HO-036 Eight-station batter-board layout kit

Keep four reference lines outside a 24 x 16 ft practice rectangle so corner points can be removed and re-established from the retained line marks; verify the whole rectangle rather than one corner alone.

Eight removable line stations form one instructional 24 x 16 ft layout kit on a verified clear, nearly level practice area. No excavation, occupied building, legal boundary, structural bracing, anchor capacity or construction-survey accuracy is approved by this design. Site-specific plans and required survey controls govern real building work.

US inches/feet control; metric figures are references. Original unbuilt instructional design; no field accuracy, soil stability, load or physical fabrication trial has been performed.

Before cutting

Read all four plates before cutting. This example is a 24 x 16 ft reference-line rectangle with 4 ft remote supports, not a habitable building design.

Use only a clear practice plot with verified safe stake penetration and protected access. No drilling into building services or existing property monuments.

Received actual rail/stake sections control the screw and stopped-pilot calculations. A change of section requires recalculation.

Materials and actual cuts

Part	Qty	Actual size	Material and special cut
A Horizontal line rail	8	72 x 3 1/2 x 3/4 in 1828.80 x 88.90 x 19.05 mm	Straight, sound dry wood, with listed ACTUAL dimensions. Reject splits and twist. Ordinary finished cuts within 1/32 in (0.79 mm); dimensions are not nominal lumber labels. Nominal 1 x 4 stock, received actual 3/4 x 3 1/2 in. Long axis is localX; the FRONT face faces the practice rectangle. One centered 1/16 in-wide x 1/16 in-deep through-thickness top kerf, local X36, guides the line.
B Main station stake	16	36 x 1 1/2 x 1 1/2 in 914.40 x 38.10 x 38.10 mm	Straight, sound dry wood, with listed ACTUAL dimensions. Reject splits and twist. Ordinary finished cuts within 1/32 in (0.79 mm); dimensions are not nominal lumber labels. Nominal 2 x 2, actual 1 1/2 in square. Taper the bottom 3 in on four faces to the centered point. No angle setting is needed: join the tip mark to the four lines 3 in above it.
C Temporary corner pin	4	12 x 1 1/2 x 3/4 in 304.80 x 38.10 x 19.05 mm	Straight, sound dry wood, with listed ACTUAL dimensions. Reject splits and twist. Ordinary finished cuts within 1/32 in (0.79 mm); dimensions are not nominal lumber labels. Nominal 1 x 2, actual 3/4 x 1 1/2 in. Taper only bottom 2 in. Four level top marks temporarily locate A/B/C/D while checking the rectangle.
D Long-direction reference line	2	468 x 1/16 x 1/16 in 11887.20 x 1.59 x 1.59 mm	One continuous low-stretch mason-line spool, received diameter 1/32..1/16 in. Listed width/thickness are a maximum circular envelope, not square stock. 39 ft each, including 7 ft total allowance for wraps and tails across the 32 ft support span. The knots are not load-rated.
E Short-direction reference line	2	372 x 1/16 x 1/16 in 9448.80 x 1.59 x 1.59 mm	Same spool and diameter as D. 31 ft each, including 7 ft total allowance across the 24 ft support span.

Hardware and tools

32 x Exterior flat-head #10 wood screw, 2 in OVERALL, received length within 1/32 in, major <= .190 in, head OD <= 3/8 in. Four per rail, two into each B stake. Local rail X6 and 66; centers 1 and 2 1/2 in below rail top. Clearance through A; pilot into B separately before attachment.

1 x Low-stretch mason line spool, at least 160 ft. Cut D/E from this ONE spool; cut list is the four pieces, not four additional spools.

1 x Temporary witness pencil/chalk and bright removable line flags. Consumables for this kit; no separate project count.

Saw and backed drill, square, fractional-inch rule, clamps, matching countersink, depth stop and sandpaper. Additional field tools are named in the method. Wear protection appropriate to the actual tool and stock.

