



Cross-Country Obstacle Design Guidelines

The following cross-country jump descriptions and measurements were compiled by members of the then USCTA Course Design Committee in 2000 and are intended as **guidelines** for providing acceptable dimensions for the various types of cross-country fences which would be designed and built on a cross-country course.

These tables should always be seen as “a work in progress”, subject to rule changes and the evolution of the sport. Footing, terrain, the approach, the landing, and where and how a fence fits in to the overall course are additional factors which must be taken into consideration.

The charts provide the designer/builder with a progression of measurements to be used in designing the appropriate fence from Novice through Advanced levels of competitions. They will be continually revised and updated.*

– **Latest Revision: February 13, 2017*

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1. Verticals

| LEVEL | APPROPRIATE | HEIGHT FRONT | BASE SPREAD | MINIMUM WIDTH OF JUMPABLE FACE |
|-----------------|-------------|--------------|-------------|--------------------------------|
| Beginner Novice | Yes | 2'7" | 1 – 1'6" | 12' |
| Novice | Yes | 2'11" | 1 – 1'6" | 12' |
| Training | Yes | 3'3" | 1 – 1'6" | 9' |
| Modified | Yes | 3'5" | 1 – 1'6" | 7' |
| Preliminary | Yes | 3'7" | >1' | 6' |
| Intermediate | Yes | 3'9" | >1' | 5' |
| Advanced | Yes | 3'11" | >1' | 4' |

The width of a jumpable face may be reduced where the addition of wings, trees, or bushes adds up to not less than twice the recommended jumpable width.

2. Cross Question

| LEVEL | APPROPRIATE | TOP SPREAD | BASE SPREAD (DITCH) | MINIMUM WIDTH OF FACE |
|-----------------|-------------|------------|---------------------|-----------------------|
| Beginner Novice | No | | | |
| Novice | No | | | |
| Training | No | | | |
| Modified | No | | | |
| Preliminary | No | | | |
| Intermediate | Yes | 5' 3" | 7' | 16' |
| Advanced | Yes | 5' 11" | 8' | 16' |

3. Zig Zag Over Ditch

| LEVEL | APPROPRIATE | BASE SPREAD (DITCH) | MINIMUM WIDTH OF FACE |
|-----------------|-------------|---------------------|-----------------------|
| Beginner Novice | No | | |
| Novice | No | | |
| Training | No | | |
| Modified | No | | |
| Preliminary | Yes | 6' | 16' |
| Intermediate | Yes | 7' | 16' |
| Advanced | Yes | 8' | 16' |

4. Helsinki

| LEVEL | APPROPRIATE | HEIGHT | TOTAL WIDTH OF EACH JUMPABLE SECTION |
|-----------------|-------------|--------|--------------------------------------|
| Beginner Novice | No | | |
| Novice | No | | |
| Training | Yes | 3' 1" | 10' |
| Modified | Yes | 3' 3" | 9' |
| Preliminary | Yes | 3' 5" | 8' |
| Intermediate | Yes | 3' 7" | 7' |
| Advanced | Yes | 3' 9" | 6' |

Heights to be measured in the center of each section.

5. Oxers

| LEVEL | APPROPRIATE | HEIGHT FRONT | HEIGHT BACK | TOP SPREAD | BASE SPREAD | MINIMUM WIDTH OF JUMPABLE FACE |
|-----------------|-------------|--------------|-------------|------------|-------------|--------------------------------|
| Beginner Novice | Yes | 2' 5" | 2' 7" | 2' 9" | 3' 8" | 16' |
| Novice | Yes | 2' 9" | 2' 11" | 3' 3" | 4' 7" | 16' |
| Training | Yes | 3' 1" | 3' 3" | 3' 10" | 5' 3" | 12' |
| Modified | Yes | 3' 3" | 3' 5" | 4' 2" | 5' 6" | 10' |
| Preliminary | Yes | 3' 6" | 3' 7" | 4' 7" | < 6' | 8' |
| Intermediate | Yes | 3' 8" | 3' 9" | 5' 3" | < 7' | 7' |
| Advanced | Yes | 3' 10" | 3' 11" | 5' 11" | < 8' | 6' |

The top spread for all oxers must be measured from the front of the top rail to the back of the back rail. When building an oxe with front frangible technology, care must be taken that the front profile must remain convex. This may be achieved by using three rails, appropriate decoration, etc.

6. Tables

| LEVEL | APPROPRIATE | HEIGHT FRONT | HEIGHT BACK | TOP SPREAD | BASE SPREAD | MINIMUM WIDTH OF JUMPABLE FACE |
|-----------------|-------------|--------------|-------------|------------|-------------|--------------------------------|
| Beginner Novice | Yes | 2' 5" | 2' 7" | 2' 9" | 3' 8" | 16' |
| Novice | Yes | 2' 9" | 2' 11" | 3' 3" | 4' 7" | 16' |
| Training | Yes | 3' 1" | 3' 3" | 3' 10" | 5' 3" | 12' |
| Modified | Yes | 3' 3" | 3' 5" | 4' 2" | 5' 6" | 10' |
| Preliminary | Yes | 3' 6" | 3' 7" | 4' 7" | < 6' | 8' |
| Intermediate | Yes | 3' 8" | 3' 9" | 5' 3" | < 7' | 7' |
| Advanced | Yes | 3' 10" | 3' 11" | 5' 11" | < 8' | 6' |

7. Log Pile

| LEVEL | APPROPRIATE | HEIGHT FRONT | MAXIMUM BASE SPREAD |
|-----------------|-------------|--------------|---------------------|
| Beginner Novice | Yes | 2' 5" | 4' |
| Novice | Yes | 2' 11" | 4' 11" |
| Training | Yes | 3' 3" | 5' 11" |
| Modified | Yes | 3' 5" | 6' 5" |
| Preliminary | Yes | 3' 7" | 6' 11" |
| Intermediate | Yes | 3' 9" | 7' 11" |
| Advanced | Yes | 3' 11" | 8' 10" |

8. Round Tops

| LEVEL | APPROPRIATE | HEIGHT | BASE SPREAD | MINIMUM WIDTH OF JUMPABLE FACE |
|-----------------|-------------|--------|-------------|--------------------------------|
| Beginner Novice | Yes | 2' 7" | 3' 9" | 12' |
| Novice | Yes | 2' 11" | 4' | 12' |
| Training | Yes | 3' 3" | 5' | 9' |
| Modified | Yes | 3' 5" | 5' 6" | 7' |
| Preliminary | Yes | 3' 7" | 6' | 7' |
| Intermediate | Yes | 3' 9" | 7' | 5' |
| Advanced | Yes | 3' 11" | 8' | 4' |

9. Feeder/Lamb-Creep/Cabin

| LEVEL | APPROPRIATE | HEIGHT AT TOP OF CENTER | BASE SPREAD | MINIMUM WIDTH OF JUMPABLE FACE |
|-----------------|-------------|-------------------------|-------------|--------------------------------|
| Beginner Novice | Yes | 2' 7" | 3' | 12' |
| Novice | Yes | 2' 11" | 4' | 12' |
| Training | Yes | 3' 3" | 5' | 9' |
| Modified | Yes | 3' 5" | 5' 6" | 8' |
| Preliminary | Yes | 3' 7" | 6' | 7' |
| Intermediate | Yes | 3' 9" | 7' | 5' |
| Advanced | Yes | 3' 11" | 8' | 4' |

To figure out eave height, the slope of the roof should not be flatter than a 6/12 pitch. Closer to 12/12 is ideal.

