



STATE OF WASHINGTON  
**STATE BUILDING CODE COUNCIL**

May 2018  
Log No. \_\_\_\_\_

**1. State Building Code to be Amended:**

- |   |   |
|---|---|
| <input checked="" type="checkbox"/> International Building Code | <input type="checkbox"/> International Mechanical Code        |
| <input type="checkbox"/> ICC ANSI A117.1 Accessibility Code     | <input type="checkbox"/> International Fuel Gas Code          |
| <input type="checkbox"/> International Existing Building Code   | <input type="checkbox"/> NFPA 54 National Fuel Gas Code       |
| <input type="checkbox"/> International Residential Code         | <input type="checkbox"/> NFPA 58 Liquefied Petroleum Gas Code |
| <input type="checkbox"/> International Fire Code                | <input type="checkbox"/> Wildland Urban Interface Code        |
| <input type="checkbox"/> Uniform Plumbing Code                  |   |

For the Washington State Energy Code, please see specialized [energy code forms](#)

**Section(s):**

IBC Sections 1014.2, 1014.2.1, 1014.2.2 and 1014.8

**Title:**

Lateral Location of Handrails

**2. Proponent Name (Specific local government, organization or individual):**

**Proponent:** Lee Kranz, (Individual)

**Title:** Plan Review Supervisor

**Date:** 5/25/2021

**3. Designated Contact Person:**

**Name:** Lee Kranz

**Title:** Plan Review Supervisor

**Address:** 450 110<sup>th</sup> Ave NE Bellevue, WA 98004

**Office Phone:** (206) 915-5835

**Cell:**

**E-Mail address:** lkranz@bellevuewa.gov

- 4. Proposed Code Amendment.** Reproduce the section to be amended by underlining all added language, striking through all deleted language. Insert new sections in the appropriate place in the code in order to continue the established numbering system of the code. If more than one section is proposed for amendment or more than one page is needed for reproducing the affected section of the code additional pages may be attached. (Examples on the SBCC [website](#))

Code(s) 2021 International Building Code

Section(s) IBC Sections 1014.2, 1014.2.1, 1014.2.2 and 1014.8

**Add new text as follows:**

**1014.2 Location.** Handrails serving flights of stairways, ramps, stepped aisles and ramped aisles shall comply with the provisions of Sections 1014.2.1 and 1014.2.2.

**Revise as follows:**

**1014.2.1 ~~1014.2~~ **Height.**** *Handrail* height, measured above stair tread nosings, or finish surface of ramp slope, shall be uniform, not less than 34 inches (864 mm) and not more than 38 inches (965 mm). Handrail height of alternating tread devices and ships ladders, measured above tread nosings, shall be uniform, not less than 30 inches (762 mm) and not more than 34 inches (864 mm).

**Exceptions:**

1. Where *handrail* fittings or bendings are used to provide continuous transition between flights, the fittings or bendings shall be permitted to exceed the maximum height.
2. In Group R-3 occupancies; within *dwelling units* in Group R-2 occupancies; and in Group U occupancies that are associated with a Group R-3 occupancy or associated with individual *dwelling units* in Group R-2 occupancies; where *handrail* fittings or bendings are used to provide continuous transition between flights, transition at *winder* treads, transition from *handrail* to guard, or where used at the start of a *flight*, the *handrail* height at the fittings or bendings shall be permitted to exceed the maximum height.
3. *Handrails* on top of a *guard* where permitted along *stepped aisles* and *ramped aisles* in accordance with Section 1030.16.

**Add new text as follows:**

**1014.2.2 Lateral location.** Handrails located outward from the edge of the walking surface of flights of stairways, ramps, stepped aisles and ramped aisles shall be located within 6 inches (152.4 mm) measured horizontally from the edge of the walking surface. Handrails projecting into the width of the walking surface shall comply with Section 1014.8.