Measured assembly reference

ONE representative station only: localX along the 72 in rail, localY toward the rectangle, Z up from nominal practice grade. A front Y0. Stakes extend Z-10..26; four bottom tapers are cut. Rotate/translate this station using the field table; upper-family rail is 1/4 in higher.

This table locates one representative station or staff in its own local coordinates. Repeated units and field positions are identified on the plates; quantities in the cut list cover the complete kit.

Part / instance	Origin x, y, z	Size dx, dy, dz / rotation
A / 1	0, -3/4, 20 1/2 in 0.00, -19.05, 520.70 mm	72 x 3/4 x 3 1/2 in
B / 1	5 1/4, -2 1/4, -10 in 133.35, -57.15, -254.00 mm	1 1/2 x 1 1/2 x 36 in
B / 2	65 1/4, -2 1/4, -10 in 1657.35, -57.15, -254.00 mm	1 1/2 x 1 1/2 x 36 in

Numbered assembly

01. Choose a supervised practice plot with room for a 32 x 24 ft outer support rectangle plus the 72 in rails. Before ANY stake penetration, complete the applicable 811/state process and establish safe penetration locations, including private services. Do not infer clearance from an apparently empty yard. Use this example to learn layout; obtain the actual building position, offsets, excavation limits and survey controls separately for a real structure.

02. Receive eight straight nominal 1 x 4 boards with actual 3/4 x 3 1/2 in section and eight nominal 2 x 2 boards with actual 1 1/2 in square section, all at least 8 ft long; obtain one actual 3/4 x 1 1/2 in board for C. Measure both dimensions before cutting. Use the listed 1/32 in stock tolerance; record a changed section and recalculate screw entry instead of relying on its store label.

03. Cut eight A rails 72 in long. From each of eight 96 in B stock lengths cut TWO 36 in stakes. One 96 in C stock length produces four 12 in pins. Budget 1/8 in saw kerf per cut and at least 1/4 in end trim: one A needs 72 3/8 in, two B need 72 1/2 in and four C need 48 3/4 in of usable stock. Square the rail ends; label A1-A8, B1-B16, C1-C4.

04. Mark the centered point on each B end and a square shoulder line 3 in above that end. Saw four taper faces to those lines over a properly supported blank; retain the full upper 33 in section. Make the shorter 2 in tapers on C. Smooth sharp arrises without rounding the rail top or its field-facing reference edge.

05. On every A mark screw axes 6 in and 66 in from its left end, each 1 in and 2 1/2 in below its top. Drill four 13/64 in clearance holes over backing and countersink only until the received flat head will seat flush. A is not threaded by the screw. Keep the two axes on each post separated by 1 1/2 in.

06. Cut the central line kerf at A local X36 in, 1/16 in deep from the top, through its 3/4 in thickness. Keep its width at 1/16 in; use a matching fine saw or two controlled passes and a depth stop. The FIELD-facing edge of this kerf is the plan datum. Round other sharp handling edges only. Two lower string lines and two upper lines will cross with 1/4 in vertical separation, not occupy the same physical space.

07. Make a clamped bench trial with one rail front at local Y0 and back at Y-3/4 in. Two B stakes lie behind it, front Y-3/4 in/rear Y-2 1/4 in, center X6 and 66. Their center distance is 60 in. Hold the rail so its top is 2 in below the stake tops for this trial, mark all four B pilot centers through A, then REMOVE A for drilling.

08. Drill the B pilots 1/8 in diameter, with 1 3/8 in FULL cylindrical depth measured from the B front. Receive bit-point length <= .040 in; set depth within 1/64 in and confirm on scrap. Drill B with the rail removed so a short bit is not forced through the extra 3/4 in. Maximum full bore plus point is 1.430625 in, below the received B minimum 1.46875 in thickness. Do not drill through the stake.

09. Re-clamp A to B and install the four 2 in screws flush, stopping before wood is crushed. At minimum rail thickness .71875 in and maximum screw 2.03125 in, screw entry is 1.3125 in; at minimum stake thickness

1.46875 in, at least 5/32 in remains behind the tip. Make witness marks across A/B. Complete the other stations with the SAME hole pattern; field installation follows after the first trial is satisfactory.