10. Ramps

| LEVEL | APPROPRIATE | HEIGHT BACK | SPREAD OF FACE | MINIMUM WIDTH OF JUMPABLE FACE |
|-----------------|-------------|-------------|----------------|--------------------------------|
| Beginner Novice | Yes | 2' 7" | < 2' 6" | 12' |
| Novice | Yes | 2' 11" | < 3' | 12' |
| Training | Yes | 3' 3" | < 3' 3" | 9' |
| Modified | Yes | 3' 5" | < 3' 5" | 8' |
| Preliminary | Yes | 3' 7" | < 3' 6" | 7' |
| Intermediate | Yes | 3' 9" | < 3' 9" | 5' |
| Advanced | Yes | 3' 11" | < 3' 11" | 4' |

There should not be a gap at ground level. For the base spread, the front slope should not be flatter than 45 degrees. (Height and base figures should be equal.) Top edge should be rounded.

11. Palisades

| LEVEL | APPROPRIATE | HEIGHT BACK | SPREAD OF FACE | MINIMUM WIDTH OF JUMPABLE FACE |
|-----------------|-------------|-------------|----------------|--------------------------------|
| Beginner Novice | Yes | 2' 7" | < 2' 6" | 12' |
| Novice | Yes | 2' 11" | < 3' | 12' |
| Training | Yes | 3' 3" | < 3' 3" | 9' |
| Modified | Yes | 3' 5" | < 3' 5" | 8' |
| Preliminary | Yes | 3' 7" | < 3' 6" | 7' |
| Intermediate | Yes | 3' 9" | < 3' 9" | 5' |
| Advanced | Yes | 3' 11" | < 3' 11" | 4' |

For the base spread, the front slope should not be flatter than 60 degrees. Base spread should be 1/3 of height. Top edge should be rounded.

12. Sharks Teeth/Chevrons

| LEVEL | APPROPRIATE | HEIGHT | MAXIMUM BASE SPREAD | MINIMUM WIDTH OF JUMPABLE FACE |
|-----------------|-------------|--------|---------------------|--------------------------------|
| Beginner Novice | Yes | 2' 7" | < 2' 6" | 12' |
| Novice | Yes | 2' 11" | 2' 11" | 12' |
| Training | Yes | 3' 3" | 3' 3" | 10' |
| Modified | Yes | 3' 5" | 3' 9" | 9' |
| Preliminary | Yes | 3' 7" | 4' | 8' |
| Intermediate | Yes | 3' 9" | 5' | 7' |
| Advanced | Yes | 3' 11" | 6' | 6' |

Lower levels are an introduction to "look"; whereas upper levels ask for greater accuracy.

13. Bench

| LEVEL | APPROPRIATE | HEIGHT BACK |
|-----------------|-------------|-------------|
| Beginner Novice | Yes | 2' 7" |
| Novice | Yes | 2' 11" |
| Training | Yes | 3' 3" |
| Modified | Yes | 3' 5" |
| Preliminary | Yes | 3' 7" |
| Intermediate | Yes | 3' 9" |
| Advanced | Yes | 3' 11" |

Seat back should not be upright. Height of seat should equal 1/3 of total height. Depth of seat should equal 2/3 of height. This type of fence seldom needs additional material such as trees or mulch added to the base.

14. Brush Box

| LEVEL | APPROPRIATE | HEIGHT FRONT | HEIGHT BACK |
|-----------------|-------------|--------------|-------------|
| Beginner Novice | Yes | 2' 4" | 2' 2" |
| Novice | Yes | 2' 8" | 2' 6" |
| Training | Yes | 3' | 2' 9" |
| Modified | Yes | 3' 3" | 3' 1" |
| Preliminary | Yes | 3' 5" | 3' 3" |
| Intermediate | Yes | 3' 7" | 3' 5" |
| Advanced | Yes | 3' 9" | 3' 7" |

Boxes should be stuffed tight enough so a foot or leg cannot get caught. If using cedar or other brush there should be a minimum of 6" above brush box. If using birch there should be a minimum of 10" above brush box. As a general guideline, not more than 12" of brush. Height of back should always be 2" less than height of front.

15. Bullfinch

| LEVEL | APPROPRIATE | HEIGHT FRONT | HEIGHT BACK |
|-----------------|-------------|--------------|-------------|
| Beginner Novice | No | | |
| Novice | No | | |
| Training | No | | |
| Modified | Yes | 3' 3" | 3' 1" |
| Preliminary | Yes | 3' 5" | 3' 3" |
| Intermediate | Yes | 3' 7" | 3' 5" |
| Advanced | Yes | 3' 9" | 3' 7" |

Height of solid brush should be the same as a normal brush fence. See-through brush can be 1-3' higher than the brush.

16. Double Brush

| LEVEL | APPROPRIATE | FIXED HEIGHT | TOP SPREAD | BASE SPREAD | MINIMUM WIDTH OF JUMPABLE FACE |
|-----------------|-------------|--------------|------------|-------------|--------------------------------|
| Beginner Novice | Yes | 2' 5" | 2' 9" | 3' 8" | 16' |
| Novice | Yes | 2' 9" | 3' 3" | 4' 7" | 14' |
| Training | Yes | 3' 1" | 3' 9" | 5' 3" | 12' |
| Modified | Yes | 3' 3" | 4' 2" | 5' 9" | 10' |
| Preliminary | Yes | 3' 5" | 4' 7" | < 6' | 8' |
| Intermediate | Yes | 3' 7" | 5' 3" | < 7' | 7' |
| Advanced | Yes | 3' 9" | 5' 11" | < 8' | 6' |

Height of brush in front should be 2" less than height of back. Fence must be decked with a 2" lip on the back to keep the horse from slipping into the second brush.

17. Ditch and Brush Box

| LEVEL | APPROPRIATE | HEIGHT TOP RAIL | HEIGHT BACK | INSIDE WIDTH OF DITCH | MINIMUM WIDTH OF FACE | BRUSH MEASUREMENT |
|-----------------|-------------|-----------------|-------------|-----------------------|-----------------------|-------------------|
| Beginner Novice | Yes | 2' 4" | 2' 2" | insignificant | 16' | 2' 10" |
| Novice | Yes | 2' 6" | 2' 4" | insignificant | 16' | 3' 5" |
| Training | Yes | 2' 9" | 2' 7" | 3' | 16' | 3' 8" |
| Modified | Yes | 2' 10" | 2' 10" | 3' 6" | 16' | 4' |
| Preliminary | Yes | 3' | 2' 10" | 4' | 16' | 4' 3" |
| Intermediate | Yes | 3' 3" | 3' 1" | 5' 6" | 16' | 4' 5" |
| Advanced | Yes | 3' 6" | 3' 3" | 6' 6" | 16' | 4' 7" |

Legal base spread is from the front of the take off rail to the back of the wall. Depth of ditch should be 1/2 the width. If the approach is on a down hill (upper levels only), the ground should be level or slightly rising for the last 16'. In all cases, avoid a 100% upright wall. The bottom of the wall should be brought forward so that there is an approximate 5 – 10 degree back leaning slope to the wall. Also, the top leading edge should be rounded and never have a sharp profile.