**Revise as follows:**

**1014.8 Projections.** On ramps and on ramped aisles that are part of an accessible route, the clear width between handrails shall be 36 inches (914 mm) minimum. Projections into the required width of stepped and ramped aisles, flights of stairways and ramps at each side shall not exceed 4 ½ inches (114 mm) at or below the handrail height. Projections into the required width shall not be limited above the minimum headroom height required in Section 1011.3. Projections due to intermediate handrails shall not constitute a reduction in the egress width. Where a pair of intermediate handrails are provided within the

stairway width without a walking surface between the pair of intermediate handrails and the distance between the pair of intermediate handrails is greater than 6 inches (152 mm), the available egress width shall be reduced by the distance between the closest edges of each such intermediate pair of handrails that is greater than 6 inches (152 mm).

- 5. Briefly explain your proposed amendment, including the purpose, benefits and problems addressed.** Specifically note any impacts or benefits to business, and specify construction types, industries and services that would be affected. Finally, please note any potential impact on enforcement such as special reporting requirements or additional inspections required.

Surprisingly, the code does not currently regulate the lateral distance that a handrail can be located away from the edge of the walking surface of a stair, ramp or aisle. If an architect wanted to locate a handrail 24 or even 36 inches away from the walking surface, there is currently no code provision to prevent that from happening. Most building officials would not permit that design but there is no code backing to support them. The substantive data provided as part of this code change provides the justification for limiting the lateral distance of the handrail to be not more than 6” from the edge of the walking surface. This code change is needed to ensure that handrails will be located close enough to the edge of the walking surface to provide adequate support for pedestrians with limited reach capabilities. Handrails that protrude into the required width of the stairway, ramp or aisle are currently regulated in Section 1014.8. See illustration and anthropometric data attached to the end of this proposal.

- 6. Specify what criteria this proposal meets.** You may select more than one.

- The amendment is needed to address a critical life/safety need.
- The amendment clarifies the intent or application of the code.
- The amendment is needed to address a specific state policy or statute.
- The amendment is needed for consistency with state or federal regulations.
- The amendment is needed to address a unique character of the state.
- The amendment corrects errors and omissions.

- 7. Is there an economic impact:**  Yes  No

Explain:

The code change proposal will not increase or decrease the cost of construction. The proposal simply limits the distance that a handrail can be from the edge of the walking surface. It will not change the cost of construction.

If there is an economic impact, use the tool below to estimate the costs and savings of the proposal on construction practices, users and/or the public, the enforcement community, and operation and maintenance. If preferred, you may submit an alternate cost benefit analysis.

Provide your best estimate of the construction cost (or cost savings) of your code change proposal? (See OFM Life Cycle Cost [Analysis tool](#) and [Instructions](#); use these [Inputs](#). **Webinars on the tool can be found [Here](#) and [Here](#)**)

\$[Click here to enter text.](#)/square foot (For residential projects, also provide \$[Click here to enter text.](#)/dwelling unit)

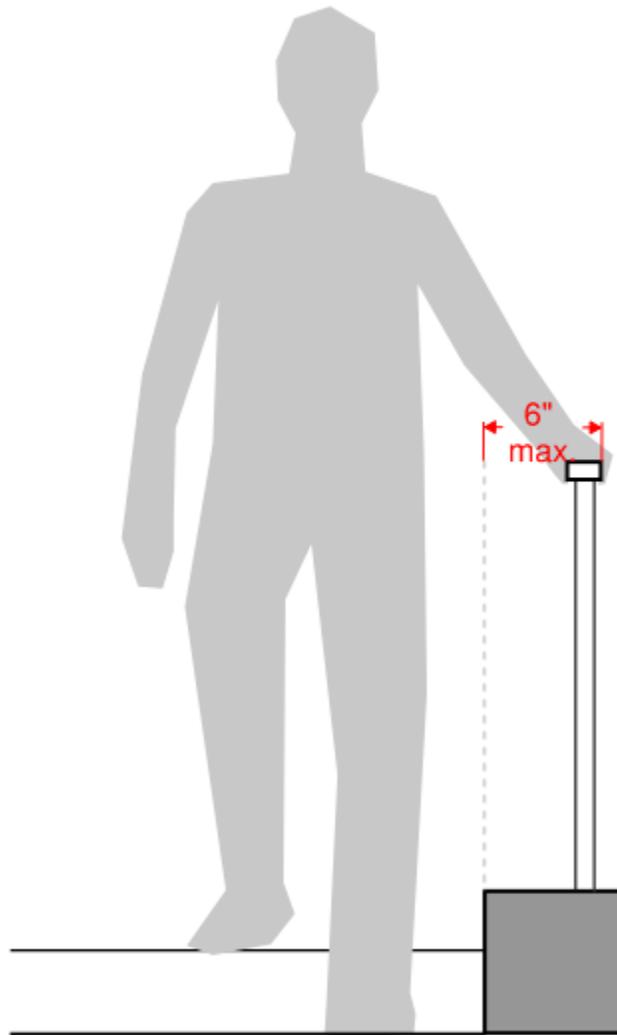
Show calculations here, and list sources for costs/savings, or attach backup data pages