10. Establish a local field coordinate system, in inches: target cornerA(0, 0), B(288, 0), C(288, 192), D(0, 192). X follows the 24 ft side; Y follows the 16 ft side. These are example reference-line intersections, NOT outside faces of an assumed footing or a property boundary. Use two checked 50 ft steel tapes and helpers; keep each measured distance in a horizontal plane with consistent tape tension.

11. Temporarily set C1/C2 at A/B, 288 in apart. Use a point E on AB 144 in from A. Find D on the chosen side of AB where its distance from A is 192 in and from E is 240 in: this is a 12-16-20 ft right triangle. Locate C with DC 288 in and BC 192 in. The alternate intersection on the other side of AB is not part of this plot.

12. Set all four temporary corner-pin top datum marks to one horizontal practice plane, nominally 4 in above the local grade, using a checked leveling instrument and its instructions. Nominal C embedment is 8 in on the stated flat plot, not a universal soil requirement. Check the four side lengths on that common plane, then BOTH diagonals: sqrt(288^2+192^2) = 346.132922 in, approximately 28 ft 10 1/8 in. Equal diagonals alone do not prove an arbitrary four-sided shape is the intended rectangle; verify the sides too.

13. Mark the eight station kerf locations from the field-coordinate table on plate 1. S1/S2 carry y = 0; S3/S4 carry y = 192; S5/S7 carry x = 0; S6/S8 carry x = 288. The supporting rail FIELD face is exactly at the listed station coordinate, its kerf centered on the extended target line. Rail boards run perpendicular to their string. The 4 ft example offset is for this practice area, not a clearance rule around an excavation.

14. At each station locate the two stake centers 30 in either side of its line mark, along the rail direction. Put the stake FRONTS 3/4 in outward from the rail field face, so A can sit flush between the field face and B. Keep the stakes plumb. Nominal B embedment is 10 in, leaving 26 in above grade; actual soil must hold the light, hand-snug line setup without rocking. If it cannot, abandon this practice setup rather than treating this embedment as a rated anchor.

15. Install S1-S4 rails with top Z24 in and S5-S8 with top Z24 1/4 in above the established grade datum. Receive every B top high enough to carry its rail with at least 1 in clear wood above the upper screw axis. Clamp each A level, transfer its four pilot centers to B, remove A, drill the same stopped pilots, then refit and screw. Use the actual placed height; the 2 in shop-trial offset is not a field-height rule.

16. Cut two 39 ft D lines and two 31 ft E lines from the 160 ft spool; 140 ft is retained and 20 ft remains for trimming or replacement. Bring a D line over the FIELD edge of S1 kerf to S2 kerf, and the other from S3 to S4. Keep the tails on the outside of the rectangle. Make two snug turns around the middle of each rail and finish with a clove hitch backed by two half hitches; keep knots away from the kerf. This is a removable layout tie, not a lifting knot or tension rating.

17. Run E from S5 to S7 and S6 to S8. These rails are 1/4 in higher, so the two line families cross without touching when the received line is at most 1/16 in diameter. Apply only enough hand tension to straighten each line; never pull a station to a desired measurement. Mark line positions and knots with witnesses, and put visible flags along the perimeter. Do not leave low strings across an access route.

18. Use a small plumb bob held below the UPPER string at each crossing. Sight its center against the lower string in both plan directions without resting it on either line; lower the bob toward the matching C top mark. Adjust station positions/kerf marks before final tightening until all four projections coincide with the accepted corner datums. The line intersection is a vertical projection, not the apparent overlap seen from the side.

19. Repeat AB/CD = 288 in, AD/BC = 192 in and both 346.132922 in diagonals on the common corner-datum plane. For this instructional setup require each side within 1/4 in of target, diagonals within 1/4 in of target and within 1/4 in of each other; repeat after walking around the OUTSIDE. These are an original practice acceptance threshold, not a construction-survey specification. If tapes sag, rails move or results do not repeat, correct the setup before using the marks.