18. Weldon's Wall

| LEVEL | APPROPRIATE | HEIGHT BACK | INSIDE WIDTH OF DITCH |
|-----------------|-------------|-------------|-----------------------|
| Beginner Novice | No | | |
| Novice | No | | |
| Training | Yes | 3' 3" | 2' 6" |
| Modified | Yes | 3' 5" | 3' |
| Preliminary | Yes | 3' 7" | 3' 6" |
| Intermediate | Yes | 3' 9" | 4' |
| Advanced | Yes | 3' 11" | 5' |

Legal base spread is from the front of the take off rail to the back of the wall. Depth of ditch should be 1/2 the width. If the approach is on a down hill (upper levels only), the ground should be level or slightly rising for the last 16'. In all cases, avoid a 100% upright wall. The bottom of the wall should be brought forward so that there is an approximate 5 – 10 degree back leaning slope to the wall. Also, the top leading edge should be rounded and never have a sharp profile.

19. Open Ditch

| LEVEL | APPROPRIATE | INSIDE WIDTH |
|-----------------|-------------|--------------|
| Beginner Novice | Yes | 2' |
| Novice | Yes | 2' |
| Training | Yes | 3' |
| Modified | Yes | 3' 6" |
| Preliminary | Yes | 4' 6" |
| Intermediate | Yes | 6' |
| Advanced | Yes | 8' |

The legal measured width includes outside of all materials, not inside width. Take off side should have very visible half round or full rail. Depth should be approximately half of inside width. Novice ditches can be revetted front and back with a contrasting material in the bottom of the ditch (no grass). BN - shallow, natural. Note on measurement: A ditch must be measured outside of visible cap at the front to outside of cap at the back. Keep in mind that the material used will greatly affect the inside width, or how wide the ditch 'looks'. A ditch built out of telephone poles (fatter material) can have an inside measurement 12" narrower (and therefore look smaller) than one built of 6x6s, but have the same legal width.

20. Elephant Trap/Horizontal Rails

| LEVEL | APPROPRIATE | HEIGHT | BASE SPREAD | MINIMUM WIDTH OF FACE |
|-----------------|-------------|--------|-------------|-----------------------|
| Beginner Novice | Yes | 2' 7" | 3' 9" | 16' |
| Novice | Yes | 2' 11" | 4' 7" | 16' |
| Training | Yes | 3' 3" | 5' 3" | 16' |
| Modified | Yes | 3' 5" | 5' 11" | 16' |
| Preliminary | Yes | 3' 7" | 6' 7" | 16' |
| Intermediate | Yes | 3' 9" | 7' 10" | 12' |
| Advanced | Yes | 3' 11" | 8' 10" | 8' |

Highest point of top rail must not be further back than 3/4 the base spread.

Beginner Novice – Not less than 6" front rail – insignificant ditch- gap between rails must be <3" or >8"

Novice – Not less than 6" front rail – insignificant ditch – gap between rails must be <3" or >8"

Training – Not less than 6" front rail – insignificant ditch – gap between rails must be <3" or >8"

Preliminary – Not less than 6" front rail – gap between rails must be <3" or >8"

Intermediate and Advanced – No ground line necessary – gap between rails must be <3" or >8"

21. Trakehner

| LEVEL | APPROPRIATE | HEIGHT | BASE SPREAD | MINIMUM WIDTH OF FACE |
|-----------------|-------------|--------|-------------|-----------------------|
| Beginner Novice | Yes | 2' 7" | 3' 9" | 16' |
| Novice | Yes | 2' 11" | 4' 7" | 16' |
| Training | Yes | 3' 3" | 5' 3" | 16' |
| Modified | Yes | 3' 5" | 5' 11" | 16' |
| Preliminary | Yes | 3' 7' | 6' 7" | 16' |
| Intermediate | Yes | 3' 9" | 7' 10" | |
| Advanced | Yes | 3' 11" | 8' 10" | |

Beginner Novice and Novice Level – Large log, shallow ditch essential.

Training, Modified and Preliminary Levels – Large log essential.

Intermediate and Advanced Levels – Large log preferred Ideally the last 1 or 2 strides should be on level or rising ground. Take off needs to be clearly defined with a prominent ground line. There has to be some way to extricate the horse from the ditch if necessary.

Scoop ditch recommended for Novice and Training. Depth of ditch should equal 1/2 of the inside width measurement. At the Novice, Training, Modified, and Preliminary levels, brush or other appropriate material may be added to back of ground line to take horse's eye upward

22. Key Holes

| LEVEL | APPROPRIATE | HEIGHT | MAXIMUM TOP SPREAD | MINIMUM WIDTH OF OPENING |
|-----------------|-------------|--------|--------------------|--------------------------|
| Beginner Novice | No | | | |
| Novice | No | | | |
| Training | No | | | |
| Modified | Yes | 2' 6" | 1' 6" | 9' |
| Preliminary | Yes | 3' | 2' | 8' |
| Intermediate | Yes | 3' 3" | 2' 6" | 7' |
| Advanced | Yes | 3' 6" | 3' | 6' |

Height over solid box to be 6"-12"- (See Brush Boxes)

Overhead: There must be not less than 2' of brush below solid frame. 11' minimum from ground to bottom of roof or frame. Typically, keyholes do not have top spreads, but if they do, top spread should not be more than 50% of height.

23. Roofs - Vertical (Picture Frame)

| LEVEL | APPROPRIATE | HEIGHT | MINIMUM WIDTH OF FACE |
|-----------------|-------------|--------|-----------------------|
| Beginner Novice | No | | |
| Novice | No | | |
| Training | Yes* | 3' 1" | 16' |
| Modified | Yes | 3' 3" | 12' |
| Preliminary | Yes | 3' 6" | 10' |
| Intermediate | Yes | 3' 8" | 12' |
| Advanced | Yes | 3' 10" | 8' |

* Greater than 11' height and of minimal impact

Modified-Advanced – 11' minimum from round to bottom of roof top or frame. "Hole" should not be less than 6' x 6'. Never to be used in association with water. Jump materials should be of light color in situations where shadows come into play. Where roof takes "effect", i.e. has great effect on the horse, top spread should not be more than 50% of height permitted.

24. Roofs - Table

| LEVEL | APPROPRIATE | HEIGHT FRONT | HEIGHT BACK | TOP SPREAD | BASE SPREAD |
|-----------------|-------------|--------------|-------------|-----------------|-------------|
| Beginner Novice | No | | | | |
| Novice | No | | | | |
| Training | No | | | | |
| Modified | Yes | 3' 2" | 3' 4" | < 2' 6" – 3' 6" | < 5' |
| Preliminary | Yes | 3' 4" | 3' 6" | < 3' – 4' | < 5' 6" |
| Intermediate | Yes | 3' 6" | 3' 8" | < 3' 6" – 4' 6" | < 6' |
| Advanced | Yes | 3' 8" | 3' 10" | < 4' – 5' | < 7' |

11' minimum from ground to bottom of roof top or frame. Heights and top spreads can be greater if fence is under a structure where the eaves do not come into play. Where roof takes "effect", i.e. has great effect on the horse, top spread should not be more than 50% of height permitted. Never use in association with water. Jump materials should be of light color in situations where shadows come into play.

