan to rapidly remove surface water after a rain or thaw has never been developed and implemented. The priority should be on surface drainage first (remove the water *before* it has a chance to infiltrate) and subsurface drainage second. Only 6″ fall per 100′ of run (1/16th inch/foot) is required for surface water removal (some specifications suggest as little as 3″/100′ can be effective).

Improve Farmstead Roads, Passageways and Walks

Many farmstead roads were never really "built" — people simply started driving there and as mud holes and ruts developed, gravel and crushed stone were added. Much of this stone fill is too coarse (1″-2″) to make an easy surface for small wheeled and small tired vehicles such as wheelchairs, and many electric scooters.

Farmstead roads in heavy soil conditions need to be dug out 8″-12″ below the intended surface level and the cut filled roughly two-thirds full using 3-4″ crushed rock. Compact this fill and then add a 4″ thick surface cover graduated from an initial layer of 3/4″-1″ aggregate to a top surface of fine crushed rock. Compact in place. It is best if the resultant surface crown of the road is higher than the surrounding soil grade on either side of the road bed.

A parking area convenient to the entry for each building should be planned.

Install Handling and Processing Equipment Permanently

A good plan can help to avoid having to move equipment every time something needs to be done. Multiple equipment moves and setups (e.g., portable inclined augers) require considerable time and physical strength to execute. Evaluate permanently installed inclined units plus top conveyors or alternative permanent elevators, to avoid moves. Choose equipment with power assists if multiple moves cannot be avoided.

Support portable processing equipment such as a PTO-powered transport grinder-mixer with a fixed processing location. Incorporate tractor-seat remote control of all ingredient flow to that location using combination of working (gravity flow) bins and powered ingredient conveyors. Choose a grinder-mixer with an on-board electronic scale system to control ration formulation. Large operators may want to evaluate a fully automated feed processing system that may incorporate air distribution.

Evaluate New vs. Remodeled Buildings for Efficiency, Access

A new building offers greater freedom in selection of type and location but at a higher initial (up front) cost, compared to a remodeled unit. In some cases, the remodeled unit may afford excellent opportunity for improved access at very little increased cost. This will be due to leftover space available that cannot be used or is not needed in the conversion. The result can be wide service aisles at very little, if any, added cost.

Consider conversion of existing structures that are very depleted and/or in the wrong location, to utility functions. The objective should be to obtain continued function with minimum new investment. Plan to "use the building up" in a short number of years (5-10 maximum) and then eliminate it.

Coordinate and Link Building Complexes

Consider inter-connecting multiple building complexes (e.g., gestation, farrowing, nursery, grow-finish in swine) with covered, all weather passageways. Coordinated building complexes should be compact but not cluttered or growth locked. Consider fire risk and air circulation restriction added by the interconnection.

Consider a small shop/repair center somewhere in the complex equipped to service routine electrical, plumbing, and wood components. Possibly include light sheet metal work but probably not welding.

Animal performance and status data should be accessible on-site, probably using a data transfer link to the central computer located in the farm business office.

Install Livestock Guards and Power-Operated Gates

Garage door openers can be adapted for use with sliding or roller carried gates that travel laterally. The door opener may require weather protection. Cattle guards are old technology that work well. Most are designed by producers or contractors to fit specific needs using materials at hand.

FARMSTEAD PLANNING BASICS

Area Allocation and Goose-Egg Planning for Preliminary Layouts

Figure 1 presents a schematic of a farmstead map divided by concentric areas or rings radiating from the family living area. Superimposed on the rings are location factors that designate the type of facilities best placed in that area. Goose-egg shapes representing specific buildings or complexes are placed on the map, using the rings and location factors as a guide for positioning. Try to proportion the goose-eggs to truly approximate the building length and width matched to the scale of the drawing, i.e., a 24′ x 80′ farrowing house on a 1″=50′ map scale should be roughly 1/2″ wide x 1- 1/2″ long. This will ensure that the proposed layout will represent a true picture of space use.

A work sheet listing 12 location factors that can be weighted for alternative farm facilities and complexes is presented in Table 1. Location factors are factors that influence or guide the location of buildings/facilities on the farmstead area, both with respect to the overall layout and the layout within the sub-system or enterprise. That is, one has to evaluate both the location of the farrowing house in relation to the nursery and gestation unit while at the same time be concerned with the location of the overall hog complex in the total layout.

Location factors should be weighted in terms of whether they are of Critical, Median or Nil importance in locating a particular building unit. Usually three or four factors will tend to force location of a given building unit, but it will not be the same three or four factors for each of the buildings. For example, water is not a critical issue unless the availability of water forces the location. If there is a good water source, placing a livestock complex another 500′-1000′ away simply means a larger water line. But the pipe is buried for a 25-year life — the cost of the extra size is insignificant if the building location helps solve the drainage and smell problem. The same logic applies to feed distribution via feed wagon — once the farmer is loaded and in the tractor cab, the penalty for adding another 500′ of run is small if it provides room for future expansion and helps control air pollution and drainage. If conveyor feed distribution is planned, the evaluation has to be different since pipe runs cannot exceed 400-500 feet.

Figure 2 presents an idealized farmstead with key planning and accessibility ideas identified. These planning ideas or guidelines are applicable to any farmstead layout, no matter if it is a new or an existing farmstead.

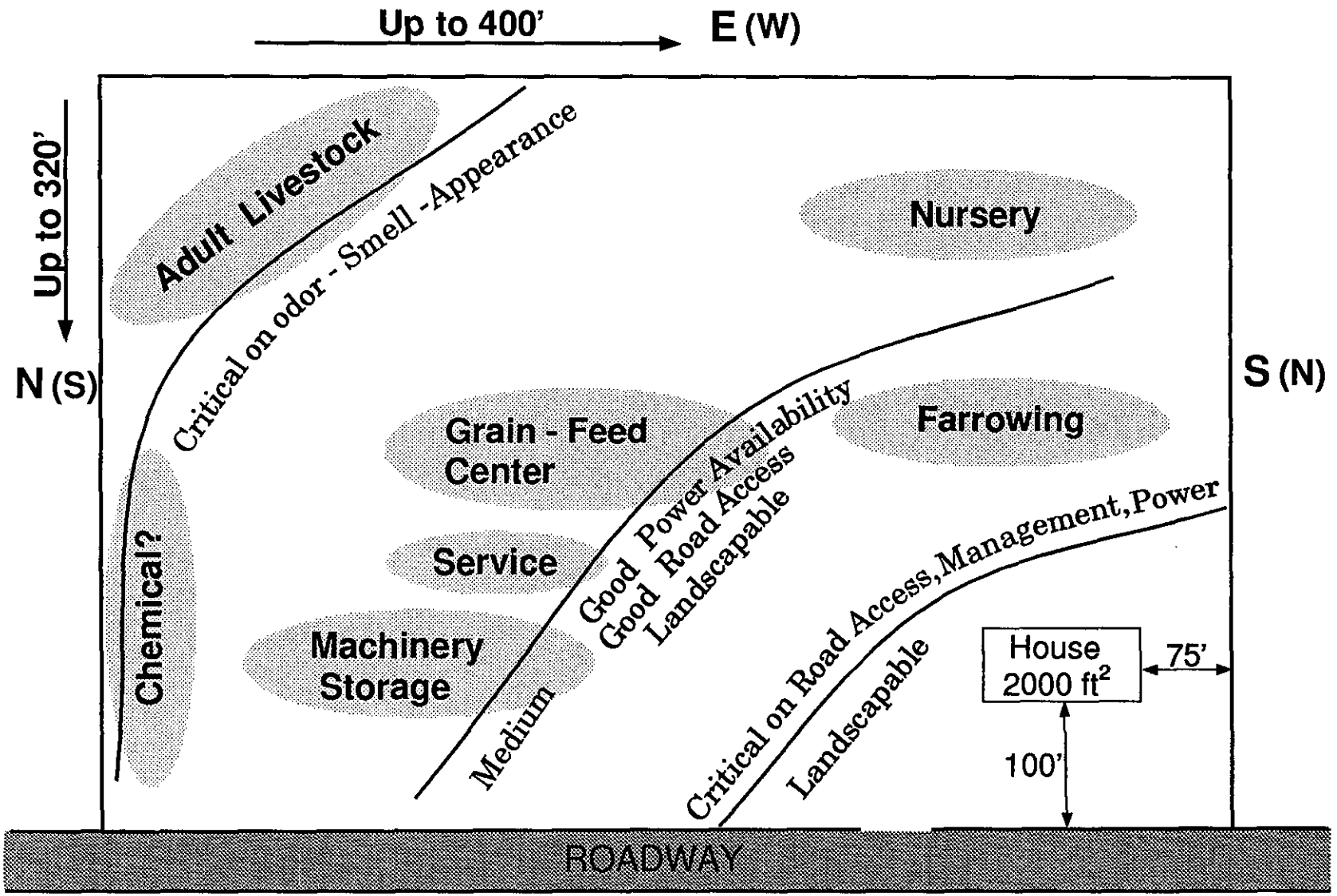

Figure 1. Goose-egg planning for preliminary layouts.

Table 1. Worksheet — Weighting of factors in locating farmstead facilities.
N = Nil; M = Median; C = Critical

		Types of Facilities					Farm Supplies			
	Location Factors	**Livestock** • Feedlot • Feeding building • Production building facilities • Birthing • Hatching • Nursery facilities		**Machinery** • Machinery & storage • Shop facilities	**Grain & Feed** • Handling • Dry & store • Grind & mix facilities	**Hay & Silage** • Handling • Storage • Mix/blend facilities	**Feeds** • Bean Meal • Bags • Base Mix • Medicants	**Seeds** • Bulk • Bagged	**Chemicals** • Fertilizer • Pesticides	**Fuels/Lube** • Gasoline • Diesel • Oils • Grease
1.	Management supervision/Access									
2.	Roads - passageways-walks									
3.	Wind and weather									
4.	Equipment flow									
5.	Material flow									
6.	Drainage									
7.	Odor control and flow									
8.	Expansion room									
9.	Power									
10.	Water									
11.	Appearance									
12.	Safety and security									

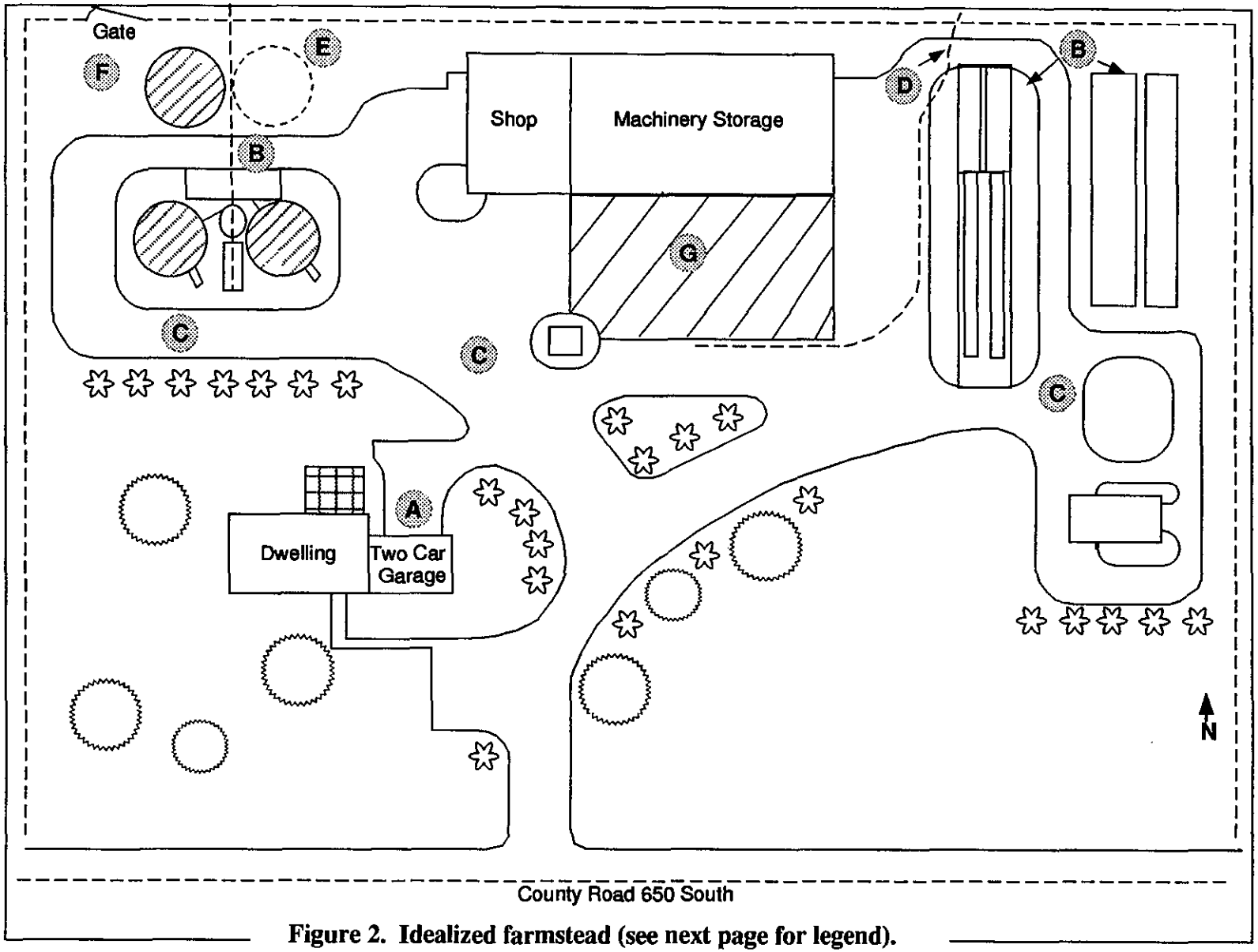

Figure 2. Idealized farmstead (see next page for legend).

Figure 2 Legend

A. Family parking and entrance walk/ramp screened from public view.

B. Coordinated building complexes or sub-systems allow convenient permanent installation of handling and processing equipment.

C. Convenient road system improves traffic flow and accessibility.

D. Drainage reduces mud problems.

E. Planned growth, expansion space determined by "Double and Detail" planning method.

F. Power-operated gate or drive-through gate improves accessibility.

G. Work apron on south (or east) side of machinery storage makes walking or rolling around machinery easier.

Mapping an Existing Farmstead

The best starting point for most farm families is to develop a map of the existing farmstead. The map should generally show the location of all buildings, utilities, roads, boundaries and desirable trees, shrubs, etc. The use of a scale divided into tenths of an inch rather than 1/8 inch may work better for this overall plan. An overall scale in the range of 1″=20′ (for 18″ x 24″ paper) or 1″=40′ or 1″=50′ (for 8″ x 11″ paper) works well. The larger paper often works better for the initial drawing. It is available in cross-hatched design marked 10 units/inch at college bookstores, office supply houses, or engineering supply firms.

SUMMARY

Developing a plan for farmstead layout is beneficial for increasing accessibility and mobility around the farmstead as well as for increasing the overall efficiency and performance of the farmstead.

The biggest impact can be made when layout planning is applied to a new farmstead, but planning is also important when adding a new building or operation to an existing farmstead. By organizing and making a long-range plan, the farmstead layout can be effective and accessible for everyone's needs for years to come.

RESOURCES

Farmstead Planning Handbook, MWPS-2, 1974. Midwest Plan Service. Ames, IA: Iowa State University.

Farmstead Planning for Efficient Swine Production, ID-162, 1984. Jones, D.D., Bache, D.H. and Muehling, A.J. West Lafayette, IN: Purdue University Cooperative Extension Service.

Wind and Snow Control for the Farmstead, AE-102, 1980. Jones, D.D., Friday, W.H. and DeForest, S.S. West Lafayette, IN: Purdue University Cooperative Extension Service.

Farmstead Layout Efficiency and Accessibility Checklist

This is a checklist of accessibility problems that farmers, ranchers or family members may face in Farmstead Layout. Potential solutions are suggested for each problem listed. Individual abilities must be considered before making any decision regarding which solution to use.

Problems	Solutions
Planning	
❑ There is no well-defined long range plan to guide the farmstead layout.	• Make long range plans (20-25 years) to make best use of layout for performance and accessibility. • Use "Double and Detail" method of planning.
❑ The farmstead plan does not involve family living needs.	• Plans should address quality-of-life values at the same time as improving performance of the farm enterprise.
Increased Accessibility	
❑ Water drainage is not adequate to prevent major mud problems.	• Eliminate drainage problems by addressing surface drainage first, then subsurface drainage. Only 6" fall per 100' of run (1/16th inch per foot) is required for surface water removal.
❑ Farmstead roads, passageways and walks are difficult to traverse by manual or powered wheelchair.	• Replace coarse gravel surfaces (that hinder wheelchair travel) with compacted fine crushed rock or concrete.
Equipment	
❑ It is difficult to frequently move and set-up handling and processing equipment.	• Permanently install equipment to avoid moves. • Choose equipment with power assists if multiple moves are necessary.
Livestock	
❑ It is difficult at each livestock gate to get out of and into the vehicle several times.	• Install automatic opening gates. • Install homemade or commercial drive-through gates. • Install cattle guards.

2. Farmhouse Accessibility[1]

A farm family that needs to adapt a home to accommodate a family member with a disability faces difficult challenges. Moving is not an easy option. Local resource people with expertise in planning and designing accessible housing modifications are not readily available. Spending money to keep the farm operation going usually takes precedence over making farmhouse improvements.

When a farmer experiences a disabling accident or injury, the primary focus is usually placed on getting him or her "back in the field" as soon as possible. The importance of the housing environment in helping family members adapt to the new situation may not be recognized. A home that is accessible and convenient can pay big dividends in terms of lifting spirits, increasing independence, and improving productivity.

This chapter describes a systematic approach that can be used to help a farm family analyze its housing situation and offers solutions for making the farmhouse more accessible. No-cost and low-cost solutions are emphasized. Possible funding sources and additional resources are also identified.

START WITH THE BASICS

It will be difficult or impossible for family members who use a wheelchair or have other mobility impairments to live in the farmhouse unless they can answer *yes* to three basic questions:

1. Can they get in the house?
2. Can they get through the doorways?
3. Can they use the bathroom?

If the family has problems answering *yes* to any of these questions, some additional issues need to be discussed before deciding whether to remodel the home or move to another location.

- Do they need to postpone housing decisions until a care giving routine has been established?
- Do they need space to accommodate an outside caregiver?
- Does the structural condition of their home warrant extensive remodeling?
- Will they need more housing changes in the future if their abilities should decline?

---

[1] Prepared by Mary H. Yearns, Extension Housing Specialist, Iowa State University, and Therese Willkomm, past Director of FaRM (Farm Family Rehabilitation Management) Program, The Easter Seal Society of Iowa, Inc.

- Can necessary modifications be made without destroying the architectural appearance or resale value of the home?
- Do they have enough money to pay for needed housing modifications and/or services of a caregiver?

If these questions have been carefully studied, here are some ways to proceed with the basic remodeling plans:

Accessible Entrance

At least one entrance with no steps, or a way to get around existing steps is needed. There are several options for creating an accessible entrance:

- Use portable ramp as a temporary solution
- Build ramp with no more than 1″ rise for every 12″ length (1 to 12 ratio; see references on building ramps in Resources section for detailed instructions)
- Regrade site to make ground level entrance without steps (see Figure 1)
- Build "bridge" to connect house and yard on sloping site (Figure 2) or flat site (Figure 3)
- Unload from wheelchair lift in van directly onto deck, porch, or landing pad
- Install weather-resistant lift or elevator or provide a protective structure over it (some have been installed in garages)

Wide Doorways

Persons who use wheelchairs need a doorway that provides at least a 32″ clear opening to be able to roll a wheelchair through a doorway under their own power and avoid scraping their knuckles. Here are some ways to make an existing doorway wider:

- Remove door temporarily
- Install swing-clear hinges
- Reverse swing of door to allow it to open wider
- Remove some or all of woodwork around door
- Replace existing door with wider one

Usable Bathroom

At least a 60″ diameter maneuvering space is needed to be able to reach bathroom fixtures from a wheelchair. There are several alternatives to gain more usable floor space:

