# how to build RAMPS for home accessibility

*4th edition*

THE HOME RAMP PROJECT
METROPOLITAN CENTER FOR INDEPENDENT LIVING

JIM RAMSTAD
THIRD DISTRICT, MINNESOTA

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July 23, 1993

John D. Walsh
Executive Director
Metropolitan Center For Independent Living
1600 University Avenue West
Suite 16
Saint Paul, Minnesota 55104-3825

Dear John:

As a person who has long been involved with issues of importance to persons with disabilities, I know very well the physical and financial barriers people face every day. The ramp design presented in this manual is an effective, low-cost solution to meet the access needs of persons with disabilities.

This unique and creative approach builds on the strengths of the community. It involves volunteers, ensures quality and safety, and can be adapted to an individual's situation. One of the most notable characteristics of the design is the modular system which allows the ramp to be reused time and again.

That same design also allows families to construct ramps at a much faster pace, when time is of the essence to get loved ones back together again.

I applaud the Metropolitan Center for Independent Living for their innovative approach to increased independence and access for people with disabilities.

Sincerely,

JIM RAMSTAD
Member of Congress

JR:lo

ACCESSIBLE

# RAMPS

## Volunteers:

The consumer is actively involved and utilizes their own support system; such as family friends, church members, etc.

## Lower Cost:

Consumer and volunteer involvement cuts cost in half!

## Quality:

Professionally designed and engineered. Supervision assures compliance with all building codes and proper construction.

## Versatile:

Modular units can be easily used at other locations Reuse is feasible and cost effective.

# *Resources*

**Independent Life Styles**
709 Mall Germain #200
St. Cloud, MN 56301
**320/529-9000** Voice/TTY
**320/529-0747** FAX

**CIL of Northeastern Minnesota,**
Mesabil Mall #11
Hibbing, MN 55746
**218/262-6675** Voice/TTY
**218/262-6677** FAX

**Southwestern Center Independent Living (SWCIL)**
109 South Fifth Street
Marshall, MN 56258
**507/532-2221** Voice/TTY
**507/532-2222** FAX

**Southern Minnesota Independent Living (SWCIL)**
109 South Fifth Street #700
Marshall, MN 56258
**507/532-2221** Voice/TTY
**507/532-2222** FAX

**Southeastern Minnesota Center for Independent Living (SEMCIL)**
1306 Seventh Street N.W.
Rochester, MN 55901
**507/285-1815** Voice/TTY
**507/288-8070** FAX

**Metropolitan Center for Independent Living (MCIL)**
1600 University Avenue West,
Suite 16
St. Paul, MN 55104
**651/646-8342** Voice
**651/603-2001** TTY
**651/603-2006** FAX

**Options, Interstate Resource Center for Independent Living**
318 Third Street N.W.
East Grand Forks, MN 56721
**218/773-6100** Voice/TTY
**218/773-7119** FAX

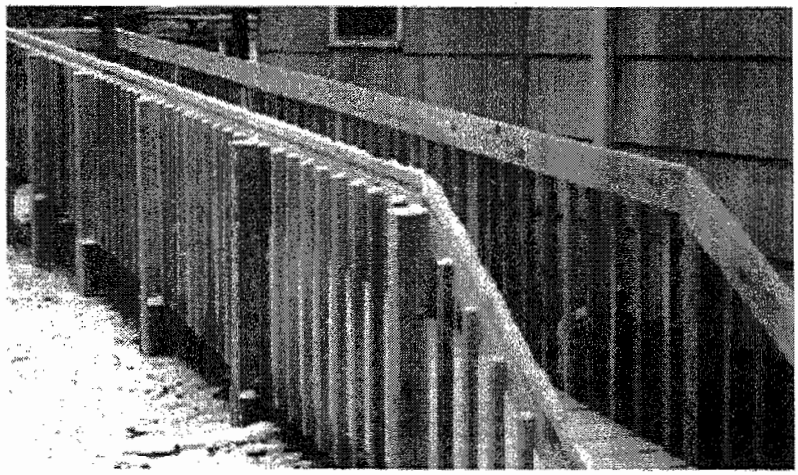
**Freedom Resource Center**
3505 8th Street South
Moorhead, MN 56561-0917
**218/236-0459** Voice/TTY
**218/236-0510** FAX

**Minnesota Housing Finance Agency**
Suite 300, Sibley Street
St. Paul, MN 55101
**612/296-7608**

**Breaking New Ground Resource Center**
Purdue University
1146 Agricultural/Engineering
Building, West Lafayette, Indiana
47907-1146

Contact the National Council on Independent Living (NCIL) for the name of Independent Living Center nearest you.

**NCIL**
2111 Wilson Blvd., Suite 405
Arlington, VA 22201
**703/525-3406** Voice
**703/525-3407** TTY
**703/525-3409** FAX
e-mail: **ncil@tsbbso2.tnet.com**



## *Making ramp accessibility more affordable and available!*

The Ramp Project began in the summer of 1991. We wanted to lower the costs of residential ramps, increase the speed of completion and involve consumers in an active role to solve their ramp access needs. The concept was to have one paid construction-site supervisor who would assist volunteers in the building of post and beam wheelchair ramps. Money was donated for a complete tool kit and an access design specialist was hired to design and supervise construction. Costs were significantly reduced and ten ramps were completed by mid-December (before frost).

The early success and increase in demands led to discussion about how to build in the winter months and how to make these ramps available for temporary usage. The modular system was the result. A professional engineer was hired to review, modify and provide evaluations of the design. The report was then reviewed by the Minnesota Department of Administration (copy of letter on page 16).

The final design has a 60 lbs. per square foot live-load capacity and does not need to be placed on frost footings. The design works well for short and long term use. The combination of supervised volunteers and a modular system has led to construction of hundreds of ramps in the metro area. Many ramps have already been reused at new locations at considerable savings.

The purpose of this manual is to distribute this knowledge and to encourage organizations on how to provide support for ramp projects of their own and their communities.

The Ramp Project goal is to help individuals and organizations increase quality of life and independence.

**The Ramp Project was honored as a finalist in the 1995 Ford Foundation "Innovations in American Government" award program.**

**The purpose of this manual is to make available sound wheelchair ramp design and construction principles and techniques to a wide variety of interested people and their communities.**

**This is a new concept in wheelchair ramp design. Modular components are used. No footings are required. The ramps are reusable and very adaptable to varied home situations.**

**The ramps are built quickly, safely and easily with the help of volunteers, informal support systems and families.**

**This unique process makes the ramps very affordable to all.**

This program started as a joint project of the Metropolitan Center for Independent Living, Minnesota Division of Rehabilitation Services, Multiple Sclerosis Society and United Handicapped Federation.

From a *Ramp Project Handout* used at the beginning of the program:

## RECYCLING ACCESS - COMMUNITY PARTICIPATION IN RAMP-BUILDING PROJECTS

This is a new project developed to provide wheelchair ramps for home access to people who have mobility needs. By recruiting the services of an access specialist and providing assistance in recruiting volunteers, training in basic construction techniques for volunteers and on-site construction assistance to volunteers, the cost of home ramps is significantly reduced. This frees up funds for other access requirements the person may have and allows more people with access problems to be served.

The project is co-sponsored by the Multiple Sclerosis Society of Minnesota, the Metropolitan Center for Independent Living, the United Handicapped Federation and the Minnesota Division of Rehabilitation Services.

Construction crews of 3 to 4 volunteers will be recruited for each ramp project. The time commitment will vary depending on the complexity of the ramp design. General skills required are post-hole digging, shoveling, using a power saw, nailing and lifting. We may eventually be involved in minor concrete work. This is a physically demanding project with eight-hour days scheduled. Volunteers with endurance limitations may wish to consult with project staff prior to volunteering.

This is a challenging and very rewarding volunteering opportunity. You will leave the project with the satisfaction of having contributed to a tangible, well-designed, well-built, functional access ramp, as well as the knowledge of having provided a fundamental necessity to someone.

**It is important to have one project supervisor (either paid or volunteer) who is knowledgeable in construction techniques. This will insure success of the ramp building project and participant safety.**

*Article from Ridgedale YMCA Newsletter, fall 1992.*

## ACTING ON ACCESSIBILITY

Through the National Youth Leadership Project, YMCA's
Minnesota Leadership for Empowerment Program, and the Center For Independent Living, a hands-on project for an inclusive group of youth was undertaken this summer. The project was to build wheelchair ramp sections. While planning the project, it was discovered that some of the participants helping to make the sections would themselves benefit from having a ramp. It seemed only natural for the group to build a ramp where the ramp would be appreciated day in and day out, by a youth, who himself, was there to help others. So the task was set and everyone involved worked with sincere dedication to making sure a quality ramp was built, and it was.

The Star Tribune even captured the moment in the paper. What a reward for a job well done. Not only was the youth excited to be able to easily enter and exit from his home without help, and spent hours at first doing just that, but his parents were also grateful for the group's devotion to the project. Since the project's completion, more and more families have come forward expressing their needs for a wheelchair ramp as well. That is a good sign that this project could remain ongoing, and passing the knowledge of ramp construction on to more groups will hopefully keep it going and going and going...

*Article accompanied by picture of "The Volunteer Ramp Building Team from National Youth Leadership, YMCA Leadership for Empowerment, and Center for Independent Living Programs."*

▼
Collaborations are possible between all types of individuals, groups and programs.

▼
Not only will this ramp project help community members to assist others who need a ramp, they will benefit too.

▼
High schools, technical colleges, church groups, service clubs (like: the Jaycees, Lions, VFWs or Legions), scout organizations, unions, employee service groups, government agencies, rehabilitation facilities, centers for independent living, and many, many more can initiate or participate in a community ramp project.

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Call MCIL for more information:
**651/646-8342 Voice**
**651/603-2001 TTY**
**651/603-2006 FAX**
**e-mail: mcilx@aol.com**

# *Community Participation*

The purpose of this manual is not only to instruct individuals on how to build their own ramp, but also to encourage organizations on how to become involved in meeting community needs.

Lower cost, reusable ramps give people more choices in their living situations and allow for significant cost savings each time a ramp component is reused. The construction ideas in this manual can be used by anyone interested in assisting people with mobility impairment.

The history of the Ramp Project demonstrates one way that organizations can be involved. From its beginning in August, 1991, the Ramp Project has benefitted from the cooperative efforts and contributions of many organizations and agencies. The start of the project was made possible by the donation of $1,000 from the Minnesota Multiple Sclerosis Society for a tool kit to be used. The ideas created were modified through various state agency discussions, the Metropolitan Center for Independent Living staff, local building officials and private non-profit groups.

A key development was the willingness and ability of the Metropolitan Center for Independent Living (MCIL) to provide insurance coverage for volunteers working on ramp projects, as well as for the general liability coverage. Available low-cost insurance makes it possible to rent ramps to consumers and third party funders. This means a great cost savings for people with tight budgets and restrictive needs.

MCIL's rental policy allows payments to stop after insurance, labor and materials costs have been recovered. The user can continue to use the ramp as long as it is needed at that site. MCIL provides inspection and maintenance service to insure the ramp's continued safety.

## A FEW FACTS ON INSURANCE...

We have arranged for four types of insurances.

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Volunteer Coverage - which pays up to $2,500 in medical care in case of injury to volunteer.

▼

General Liability - covers damage and injury during construction.

▼

Product and Completed Operations Liability - after completion for any occurrence.

▼

Theft, Fire and Vandalism - for modules and materials while in storage.

**MCIL rents out ramps on a limited basis.**

# *Design Overview*

## RAMP DESIGN FOR INDIVIDUAL SITUATIONS

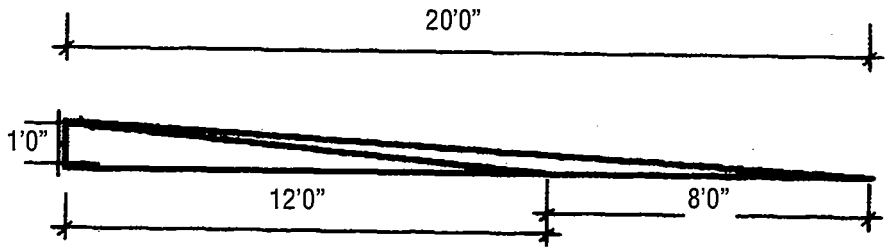
This chapter reprints materials regarding ramps from the Minnesota Housing Finance Agency ***Home Accessibility Information Series*** and from excerpts The Breaking New Ground Resource Center, A Special Technical Report ***Plowshares #11:*** *Guidelines for Construction of Ramps Used in Rural Settings,* in order to familiarize you with ramp design principles. Both articles were written before the development of modular ramp systems.

### *From Plowshares #11:*

Ramps are an important feature in accessing a home or agricultural building. This applies not only to people who use wheelchairs but also to those who have difficulty climbing stairs, such as people who have arthritis or hemiplegia and those who use walkers, crutches or canes. To be safe and most effective, ramps should be built with a few basic guidelines in mind.

***Slope:*** Slope is the term used to describe how steep a ramp is. The slope is extremely important because it affects how difficult it is to travel up and down the ramp. **If the slope is too steep, the ramp may be too difficult for someone to use or may even be unsafe.**

**Comparison of 1:12 and 1:20 slopes**




A more gentle slope has less resistance for either walking or wheeling. The 1 to 12 slope should be seen as the steepest slope to be built and may be too steep for some people.

***Width:*** The width of the ramp should be at least 36 inches.

Before building a ramp ask this question:

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### *"Is a ramp the best solution?"*

There may be alternatives available that will do a better job of meeting the needs of all of the people involved. Sometimes a new set of long-trend low-riser steps can be built for a person using canes, crutches or a walker. Sometimes, a lifting device can be used rather than building a ramp. Consider the length of time the access solution is likely to be needed. If the anticipated need is quite short, it may be cost-effective to consider alternate living arrangements. Many factors need to be evaluated in order to come up with the solution that best meets your needs. Assistance for access planning may be available from a Center for Independent Living in your area.

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Look on page ii of this manual for a listing of Centers in Minnesota as well as other resource information.

## Consider these points once you have decided that a ramp is the best solution.

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Who's the primary user?

▼

What type of assistive device does the person use (cane, crutches, walker, manual or electric wheelchair, motorized 3-wheel cart)?

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Will the person's abilities change? Plan for anticipated changes.

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Will the person use the ramp independently or will help be needed?

▼

Who will provide help and what are that person's abilities?

▼

Which entryway is best for the ramp? Consider the inside as well as outside. Narrow doors or hallways can prevent access to a doorway from the inside.

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Placement of existing door handles and swing direction of doors.

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Where does the person want to go most often (garage, driveway, front sidewalk)? Where is the best place to access transportation?

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If there is an attached garage, can a ramp be placed inside?

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How will the ramp affect available yard space?

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Are there barriers such as trees, shrubs, poles, etc.?

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How will the ramp appear?

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What are the local zoning requirements for lot lines and set-backs?

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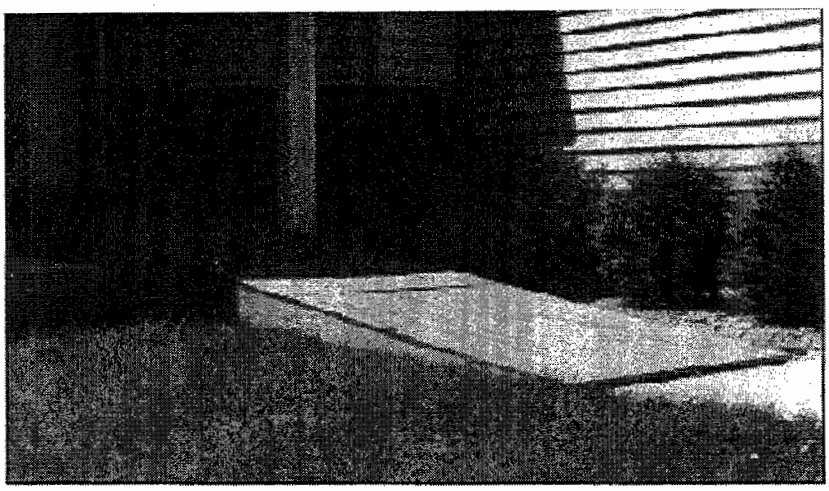
What will the cost be. Is there help available for financial assistance if needed?

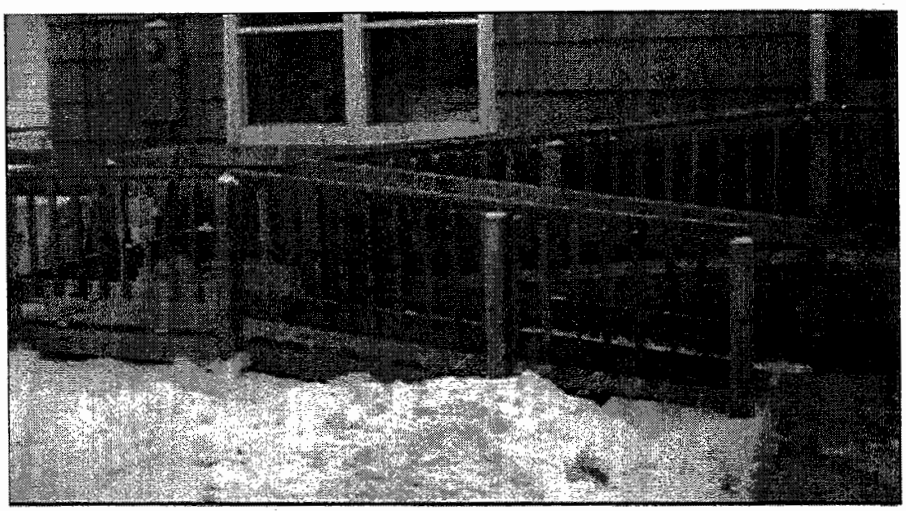
***Getting a Ramp Built:*** With information and materials available from most local building supply stores, an individual with ordinary carpentry skills can fabricate his or her own ramp. This is clearly demonstrated by the millions of homemade decks that have been constructed over the past few years. If a person lacks the basic carpentry skills, a local carpenter or contractor should have little trouble constructing a ramp. **However, don't assume the builder you choose will have knowledge of the guidelines for ramps included in this publication.** If the builder is unfamiliar with ramps for use by people with disabilities, a copy of this publication or similar information regarding guidelines for ramp construction should be provided to the builder to avoid an unsafe or unusable structure. **Remember who the user will be — it won't be the builder.**

In cases where financial resources are limited, the ramp might become a public service project of a local service organization, school carpentry class, carpenter's union, or vocational agriculture class. Contact one of these groups or the local Easter Seal Society, Office of Vocational Rehabilitation, or volunteer hotline for possible assistance.

For information on long-tread low-riser steps, see page 56.



**Example of bad ramp:** This ramp is 8' too short, there is no level landing, guardrail, or wheel stop, and the lip at the bottom is not flush to the ground.
A contractor designed and built it for $550.



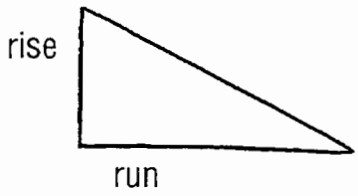
**Example of good ramp:** 20' of sloped surface for 18" rise.
Volunteers built it for $625

The modular ramp design creates the possibility that ramps will become easily recyclable. The design allows flexibility in creating various length runs of sloped surface and pre-made modules can be matched to custom segments built on-site to create the needed ramp. The width of the ramp can be tailored to individual needs by changing the width of each module. Usually the landing at the doorway will require customization and sometimes the ground level end of the ramp will need to be modified to meet site conditions. Having reusable components for the majority of the ramp reduces costs and increases the possibility of obtaining either short-term or long-term access.

## *From Minnesota Housing Finance Agency, Home Accessibility Series: #3 Ramps*

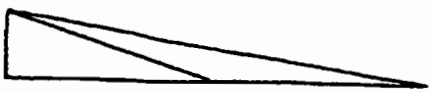
Ramps are built for people who can't use stairs, or need a gentler, less stressful way to change levels. A successful home rampbuilding project requires careful planning, because compromises may have to be made among many competing needs — of the person with a disability, other household members, budget available, security concerns, appearance, property market value. The following information should guide you in this planning process.

Slope




***Slope:*** A ramp's slope — the angle of the inclined surfaces — is perhaps a project's most critical consideration, because of its impact on layout requirements, the expense involved, and the ramp's ultimate usefulness. Slope is the right–angle relationship of vertical height (rise) to horizontal length or projection (run). It is usually expressed as a ratio of these two measurements, with the rise figure frequently set at a unit of one. For example, a slope of 1:12 means that as each dimension unit of height changes, the other right–angle side projects out 12 units, which together result in a certain angle for the inclined, third side of the triangle.

Comparison of slopes



It's important to point out that the larger the run figure in a slope ratio, the **gentler** the angle for the inclined surface will be — a 1:16 slope, for example, is **not** as steep as a 1:12 slope. This fact is a source of initial confusion for many people, who conceptualize that a bigger number must mean a steeper slope. A comparative drawing (left) shows that it's exactly the opposite situation.

**SAFETY ADVISORY:**

There may be a temptation to build a ramp that is steeper than the recommended 1 to 12 minimum in order to conserve space or reduce costs. Before deciding to build such a ramp, remember that the steeper the ramp is, the more dangerous it becomes to anyone using it. Ramp Project personnel have replaced steep ramps that have caused falls resulting in serious injuries and ramps that were so steep that the person needing it could not use it independently.

**DO NOT BUILD RAMPS THAT ARE STEEPER THAN 1 TO 12**

**UNLESS**

you have considered all the choices and your particular situation leaves you with no other choice.

Safety and independence are far more important than short-term savings or having a little less space.

The issue of how to choose a slope for a residential ramp isn't clearly addressed in the codes or handbooks, and is another source of confusion for many people. Minnesota has a section in its building code — Chapter 1340 — that mandates the design for certain accessibility features that must be installed in public/commercial settings. Chapter 1340 mandates slope ratios for ramps built for public/commercial properties within the state, but single–family residences are exempt from having to comply with these code requirements because each ramp's design must be tailored for a particular person's and home's circumstances.

For ramps in public/commercial settings, separate maximum slopes for exterior and interior ramps are actually set in the code. Interior and protected ramps may have slopes up to a 1:12, while exterior ramps (which in precise code language are referred to as "walks") must have gentler slope not exceeding 1:20. Because the code uses a 1:20 slope for exterior ramps, many people make the assumption that this is the only slope that can be used at houses as well.

In actuality, ramps for homes can be built at many different slopes and still be "right". For many households, the selection process requires balancing the desire for a very gentle slope with the amount of construction/cost involved, yard space that must be used, and appearance. The one general guideline that should be followed

is that the slope should not exceed 1:12. Slopes steeper than this may be beyond the strength of many people using manual chairs, and may also cause an ascending electric wheelchair to tip backwards from a weight imbalance due to the low position in which the chair's battery pack is carried. They can also cause or aggravate back problems for helpers pushing a chair up a ramp, or controlling a chair traveling down one.

The slope determination process starts by first establishing how much total rise has to be covered. Two measurements must be checked to determine this figure. The first figure is the distance from the exit door's sill down to the ground, or "grade", at the house's foundation. Since a ramp is constructed a certain distance out from the house into the yard, though, any change in grade in the area for the ramp's construction also must be taken into account. For example, if the change in grade from a home's doorsill to the ground at the foundation is 29", and the yard out where the ramp will be sited is flat — no change in grade — then the total rise that must be covered is 29". However, if the change in grade at another house's foundation is 29" (a), but the yard where the ramp will be located drops away another 13" (b), then the total rise that must be covered is 42" (c). (See diagram to the right)

Once total rise (typically stated in inches) is determined, it's then multiplied by the slope (in inches) chosen, to obtain the total amount of horizontal projection (in inches) required to achieve the particular slope. Dividing this figure by 12 converts it into a more workable measurement of feet of horizontal projection required. For example, say that a ramp with a 1:12 slope is to be built at the home with a 29" total rise described above. The required horizontal projection is 29" X 12" = 348", or when converted to feet, 29'. Say, however, that a ramp with a gentler slope — a 1:16 — is desired. 29" of total rise X 16" of slope = 464", and when divided by 12 to convert to feet, equals over 38 feet of horizontal projection needed.

It's important to note that the resulting figure is a measurement of amount of horizontal projection the layout must contain to achieve a desired slope. It is **not** a measurement of distance travelled along the inclined surface, as some people mistakenly believe, and it **doesn't** include any distances/areas required for necessary landings — these are extra.

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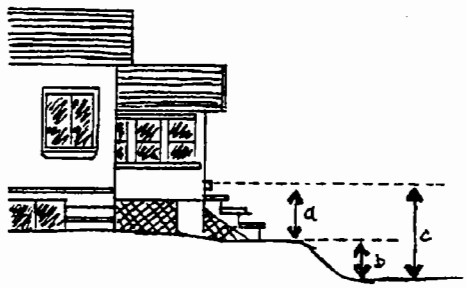
**Weather conditions affect ramp surfaces. A more gentle slope is less adversely affected by rain, snow and ice.**




Determining total rise

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## To compute Slope Ratio

Each inch of height requires a certain number of inches in distance to provide a slope.

Multiply inches of rise (29" as an example) by the ratio you want, getting inches first and then dividing by 12 to convert to feet.

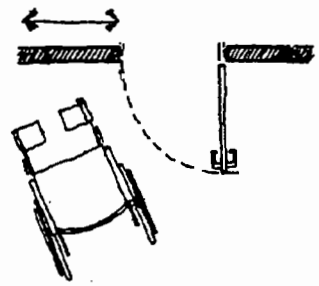
| 1 to 20 | | 1 to 12 |
|---|---|---|
| 20 | rise | 12 |
| x 29 | length (inches) | x 29 |
| 580 | | 348 |
| **48'4"** | ÷by 12 (to convert to feet) | **29'** |

**LENGTH OF SLOPE IN FEET**

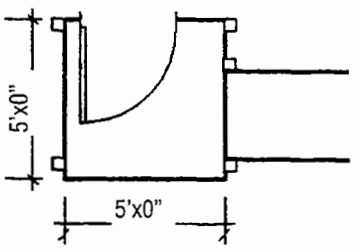
***Landings:*** Landings are the level areas required at the top, bottom, and sometimes at intermediate locations in a rampway. These areas allow a person to maintain balance while performing tasks like opening doors, transferring in and out of a vehicle, resting for a time, and safely changing direction of travel when a ramp makes a turn. Recommended landing sizes are based on these functions.