20. Practice removing ONE temporary corner pin after recording its top datum and verifying all other witnesses. Re-establish its plan point from the same two line projections and reinstall its datum at the previously verified horizontal height. Recheck all sides/diagonals. This recovery from retained remote marks is the kit function; the eight rails are not eight separate projects.

21. After any bump, rain, wind, knot slip or soil change, check rail/stake witnesses, both line heights, sides and diagonals again. Stop when a stake rocks or a screw/kerf has split. Record the changed station; never quietly move one line and keep an old square-layout result.

22. For teardown release line tension first, remove and coil each line, back out the 32 rail screws into a tray and lift off A. Remove stakes with an appropriate hand method for the received ground, not by levering against a rail. Cover points during storage. Preserve the station labels and re-establish every height/coordinate on the next use.

Acceptance and intermediate checks

Complete stock: 8 rails+16 mainstakes+4 cornerpins+4 linepieces; 32 rail screws. Four lines are one kit, not four projects.

One station: 72 in rail, 60 in post-center distance, kerf X36; screw centers X6/66, top offsets 1 in and 2 1/2 in.

Received stock and full pilot/point/tip margins meet methods 2, 8, 9; the rail is removed for pilot drilling.

All 8 field-face/kerf coordinates match plate 1 and the table; line-family top heights 24/24 1/4 in keep crossing lines apart.

The four temporary corner datums share a horizontal plane. Check all sides and BOTH diagonals at that plane, not by sloping a tape between different heights.

Actual practice repeat checks meet the stated 1/4 in threshold after line installation and corner-pin recovery. This is not proof of a real foundation or a surveyed boundary.

Use and maintenance

Eight removable line stations form one instructional 24 x 16 ft layout kit on a verified clear, nearly level practice area. No excavation, occupied building, legal boundary, structural bracing, anchor capacity or construction-survey accuracy is approved by this design. Site-specific plans and required survey controls govern real building work.

Dry and label rails; replace any split kerf or elongated screw receiver.

Inspect points, screws, line wear and witness marks before reuse; recheck all field geometry after assembly.

Measured interface notes

Metric references: 24 ft = 7315.2 mm; 16 ft = 4876.8 mm; 4 ft = 1219.2 mm; 72 in = 1828.8 mm; 36 in = 914.4 mm. The diagonal is 8791.77623 mm, rounded from the original inch calculation.

Field table columns are S / kerf field-face X, Y / rail long axis / rail topZ, all inches: S1: (-48, 0), Y, Z 24; S2: (336, 0), Y, Z 24; S3: (-48, 192), Y, Z 24; S4: (336, 192), Y, Z 24; S5: (0,-48), X, Z 24.25; S6: (288,-48), X, Z 24.25; S7: (0, 240), X, Z 24.25; S8: (288, 240), X, Z 24.25. These are positions of the field-facing edge, not rail center planes.

Two crossing strings of maximum 1/16 in diameter, with their support top planes 1/4 in apart and equal kerf depths, have at least 3/16 in nominal vertical clearance. Verify no contact on the actual setup; there is no certified sag/wind bound.

The bottom 3 in taper of a main stake and bottom 2 in taper of a corner pin are machined waste, not full rectangular material. Soil embedment and stability are actual receiving conditions, not inferred from a drawing.