- Reverse swing of door to make it open out of rather than into bathroom

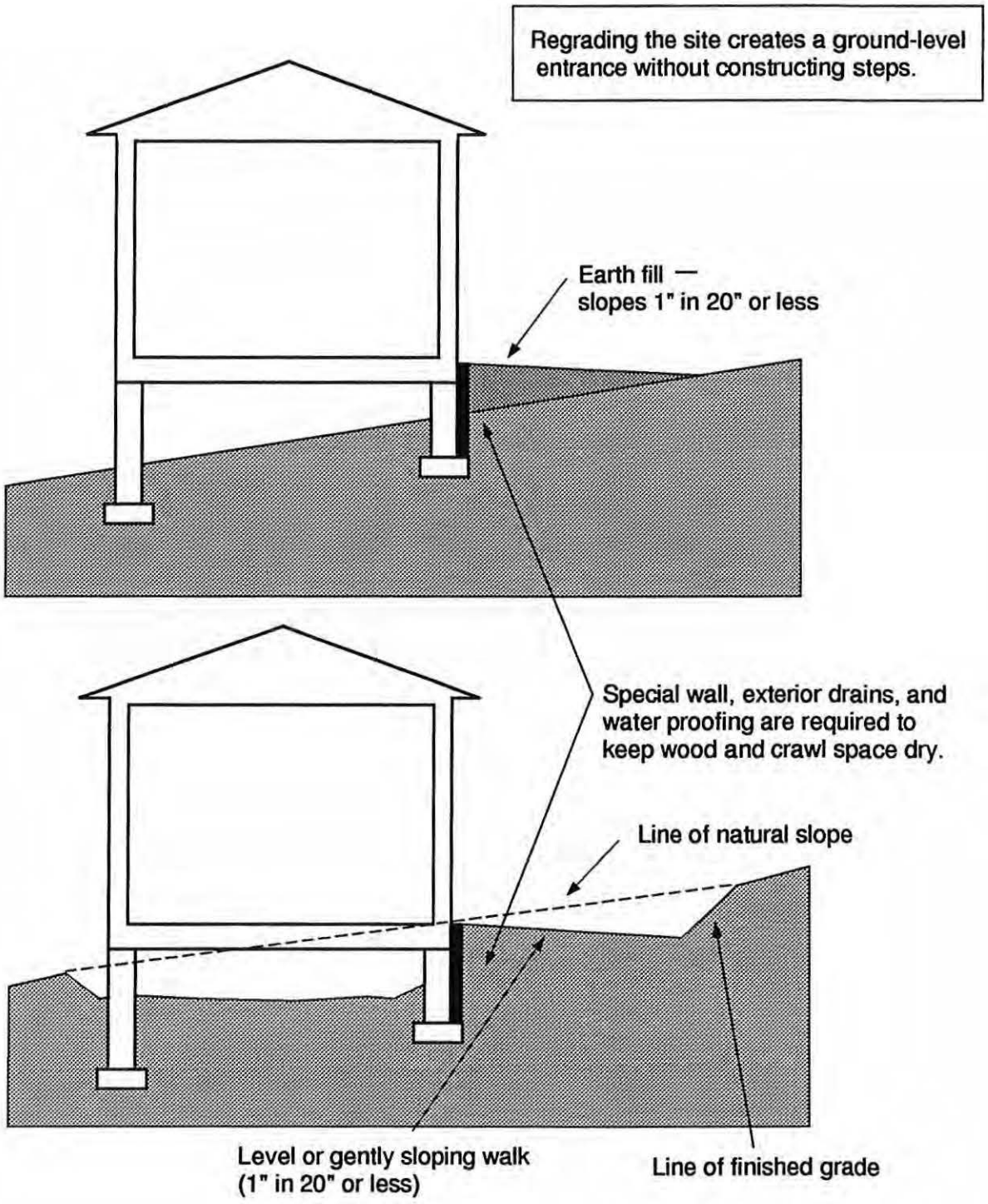

Figure 1. Earth fill or earth cut grading at house entrance for sloping site.*

* Adapted from *Accessible Housing Design File.*

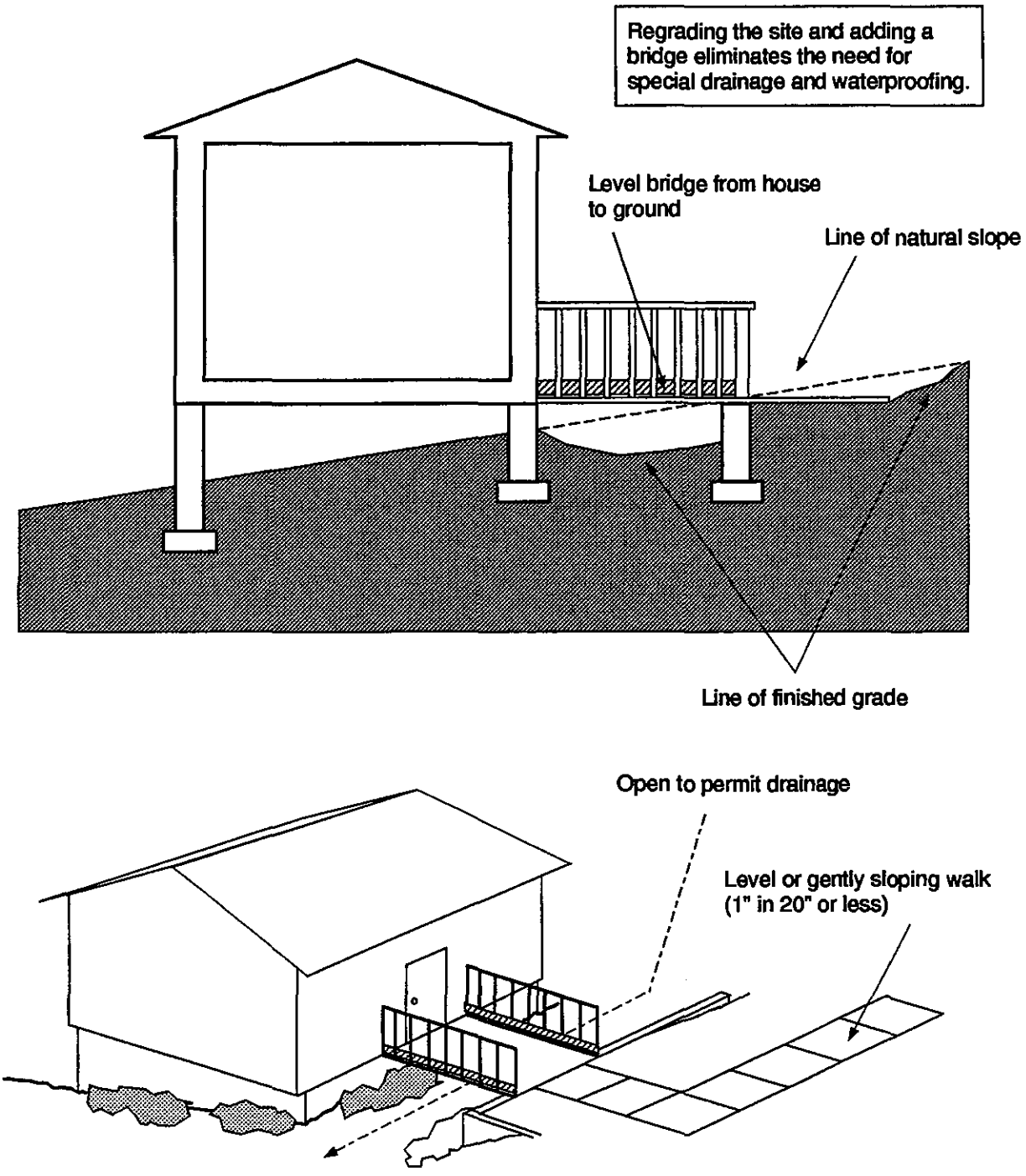

Figure 2. Bridge used as accessible entrance on sloping site.*

* Adapted from *Accessible Housing Design File.*

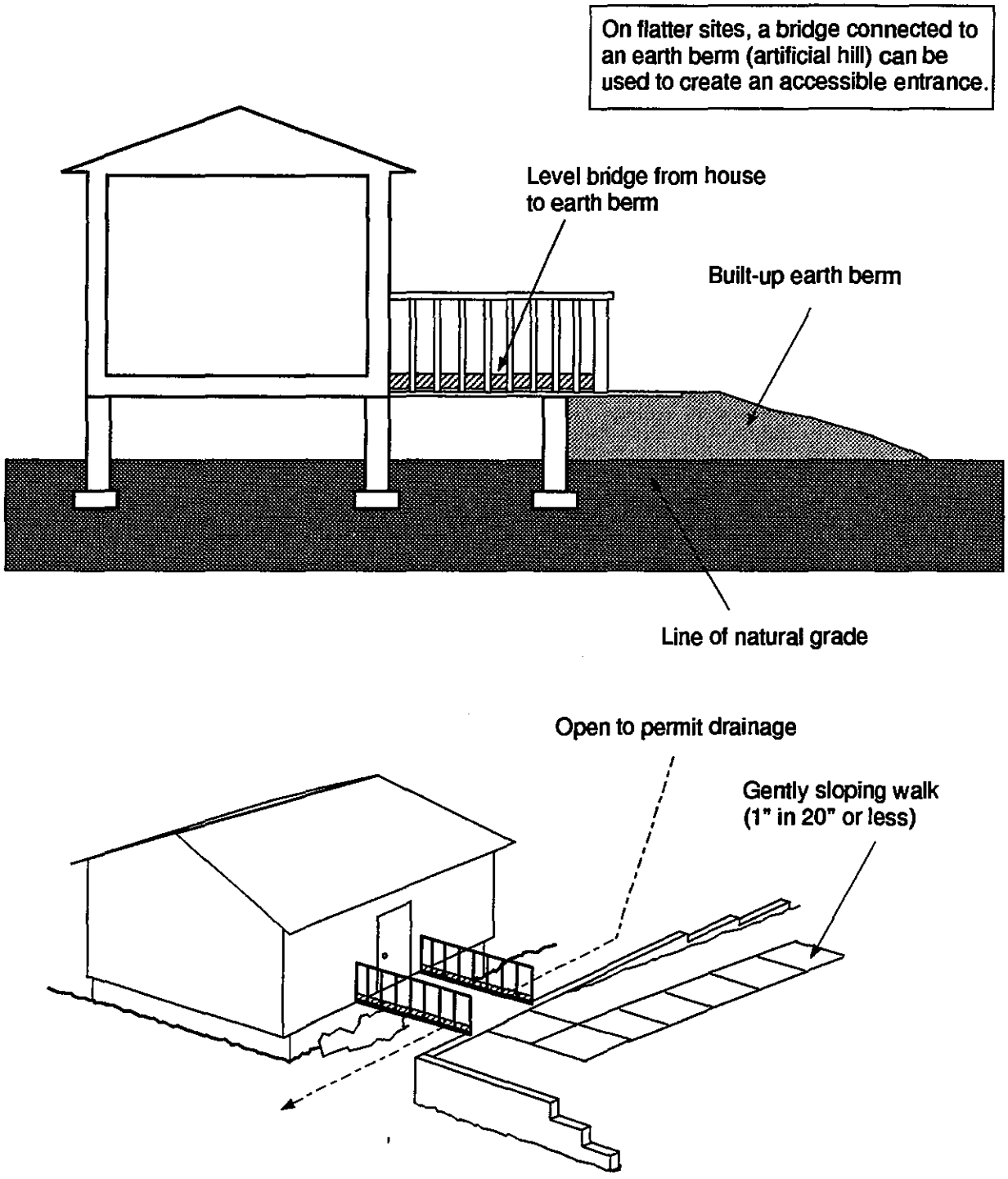

Figure 3. Bridge used as accessible entrance on flat site.*

* Adapted from *Accessible Housing Design File.*

- Replace existing door with pocket door
- Remove door (use curtain for privacy)
- Remove base cabinets to provide knee space under sink
- Relocate fixtures to create more floor space
- Replace tub with shower unit
- Remove tub and/or shower unit; install tile floor and floor drain, and bathe while seated on toilet
- Move sink to another space where privacy not needed
- Relocate toilet or shower to corner of bedroom
- Take sponge baths instead of tub bath or shower, and do bathing in bedroom
- Borrow space from an adjacent room to make bathroom larger
- Add on a new bathroom that is wheelchair accessible

RELOCATE, REARRANGE, AND RESTRUCTURE

Before plans are made for additional remodeling, no-cost or low-cost ways to relocate activities, restructure tasks, and rearrange furnishings should be considered. Refer to Figure 4 for an example of a home makeover.

Relocate Activities

Families who live in a two-story home or split-level house may need to consider ways to relocate activities for eating, sleeping, bathing, and living on one floor before installing an elevator or stair lift.

For example, a family who lived in a tri-level farmhouse made the following housing changes after the husband was injured in an auto accident and needed to use a wheelchair for mobility: 1) the living room on the main floor was turned into the master bedroom (bi-fold doors were installed for privacy); 2) guests are now entertained in the lower level family room; 3) a children's TV room was created in a daughter's bedroom on the top floor, using the furniture from the vacated living room; and 4) the daughter's bedroom furniture, along with a piano from the former living room, was moved to the master bedroom that used to be on the lower level.

These shifts allowed the husband to function independently during the day when his family was not around. He now had access to kitchen, bathroom, bedroom, dining room, and office area on one level. During the evening he could move his wheelchair to the lower level, with family assistance, by going out the front door, around the house on a ramped sidewalk, and through the sliding glass doors to the family/living room.

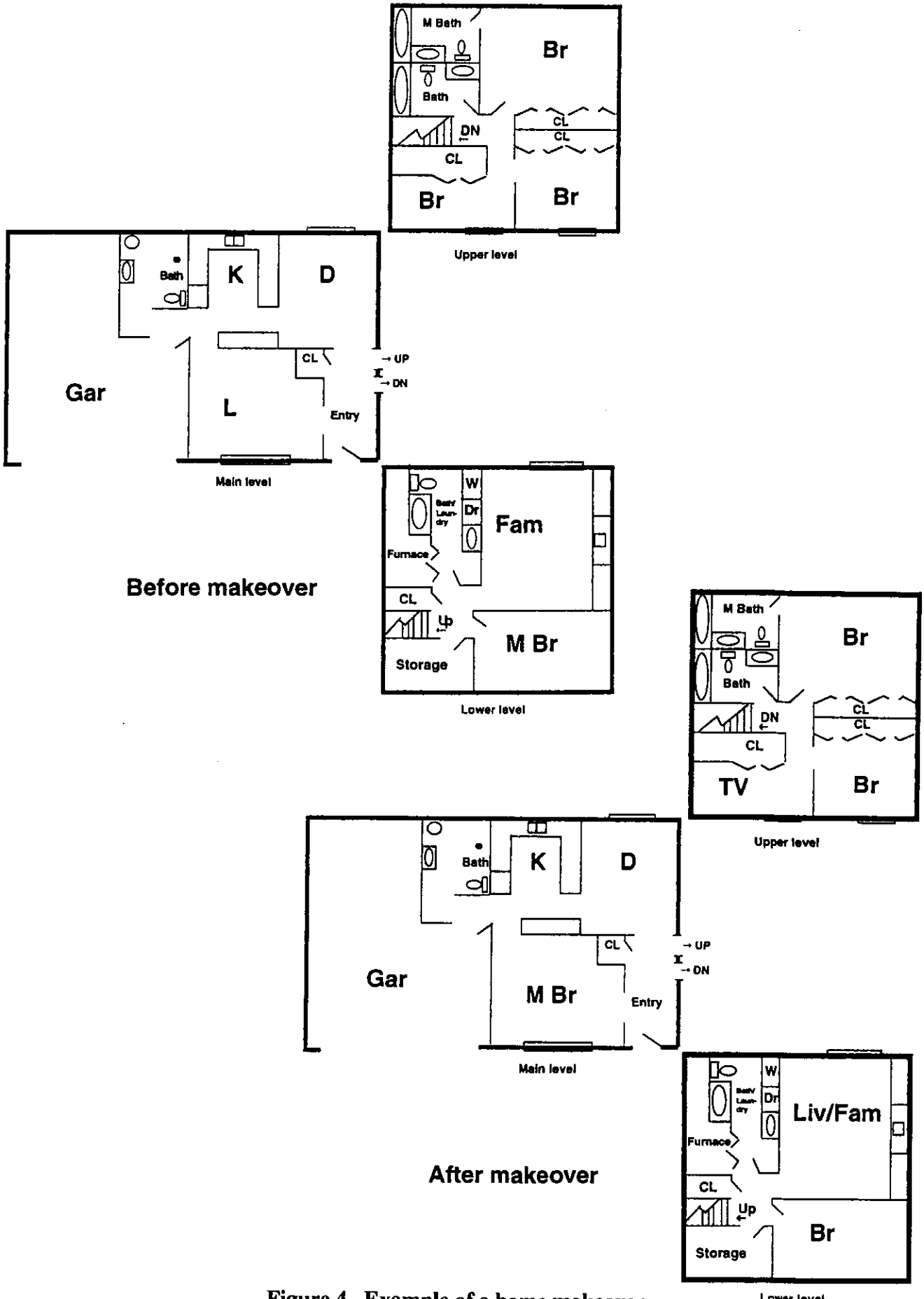

Figure 4. Example of a home makeover.

Rearrange Furnishings

Less is more. More space is needed for traffic lanes to maneuver a wheelchair, scooter, or walker. Large pieces of furniture may block access to rooms or make it difficult to get around. Rearrange furnishings in these rooms to create straight traffic lanes — it's difficult to turn sharp corners or zig-zag around furniture in a wheelchair. Move large items to another location. Some pieces of furniture may need to be stored, given away, or sold.

Restructure Tasks

If some household tasks are no longer accessible to an individual, eliminate these tasks or have someone else do them. For example, other members of the household could get the mail or do the laundry. In return, the family member with a disability could assume some of his or her responsibilities. In one family, the husband who was disabled as the result of an auto accident learned to prepare meals so his wife could drive the combine during harvest season.

IDENTIFY PROBLEMS AND SOLUTIONS

Now take a detailed look at specific areas of the home where the family member with a disability may be having difficulties. Pay special attention to activities that he/she wants to be able to do. The Farmhouse Accessibility Checklist at the end of this chapter identifies potential problems in the housing environment and possible solutions for eliminating them. Many are low-cost solutions. For more information about major remodeling or new construction, refer to the Resources section at the end of this chapter.

FUNDING

The following list identifies potential funding sources for making needed modifications. Contact these organizations to determine their eligibility criteria and process for obtaining financial assistance.

- Independent living funds through State Department of Vocational Rehabilitation
- Catastrophic case management programs available through some health insurance companies
- Worker's compensation insurance benefits
- Veterans Administration
- Public and private social service agencies
- Local church groups
- Community organizations, such as Farm Bureau, Shriners, Lions, Optimists
- Centers for Independent Living

- Area Agencies on Aging
- Federal income tax (deduct medically necessary equipment and structural modifications as medical expenses)
- Community fund raising events for individuals or families

RESOURCES

The following list of resources includes publications that are free or low-cost, as well as major reference books. You may be able to borrow some of them from a public library or Cooperative Extension office.

Free Publications

ABLEDATA. A computerized data base of commercially available assistive devices, such as fold-away door hinges, roll-in showers, and accessible sinks. Contact your state program for assistive technology or call toll-free 1-800-227-0216.

Designs for Independent Living, Form No. 1B310 Rev. A., 1986, and *Tools for Independent Living*, Form No. 1B314 Rev. A., 1986. Appliance Information Service, Whirlpool Corporation, Benton Harbor, MI 49022.

The DoAble, Renewable Home: Making Your Home Fit Your Needs, 1991. John P.S. Salmen, Consumer Affairs Program Department, The American Association of Retired Persons (AARP), 1909 K Street, NW, Washington, DC 20049.

Housing Information Packet. Paralyzed Veterans of America, 3636 16th Street, NW, Washington, DC 20010.

The Hartford House: How to Modify a Home to Accommodate the Needs of an Older Adult, 1990. The Hartford House, c/o The Hartford Insurance Group, Hartford Plaza, Hartford, CT 06115.

Home Safety Checklist for Older Consumers, 1986. U.S. Consumer Product Safety Commission, Washington, DC. Call 1-800-638-2772; dial 229 for publications ordering #701 (Spanish edition #701S).

Modest Home Makeovers: Making More of the Space You've Got, 1987. Mary H. Yearns, Lois N. Warme, and Debra A. Steilen, North Central Regional Extension Publication No. 328, Iowa State University, Ames, IA 50011.

Low-Cost Publications

Accessible Stock House Plans, 1993. Center for Accessible Housing, North Carolina State University, Raleigh, NC.

A Consumer's Guide to Home Adaptation, 1989. The Adaptive Environments Center, 374 Congress St., Suite 301, Boston, MA 02210. $9.50.

The Gadget Book: Ingenious Devices for Easier Living, 1985. Dennis R. LaBuda, American Association of Retired Persons, 1909 K Street, NW, Washington, DC 20049. $10.95.

Guide to Independent Living for People with Arthritis, Catalog Number 4081. Arthritis Foundation, 1314 Spring St., NW, Atlanta, GA 30309. $4.50.

Guidelines for Construction of Ramps Used in Rural Settings, Plowshares #11, Special Breaking New Ground Technical Report: 1991. Dean A. Brusnighan and William E. Field, Breaking New Ground Resource Center, Purdue University, 1146 Agricultural Engineering Building, West Lafayette, IN 47907-1146. $2.

**House Planning Handbook,* 1988. Midwest Plan Service, Iowa State University, Ames, IA 50011. $6.

How to Build Ramps: Reusable, Economical, Safe. Metropolitan Center for Independent Living, Inc., 1600 University Avenue West, St. Paul, MN 55104-3825, $10.

Making Life More Livable: Simple Adaptations for the Homes of Blind and Visually Impaired Older People, 1983. Irving R. Dickman, American Foundation for the Blind, 15 West 16th St., New York, NY 10011.

Books

The Accessible Housing Design File, 1991. Barrier Free Environments, Inc., Van Nostrand Reinhold, New York, NY.

The Complete Guide to Barrier-Free Housing, 1991. Betterway Publications, White Hall, VA.

Housing Interiors for the Disabled and Elderly, 1991. Betty Ann Boetticher Raschko, Van Nostrand Reinhold Company, New York, NY.

Transgenerational Design: Products for an Aging Population, 1994. James Joseph Pirkl, Van Nostrand Reinhold, New York, NY.

Video

Building and Remodeling for Accessibility, (approx. 25 min.), 1993. Hometime, 4275 Norex Dr., Chaska, MN 55318. 1-800-877-6644, $11.95 + $3 shipping.

* This publication is included at the end of this chapter.

Farmhouse Accessibility Checklist

This is a checklist of problems that farmers, ranchers or family members may face in making the farmhouse accessible. Potential solutions are suggested for each problem listed. Individual abilities must be considered before making any decision regarding which solution to use.

Problems	Solutions
Yard, Walkways, and Driveway	
❑ Rough terrain makes wheelchair, walker, cane, or crutches difficult to use.	• Repair or replace broken sidewalks. • Sweep walks frequently to remove debris — twigs, nuts, loose gravel. • Use crushed limestone to make pathways smoother. • Use broad-based cane tips to help prevent falls.
❑ Mobility aids get muddy in wet weather.	• Pave walks and driveway with asphalt or cement. • Pave new paths to major farm buildings. • Pave four-foot aisle next to parking area for wheelchair maneuvering space.
❑ Pushing wheelchair from driveway to house requires too much energy.	• Relocate driveway to get as close as possible to accessible entrance. • Pave wheelchair travel routes to make pushing easier. • Regrade site to make slope less steep.
❑ Rain protection is lacking when loading or unloading vehicles.	• Build covered walkway from parking area to house. • Build open breezeway for overhead protection between house and garage. • Extend the roof line of the house or porch to create overhead protection. • Build carport or attached garage (plan adequate overhead door clearance for raised roof van).
❑ Going to mailbox takes too much energy.	• Move mailbox to more accessible location. • Pave path to mailbox. • Put mailbox on pulley system to transport mail between house and mailbox.
❑ Farm buildings are difficult to find because of low vision or blindness.	• Pave path from house to major farm buildings. • Hang different wind chimes on each building. • String ropes for guidelines between house and farm buildings.

Problems	Solutions
Garage/Carport	
❑ Steps prevent wheelchair access from garage/carport to house.	• Build new drop-off parking area outside garage that is accessible to house at ground level. • Build ramp inside garage. • Add lift or elevator inside garage. • Slope floor of garage so steps or ramp not needed (front end near house high, back end near overhead doors at ground level).
❑ Garage is too narrow to get in and out of vehicles.	• Remove part of garage wall to gain maneuvering space for wheelchair or walker; create new path to this "entrance."
Porch or deck	
❑ Steps prevent access ***from ground*** to porch or deck.	• Remodel porch or deck so person in wheelchair can be unloaded directly from van. • Regrade site to make ground level access at one end of porch or deck. • Build ramp (see Resources section for detailed instructions). • Build "bridge" to connect porch or deck and parking area on sloping site.
❑ Steps prevent access to porch or deck ***from house.***	• Raise floor of porch or deck. • Use portable ramp to get from house to porch or deck. • Build short ramp to connect house with porch or deck.
❑ Wheelchair user may drop off edge of porch or deck.	• Install railings, curbs, benches, or planters at all drop-off edges.
Ramp	
❑ Ramp detracts from appearance of house and alerts outsiders that person with disability lives here.	• Disguise ramp with shrubbery, plantings, retaining walls, or fences. • Replace ramp with earth berm or "bridge" to connect house and yard. • Unload from wheelchair lift in van directly onto deck or porch. • Locate ramp on side of house away from road.
❑ Ramp is slippery, especially in rainy or snowy weather.	• Clean off moss or fungus growth as needed. • Add non-slip surface, such as silica sand, self-adhesive "grit" strips, or indoor-outdoor carpeting. • Add wood strips, placed horizontally on ramp at 2-foot intervals, to provide traction for person pushing wheelchair. • Replace wooden flooring with metal gridwork that allows water and snow to fall through holes. • Extend roof or porch over ramp to provide weather protection. • Install plastic sheeting on sides of ramp during winter months to provide protection from wind and snow.

Problems	Solutions
Ramp — (Continued)	
❑ Ramp is dangerous to use.	• Reduce slope of ramp. • Add level platforms for landing spots at top and bottom of ramp. • Add level platforms for resting spots on long ramps. • Add edge protection to keep wheelchair, crutches, cane, or walker from slipping off edge. • Install handrails on both sides. • Provide alternate route for people who use crutches, canes, or walkers.
Outside Entrance	
❑ Steps are difficult to see.	• Paint alternate stair treads in contrasting colors. • Place reflector strip on front edge of each tread. • Install more exterior lighting.
❑ Steps are difficult to climb.	• Add sturdy handrails on both sides (should extend beyond the last step, both top and bottom). • Repair broken or loose steps. • Enclose risers. • Add non-slip surfaces. • Rebuild or replace steps if too narrow or too steep. • Build ramp to create alternate route.
❑ Door is hard to reach.	• Build larger landing for wheelchair maneuvering space. • Add maneuvering space next to latch side of door. • Move furniture and large items out of entrance area. • Add package shelf near door so that both hands can be free.
❑ Door is difficult to open and close.	• Replace doorknobs with lever handles or push plates. • Modify doorknob with add-on lever handle. • Purchase or make add-on key "handle." • Replace existing locks with push button combination locks. • Adjust force required to open door by altering weather stripping or removing closer or spring. • Install auxiliary loop handle for closing on pull side of door. • Install automatic door opener.
❑ Storm/screen door closes before wheelchair gets through doorway.	• Remove storm/screen door. • Adjust or replace closer on storm/screen door. • Attach rope pulley overhead to swing storm/screen door out of path.
❑ Door gets damaged when wheelchair bumps into it.	• Tack carpet remnant to bottom of door. • Install kick panel to protect door.
❑ Raised threshold blocks wheelchair access and poses tripping hazard.	• Replace raised threshold with one that has tapered lip. • Install wedge-shaped piece of lumber to bridge gap between threshold and floor. • Install new threshold that is flush with the floor (doors will also have to be replaced).

Problems	Solutions
Entry Space	
❑ Doorbell can't be heard.	• Install flashing light to operate when doorbell rings. • Use portable control device that lights up or vibrates when doorbell rings.
❑ Entry space is too small for wheelchair use.	• Raise floor. • Construct short ramp. • Relocate entry to another part of house that will not require change in floor levels.
❑ Entry floor has step up or down to next room.	• Remove interior door. • Replace interior door with sliding or pocket door. • Attach rope pulley overhead to swing doors open and shut. • Remove or relocate entry wall to create more space. • Move furniture and large items out of entry area.
Mud Room	
❑ Wheelchair brings mud, dirt and/or livestock odors into house.	• Use separate wheelchairs for inside and outdoor work; transfer from one chair to other in mudroom. • During summer months, hose down wheelchair outside before entering house; dry by rolling over washable throw rugs or newspapers. • Install roll-in shower area where both person and wheelchair can be cleaned.
❑ Faucets and sink are difficult to reach from seated position.	• Remove cabinets under sink to provide knee space; relocate pipes to back for extra leg room; insulate pipes to prevent burns. • Remove floor of sink cabinet and center doorstop to create knee access (attach doorstop to back side of door so cabinet appearance is not changed). • Replace old sink with wheelchair-accessible lavatory.
Kitchen	
❑ Counters are too high to be able to work comfortably from seated position.	• Remove one or more base cabinets and install lower counter or table for seated work area. • Use pull-out cutting board as lowered work surface. • Place board across top of open drawer. • Use lap tray for food preparation area. • Pull kitchen table or card table near existing kitchen to create new seated work area. • Use hollow-core door across sawhorses, cabinets, or shelf units to provide leg room for new work area.

Problems	Solutions
Kitchen — (Continued)	
❑ Sink faucets are hard to reach from wheelchair.	• Remove floor of sink cabinet and center doorstop to create knee access (attach doorstop to back side of door to keep cabinet appearance); insulate pipes to prevent burns. • Replace separate hot and cold faucets with single-lever control. • Add extension arm to single-lever faucet.
❑ Sink faucets are difficult for person with weak grip or arthritis to operate.	• Replace faucets that turn with single-lever control. • Install electronic faucet for hands free operation.
❑ Rolling wheelchair around kitchen to prepare meal is exhausting.	• Simplify meal preparation with one-dish menus, prepacked foods, soups, and sandwiches. • Create "mini-kitchen" that's reachable from one spot with microwave oven, portable appliances, and *essential* supplies and utensils; store small items on counter-top shelf unit or rolling cart. • Relocate refrigerator so that latch side is next to seated work area.
❑ Wheelchair needs more maneuvering space to reach cabinets and appliances.	• Remove some base cabinets to create more turning space. • Remodel kitchen for convenience and accessibility (see Resources for additional information).
❑ Items stored in wall cabinets can't be reached.	• Relocate cabinets to lower height on wall. • Store small items on lazy susans. • Store light-weight unbreakable items on upper shelves and use "reacher" to grab them.
❑ Open cupboard doors are hazard for blind people.	• Remove cabinet doors. • Install doors that swing up and out of way.
❑ Items stored in base cabinets can't be reached.	• Replace door and drawer knobs with loop handles. • Use lazy susans to make items accessible. • Replace shelf units with pull-out drawers. • Hang items from overhead hooks or on pegboard. • Install pantry shelving with range of heights. • Install commercially-available pantry unit with swing-out shelves for easy access.
❑ Range controls are difficult to operate.	• Use microwave oven and broiler/toaster oven instead of existing range. • Replace range with separate cooktop and wall oven. • Purchase range that has front controls. • Use knob turner or turner with extended handle.

