

Tread run** calculation for 10" code minimum run dimension at 12" walk path on curved or winding treads
per 2003 and 2006 IRC R-311.3.5.2 (as interpreted with straight linear dimensioning**)

↓ Smallest legal inside framed radius and splay angle produces the smallest legal inside tread depth of 6" with a minimum 10" run @ walk path.

Inside Radius of Stair Frame	→	18"	24"	30"	36"	42"	48"	54"	60"	66"	72"	78"	84"	90"	96"	102"	108"	114"	120"	
Radius @ 12" WALK PATH	→	30"	36"	42"	48"	54"	60"	66"	72"	78"	84"	90"	96"	102"	108"	114"	120"	126"	132"	
Min. legal splay° for 10" run	→	19.19°	15.97°	13.67°	11.96°	10.63°	9.56°	8.69°	7.96°	7.35°	6.82°	6.37°	5.97°	5.62°	5.31°	5.03°	4.78°	4.55°	4.34°	
number of treads	↓	splay ° carried out to the correct number of treads for any given flight ↓										↑	example stairs page 2 of 2							
↓																				
1		19.19	15.97	13.67	11.96	10.63	9.56	8.69	7.96	7.35	6.82	6.37	5.97	5.62	5.31	5.03	4.78	4.55	4.34	
2		38.38	31.94	27.34	23.92	21.26	19.12	17.38	15.92	14.7	13.64	12.74	11.94	11.24	10.62	10.06	9.56	9.1	8.68	
3		57.57	47.91	41.01	35.88	31.89	28.68	26.07	23.88	22.05	20.46	19.11	17.91	16.86	15.93	15.09	14.34	13.65	13.02	
4		76.76	63.88	54.68	47.84	42.52	38.24	34.76	31.84	29.4	27.28	25.48	23.88	22.48	21.24	20.12	19.12	18.2	17.36	
5		95.95	79.85	68.35	59.8	53.15	47.8	43.45	39.8	36.75	34.1	31.85	29.85	28.1	26.55	25.15	23.9	22.75	21.7	
6		115.14	95.82	82.02	71.76	63.78	57.36	52.14	47.76	44.1	40.92	38.22	35.82	33.72	31.86	30.18	28.68	27.3	26.04	
7		134.33	111.79	95.69	83.72	74.41	66.92	60.83	55.72	51.45	47.74	44.59	41.79	39.34	37.17	35.21	33.46	31.85	30.38	
8		153.52	127.76	109.36	95.68	85.04	76.48	69.52	63.68	58.8	54.56	50.96	47.76	44.96	42.48	40.24	38.24	36.4	34.72	
9		172.71	143.73	123.03	107.64	95.67	86.04	78.21	71.64	66.15	61.38	57.33	53.73	50.58	47.79	45.27	43.02	40.95	39.06	
10		191.9	159.7	136.7	119.6	106.3	95.6	86.9	79.6	73.5	68.2	63.7	59.7	56.2	53.1	50.3	47.8	45.5	43.4	
11		211.09	175.67	150.37	131.56	116.93	105.16	95.59	87.56	80.85	75.02	70.07	65.67	61.82	58.41	55.33	52.58	50.05	47.74	
12		230.28	191.64	164.04	143.52	127.56	114.72	104.28	95.52	88.2	81.84	76.44	71.64	67.44	63.72	60.36	57.36	54.6	52.08	
13		249.47	207.61	177.71	155.48	138.19	124.28	112.97	103.48	95.55	88.66	82.81	77.61	73.06	69.03	65.39	62.14	59.15	56.42	
14		268.66	223.58	191.38	167.44	148.82	133.84	121.66	111.44	102.9	95.48	89.18	83.58	78.68	74.34	70.42	66.92	63.7	60.76	
15		287.85	239.55	205.05	179.4	159.45	143.4	130.35	119.4	110.25	102.3	95.55	89.55	84.3	79.65	75.45	71.7	68.25	65.1	
16		307.04	255.52	218.72	191.36	170.08	152.96	139.04	127.36	117.6	109.12	101.92	95.52	89.92	84.96	80.48	76.48	72.8	69.44	
17		326.23	271.49	232.39	203.32	180.71	162.52	147.73	135.32	124.95	115.94	108.29	101.49	95.54	90.27	85.51	81.26	77.35	73.78	
18		345.42	287.46	246.06	215.28	191.34	172.08	156.42	143.28	132.3	122.76	114.66	107.46	101.16	95.58	90.54	86.04	81.9	78.12	
19		364.61	303.43	259.73	227.24	201.97	181.64	165.11	151.24	139.65	129.58	121.03	113.43	106.78	100.89	95.57	90.82	86.45	82.46	
20		383.8	319.4	273.4	239.2	212.6	191.2	173.8	159.2	147	136.4	127.4	119.4	112.4	106.2	100.6	95.6	91	86.8	
21		402.99	335.37	287.07	251.16	223.23	200.76	182.49	167.16	154.35	143.22	133.77	125.37	118.02	111.51	105.63	100.38	95.55	91.14	