25. Narrows and Single Chevron with or without Brush

| LEVEL | APPROPRIATE | HEIGHT | BASE SPREAD | MINIMUM WIDTH OF JUMPABLE FACE |
|-----------------|-------------|--------|-------------|--------------------------------|
| Beginner Novice | No | | | |
| Novice | No | | | |
| Training | Yes | 3' 3" | 3' 3" | > 8' |
| Modified | Yes | 3' 5" | 3' 5" | > 7' |
| Preliminary | Yes | 3' 7" | 3' 7" | > 6' |
| Intermediate | Yes | 3' 9" | 3' 9" | > 5' |
| Advanced | Yes | 3' 11" | 3' 11" | > 4' |

26. Corner

| LEVEL | APPROPRIATE | HEIGHT FRONT | HEIGHT BACK | DEGREE OF ANGLE | MINIMUM WIDTH OF JUMPABLE FACE |
|-----------------|-------------|--------------|-------------|---|--------------------------------|
| Beginner Novice | Yes | 2' 5" | 2' 7" | See Notes | 12' |
| Novice | Yes | 2' 9" | 2' 11" | See Notes | 12' |
| Training | Yes | 3' 1" | 3' 3" | See Notes | 10' |
| Modified | Yes | 3' 3" | 3' 5" | Approximately 40 degree angle when short reaction time is involved, board in corner | 8' |
| Preliminary | Yes | 3' 6" | 3' 7" | Approximately 45 degree angle when short reaction time is involved, board in corner | 6' |
| Intermediate | Yes | 3' 8" | 3' 9" | Approximately 60 degree angle when short reaction time is involved, board in corner | 5' |
| Advanced | Yes | 3' 10" | 3' 11" | Approximately 75 degree angle when short reaction time is involved, board in corner | 5' |

Beginner Novice Angle of corner should not exceed 15 degrees- always boarded in. Top Spread should not exceed 2'9", 12' from point.

Novice Angle of corner should not exceed 20 degrees – always boarded in. Top spread should not exceed 3'-3", 12' from point.

Training Angle of corner should not exceed 25 degrees – always boarded in. Must have a solid top at least 10' long with unjumpable decoration at wide end.

Modified/Preliminary/Intermediate/Advanced Corners with a good long approach should not be boarded in. Corners demanding quick reaction time including corners that are blind should be boarded in. When the corner is open, trees should be placed on the back rail, not in the middle of the apex. See notes on Double Brush Obstacle for double brush corners.

27. Steps

| LEVEL | APPROPRIATE | HEIGHT SINGLE | HEIGHT PART OF COMBINATION |
|-----------------|-------------|---------------|----------------------------|
| Beginner Novice | Yes | 2' 5" | 2' 3" |
| Novice | Yes | 2' 9" | 2' 7" |
| Training | Yes | 3' 1" | 2'10" |
| Modified | Yes | 3' 2" | 2' 11" |
| Preliminary | Yes | 3' 3" | 3' 1" |
| Intermediate | Yes | 3' 5" | 3' 3" |
| Advanced | Yes | 3' 7" | 3' 6" |

Beginner Novice: Maximum two steps with a minimum of 3 strides between

Novice: Maximum two steps with a minimum of two strides between.

Training: Suggested one stride or more.

Modified: Can introduce bounce.

28. Drop Fences

| LEVEL | APPROPRIATE | MAXIMUM DROP |
|-----------------|-------------|--------------|
| Beginner Novice | Yes | 3' 3" |
| Novice | Yes | 3' 11" |
| Training | Yes | 4' 7" |
| Modified | Yes | 4' 11" |
| Preliminary | Yes | 5' 3" |
| Intermediate | Yes | 5' 11" |
| Advanced | Yes | 6' 7" |

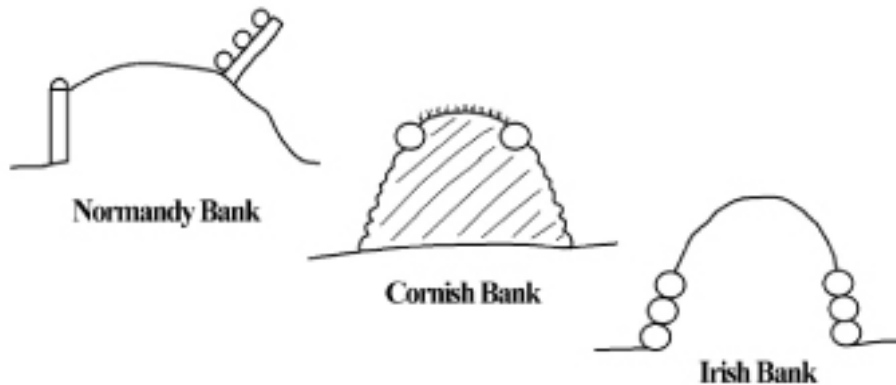
If possible, never land on flat ground. If drop is on flat ground the maximum drop must be significantly reduced. The top profile should be rounded with no sharp edges so that a horse may drag its stifles without injury.

29. Banks (*simple - jump on/jump off*)

| LEVEL | APPROPRIATE | MAX DROPS |
|-----------------|-------------|-----------|
| Beginner Novice | Yes | 2' 5" |
| Novice | Yes | 2' 9" |
| Training | Yes | 3' 1" |
| Modified | Yes | 3' 3" |
| Preliminary | Yes | 3' 5" |
| Intermediate | Yes | 3' 7" |
| Advanced | Yes | 3' 9" |

Beginner Novice – 3 strides (40'); **Novice** – 3 strides (40'); **Training** – 1 or 2 strides (18' or 30'); ; **Modified** – 1 stride (18'); **Preliminary/Advanced** – Banks should be no less than 12' across the top.

30. Banks (*Normandy, Cornish, Irish*)



| LEVEL | APPROPRIATE | HEIGHT FRONT | DISTANCES ACROSS THE TOP |
|-----------------|-------------|--------------|--------------------------|
| Beginner Novice | No | | |
| Novice | No | | |
| Training | No | | |
| Modified | Yes | 3' 1" | 18' |
| Preliminary | Yes | 3' 3" | 18' |
| Intermediate | Yes | 3' 5" | 18'-22' |
| Advanced | Yes | 3' 7" | 9'-12' |

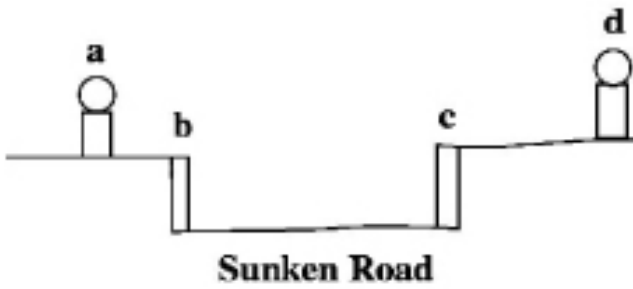
Definitions of banks:

Cornish - Could be jumped in one effort - large table (walled, sod table) - maximum top spread

Irish - Jump on to the face of the bank; greater than 9' - 1 stride or a bounce

Normandy - Jump up on to a bank (rounded or ascending, fence off)

31. Sunken Road



For minimum distance:

Training – Flat Terrain – 30’ between A & B; 32/33’ between B & C. 33’ between C & D. B & C max height 2’6”

Modified – Flat Terrain – 30’ between A & B; 32/33’ Between B & C; 18’ between C & D max. height step 2’9”.

Preliminary – Flat Terrain – 18’ between A & B; 21’ between B & C; 18’ between C & D

Intermediate – 16-18’ between A & B; 20’-21’ between B & C; 9’-12’ or 18’ between C & D

Advanced – 9’-12’ or 16’-18’ A & B; 19’-20’ B & C; 9’-12’ or 18’ C & D.