Problems	Solutions
Kitchen — (Continued)	
❑ Items stored in refrigerator or freezer can't be reached.	• Use lazy susan to make items accessible. • Purchase side-by-side refrigerator for easier access. • Select refrigerator that has water and ice dispenser in door. • Purchase small refrigerator for supplementary storage next to seated work area. • Loop strap or towel through handle to help person with weak grip open door easier. • Ask someone else to transfer items from chest freezer to freezer section of refrigerator once a week.
❑ Controls on appliances are difficult to read.	• Use plastic label maker to mark controls; braille label makers are also available. • Obtain braille or large print overlays for control panels from appliance manufacturers.
Living Areas	
❑ Windows and window coverings are hard to open and operate.	• Install auxiliary handle on bottom sash of double hung windows. • Replace double-hung windows with casement style windows that have hand crank or sliding windows. • Clear floor space in front of window so controls are easier to reach. • Select mini-blinds with long wand to control light. • Install power operated windows and draperies.
❑ Windows are in wrong locations to see outside.	• Replace small windows with larger ones that person can see out of from both standing and seated position.
❑ Electrical switches and outlets are out-of-reach.	• Relocate switches and outlets to waist level. • Use light switch extender. • Use outlet extension cord.
❑ Light switches are hard to operate.	• Replace toggle switches with rocker switches or touch-sensitive switches. • Use light switch extension.
❑ Getting out of chair or sofa is difficult.	• Place pneumatic seat lifter in chair. • Use chair that has sturdy arms. • Raise chair or sofa on wood blocks.
❑ Furniture, walls, and woodwork get damaged by wheelchair.	• Move fragile or valuable furniture to protected location. • Staple carpet remnants around door frames. • Make "sleeves" from carpet remnants to protect chair legs. • Select durable furniture. • Use corner guards and plexiglass sheets to protect walls.

Problems	Solutions
Bedrooms	
❑ Bedroom on upper floor is not accessible.	• Relocate bedroom on accessible floor. • Place bed in one end of room on accessible floor; use bookcases or screens to create privacy "walls." • Use daybed in living room to create sofa by day and bed at night. • Install chair-lift to second floor (requires transfer to and from lift). • Install stair-lift to second floor if space permits (lifts both wheelchair and person). • Install residential elevator; elevator shaft can be located outside house by converting windows to access doors.
❑ Bedroom is too small for maneuvering wheelchair.	• Use smaller bed. • Push bed against one wall to create wider access route. • Relocate furniture to another room.
❑ Getting trapped by fire is a worry.	• Move bedroom close to accessible entrance. • Install windows for fire exits. • Install smoke alarms with warning light for deaf person.
❑ Getting in bed leaves person with mobility limitations stranded.	• Install intercom. • Create "control center" near bed with phone, light switches, remote controls for TV and radio, and emergency call buttons within reach. • Program automatic dialer phone with emergency numbers.
❑ Transfers in and out of bed requires assistance.	• Suspend trapeze from overhead pipe framework (cover with dust ruffle to create canopy bed effect). • Install boom lift on rolling base or in floor socket.
❑ Closet door blocks entrance to closet.	• Remove closet door. • Use swing-clear hinges to make door open wider. • Make door opening wider; use bi-fold or double doors.
❑ Clothes can't be reached from wheelchair.	• Lower closet rod. • Use "reacher" to grab clothes on high rod or shelves. • Store items on open shelves or hang on wall pegs.
❑ Storage space is inadequate.	• Install roll-in closet that has both hanging space and open shelving.

Problems	Solutions
Bathrooms	
❑ Falling is a risk when using bathtub or shower.	• Install grab bars near tub and shower (be sure grab bars are securely fastened into wall studs). • Replace existing shower head with hand-held shower to bathe while seated. • Purchase bath bench that straddles tub (two legs inside, two legs outside). • Use hydraulic seat or boom lift to transfer in and out of tub. • Install overhead track lift. • Build in a transfer surface at end or side of tub. • Install transfer shower with built-in seat. • Install roll-in shower (requires transfer to shower chair). • Build combination shower/toilet compartment so toilet can be used as shower seat (useful for someone with high level spinal cord injury).
❑ Getting burned by hot water is a risk when bathing.	• Install scald proof valves in tub and shower. • Install electronic faucet to control temperature at sink.
❑ Faucet controls and shower head are difficult to reach and operate.	• Install hand-held shower head on a slide-bar mount. • Move faucet controls so they are reachable from both outside and inside tub. • Replace existing faucet controls with wing-style handles. • Use single lever faucet instead of separate faucets for hot and cold. • Install electronic faucet for hands free operation.
❑ Hot water pipes may cause leg burns for persons who use wheelchairs.	• Relocate pipes to back of sink for more leg clearance. • Insulate exposed pipes under bathroom sink.
❑ Mirror is not usable.	• Lower existing mirror for viewing from seated position. • Tilt existing mirror for better viewing. • Install larger mirror that can be used from both standing and seated position. • Use separate, lighted makeup mirror on counter. • Install extension mirror that pulls out from wall when needed.
❑ Toilet is not easy to use.	• Raise toilet base or use elevated seat to allow level transfer between wheelchair and toilet. • Use overhead trapeze to allow person to pull into position. • Attach seat-mounted grab bars for people who have difficulty walking. • Install electronic toilet seat lifter for people who have trouble sitting down and getting up.
❑ Bathroom lacks storage space for makeup and other supplies near sink.	• Install counter around sink that has kneespace underneath. • Use rolling carts to pull supplies close.

Problems	Solutions
Office	
❑ Desk lacks adequate knee space for person who uses wheelchair.	• Put desk on blocks to make knee space higher. • Use wheelchair that has cut-away arms to fit under desk. • Transfer to secretarial chair while doing desk work. • Purchase hollow-core door or laminated counter to use for desk top; support with two-drawer file cabinets, short bookcases, sawhorses, or blocks.
❑ Work area isn't very efficient.	• Create L-shaped work area with two work surfaces at right angles to each other (use secretarial chair to pivot from one counter to the other).
Laundry	
❑ Laundry is located on inaccessible floor.	• Move existing laundry equipment to accessible floor. • Replace existing equipment with stacked washer-dryer unit located on accessible floor.
❑ Controls on laundry equipment can't be reached.	• Use "reacher" to operate controls. • Purchase laundry equipment that has touch controls or front controls. • Purchase front-loading washer and dryer for easier access.

3. Accessibility for Gardens, Orchards and Yard

For individuals with physical disabilities, the flower and vegetable gardens, orchard, yard, or greenhouse near the home often present challenges. This chapter addresses accessibility, care, and safety issues related to these areas of the farmstead. For simplicity, these areas will collectively be called the "home grounds."

Chapter One sets the stage for tackling accessibility to the home grounds by briefly analyzing the broader problem of general farmstead layout. Home grounds accessibility can be further studied by conducting a site analysis. A site analysis consists of: (1) a layout sketch that locates existing buildings, trees, shrubs, and fixed elements such as sidewalks and fences), and (2) written description of site features. These observations, measurements, and thoughts are compiled to provide background information that can later be used as a resource for modification plans. The site analysis should help in preparation of a final plan for improving accessibility to the home grounds.

A layout sketch provides an overall view of the home grounds. Areas that present accessibility problems can quickly be highlighted on the sketch for possible modifications. The sketch involves the layout of the farm homestead with respect to the house, and adjacent outbuildings, driveways, farm roads, paths, fields (if nearby), and gardens such as the vegetable garden, orchard or nut trees, and home landscape. This sketch will require some patience and time to reduce needed re-work later. Some follow-up may be necessary to examine areas that may have been missed in the first trip. No one has to be an artist to perform this task. What matters most is that the completed layout sketch can be easily interpreted.

DRAWING THE LAYOUT SKETCH

The person with a disability should accompany you during the site analysis. That person may give some valuable insight into identifying key areas for modification. His or her input is crucial to adapting the home grounds to facilitate livelihood, enjoyment, and accessibility.

This tour of the home grounds may be brief and will concentrate on noting obstacles and features of the farmstead, such as property boundaries, creeks, windbreaks, and location of utilities. In addition, fixed elements such as lampposts, utility lights, and fences should be noted on the sketch.

For easier interpretation, think of viewing the farm layout from a "bird's-eye view" (see Figure 1). Sketch and label the home as homebase and note how the main road orients itself to the house. Establishing the house as homebase provides easy reference for locating other buildings relative to the house. Observe the orientation of the house: does the front of the house face north, south, east

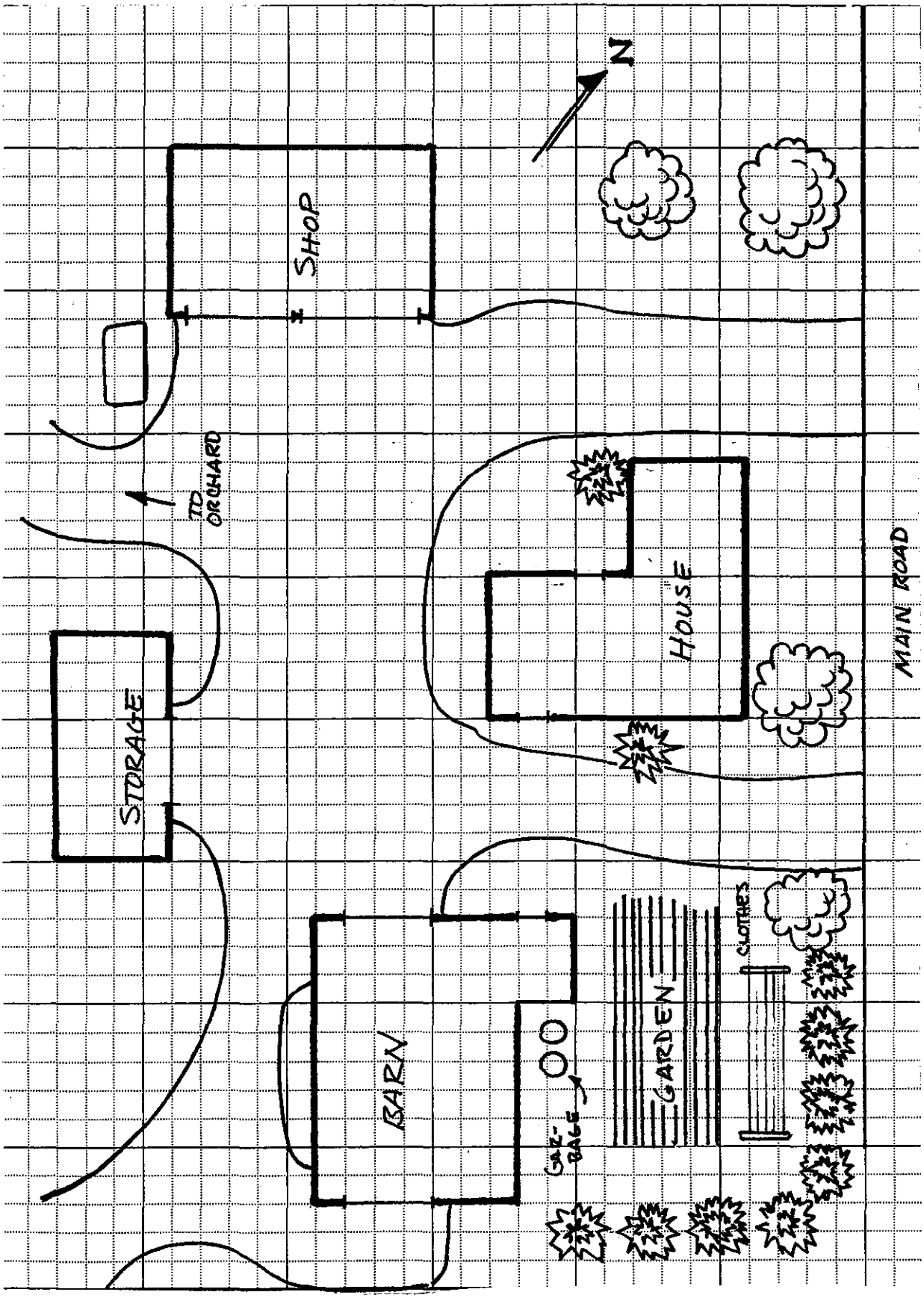

Figure 1. Hand sketch of farm layout.

or west? Locate adjacent buildings such as the garage, barn, shop, shed, or greenhouse and their positions relative to the house. It may be unnecessary to locate all buildings — concentrate on those buildings that may hinder accessibility to the orchard, garden and yard, and remember to highlight those areas on the sketch that may need modifications. Measure or estimate the distances that the deck/patio, orchard, and garden may be from the house.

Next, sketch the location of the driveway and farm access roads and examine the paving materials. Pace the distances that the driveway/roads are from the house and garden areas. Note where paths/trails weave through the yard, and pay particular attention to paths that intersect farm roads.

IDENTIFYING PROBLEMS AND MAKING DECISIONS

With a framework for the site analysis now laid, it may be useful to fine-tune the layout sketch by touring the home grounds a second time. (Note: Fine-tuning the layout may be easier with a close-up sketch of the home grounds as shown in Figure 2). Look for protruding tree branches and branch heights of trees and shrubs adjacent to paths. Note the widths of paths and whether they contain sharp turns that could be difficult to negotiate using a mobility aid. Examine the paving materials of the paths. Are they comprised of mud, crushed stone, blacktop, or mulch? The person's disability and abilities will dictate whether a change in paving materials is necessary.

Look for borders or boundaries that separate the home grounds, including fences, retaining walls, handrails, gates, windbreaks, and low shrubbery borders. Check their widths and heights to ensure that they do not hinder access to high traffic areas (highly traveled areas) or open areas of the home grounds that need to be kept open and clear. Examine the fence materials and railings: are they comprised of wrought iron, wood, or vinyl? Fences and railings made of wood may splinter, giving slivers, for example, to a person using a handrail as a guide. Along the path, check the outdoor lighting; is lighting adequate to make travel along the path safe at night?

For a closer analysis of the home, label on the sketch which entries and exits are most often used. Focus on those entries/exits that most affect high traffic areas and access to the garden, orchard, or yard. Examine the railings and the height of the deck or patio and steps. Is the deck floor flush with the door sill? Note the materials that make up the deck or patio. Locate an adjacent outdoor water faucet. Examine it's height and how it is attached to the house. Perhaps plants adjacent to the deck or patio are overgrown and shroud the faucet, making the faucet inaccessible for watering plants.

Look for trees and shrubs that obstruct the sightline or path to the garden or orchard. More specifically, identify the location of the flower gardens, evergreen and deciduous (plants that lose their leaves every winter and re-leaf the following spring) trees and shrubs in the yard. Do any of the deciduous plants shed their leaves on pathways? Look for flowering trees and shrubs; fallen

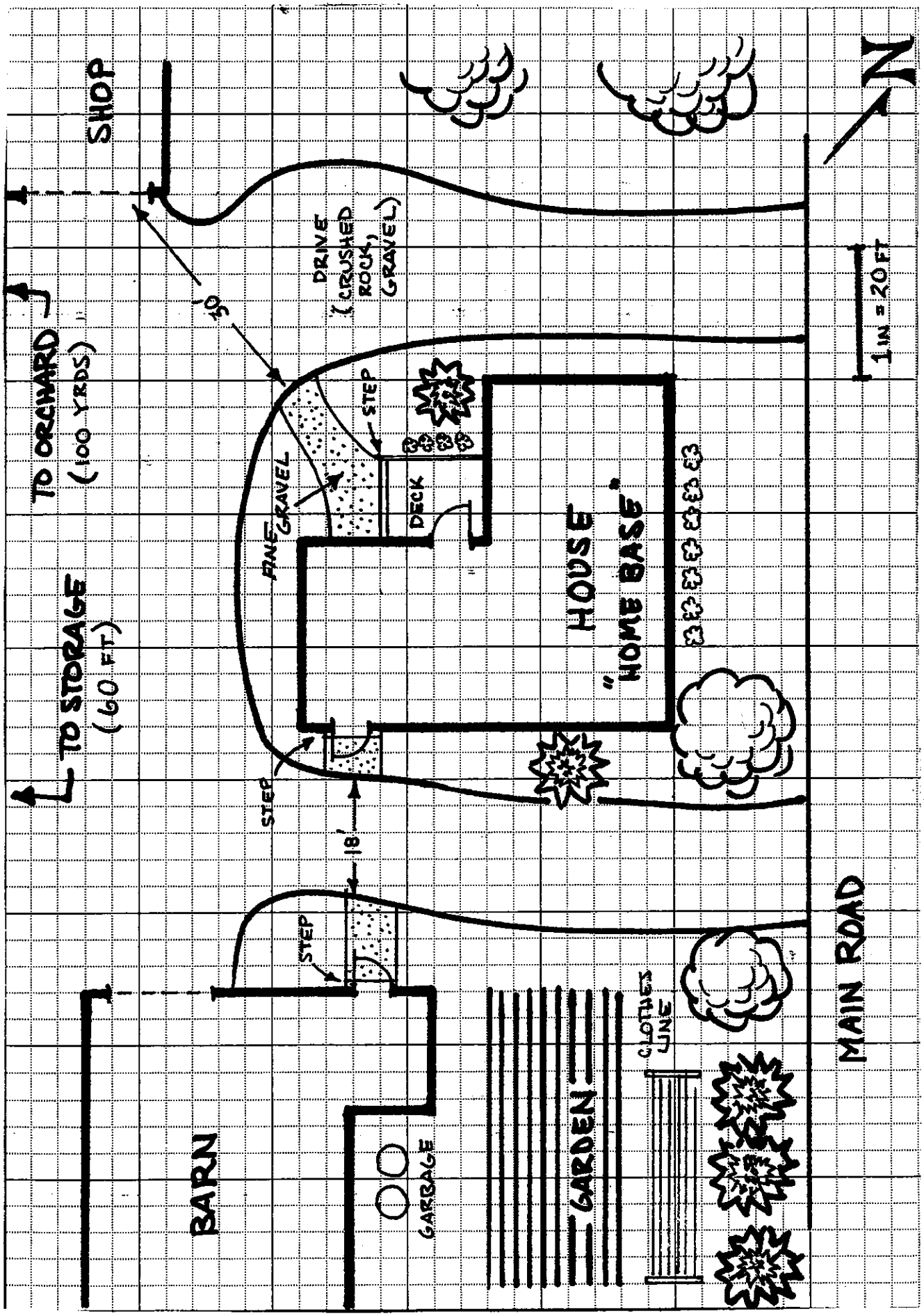

Figure 2. Detailed hand sketch of the home grounds.

petals or fruit can create a very slippery surface on a blacktop or concrete pavement. Thorny plants such as roses may border some paths and be a safety concern. Thorns can tear clothing, puncture tires of mobility aids, or become embedded in one's skin if an individual accidentally falls and lands on a bed of thorns. Thorny plants bordering walkways wreak havoc with anyone, but may especially interfere with someone using a wheelchair or someone with a visual impairment who frequently traverses the path or walkway.

MAINTENANCE

Low maintenance of the grounds around the home provides an added bonus for everyone. Careful planning can save money, time, and energy in maintaining the home grounds. For a person with a disability, these savings can reduce frustration and provide a cheerier atmosphere for coping with the disability.

Techniques for reducing maintenance include selection of appropriate plants for the site, and location of plants in the site. Other methods include mulching plant beds to deter weeds, growing plants in containers or raised beds, or by hydroponics; selecting appropriate paving materials; and re-shaping and rounding the outlines of planting beds.

Dwarf forms of plants enable people to more easily maintain them, partially because plants maintain a shorter height, reducing the need to prune plants that overgrow their space. Short plants may provide a border that a visually-impaired person may use as a guide along a path. Dwarf plants, if properly selected, will not overgrow windows and necessitate pruning or removal because of overgrowth. Dwarf plants ideally provide lower plants for surrounding a deck (depending upon deck height) because these plants will not peer above the deck floor and obstruct views, adding another maintenance headache.

Concerning tree selection for the orchard, choose dwarf varieties of trees to allow harvesting of fruits or nuts at lower heights. Pruning also becomes easier because of lower tree limbs. A person with a visual impairment can more easily see fruit on lower branches to determine ripeness and to pick the fruit. Another method of lowering maintenance in the orchard would be to establish grassways between trees, which reduce watering and weeding.

Use of native plants can also reduce maintenance of the home grounds. Plants native to an area are more suitable for the rigors of the local climate. Placing plants in the home grounds that have to be pampered (e.g., protected with burlap in the winter that must be removed every spring) can create a nuisance. Properly selected native plants economize costs and maintenance by preventing the need to remove or replace plants that do not survive the local climate.

Plant location also needs to be considered. Locating an orchard close to the house facilitates easier accessibility because of proximity, especially for a person who may have limited mobility. Locate plants on a level area to facilitate accessibility. Placing the orchard in the side yard may be safer so that no one stumbles on fallen fruit or trods in spiny chestnut husks on the front sidewalk.

Locating deciduous shade trees on the south side of a house furnishes shade in summer and allows more natural indoor light in winter, which may be advantageous to a person with a visual impairment. Planting perennial flowers that come up every year eliminates the need to plant annuals every year. Mulching those beds with bark chips or decorative stone will deter weeds and reduce watering. Perennial or annual groundcovers could be substituted for mulch. Fewer plants could also be chosen to lower landscape maintenance.

Paving materials such as bricks, flagstone, asphalt, and pressure-treated lumber provide a more stable walking surface than does crushed stone. A wheelchair user can travel more easy over such materials. They make care easier because no one has to throw straw on the muddy path or revert to other lawn areas for trekking through the rain, adding yet more work to the list of maintenance tasks.

Gardening can also be accommodated by growing plants in containers or raised beds, or by hydroponic gardening. Potted tomatoes could be grown in containers on the deck or patio. A kitchen garden full of herbs and lettuce fixings could be located outdoors in a raised bed of pressure treated timbers or railroad ties, adjacent to kitchen, and still complement the home grounds. Hydroponic gardening could be set up indoors to bring the enjoyment of vegetable gardening to a person with limited mobility.

Reduced maintenance of the home grounds can be further enhanced by the appropriate use of edging along the borders of planting beds. While some borders use no formal edging, these borders require a higher maintenance to prevent the lawn from encroaching into the bed. Installing edging along these borders can reduce maintenance requirements. Edging may also be beneficial as a border guide for an individual who is visually-impaired. Re-shaping and rounding the corners of planting beds also need to be considered. Rounding abrupt turns may make the path easier to travel in a mobility aid.

SUMMARY

Performing a site analysis of the home grounds can help the farm family to visualize the home grounds and establish priorities for accommodating the individual with a disability. The site analysis also lays the groundwork for devising a low maintenance plan to ensure that everyone can relax and appreciate the beauty of the home grounds.

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Accessibility for Gardens, Orchards and Yard Checklist

This is a checklist of accessibility problems that farmers, ranchers or family members may face in the garden, orchard and yard. Potential solutions are suggested for each problem listed. Individual abilities must be considered before making any decision regarding which solution to use.

Problems	Solutions
Access to Home Grounds	
❑ Paths to the garden or orchard intersect farm roads.	• Reroute path to bypass farm road. • Relocate garden or orchard so that path does not intersect road.
❑ Deck/patio surface not flush with the door sill.	• Construct a ramp. • Install a wide step that is flush with the door sill to step onto the deck. • Consider another entry to the deck.
❑ Paths unreliable in some weather conditions.	• Construct permanent paths of pressure-treated lumber, asphalt, or a compacted gravel/clay mixture (see Chapter 6). • Improve drainage near paths.
Maintenance	
❑ Overgrown shrubs shroud the outdoor water faucet.	• Prune existing shrubs. • Replace shrubs with a dwarf variety requiring less pruning. • Replace shrubs with perennials.
❑ Weeding the garden require too much energy, too much strength, or too much time.	• Use a mulch such as bark chips, pine needles, or black "cloth" to hinder weed growth. • Plant a groundcover such as myrtle or English ivy to choke out weeds.
❑ Mobility impairment limits maintenance activities outside the house.	• Construct planters to grow vegetables and flowers on the deck or patio. • Consider hydroponics for growing tomatoes.
Safety	
❑ Thorny or fruiting plants border pathways.	• Prune so fruit or thorns do not overhang. • Relocate plants to a new area. • Consider a different, more slip-resistant path material if fruit dropped onto the path poses a risk of a fall.
❑ Fences/railings consist of wood that splinters.	• Sand railings and apply polyurethane to seal the surface. • Replace wood railings with vinyl, recycled plastic, or wrought iron railings that do not splinter.

4. Farm Shop Accessibility

WHY HAVE A FARM SHOP

The main reason for a farm shop or service center is to make provisions for service and repair. Machines and equipment that are serviced and maintained regularly do the work required of them more rapidly and with less downtime and expensive repairs. When repairs are needed, the shop provides a place and facilities for doing the repair work. By being proficient in the use of tools and having suitable facilities in which to perform jobs they are capable of doing, farmers and agricultural workers can save considerable time, inconvenience, and money.

Having a shop may be even more important to the farmer/rancher with a disability. Preventive maintenance (in a clean, dry, warm shop) before planting or harvest seasons can save days of downtime and eliminate the barriers of repairing equipment in the field. Preventive maintenance in the shop can also prevent secondary injuries or other health problems attributed to repairs in the field.