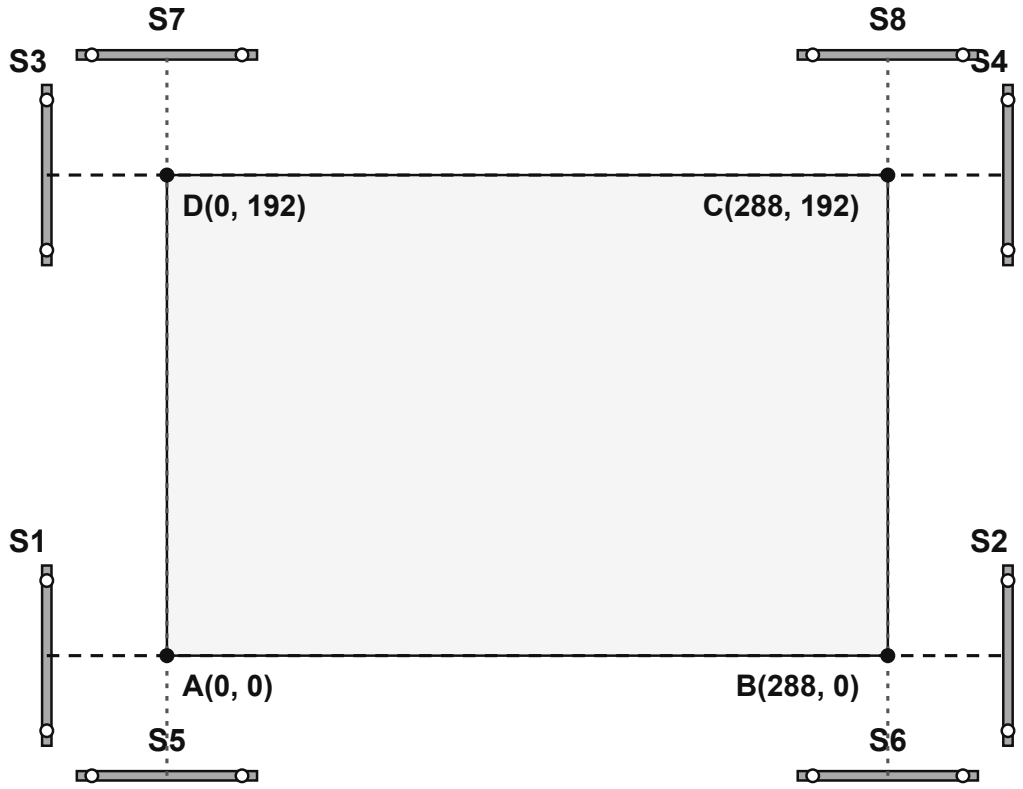
Primary context references

H1: Pennsylvania Department of Education, Carpentry T-Chart: Properties of Quadrilaterals, reviewed June 2015. Context only: verify opposite sides and both diagonals of a rectangular layout. The kit, stock schedule and worked dimensions here are original, not an agency-endorsed plan. https://www.pa.gov/content/dam/copapwp-pagov/en/education/documents/instruction/career-and-technical-education/teacher-resources/math-t-charts/carpentry%20t-chart%20-%20properties%20of%20quadrilaterals.pdf

H3: Common Ground Alliance, 811 in Your State. Use the applicable state process before ground penetration. This guide supplies no state-specific waiting period or permission to penetrate an unverified area. https://811beforeyoudig.com/811-In-Your-State/

HO-036 | Eight remote stations, one retained rectangle

PLAN, inches. Board FIELD face and kerf coordinates control; no footing or boundary is inferred.



S / kerf(X, Y) / axis / topZ

S1 (-48, 0) Y Z 24
S2 (336, 0) Y Z 24
S3 (-48, 192) Y Z 24
S4 (336, 192) Y Z 24
S5 (0,-48) X Z 24.25
S6 (288,-48) X Z 24.25
S7 (0, 240) X Z 24.25
S8 (288, 240) X Z 24.25

Coordinates in inches.
Support offsets 4 ft
are this example ONLY.
Lower y-lines top Z24;
upper x-lines top Z24 1/4.