***Top Landings:*** Top landings should be nearly flush with the exterior door threshold. 1/2" is the typical maximum, particularly when a wheelchair user is involved —anything larger will abruptly stop a chair's relatively small front wheel, or is a tripping hazard for walkers. Pay attention, too, to threshold specs if a new primary door is being installed. If a prehung unit's going in, most don't have the low threshold that's needed here.

Elbow room



Level Slope




For homes on footed foundations, it's advisable in most parts of the state to bolt the top landing into the home's foundation. This will avoid the potential problem of the relatively lightweight ramp landing lifting up due to frost heave and jamming under an outswinging door (like a storm door). For unfooted structures, or temporary foundations such as mobile homes on blocks, bolting the landing may still be appropriate, but the ramp shouldn't be footed for the opposite reason. Local soil conditions — e.g., clay vs. loam — will also play a definite role here.

Top landings at minimum should be at least 60" X 60" if there is an outswinging door, with at least a 12" to 24" of "elbow room" space provided off the door's handle side, particularly for a person using mobility equipment. These dimensions give enough room for a person to move off to the side while opening the door without having to back up to get out of the way of its swing. If there is no outswinging door, the landing may be somewhat narrower — probably 48" at minimum.

***Intermediate Landings:*** Intermediate landings for a long, in-line run of ramp can have the same width as the running surface's, and length can range from 36" to 60" — the slope chosen is a factor to account for here, with a steeper slope like a 1:12 requiring a longer distance in which to stop when descending. A rough guideline to use is to install an intermediate landing if a section of ramp covers more than a 30" change in rise, but persons with limited stamina/control may need

one sooner than this. Dimensions for intermediate landings where a direction change occurs depend on ramp width and the user's circumstances. When a chair user's involved, a 48" X 48" landing for a 90 degree turn is comfortable; for an 180 degree turn, 48" by twice the width of the two ramp sections is typical.

***Bottom Landings:*** For bottom landings, typical minimum dimensions when in–line travel's involved are as wide as the ramp by about 48" long for someone walking, and about 60" to 72" for a chair user. Larger–width landings may be called for if the person has to make a direction change (e.g. 90–degree turn). Make sure the ramp/landing intersection doesn't have a "lip" greater than 1/2" which would become a tripping/rolling hazard.

## Rampway Widths and Running Surface Features

Running surface widths can range from 36" to 48", depending on the personal assistance or mobility equipment involved. 36" may be appropriate for someone walking or using a cane, crutches, or a walker. (32" may be appropriate for persons who need to lean on both railings when moving.) 42" to 48" is appropriate for someone using a wheelchair, or where a person can walk with assistance at the side.

Surface height changes from the doorsill and top landing to the bottom landing shouldn't vary more than 1/2". Higher bumps can abruptly stop a wheelchair, or trip people walking, particularly those with an irregular gait.

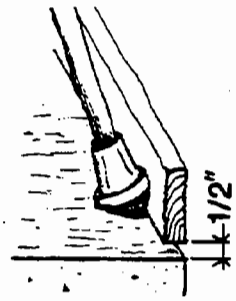
All ramp runs and landings must be level from side to side. A cross slope (slope perpendicular to the direction of travel) can upset a person's balance and require more strength and effort on the person's "downhill" side. Even the almost unnoticeable slope (1:96) built into public sidewalks to aid with water runoff can be tiring for a wheelchair user to negotiate.

It's advisable for ramps to have an "anti-slip" running surface; depending on local building code enforcement, this may be a requirement. On wooden ramps, treatments that are used include commercially–available "grit" tapes, strips of rolled roofing or shingling, or laying down coats of polyurethane into which sand is sprinkled. For concrete ramps, the surface can be brushed with a broom before it hardens to create a rough texture.

***Safety Features:*** Installation of safety features including handrails, guardrails, "crutch stops", guttering and sheltering should also be considered for a rampbuilding project.

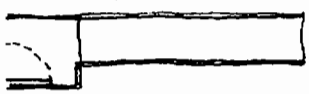
Handrails should account for variables including a person's height, arm and hand strength, how the rails are used, and any local building code requirements that may apply. For example, standing users who lean on rails for support with arms extended often need a very different rail height than that used by persons propelling a wheelchair by pulling along the rails. 31" to 34" is the typical height range, and the rails should be capable of supporting a 250 lb. load at any point along the length. The diameter should be no more than 1 1/2", and may need to be smaller for children or adults with impaired grip strength. The preferred material is wood — metal piping is sometimes used, but may present a problem for exposed skin in the wintertime.

Crutch stop

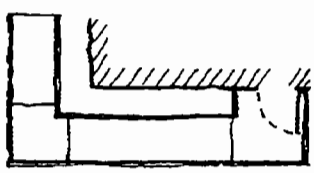



Guardrails and edging called "crutch stops" or "bump boards" are also good safety factors that keep users from slipping off the side of a ramp or landing. Guardrails are mounted along the structure's perimeter, usually at a seated person's knee height — 18" to 20" or so. "Crutch stops" are curbing mounted on, or a few inches above, the surface of the structure's perimeter.

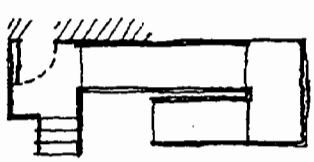
Two additional safety features to consider are guttering and sheltering. If not present, roof gutters may be advisable for ramps running close to a home to handle water runoff that may create slipping hazards. In cases where the person's mobility is severely restricted, some form of rampway sheltering may also need to be considered. Depending on siting and home roofline, one strategy for ramps hugging a house is to build a small extension off the roof. Support for the lower edge can be provided by extending the ramp's posting vertically.



Straight or in-line



Dog-legged or L-shape



Switchback

***Layout Issues:*** The three most common ramp layouts are:

- "straight-shot" — landings and rampway in a straight line;
- "dog-legged" or "L-shaped" — ramp changes direction 90 degrees at an intermediate landing; can also be called a "wrap-around" when it hugs the house;
- "switchback" — 180 degree change in direction between one run of rampway, an intermediate landing, and another run of rampway.

Generally, ramps follow a path of travel frequently used by all household members, such as from the kitchen to the garage or driveway. However, using a main pathway may create a problem for some households, making it advisable to locate the ramp at a lesser–travelled exit. In some situations, though, none of a home's exits provide a workable ramping option. In these cases it may be necessary to creating a new exit. One possibility to consider is converting an existing window into a new doorway— the window area already may have some of the structural framing a doorway needs.

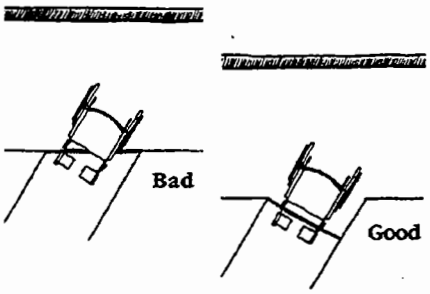
Incorporating a run of stairs off the ramp's top landing is a good design feature to include, enabling other household members and visitors to enter/exit directly instead of having to use the rampway.

A ramp's visual impact may be a factor to consider in choosing a layout. Straight ramp runs, particularly those that project directly out into a yard or are extremely long, may look unattractive, while those sited close to/around a house may have a more pleasant appearance. Landscaping (bushes and plants, timbers, etc.) and other finish details (e.g. skirting to mask the area below) can improve appearance as well. Is there a concern about security and "curbside" appearance? If so, locating the ramp to the side or back of a property may minimize the visual indication of a resident with a disability.

Locating the ramp to take advantage of southern exposure so the sun can help dry the surface or melt snow is another factor to keep in mind. Additionally, positioning that takes advantage of neighborhood/lot wind patterns may aid in clearing snow and leaves. There also may be locations near trees or bushes that should be avoided for the leaves or pods they drop.

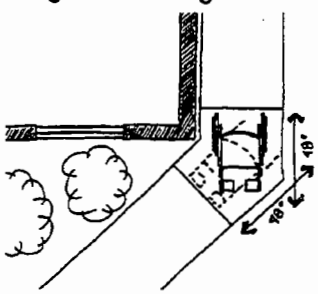
Don't forget to give some thought to the impact a ramp's location will have on competing yard uses in the area. For example, running a ramp from a door straight through the back yard to the garage may be the most efficient and least costly layout. If this placement limits games and other recreation activities that frequently have gone on in this area, is the tradeoff acceptable? How about ease in mowing? Getting back and forth between a garden area over on one side and where tools are stored on the other?

Ramp intersecting landing at an angle




Most landings are designed as squares or rectangles, with rampways usually intersecting them head–on. The resulting seams joining the flat and inclined portion cut perpendicular across the path of travel. If a landing isn't square or rectangular, and/or if a rampway approaches a landing at other than head–on, special attention must be given to making sure that the intersections of the flat and inclined portions still cut perpendicular across the path of travel. If they don't, and if persons using wheelchairs are involved, safety problems may result. The reason for this has to do with the timing when each of the chair's front wheels crosses over the boundary between the flat and inclined surfaces. When the two portions join head on, both wheels pass over the change in surface at the same time. However, if an angled intersection is present, one wheel crosses this boundary ahead of the other, resulting in an imbalance that could potentially cause a descending chair to tip.

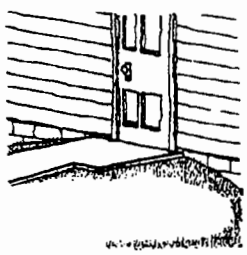
Angled landing




Angled landings also require special attention. Seams between the flat and inclined portions in this type of construction similarly must join perpendicular to the direction of travel. when wheelchair users are involved, the landing additionally must provide enough space for rolling onto the landing, turning slightly, and rolling off. this is usually about 46" in each direction of travel.

## Construction Methods

Berming



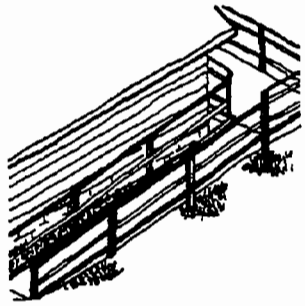
***Berming:*** Berming can be a good, economical, way to handle total rises that don't exceed about 18". The grade along the path of travel is built up with dirt or sand, then a walk is installed out of concrete, blacktop, patio blocks, or even treated wood decking. The yard can be finished as desired with new sod, reseeding, and plantings. By blending in with the house and yard, the "ramping" provided in this manner is usually much less visible than a frame structure.

***Post–and–Beam:*** A majority of ramps built at homes are of the "post-and-beam" construction type. These structures are typically built with wooden framing, but metal framing is infrequently used. When wood is used, lumber should be of a species naturally resistant to decay (e.g. redwood or cedar), or treated with chemical preservatives.

There are two common ways to install the posts. One is to sink timbers vertically into the ground below the frost line into holes

filled with sand, gravel, or concrete. The other is to pour concrete into the hole and install an anchoring bracket on top into which the posts are bolted. Horizontal "beams" are then attached between posts to frame the perimeter for landings, and between rampway posts to create the running surface support. Finally, the "joists" providing support for landing and ramp surfaces are installed at right angle to the beams.

Post-and beam-construction

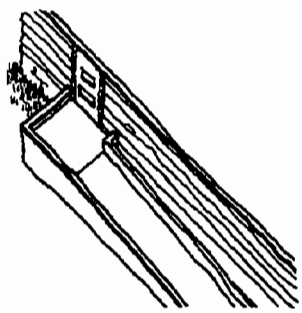


Post–and–beam rampway/landing surfacing is typically also installed out of wood, infrequently, out of metal grilling, or concrete over a corrugated metal or plywood base. When wood is used, the preferred method is to lay dimension lumber (e.g. 2" x 6s") perpendicular to the direction of travel, spaced with a slight gap (about 1/4") through which rain/snow/dirt can fall. Plywood is sometimes used, but problems develop because it can separate over time, and its surface can become very slippery with ice/rain. Indoor/outdoor carpeting is also sometimes installed, but similarly, it's not appropriate for ramps exposed to the weather because it can stretch over time, and collect/hold water.

A post–and–beam bottom landing may be created as a continuation of the surface decking (e.g. a "duckwalk"), or out of concrete. Specs for concrete are essentially the same as for a typical sidewalk — the pathway is excavated approximately 4", sand/wire mesh is laid to give a good foundation, then 3" to 4" of concrete is poured with expansion joints every 36" to 48".

Round, wood handrails may be installed, or 2"x4" lumber notched on one side to create a finger–hold area can also be mounted. Guardrails commonly are out of 2"x 4" lumber, crutch stops out of 1"x 2" lumber.

Solid or one piece construction



***Solid Construction:*** This type of ramping is typically built out of concrete, and while infrequently used at homes, is the most stable and probably most efficient for wider widths (e.g. 42" to 60"). It is constructed by erecting temporary forms (usually wooden), into which rubble (field stone, broken concrete blocks, bricks, etc.) and then concrete are poured to create the one–piece structure. Concrete ramp design is best done by masonry professionals, because of the possible need for reinforcing, expansion joints, and structural tie–in with the house.

# Codes and Permits

## INFORMATION YOU WILL NEED FOR A PERMIT

- **Site Plan:**
A sketch of home and lot showing where lot lines are and where ramp will be placed. Indicate height, length and width of ramp.

- **Determine Slope Ratio:**

- **Framing Plan:**
A sketch of how your ramp will be built. It is helpful to copy pages from this manual to describe components.

- **Engineering Documentation:**
Use the Rudin Structure found on page 43.

- **Estimated Cost of Materials:**
This is needed to determine the cost of permit.

- **Photographs:**
Although not required, they would be helpful when discussing your project with building officials.

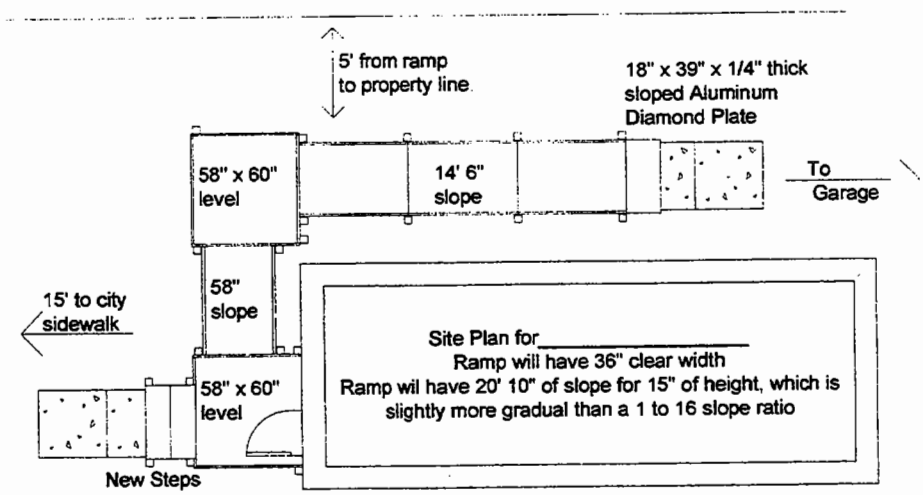
Is a building permit needed for your ramp-building project? **The only way to find out is to contact the building code office for your community.**

Telephone numbers are listed in the Government section of the phone book under Building Inspection or call the administrative office, and they will direct you. When speaking with local building code officials, be sure to inform them if the ramp will be temporary or permanent because this may have a bearing on whether or not a building permit is needed.

It is strongly advised that you work with the local officials because they can help you determine if a permit is needed, as well as with information regarding specific construction questions. If you do need a permit, it will be very helpful to have a site plan, elevation plan, framing plan, and estimated costs for the ramp. Information from this manual can be used in the application process. Be sure to take the engineering documentation with you for your plan review. (Sheets signed by Jeffrey Rudin, professional engineer, who created the documentation, are on page 43).

Ramp project personnel worked closely with local building officials and the Minnesota State Department of Administration during the design process to insure that the ramp design presented here is acceptable under Minnesota guidelines. Other states may differ in circumstances which may require variations in this design. Please check with your local officials before you begin a ramp.

### Sample Site Plan



## More Permit Information

During your plan review, the building official may have an opinion regarding the slope at which your ramp should be built. While the Minnesota codes for public settings require a 1 to 20 slope for outside ramps, and various design codes recommend a 1 to 12 slope private homes do not have to comply with those provisions. (See "Other" on page 17). The slope of the ramp you are building should be determined by the needs of the user and a 1 to 20 slope may be appropriate. However, a shorter ramp with a slope anywhere between 1 to 12 and 1 to 20 may also be appropriate.( See the chapter on ***Design*** for more information on slope and other considerations.) You should be able to show that the slope you have chosen is both safe and convenient for the person using the ramp. If you wish to build a ramp that is steeper than 1 to 20 and the building official indicates that you cannot, you may wish to refer them to Chapter 1340.0200 Subp. 2. A.

This information has been distributed to building officials throughout Minnesota. Several building officials have provided ideas and assistance during the development of the Ramp Project. Local officials are available to review your ramp plans. They can help you build the best ramp possible to suit your needs.

**PLEASE REMEMBER: SPECIFICATIONS FOR THIS MODULAR RAMP SHOULD NOT BE CHANGED...**

**The modular ramp design insures the strength and stability needed for safe use.**

**Changing or eliminating any of the components can reduce the structural integrity of the ramp and create dangerous situations**

**If you are building the ramp outside of Minnesota, be sure to check with your local building officials regarding this design and their requirements by law.**

**A LETTER FROM**
**THE STATE OF MINNESOTA,**
**DEPARTMENT OF ADMINISTRATION,**
**BUILDING CODES AND STANDARDS DIVISION, SEPTEMBER 24, 1992**

**A review of the building code requirements for the modular wheelchair ramp.**

***Building Permits:*** Uniform Building Code (UBC) section 301(b)7 exempts "platforms, walks and driveways not more than 30 inches above grade" from the requirement for a building permit. However, this section makes it clear that the work must still comply with the applicable provisions of the building code as well as any other laws or ordinances of the jurisdiction.

***Land Use/Zoning Permits:*** Local government regulates land use through zoning codes. There may be restrictions on distance to property lines, maximum area and height, etc. Specific requirements will vary among jurisdictions so it is necessary that the appropriate local government department be contacted prior to beginning construction. Permits, including a site plan showing the location of the proposed ramp, may be required to verify compliance with zoning code provisions.

***Guardrails:*** UBC 1711 states in part that open and glazed sides of stairways, landings and ramps, which are more than 30 inches above grade shall be protected by a guardrail. When a guardrail is required on a ramp or landing serving a single family dwelling, the guardrail must not be less than 36 inches high with intermediates spaced such that a sphere six inches in diameter cannot pass through. The dimensions must be on the plan when this requirement is applicable.

**As of March 20, 1995, the Minnesota State Building Code changed to require intermediates to be installed to prohibit passage of a 4" sphere**

***Ramps:*** According to UBC 3307, ramps used as exits from the building shall comply with this section.

**Subpart (c)** states that: the slope of the ramp shall not be steeper than 1 vertical to 8 horizontal. The slope should be identified on the plans. **(Note: this vertical to horizontal slope is not recommended because it is too steep. Minimum recommended slope is 1-12).**

**Subpart (e)** states that when the slope of the ramp is steeper than 1 vertical to 15 horizontal, a handrail must be installed. The handrail must comply with Section 3306(j) and be mounted not less than 34 inches nor more than 38 inches above the ramp surface. The handrail must be dimensioned on the plan.

**Subpart (g)** states that the surface of the ramp shall be roughened or shall be of slip-resistant materials. This should be identified on the plan.

***Weather Exposure:*** UBC 2516(c)11 requires that the members which form the structural supports be of approved treated wood (or of natural resistance to decay). It appears that this has been clearly covered in the plans.

***Footings:*** UBC 2907(b) exception 1 permits a one-story wood building not over 400 square feet in area to be supported on a wood foundation plate when approved by the building official. In our opinion, the support of this ramp should be considered adequate provided that (1) the design engineer has accounted for anticipated frost and thaw action, (2) the ramp is secured to the house landing or threshold, and (3) wood in contact with the ground is pressure treated to at least .40lbs/cu. ft. of retention.

***Other:*** As long as these ramps serve only single family, R-3 occupancies, they are not required to comply with the requirements of Chapter 1340, Facilities for the Handicapped.

The completed plans for the ramp should include compliance with all applicable code provisions, the detailed specifications and the certification of the Minnesota registered engineer.

Scott D. McLellan

Scott D. McLellan, Building Code Representative


**"Last year we built a ramp with the new system of support beam footings.**

**Our ramp hasn't shifted in the least. We have used it daily throughout all kinds of Minnesota weather without a problem. It was ideal for a residential setting and construction was relatively easy.**

**We organized a "ramping bee" and because we didn't need cement footings we were able to be more flexible in the construction and placement of the ramp."**

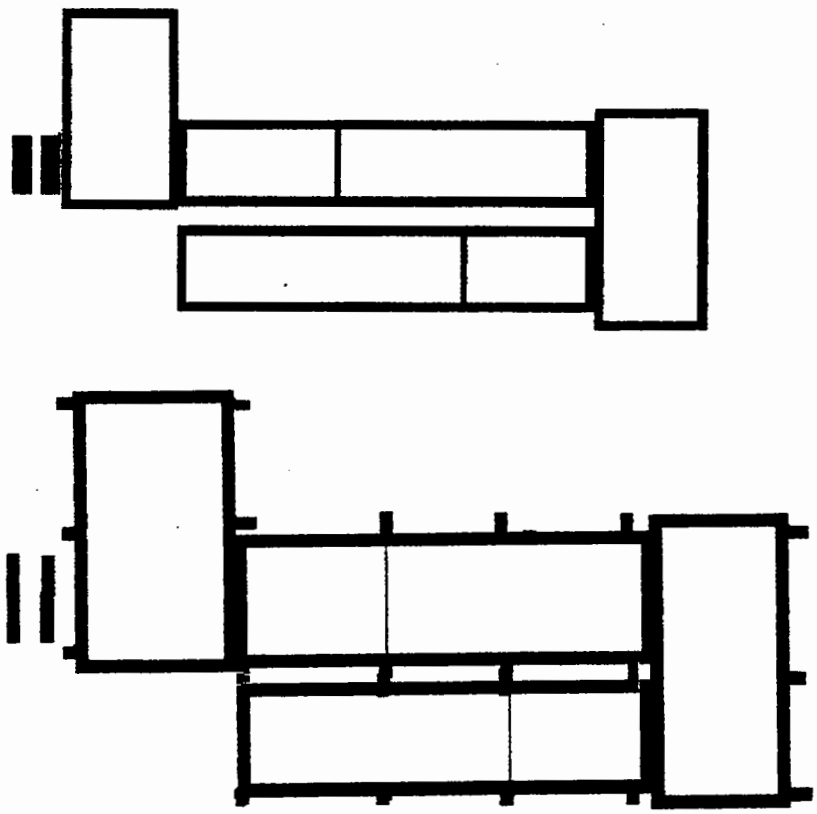
*–Gregory Knox-Carr*

See page 41 for an additional comment on footing requirements.

# Ordering Materials

**Example ramp:**
Two level landings, each 58" x 98 1/2"; 29' of sloped surface required. Use two 116" modules and two 58" modules to obtain the needed length (other combinations are possible).

Draw an overhead view of the ramp and make several copies. On the first copy, determine the number of landings and modules needed. **Pages 22 through 26 describe the materials needed.** Begin a materials list, keep a separate page for each landing and module ordered so that during construction pieces can be matched to their intended purpose.



On the next copy of your overhead view, determine the number of support structure needed. **Page 27 and 28 describe the materials needed.** You can estimate how long each 4x4 needs to be by adding 34" to the distance between the ramp surface and the ground for each post location. Remember that the legs of the support structures do not have to be equal in length. Also, if you are placing 4x4s in the ground for handrail support at the bottom of the ramp add at least 2' for each sunken 4x4. Determine the 2x6s needed for the cross supports for the landings and modules. Add this material to your list.

Now determine if 2x4 diagonal is bracing needed, keeping in mind that diagonal bracing is needed when the top of the cross support is more than 21" off the ground, and that diagonal bracing is needed on each side of the 4x4 support posts. Also determine the number of gussets you will need and the number of 1'x 1' plywood pads needed for the base of the support posts (thirty-two 1'- square pads can be made from a 4x8 sheet of 3/4"-thick plywood).

Determine the number of 3/8" carriage bolts needed to connect modules and landings together (three per connection). To determine number of 1/2" carriage bolts, remember 4x4's with diagonal bracing require 10" bolts, 4x4's with gussets require 8" bolts, and 4x4's bolted to only one cross support require 6" bolts.

The next step is to determine the dimensions for the guardrail/ handrail (see page 34). Decide if you are going to use plowed 2x6 for the top handrail or if you will have a 1 1/2"-round handrail.

On the overhead view of the ramp determine the lengths needed for the guardrail. You should have an equal number of 2x6s and 2x4s. Use the longest possible continuous 2x6 for your top railing. If you have a 15' long section of ramp, order 16' long boards. (Maintain a 4"-spacing between the spindles, ten 30"-long spindles per 59" run of ramp).

The last step is to determine lumber for steps or boardwalks that might be needed. You are now ready to combine all of the lumber needed onto to a materials order form (page 20). Keep the individual component sheets to refer to during construction. This will reduce the chance of using the wrong lumber for a particular component.

## MINNESOTA STATE SALES TAX LAW CHANGES

Chair lifts, ramps, and elevators and building materials used to install or construct them are exempt from Minnesota sales tax if they are authorized by a physician and installed in or attached to the owner's homestead. Sales tax must be paid on the purchases and a claim for refund filed by the owner of the homestead property to obtain a refund of the sales tax paid. If tax was paid by a contractor, the home owner must file a claim for refund of sales tax paid by the contractor including sufficient information to verify the amount of sales tax paid on he project. Contractors are required to furnish a statement to the home owner for material costs and taxes paid.
This exemption is effective for sales after January 1, 1990.