COSTS/BENEFITS OF A FARM SHOP

Although there are many benefits to building a shop, it is very important to weigh the benefits against the cost of ownership. If the farmer can afford the initial cost, the chances are good that the benefits derived will be worth the cost in the long run. The shop can be used to reduce farm operating costs by providing the facilities for service and maintenance of agricultural equipment.

One factor to consider is whether service and repairs are readily available elsewhere. Agricultural workers and farmers cannot hope to be specialists in all the jobs of a mechanical nature that they encounter. Specialized jobs such as completely overhauling a tractor, using a welder to build up worn shafts and/or other worn machinery parts, and repairing complex electrical equipment, in most instances, should be taken to a specialized mechanic. However, if machinery and equipment must be transported considerable distances, much time can be saved by performing more routine service and repair in the individual's own shop. In addition, hired labor may be maximized during the winter months by completing mechanical repairs and equipment preparation in the farm shop.

Operators who have a disability will have additional factors to consider. For instance, farmers with mobility impairments will likely require more space to maneuver around equipment. Will the greater expense of increased size be justified, or would it be more cost effective to reassign farm shop tasks to a family member or employee who would not require extra space?

Another factor for operators with disabilities to consider is the amount of time they will have available for service and maintenance. If morning and evening routines for getting dressed or

undressed, meals and hygiene require four to six hours, how much time will remain for farm shop activities after the daily farm chores are completed? Individual priorities will determine whether the amount of time available is enough to justify building or modifying a farm shop.

FARM SHOP LAYOUT

Whether the farm shop is newly constructed or is an existing building, the shop will vary greatly depending upon its uses and type of disability of the farmer/rancher. The farm shop should:

1. provide ample space,
2. be of desirable construction,
3. have a suitable floor,
4. have a large main entrance,
5. have adequate lighting and ventilation, and
6. contain a satisfactory heating and cooling system.

Ample space is especially important for farmers who use mobility aids such as crutches, three-wheeled scooters, or wheelchairs. A suitable floor may be smooth, level concrete but it probably does not need to be for most farmers. Any hard-packed, stable surface will benefit all shop users, especially users of a leg prosthesis or wheelchair. Adequate lighting and ventilation will be more important for farmers with visual impairments and respiratory impairments, respectively.

If possible, the equipment should be arranged along the walls of the shop so that the center floor space is available for repairing and constructing large pieces of equipment. Workbenches should be placed along the walls with tool cabinets above them. The height of the workbenches depends upon type of disability of the individual using the facilities (Figures 1 and 2). Workbenches should be high enough that an individual does not have to bend over all the time while working at the bench. Workbenches should also provide adequate knee clearance for someone in a wheelchair (usually 27"-29"). Likewise, an individual should be able to easily reach the back of the workbench. Otherwise it becomes a storage, or junk collection location. Low, mobile or portable workbenches are valuable to some farmers/ranchers.

Most tool cabinets are typically wall mounted. This provides the capability to organize similar tools and to provide a much more efficient use of space. However, if wall cabinets are impractical or inaccessible, they can be moved under the workbench or placed on a mobile unit. Thus, they can be moved into the shop for use, depending upon the job being performed. Mobile units may be especially helpful for wheelchair users or others with limited ability to reach wall-mounted tools. Another option is to purchase a stand-up wheelchair.

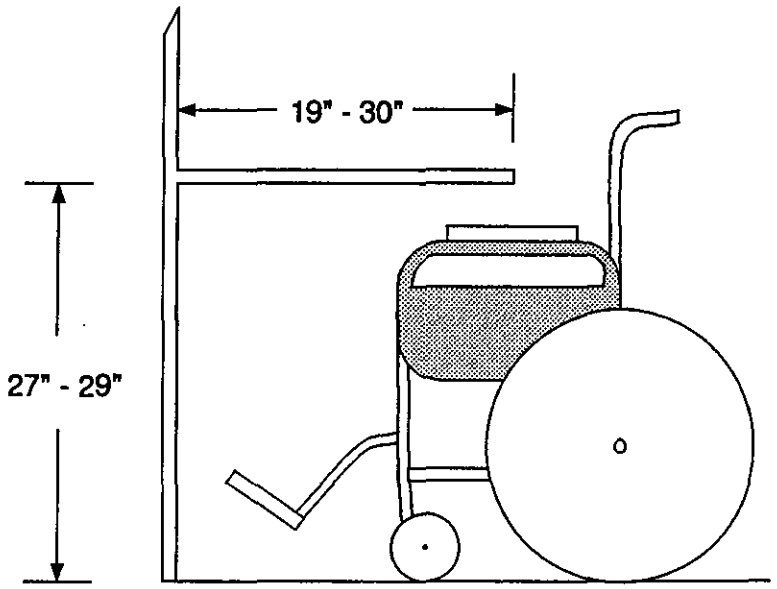

Figure 1. Workbench dimensions for wheelchair user.

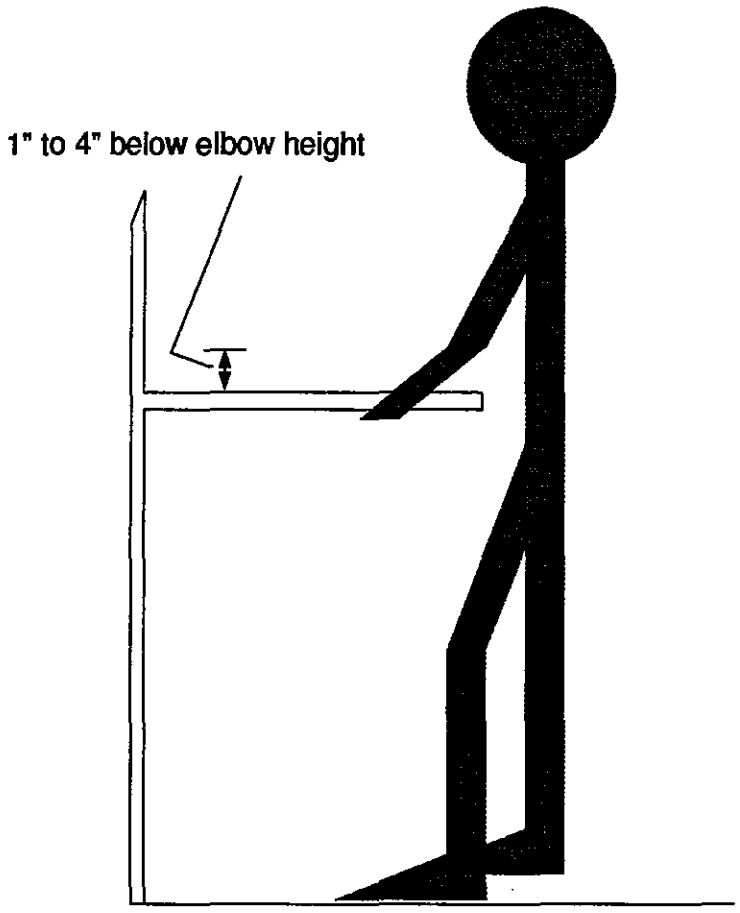

Figure 2. Workbench dimensions for standing work surface height.

Built-in equipment lifting cranes and overhead hoists at strategic locations can not only assist people with lifting impairments, but prevent injuries to farm workers without disabilities. When designing and building "home-made" lifts and hoist systems, resist the temptation to just use whatever's available around the farm. Use only good quality, brand-new material if possible and be sure over-design your system for safe margins in lifting capacity.

Bulk storage and dispersing units of frequently used maintenance material can aid in speeding-up oil changes and other related tasks: rack of oil and fluid drums with easily accessible spouts; roller-chain, rope, fertilizer and hydraulic hose or other items are more easily handled, measured, and stored in bulk rolls.

When large shop tools present a problem in limited space, mounting wheels or rollers may allow them to be moved into temporarily cleared, safer work areas. Be sure any "mobility system" for tall, or unwieldy equipment is stable and can be secured adequately to safely use the tool, once in place.

Air hoses, water hoses and electric power cords can be readily used if mounted on commercially available, spring-loaded rollers. These devices can save time, and keep floors clear of clutter, leaving pathways safer for mobility-aid users.

Principles of good farm shop arrangement are based upon, but not limited to, the following guidelines:

1. Make all areas of the shop well-lit.
2. Arrange equipment to permit free movement (aisles at least 4 feet wide for primary traffic).
3. Keep space open in front of entrance/exit doors.
4. Provide open space around tool panels, storage cabinets, etc.
5. Allow adequate space in shop where large projects are assembled or worked on.
6. Leave 4-5 feet clearance around workbenches that are away from the wall.
7. Provide sufficient area around power machines to adequately handle long stock lengths.
8. Place the more dangerous machines farthest from main traffic flow.
9. Arrange machines or equipment that may be used in sequential order close together and near sources of materials.
10. Do not place equipment where it will interfere with the opening of doors or cause unintended detours in passing to or from them.
11. Locate machines so that operator can use natural light, if available.
12. Isolate welding as far as possible from the rest of the shop (typically near large outside door where apron is located).
13. Place equipment so that it will be easy to clean around (a clean shop is a safe shop).
14. Put fire extinguishers near dangerous areas, not in them.

15. Maintain a safe area around machines, with nonskid pads located at machines, if practical.
16. Provide sufficient light, uniformly distributed, so that the work area is shadow free.
17. Make walls and ceilings light colors if possible.
18. Keep oils and lubricants away from welding area (near smaller service door).
19. Provide safety containers for flammable materials.
20. Have first aid equipment readily available.
21. Ground all power tools and equipment.
22. Have some type of communication device accessible (CB, FM or cellular phone).

SAFETY

Safety is always of prime importance, and farm shop arrangement can contribute greatly to making the area more safe. In all the principles of shop arrangement, consideration for operator safety should be uppermost. Safety and the most efficient use of space should be of prime importance in arranging equipment in a shop. Many accidents that happen in a farm shop can be prevented by carefully planning the arrangement of the equipment.

Where practical, safe zones and nonskid areas are recommended around pieces of power equipment.

1. Safe zones outline a safe, noncongested work area.
2. Provide nonskid floor covering to assure firm footing.
3. Only one person should be in a safety zone, the operator of the piece of equipment.
4. Permit only the machine operator to make adjustments and/or touch the control switch.
5. Involve only one person in the use of a piece of equipment unless it is a two-person operation.

VENTILATION (AIR QUALITY) SYSTEM

Farm shop planning publications provide information about the importance of proper ventilation and how to provide it. These resources typically discuss ventilation for welding areas, engine exhaust, painting areas, as well as the requirements for cooling in hot weather, but rarely mention dust problems. It is not unusual, however, for a farm shop to have several power tools requiring some type of dust collector system. These generally include woodcutting tools, such as table saws, radial arm saws, jointers and planer, and metal working tools, such as grinders, sanders, and buffers. Dust from machines is generally a nuisance, and may be harmful to the machine operator's health. In cases where the health of the operator is not impaired, the major objection to dust and dirt is one of housekeeping.

Two types of dust collectors are used in farm shops — mechanical centrifugal collectors and fabric (cloth) collectors. Centrifugal collectors are commonly used where large quantities of material are being handled and where the particle sizes are large. These units are highly efficient in cleaning the air of particles of approximately 20-microns in size (a human hair is 50 microns). Fabric collectors are most effective in removing of extremely fine particles less than 20 microns in size (a dust particle in a sunbeam is nine microns in size). Units may be stationary or portable and can be muffled to reduce sound levels.

Another alternative for farmers/ranchers with respiratory problems is to utilize an air-filtering helmet or similar device (e.g., an Airstream™ dust helmet). Filtering helmets are well suited to agricultural applications where dusts, spores, and molds are found.

MAINTAINING THE SHOP AND EQUIPMENT

Proper maintenance of the farm shop and equipment cannot be over-emphasized. The equipment should be kept oiled and adjusted and in good working condition at all times. Check each piece of equipment frequently to see if it is in good working condition. Improperly working tools and equipment are two of the leading causes of accidents in the farm shop. Every precaution should be taken to make the farm shop a safe place to work. Workers in the farm shop should recognize the dangers and hazards connected with using shop tools and equipment and take the necessary measures to avoid all dangers.

SUMMARY

For farmers/ranchers with physical disabilities a farm shop can be an invaluable asset to the farm. With proper layout, design, ventilation, and planning, the farm shop becomes an economic asset to the farm. The farm shop provides a safe, climate controlled environment for preventive maintenance on equipment. It may also maximize the use of hired labor during bad weather or winter months, and prevent secondary injuries by reducing the number of repairs that are requited in the field.

RESOURCES

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Farm Shop Accessibility Checklist

This is a checklist of problems that farmers, ranchers or family members may face in making the farm shop accessible. Potential solutions are suggested for each problem listed. Individual abilities must be considered before making any decision regarding which solution to use.

Problems	Solutions
Planning to Build	
❑ Shop design does not meet needs.	• Review alternative designs with the county extension agent. • Obtain ideas from other farmers who have similar disabilities. • Carefully consider abilities and limitations when examining a design.
Economics	
❑ Building or renovating shop a matter of economics.	• Examine ability of each person to perform mechanical tasks. • Consider whether more floor space will be required to permit movement in a wheelchair. • Examine the amount of time available for farm shop activities.
Layout	
❑ Lighting as laid out is inadequate.	• Install windows for increased natural light. • Install more light fixtures or brighter bulbs. • Paint interior walls and ceiling a light color to reflect more light.
❑ Workbenches are not arranged at correct height.	• Re-hang the workbenches at the appropriate height: ❖ usually 27"-29" to bottom edge for operators who use wheelchairs. (check height of arms on wheelchair) ❖ usually 34" or higher for operators who have difficulty bending their backs. • Purchase or construct adjustable-height workbenches. • Purchase or construct low portable workbenches on wheels.
❑ Wall-mounted tool cabinets make tools inaccessible.	• Move tool cabinets below workbenches. • Construct a mobile tool rack. • Purchase a wheeled tool chest if shop floor is smooth and hard. • Purchase a stand-up wheelchair.
Safety	
❑ Communication device is missing or not accessible.	• Move an existing or install a new CB radio, FM radio, or standard or cellular telephone in an accessible location.

5. Machinery Storage

A machinery storage building is usually one of the last buildings added to the farmstead. Benefits of such a building include preservation of equipment for extended life or higher trade-in value, better security, greater convenience, and pride of ownership. The question often raised is: Can the building's benefits justify the capital outlay?

The need to justify the outlay can become even more critical if the farmer has a disability. Building size and configuration — two main factors in machinery storage — may be greatly affected by the individual's disability. This could translate into increased cost for the facility.

Generally, the machinery storage building is not used nearly as often as some other farm buildings. For this reason, it might be appropriate to look at a reassignment of job responsibilities. Would it be more cost effective to have an able-bodied person move equipment into and out of such a storage building?

Assuming the money for this building is readily available or the farmer is intent on becoming as independent as possible, proceed with facility planning. This chapter deals mainly with the accessibility concerns for the farmer with a disability.

SITE SELECTION

The storage building should be about 150 feet from the farm home, near the farm shop and main flow of machinery traffic (see Figure 1). This distance is usually far enough away to protect the living area from the noise and traffic of large machinery, but close enough for security. Depending upon the type of disability, the building's distance from the house may need to be reduced. The building should be close enough to allow someone with a mobility impairment to reach it without driving or undue effort that could result in fatigue. An individual with a visual impairment must be close enough so as not to lose orientation, especially in winter when sounds can be muffled by snow.

The orientation of the building should take into account wind and snow in the northern states. The building should be sited so at least a walk-in entrance will remain free from drifting snow. An open-sided building should be south-facing to take advantage of solar drying of the interior.

Part of building orientation is the topography involved. Place the building floor about 12 inches above surrounding grade. A gradual slope (not greater than 1:20) should be used between the surrounding area and the building floor. There should be no bumps or abrupt level changes between existing grade and any concrete aprons, entrances, etc. (see Figure 1). The "lay of the land" from the house to the storage building is very important for the mobility impaired. A well-drained area free of obstacles, such as ditches and large rocks, is necessary to allow travel throughout most of the year.

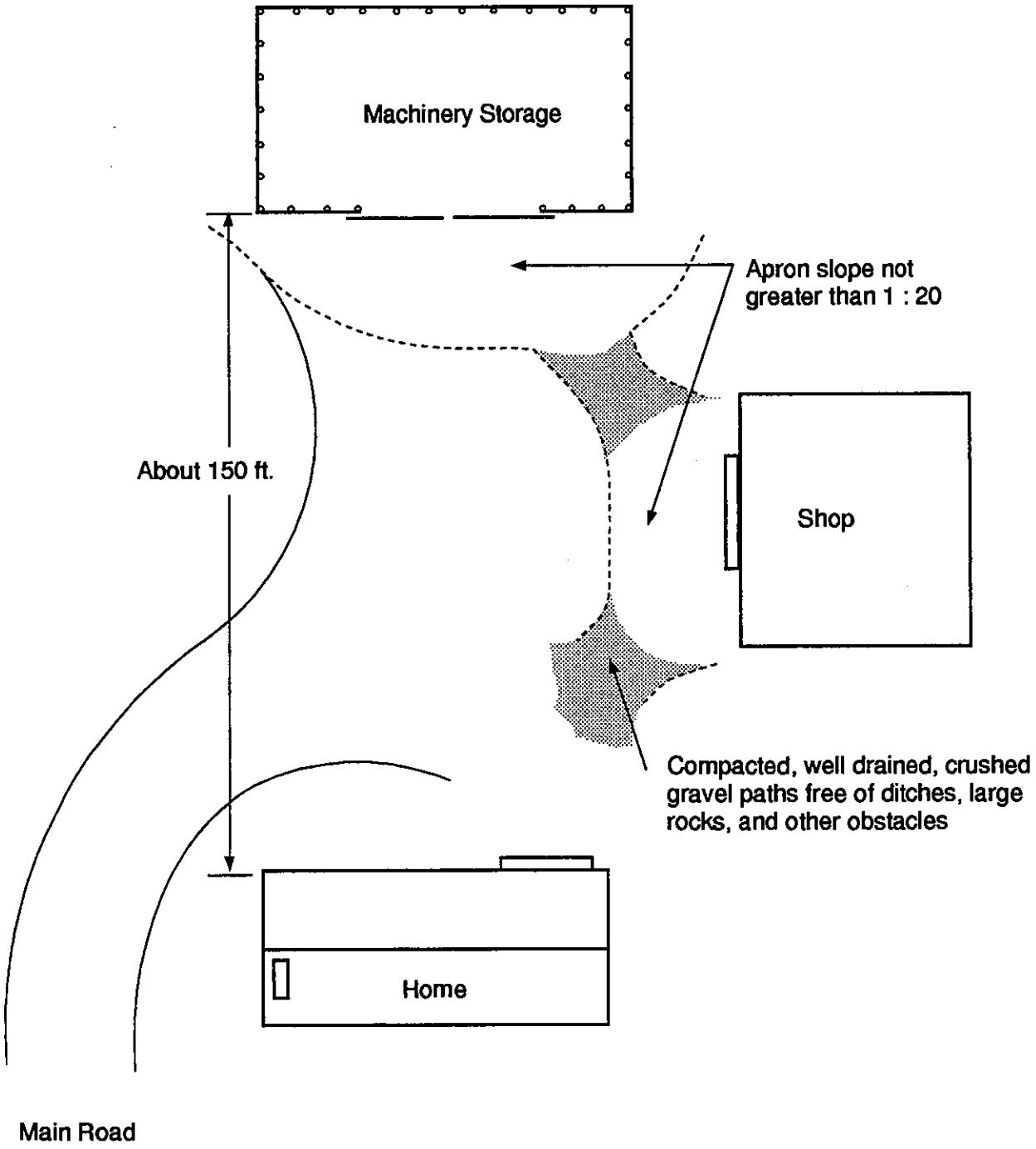

Figure 1. Site enhancements.

A gravel mix can be used on a well-drained pathway to allow formation of wheelchair trails. One used with success (10 year history) consists of the following:

Crushed gravel 3/8 inch and smaller	85 - 90% by weight
"Fines" (very fine powder)	10 - 15% by weight
(1/3 - 1/2 of "fines" consists of clay)	

If this is packed after being put down with a slight crown (raise) in the center, it should hold up well with little maintenance. This mix might also be used as a floor surface in storage areas (see "Building Details" below).

STRUCTURE PLANNING

Floor space requirements are increased for many individuals with mobility impairments. Crutches, walkers and wheelchairs will require more room between machines than what an able-bodied person can squeeze through (see Figure 2). Wheelchairs may require 30″ - 32″ for passage, walkers 20″ - 30″ (estimates). More room yet may be required if it is necessary to make any tight turns with a wheelchair in travel between machines.

Building configuration is directly affected by floor space requirements. When planning a new building, use careful thought to coordinate the type of building with the type of disability. If a person in a wheelchair had to get on a piece of equipment, move it, get off, move to another piece, get on, move it, etc., the time required would become prohibitive! For this type of disability, a long, narrow, open-sided building would probably be most appropriate. The farmer could get to the desired piece of equipment without making any turns, get on and move the equipment out of the building, and back in without disturbing any other piece of machinery.

A slightly different alternative would be to have a configuration that would allow machinery required during a given season to be readily accessible. Any piece of machinery required during a given season could be retrieved without moving other equipment. Help from an able-bodied person in moving equipment would then only be required seasonally.

BUILDING DETAILS

A concrete floor would be best, but would also be the most expensive. A dirt or gravel floor will become rutted over time from maneuvering equipment or may settle unevenly, but will be much less costly. In all cases, the floor's surface should be as level as possible to eliminate any abrupt changes in height that could make mobility difficult or dangerous for persons with disabilities.

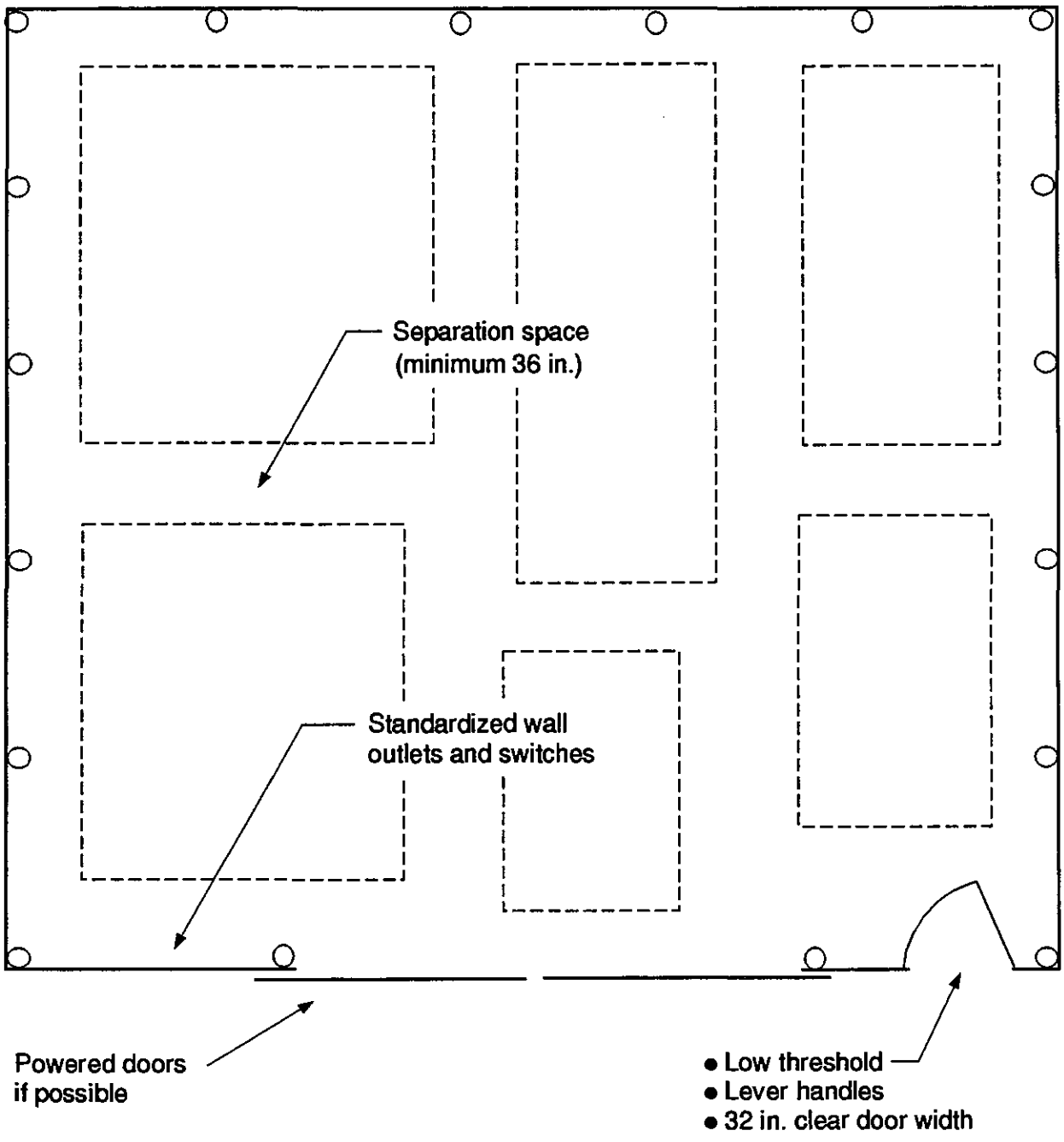

Figure 2. Building enhancements.

If gravel is used, include enough "fines" (30 -50% clay) so that solid, stable compaction can be achieved. This fine material takes up the spaces between the rock, and the clay in the fines helps hold the mixture in place. The result is a more stable surface passable to wheelchairs. Commercial binders (surfactants) are available that can be mixed in during construction that will keep dust levels down and provide a more water resistant surface.