total splay angle of staircase ▼

LEGEND	< 90°
	> 90° to < 180°
	> 180° but < 270°
	> 270° to < 360°
	> 360°

NOTES ▼

Inside radius of stair frame = narrowest portion of tread (no less than 6") also ≈ typical inside radius of handrail ± 1/2"
Radius of staircase WALK PATH is measured 12" from the narrowest point on stair FRAME and cannot be less than 10" run
Minimum splay angle (in degrees) at the radius listed in order to maintain a minimum 10" run along the walk path.
19.19° splay angle change at 18" radius w/10" run will create an illegal run if decreased, or an illegal inside tread depth if increased
**straight linear dimensions =point to point in a straight line (as opposed to following the curve of the stair)
**tread run is measured from face of riser to face of riser OR nose overhang to nose overhang NOT combined full tread depth

EXAMPLE OF A LEGAL CURVED STAIRCASE TREAD RUN:

TOTAL SPLAY ANGLE = 90°

INSIDE FRAMED RADIUS = 6' (72")

Total # risers = 14 Total # of treads = **13**

$90^\circ \div 13 = 6.923^\circ$ (or greater than the minimum splay angle of 6.82° per tread to maintain the minimum 10" run at the walk path)

note: @ 7 3/4" maximum riser height = maximum finished floor to finished floor dimension is 108 1/2" ($14 \times 7\frac{3}{4}$ ") in this example

This stair produces a straight linear tread run dimension of :

10 5/32" @ 7' radius

EXAMPLE OF AN ILLEGAL CURVED STAIRCASE TREAD RUN:

TOTAL SPLAY ANGLE OF 90°

INSIDE FRAMED RADIUS = 6' (72")

Total # risers = 15 Total # of treads = **14**

$90^\circ \div 14 = 6.429^\circ$ (or **LESS** than the minimum splay angle of 6.82° per tread to maintain the minimum 10" run at the walk path)

This stair would either need a larger inside radius, or or less treads in the total splay, or increase the splay by .39° per tread to be legal

note: @ 7 3/4" maximum riser height= maximum finished floor to finished floor dimension is 116 1/4" ($15 \times 7\frac{3}{4}$ ") in this example

This stair produces a straight linear tread run dimension of :