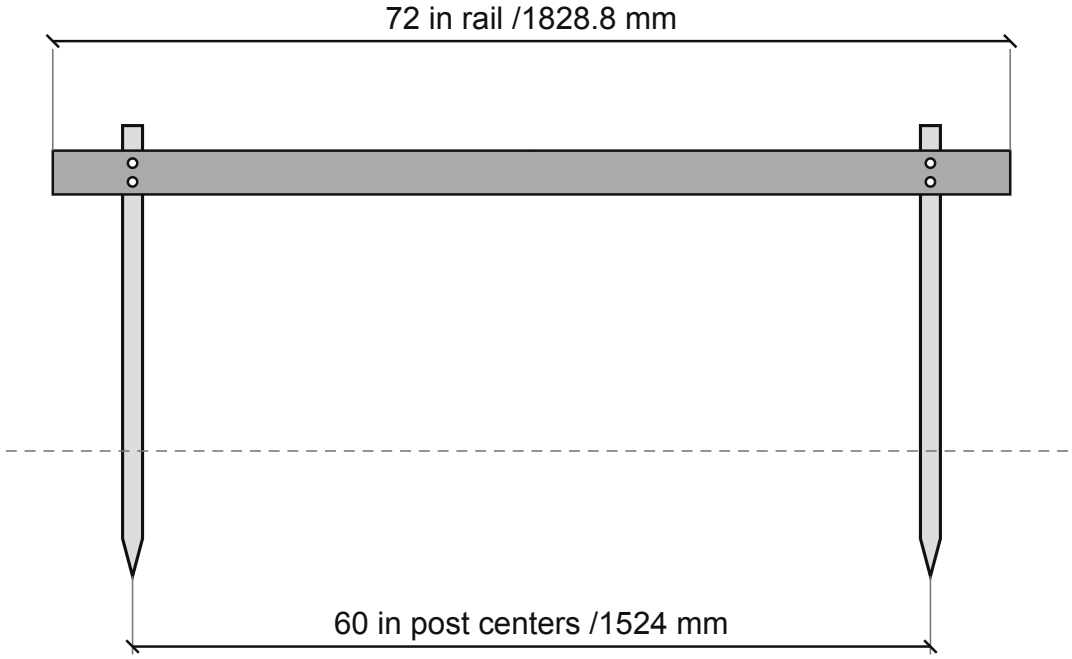
S1-S4 rails run Y; S5-S8 run X. Each rail 72 in; post centers 60 in apart.

Two 39 ft lines + two 31 ft lines. Crossings are vertical PLAN projections.

Original B/W measured drawing - not a full-scale template - unbuilt / untested

HO-036 | Rail, stakes and all four screw axes

FRONT of one station, not to scale. Field front Y0; posts behind the rail. Inch dimensions control.



A: 72 x 3 1/2 x 3/4 in
B: 36 x 1 1/2 square

Screw X6 and 66
Top offsets 1 and 2 1/2 in
Four #10 x 2 in total

Kerf X36, 1/16 deep
and 1/16 wide.

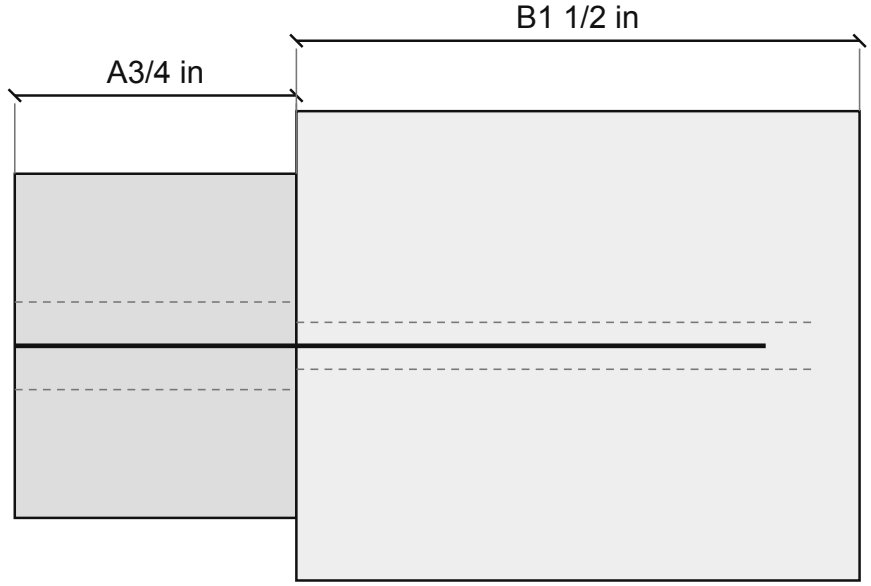
Nominal grade Z0
B tip Z-10; top Z26
Bottom 3 in is tapered.