Entrances on closed buildings should have thresholds with small or no level changes. This may dictate overhead or bi-fold type doors for large entry instead of sliding doors which often use a concrete shoulder in the floor for support to help prevent wind damage.

Large entry doors should be powered (see Figure 2). Individuals with visual impairments can have problems locating ropes on nonpowered doors and people who have mobility impairments may not have the strength to operate them.

Walk-in entrances should also have the appropriate type of door. Quadriplegics typically prefer automatic door openers or lever-type door handles. Amputees may prefer rings attached to the lever handles. The door should have a minimum clear opening of 32″ (see Figure 2).

Well-lighted buildings are almost always a benefit. For the visually impaired this can be very important. Use 250-watt bulbs or mercury lights uniformly spaced throughout the building. Check with the electric utility company on the availability of high-efficiency lighting systems. Another option, if interior paint is used, is to paint all interior walls a light color.

A retractable power cord mounted in an always accessible area, possibly near the door, has been suggested by people with several types of disabilities. It can be used by those in wheelchairs when fixed outlets are blocked by machinery. It is also readily available for a visually impaired individual and does not tangle easily. A good quality rubber cord can be knotted with a tool or appliance cord, which prevents the two from coming apart. This is an advantage for persons with visual impairments since cord separation would require more time to relocate the extension cord.

FURTHER TIPS

If water is available for cleaning machinery before storage (a real advantage), a water hose reel offers some of the same benefits as the cord reel described above. The water hose can be used to clean mud, grain, fertilizer, etc. from machinery.

In the interest of overall safety, a concerted effort should be made to eliminate all sharp edges or protrusions on machinery that could cause injury to someone walking by. For protruding objects on equipment that cannot be eliminated, some type of barrier must be used. For example, approaching a combine from the rear could be hazardous for a visually impaired person. The standard cane movement could not detect the parts of the combine that would hit someone's head!

There are several options here. Feed sacks or ropes hanging down from the ceiling, portable free-standing hand rail panels, or free-standing rope barriers are all possibilities. The idea is to hit a soft barrier that will not harm someone before coming in contact with some immovable object that will!

If children or employees with visual impairments participate in the farm operation, increased safety in moving vehicles backward out of the storage shed can be accomplished through use of beepers that are activated with engagement of reverse gear. Backup strobe lights can be used for those who have hearing impairments.

Smoke alarms with both audible and visual signals should also be standard.

SUMMARY

Disabilities are as unique as each farmer's operation. Information presented here does not encompass all solutions for all types of disabilities. Instead, areas of concern have been pointed out and some example solutions have been illustrated. Each farmer with a disability must develop his or her own best solution.

RESOURCES

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Mayer, Richard D. Chief, Design and Construction Bureau. Montana Department of Fish, Wildlife, and Parks. Helena, MT.

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Machinery Storage Accessibility Checklist

This is a checklist of accessibility problems that farmers, ranchers, or family members may face in machinery storage. Potential solutions are suggested for each problem listed. Individual abilities must be considered before making any decision regarding which solution to use.

Problems	Solutions
Site Selection	
❑ Determining the best site for a new storage building.	• Provide good drainage. • Located about 150 feet from the home and near the farm shop. Closer if necessary. • Located where the building entrance will remain free of drifting snow.
Structure Planning	
❑ Floor space is inadequate.	• Individuals that use mobility aids will usually require an "aisle" or minimum distance between machines that depends on the person's ability: ❖ 20″ to 30″ for walkers ❖ 30″ to 36″ for wheelchairs ❖ more space for turns around machines.
Building Details	
❑ Floor is difficult to travel.	• Floor should be filled and levelled to eliminate abrupt level changes. • Floor surface should be hard or compacted for easier travel with mobility aids — concrete, gravel, or soil. • If gravel is used, include "fines" for solid, stable compaction.
❑ Difficult entry.	• Walk-in entrances should have: ❖ Level thresholds ❖ Lever knobs or automatic openers ❖ 32″ clear opening.
❑ Inside lighting is not bright enough.	• Install windows or sunlights for increased natural light. • Install more light fixtures or brighter bulbs. • Install maneuvering lights uniformly spaced throughout the building. • Paint interior walls a light color to reflect more light.
❑ Cannot always find an electrical outlet.	• Mount a retractable power cord in an always accessible area — possibly near the entrance.

Problems	Solutions
Further Tips	
❑ Some machines have sharp edges or protrusions that are exposed.	• Eliminate the sharp edges when possible. • Permanently cover the sharp edges with water hose or something similar. • Construct and install a soft barrier that will be contacted before running into the sharp edge or protrusion, for example: ❖ a feed sack or rope hanging from ceiling ❖ free-standing handrail panels or rope barrier.
❑ Smoke alarm cannot be detected because of a hearing impairment.	• Install a smoke alarm with audible and visual signals.

6. Storing and Handling Grain, Hay, and Silage

Crops are stored on farms for two major purposes: 1) for livestock feed, and 2) for sale at a later date. Grains such as corn, soybeans, or wheat may be stored on farms for either purpose. Silage and hay are usually stored on the farm for livestock consumption. Storage methods vary considerably from farmer to farmer and through different geographic regions.

GRAIN STORAGE AND HANDLING

Introduction

Most farmers use upright metal bins for grain storage. Occasionally, horizontal buildings are used for grain storage, but this practice is uncommon on most farms. Because of wide variations in grain storage systems, a general overview of accessibility issues is provided.

The size of upright bins varies considerably according to the farm's size and the purpose of the structures. Most farm bins range from 1,500 to 30,000 bushels of dry grain capacity. Often two or more bins are located in one location, creating a farm's "grain center." The bins are filled from the top by methods described below. Grain is usually removed from bins by an auger located under the floor.

Many farmers use portable inclined augers for filling grain bins. These augers are usually powered by a tractor power take-off (PTO), but in some cases an electric motor or gasoline engine may be used for an inclined auger. Grain is dumped from a truck or wagon into a pan where the auger end rests. The grain is then drawn into the auger, where it is transported to the bin peak.

Larger grain farming operations may use a grain "leg" for distributing the harvested crops among various bins. When a truckload or wagonload of grain is delivered to storage, it is dumped into a pit covered by a grate. An auger then transports the grain to a bucket elevator. The elevator moves up the leg, which may be 75-100 feet high. Grain is then directed downward through a tube toward the desired storage bin.

Farm grain storage operations present unique accessibility problems for the farmer with a physical disability. These issues will be discussed in three sections, which relate to various aspects of grain handling and storage:

1. Receiving — delivery of grain and filling of bins.
2. Storage — considerations when grain is in storage.
3. Processing — drying of grain and emptying of bins.

Receiving

Consider Permanent Facilities. Accessibility can be enhanced by designing grain handling facilities for long term use. Grain systems that use a grain leg should be very adaptable to mobility impairments. Grain leg systems can be operated with electric controls. Relocation of controls to allow accessibility may be necessary.

The expense of installing a grain leg makes this option impractical for many farmers who use inclined augers for filling bins. These augers present several challenges for the mobility impaired individual with a mobility impairment. As each load of grain is dumped, the tractor must be started and the PTO engaged. Then the unloading door must be opened on the truck or wagon. Once the load is empty, the tractor must be turned off. This process would be slow for individuals with certain disabilities. Various options exist for easing this process:

- Use a central unloading location — Rather than moving the auger to each bin, add top conveyors between bins or additional augers and arrange so that one unloading area can be used.
- Consider electrically powered augers — Augers with electric motors eliminate starting the tractor and PTO.
- Make a permanent grain unloading area — A concrete slab within "auger-reach" of several bins helps eliminate the need for moving augers to each bin.

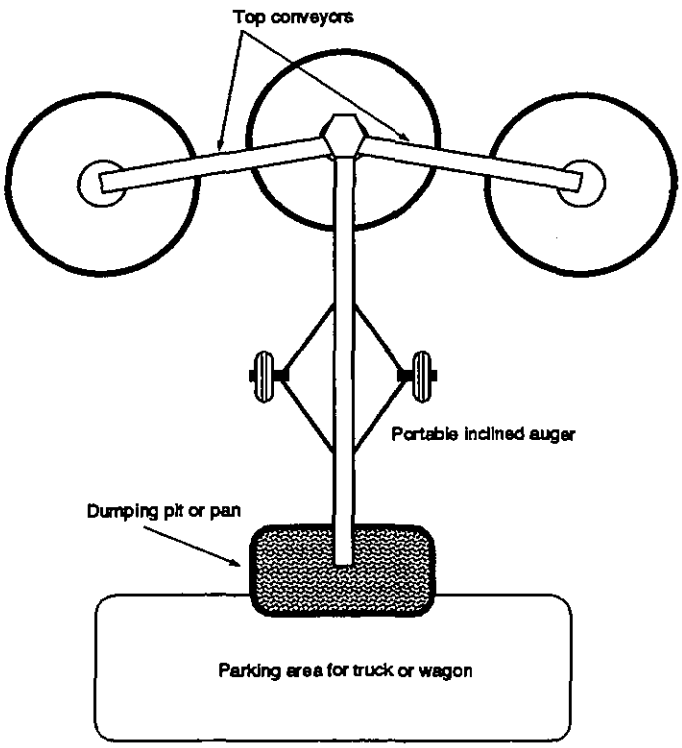


Figure 1. Semi-permanent unloading area using inclined augers.

Surface. The ground surface around the grain unloading area should be smooth and level. Concrete would increase mobility for users of wheelchairs, canes, or crutches. Avoid rough or muddy ground.

Space. There should be adequate space to move around the truck or wagon being unloaded. Dump pits may be located in sheds that lack room for maneuvering. Inclined augers present space problems due to the tractor, auger pan, PTO shaft, and vehicle being in such close proximity. If adequate space cannot be made, it may be safest to reassign the task.

Grain Transport Vehicle. Trucks with hoists, auger wagons, and gravity flow wagons are used for hauling grain. When unloading trucks, grain will often "hang up" in the bed, requiring someone to push the grain toward the unloading door. Gravity wagons or auger wagons may alleviate this problem. Special grain shovels and clean out augers are available for grain truck cleanout.

Storage

Layout of Grain Storage Center. As mentioned, grain bins are usually placed in a central location on the farm. To improve accessibility, the bin site should be free of obstructions on the ground. Sufficient space around the bins should be provided for maintenance and access to augers.

Access to Bins. While grain is in storage, the farmer periodically checks grain level, moisture, temperature, and other factors. Bins typically have three openings: 1) a door near the bottom, 2) a cap at the peak where the bin is filled, and 3) a door near the edge of the bin roof. The door at the bottom can be used only when the bin is nearly empty, and grain level is below the door. The door on the bin roof is usually accessed by a ladder, and allows an individual to climb into the bin and down to the grain. Following are suggestions of products which ease access to bins, or allow monitoring from the outside.

- Bin stairs. Commercially made stairs can be installed on bins, eliminating the need to climb a ladder to the bin roof.
- E-Z Eye™. A commercial product that eliminates the need to climb a ladder to the bin roof to monitor grain level in the bin. The product is installed at intervals up the side of the bin, and the devices change color when the grain level falls below each interval.
- Remote monitoring devices. Equipment is available which can measure the grain's temperature from outside the bin, eliminating the need to enter the bin for that reason.
- Bulk seed, feed other material handling. Over-head gravity feed bins (for smaller amounts of seek, ground feed, "range cubes," fertilizer or other dry materials) can solve some of the access problems in distributing frequently used materials. These bins are on posts or stilts, set high enough for trucks to drive directly under and fill via gravity flow trap doors. These

doors can be operated from the truck/pickup/tractor seat, thus freeing the mobility-impaired driver from having to get out of the vehicle to load his cargo. All the previously mentioned goods and materials can be ordered and delivered in bulk' again, saving labor and time.

Processing

Controls. Electrical controls for the grain system can be made accessible. Doing so may require relocation of control panels or switches. Any electrical work should be done according to safety specifications.

Drying Systems. To remain in storage, grain must be maintained at proper moisture levels. Attaining the proper moisture levels often requires drying of the grain. Grain is either dried in the bins through use of aeration fans and heat, or with the use of high-speed dryers. High speed dryers allow grain to flow through at a prescribed rate, where it is heated to a high temperature to remove moisture. High speed dryers eliminate the need to enter the bins to check moisture levels; however, the cost may be prohibitive. An alternative may be a "tub" dryer, which is essentially the bottom few feet of a bin, with an open top. The floor aeration and heat dries the grain, which is then transported to the desired bin. The Cooperative Extension Service can provide assistance in evaluating drying system options, while dryer manufacturers can help create a system designed to meet individual needs.

HAY STORAGE AND HANDLING

Introduction

Hay may be fed to nearly every type of large farm animal except swine. Dairy and beef cattle, sheep, goats, and horses are fed hay to provide nutrients and roughage, especially during colder times of the year when pasture is unavailable.

Today, hay is harvested and stored by three major methods: 1) small square bales, weighing 50 to 100 pounds; 2) large round bales, which may weigh from 800 to 1,500 pounds; and 3) loose stacks or loaves (most common in western states). In some areas, most hay is harvested as haylage or silage, which totally eliminates the manual handling of bales or stacks. Accessibility issues for each of the three methods will be discussed separately. Again, because of the wide variation in needs among farmers, no specific solutions can be offered, only general points and issues to consider.

Square Bales

Square hay bales are usually stored in barns or lofts. Occasionally, bales may be stacked outside and covered with plastic. Accessibility problems often relate to two major concerns: handling of bales and storage location. The information contained in this particular section can also apply to wheat or oat straw, which is square baled and used for livestock bedding on many farms.

Handling of Bales. Square bales are usually carried by hand, which naturally presents difficulties for individuals with mobility impairments, back problems, and amputations. Several steps may be taken to alleviate this problem, which may or may not require additional farm equipment.

- Lighter bales. A 50-pound bale of hay is considerably easier to move or carry than a bale weighing twice as much. Adjustment of baling equipment to produce lighter bales can ease handling difficulties. This solution might only be practical for operators needing small amounts of hay. The lighter bales will require more storage space, and will obviously involve handling more total bales.
- Handling equipment. When handling baled hay, various types of equipment can reduce the amount of lifting and carrying. All-terrain utility vehicles, small wagons pulled by utility tractors, or wheelbarrows can be used to transport bales of hay from storage to the feeding area.
- Automated stacking equipment. Machinery is available that loads bales in the field and stacks the bales of hay or straw in the storage area. Information about this machinery can be obtained from local implement dealerships.

An alternative, if available, is to assign bale handling tasks to other individuals.

Storage Location. Square bales are usually stored in barns or sheds. The traditional "hayloft" is still in use on many farms. The hayloft presents obvious access problems for individuals with mobility impairments. However, options exist that can improve accessibility to square bale storage areas.

- Floor storage. Stacking hay on the floor level of buildings may be the simplest method of accessing square bales. By limiting the height of the haystack, persons with mobility impairments would be able to reach bales. However, floor storage may not be as space-efficient as lofts. A solution may involve construction of an inexpensive pole shelter specifically for baled hay.
- Proximity to feeding area. The closer the storage area is to the feeding location, the less effort is required in moving the bales. A hay storage shed adjacent to the hay feeding bunk might allow the hay to be dropped directly into the feeder (see Figure 2).
- Lofts. Farmers utilizing lofts can improve access by replacing ladders with stairs to the loft area. Also, leaving floor space in the loft for walking, and limiting stack height can reduce the difficulties faced by individuals with disabilities (see Figure 2).

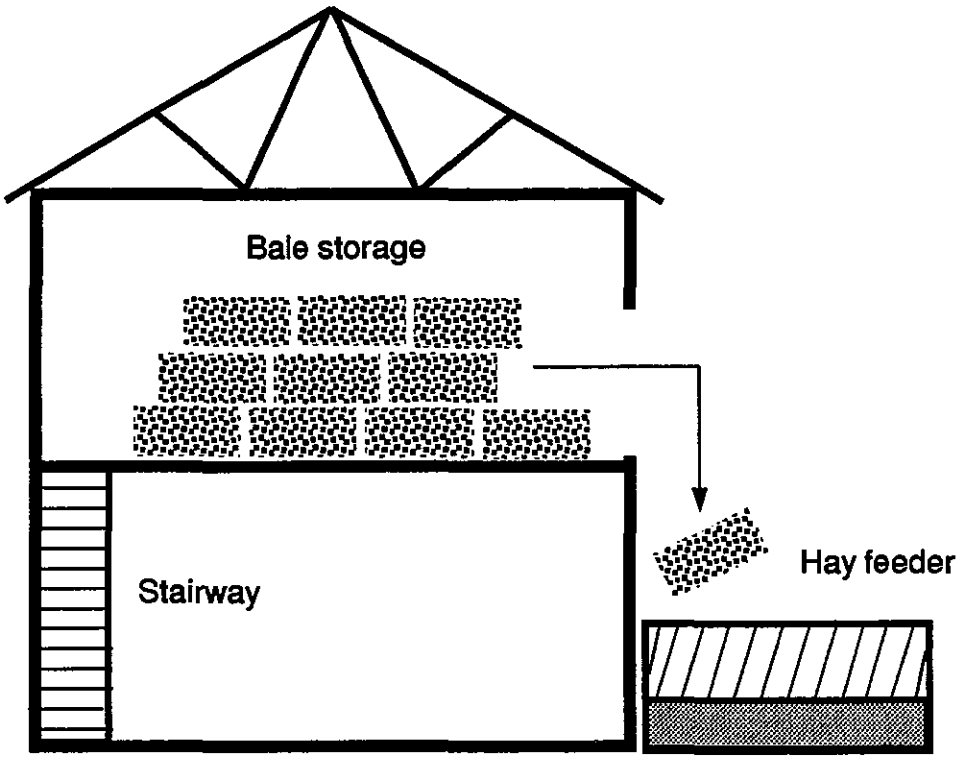


Figure 2. Possible square bale storage and feeding area for individuals able to climb stairs.

Big Round Bales

Large round hay bales have become very popular, especially among cattle producers. Each round bale contains the hay of 10 to 20 square bales. Round bales are usually transported by means of a large fork or spear mounted on the front or rear of a tractor. These round bales are most often stored outdoors. One disadvantage of the large bales is the loss of hay quality in the outer layers of the bale when stored outdoors. The use of large round bales should present fewer problems for farmers or ranchers with disabilities than do square bales. If the individual is able to operate a tractor, round bale feeding should present few problems. However, some issues need to be addressed. Storage Area Access. A problem with the use of round bales could be accessing the bale storage areas. If bales are kept in a fenced area, gates should be easy to open, or possibly automatic gates could be used that do not require dismounting the tractor.

Hitching Bale Fork. It is uncommon for a bale forks to remain on a tractor at all times, so another potential problem with round bales is the hitching and unhitching of the bale fork to the tractor. However, the installation of a quick-hitch device to the bale fork can eliminate the need to dismount the tractor when hitching, or the need for another person to assist.

Moving Portable Hay Bunks. Many farmers use portable round metal hay feeding bunks, which can be lifted and rolled from location to location by an able-bodied individual. Brackets mounted on the feeder could allow a tractor-mounted hayfork or front-end loader to lift and move the feeder to a new location.

Loose Stacks or Loaves

Loose stacks or loaves are generally used in western states, where less rainfall is received. When harvested, the hay is formed into what amounts to a large pile, measuring 15 to 20 feet long. This stack looks somewhat like a giant loaf of bread, and is stored outside. This stack is winched onto a low wagon, and transported to the feeding area. The stack is slid off the wagon, and animals are allowed to self-feed. As with big round bales, this system should present few accessibility problems to individuals who are able to operate a tractor. As with round bales, gates to storage and feeding areas should be easily opened or be automatic.

Space around Stack. The stack storage area should allow wheelchair accessibility if needed. Avoid ruts in the stack yard, and provide maneuvering room between the stacks to attach necessary equipment.

SILAGE STORAGE AND HANDLING

Introduction

Silage is commonly fed to both beef and dairy cattle. The two major types of storage systems are horizontal and upright silos. Horizontal silos, or trench silos, generally have a concrete floor and concrete or wooden sides. The harvested silage is packed in the trench by a tractor as the silo is filled. Silage is removed from the horizontal silo by a tractor and scoop, or skid-steer loader. Upright silos may be top or bottom unloading. Top unloading silos remove silage from the top down, dropping the silage down a chute along the side of the silo to an auger or feeding equipment. Bottom unloaders pull the silage from the bottom of the silo.

As with grain and hay storage, large variations in silage handling and feeding methods exist from farm to farm. This section will identify a few general accessibility issues involved with the use of silage.

Horizontal Silos

Access to Silo. Horizontal silos eliminate the need to climb. An individual with a disability could perform most of the necessary tasks from a tractor or skid-steer loader, including the packing of the silage during harvest, as well as the removal to a feed truck or wagon.

Possible Advantages over Upright Silo. Horizontal silos require:

- No climbing. Horizontal silos eliminate the need to climb to perform maintenance or open silo doors, which would be an advantage for an individual with a mobility impairment.
- Shortage of labor. As most of the tasks associated with filling and unloading a trench silo can be accomplished from a tractor, farmers with a shortage of labor may find horizontal silos to be an advantage.

Upright Silos

Top Unloading. Top unloading silos are very common and are usually constructed of concrete. Unloading doors are located at intervals up the side of the silo. As the silage level decreases, these doors must be opened, which would cause difficulties for individuals who cannot climb ladders, such as persons with mobility impairments or upper limb amputations.

Bottom Unloading. Bottom unloading silos empty from the bottom, which eliminates the need to climb and open unloading doors. An example of a bottom unloading silo is the blue A.O. Smith Harvestore. However, the cost of such silos may be prohibitive for many farmers.

Feeding And Handling Silage

Proximity to Feeding Area. As with hay, silage feeding can be simplified by feeding directly from the storage area.

- Augers to feed bunks. Upright silos can have auger systems which convey the silage directly to feed bunk, especially if located adjacent to the feedlot area.
- Feeding area adjacent to horizontal silo. Locating a horizontal silo near the feedlot area could allow unloading of silage directly from storage to feeder by means of a tractor with a scoop or skid-steer loader.

Silage Transport and Feeders. Transportation and feeding of silage can be simplified by using:

- Side unloading wagons or trucks. Auger wagons or trucks that are controlled from the driver's seat can simplify the feeding of silage.
- Fenceline feeders. Silage feeders can be located along fencelines, that allows feed delivery with a minimum of opening gates.

SUMMARY

With thought and planning, crop storage and handling facilities can be made accessible to most individuals with disabilities. The most important consideration when modifying or adding crop handling facilities is to reduce physical labor and mobility requirements. The use of a grain leg system or construction of a central unloading area for grain allow increased mobility around the

storage area and eliminates the need to reposition inclined augers. Using electric controls on augers and other equipment can eliminate many accessibility concerns. In addition to automation of facilities, silage and hay handling can be eased by steps such as locating feeding areas close to the silo or hay storage area. Simple ideas such as using lighter hay bales, or using big round bales instead of square bales, can reduce physical labor requirements for the farmer or rancher with a disability.

Improving accessibility to crop storage and handling facilities and activities should not require major and expensive modifications to existing systems. By adapting the equipment and practices already in place, the grain, hay, and silage handling requirements on most farms can be made accessible to persons with many types of disabilities. In addition, the modifications will often increase the labor efficiency and safety of the farm operation, helping to offset the initial cost of the changes.

RESOURCES

Grain, drying, handling, and storage handbook (2nd ed.) *MWPS-13*, 1988, Midwest Plan Service, Ames, IA: Iowa State University.

Structures and Environment Handbook (11th ed.), *MWPS-1*, 1983, Midwest Plan Service, Ames, IA: Iowa State University.

Storing and Handling Grain, Hay and Silage Checklist

This is a checklist of accessibility problems that farmers, ranchers or family members may face in storing and handling grain, hay, and silage. Potential solutions are suggested for each problem listed. Individual abilities must be considered before making any decision regarding which solution to use.

Problems	Solutions
Grain Storage and Handling	
❑ Inclined augers present challenges when operating or moving them.	• Use a central unloading location. • Use electrically powered augers — augers with electric motors eliminate starting the tractor and PTO. • Make a permanent grain unloading area that is flat and level, such as concrete. • Maintain adequate maneuvering space around equipment to allow for mobility aids. • Use self-unloading transport vehicles.
❑ Difficult to check grain levels, moisture, temperature, and other factors in grain bins.	• Install bin stairs to replace a bin ladder (stairs available commercially). • Install E-Z Eye™ product that indicates level of grain in bin. • Install remote monitoring devices.
Hay Storage and Handling — Square Bales	
❑ Square bales are too heavy or awkward to carry.	• Adjust baling equipment to produce lighter bales, if storage space for increased number of bales is available. • Make use of handling equipment such as ATVs or utility vehicles to reduce lifting and carrying. • Locate storage close to feeding area to reduce handling of bales. • Make use of automated stacking equipment. • Assign bale handling tasks to others.
❑ Bales often stored in a location that is difficult to access.	• Replace ladders with stairs for loft storage. • Consider floor storage in an existing structure or an inexpensive pole shelter.
Hay Storage and Handling — Big Round Bales	
❑ Large round bales also cause storage access problems.	• Install automatic gates that do not require dismounting from the tractor.
❑ Attaching and removing the bale fork from tractor is time consuming and difficult.	• Install a quick-hitch device on the tractor and bale fork to eliminate dismounting from the tractor.

Problems	Solutions
Hay Storage and Handling — Big Round Bales — (Continued)	
❑ Round metal hand feeding bunks are a challenge to move.	• Mount brackets on the feeding bunks to allow a tractor-mounted hayfork or front-end loader to lift and move the feeder to a new location.
Silage Storage and Handling	
❑ Climbing a ladder in an upright silo is a difficult task.	• Construct a trench silo or bottom unloading silo.
❑ Time and energy wasted transporting silage from storage to feeding area.	• With upright silos, attach an auger system to convey silage from the silo directly to the feedbunk. • With trench silos, locate the silo near the feedlot area to allow skid-steer loader to be used for feeding.