9 13/32" @ 7' radius

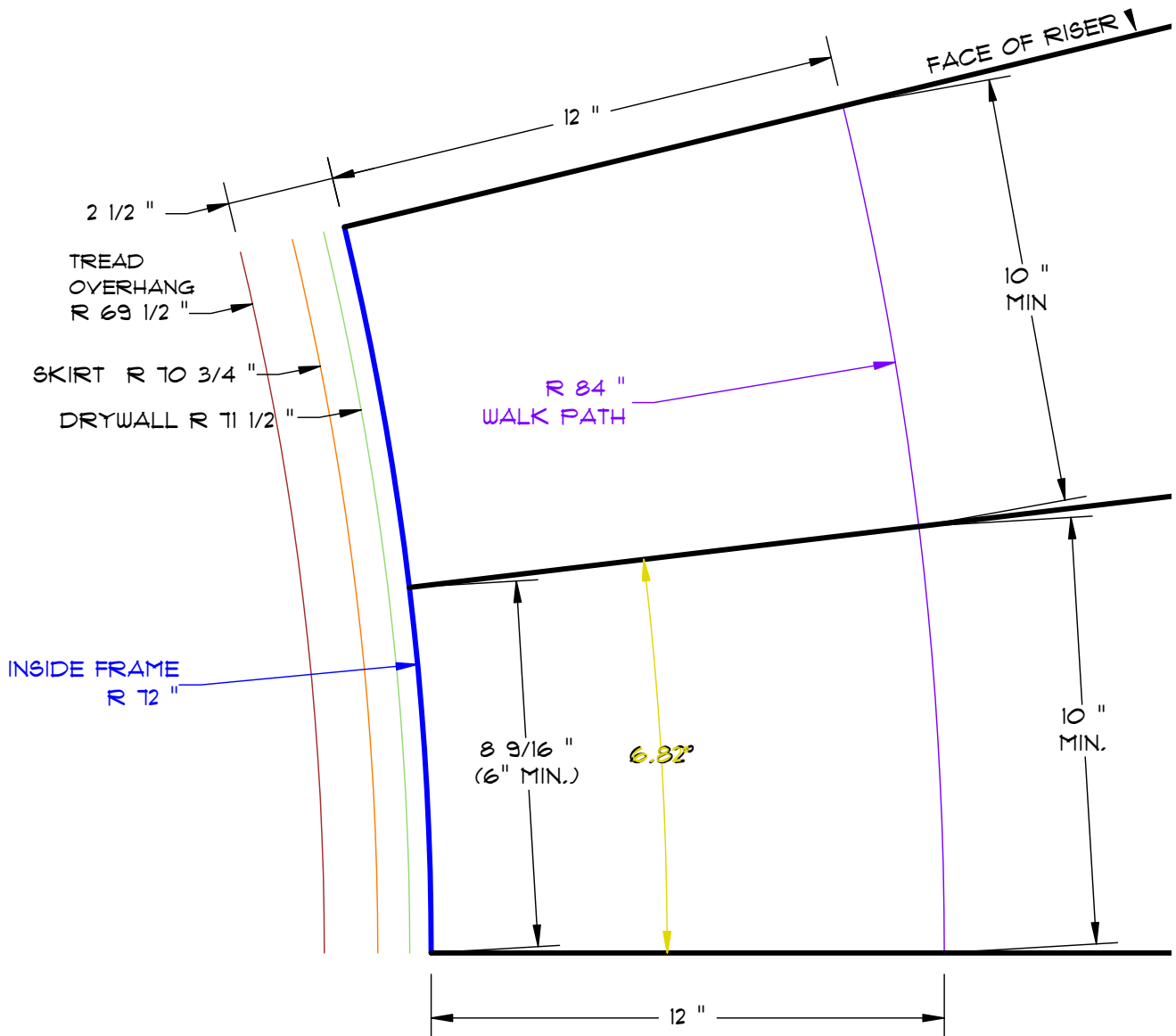
Pertinent code: 2003 [and 2006] International Residential Code for one and two family dwellings®

The entire chapter 311 and 312 code text is available on this site's downloads page.

<http://www.staircraft.com/Document%20Download%20Page.htm>

311.5.3.2 Tread depth.

The minimum tread depth shall be 10 inches (254 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than 3/8 inch (9.5 mm). Winder treads shall have a minimum tread depth of 10 inches (254 mm) measured as above at a point 12 inches (305) mm from the side where the treads are narrower. Winder treads shall have a minimum tread depth of 6 inches (152 mm) at any point. Within any flight of stairs, the greatest winder tread depth at the 12 inch (305 mm) walk line shall not exceed the smallest by more than 3/8 inch (9.5 mm).



DRAFTING & DESIGN BY:

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Staircraft
Staircase design & construction

EXAMPLE OF 72" INSIDE RADIUS FRAME

DRAWN BY: C.A.G.
DATE: 3/15/07
SCALE: 3" = 1'

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