All distances are relevant to:

1. Height of first element
2. Height of step in and step out
3. Height of last element, i.e. larger the height, greater the distance.

At all levels adjust for upslope or downslope. Uphill a little shorter; downhill a little longer.

32.a. Bounces Into Water

| LEVEL | APPROPRIATE | HEIGHT OF FIRST ELEMENT | HEIGHT OF SECOND ELEMENT |
|-----------------|-------------|-------------------------|--------------------------|
| Beginner Novice | No | | |
| Novice | No | | |
| Training | No | | |
| Modified | No | | |
| Preliminary | No | | |
| Intermediate | Yes | 3’ 6” | 2’6” |
| Advanced | Yes | 3’ 8” | 3’ 3” |

Distances between elements should be 13’ 6”.

32.b. Bounces

| LEVEL | APPROPRIATE | HEIGHT OF FIRST ELEMENT | HEIGHT OF SECOND ELEMENT | WIDTH OF SPREAD TOP TO TOP | MINIMUM WIDTH OF FACE |
|-----------------|-------------|-------------------------|--------------------------|----------------------------|-----------------------|
| Beginner Novice | No | | | | |
| Novice | No | | | | |
| Training | No | | | | |
| Modified | Yes | 3’ 1” | 3’ 5” | See explanation | |
| Preliminary | Yes | 3’ 5” | 3’ 6” | 15’ flat | 16’ |
| Intermediate | Yes | 3’ 7” | 3’ 8” | 14’ 6” – 15’ 6” | 12’ |
| Advanced | Yes | 3’ 9” | 3’ 10” | 14’ 6” – 15’ 6” | 12’ |

Bounces can be introduced at the **Modified level**. Bounces must include a step to another element (either another step or ascending vertical). No Bounces at this level shall include two ascending verticals. Bounce step height should be <3’ second step height <3’. Distance between A & B should be 9’. Height of Ascending vertical should be brushed with fix height to be 2’6” brush to be 3’6”. Step should be on a gradual uphill and off a soft turn.

Bounces for **Preliminary** should never be downhill or at the end of long, straight gallop. Off a turn and slightly uphill is essential. Ideally color at the top of both elements should be contrasting. A simple bounce may be defined as 2 similar fences on (reasonably) flat ground. Preliminary: Off significant turn and or uphill may reduce to 14’ distance accordingly. Seldom less than 13’ 6” off significant turn and/or uphill.

33. Coffin

| LEVEL | APPROPRIATE | HEIGHT FRONT | BASE SPREAD | TOTAL WIDTH OF FACE | STRIDING |
|-----------------|------------------|------------------------------------|---|--------------------------------------|---|
| Beginner Novice | No | | | | |
| Novice | Yes, half coffin | | | Elements a) 16' b) 18' c) 12'-16' | half coffin jump to ditch minimum 3 strides 43' 6". Elements numbered separately. Ditch to jump – minimum 3 strides 45' Insignificant ditch Terrain will significantly affect distances of stride – distances will be adjusted for terrain. |
| Training | Yes | Elements a) 2' 11" b) n/a c) 3' 3" | Elements a) n/a b) no more than 4' base spread c) n/a | Elements a) 16' b) 18' c) 10'-16' | a) 30' – 33' between fence & ditch – flat ground A-B; b) ditch; c) 21' – 22' between ditch and a fence 1 stride – flat ground B-C; 33' – 35' between ditch and a fence 2 strides At least 2 elements numbered separately. |
| Modified | Yes | Elements a) 3' 11" b) n/a c) 3' 5" | Elements a) < 3' 6" for ditch | Elements a) 12' b) 16' c) 10' | a) 18' – 21' between fence(ht 3'3") and ditch(width <4'6") 1 stride going in.- adjust for slight slope of ground; b) ditch; c) min 21'-22'(1 stride) between ditch and fence(ht 3'5") – Flat ground B-C 33'-35' (2 strides). |
| Preliminary | Yes | Elements a) 3' 5" b) n/a c) 3' 7" | Elements a) n/a b) no more than 5' base spread c) n/a | Elements a) 12-16' b) 16' c) 8'-16' | a) 18' – 21' between fence and ditch on flat ground 1 stride going in – adjust for slight slopes of ground; b) ditch; c) min 21' – 22' (1 stride) between ditch & fence – flat ground B-C or 33' – 35' (2 strides) |
| Intermediate | Yes | Elements a) 3' 7" b) n/a c) 3' 9" | Elements a) n/a b) no more than 6' base spread c) n/a | Elements a) 10-16' b) 16' c) 6'-16' | a) 18' – 20' between fence and ditch – A-B; b) ditch; c) 19' – 22' for the first stride ditch to fence then add 9'-12' for the second stride B-C depending on the slope coming out of the coffin |
| Advanced | Yes | Elements a) 3' 9" b) n/a c) 3' 11" | Elements a) n/a b) no more than 6' base spread c) n/a | Elements a) 12-16' b) 16' c) 5'-16' | a) 18' – 20' between fence and ditch – A-B; b) ditch; c) 19' – 22' for the first stride ditch to fence then add 9'-12' for the second stride B-C depending on the slope coming out of the coffin. |

34. Frangible Fence

| LEVEL | APPROPRIATE | HEIGHT FRONT | TOTAL WIDTH OF FACE |
|-----------------|-------------|--------------|---------------------|
| Beginner Novice | No | | |
| Novice | No | | |
| Training | No | | |
| Modified | Yes | 3' 5" | Max. 16' |
| Preliminary | Yes | 3' 7" | Max. 16' |
| Intermediate | Yes | 3' 9" | Max. 16' |
| Advanced | Yes | 3' 11" | Max. 16' |

The Frangible Technology refers to a construction technique used for a variety of obstacle types available for cross-country designers to choose from.

In the following situations, the use of the frangible fence should be used in place of standard rails or gates. Please refer to the handbook, *An Introduction to Frangible Fences* for installation instructions.

- Bounces (both elements)
- Sunken Roads
- Triple Bars
- Gates
- Coffins
- Open Oxers
- Corners

Refer to *An Introduction to Frangible Fences* for more information.

35. Triple Brush

| LEVEL | APPROPRIATE | WIDTH AT BACK | WIDTH AT FRONT | BASE SPREAD | HEIGHT AT FRONT | BACK |
|-----------------|-------------|---------------|----------------|-------------|-----------------|-------|
| Beginner Novice | No | | | | | |
| Novice | No | | | | | |
| Training | No | | | | | |
| Modified | Yes | 7' 6" - 8' | 2' 6" - 3' 6" | 4' | 1' 6" | 3' 1" |
| Preliminary | Yes | 6' 6" - 7' | 2' - 3' | 4' 6" | 1' 6" | 3' 3" |
| Intermediate | Yes | 5' 6" - 6' | 2' | 5' - 5' 6" | 1' 6" | 3' 5" |
| Advanced | Yes | 4' 6" - 5' | 1' 6" - 2' | 5' 6" - 6' | 1' 6" | 3' 6" |