7. Livestock Buildings

This chapter will explore possibilities for modifying farm buildings used in livestock production. The focus will be on the major aspects of livestock production in general, rather than on specific livestock enterprises. The aspects discussed in this chapter include: general building access, animal care and handling, waste handling, feeding, and environmental control.

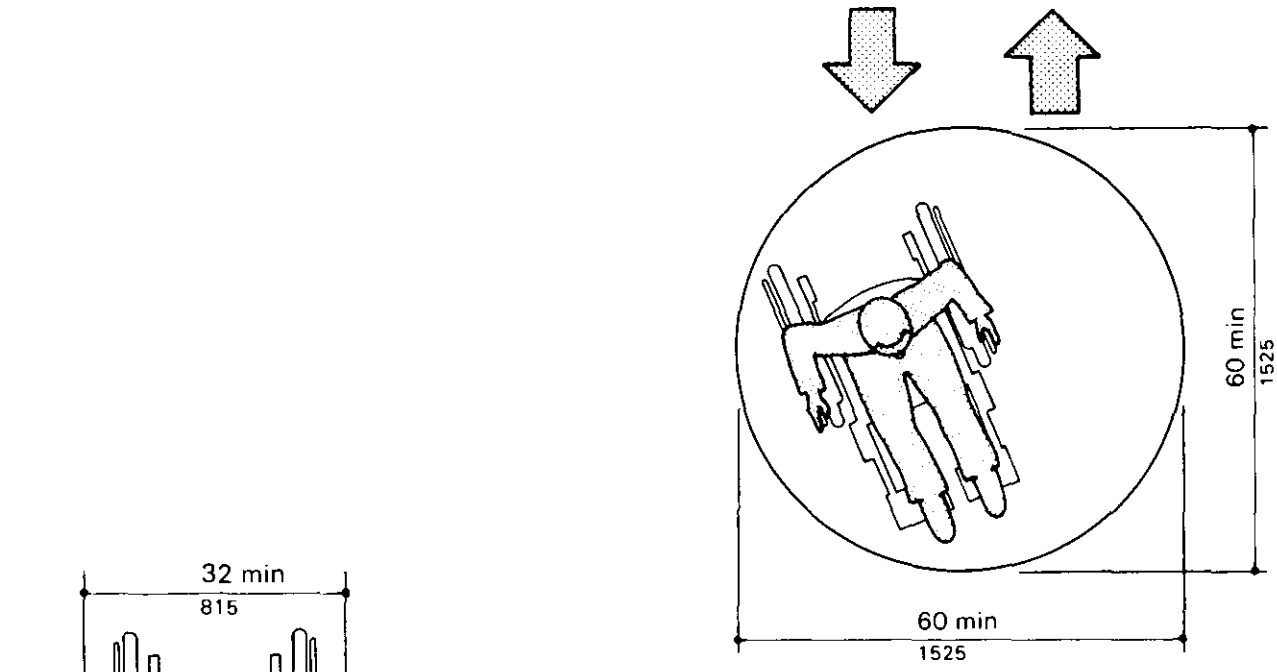
BUILDING ACCESS

Since the introduction of slotted floor livestock confinement buildings more than 30 years ago, a great deal of research has been conducted to enable design for optimum comfort and production of the animal. Virtually no research, however, has dealt specifically with the comfort of the operator.

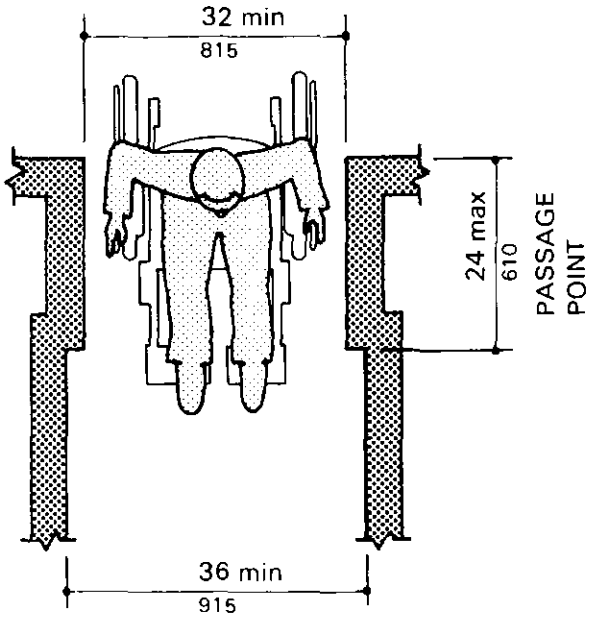
Wheelchair and Limited-Mobility Access

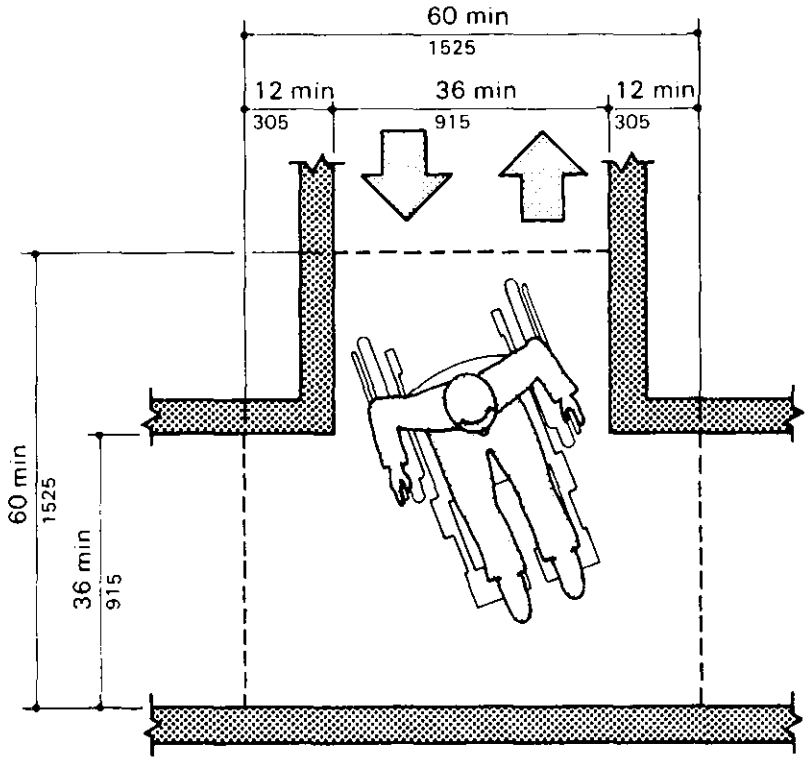
Farmers with limited mobility must be concerned with removing barriers such as curbs or high door thresholds, allowing sufficient aisleway clearances and acceptable reach distances, and providing pen access from aisleways. For individuals with ambulatory-related impairments, maintaining wide, clear aisleways is of primary importance. In many cases, accomplishing this may be as simple as keeping the floors clear of tools, equipment and debris. In other instances structural changes may be necessary to provide adequate aisleway clearances.

Figures 1-4 show acceptable clearances for persons who use wheelchairs, as provided in the American National Standard for Buildings and Facilities (ANSI A117.1-1986) and the Americans with Disabilities Act (ADA). These standards, while perhaps too stringent for producers who do not use wheelchairs, can serve as useful design goals. (Note that farm operators are not generally required to comply with provisions of the ADA, except in regard to hiring practices or if their business involves making farm facilities open to the public.) Be sure to see Table 1 for a general list of commonly used aisle widths and Table 2 for specific heights of animal pen partitions. A number of modifications may be needed to make conventional farm buildings fully accessible to mobility impaired operators. Compare Tables 1 and 2 to the recommendations in Figures 1-4.



60-in (1525-mm)-Diameter Space

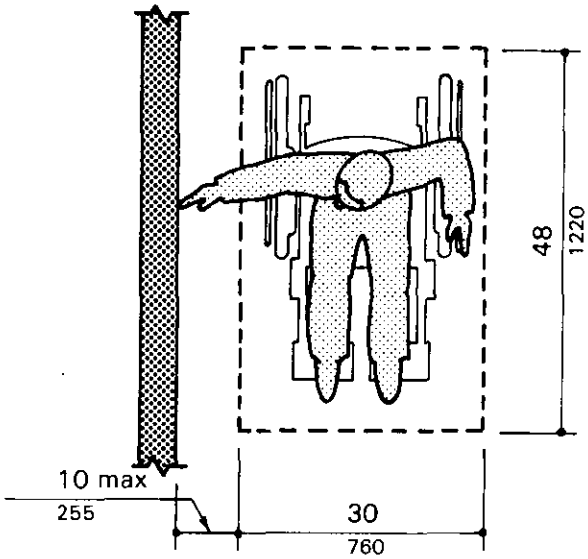




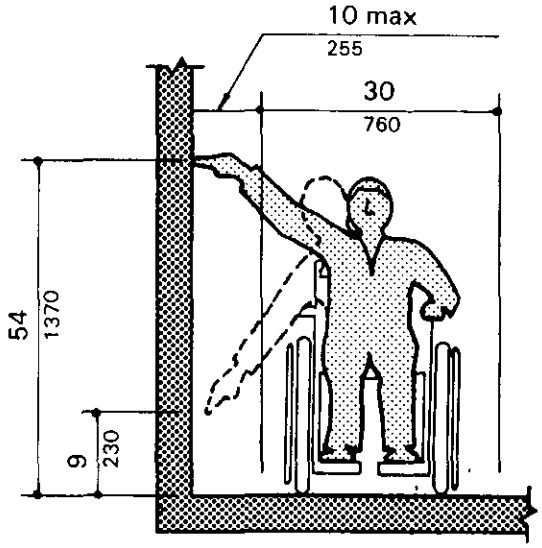
NOTE: Dashed lines indicate minimum length of clear space required on each arm of the T-shaped space in order to complete the turn.

T-Shaped Space for 180° Turns

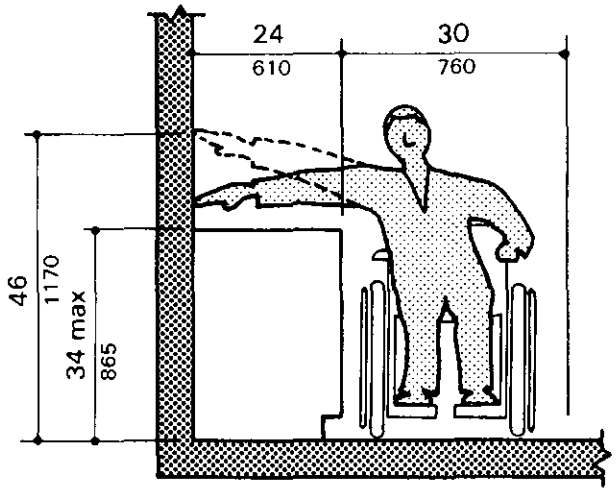
Figure 1. Minimum recommended wheelchair clear width and turning space requirements. (American National Standards ANSI A117.1-1986).



Clear Floor Space — Parallel Approach



High and Low Side Reach Limits



Maximum Side Reach over Obstruction

Figure 2. Minimum recommended clear floor space and maximum side reach limits for wheelchair users. (American National Standards ANSI A117.1-1986).

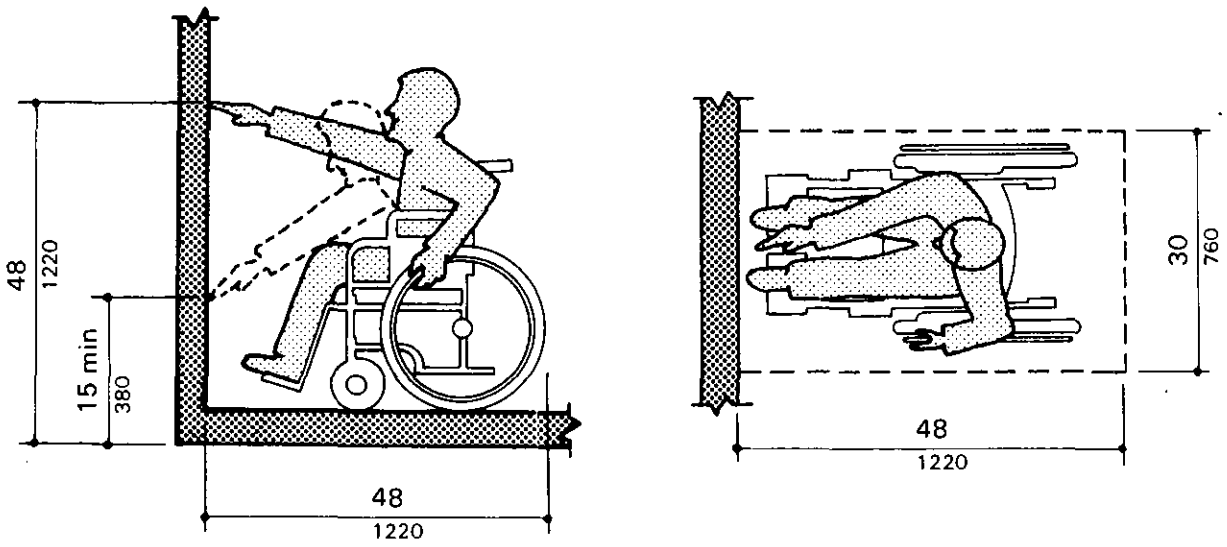


Figure 3. Maximum recommended ramp slopes for use in existing buildings and in new construction. (American National Standards ANSI A117.1-1986).

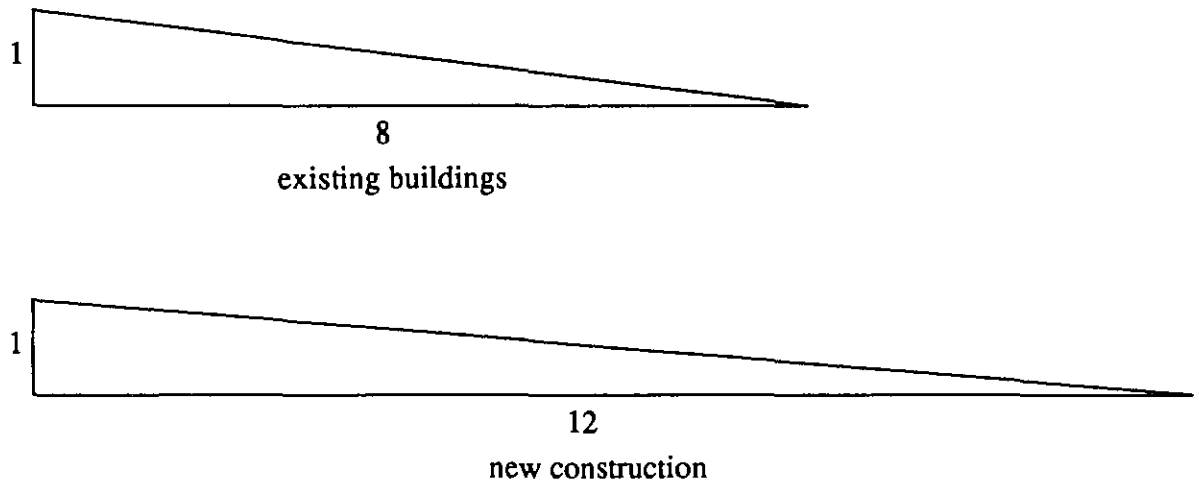


Figure 4. Maximum recommended ramp slopes for use in existing buildings and in new construction. (American National Standards ANSI A117.1-1986).

Table 1: Livestock building aisleway clearances.		
Aisleway use	**Recommended width (feet)** **Conventional use**	**Wheelchair use***
Feeding		
Pushcart	4 - 5	4 - 5
Automatic transport	2	3
Animal Care		
Handling	1 1/2 - 2 1/2	3
Observation	2	3
* Minimum required width is 4 feet if pens must be accessed from the aisleway.		

Table 2: Typical minimum pen partition height*	
Animal type	**Partition height**
Swine	
Farrowing	
Sow	3′
Creep	1′
Nursery	2′
Growing/Finishing	2′ - 8″
Gestation	2′ - 8″
Boars	4′
Pasture fence	3′ - 4′
Dairy	
Calves	3′- 6″
Cows	
Freestall or lot	4′
Pasture fence	4′ - 6″
Beef	4′ - 6″
* Animal handling facilities require fences 6" to 1′ higher than do pens, lots, and pasture.	

Any livestock building with narrow aisles, heavy gates and doors, or row upon row of pens or stalls presents a veritable obstacle course to a producer with a disability. Producers who have a disability may want to consider managing livestock outside on pasture or in large pens, rather than dealing with the accessibility problems of confinement buildings.

Removing Other Access Barriers

Modifications that provide improved access to wheelchair users can also be beneficial for others. Livestock operators with upper limb amputations, cerebral palsy, arthritis, or visual impairments, for example, will undoubtedly benefit from removing barriers and obstacles in livestock buildings.

Cluttered aisleways, low-clearances, and wall protrusions or sharp-edged panel corners can be accessibility barriers and safety hazards for individuals with visual impairments or limited strength or balance. Sharp edges and protrusions that cannot be removed should be padded or covered to avoid causing injury. Operators with visual impairment would also benefit from marking these obstacles to reduce the risk of collision. Simple adaptations such as hanging feed sacks or pieces of twine or rubber hose from the ceiling can warn against low beams, doorways, and light fixtures.

ACCESS TO ANIMALS

The ability to safely access animal pens depends largely upon the physical ability of the operator. In general, as an individual's level of mobility and physical ability decreases, the amount of direct contact with livestock also decreases. Operators with more serious mobility impairments may find that it is more practical, and safe, to allow employees or others to handle the tasks requiring direct contact with livestock in pens.

If entrance to livestock pens is desired, modifications may be necessary to ensure that the operator can move easily and safely around livestock. Narrow aisleways usually present the most serious access problem for disabled producers, but other barriers can also restrict mobility within or around the animal area. Mobility also depends greatly upon the type of floor surface in aisles and pens.

Floors and Surfaces

Bedded floors result in deeper manure on the floor, creating a very rough surface on which to move. Wheelchair maneuverability on manure packed floors is nearly impossible, usually requiring an alternate form of transportation, such as a motorized three-wheeled scooter with flotation tires. The most typical alternative in confinement buildings, slotted or partially-slotted floors, presents a unique problem for conventional wheelchairs, crutches, and walkers. The minimum slot widths needed for adequate manure removal for larger animals are too wide for the wheels of conventional wheelchairs or the tips of canes and walkers (see Table 3). However, if this

Table 3: Recommended slotted floor opening for various farm animals.	
Animal type	**Slot widths (inches)**
Swine	
Farrowing/nursery	3/8
Growing/finishing	1
Gestation	1
Dairy	
Calves	1 1/4
Cows	1 3/4
Beef feeders	1 3/4

maneuverability problem can be solved through the use of extra wide tires or duals, a slotted floor may be the best floor type for wheelchair users, since it is level and remains relatively clean.

Woven wire or punched metal flooring, with slot openings of about 3/8″ x 1/2″ is now popular for swine farrowing buildings and other animal housing. These flooring types should present no major difficulties to wheelchair mobility, and have the added benefit of requiring less time to sanitize between animal groups than conventional concrete floors.

The benefits of modern confinement facilities, however, may not be available to the majority of livestock operations. Wood or dirt floors are still relatively common in many livestock housing facilities. Floors in these facilities, particularly aisles, should be modified to provide smooth, clean, non-slip surfaces. Bedded stalls can create obvious mobility difficulties. Care should be taken to keep these areas as clean as possible from manure and waste. Depending upon the operator's level of mobility and balance, different bedding materials such as wood chips or shredded paper may offer more desirable surfaces.

Nursery Pens

Elevated decks are often used in confinement facilities for swine farrowing, nursery animals, and dairy calves. These decks are usually raised off the floor eight to 12 inches to facilitate cleanout under the animal and to eliminate the effect of floor drafts.

Based on the guidelines in Figure 2, it appears that decks elevated to a height of at least nine inches, and preferably 12 or even 16 inches, would be a more convenient reach height for an operator using a wheelchair. Of course, a swing-up or swing-in gate would also be needed to enable the person to reach the animals. With an elevated deck, animal movement in and out of the pen obviously becomes more difficult. In some cases, hindered operator and animal access may outweigh the benefits of elevated pens.

Since a wheelchair would not be able to actually enter an elevated pen, some method must be devised for capturing and holding animals for routine activities such as vaccinations, castrations, tail docking, etc. One solution used by some swine producers is to locate a heated creep-feeder at the front of an extra long pen (8´ vs. 7´) adjacent to the aisleway. The young animals are naturally drawn to the enclosed feeder area, and once inside, can be captured by closing the entrance of the feeder. Another solution for both swine and sheep producers might be to use a padded "animal hook." This device could be manipulated from the aisle to snare and draw a pig or lamb to the producer for medication or closer observation. Where snares and creep-feeders are not applicable, at least five feet of aisle clearance should be provided to allow room for turning and maneuvering a wheelchair (see Figure 1).

Gates and Latches

Gate design may present another obstacle to animal pen access. Many confinement buildings use double-hung gates. These gates hinge on both ends and swing open from the center, allowing the entire pen partition to open into the aisleway. Producers who use wheelchairs should consider using four to six-foot wide gates, double-hung or perhaps cable supported from the ceiling, to reduce the weight of the gate. The gate design must provide convenient access and allow animal movement in either direction.

Care should be taken in designing the gate so that it swings freely and does not need to be lifted as it is opened and closed. A heavy gate already in use can be made more manageable by cable supporting it from a side post (see Figure 5). A floor clearance of about two inches allows for some sag by a four to six-foot wide gate and should clear any manure buildup on the floor that would obstruct gate movement. Figure 6, which shows the ADA recommendations for door access, indicates that the latch side of the gate should be set in at least 12 inches from the side of the pen to allow the producer to conveniently open the gate from the inside.

For operators with limb amputations or limited hand dexterity or strength (e.g., arthritis), gate latches present a particular challenge. Gate latching mechanisms should move freely and be easy to operate. Small hooks, slide bolts, and chains should be replaced by lever-action sliding bar mechanisms or self-locking latches designed for easy operation.

Milking Parlors and Stanchion Barns

Another consideration regarding access to animals involves providing adequate access to the milking parlor or stanchion barn. When planning a new milking parlor, allow for a slightly shallower pit than normal. It might also be useful to cantilever the cow platform out into the pit area a little farther than usual to provide knee clearance under the platform and an easier reach to the cow's udder. Circular or carousel units have been constructed by at least one producer to simplify wheelchair movement. Existing milking parlors might be modified by constructing ramps

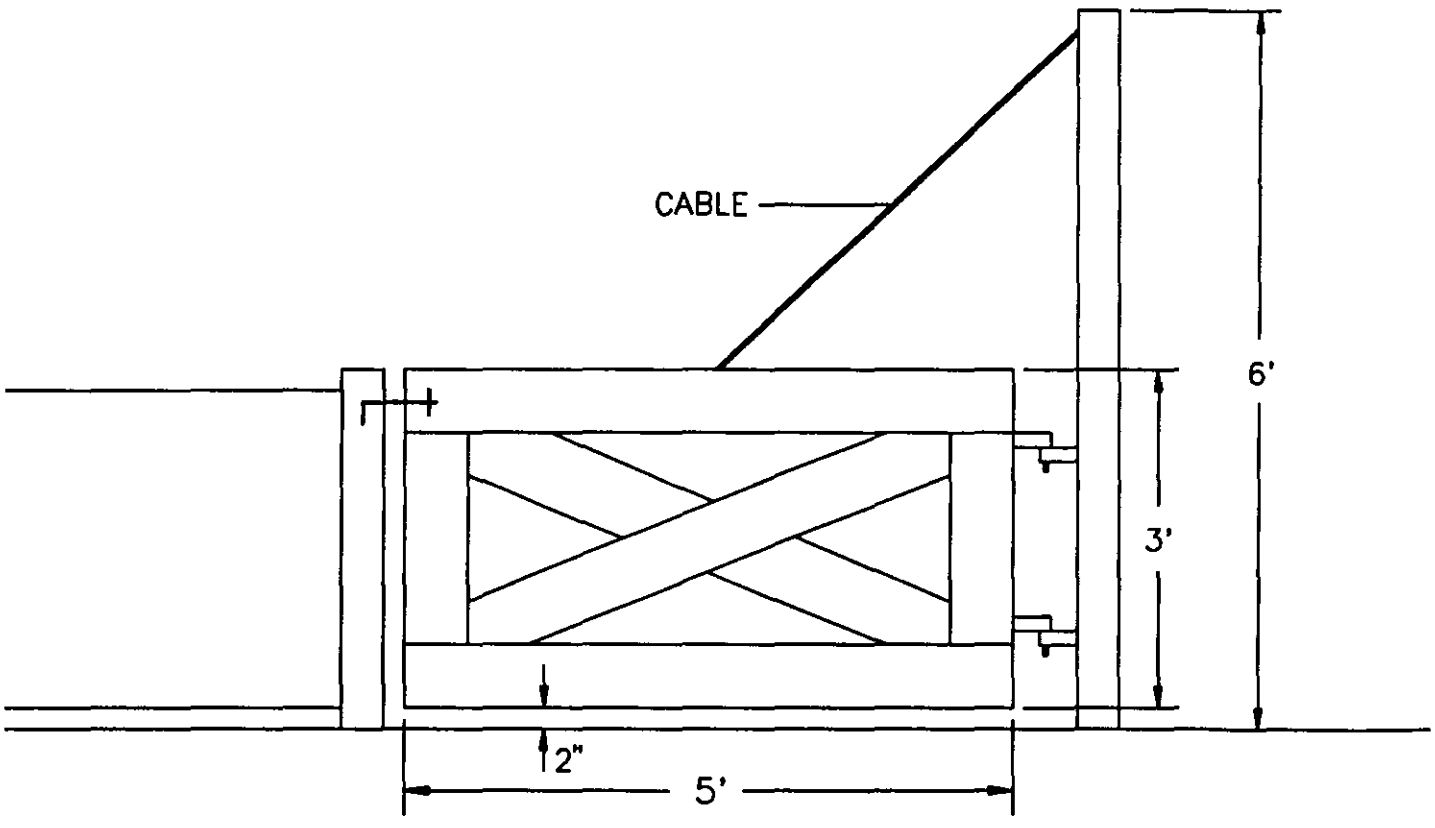
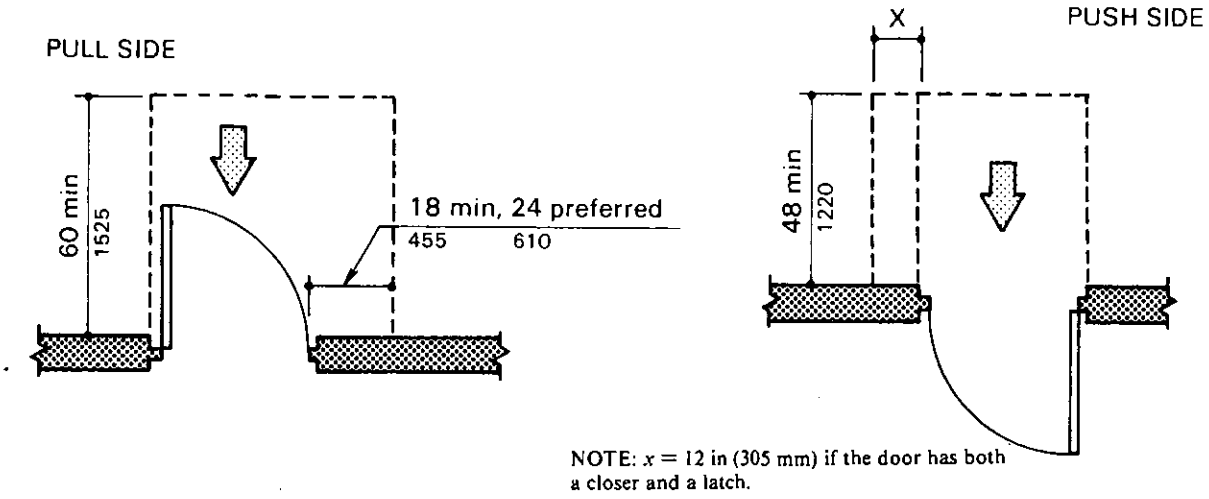


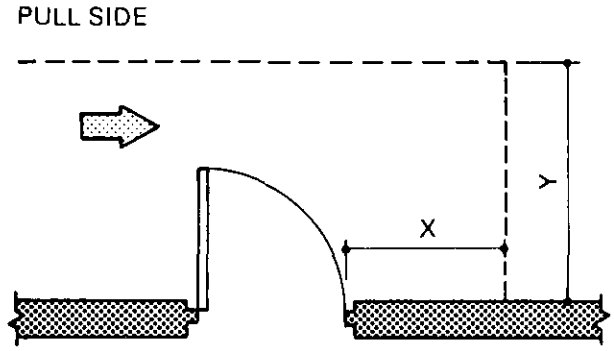
Figure 5. Gate that is cable-supported from a side post.