Upper-family rails sit 1/4 in higher. Their screw pattern remains referenced to the actual rail top.

Original B/W measured drawing - not a full-scale template - unbuilt / untested

HO-036 | Separate clearance, pilot and screw paths

SECTION at one axis. Drill the bare stake pilot before refitting the rail; dimensions below are inches.



A clearance 13/64 in
Countersink actual head
flush, without crushing.

B pilot 1/8 in diameter
Full cylinder 1 3/8 in
Point <= .040 in
Stop error <= 1/64 in

Worst screw entry 1.3125
Minimum rear wood 5/32.

Pilot point maximum 1.375+.015625+.040 = 1.430625 in.

Received minimum B thickness 1.46875 in; pilot back reserve .038125 in.

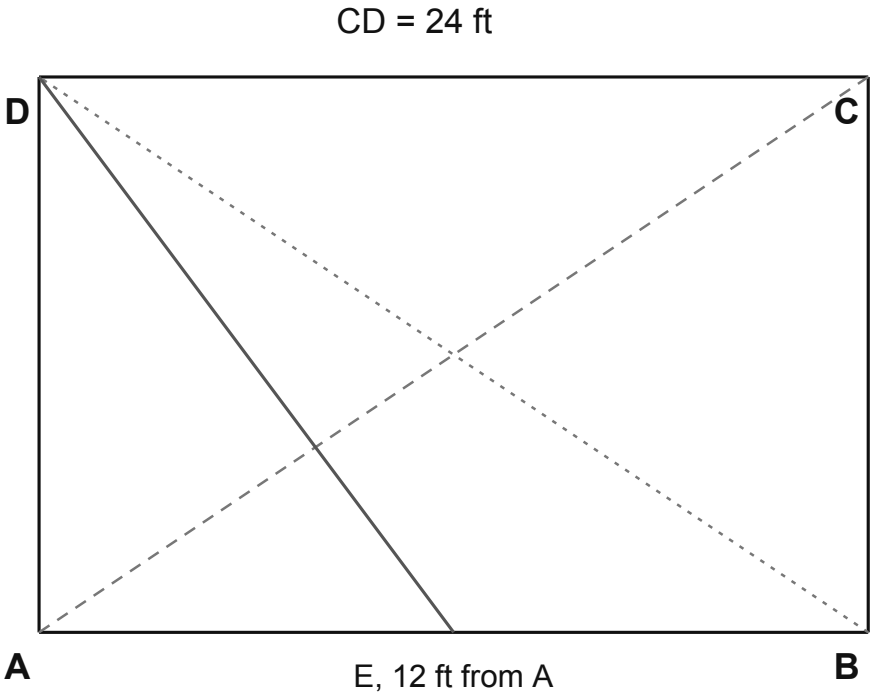
Shortest full pilot 1.359375 in exceeds maximum screw entry 1.3125 in.

Check an actual scrap cut open before drilling the 16 stakes.

Original B/W measured drawing - not a full-scale template - unbuilt / untested

HO-036 | Square the whole rectangle and recover a corner

The four corner datum marks share ONE horizontal plane. Upper/lower strings remain separate.



AE 12 ft; AD 16 ft; ED 20 ft

Each full diagonal:
346.132922 in
about 28 ft 10 1/8 in

Verify sides AND both diagonals before recovery.

Plumb from separated string crossings down to corner datum marks.

Practice threshold: each target and diagonal agreement within 1/4 in; repeat after disturbance.

Do not transfer this practice threshold to a real foundation or a legal boundary.

Original B/W measured drawing - not a full-scale template - unbuilt / untested