36. Water - Depths & Distances

| LEVEL | APPROPRIATE | HEIGHT DROP INTO WATER | MINIMUM WIDTH OF WATER CROSSING | MAXIMUM DEPTH OF WATER AT LANDING OR TAKE OFF | MINIMUM DISTANCE | TOTAL WIDTH OF FACE |
|-----------------|-------------|------------------------|---------------------------------|---|---|---------------------|
| Beginner Novice | Yes | N/A | 20' | N/A | N/A | 16' |
| Novice | Yes | N/A | 20' | N/A | N/A | 16' |
| Training | Yes | 2' 8" Max | 30' | 14" (35cms) FEI 6"-10" ideal | 19' 6" (6m) before any obstacle in water. Minimum distance between obstacles sited in water – 30'. FEI (9m) | 16' |
| Modified | Yes | 3' 10" Max | 30' | 14" (35cms) FEI 6"-10" ideal | 19' 6" (6m) before any obstacle in water. Minimum distance between obstacles sited in water – 30'. FEI (9m) | 16' |
| Preliminary | Yes | 4' 7" Max | 30' | 14" (35cms) FEI 6"-10" ideal | 19' 6" (6m) before any obstacle in water. Minimum distance between obstacles sited in water – 30'. FEI (9m) | 16' |
| Intermediate | Yes | 5' 3" | 30' | 14" (35cms) FEI 6"-10" ideal | 19' 6" (6m) before any obstacle in water. Minimum distance between obstacles sited in water – 30'. FEI (9m) | 10' |
| Advanced | Yes | 5' 11" | 30' | 14" (35cms) FEI 6"-10" ideal | 19' 6" (6m) before any obstacle in water. Minimum distance between obstacles sited in water – 30'. FEI (9m) | 8' |

Width of water; where there is a jump into water and revetted exit, bank must be greater than or equal to 3 strides (42'6" - 46') from entry jump/drop and/or bank down/drop in to water. FEI Rule – Maximum depth of water 35cms. Novice & Training entry or exit obstacles: Drops into water will ride better with a small round rail.

Novice – Maximum 10" depth of water.

Training – Fence before a revetment or obstacle into water should not be closer than 30'. Fence after water not less than 30' after revetting.

Modified – Water to water obstacle allowed with a height of 3' 2" with no top spread; jump in water must be a minimum of 12' and be inviting in nature.

Preliminary – Fence after water not less than 18' after revetting.

Intermediate – Fence after water not less than 9' after revetting. A bounce into water is acceptable. Must be well presented with the 2nd element small (approximately 20") and straightforward. Any significant downhill slope between elements is not appropriate.

Advanced – Fence after water not less than 9' after revetting.

Training/Advanced – Adding a log at the base of the step out can be helpful for all divisions.

The height of the fence is determined by the allowed drop in M, P, I & A divisions. In most cases, maximum height will be determined by the recommended/allowed drop. Depth of water 10" maximum; 5"-6" ideal.

37. Bending Lines

| LEVEL | STRIDES | ANGLE |
|--------------|---------|-------|
| Modified | 4 | 45* |
| | 5 | 60* |
| | 6 | 90* |
| | | |
| Preliminary | 4 | 45 |
| | 5 | 60 |
| | 6 | 90 |
| | | |
| Intermediate | 4 | 60 |
| | 5 | 90 |
| | | |
| Advanced | 3 | 60 |
| | 4 | 90 |
| | | |

* Second element to have no top spread at maximum allowed bend.

38. Frangible Pin Handbook

An Introduction to



Frangible Fences

11th Edition: March 21, 2010

*Compiled and edited by Dan Starck
Design and Layout donated by Lola Starck
Starck Studios, Carterville, IL (618) 985-8086*

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1. BACKGROUND INFORMATION

An incident report form applying to all falls of horse and/or rider was developed and piloted during the 2000/2001 season. The Transport Research Laboratory (TRL) conducted film analysis of 100 accidents, including 75 cross-country fences and 25 show jumping fences. It was found that the potential for a crushing injury was related to the rotating motion and landing angle of the horse. A landing angle of more than 90 degrees was considered to provide a significant risk of crushing injury to the rider. This happened when the horse hit a fixed obstacle between its knee and elbow. Below this, the horse was able to scrabble over, but above this, the horse stayed behind the fence with the rider staying seated or ejected over the fence. A mathematical model was developed and a full-scale crash test horse was used to simulate the load conditions between a horse and fence. Based on the results of the test program, TRL established that if the rail anchorage was designed to break at a controlled load to ensure that the rail would fall, this would remove the vertical load between the horse and the fence.

TRL designed a breakable pin with the precise failure strength to allow the rail to drop, thereby stopping the horse from rotating or somersaulting. This means the horse can hit the rail fairly hard without the fence collapsing and still keep its footing, but if the critical load is reached, the pin would fail with the potential of minimizing risk of injury to both horse and rider. The final design and manufacture of the pins has been carried out by *Barriers International, Ltd.* A small team of British Eventing cross-country course builders and designers looked at the practicalities of the proposed system and how to implement it into the sport. Having tested the system, the pins were trialed throughout the 2002 season at 13 British Eventing from Training to Advanced; and at 14 FEI events across three continents. Video and eyewitness accounts confirm that the system is robust with fences installed with the pins having been hit in many ways, at all levels. Pins have broken twice during the 2002 season, and on both occasions, serious injury to both horse and rider was averted.

The first break was at Weston Park Prelim at the first rail of a rail-ditch-rail combination:

The horse took off from a standstill. Momentum carried the horse over the fence to the critical position of downward pressure on the rail. The pin sheared at the point when downward pressure reached the pre-determined maximum. The rider was thrown free; horse was restricted to take-off side of the fence. The horse walked away uninjured. Fence repair crew replaced the pin in under 1.5 minutes and the course was not held. The horse and rider were fit to continue, but were awarded the appropriate penalties and compulsory retirement.

The second break was at Boekolo CCI***:

A tired horse failed to make the back rail of an oxer. Both pins broke and both horse and rider escaped unharmed from an incident that eye-witness accounts suggested would have resulted in significant injury had the pins not been in use.

These two situations show that the system was immediately proven to contribute towards rider safety by reducing the chance of rotational and other potentially dangerous falls in certain circumstances.

The merits of the system include:

- Significant research and testing
- Maintains integrity of the cross-country phase

- Easy to install
- Easy and quick replacement of pins following activation (approx. 1-2 minutes)
- Affordable (approx. \$68.00 pair of pins with sleeves. Cost currently covered by USEF.)

2. ROLL-OUT PLAN (U.S.A.):

HOW SOON MUST THE SYSTEM BE INSTALLED INTO FENCES?

- It is required for use in obstacles after December 1, 2008 for which frangible technology is appropriate. Obstacles constructed prior to December 1, 2008 for which frangible technology is appropriate must be retrofitted prior to December 1, 2009.
- The use of the Frangible Fence Pin System is outlined in the newly revised "Guidelines for Cross Country Obstacle Design".
- The guidelines call for the use of the pin system in certain appropriate situations, namely: back rails of open oxers, triple bars, coffins, rails before sunken roads, bounces, and open corners at preliminary, intermediate, and advanced levels.
- The Technical Delegate, in discussion with the Course Designer, will be responsible for determination of obstacle appropriateness, as usual.

3. DESIGN & BUILDING SPECS:

INTO WHICH FENCES CAN THE PIN SYSTEM BE INSTALLED?

Specification of fences to which the system should be installed:

- Post and rail construction using timber of appropriate specification (see Construction Specs below)
- All top rails of 15-inch diameter or less.
- Back and front rail of all oxers (square and ascending)
- Back rail only of any triple bar type construction
- Any rail that measures at least 37.5 inches (0.95 m) in height from the BASE of the fence (not measured from point of take-off). It may be installed in fences of a lower height if you choose only if the rail can drop 16-inches. This should be discussed with the Course Designer.
- Corners of post-and-rail construction: both rails that form corner, if all of standard post-and-rail construction; back rail only if front is of solid construction (i.e. palisade, see section 4 and Appendix diagram).