## MATERIALS ORDER FORM

TREATED LUMBER

_____ 3/4 Treated Plywood

_____ 5/4x6x8 Decking

_____ 5/4x6x10 Decking

_____ 5/4x6x14 Decking

_____ 2x2x8 Balluster Spindle

_____ 2x4x8 Treated

_____ 2x4x10 Treated

_____ 2x4x12 Treated

_____ 2x4x14 Treated

_____ 2x4x16 Treated

_____ 2x6x8 Treated

_____ 2x6x10 Treated

_____ 2x6x12 Treated

_____ 2x6x14 Treated

_____ 2x6x16 Treated

_____ 4x4x8 Treated

_____ 4x4x10 Treated

_____ 4x4x12 Treated

_____ 2 Step Stringer

_____ 3 Step Stringer

_____ 4 Step Stringer

_____ 5 Step Stringer

HARDWARE

_____ 2x6 Joist Hanger

_____ 2x4 Joist Hanger

_____ Hanger Nails

_____ 3/8x4 Carriage

_____ 3/8 Hex Nuts

_____ 3/8 Washers

_____ 1/2x6 Carriage

_____ 1/2x8 Carriage

_____ 1/2x10 Carriage

_____ 1/2 Hex Nuts

_____ 1/2 Washers

_____ 2.5" Galvanized Deck Screws

_____ 3" Galvanized Deck Screws

_____ Handrail Bracket

_____ 1.5" Handrail

_____ Other

_____

_____

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**Date order:**

**Ship to:**

# Building Process

The process used in building a modular ramp involves creating a level landing at the doorway and then attaching the sections one after another until the end point is reached. Because slope adjustments may be needed during construction, it is wise to attach sections temporarily and insure that the slope is correct before bolting, adding trimmers and the bracing. Adding guardrail and handrail is the final task. Steps can be added to the landing after it is completely supported. Standardized components allow the units to be easily recycled and used at other locations. The ramps are designed for easy disassembly and may be used more than once.

1. Notch 2 x 6s used to create level landing at door.

4. Trimmers and gussets are permanently attached after slope is correct and 4 x 4s vertical.

2. The first module in place, level landing established, bumper jack is being used for temporary positioning.

5. Attach 2x6s and 2x4s to 4x4s.

3. Landings are level, and slopes are correct.

6. Guardrails are the last step to compete the ramp.

▼

**It is helpful to have copies of these following construction pages available at the ramp site.**

▼

**To make ramp with 36" clear space make modules 39" wide.**

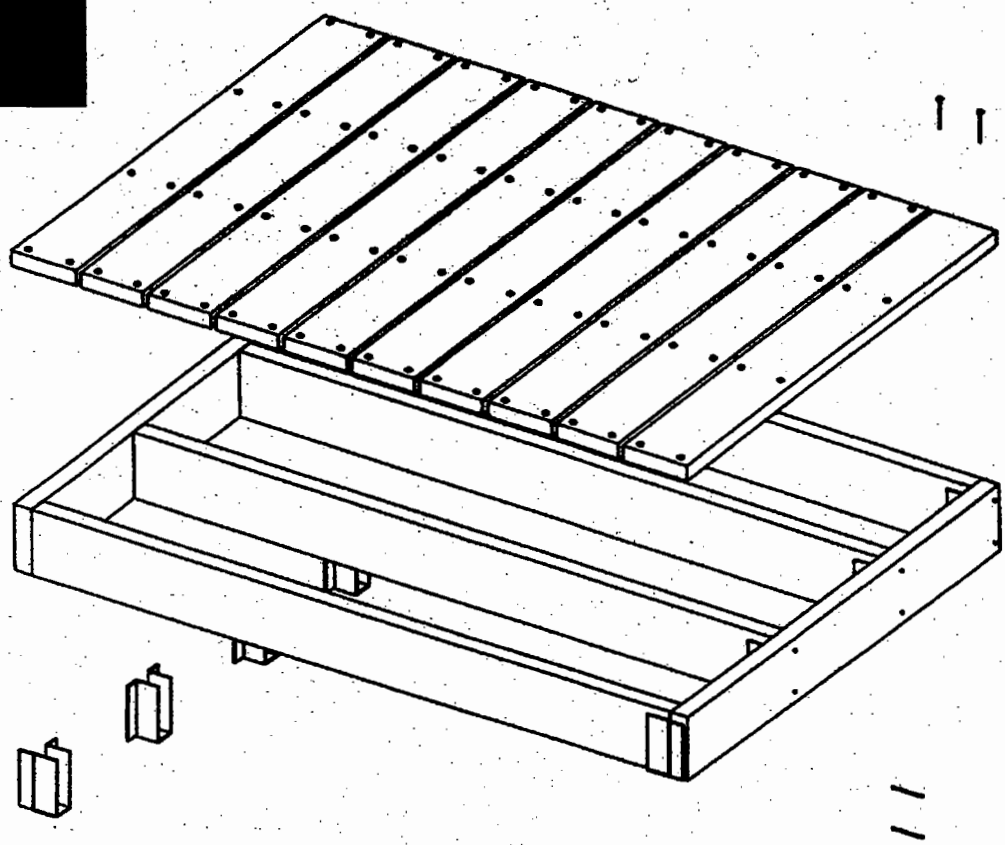
## 58"-long x 42"-wide Ramping Module

**(for ramp with 39" clear width)**

**Components:**

**4** 2x6 by 55" Joists (Order two 2x6x10 and cut 4 joists)
**2** 2x6 by 42" End Pieces (Order one 2x6x8 and cut 2 end pieces)
**10** 5/4" x 6" by 42" Decking (Order 14' decking and cut 4 pieces from each. Two and one-half 14' decking equal ten 42" pieces.)
**80** 2 1/2" Deck Screws (8 per Decking Plank)
**16** 3" Deck Screws (To attach end pieces to joists)
**8** 2x6 Joist Hangers
**80** Joist Hanger Nails (10 per Hanger)

**Ramp and landing modules are designed to use 10 pieces of decking for each 58" length, to insure proper gaps between decking.**



▼

**Standard length modules make reuse easier. If a non-standard length is needed for a particular ramp, build the length you need using these guidelines**

**Construction Notes:**

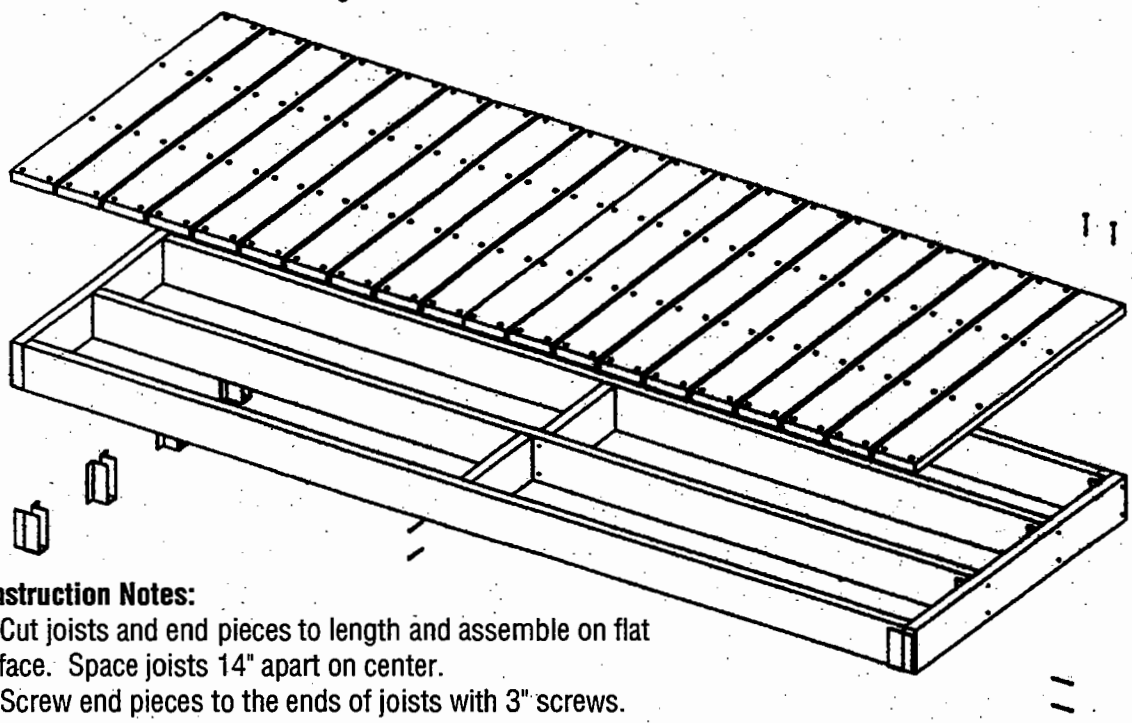
**1.** Cut joists and end pieces to length and assemble on flat surface. Space joists 14" apart on center.
**2.** Screw end pieces to the ends of joists with 3" screws.
**3.** Insure module is square and nail on joist hangers.
**4.** Bend outside flange of four corner joist hangers flat against end pieces of module.
**5.** Decking may be attached at this point or after module frame is placed in a ramp. Decking adds significant weight to module. If decking added, you will need to remove decking end pieces when assembling ramp.
**6.** Drill a 3/8" hole centered on the end pieces and drill two 3/8" holes 6" from each side. All three holes to be centered vertically on the end piece.

## 116"-long x 42"-wide Ramping Module

Can be used to replace two 58" modules

**Components:**

**4** 2x6 by 113" Joists (Order four 2x6x10 and cut 4 joists)
**2** 2x6 by 42" End Pieces (Order one 2x6x8 and cut 2 end pieces)
**20** 5/4" x 6" by 42" Decking (Order 14' decking and cut 4 pieces from each. Five 14' decking equals twenty 42" pieces.)
**160** 2 1/2" Deck Screws (8 per Decking Plank)
**6** 3" Deck Screws (To attach end pieces to joists)
**8** 2x6 Joist Hangers
**80** Joist Hanger Nails (10 per hanger)
**3** 2x6 Blocking at mid-point of module (To maintain width and add stability)
**12** 3" Deck Screws for blocking

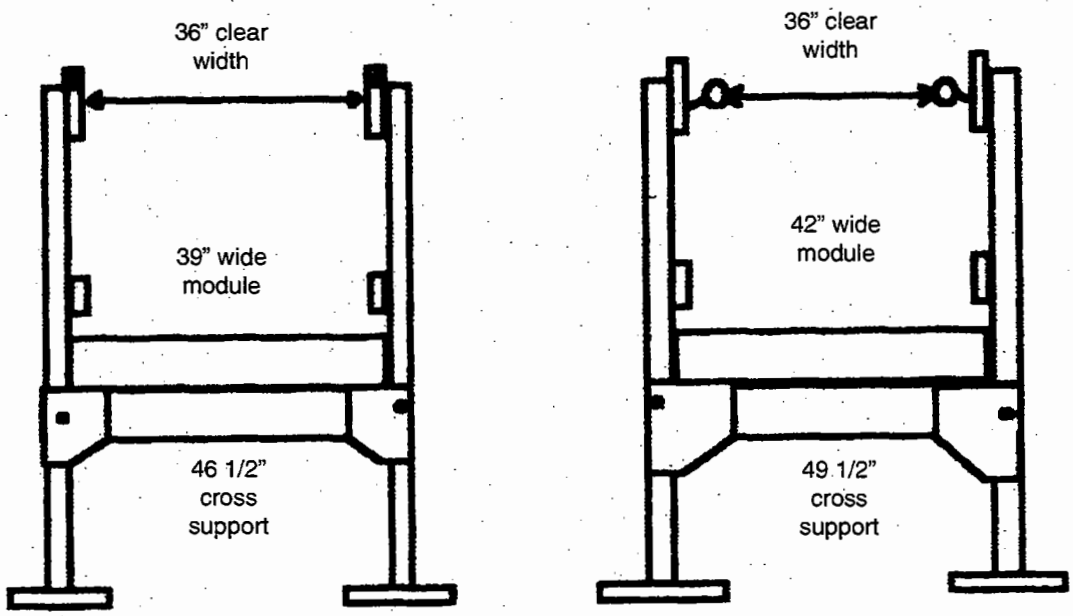


**Construction Notes:**

**1.** Cut joists and end pieces to length and assemble on flat surface. Space joists 14" apart on center.
**2.** Screw end pieces to the ends of joists with 3" screws.
**3.** Insure module is square and nail on joist hangers.
**4.** Bend outside flange of four corner joist hangers flat against end pieces of module.
**5.** Screw blocking in place. Blocking maintains 42"-width of module and adds stability to module.
**6.** Decking may be attached at this point or after module frame is placed in a ramp. Decking adds significant weight to module. If decking added, you will need to remove decking end pieces when assembling ramp.
**7.** Drill a 3/8" hole centered on the end pieces and drill two 3/8" holes 6" from each side. All three holes to be centered vertically on the end piece.

## Chosing the width of your ramp

Proper width of the ramp is important for the person using the ramp. A minimum of 36" of clearance is needed and sometimes wider widths are advisable. The ramp modules can be made to the width that best meet the users needs. 39" and 42" wide modules have been described. If a wider ramp is desired, such as 48" wide, you need to adjust the materials ordered



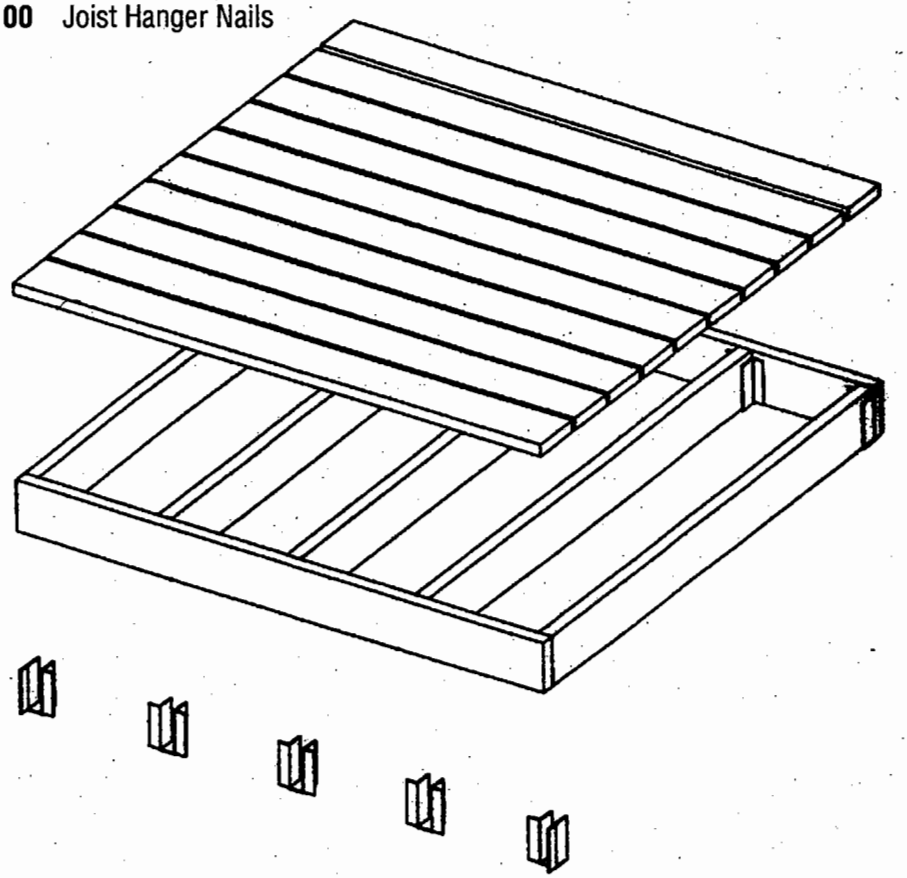

**Please refer to page 34 for more guardrail/handrail information!**

## 58"-long x 60"-wide Landing Module

Used for level landings in right-angle ramps and sometimes at doorway.

**Components:**

**5** 2x6 by 55" Joists (Order three 2x6x10 and cut five joists)
**2** 2x6 by 60" End Pieces (Order one 2x6x10 and cut two end pieces)
**10** 5/4x6 by 60" Decking (Order five 5/4x6 by 10 and cut ten pieces)
**100** 2 1/2" Deck Screws (10 per decking plank)
**20** 2 1/2" Deck Screws (to attach end pieces to joists)
**10** 2x6 Joist Hangers
**100** Joist Hanger Nails



**Construction Notes:**

**1.** Cut joists and end pieces to length and assemble on flat surface. Space joists 15" apart on center.
**2.** Screw end pieces to the ends of joists with 3" screws.
**3.** Insure landing is square and nail on joist hangers.
**4.** Bend outside flange of four corner joist hangers flat against end pieces of landing.
**5.** Decking may be attached at this point or after landing frame is placed in a ramp. Decking adds significant weight to landing. If decking added, you will need to remove decking end pieces when assembling ramp.
**6.** 3/8" holes to allow connection to ramp modules will be drilled at time of ramp construction.

▼
**Use 92 1/2" wide module if using 39" ramping modules.**

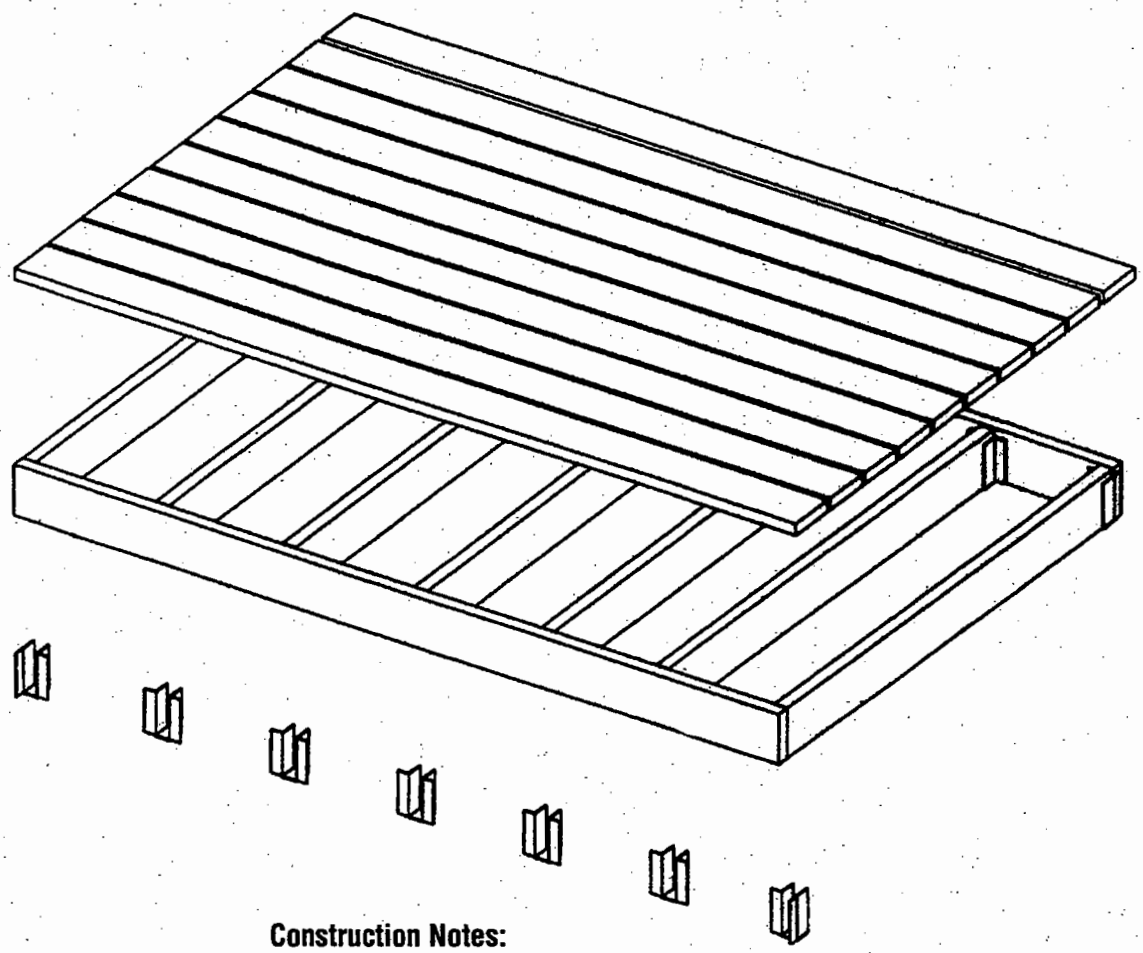
## 58"-long x 98 1/2"-wide Landing Module

**(for 42" modules)**

Used for level landings in180-degree switchback ramps and sometimes at doorway

**Components:**

**7** 2x6 by 55" Joists (Order four 2x6x10 and cut seven joists)
**2** 2x6 by 98" End Pieces (Order two 2x6x10 and cut two endpieces)
**10** 5/4x6 by 98" Decking (Order ten 5/4x6 by 10 and cut ten pieces)
**140** 2 1/2" Deck Screws (14 per decking plank)
**28** 3" Deck Screws (to attach end pieces to joists)
**14** 2x6 Joist Hangers
**140** Joist Hanger Nails



**Construction Notes:**

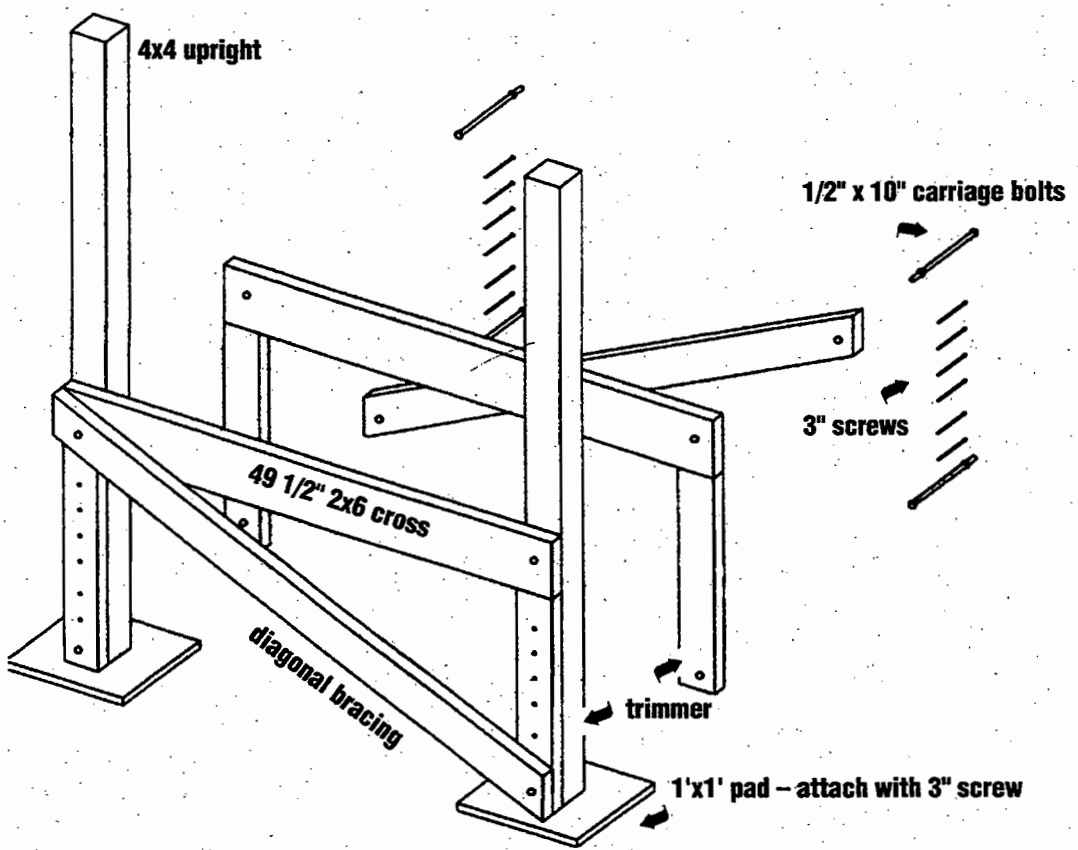
**1.** Cut joists and end pieces to length and assemble on flat surface. Space joists 16" apart on center.
**2.** Screw end pieces to the ends of joists with 3" screws.
**3.** Insure landing is square and nail on joist hangers.
**4.** Bend outside flange of four corner joist hangers flat against end pieces of landing.
**5.** Decking may be attached at this point or after landing frame is placed in a ramp. Decking adds significant weight to landing. If decking added, you will need to remove decking end pieces when assembling ramp.
**6.** 3/8" holes to allow connection to ramp modules will be drilled at time of ramp construction.

## Support Structure (for 42" modules)

Used when distance between top of cross support and plywood pad exceeds 21"

**Components:**

- **2** 4x4 Support Posts (Length determined by height requirements of ramp )
- **2** 1'x 1' by 3/4" Treated Plywood Pads (Will be screwed to bottom of 4x4 with three 3" deck screws)
- **2** 2x6 by 45 1/2" Cross Supports
- **4** 2x4 Trimmers (Length equals distance between bottom of cross support and plywood pad.) (Trimmers will be screwed to 4x4.)
- **2** 2x4 Diagonal Braces (Length will be determined by height of cross support)
- **4** 1/2" 10 Carriage Bolts with nuts and washers (9/16" holes will be drilled in support structures for these bolts)




**Construction Notes:**

**1.** During construction, determine the length of the 4x4s by measuring from a string line that equals the height and slope of the ramp you are building.

**2.** A standard guardrail height of 36" can be obtained by having 34" of 4x4 extend above the ramp surface. Compute the length of each 4x4 upright by measuring down from ramp surface to plywood pad on the ground and add 34" to that number.

**3.** The two legs are often not the same length due to uneven terrain.

**4.** The cross supports are an extra 1/2" long to allow space to easily set modules in place.

**5.** During construction, be sure that 4x4s are plumb and cross supports are horizontal before installing carriage bolts, trimmers, gussets and bracing. Temporarily attach cross supports with screws to allow for adjustments and place bolts, bracing and gussets after all modules are in place.