Front Approaches — Swinging Doors

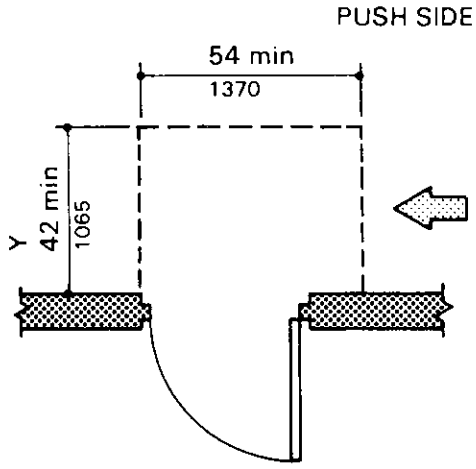


NOTE: x = 12 in (305 mm) if the door has both a closer and a latch.

Hinge-Side Approaches — Swinging Doors



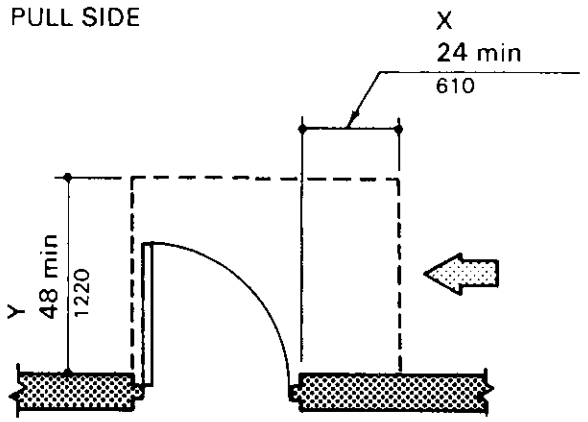
NOTE: x = 36 in (915 mm) minimum if y = 60 in (1525 mm); x = 42 in (1065 mm) minimum if y = 54 in (1370 mm).



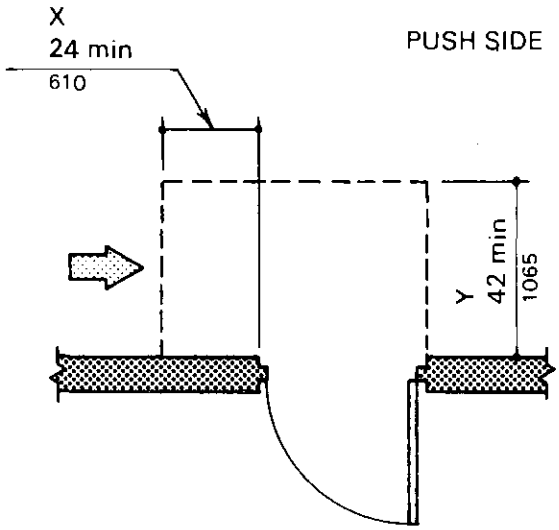
NOTE: y = 48 in (1220 mm) minimum if door has both a latch and a closer.

NOTE: All doors in alcoves shall comply with the clearances for front approaches.

Latch-Side Approaches — Swinging Doors



NOTE: y = 54 in (1370 mm) minimum if the door has a closer.



NOTE: y = 48 in (1220 mm) minimum if the door has a closer.

Figure 6. Minimum recommended wheelchair maneuvering clearances around doors and pen gates. (American National Standards ANSI A117.1-1986).

to improve pit access for mobility impaired operators. Ramps should slope no more than 1 in 12 feet from an adjacent milk room (Figure 4). An aisle at pit level should extend into the holding pen through a fenced alleyway. Other considerations may include hanging milking equipment from the ceiling rather than mounting it on the floor and utilizing automated animal movement equipment such as electric, motor-driven crowd gates.

Stanchion barns, more prevalent on smaller dairy farms, present different challenges for operators with mobility-limiting impairments. Unlike parlors, both cows and operators are on the same level, eliminating the need for stairs or ramps. However, stanchion barn milking requires that the operator be able to reach under the cow to attach the milker to the udder and move relatively quickly from one stanchion to another between cows and over manure gutters. While this arrangement may not be appropriate for operator who uses wheelchairs, persons with less restricted mobility (e.g., cerebral palsy, knee or hip replacement, arthritis) may be able to adapt the facility for functional use. Automatic-catch stanchions and auto-takeoff milkers can reduce the degree of physical effort and movement required in stanchion barn milking. Installing grate "bridges" over manure gutters at access points between stanchions can also facilitate movement. Slotted or partly-slotted floors in the stanchion area may eliminate the need for gutters entirely. Other considerations may include easy-attaching hose couplers for milking machines, and applying "barn lime" to concrete floors to absorb moisture and provide more stable footing.

Other Livestock Activities

Sorting and loading animals can be extremely difficult for farmers with disabilities because these procedures have not yet been automated to any significant degree. An obvious suggestion is to use gooseneck trailers or depressed truck parking ramps to eliminate the need for an inclined loading chute. This is probably one area in which assistance from more mobile persons will be needed.

WASTE HANDLING

The most practical waste handling system for confinement facilities may be a large manure storage pit beneath slotted floors, and contracting a custom manure hauling service to remove and spread the manure on cropland. Though the cost of custom hauling is often as much as the approximate fertilizer value of liquid manure, this option may still be more cost effective than purchasing waste handling equipment.

Another possible system for confinement operations is the use of automated open-gutter scraper units, or using a tractor to scrape below slotted floors. These methods involve collecting waste at one end of the barn and then pumping or otherwise conveying it to long-term storage. One manufacturer produces a rear load-unload liquid manure tanker wagon that can be backed down a ramp directly into a below-ground earthen manure storage. This eliminates the need for an

auxiliary tractor and manure agitation pump; thus, the operator does not have to mount and dismount a tractor each time the tanker is loaded. Bedded floors common in conventional livestock facilities and shed-and-lot operations commit the producer to a solid manure system in which fresh bedding must be stored nearby and added periodically to keep livestock areas dry. Pens can be cleaned with a front-end loader, and the waste hauled with a solid manure spreader. Normally, this system would require that the operator either change tractors or hitch and unhitch the spreader each time the spreader is loaded. Fitting a tractor with an automatic hitching device will enable the operator to both clean pens and pull a manure spreader without changing tractors.

FEEDING

A stationary, centralized bulk feed storage and processing center is probably the most useful and efficient system for many producers with disabilities. Centralized feeding units make it possible to utilize automated feeding systems in confinement facilities. Depending upon the manufacturer and the local equipment supplier, it may also be possible to purchase an annual maintenance contract for automated equipment. Centralized storage and mixing of feed also facilitates more efficient feed handling and distribution for conventional barns and outdoor pens. See Chapter 6, "Storing and Handling Grain, Hay and Silage," and Chapter 8, "Ranch Accessibility," for more discussion on feed handling methods.

ENVIRONMENTAL CONTROL

Most ventilation systems in confinement facilities can be almost entirely automated to respond to changes in building temperature. Solid state control packages are available to interlock the ventilation fan capacity, the air inlet system, and the heating system to maintain the desired temperature with very little operator intervention.

Temperature-controlled winches are also available to open and close sidewall ventilation doors in naturally ventilated buildings. This should also minimize operator involvement in maintaining the desired building environment.

SUMMARY

Before undertaking any new construction or major remodeling project, it is wise to prepare a full worksite assessment and thorough cost analysis. Though modification to livestock housing facilities is possible, the wider aisleways and pen widths needed by individuals with limited mobility are almost certain to increase unit building costs over conventional construction. Altering existing structures to provide improved access, though not as expensive as new construction, may not always be cost effective when considering the degree of improved access.

Nonetheless, many automated practices available today can reduce labor requirements and provide better control over facility environment, feeding processes, and other livestock production practices. While some types of farm buildings may be too complicated to modify inexpensively for use by farmers with disabilities, simple and practical modifications can often enable these farmers to continue to produce livestock efficiently. By wisely applying available technology, it is possible to provide a safe and comfortable work environment for both producers and livestock.

EDITOR'S NOTE:

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RESOURCES

MWPS-6: Beef Housing and Equipment Handbook (4th ed.), 1983. Midwest Plan Service. Ames, IA: Iowa State University.

ID-93: Considerations in Selecting Dairy Calf Housing, 1973. Moeller, N.H., and Friday, W.H. West Lafayette, IN: Purdue University Cooperative Extension Service.

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ID-109: Handling Facilities for Beef Cattle, 1976. Singleton, W.L., Nelson, L.A. and Jones, D.D. West Lafayette, IN: Purdue University Cooperative Extension Service.

NRAES-37: Planning Dairy Stall Barns (rev. ed.), 1988. Irish, W. and Frabes, R. Ithaca, NY: Northeast Regional Agricultural Engineering Service, Cornell University.

MWPS-3: Sheep Housing and Equipment Housing (3rd ed.), 1985. Midwest Plan Service. Ames, IA: Iowa State University.

MWPS-8: Swine Housing and Equipment Handbook (4th ed.), 1983. Midwest Plan Service. Ames, IA: Iowa State University.

Livestock Building Accessibility Checklist

This is a checklist of problems that farmers, ranchers or family members may face in making livestock buildings accessible. Potential solutions are suggested for each problem listed. Individual abilities must be considered before making any decision regarding which solution to use.

Problems	Solutions
General Building Access	
❑ Thresholds and curbs are too high.	• Make curb cut-outs and remove high thresholds where possible.
❑ Aisles are not wide enough to provide for wheelchair access.	• Adjust size of portable pens to allow wider aisles. • Clear equipment, tools, feed, and other items from aisles.
❑ Pen partitions are too high to reach or see over.	• Replace tall pen partitions or panels with shorter panels appropriate for the type of livestock.
❑ Partition corners and other protrusions present safety hazards.	• Cover protrusions with padding. • Mark hazards with burlap feed sacks or pieces of hose or twine.
Access to Animal Pens	
❑ Floors of pens are not clean or free of excess bedding and manure.	• Keep pens clean and free of packed manure. • Use alternative bedding material such as wood chips or shredded paper. • Install slotted or partly-slotted floors. • Use mobility aid with wide, flotation tires.
❑ Slot widths in slotted floors cause wheelchair/cane problem.	• Use wider tires or cane/walker tips. • Replace slotted floors with woven wire or punched metal flooring.
❑ Animals in elevated decks or nursery pens are not easy to reach from a wheelchair.	• Raise decks to 12-19 inches to be within easier chair reach. • Install swing-in or swing-up gates. • Use heated creep-feeder to capture young animals. • Use padded animal hook to snare young animals.
❑ Pen/stall gates do not swing open easily.	• Install double-hung or cable-suspended gates to reduce weight and sag (allow 2 inches clearance under gate).
❑ Aisles do not provide enough clearance to open gates and enter pens.	• Rearrange pens to allow at least 4 feet of aisle clearance. • Install sliding gates.
❑ Gate latches difficult to manipulate.	• Replace small hooks and chains with lever-action mechanisms and self-locking latches.

Problems	Solutions
Milking Parlors & Stanchion Barns	
❑ Parlor pit is inaccessible by wheelchair users and other restricted-mobility persons.	• Install a ramp sloped 1:8 from the adjacent milk room. • Raise floor of pit (make more shallow) in new parlors.
❑ Pit design does not allow easy wheelchair movement and access to cows.	• Cantilever the cow platform further into the pit area to provide more knee clearance. • Construct circular or carousel parlor when upgrading facility.
❑ Milking equipment is difficult to reach and manipulate.	• Hang milkers from ceiling or from overhead piping system. • Utilize auto-takeoff milkers. • Use easy-attaching hose couplers on stanchion barn milkers.
Livestock Handling	
❑ Animal loading presents problems for mobility-impaired operator.	• Use gooseneck trailer or depressed parking ramp to eliminate need for inclined chute. • Use assistance of others.
Waste Handling	
❑ Cannot operate manure handling system efficiently and independently.	• Contract with custom hauling service to remove manure from storage pit beneath slotted floor barn and spread on cropland. • Use automated open-gutter scraper unit to convey manure to long-term storage. • Use tractor to scrape manure from beneath slotted floor barn. • Use rear load-unload manure tanker wagon to remove manure from below ground storage.
❑ Bedded-pen manure removal system has drawbacks.	• Utilize a tractor fitted with an auto-hitch device to clean pens and pull manure spreader (eliminates need to change tractors).
Feeding	
❑ Feed must be lifted and carried between pens and buildings.	• Use centralized bulk feed system and automatic feed delivery system, self-propelled feed cart, or auger truck.
Environmental Control	
❑ Barn ventilation system not easy to operate without assistance.	• Install automated system with solid-state control package to link fan capacity, inlet system, and heating system. • Use temperature-sensitive winches to open and close side-wall ventilation doors.

8. Ranch Accessibility

Worksite accessibility and task-oriented concerns for livestock operators with physical disabilities sometimes differ from the accessibility concerns of their crop farming counterparts. While many tasks and activities are indicative of both cropping and livestock operations, certain agricultural activities are unique to ranching — those agribusiness operations consisting primarily of livestock production and their supporting forage production enterprises.

Each ranching operation, however, is unique, and each individual has unique needs, expectations and abilities. This chapter provides guidelines for making livestock operations, in general, more accessible and "user friendly" for operators with physical disabilities.

Our discussions will be limited to the general aspects of livestock production, specifically range-type livestock operations, and will address basic solutions and modifications that can be readily adopted and implemented. The primary topics addressed in this chapter include:

- transportation and general mobility
- access to pastures and pens
- livestock care and handling
- feed handling, and
- miscellaneous work activities.

These topics are divided into two parts;: 1) general mobility and access, and 2) work activities.

GENERAL MOBILITY AND ACCESS

Transportation and General Mobility— Staying on the Move

The ability to travel and move freely throughout the workplace is basic to establishing work independence. For a ranch operator, this fundamental need for independent mobility is complicated by what could be called a "mileage factor." On a typical ranch, pastures and hay meadows may cover many square miles and be located long distances from the ranch headquarters.

The ability to travel to remote locations over varied terrain and surfaces is essential for monitoring livestock, checking fence-lines, and performing other routine ranch tasks. For an operator with a mobility impairment, such travel may pose a serious challenge, in which case a reliable mode of transportation is invaluable.

The 4-wheeldrive (4-WD) pickup truck is still the choice vehicle for long-distance and heavy ranch work. However, when traveling shorter distances in good weather, working stock, or

performing "lighter" chores, a four-wheel all-terrain vehicle (ATV) with modified controls and seating may be a more appropriate mobility aid. For operators with limited upper torso movement, four-wheel utility vehicles such as the Kawasaki "Mule" may be more convenient. These vehicles are low to the ground, provide easy transfer access for the driver, room for one passenger, and come equipped with a 4′ x 4′ tilt cargo bed.

Using open pastures requires additional considerations of how animals will be herded and corralled. Care must be used when considering the size and temperament of the animals to be handled (see "Livestock Care and Handling Practices"). Operators with very limited mobility may wish to use the larger six and eight wheel, skid-steer ATVs. Their size and design would normally protect operators from all but the larger breeds of horses and cattle, while still providing the "cut and turn" maneuverability needed for herding.

Certain tasks may require a combination of both a 4-WD and a smaller, more maneuverable vehicle. To accommodate this need, some operators utilize hoists and chair lifts to load ATVs or wheelchairs onto a pickup or trailer for transport to remote work locations.

Vehicles should be adapted to accommodate the specific abilities of the driver to assure optimum utility and safety. Hand controls, special restraints and seating may be required to ensure safe operation. All vehicles should be equipped with communication devices. Vehicles with cabs should be equipped with air conditioning and heating systems for operators with limited or no ability to regulate their body temperature (e.g., persons with multiple sclerosis or a spinal cord injury). Other considerations for trucks or jeeps include "on-the-fly" 4-WD versus standard hub-locks, a chair-lift or hoist for transfers and an extended cab to allow space to stow a wheelchair.

Transportation and Mobility Summary:

- Assess mobility needs (traveling distance, nature of task, and required maneuverability).
- Select proper vehicle: 4-WD vehicle, ATV, or other utility vehicle.
- Ensure safe operation by using appropriate controls, seating, communication devices and safety belts.

Pasture and Pen Access —The Ins and Outs

Everyone knows opening and closing the wire gates found on most ranches is an undesirable and sometimes difficult job. That's why no one ever volunteers to sit next to the pickup passenger door. For individuals with certain physical disabilities, opening a gate is more than just an inconvenience; it may be virtually impossible. The ability to move easily through gates to pastures, pens, hay meadows, and other work areas is critical to an operator's ability to complete work tasks independently and efficiently.

Improving gate accessibility usually requires a certain degree of modification. The extent to which a particular gate should be modified depends upon the operator's level of physical ability and the gate's usage. Be aware that operators with spinal cord injuries or other more serious mobility limitations will likely remain in, or on, their vehicle while moving through a gate. To accommodate these persons, main entrances and other gates used most frequently should be replaced with cattle-guards where economically feasible. Gates used less frequently may be replaced with drive-through or automatic gates. This option may be preferable for individuals with limited, but functional, upper torso movement.

Though a wide variety of automatic gates are available commercially, home engineered designs often work as well, and usually cost much less. For example, one individual with a spinal cord injury constructed an electrified drive-through gate from polyvinyl chloride (PVC) pipe. The gate, operated only by rubber tarp straps, allows him easy access to his calving pasture (see Figure 1).

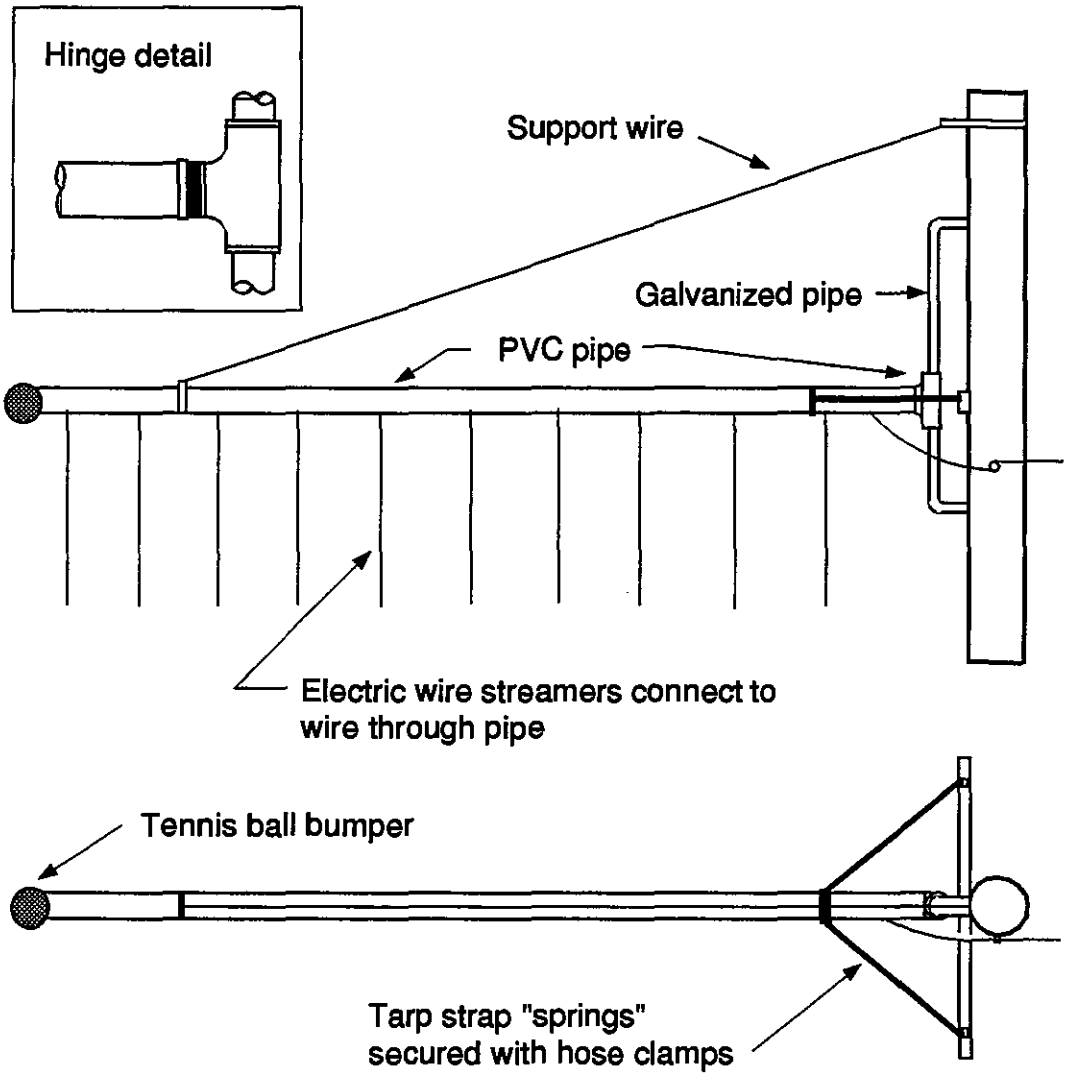

Figure 1. Electrified PVC drive-through gate.

Operators with spinal cord injuries who have good upper body strength, or individuals with hand/arm amputations or arthritis, may choose to install easy-operating latches or free-swinging, cable-suspended gates, rather than automatic models or cattle-guards. In some instances, improving gate access can be as simple as using a fence-stretcher or "come-along" to close standard wire gates. The primary goal should be to allow easy, independent access to as many work areas as possible.

Pasture/Pen Access Summary:

- Determine need for gate modifications (level of mobility, frequency of gate use).
- To accommodate a severe mobility impairment, replace frequently-used gates with cattle-guards where appropriate. Replace other gates with drive-through or automatic gates where possible.
- To accommodate less severe impairments, replace gates with free-swinging, easy-latch gates where cattle-guards or drive through gates are not possible. Use fence-stretcher or "come-along" to close standard wire gates.

WORK ACTIVITIES

Livestock Care and Handling Practices

Working with livestock always involves a certain degree of risk. These risks should be considered when determining the degree to which an operator with a physical disability will work with livestock.

The physical ability and confidence of the individual rancher will determine which livestock-related tasks can be realistically and safely accomplished independently, which will require assistance, and which should be delegated to others. In general, as an individual's level of mobility and physical ability decreases, the amount of direct contact with livestock should also decrease. Operators with more serious mobility impairments have found that it is often more practical and safer to allow employees or others to handle the tasks requiring direct contact with livestock.