Construction Specifications:

- No more than 16 feet between pin centers
- Rail not to exceed 550 pounds (SEE APPENDIX B)
- Diameter of rail at each pin to be 6.5 to 15 inches.
- Timber of greater diameter can be used as long as the center of the log sits on the setting marker on the pin, and that the overall weight does not exceed 550 pounds. This could be achieved by notching the rail back onto the posts, but **MUST** be discussed with, and approved by, the Course Designer.

- Once installed, the rail must be free to drop at least 16 inches (40 cms) at each pin position, and be retained by roping.
- All back rails (oxers, triple bars, etc.) should have no lower rails or filling.
- Uprights and front rails with pins installed can have lower rails and/or filling. Suggested methods of achieving this are shown in the Appendix.
- For full construction methodology and supporting diagrams, see section 4 and the Appendix

Prior to installation, the Technical Delegate should approve the use of the pin system in the chosen fences, and MUST be satisfied that the course builder is adequately experienced to carry out the installation.

4. CONSTRUCTION AND INSTALLATION: HOW DO I INSTALL THE PIN SYSTEM?

- The careful and accurate installation of the pins is key to the successful activation of the system.
- The post must be vertical -- the system CANNOT be installed in a post set at an angle.
- Temporarily set the rail in the traditional way on prop-blocks. Next, fine-tune to satisfaction of the designer and TD.



- Remove or lift rail out of the way.
- Attach prop-block to post (i.e. with timber-lock screws). Mark post for bottom of rail. Cut off catch-block 16" below rail mark.

- Mark the position for the hole so the top of the hole will be at the bottom edge of rail. (centered 3/4" below rail / 19 mm). The pin cannot be adjusted by less than 2-3 inches once the hole for the sleeve has been drilled.
- Drill a 1 1/2 inch hole HORIZONTALLY all the way through the post.



- The hole must not exceed 1 1/2 inch, as an insufficiently tight fit will cause significant variation in the load required to break the pin, and the system will not perform correctly.

- Drive the sleeve into the post using the driving tool that is supplied with the sleeves, so as not to damage the sleeve. Alternatively, if post diameter allows, drive sleeve from back of post.
- Leave the ‘pin locking hole’ about 1/4 inch outside the post on the ‘rail’ side.
- Accurate positioning of the sleeve: The sleeves are now being produced with a marker line (groove) just behind the locking hole. The sleeves should be inserted into the posts as far as possible, just allowing enough protrusion to insert the “R” clip through the locking hole. In any case they must be inserted at least so that the marker line is no longer visible.



“R Clip”

- Determine correct pin length (short pins: up to 12.5” diameter; long pins: up to 15.5” diameter).
- Insert the pins into the sleeves at each end of the rail.
- Set the rail onto the pins and adjust the pins using one of the three ‘locking holes’, thus ensuring the ‘setting mark’ is at the center point of the rail.
- Accurate positioning of the rail on the pin: It is vital that the pin breaks under the load for which it has been designed. Therefore, the rail must be positioned onto the pin so that the contact point of the rail is DIRECTLY over the setting mark (groove) on the pin. If the rail center is off the setting mark (groove) by 4-3/16 inches (30 mm), the effective strength or weakness of the pin will be 43% greater or less than with the rail installed on the groove. The ‘locking holes’ are positioned to help you achieve this. If the locking holes do not allow you to position the rail correctly, you must either pack the rail out from the post, or notch the rail back onto the post.



- If the rail bottom contact point is not obvious (flat), a dowel can be attached to create a clear contact point.
- Lock the pin in position in the sleeve with the retaining clip.



- Rope the rail to the post ensuring that the rail is free to drop at least 16 inches (40 cms) at each pin position when the pin breaks. Roping must be as tight as possible and fixed 8 inches below pin.
 - Measure down 16 inches (40 cms) from the bottom of the rail and secure catch block with its top at this point.
 - See Appendix for styles.
 - Once installed, remove the pin and check that the rail can drop freely, including where the pin is installed at the joints. To prevent the rail from snagging on the pin residue (stub), the rail must be able to rotate as it drops.
 - Middle Posts: There may be a post in the middle of a fence for aesthetic reasons. There is a possibility of a rotation occurring directly over this post. The top of the post could take the resulting force, and thus stop this force being exerted on the rail itself and hence the pins. Therefore, where a middle post is used without a joint and pin, the top of the post should be cut flat just above the mid-point of the rail.
- The Technical Delegate is responsible for checking the correct installation of the system prior to the start of competition.
 - Currently, the pins and sleeves are manufactured from an aluminum alloy. To minimize the potential for corrosion, it is recommended that:
 1. The pins ARE removed during the closed season, lightly oiled and stored in a dry place. They should then be cleaned and lightly oiled prior to setting up the jump for the next season.
 2. The sleeves ARE NOT removed from the jumps during the closed season. They should be oiled at the end of each season, then cleaned and oiled again prior to setting up the jump for the next season.
 - The latest information and recommendations for proper installation may be viewed at www.barriersint.com.

5. REPLACING PINS:

WHEN MUST THE PINS BE REPLACED AND WHO IS RESPONSIBLE?

- The obvious answer is that the pin must be replaced when broken. However, a pin will bend (not shear) if the fence is hit with a force approaching the pre-determined level at which the pin is designed to shear.
- All pins should be checked regularly throughout the day of competition, and must always be checked immediately after the fence has been hit. This should be done initially by the Fence Judges, having been briefed by the Technical Delegate prior to the start of competition.
- A pin must be replaced as soon as there is any sign of bending.
- The Organizer must be sure that extra pins are present at competition
- The Event should also ensure that all broken or bent pins are forwarded to the USEF.

6. SHEARED PINS

In National Level Events, if a pin is broken, it is treated as any other fence. No penalty is issued if forward momentum is maintained and no fall of horse or rider occurs. The fence must be pulled from the course if supply of spare pins is exhausted.

7. GETTING THE PIN SYSTEM:

WHO SUPPLIES THE PIN SYSTEM AND HOW DO I ACQUIRE FRANGIBLE PINS?

Mick Costello will be distributing the pins free of charge on behalf of the USEF as a service to the sport at not profit to himself. Shipping can be arranged by contacting Mick.

Mick Costello
Lexington, Ky.
Phone: 859-312-8193

ANY SUGGESTIONS OR QUESTIONS MAY BE DIRECTED TO:

Dan Starck
P.O. Box 84
Palmetto, GA 30268
e-mail: jumpbuilder@earthlink.net
cell phone: 618-201-1964

APPENDIX A

Drawings based on diagrams originally provided by British Eventing.