**Onsite construction assembly procedures are provided in the following pages.**

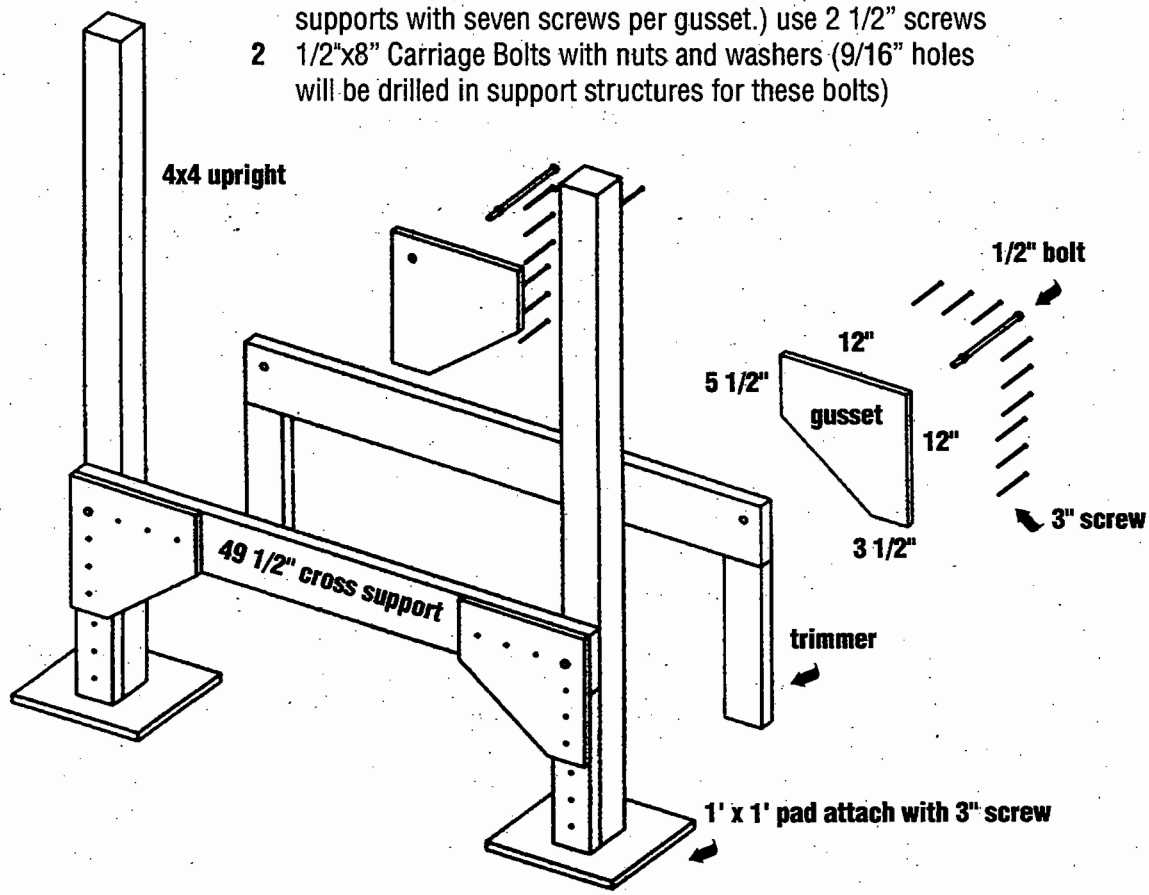
## Support Structure

**(for 42" modules)**

Used when distance between top of cross support and 1'x 1' x 3/4" pad is 12" to 21"

**Components:**

- **2** 4x4 Support Posts (Length determined by height requirements of ramp)
- **2** 1'x 1' by 3/4" Treated Plywood Pads (Will be screwed to bottom of 4x4 with three 3" deck screws)
- **2** 2x6 46 1/2" cross supports for 39" module
- **4** 2x4 Trimmers (Length equals distance between bottom of cross support and plywood pad.) (Trimmers will be screwed to 4x4.)
- **4** 3/4"-thick Treated Plywood Gussets (see drawing for dimensions) (Gussets will be screwed to trimmer and cross supports with seven screws per gusset.) use 2 1/2" screws
- **2** 1/2"x8" Carriage Bolts with nuts and washers (9/16" holes will be drilled in support structures for these bolts)




**Construction Notes:**

**1.** During construction, determine the length of the 4x4s by measuring from a string line that equals the height and slope of the ramp you are building.

**2.** A standard guardrail height of 36" can be obtained by having 34" of 4x4 extend above the ramp surface. Compute the length of each 4x4 upright by measuring down from ramp surface to plywood pad on the ground and add 34" to that number.

**3.** The two legs are often not the same length due to uneven terrain.

**4.** The cross supports are an extra 1/2" long to allow space to easily set modules in place.

**5.** During construction, be sure that 4x4s are plumb and cross supports are horizontal before installing carriage bolts, trimmers, gussets and bracing. Temporarily attach cross supports with screws to allow for adjustments and place bolts, bracing and gussets after all modules are in place.

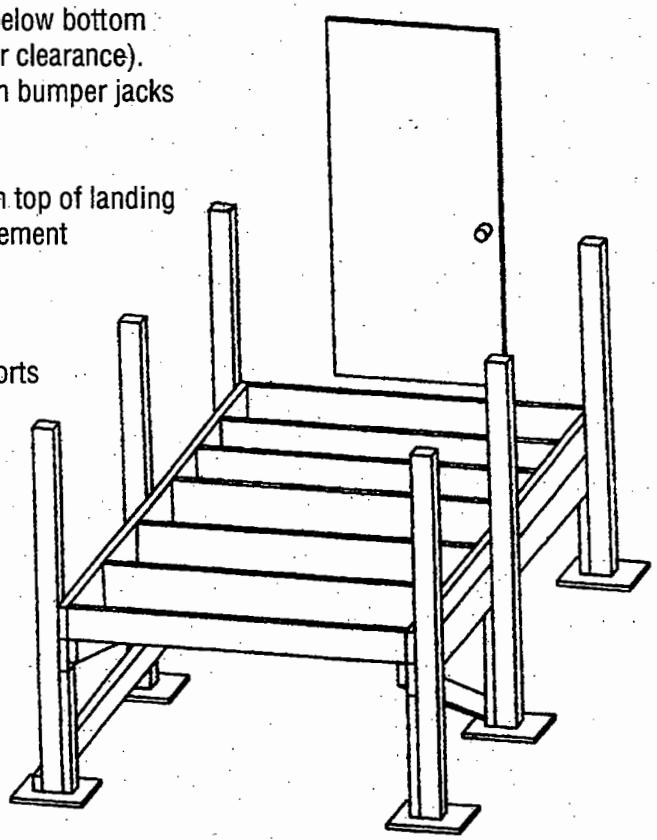
**Straight, right-angle and switch-back layouts are shown.** For illustrative purposes, a 58" x 7'11" level landing is shown at the doorway. The first sloped section is the same on all three ramps (much of the construction for all three styles is identical). All ramps have twenty-nine feet of sloped surface and could be made with 58" length modules, combinations of 116" and 58" modules.

The design of the level landing at the doorway is critical to the functional use and construction of the ramp. Because of the wide variety of existing stoops and entry-way configurations, it is not possible to design a modular component that will meet the needs of all entry ways. Usually construction of the level landing requires customization on-site. Keep in mind the space requirements for use of the doorway and the requirements of the other users of the doorway (see page 8). Steps will often need to be built to the new landing to replace the old steps covered. Steps are probably the hardest component to build. Experienced builders should handle that task. Before beginning construction, be sure to review the design principles listed in this manual as a final check. It is easier to change the design before construction than after construction.

▼ Place landing module so that 2x6 joists are 1 3/4" below bottom of door (when decking is added you will have 1/2" door clearance). Insure that the landing is level (temporary support with bumper jacks is helpful in leveling landing).

▼ Place pads as shown in drawing then measure from top of landing including decking to each pad. Add 34" to this measurement and cut 4x4's to this length.

▼ Attach pads to 4x4's with screws and place in position, insure they are plumb. Attach cross supports with screws temporarily. Be sure cross supports fit snugly under landing and that landing is level.



## TO DETERMINE SLOPE OF THE RAMP:

**(for ramp example shown)**

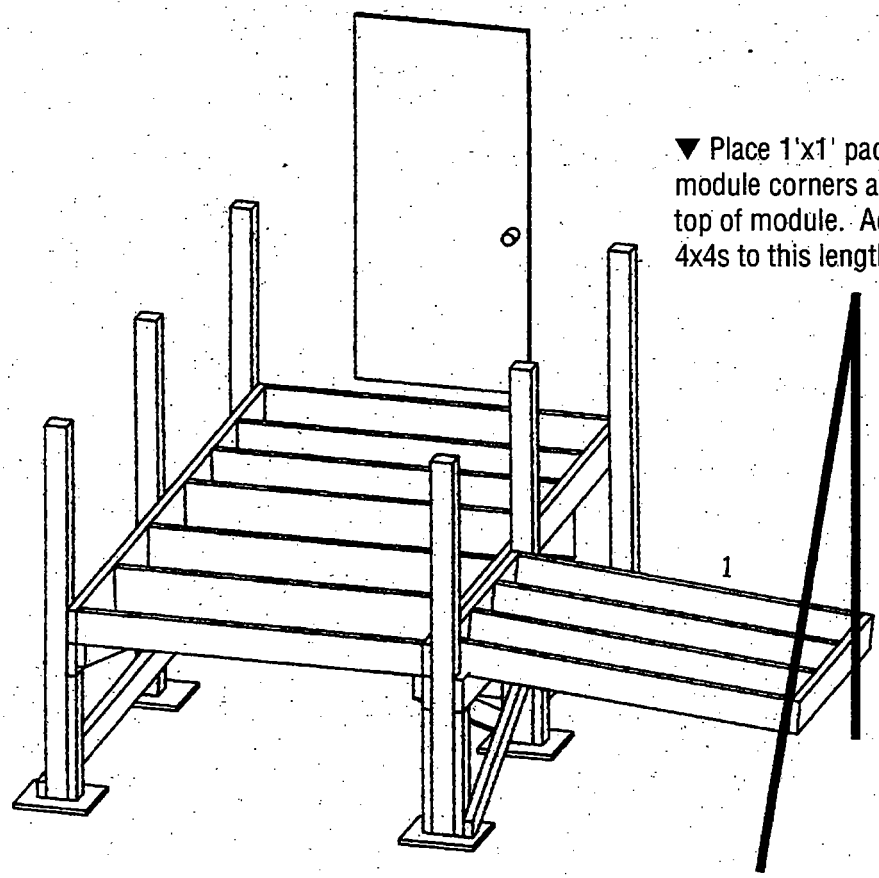
Run a 14' 6"' string line from top landing to where next level landing will begin. This line represents 1/2 of total vertical drop. Use a line level to determine horizontal height from top landing and measure 14 1/2" down. Bottom end of string line should be supported to this height. You will match the slope of the modules to this line.

## TO HANG MODULES:

▼ Drill 3/8" holes in landing to match the 3/8" holes pre-drilled in Module 1.

▼ Place 3/8"x 4" carriage bolts in the holes in the landing, slide module onto bolts. Support lower end of module to approximate height of string line, add washers & nuts, and tighten (do not over-tighten as this will pull end piece away from lower module).

▼ Match module slope to string line and insure module is level side-to-side. Temporary support with bumper jacks is helpful in adjusting heights.

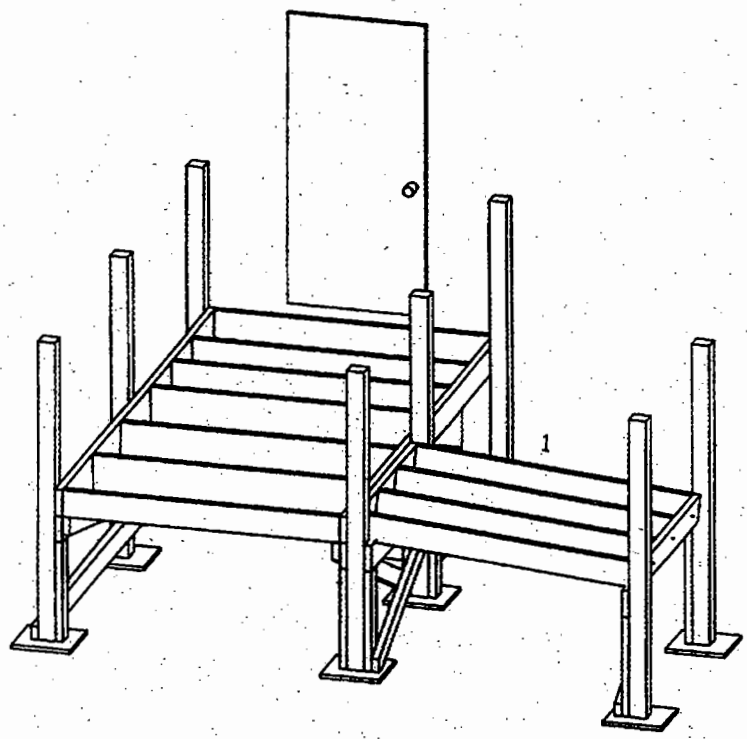



▼ Place 1'x1' pads beneath module corners and measure to top of module. Add 34" and cut 4x4s to this length.

▼ Attach pads to 4x4's and stand in place at lower end of Module #1. Insure that 4x4's are plumb, and module is level horizontally and at proper slope (by matching to string line).

▼ Attach beveled cross support with screws to each 4x4 at lower end of Module #1. This will hold cross support temporarily. Trimmers and bolts will be applied at lower end of Module #1 after all modules are in place.

▼ At upper end of module, place beveled cross support tightly beneath module and screw in place. Insure 4x4's are plumb.

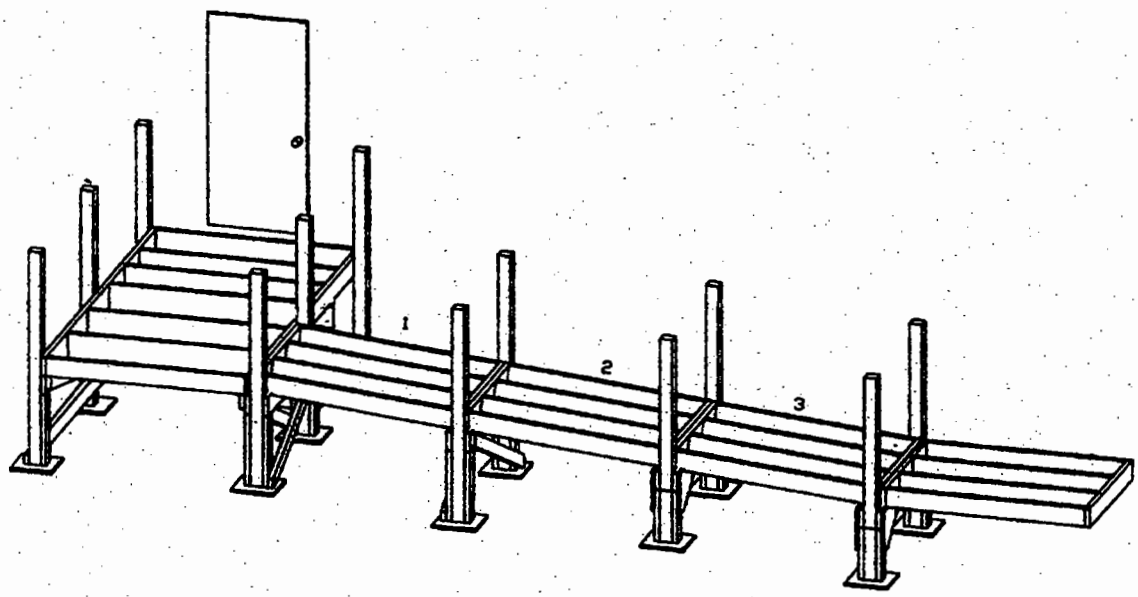



NOTE: Modules 1, 2, and 3 could be replaced with a 58" and a 116" module.

The cross support structures will always be 58" apart. When constructing the ramp, you will place the first support structure at the lower end of the first complete module you are working with and add remaining support structures later if the first module is 116".

▼ Attach Module #2 to Module #1 with 3/8" bolts and tighten firmly. Support lower end of Module #2 with jacks and match slope to string line. Cut 4x4s to length, stand in place at lower end of Module #2, and attach cross supports with screws.

▼ At top of Module #2, attach cross support to 4x4's with screws..

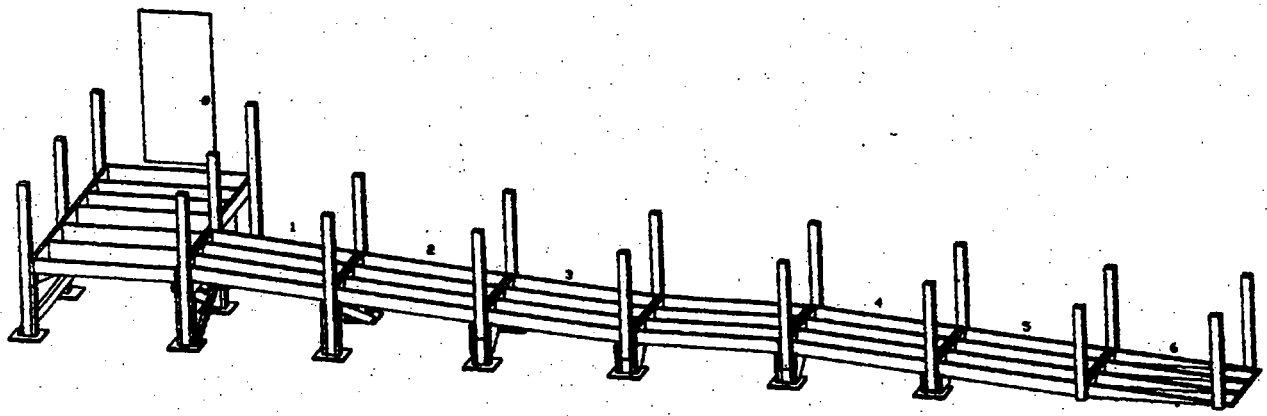


▼ Repeat process to add Module #3.

▼ The level landing is erected in the same manner as the sloped modules. In this example, a level landing is shown because it is recommended that ramps 29' or more in length have a level resting place.

Note: Place string line from end of level landing to point where ramp will end in order to determine proper ramp slope.

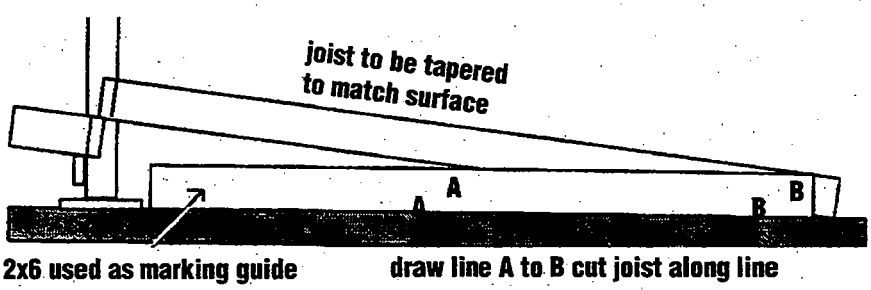
▼ Continue hanging modules and note that no gusset is needed between Modules #4 and #5. You will need to use 2x4 cross supports at the junction of #4 and #5.



▼ Gussets are placed after the 1/2" carriage bolts have been inserted and tightened. A 1 1/2" hole is drilled to allow the threaded end of the bolt to pass through the gusset. A 1 1/2" indentation is made in the other gusset for the head of the carriage bolt.

▼ When all landings and modules are in place, make any adjustments needed to insure the slopes of each section are equal. Install the trimmers, 1/2" carriage bolts, bracing and gussets again making sure that 4x4s are vertical and ramp surface is level.

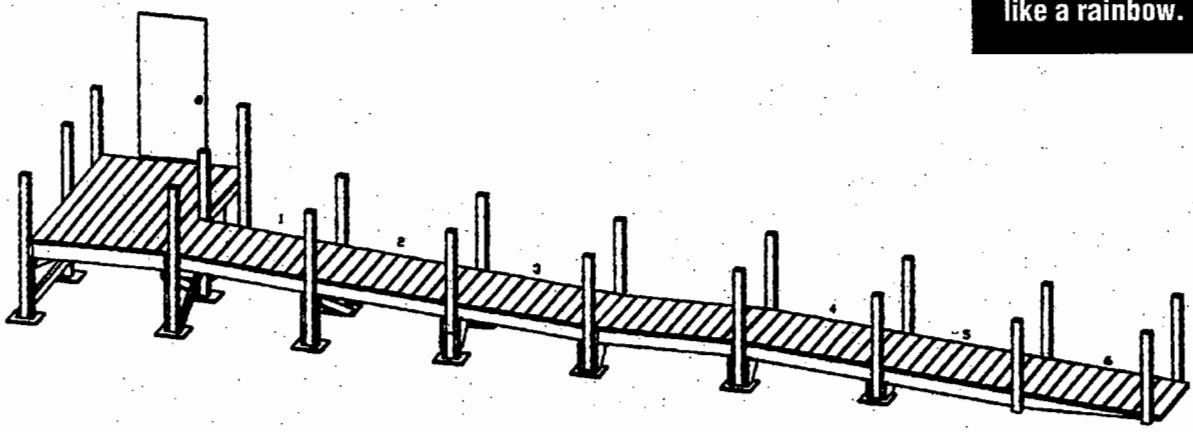
## CUTTING TAPERED JOIST NEEDED FOR OPTION B




Assemble one end piece of a module, NAILING HANGERS TO THE END PIECE ONLY. Place this end piece on top of ramp module as shown above and set a joist into each hanger making sure all 4 are parallel. The opposite end of the joist will rest on the ground. If the surface under the joist is uneven, try to level as much as possible. Place the 2x6 marking guide beside each joist and draw a pencil line from A to B. Remove each joist and cut along the pencil line. Bolt the end piece to the upper ramp module. Place tapered joist back in the hangers and install hanger nails into the two middle joist. You will be cutting a notch in the outside joists for the outrigger, so do not attach them to joist hangers until the outriggers are completed. Proceed as described on page 33A.

▼ Decking can now be installed. Use 10 5/4 x 6 pieces of decking for every 58" of landing and slope. Due to variations in the size of decking due to moisture content, it is important to lay all 10 boards in place and make sure the gaps between them are equal. Equally spaced gaps are needed for good drainage. "Wet" decking boards will shrink a little to create proper spacing.

**▼ Check the end grain of each decking piece. Attach to joist so that the grain is facing down like a rainbow.**

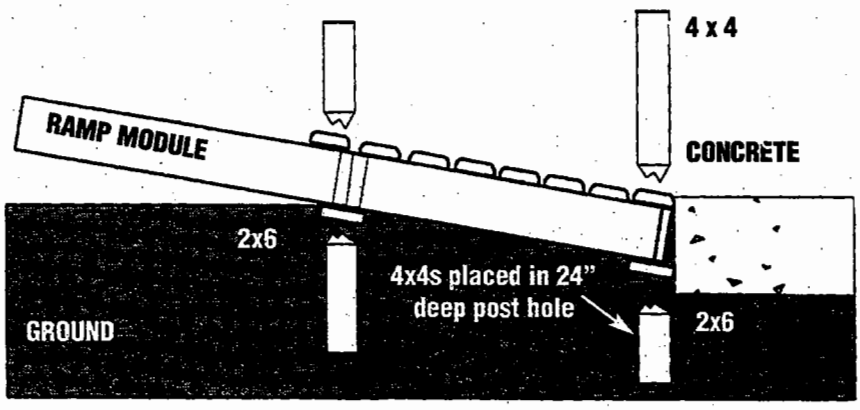


## TRANSITION FROM RAMP TO GROUND

### Option A:

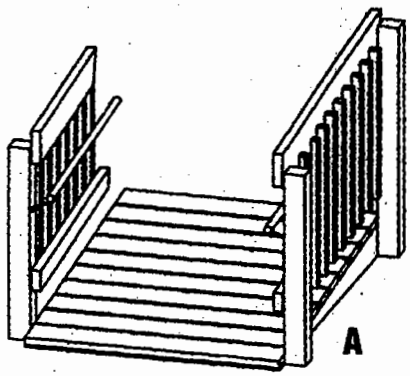
Working over dirt, remove enough dirt to allow modules #5 and #6 to maintain the proper slope for a smooth transition to ground level. A 42"-long 2x6 is laid underneath the end of Module #6, and another under the junction of Modules #5 and #6. The lower two sets of 4x4's are set into the ground to a depth of 24".

The newly cut end of any piece of treated lumber that will be in ground contact should be protected with a fence post preservative type of product. Uncut ends do not need extra protection. Consult with the lumberyard where you purchased the lumber for advice on specific products.



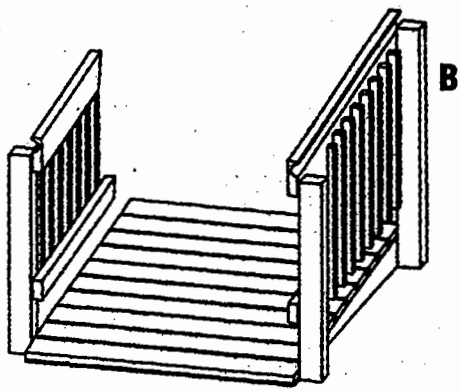

**Be sure to create a smooth transition from ramp to concrete or asphalt.**

## GUARDRAIL/HANDRAIL




### Option A:

Attach 2x4 boards to 4"x4"s parallel to ramp surface, 4" above ramp surface. Attach 2x6 boards parallel to 2x4's so that top of 2x6 is 36" above ramp. Cut 2x2 spindles to 30" lengths and attach vertically to 2x4 and 2x6's with 4" space between each. Use a 3 7/8" spacer to make spindles installation easier. 1 1/2" round hand rail can be attached to the 4x4's or the 2x6 at a height that is most convenient to the user.(The reason the 2x4 is placed 4" above the ramp is to allow for easier snow removal.)