In many cases an operation can be adapted to accommodate an operator's abilities. Individuals with sufficient mobility are often capable of safely performing livestock-handling tasks with the aid of devices or facilities designed to restrain or control livestock. For example, an operator with a hand or arm amputation could utilize a small squeeze chute or "calf table" to independently restrain a small animal to administer medical treatment or perform other routine activities. Livestock magazines and equipment catalogs can serve as good sources for adaptive aid ideas. Be aware, however, that each person's needs and abilities are unique. Adaptive equipment must be used in a safe and proper manner and should appropriately accommodate the operator's abilities.

In certain situations, it could prove beneficial to convert an operation to one better suited to the operator's resources. A labor-intensive cow/calf enterprise, for instance, could possibly be converted to a summer yearling operation. Other options could include switching livestock species, from beef to sheep or, dairy cattle to dairy goats, or share-cropping to optimize the use of labor and financial resources.

The decision to install modifications or alter livestock management practices should be deliberated carefully and should include an examination of such factors as the cost of modification, availability of alternative labor, and the necessity of the task or activity. Often, livestock-oriented activities can be made more accessible with very basic changes in handling practices or by altering facility layout.

Efficiency and productivity can be improved by eliminating unnecessary or redundant activities, particularly when handling livestock. Good management practices, appropriate facility design and proper handling methods save time and labor and minimize stress and risk of injury for livestock and operator alike. Working facilities, for example, should be of sturdy construction, located in a well-drained area, be free of sharp edges or protrusions, and should allow for unobstructed livestock traffic flow (see Figure 2).

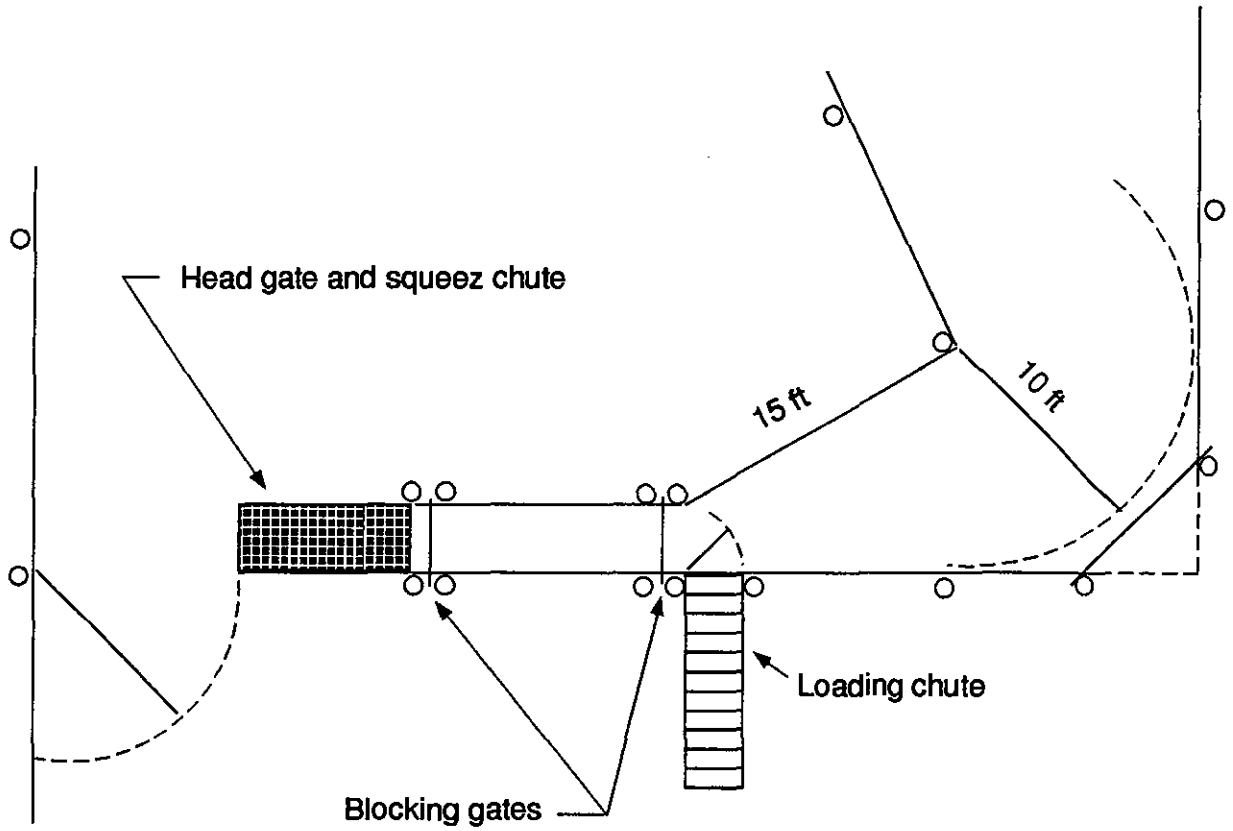

Figure 2. Basic handling facility easily constructed in existing lot.*

* Adapted from Handling Facilities for Beef Cattle, ID-109, Cooperative Extension Service, Purdue University.

For information concerning improving livestock facility accessibility see Chapter 8, "Livestock Buildings." For more information regarding facility design, consult your county Cooperative Extension Service. Your county extension educator can provide you with handbooks and designs for improving livestock handling and housing facilities.

Moving, Gathering and Sorting Stock. A very common and necessary activity in any ranching operation involves moving large groups of livestock from one pasture to another, or from a pasture to holding pens and working facilities. The methods of moving livestock can vary greatly. Operators commonly utilize riders on horseback, stock dogs, ATVs, 4-WD vehicles, and various combinations of these and other methods.

Some activities, however, involve moving only individual animals, pairs, or small groups. By utilizing an ATV or similar vehicle as a "saddle horse," many operators can often accomplish this task independently. Well trained stock dogs can also be very useful for moving stock, particularly in areas difficult to negotiate with an ATV, such as rocky terrain, or heavy brush or timber.

Safety Precautions. Safety must be a primary consideration when working with livestock. Operators must avoid placing themselves in hazardous situations and "tight spots" when handling animals, or in situations in which they must work alone or in an isolated area. Operators should always carry a reliable communications device to alert others in the event they need assistance. Use animal restraining devices properly when such equipment is required.

Livestock Handling Summary:

- Determine whether operation can be modified to accommodate the rancher's level of physical ability or if fundamental changes should be made in the enterprise. Be realistic and think long-term.
- Determine which livestock-oriented tasks can be realistically completed safely and independently and which should be delegated to others.
- If necessary, modify handling facilities to improve livestock handling efficiency.
- Use an ATV or other small utility vehicle to move or gather stock. Utilize trained stock dogs when possible.
- Take safety precautions. Carry a communications device to alert someone in case help is needed.

Feed Handling

Standard methods of handling livestock feeds such as hay, cake feed, concentrates, and salt/mineral supplements in large operations often involve using mobile feeding equipment such as hay choppers and spreaders or portable grain augers. Some operators have developed variations on this

theme, using forklifts or other implements to spread round hay bales in pastures. The common denominator among many successful feed handling practices is mechanization and eliminating the need to move, lift, or distribute feed by hand.

Solutions to feed handling problems need not be expensive, however, and are often homemade "cowboy-engineered" modifications. In one case, a rancher with a leg amputation designed a means to feed cake using a 55-gallon drum mounted on the arms of the Do-Eez™ hay feeder on his flat-bed truck. He dispenses the cake by raising the feeder's hydraulic arms (controlled electronically from the truck cab), which tilts the drum and distributes the contents evenly as the truck moves through the pasture.

Distributing small loads, carrying single square bales or grain sacks, and other light feeding chores can usually be accomplished by using an ATV or other small utility vehicle. Even in larger operations, small jobs can require the attention of the ranch manager. In range conditions, for example, operators usually prefer to oversee the placement of salt and mineral blocks and feeders because the location of feed supplements plays an important role in grazing management and pasture use.

Feeding grain and other concentrates often presents an additional challenge during feeding activities because the operator may need to move in and around animals in a confined area while distributing the feed. By mechanizing the feed delivery process, the operator can reduce direct animal contact and physical exertion. Carefully arranged pens and feed bunks can also ease the process. Locating feed bunks along fence-lines or arranging them in a large pen permits more convenient feed delivery via auger truck or wagon (see Figure 3). Utilizing overhead, drive under storage grain bins (see "Access to Bins" in Chapter 6), the rancher then has the option of using tractor-pulled feeder-wagons, dump trucks, or pick-ups with side delivery feeder bins to handle grain and concentrated feed rations or "range cube" cake rations. These systems can be set-up to operate totally from the driver's seat. When feeding in a pen rather than fence-line arrangement, deliver feed to bunks before allowing livestock in the feeding area. This avoids unnecessary congestion and reduces risk of injury to both operator and animals.

Feed Handling Summary:

- Mechanize feeding operations whenever possible, particularly hay and cake feeding.
- Reduce feed handling (See Chapter 8, "Grain, Hay and Silage Storing and Handling").
- Increases delivery efficiency by reducing direct contact with livestock and modifying feed area arrangement to optimize movement of operator and livestock.

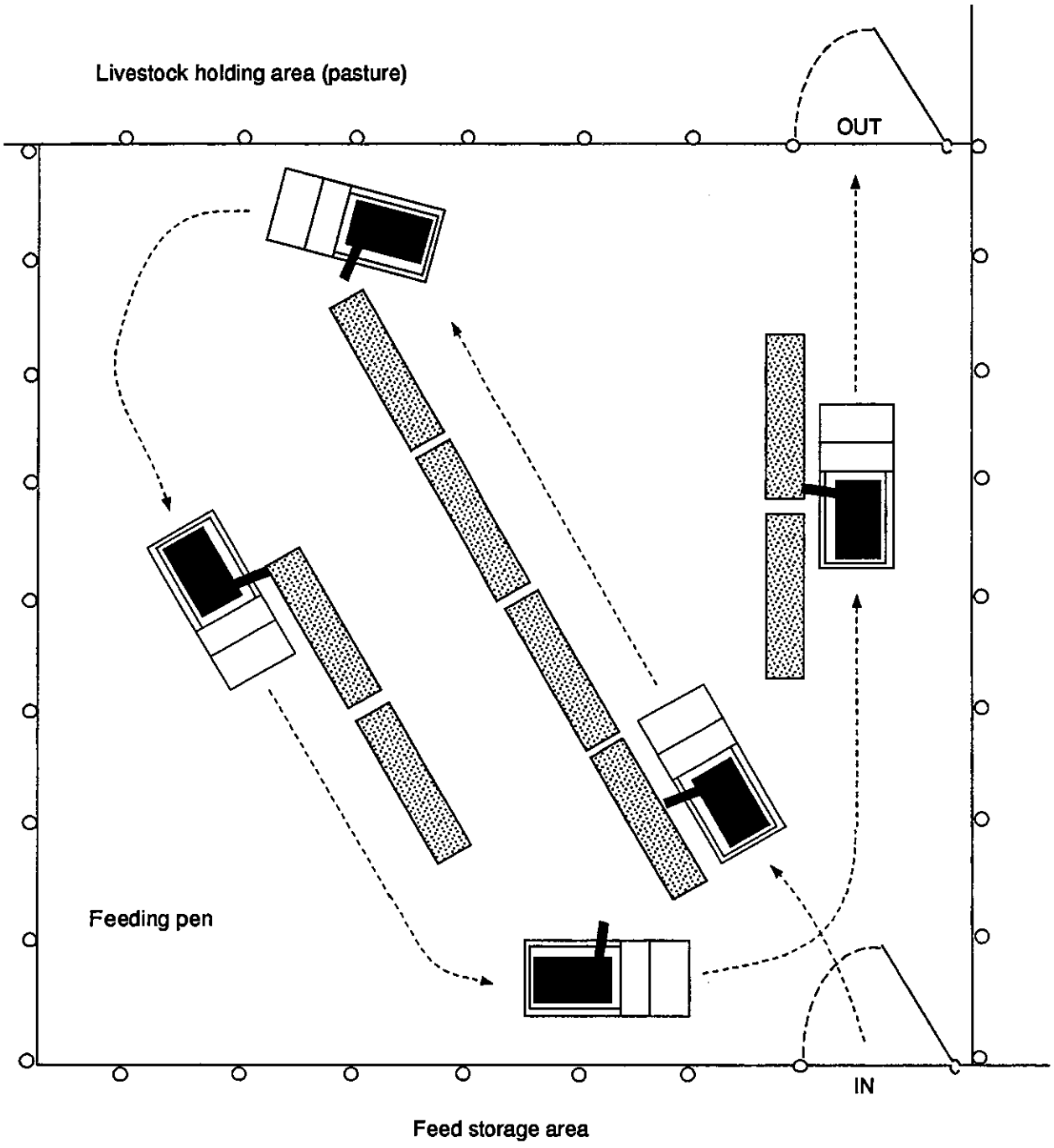

Figure 3. Feed bunk arrangement optimizing auger truck.

Miscellaneous Work Activities

Tasks requiring the use of tractors or similar equipment, such as hay harvesting, irrigating, and fence construction, can often be accomplished by utilizing equipment modified with controls and

safety features designed to appropriately accommodate the abilities of the operator (see the resource list at the end of this publication for information on assistive devices and worksite and equipment modifications).

SUMMARY

The major concerns of ranch worksite accessibility involve transportation and general mobility, access to pastures and pens, livestock care and handling, and feed handling. The following accessibility issues should be given special consideration. First, ensure that vehicles are capable of traveling to remote locations over varied terrain and surfaces. Vehicles should be adapted to accommodate the specific abilities of the driver to assure optimum utility and safety. Secondly, pasture and corral gates should be modified to allow "hands-free" operation whenever possible. Third, automated systems, whether commercial or homemade, should be a primary consideration for labor intensive feed handling activities. Finally, working with livestock always involves a certain degree of risk. Determine whether the operation can be modified to accommodate the rancher's level of physical ability, or if fundamental changes should be made in the enterprise. Be realistic and think long-term. Certain livestock-oriented tasks can be completed safely and independently, but recognize that "high-contact" tasks may best be delegated to others. Safety must be a primary consideration when working with livestock.

RESOURCES

MWPS-6: Beef Housing and Equipment Handbook (4th ed.), 1971. Midwest Plan Service, Ames, IA: Iowa State University.

MWPS-15: Horse Housing and Equipment Handbook (4th ed.), 1971. Midwest Plan Service. Ames, IA: Iowa State University.

MWPS-3: Sheep Housing and Equipment Handbook (3rd ed.), 1971. Midwest Plan Service. Ames, IA: Iowa State University.

Other sources to consider for information regarding improved management practices: Livestock Associations, County Extension Agents and University Livestock and/or Range Management Specialist.

Ranch Accessibility Checklist

This is a checklist of accessibility problems that farmers, ranchers, or family members may face in making their ranch accessible. Potential solutions are suggested for each problem listed. Individual abilities must be considered before making any decision regarding which solution to use.

Problems	Solutions
Access to Pens/Pastures	
❑ Corral and pen gates are difficult to open and close.	• Install one-handed, "easy-latch" gate latches. • Install free-swinging, cable supported gates.
❑ Wire pasture gates hard to open and close.	• Use "come-along" or fence-stretcher to open standard wire pasture gates, or install lever-action closing device. • Install cattle guards.
❑ Level of mobility requires remaining in/on the vehicle.	• Install cattle guards between pastures requiring most frequent access. • Install drive-through or automatic gates.
Livestock Handling/Care	
❑ Gathering/moving livestock from/to pastures is a problem.	• Use ATVs, 4-WD vehicles, and trained stock dogs more extensively.
❑ Animals are difficult to capture or bring in from pastures for medical treatment.	• Use a syringe dart rifle to administer vaccinations to sick animals in pasture.
❑ Feeding "cake" and grain supplements to livestock in pastures difficult.	• Use feed bin with electrically-controlled automatic auger to dispense feed from pickup truck.
Safety Concerns	
❑ Mobility impairment prevents escape from the vehicle in case of fire.	• Carry fire extinguisher and portable communications device on all vehicles, including ATVs.

9. Farm/Ranch Accessibility and Safety

With increased accessibility around the farm can come increased risks. Avoiding injury or the potential for injury should be a main concern for all farmers and ranchers. It is important for one to control situations that may present the potential for injury in his/her farming or ranching operation. By making adaptations or corrections in unsafe work areas, situations that could cause serious injury or even death can be avoided.

The following information does not cover all aspects of farm and ranch safety. It does provide some general guidelines for safety that are especially relevant to the farm or ranch operator who has a physical disability.

FIRE PROTECTION

Fire is a major threat to anyone. When mobility is restricted by a physical disability, rapid evacuation of a combine, tractor, or building may create even more serious risks for the individuals.

Since fire is always a threat in the agricultural workplace, it is a good idea to take precautions in the event of a fire emergency.

- Make sure that all self-propelled machinery is equipped with a communication device. In the event a fire does get started, it will be important to call for assistance immediately. (See the following section, "Communication.")
- Have portable fire extinguishers placed in strategic locations, including self-propelled machinery as well as buildings. Several farmers have used extinguishers in their combine cabs to put out potentially serious, even life-threatening fires. Garden water hoses connected to a water supply can provide a backup to extinguishers in some locations.
- Keep the inside and outside of buildings free of trash. An accumulation of trash allows the opportunity for fires to start.
- Gasoline, fuel oils, liquid petroleum (LP) gas, other flammable liquids and gasses, and anhydrous ammonia should be stored at least 75 feet from buildings.
- Keep all emergency phone numbers, especially fire department and emergency response services, posted near each phone.

COMMUNICATIONS

In agriculture, communication between workers is an essential part of reducing the potential risk of injury. Communication is achieved by: 1) proximity to other workers, and 2) communication equipment.

Farmers with disabilities, as with all farm operators, should avoid working alone or working in isolated areas. Communication in these instances is cut off, removing the possibility of summoning assistance from others to avoid an accident or to conduct a rescue following an accident. If the operator still chooses to work alone, he or she should tell others what jobs will be performed, where they will be, and the length of time the jobs will take to complete.

Many farmers and ranchers have had accidents, equipment fires, and breakdowns that could have been prevented by a quicker means of communication. The time and money lost in these incidents would have made communication equipment a worthwhile investment. Having a physical disability makes it more imperative to plan for these problems and have effective communication equipment.

- Cellular phones have become a popular communication item on the farm. They can be stationary in one vehicle, movable from one vehicle to another, or totally portable using a battery pack. An individual with a cellular phone can call anyone with a regular or cellular phone.
- Frequency modulation (FM) or two-way radios are a practical means of communicating with co-workers and family members. They are very effective when you need to communicate simultaneously with several mobile or portable units.
- Citizen Band (CB) radios have been used by farmers as a source of communication for many years to talk to family members from the field. CB radios are the cheapest to own and operate, and are relatively easy to install in a vehicle or tractor.

When operating FM and CB radios, there must be another party on the receiving end of the radio, and the radio must be turned on, or the message will not be heard. This is a major disadvantage compared to the cellular phone.

ALARMS/HAZARD WARNINGS

Alarms, horns, and high-pitched sirens can be used to alert others to problems that a farmer or rancher might face. Items such as this may be applicable around the farm shop or in areas where others are in close proximity, but may be impractical when the farmer is working alone. The farm operator who experiences a problem may be at a great disadvantage if he or she is too far from others for the alarm to draw their attention. Another problem may exist if others are operating machinery in the area and the alarm goes unnoticed because of the noise generated by machinery.

Another alert device is a strobe or flashing light. Such lights are relatively inexpensive and can be easily carried by the farmer. Hand-held models are available that run on battery packs. Again, the device can be very effective if others are in the immediate area and are able to recognize that help is needed. A major disadvantage to using a strobe light is that it may be less likely to be seen during daylight hours even if others are in close proximity. Devices such as this are most effective during the evening hours.

Alarms and hazard warnings should not be considered as a main source of communication. If an extreme emergency should occur, a farmer needs to have a more reliable means available to get help. Horns, sirens, and flashing lights can be incorporated as a means of secondary communication, with cellular phones or radios being the primary communication means.

MOBILITY

When a farmer or rancher is faced with a physical disability, mobility can be a problem. The functional ability of a farmer or rancher with a physical disability varies considerably because of the level of his/her disability and personal characteristics. Other factors can influence mobility, too. A few examples may be terrain, climate, and poor weather conditions.

- Accessibility in and out of farm buildings and equipment can be a major problem, especially in an emergency.
- The possibility of being stranded with equipment failures is a major concern when mobility is limited. This is another example of where communication devices are an important asset when working in and around the agricultural worksite.
- Improperly designed assistive equipment, such as lifts and hand controls, may present a great potential for injury, especially if the assistive equipment has been locally designed with little or no regard to established engineering standards. Where mobility is concerned, it is a must that assistive equipment be designed with safety in mind.

GUARDING HAZARDS

With agriculture being one of the most hazardous occupations in the United States, safeguarding against potential hazards should be recognized as a primary concern. Risks associated with hazardous farm-related tasks can be reduced by being aware of where these dangers exist, then putting appropriate guards into place or taking corrective action.

Here are a few examples of what can be done to guard against hazards on a typical farm or ranch. Many can be regarded as "common sense" rules, but these are precisely the rules that are many times overlooked until it is too late. By then, the farm operator or co-worker has been injured.

- Make sure all walkways, doors, ramps, and heavily traveled areas in and around farm and ranch buildings are free of trash, manure, snow, mud, and debris which may hinder mobility.
- Ramps and steps should be protected from freezing rain or snow/water that could freeze.
- Shields and guards need to be in place when operating agricultural machinery.
- Proper lighting is necessary when working during the nighttime hours or in dark areas of farm buildings or the shop.
- Outdoor ramps exposed to the weather should have a slope no greater than 1:20.
- Fire extinguishers should be readily available in all farm buildings and equipment.
- Personal protective equipment such as earplugs, goggles, dust masks, and rubber gloves should be worn when performing tasks that demand their use.

COMPANION OR WORKING DOGS

Many people have a strong relationship with their dog as a friend, companion, and even co-worker. Dogs have been used for years to aid in the mobility of individuals with physical disabilities. Seeing-eye dogs have helped those who are visually-impaired. Dogs are used on farms and ranches to herd livestock and do the work that would normally take several humans to accomplish.

A properly-trained dog can make working livestock a much safer and easier chore especially when a farmer or rancher's ability to perform certain tasks is hindered because of a disability. Many of these working dogs are even able to "single out" an animal from a herd and guide the animal exactly where it is needed.

Several breeds of working dogs are known for their "livestock sense," where they are bred for their ability to work well with livestock. Most working dogs respond to voice commands and/or hand signals. The Border Collie, Australian Shepherd, and Red/Blue Heelers are common breeds used to assist in many farming and ranching operations.

Whether the job could be made safer, or a companion is needed, a dog is one of the best choices a farmer or rancher with a physical disability could make. A dog truly is man's best friend, and sometimes his hardest working employee.

SUMMARY

This chapter has discussed several areas where the potential for injury can be reduced. Each area is important and should be given consideration by all farmers and ranchers to ensure their own safety as well as that of family members. A checklist is included which may help an individual spot trouble situations before a serious injury occurs.

RESOURCES

Assistive Communication Devices for Farmers and Ranchers with Physical Disabilities, Plowshares #16: A Special Breaking New Ground Technical Report, 1992. Sillery, B. and Allen, P.B. West Lafayette, IN.

Fundamentals of Machine Operation: Agricultural Safety, 1987. Bittner, P.H. Deere and Company, Moline, IL.

Potential Health and Safety Risks of Farming with Physical Handicaps, Plowshares #1: A Special Breaking New Ground Technical Report, 1983. Tormoehlen, R.L. and Field, W.E. West Lafayette, IN.

MWPS-1: Structures and Environment handbook (11th ed.), 1983. Midwest Plan Service. Ames, IA: Iowa State University.

Farm/Ranch Accessibility And Safety Checklist

This is a checklist of accessibility and safety problems that farmers, ranchers, or family members may face. Potential solutions are suggested for each problem listed. Individual abilities must be considered before making any decision regarding which solution to use.

Problems	Solutions
Fire Protection	
❑ Fire extinguishers not placed in strategic, accessible locations.	• Install extinguishers in self-propelled machinery as well as buildings. • In buildings, place fire extinguisher handles no higher than 48" above the floor for someone who uses a wheelchair.
❑ Tractors, combines and other self-propelled machinery are not equipped with communication devices.	• Install a citizen band (CB) or FM radio, or a cellular telephone in each machine. (See BNG Plowshares #16.)
❑ Trash and/or oily rags accumulated.	• Keep the inside and outside of buildings free of trash to reduce the opportunity for fires to start. • Keep exit paths and doorways clear of trash to allow an escape route if needed.
Communications	
❑ Tractors, combines and other self-propelled machinery not equipped with communication devices.	• Install a citizen band (CB) or FM radio, or a cellular telephone in each one. (See BNG Plowshares #16.)
Alarms/Hazard Warnings	
❑ Work environment or disability prevents shouting to bring assistance in an emergency.	• Install or carry an alarm, horn, or high-pitched siren that could alert others in an emergency.
Mobility	
❑ When equipment fails, operator becomes stranded.	• Always carry a communication device. • Tell others when and where you'll be working. • Wear clothing appropriate for the weather conditions.
❑ Farm buildings are not easily accessible (for entry and exit) in an emergency.	• Keep escape routes and doorways clear both inside and outside the building.

Problems	Solutions
Guarding Hazards	
❑ Shields and guards are not in place on agricultural machinery.	• Repair, replace, or purchase and install all recommended shields and guards.
Companion or Working Dogs	
❑ Operator exposed to unreasonable risk when working directly with livestock.	• Obtain a working dog. Common breeds are Border Collie, Australian Shepherd, and Red/Blue Heelers.