Diagram 1 - Post and Rail with suggested method of retaining lower rail

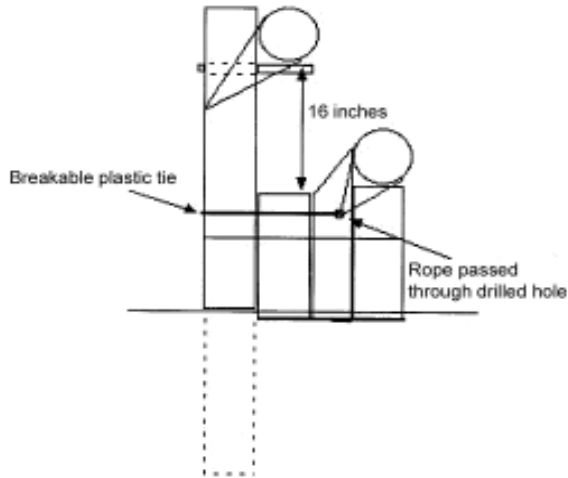


Diagram 2 - Flower Box

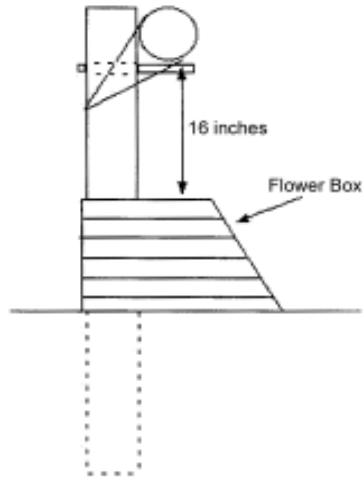


Diagram 3 - Triple Bar

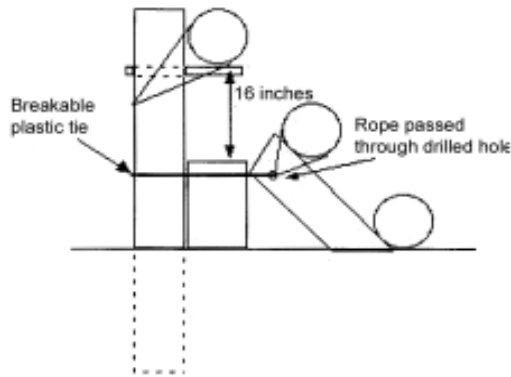


Diagram 4 - Post and Rail with brush fill

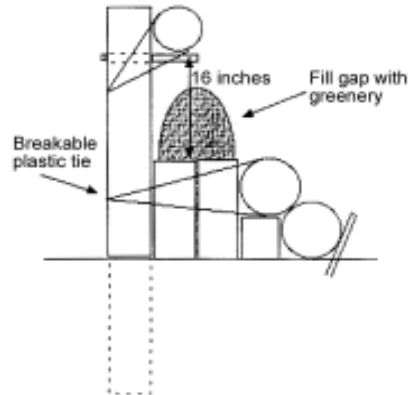


Diagram 5 - Joint

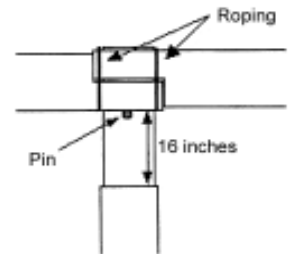


Diagram 6 - Corner Layout (from above)

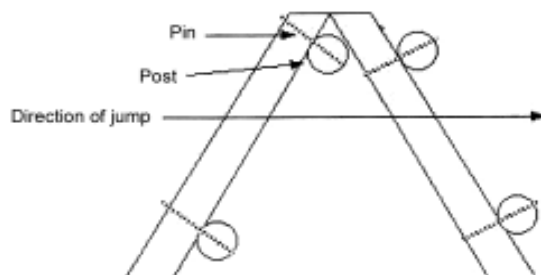
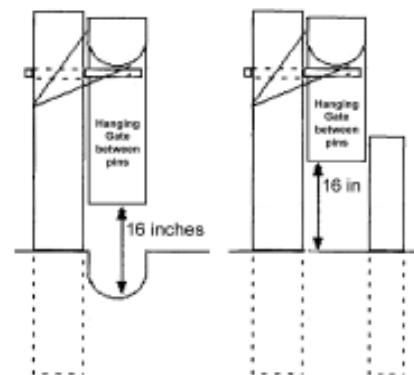


Diagram 7 - Square Timber or Gate



APPENDIX B
APPROXIMATING THE WEIGHT OF LOGS

METHOD A:

1. Cut known length of log from end.
2. Weigh cut off section.
3. Divide rail length to be used by length of cut section.
4. Multiply that number by weight of cut section.

METHOD B:

1. Find the volume of log in cubic feet:
 $0.0795 \times \text{length in feet} \times \text{average girth in feet} \times \text{average girth in feet}.$
2. Multiply by weight per cubic foot (from chart).

EXAMPLE:

Freshly cut sycamore log = 16 feet long

Circumference around mid-point of log = 31.5 inches (10 inch diameter) ($\pi \times \text{diameter}$)*

Convert girth to feet: 31.5 inches divided by 12 = 2.625 feet

Formula:

$$0.0795 \times 16 \times 2.625 \times 2.625 = 8.765 \text{ cubic feet}$$

Multiply times density from chart:

$$\times 63.7 \text{ pounds per cubic foot} = 558.3 \text{ pounds} \quad \textbf{TOO HEAVY!!}$$

On-line calculator available at: shagbarkfarms.com/LmbCalc/VolCalc_Q2.html * pi = 3.14

| DENSITY OF SPECIFIC WOODS IN POUNDS PER CUBIC FOOT | | | | | |
|---|--------------|------------|---------------------|--------------|------------|
| SPECIES | GREEN | DRY | SPECIES | GREEN | DRY |
| Apple | 60.6 | 48.6 | Kentucky Coffeetree | 48.4 | 38.9 |
| Ash, Green | 52.3 | 41.1 | Locust, Black | 57.7 | 50.2 |
| Ash, White | 49.4 | 43.4 | Locust, Honey | 58 | 47.9 |
| Basswood | 41.3 | 24.7 | Maple, Hard | 58.7 | 41.9 |
| Birch, Paper | 53.9 | 37.4 | Maple, Silver | 48.8 | 34.4 |
| Boxelder | 44.9 | 32.9 | Mulberry | 58.9 | 46.4 |
| Buckeye | 52.6 | 24 | Oak, Red | 61.1 | 44.1 |
| Catalpa | 57 | 29.5 | Oak, White | 69.7 | 52.5 |
| Cedar, Eastern Red | 36.9 | 32.9 | Osage Orange | 64 | 59.1 |
| Cherry, Black | 46.2 | 36.6 | Pine, Jack | 45 | 29.2 |
| Cottonwood | 58 | 28.4 | Pine, Ponderosa | 45 | 29.2 |
| Elm, American | 55.7 | 35.9 | Pine, White | 34.7 | 28 |
| Fir, Douglas | 41.5 | 37 | Spruce | 35 | 28 |
| Hackberry | 49.8 | 38.1 | Sycamore | 63.7 | 35.1 |
| Hickory, Shagbark | 63.8 | 49.4 | Walnut, Black | 57.3 | 39.6 |
| Iron Wood | 57.4 | 50.2 | Willow | 54 | 31.7 |

HIGHLIGHTS FOR OFFICIALS

- It is very difficult to change the height of pinned rails, so we are recommending that rails be set temporarily on prop blocks (traditional method) until checked by TD and/or CD. Ideally this would be done at an early course inspection.
- Rail must contact pin at line on pin.
- Pins must be rigid in posts. This may be difficult to check with weight of rail on pins, but if sloped, should be checked closer.
- Pins must be perpendicular to posts
- Maximum 16 feet between pins.
- Maximum 550 pounds per rail. Ask builder if checked or figure using formula.
- Rail must have 16 inches of free fall space below.
- Must be roped to not restrict fall.
- Ensure that Organizer has spare pins on site.
- Repair crew knowledgeable.
- Jump Judges briefed to check pins for damage after hits.