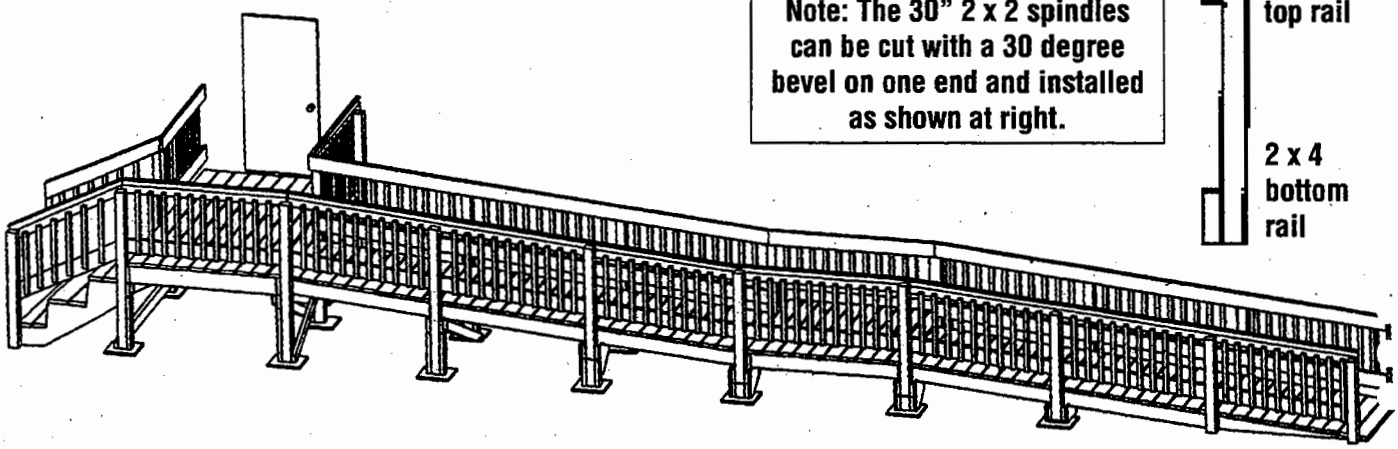

### Option B:

Same as above, except that top rail consists of 2x6 board that has been plowed for a hand grip. The plowed groove is placed on the outside of the ramp.

When ordering lumber for guardrail, order the longest board possible; i.e 15' of guardrail from 2x6x16. You can get 3, 30" spindles from an 8' length and you need 10 spindles per 59" section.

Note: Type of guardrail/handrail selection is based on needs of the user.
It may be easier for someone to pull themselves up the ramp using the 1 1/2" round hand rail rather than using the plowed-style of 2 x 6 handrail.

## COMPLETED RAMP



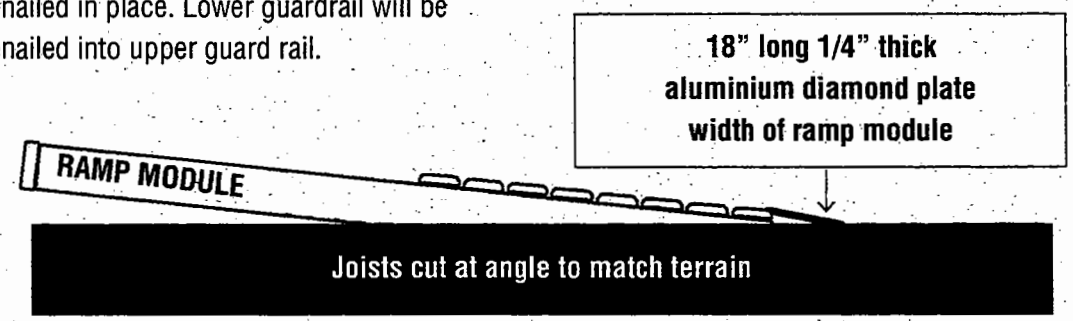
**Note: The 30" 2 x 2 spindles can be cut with a 30 degree bevel on one end and installed as shown at right.**

## Option B: See page 32 for cutting taper

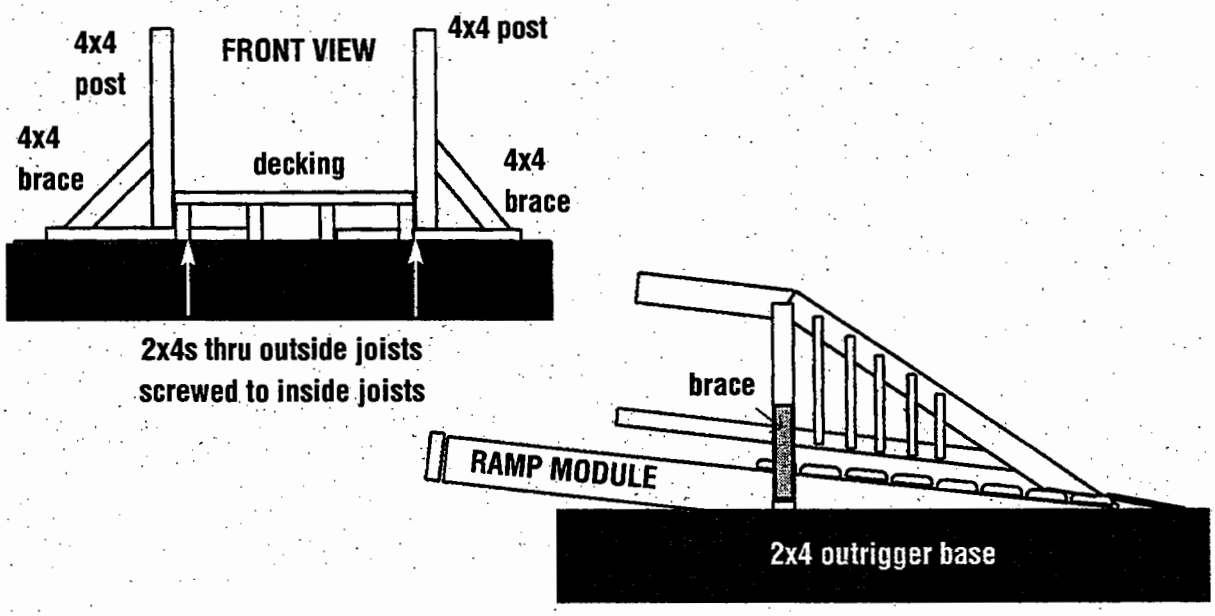
Working over concrete, blacktop, or frozen ground, four 114 1/2" joists are cut to taper that matches the ground level. An endpiece is attached to these four joists, and this is bolted into place in the same manner as the module (this replaces Module #5 and #6). An outrigger is placed underneath this section where the junction of Module #5 and #6 would be. The 4x4 post is braced using this outrigger.

▼ To construct outrigger, cut a 1 1/2" x 3 1/2" notch in each outside joist where the junction of Modules #5 and 6 would be. Place a 26" long 2x4 through this notch and attach to inside joist. Stand 4x4 in place and cut a 15" long brace with a 45-degree angle cut on each end using 4x4s. Attach this brace with screws to the upright 4x4 and the horizontal 2x4.

▼ Upper guardrail will be angled to the end of ramp and toenailed in place. Lower guardrail will be toenailed into upper guard rail.

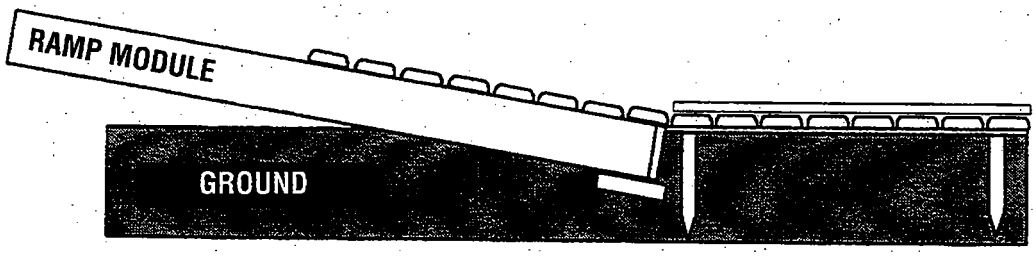


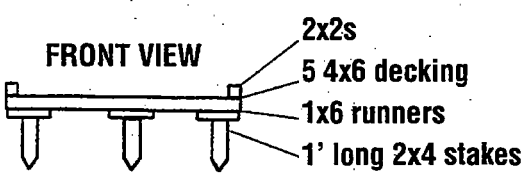

**Aluminum diamond plate is skid resistant and provides a smooth transition from end of ramp to a hard surface. Attach to last piece of decking with 4 1 1/4" flat head screws. Masonary screws can be used to attach the plate to concrete.**



Landscaping fabric can be placed under the boardwalk to prevent plant growth between the decking boards.

## BOARDWALK TO CREATE HARD SURFACE FOR WALKING AND WHEELING




**Eliminate 2x4 stakes when working over frozen ground or other hard surfaces.**

**Boardwalk, leading from the ramp to driveways or sidewalks, can be installed instead of concrete or asphalt walkways. Three 1x6 treated boards are staked to the ground with 1' long 2x4 stakes at 5' intervals. Decking boards are then attached to the three parallel runners. 2x2s can be screwed in place on each outside edge to act as a wheel guard. Any length boardwalk can easily be installed, with turns as needed. Boardwalk, like modular ramps and stairs, can be used as long as needed and then also easily removed.**

## RIGHT ANGLE TURN

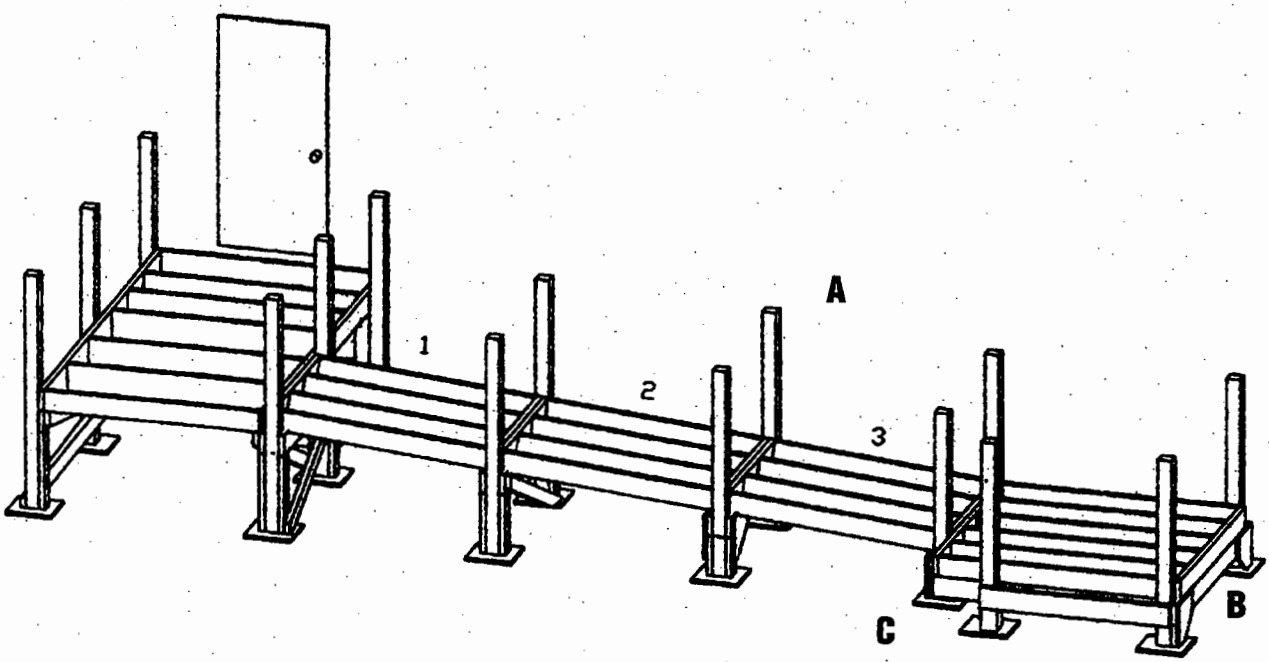
▼ Attach 58"x 60" platform to bottom of Module #3 with 3/8" x 4" carriage bolts. Support platform temporarily with jacks. Make sure the platform is level. Take measurements for length of 4x4's, cut 4x4's to length, attach pads and place 4x4's as in diagram.

▼ Attach 58"-long cross support with screws on landing side of 4x4's at bottom of Module #3 (side A in diagram).

▼ Attach cross support to 4x4's with screws on opposite side of landing (side B in diagram).

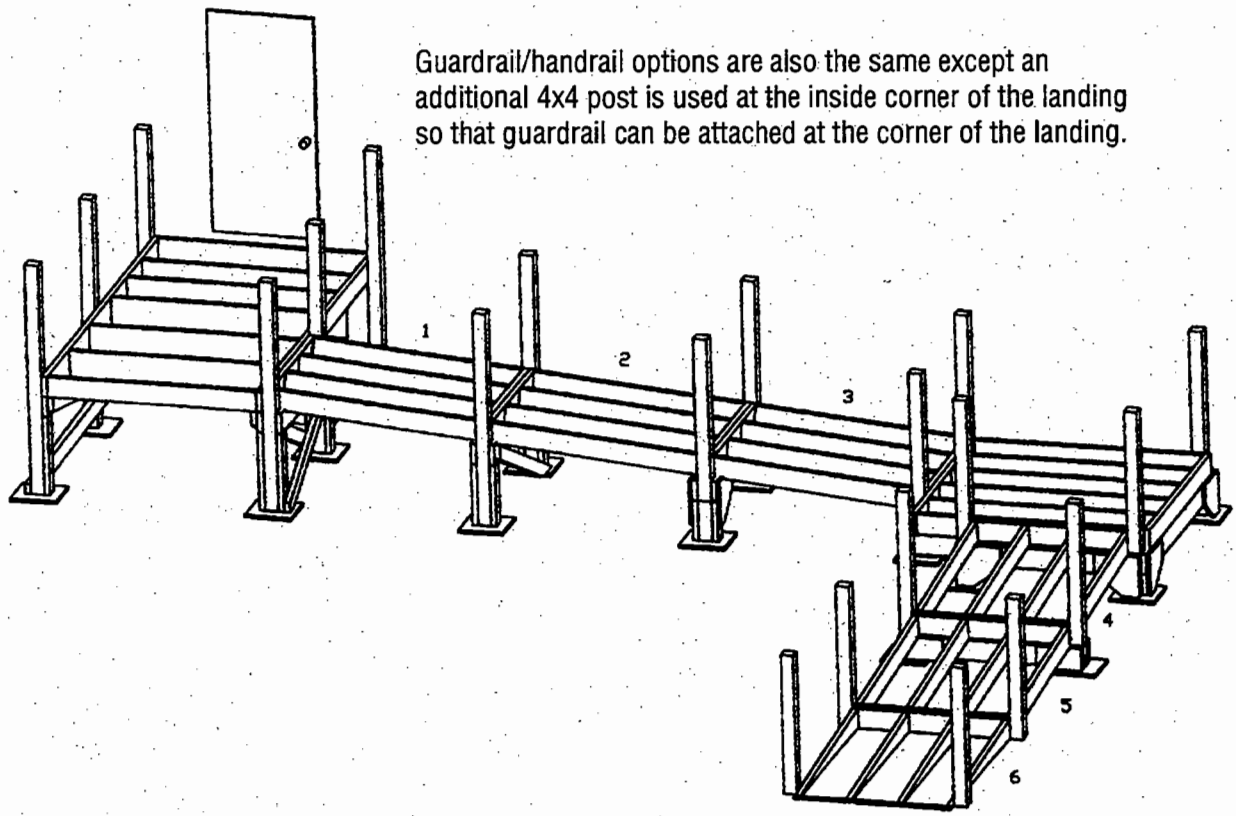
▼ Attach cross support to side C.

NOTE: To build a ramp with a right-angle turn, complete the first section of the ramp as described in previous pages (the lengths of each section do not need to be equal, ex: a 14'6" top section and 9' 8" lower section could be used). Use a 58"x 60" platform and support with 58"-long cross supports. Five 4x4's are used for this landing. (See illustration on page 36.)
All support structure assembly is the same as for sloped sections.

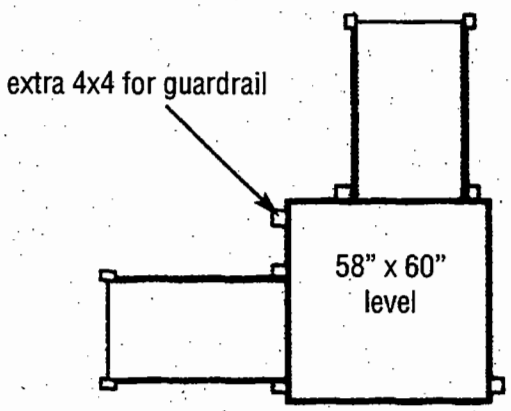


▼ Attach string line from top of level landing to point where ramp will end and attach Module #4 in the same manner as described for the top level landing.

NOTE: The same options for transition to the ground are used for this design.



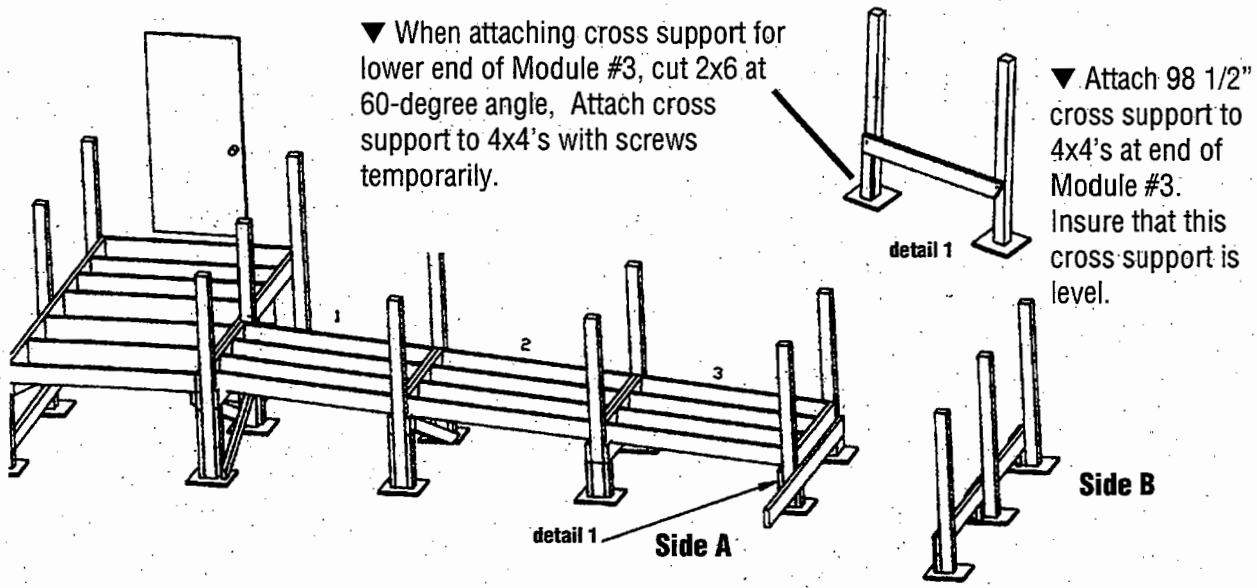

Guardrail/handrail options are also the same except an additional 4x4 post is used at the inside corner of the landing so that guardrail can be attached at the corner of the landing.

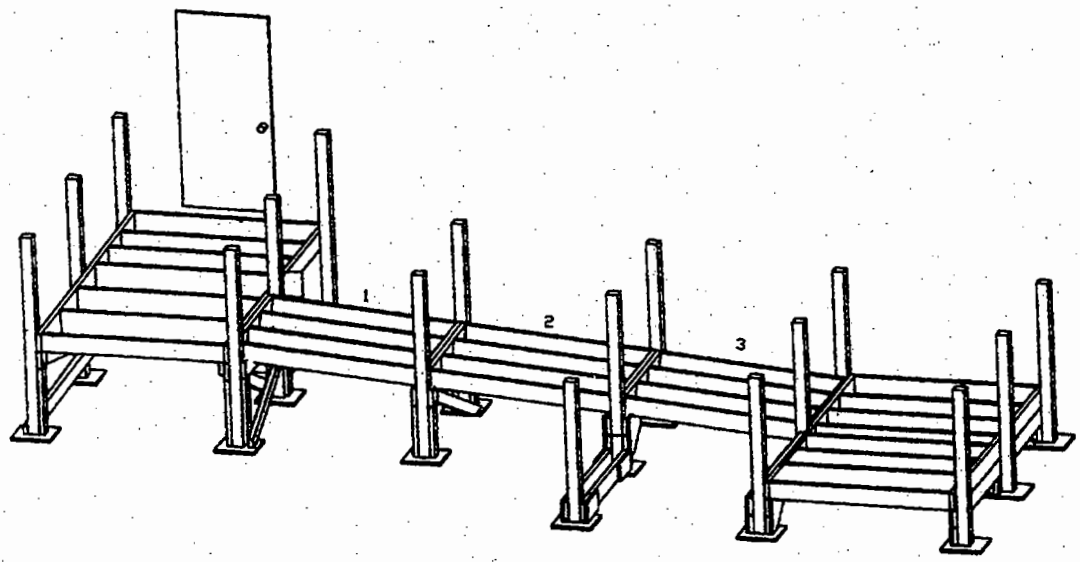



4x4 posts are positioned so that guardrails is above outside 1 1/2" perimeter of landings and slope. 3" screws are used to attaich rail to posts, always inserting screw through rail and then into 4x4

## 180 DEGREE RAMP

To build a ramp with a 180-degree turn, complete the first section of the ramp as described in previous pages (the lengths of each section do not need to be equal, ex: a 19'4" top section and a 14'6" lower section could be used). Use a 58'x98 1/2" platform and support with 98 1/2" cross supports.




▼ Drill three 3/8" holes in 58"x 98 1/2" landing to match holes in end of Module #3. The end of the level landing will be at the outside edge of the 4x4 so be sure to adjust measurements for hole alignment.

▼ Attach 58"x 98 1/2" platform to module 3 and support other end with jacks. Level platform and measure for 4x4's. Place 4x4's on side B as in diagram and attach cross support.

▼ Attach cross support to side A.

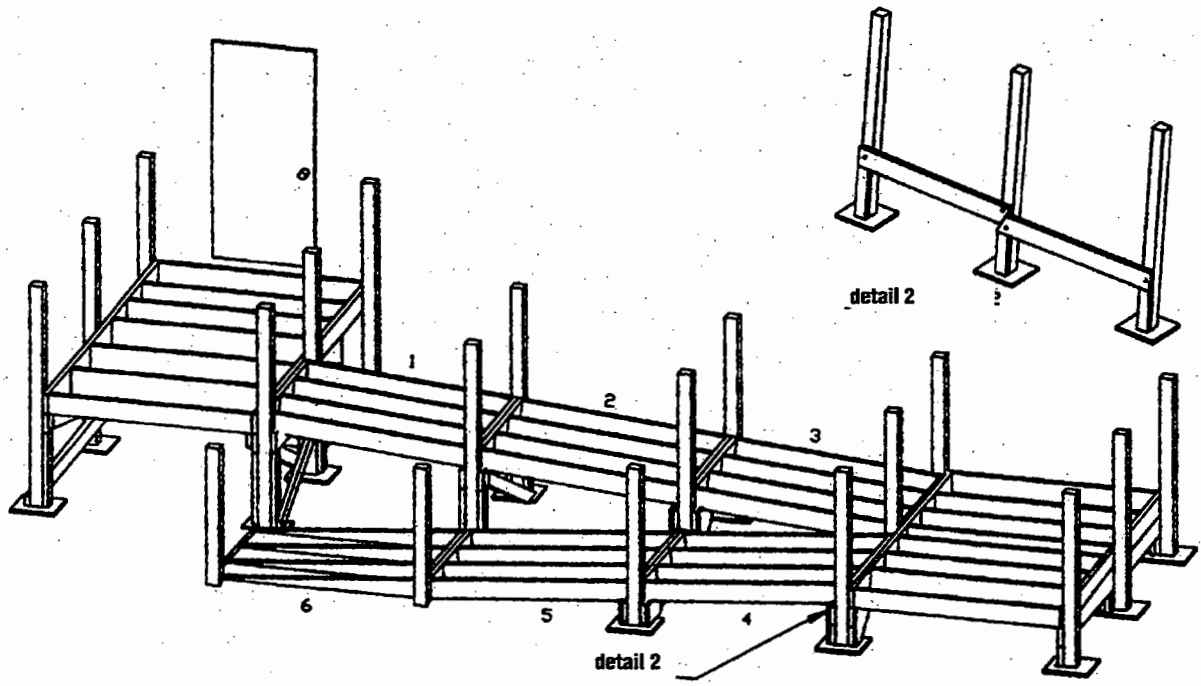
▼ Put 4x4 for Module #4 in place and attach with deck screws.

▼ Attach string line from top of level landing to point where ramp will end.

▼ Bolt Module #4 to landing with 3/8"x 4" carriage bolts. Match module slope to string.

▼ Attach cross support for Module #4 as shown in detail 2.

▼ Cross supports for the junction of Modules #4 and #5 will be attached to the 4x4 at the junction of Modules #2 and #3.

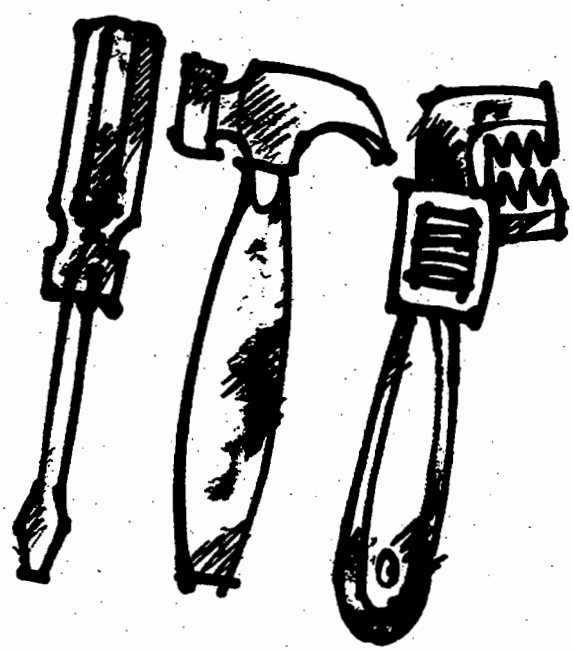



Note: The same options for transition to the ground are used for this design. Guardrail/handrail options are also the same except the inside guardrail on the lower portion of the ramp will be attached to the center 4x4's. Between modules 3 & 4 some 2x2x30"spindles will need to be screwed in place from inside the ramp.

# USEFUL TOOLS TO HAVE ON HAND

**Power Miter Saw with 10" Blade**
Very helpful for cutting 4x4's and for repetitive same-length cuts such as decking and for angle cuts on guardrail
**Circular Saw with 7 1/4" Blade**
**Hand Saw**
**Block Plane**
**Saw Horses**
**3/8" Variable Speed Reversible Drill**
Used for drilling 3/8" holes for driving deck screws
**1/2" Hammer Drill Variable Speed Reversible**
For tapcons and drilling 9/16" holes (tapcons are cement screws)
**12"x 9/16 Twist Drill Bit**
For all holes for 1/2" carriage bolts
**3/8" Twist Drill Bit**
For all 3/8" holes
**1 1/2" Fly Cut Drill Bit**
Holes & Indentations in Gussets
**#2 Phillips 1/4" Drive Bits**
Drive Deck Screws
**#3 Phillips 1/4" Drive Bits**
Drive tapcon screws (use 1/2" drill)
**Cordless Drills - VSR**
Helpful - not required
**2' Level**
For plumbing 4x4's
**4' Level**
To level landings & ramp side to side
**String Level**
To determine slope of ramp
**String Line**
To align ramp slope
**Framing Square**
To maintain square modules
**25'x 1" Tape Measure**
One per worker is helpful
**Sledge Hammer**
**6' Frost Bar w/tamping head**
For positioning Ramp

**Stanley Bar**
**Spade or Shovel**
**Post Hole Digger**
**Claw Hammers**
**Vice Grip**
Useful for Removing Screws w/stripped heads
**3/8" Ratchet Driver**
**9/16"x 3/8 Deep Socket**
**3/4"x 3/8 Deep Socket**
**8" Adjustable Wrench**
**Power Cords - grounded**
#14 Gauge Minimum
**Safety Goggles**
**Safety Face Masks**
**Bumper Jacks**
Useful for positioning landings.



# Maintenance Guidelines

### Maintaining a Non-Slip Surface

A ramp with a safe slope and spacing between boards for drainage will accommodate weather conditions in cold climates. It is important to ensure the ramp surface remains free of ice and snow. After each snowfall, shovel or sweep the snow off the ramp to prevent accumulation. Quickmelt or similar products can be sprinkled on the ramp surface to prevent ice build-up and reduce slipperiness caused by morning frost.

### Treating Your Ramp

Treated lumber does not need to be sealed, stained or painted for protection. If you wish to prevent it from appearing weathered or want to change color, consult the lumber yard where you purchased the treated wood for advice on products to use.

### Monitor the Ramp for Changes

If the user of the ramp notices the wheelchair pulling to one side or the other, the ramp surface may not be horizontal. This can be corrected by raising or lowering the appropriate side of the support structure.

If a height difference occurs between a landing and a sloped section, an abrupt rise can be created that is not easily traversed. This is also correctable by raising or lowering the support structure.

If any boards splinter or crack, they should be replaced. Also monitor handrails and brackets and replace any loose connections.

Be aware of changes in any aspect of your ramp and correct problems as soon as possible,

*We have reviewed your letter from the State of Minnesota Department of Administration regarding your compliance with the State Building Code.*

*At your request, we are furnishing this letter to substantiate our professional opinion that the handicap ramp will not be adversely affected with mud fills located at grade, in lieu of providing footings to the required frost depth. It is our opinion that wood structures of this type are inherently provided with adequate flexibility in their connections to alleviate any additional stress that might be incurred through frost heaving. The cross bracing evaluated by our office did not require the use of frost footings to provide adequate lateral stability. We do recommend, however, that it would be appropriate to review the construction of the ramp on an annual basis to determine if additional shimming below the mud fills is required to maintain the proper slopes of the ramp.*

*Sincerely,*

*Jeffrey S. Rudin, P. E.*
*Senior Structural Engineer*
*Rudin Structures*

**This letter was received in October, 1992 from the engineering firm of Rudin Structures regarding footing requirements.**

**Rudin General Structure Notes:**

**1. Design Codes** (latest edition unless noted)

a. The 1988 Uniform Building Code as adopted by the Minnesota State Building Code.

b. National Design Specification for Stress Grade Lumber and its fastenings by the National Forest Product Associations.

**2. Design Stress**

a. Sawn lumber all values for single member; use under normal load conditions
Provide **Treated Ponderosa Pine No. 2 or better:**

| | | |
|---|---|---|
| Flo | = | 850 psi |
| Fv | = | 70 psi |
| E | = | 1,100,000 psi |
| Fc | = | 700 psi (parallel to grain) |
| Fc | = | 535 psi (perpendicular to grain) |

**3. Design Live Loads.**

a. Ramp - 60 psf.

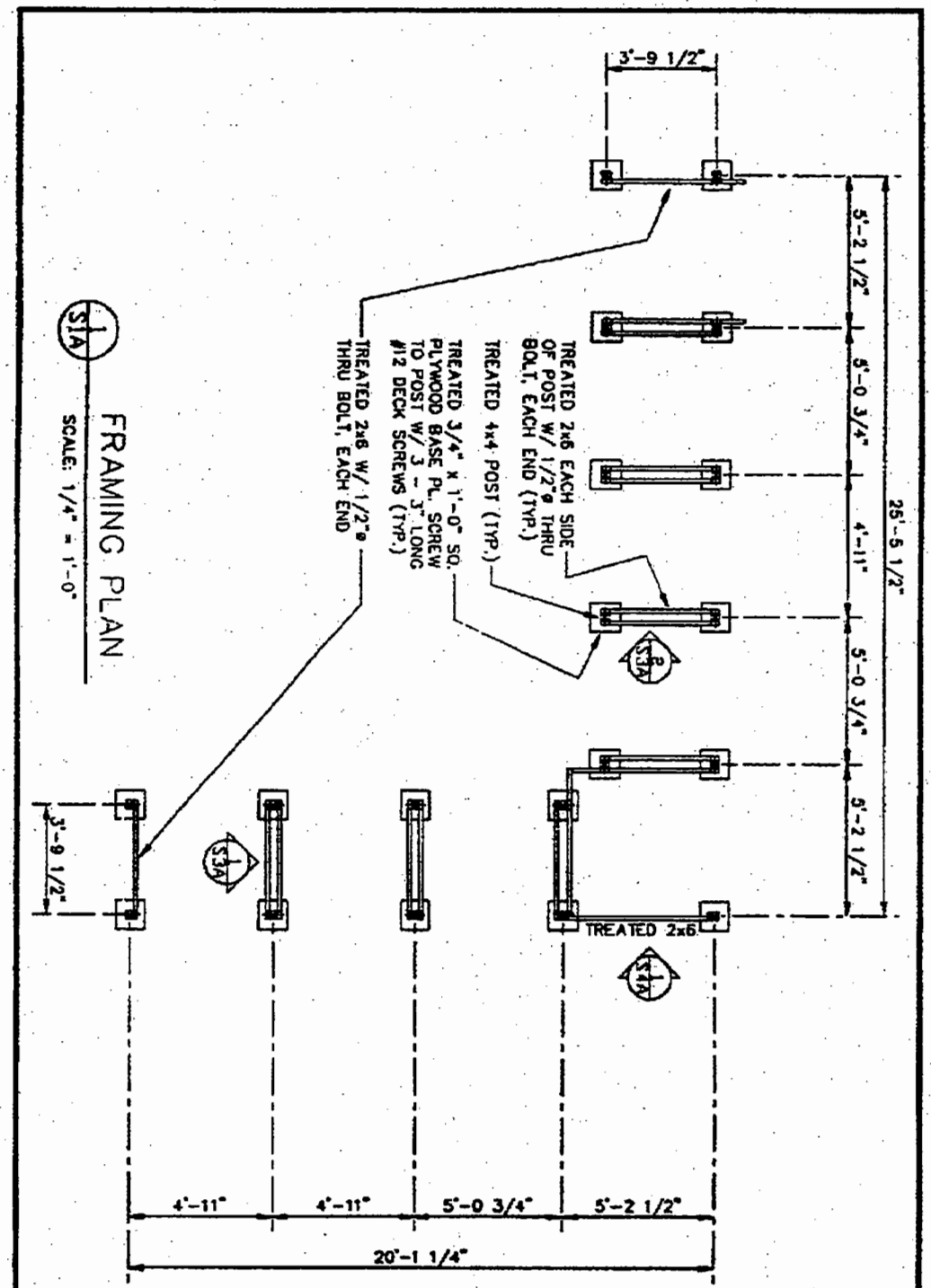
**4. Dimension Lumber**

a. All member sizes given in the drawings are nominal dimensions.

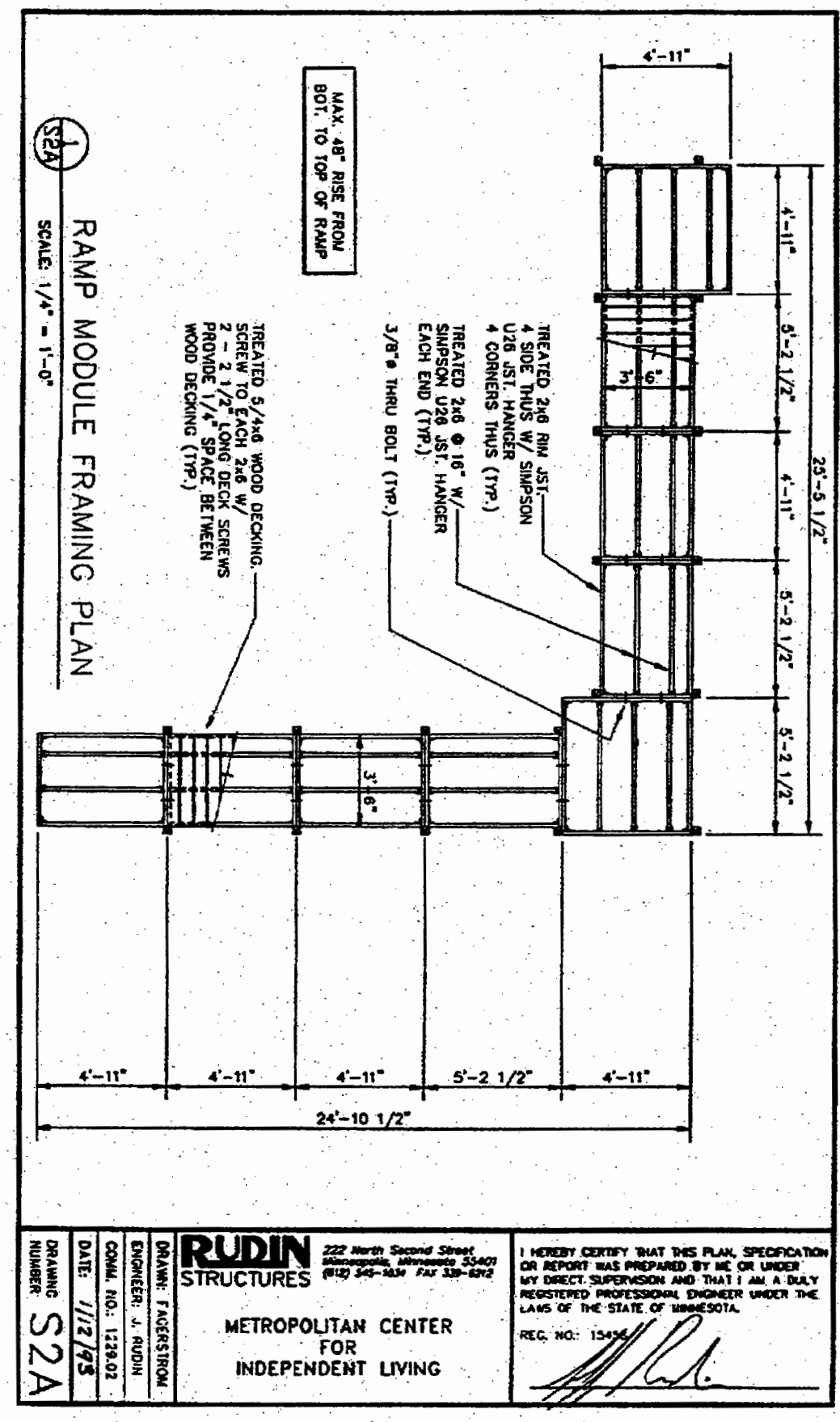
b. Where posts are called out, headers shall bear fully on posts.

c. All beams and joists not bearing on supporting members shall be framed with "Simpson Strong-Tie" joist hangers or equal. Use type "U" (or equal) for single 2x's and type "UTF" for trusses where required. The joist hangers shall be nailed using special nails supplied by the hanger manufacturer.

d. Wood headers or posts made up of 2 or more 2x's shall be spiked together.




| | | |
|---|---|---|
| DRAWING NUMBER S1A | RUDIN STRUCTURES 222 North Second Street Minneapolis, Minnesota 55401 (612) 343-1034 FAX 338-6713 | I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA. |
| DATE: 11/12/95 | METROPOLITAN CENTER FOR INDEPENDENT LIVING | REG. NO.: 15459 |
| COMM. NO.: 1220.02 | | |
| ENGINEER: J. RUDIN | | |
| DRAWN: FAGERSTROM | | |




S2A

RAMP MODULE FRAMING PLAN

SCALE: 1/4" = 1'-0"

RUDIN STRUCTURES

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Minneapolis, Minnesota 55401
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METROPOLITAN CENTER FOR INDEPENDENT LIVING

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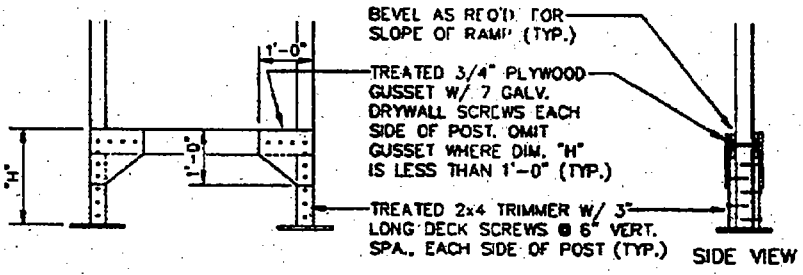
REG. NO.: 15456

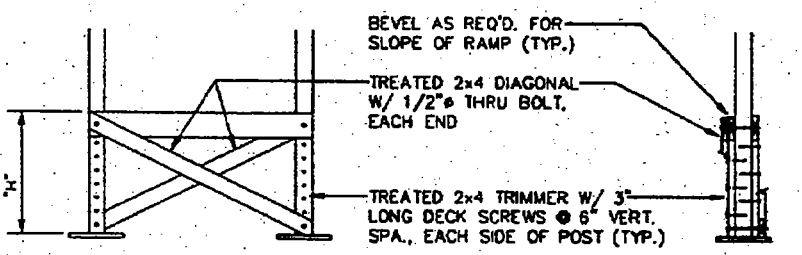
DRAWN: FAGERSTROM
ENGINEER: J. RUDIN
COMM. NO.: 1229.02
DATE: 1/12/93
DRAWING NUMBER: S2A




## ELEVATION WHERE DIM. "H" IS 1'-9" OR LESS

1/S3A

SCALE: 1/2" = 1'-0"




## ELEVATION WHERE DIM. "H" EXCEEDS 1'-9"

2/S3A

SCALE: 1/2" = 1'-0"

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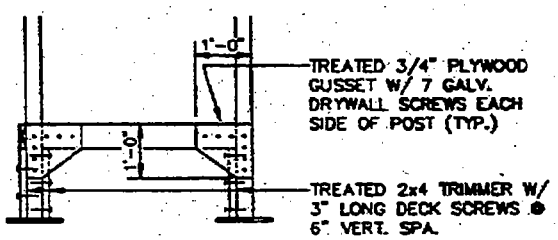
| | |
|---|---|
| DRAWN: | FAGERSTROM |
| ENGINEER: | J. RUDIN |
| COMM. NO.: | 1229.02 |
| DATE: | 1/12/93 |
| DRAWING NUMBER | S3A |




## ELEVATION

1/S4A

SCALE: 1/2" = 1'-0"

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| | |
|---|---|
| DRAWN: | FAGERSTROM |
| ENGINEER: | J. RUDIN |
| COMM. NO.: | 1229.02 |
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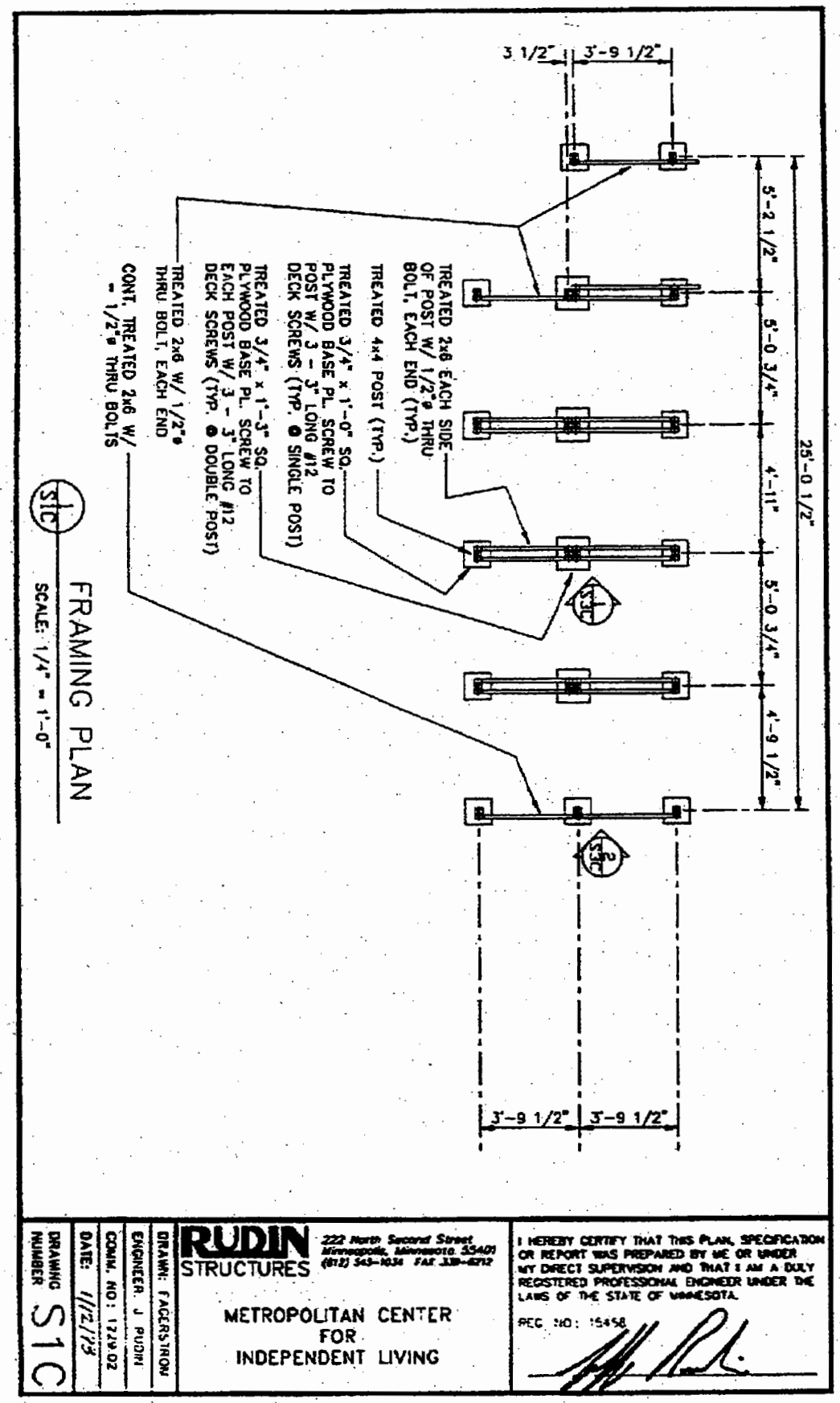


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ENGINEER: J RUDIN
COMM. NO: 1724.02
DATE: 11/21/93
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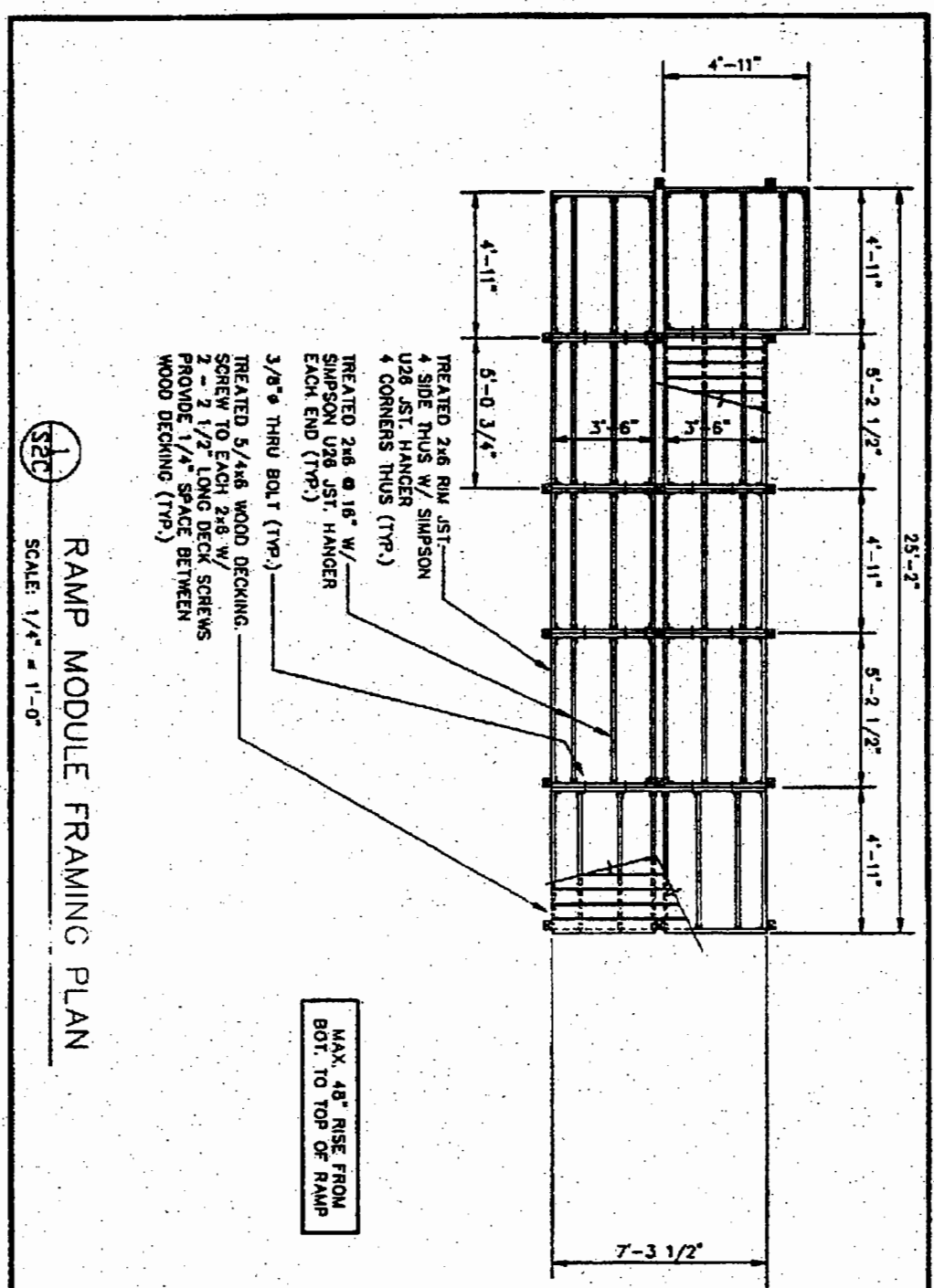


S2C 1 RAMP MODULE FRAMING PLAN

SCALE: 1/4" = 1'-0"

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METROPOLITAN CENTER FOR INDEPENDENT LIVING

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REG. NO.: 15458

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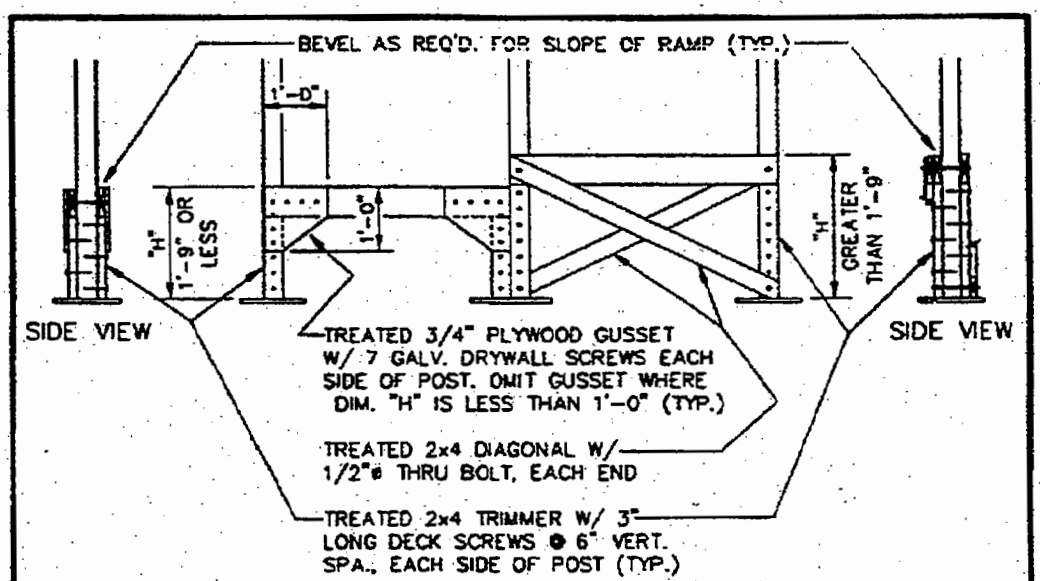
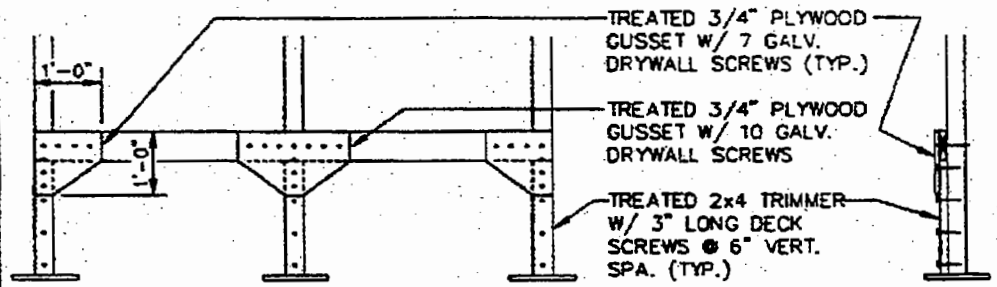
ENGINEER: J. RUDIN
COMM. NO.: 1220.02
DATE: 1/12/95
DRAWING NUMBER S2C




1/S3C ELEVATION

SCALE: 1/2" = 1'-0"




2/S3C ELEVATION

SCALE: 1/2" = 1'-0"

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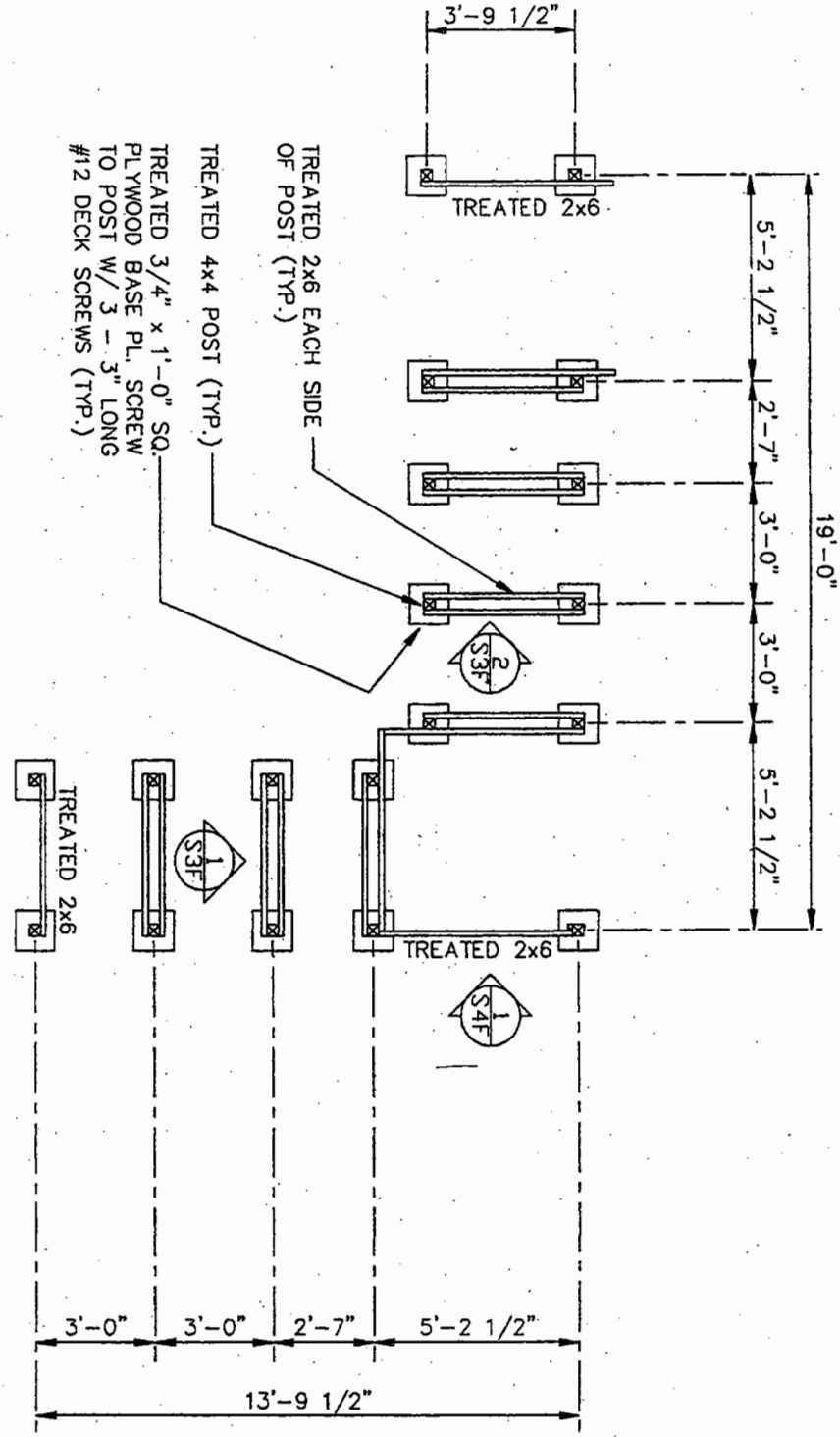
DRAWN: FAGERSTROM
ENGINEER: J. RUDIN
COMM. NO.: 1229.02
DATE: 1/12/93
DRAWING NUMBER S3C

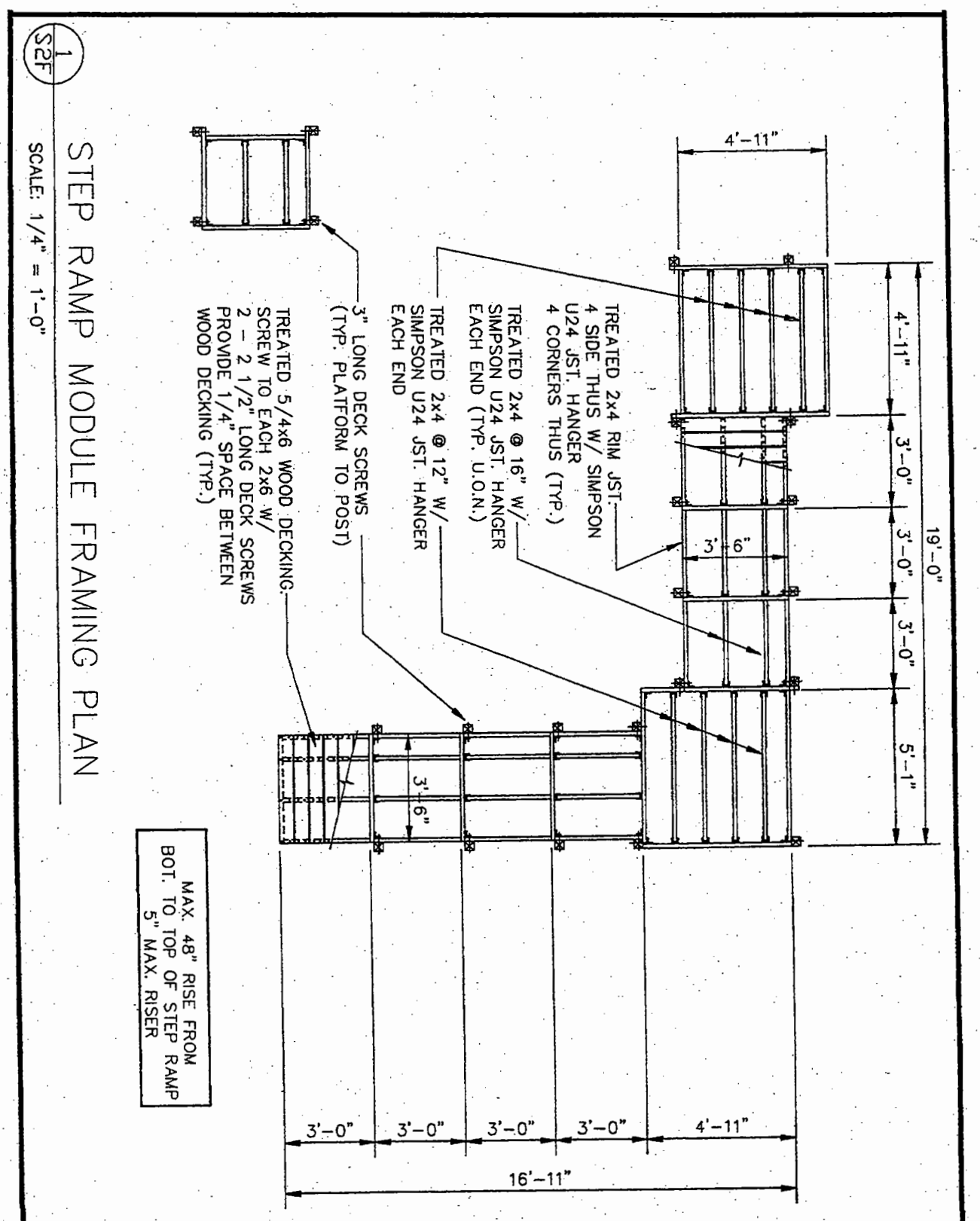



1 S1F

# FRAMING PLAN

SCALE: 1/4" = 1'-0"

| | |
|---|---|
| DRAWN: FAGERSTROM | RUDIN STRUCTURES 222 North Second Street Minneapolis, Minnesota 55401 (612) 545-1034 FAX 339-6212 |
| ENGINEER: J. RUDIN | 60 PSF LONG-TREAD LOW-RISER STEPS METROPOLITAN CENTER FOR INDEPENDENT LIVING |
| COMM. NO.: 1229.03 | I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA. |
| DATE: MAR. 9, 1995 | REG. NO.: 15458 |
| DRAWING NUMBER S1F | |




1/S2F

# STEP RAMP MODULE FRAMING PLAN

SCALE: 1/4" = 1'-0"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60 PSF LONG-TREAD
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REG. NO.: 15458

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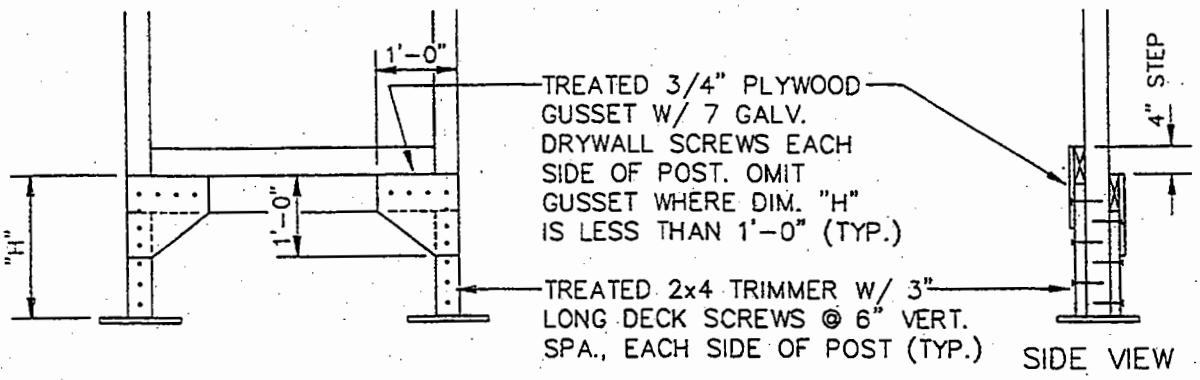
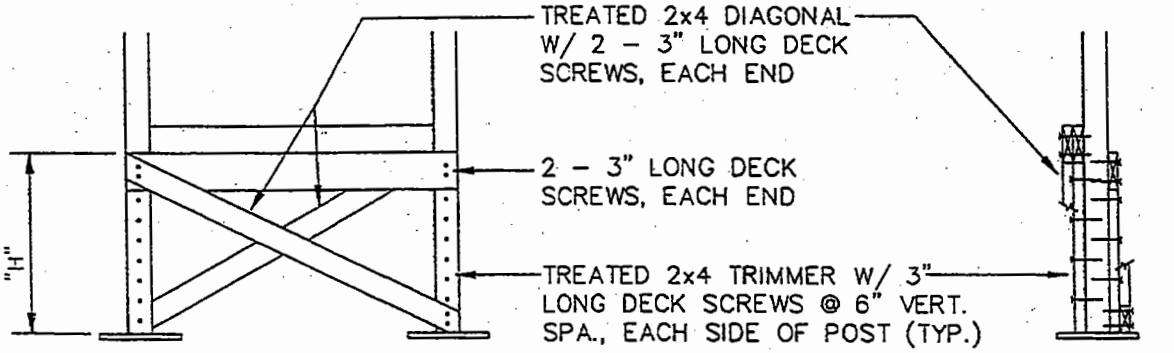
ENGINEER: J. RUDIN
COMM. NO.: 1229.03
DATE: MAR. 9, 1995
DRAWING NUMBER: S2F




# ELEVATION WHERE DIM. "H" IS 1'-9" OR LESS

1/S3F

SCALE: 1/2" = 1'-0"




# ELEVATION WHERE DIM. "H" EXCEEDS 1'-9"

2/S3F

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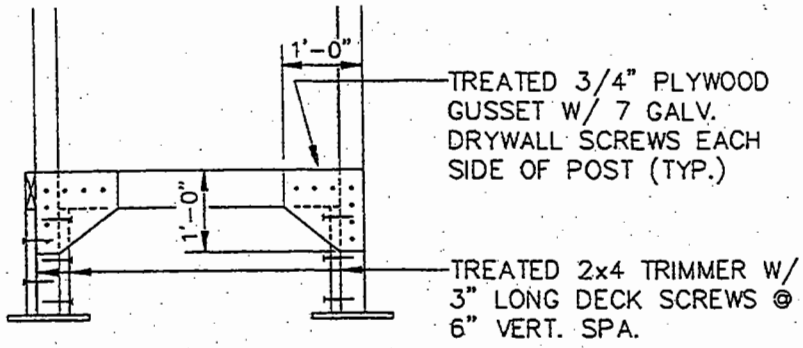
| | |
|---|---|
| DRAWN: | FAGERSTROM |
| ENGINEER: | J. RUDIN |
| COMM. NO.: | 1229.03 |
| DATE: | MAR. 9, 1995 |
| DRAWING NUMBER | S3F |




1/S4F ELEVATION

SCALE: 1/2" = 1'-0"

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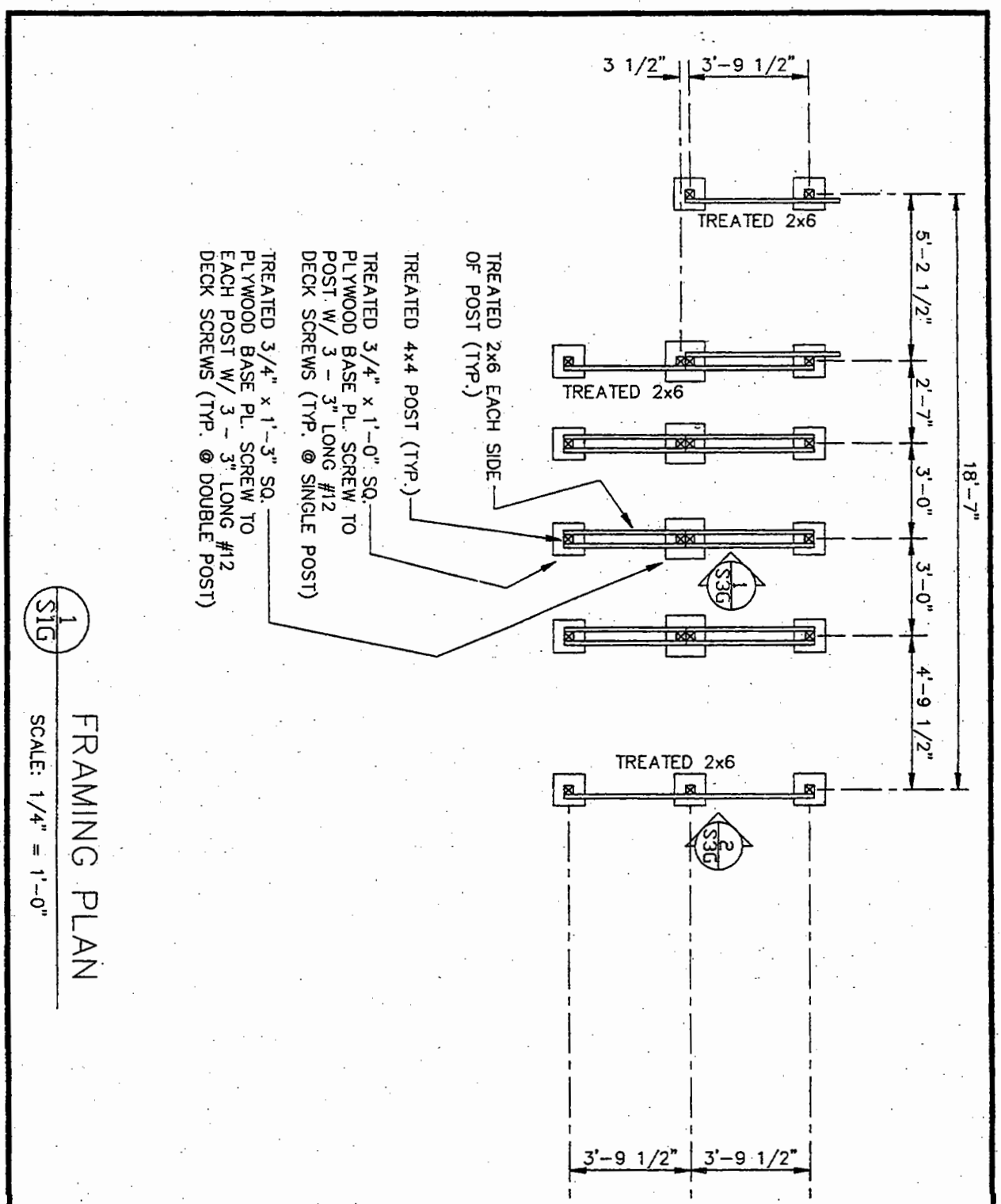
DRAWN: FAGERSTROM
ENGINEER: J. RUDIN
COMM. NO.: 1229.03
DATE: MAR. 9, 1995
DRAWING NUMBER S4F

**Step Drawings by: Drafting by Accessability**
**Stair Plotting by: Mpls Rehab Center Computer Assisted Design Training Program**

## Rudin Structures General Notes:

1. Design Codes (Latest unless noted)
   a. The 1988 Uniform Building Code as adopted by the Minnesota State Building Code.
   b. National Design Specification for Stress Grade Lumber and its fastenings by the National Forest Product Association
2. **Design Stress**
   a. Sawn lumber (all values for single member; use under normal load conditions)
   Provide ***Treated Ponderosa Pine No. 2*** or better: Flo=850 psi; Fv=70 psi; E=1,100,000; Fc=700 psi (parralel to grain); Fc=535 psi (perpendicular to grain)
3. **Design Live Loads**
   a. Ramp -60psf.
4. **Dimension Lumber**
   a. All member sizes given in the drawings are nominal dimensions.
   b. Where posts are called out, headers shall bear fully on posts.
   c. All beams and joists not bearing on supporting members shall be framed with ***Simpson Strong-Tie*** joist hangers or equal. Use type "U" or equal for single 2x's and type "UTF" for trusses where required. The joist hangers shall be nailed using special nails supplied by the hanger manufacturer.
   d. Wood headers or posts made up of 2 or more 2x's shall be spiked together.




1 S1G

FRAMING PLAN

SCALE: 1/4" = 1'-0"

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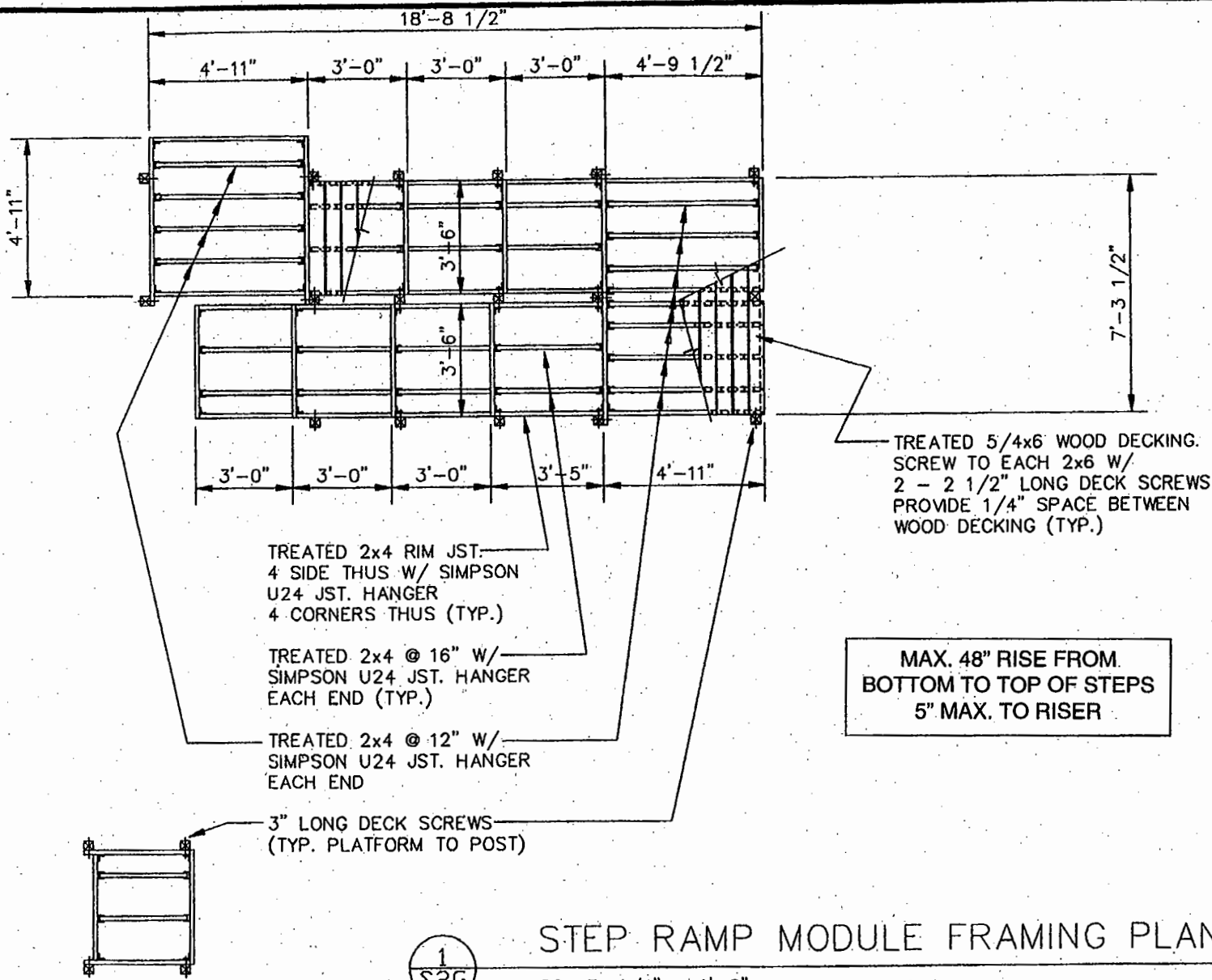


1 S2G

# STEP RAMP MODULE FRAMING PLAN

SCALE: 1/4" = 1'-0"

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COMM. NO.: 1229.03
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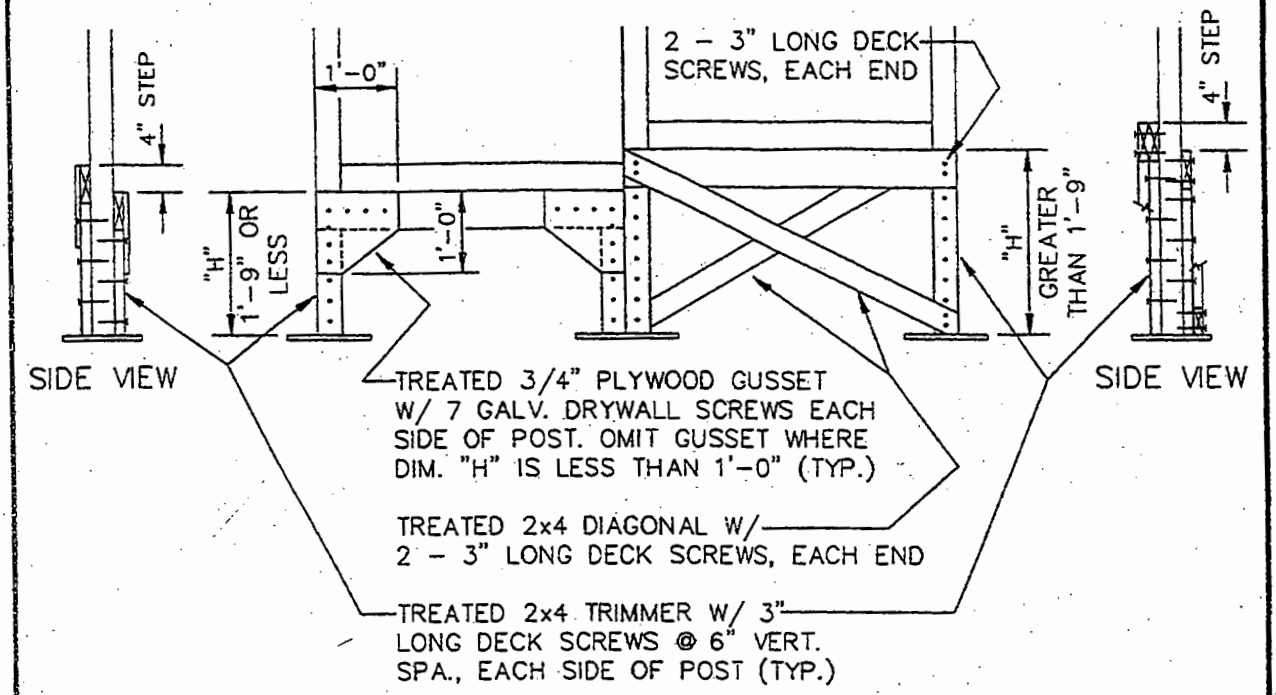
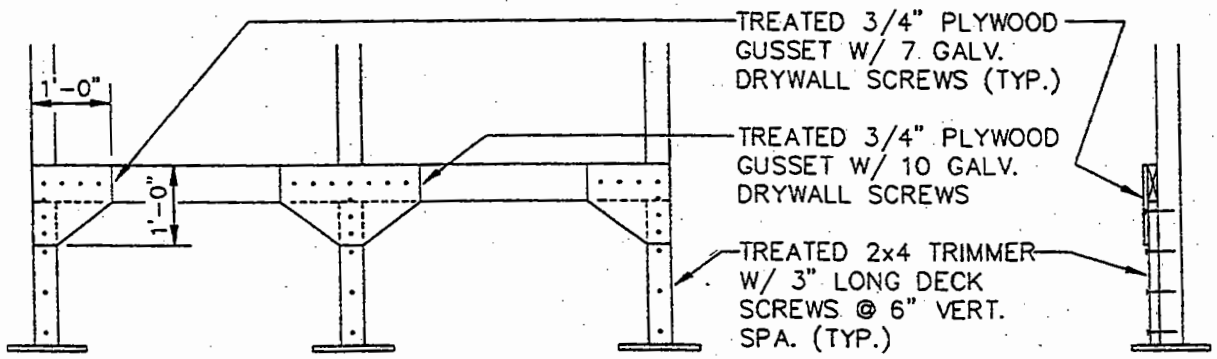



## ELEVATION

1/S3G

SCALE: 1/2" = 1'-0"




## ELEVATION

2/S3G

SCALE: 1/2" = 1'-0"

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LOW-RISER STEPS
METROPOLITAN CENTER FOR
INDEPENDENT LIVING

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**PROPERLY DESIGNED RAMPS SHOULD BE CONSIDERED AS THE FIRST CHOICE FOR SAFE WHEELCHAIR MOVEMENT. WHEN A RAMP IS IMPRACTICAL, THE LONG TREAD LOW RISER STEPS PROVIDE A SAFER ALTERNATIVE THAN CARRYING AN OCCUPIED WHEELCHAIR ON REGULAR STEPS.**

**LONG-TREAD, LOW-RISER STEPS ARE NOT APPROPRIATE FOR INDEPENDENT USE BY A PERSON USING A WHEELCHAIR AND ARE NOT INTENDED TO REPLACE PROPERLY DESIGNED RAMPS. ELECTRIC WHEELCHAIRS AND BATTERY POWERED CARTS SHOULD NOT BE USED WITH THIS TYPE OF STEP.**

## LONG-TREAD LOW-RISER STEPS

Long-tread low-riser steps have been found to be helpful for people who may use a walker, crutches or canes for assistance in walking or who have difficulty with existing steps to their home. Several examples of this style of step can be seen in ***HOME ACCESS SOLUTIONS; RAMPS AND STAIRS,*** which is the video companion to this manual. The long-tread, low-riser steps are most appropriately used by people who have some walking ability, but find regular steps difficult. For the steps to be safe and easy to use, it is very important to determine the correct height of the riser, (the vertical drop between the level treads) for the person who will be using the stairs. It is advisable to check with medical personnel, such as physical therapists, to determine the best riser height. A small variation can make the steps much more difficult to use. Construct the steps with the riser height that is most functional for the user. A range of 3 1/2 inches to 5 inches can be built with the design in this manual.

Be sure that the tread (the level part of the step that you stand on) is long enough to accommodate any assistive devices being used. This is most important for people using a walker, to insure that the walker can be placed with all 4 legs on each tread. The tread length described in this manual is 34" long. Before building the steps make sure that any device being used will fit on the tread and that the intended user will be able to use this type of step.

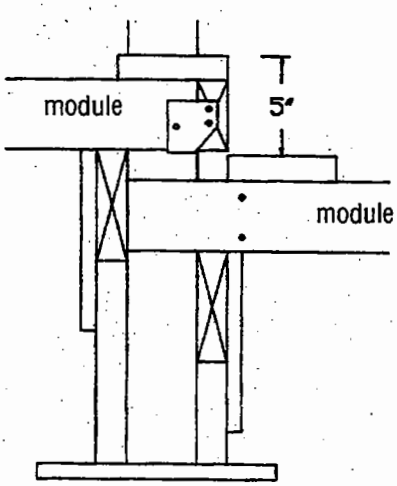
MINNESOTA BUILDING CODE REQUIRES THAT EITHER TREAD LENGTH OR RISER HEIGHT VARY NO MORE THAN 3/8 OF AN INCH. TREADS SHOULD BE EQUAL IN LENGTH AND RISERS SHOULD BE AS CLOSE TO EQUAL IN HEIGHT AS POSSIBLE.

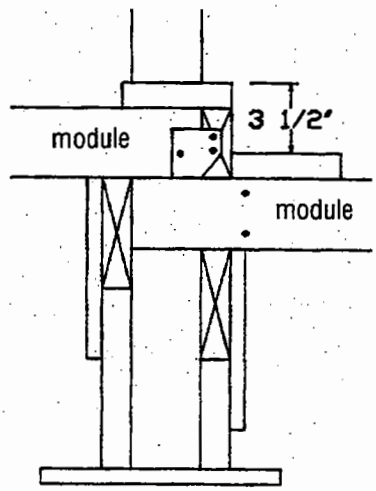
## HOW TO FIND NUMBER OF RISERS AND TREADS NEEDED FOR YOUR LOCATION

1. Determine proper riser height for person using the steps. Consultation with therapists and trying out various heights is advisable.
2. At the site you have chosen measure the vertical drop from he top landing by the door to ground level.
3. Divide the vertical drop by the riser height you need. Example; 4" riser is needed and there is 30" of vertical

drop. 30" divided by 4" equals 7.5. UNEVEN RISER HEIGHTS ARE NOT ALLOWED so round 7.5 up to next whole number. You have to have 8 risers.

4. Determine the adjusted riser height for each of the risers in your stairs by dividing vertical drop by number of risers. 30" vertical drop divided by 8 risers equals 3.75" for each riser.
5. Determine the length of run. (how far the treads will extend out from the landing) Multiply the number of treads by 34" which is the length of the module tread. You will have one less tread than risers. 7 treads times 34" per tread equals 238" or 19'10".
6. Measure 19' 10" from the top landing to where the bottom module will end. Determine the vertical drop from the landing to this point. A string level can be used for this measurement. IF THIS VERTICAL DROP IS DIFFERENT THAN THE DROP AT LANDING, DUE TO UP OR DOWN VARIATION IN THE TERRAIN YOU HAVE TO RECOMPUTE THE RISERS NEEDED, USING THE AMOUNT OF DROP FOR THE END OF THE STAIRS. SEE # 3 ABOVE this drawing shows how the 3 1/2" to 5" height range is accomplished. If a 3 1/2" riser is desired, the upper module will touch the lower module, as shown on the right. Higher riser heights are achieved by attaching the lower module to the 4x4 post as much as 1 1/2" lower. This range creates the ability to build equal risers that are best suited to a persons needs.



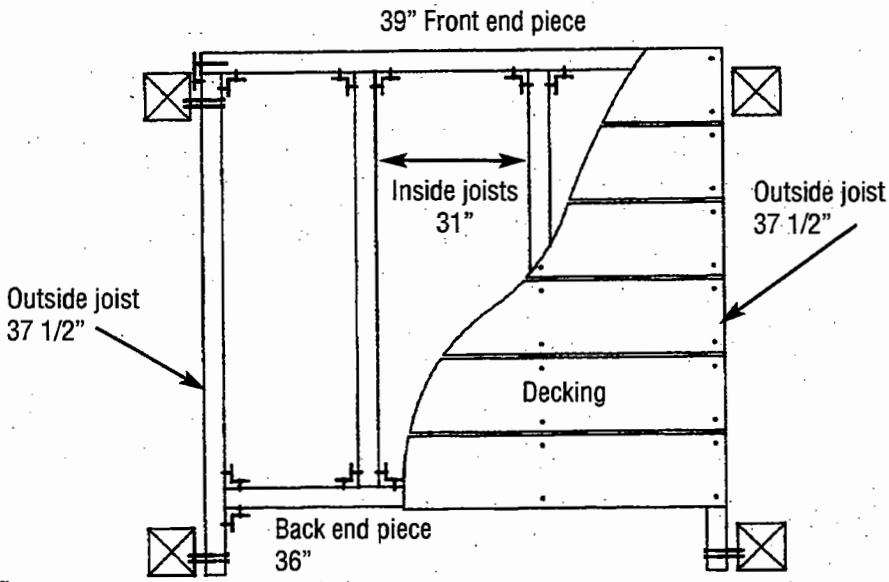



# STANDARD STAIR MODULE

(for tread length of 34" and riser heights between 3 1/2" and 5")

**COMPONENTS:**

**1** 2x4 by 39"front end piece
**2** 2x4 by 37 1/2" outside joists
**1** 2x4 by 36" back end piece
**2** 2x4 by 31" inside joists
**6** 5/4"x6" by 39" decking
(order two 10' decking and cut 39" long pieces from them)
**48** 2 1/2" deck galvanized deck screws(8 per decking plank)
**16** 3" galvanized deck screws( to attach end pieces to joists)
**8** 2x4 joist hangers
**4** 3" galvanizes deck screws( to attach front end piece joist hanger)
**48** joist hanger nails




**CONSTRUCTION NOTES:**

1. Cut joists and end pieces to lengths shown and assemble on a flat surface. Space joists 13" apart on center
2. Screw end pieces and joists together with 3" screws
3. Insure module is square and nail on joist hangers.
4. Bend outside flange of the 2 front corner joist hangers flat against end piece and use 3" screws instead of nails to attach the flange to the end of the front end piece
5. Use 3" screws to attach module to 4x4 support posts. Decking is attached after the module is in place.

**See pages 25 and 26 for door and turn landing options.**

**When attaching a step to a landing made with 2x6s, make the outside joists of the step module 34" long instead of 37 1/2" long. This allows the 34" tread length to be maintained.**

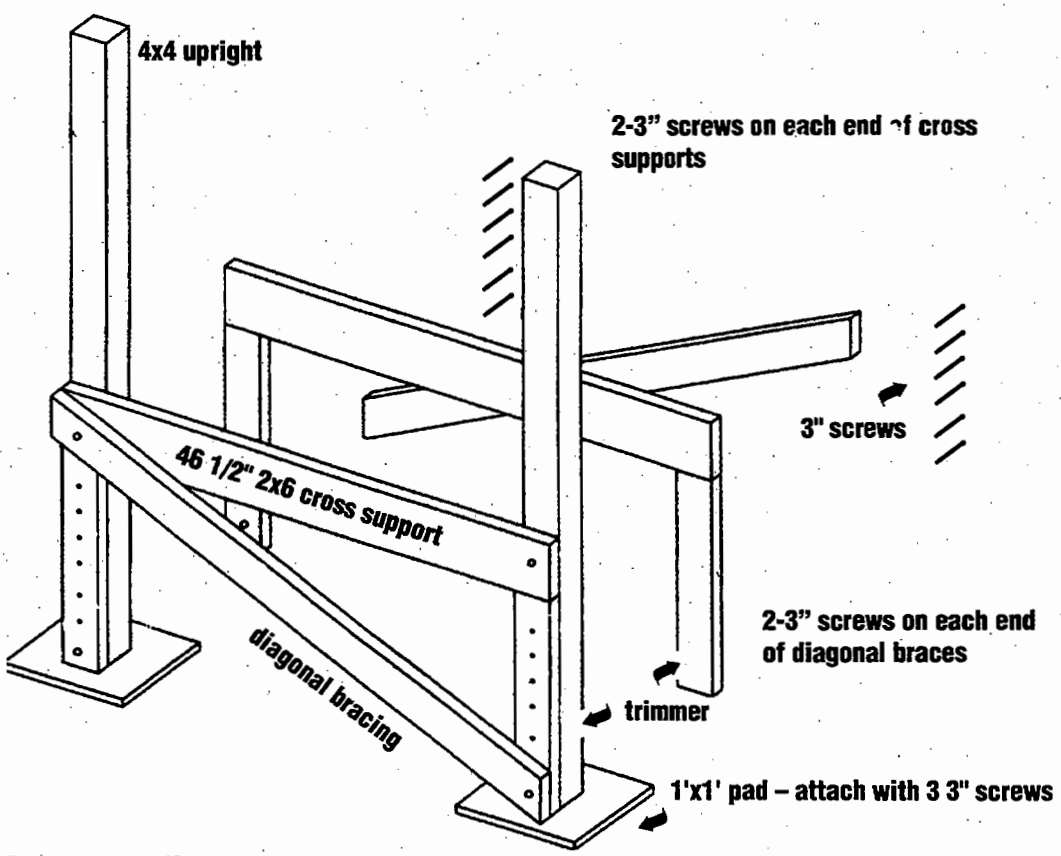
**See page 61 for installation details.**

## Support Structure (for 39" modules)

Used when distance between top of cross support and plywood pad exceeds 21"

**Components:**

**2** 4x4 Support Posts (Length determined by height requirements of stairs)
**2** 1'x 1' by 3/4" Treated Plywood Pads (Will be screwed to bottom of 4x4 with three 3" deck screws)
**2** 2x6 by 45 1/2" Cross Supports
**4** 2x4 Trimmers (Length equals distance between bottom of cross support and plywood pad.) (Trimmers will be screwed to 4x4.)
**2** 2x4 Diagonal Braces (Length will be determined by height of cross support)




**Construction Notes:**

**1.** 4x4's support the stair module, guardrails and handrail
**2.** A standard guardrail height of 36" can be obtained by having 34" of 4x4 extend above the stair surface. Compute the length of each 4x4 upright by measuring down from the stair surface at front of module to plywood pad on the ground and add 34" to that number.
**3.** The two legs are often not the same length due to uneven terrain.
**4.** The cross supports are an extra 1/2" long to allow space to easily set modules in place.
**5.** During construction, be sure that 4x4s are plumb and cross supports are horizontal before installing trimmers, gussets and bracing. Temporarily attach cross supports with screws to allow for adjustments and place bracing and gussets after all modules are in place.

**Onsite construction assembly procedures are provided in the following pages.**

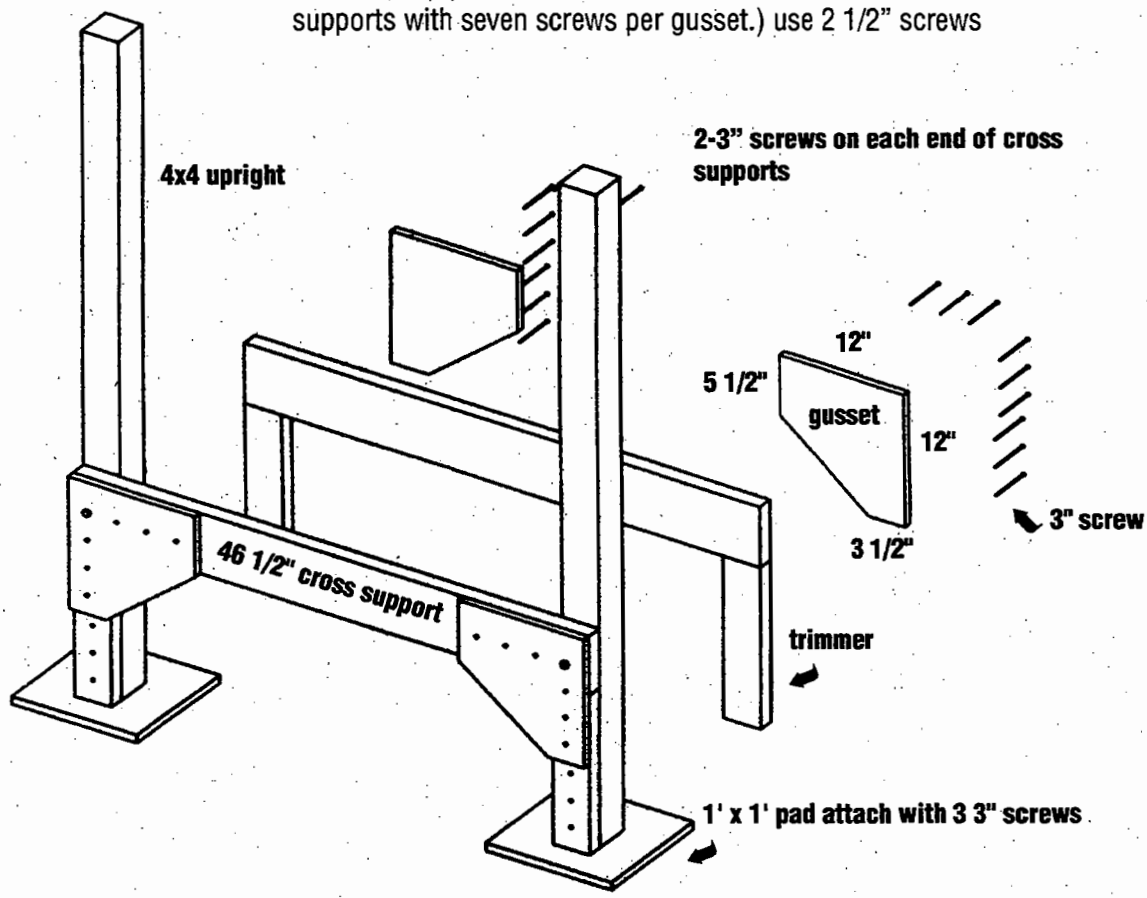
## Support Structure

**(for 39" Stair modules)**

Used when distance between top of cross support and 1'x 1' x 3/4" pad is 12" to 21"

**Components:**

- **2** 4x4 Support Posts (Length determined by height requirements of stairs)
- **2** 1'x 1' by 3/4" Treated Plywood Pads (Will be screwed to bottom of 4x4 with three 3" deck screws)
- **2** 2x6 46 1/2" cross supports for 39" module
- **4** 2x4 Trimmers (Length equals distance between bottom of cross support and plywood pad.) (Trimmers will be screwed to 4x4.)
- **4** 3/4"-thick Treated Plywood Gussets (see drawing for dimensions) (Gussets will be screwed to trimmer and cross supports with seven screws per gusset.) use 2 1/2" screws

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**5.** During construction, be sure that 4x4s are plumb and cross supports are horizontal before installing, trimmers, gussets and bracing. Temporarily attach cross supports with screws to allow for adjustments and place bracing and gussets after all modules are in place.

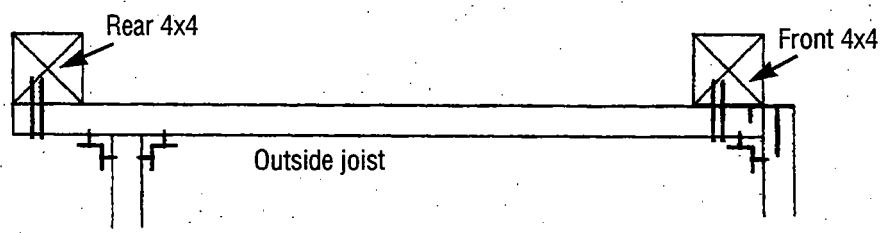
The building process for these steps is very similar to the process to build ramps, described on pages 29 through 34 of this manual. The same considerations for landings at the door and starting construction at the top and progressing down in a progressive fashion apply. Note that neither 3/8" bolts nor 1/2" bolts are called for in the engineering documents for the long-tread low-riser steps.

## TO HANG STAIR MODULES

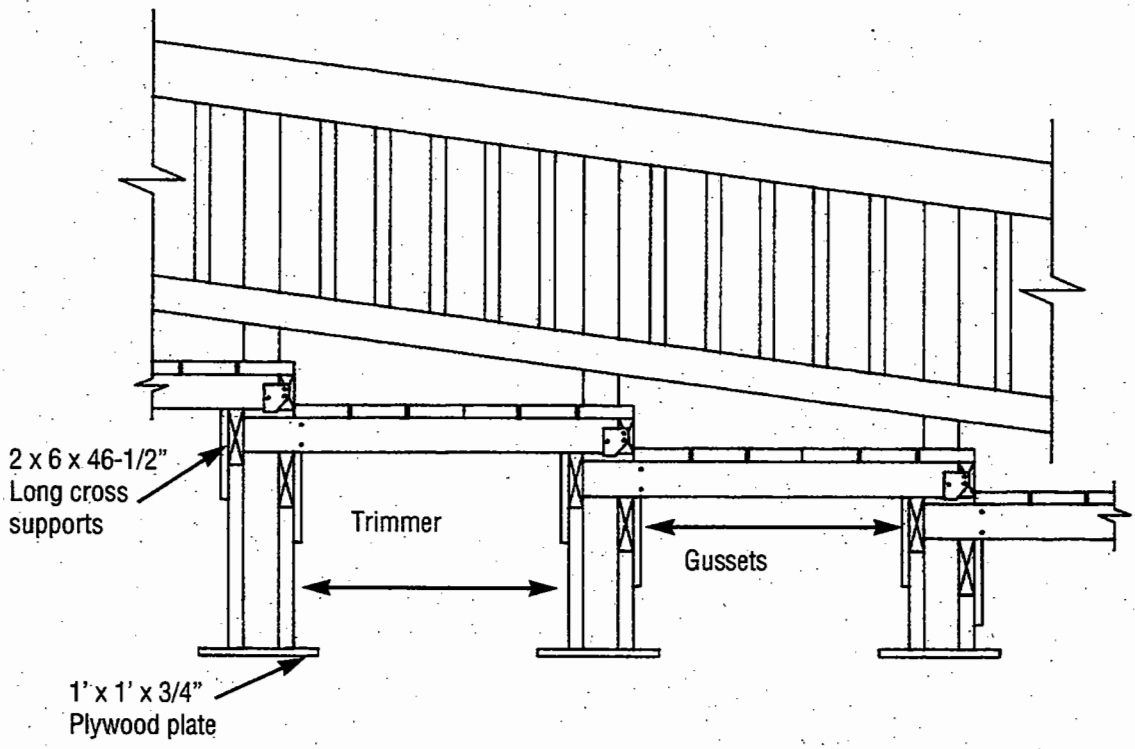
1. Build the level landing at door.
2. Attach two 4x4s 39 1/2" apart to the top landing to create the opening for the first step module.
3. Place the first module at the height needed to achieve your chosen riser height. Remember that you will be adding decking to the module, so allow for the 1 1/4" thickness of the decking.
4. Attach the module to the 2 4x4"s with one 3" deck screw on each side. The positioning of the module onto the 4x4s is shown .

**Note that the front 4x4 is 1 1/2" from the front of the module.Also note the 1 1/2" gap between the rear cross piece and the rear 4x4. This gap allows for the 3 1/2" minimum riser height.**

5. After making sure the module is level from side to side, raise or lower the front of the module to a level position.
6. Place the next pair of 4x4's in position and attach module to them with two 3" screws on each side.
7. add another 3" screw to each of the back 4x4s.




8. Install 2x6 cross supports using 2 3" screws to attach them to 4x4s. Do not add trimmers,bracing and gussets until all modules are in place and you are sure all risers will be equal and level.
9. Module is now being held in place by the cross supports. Measure down for the next riser height and install the next module in the same manner.
10. After all modules have been installed and you have determined that all riser heights are equal and modules are level, add the trimmers,braces if needed and gussets. Diagonal bracing requires 2 3" screws at each attachment point. Trimmers fit between the bottom of the 2x6 cross support and the 1 square foot plywood plate and have to fit snugly, because they are weight bearing. Trimmers require 3" screws to be 6" apart vertically. Gussets require seven 2 1/2" screws.
11. Place decking on modules and attach with 2 1/2" screws
12. Install guard rail and handrail using same techniques as described for ramps on page 34.




**When working over concrete, you will need to cut down the height of the bottom module,if your riser height is less than 4 3/4" high because the module with decking on it has a 4 3/4" riser. Make a shorter module by cutting all module 2x4s to the height needed. Remember to compute the 1 1/4" thickness of the decking.**

**You may have to remove dirt to achieve the proper riser heights when not building over a hard surface such as concrete. You may rest the module on 39" long 2x6 boards laid underneath and across each end of the module. Be sure to attach module to those boards by toe-nailing screws through the end pieces into the 2x6.**

**Several users of long-tread low riser steps have suggested that adding reflective tape to the nose of each stair tread or painting a bright strip on the nose is helpful for getting used to the longer tread length. People without walking limitations may also find this helpful.**

*I had been thinking about replacing my 1972-vintage wheelchair lift since early 1990. Cost estimates of over $2500 slowed the decision down until I heard about this program.*

*An accessibility consultant who is also an experienced carpenter and a fellow wheelchair user came out to survey the site and discuss my needs. After a few days he sent me a detailed plan, complete with a list of materials and cost. I reviewed the plan, made a few modifications via the phone and later received the final design.*

*The ramp was built on Saturday and Sunday, Oct. 12 and 13, 1991 by five volunteers equipped and led by Curt, my consultant, who also did most of the tricky angle cuts. Three workers were from a Boy Scout leaders group my father and I belong to. The other two were recruited by the program.*

*It's a long ramp, running 12 feet to one side of the house and then going back 26 1/2 feet toward our driveway. It's built of treated lumber and has railings the whole way. Stairs allow direct access to the deck outside the front door for walkers. It's a solid, well-built structure.*

*The total cost was about $1,170. DRS paid a total of $364 for the plan and part of Curt's supervisor fee. I paid about $806 for materials, the rest of Curt's fee and miscellaneous expenses.*

From a story written by Leroy DeBoom for *The Minnesota Mirror,* a monthly newsletter of the Disabled Citizens Club. His ramp was the fifth ramp built using volunteers that were supervised by this project.

This manual was made possible by a Minnesota Housing Finance Agency Grant with additional funding from the Minnesota Division of Rehabilitation Services to the Metropolitan Center for Independent Living. The goal of the grant is to make this ramp information available to as many people as possible. When making copies, please credit MCIL.

This manual may be downloaded from the DRAGnet web site located at **www.dragnet.org**. Scroll down to the MN RAMP project home page button. Click on the RAMP button and follow the instructions and links.

This manual is also available on tape, disc and in Braille.

Ramp project personnel are interested in receiving suggestions and ideas regarding this manual and ramp building. Of special interest are the experiences of groups trying to increase the ramp building capacity in their communities. To the right you will find a card to fill out and send to MCIL.

Please share your experiences!

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Layout, design and production,
Destiny 2, Inc, St. Paul, Minnesota

▼

**A videotape, entitled**
***The Ramp Project Teleconference***
**shows the design and construction ideas presented in this manual.**

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