List any code enforcement time for additional plan review or inspections that your proposal will require, in hours per permit application:

Please send your completed proposal to: [sbcc@des.wa.gov](mailto:sbcc@des.wa.gov)

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.

Illustration showing maximum allowable distance of handrail from walking surface



# ANTHROPOMETRIC DATA



Note relative distance from the extent of the walking surface to edge of foot in photos 1-5 and in videos from SMA funded pilot study of handrails as used by persons with disabilities at the following links:

- <https://stairways.wildapricot.org/resources/code-research-videos/nodevice01hr1.wmv>
- <https://stairways.wildapricot.org/resources/code-research-videos/nodevice02hr1.wmv>
- <https://stairways.wildapricot.org/resources/code-research-videos/nodevice04hr1.wmv>
- <https://stairways.wildapricot.org/resources/code-research-videos/nodevice05hr1.wmv>

The persons in these videos have difficulty walking across a room but use no device such as a cane or walker.

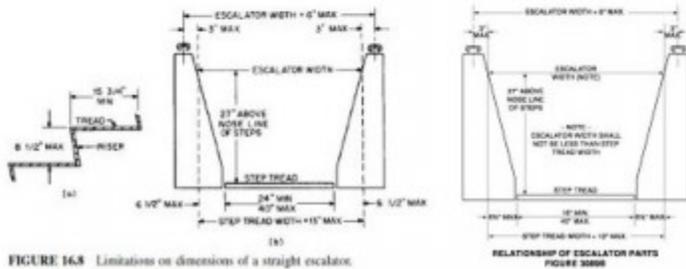
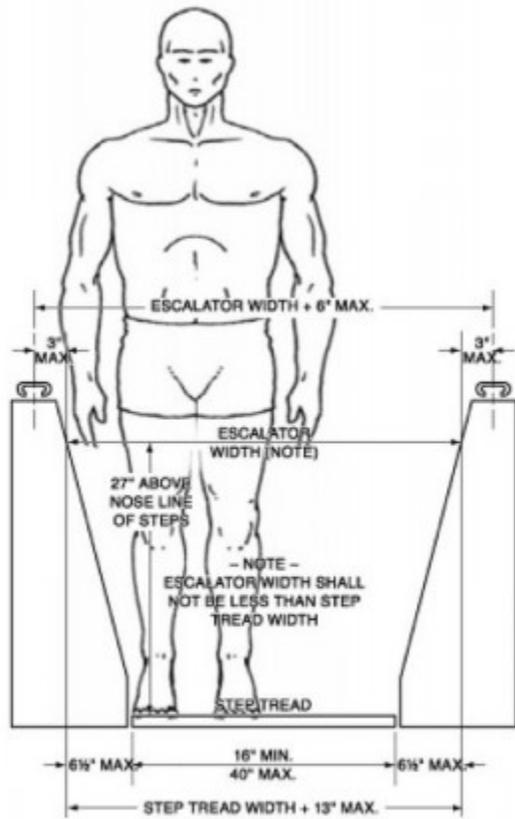


FIGURE 16.8 Limitations on dimensions of a straight escalator.

From Oregon Escalator Regulation

From California Escalator Regulation

Typical Escalator regulations allow up to 9 1/2 inches from end of walking surface to center of handrail

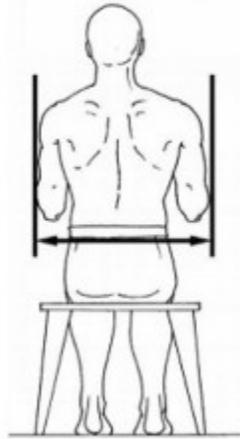


**RELATIONSHIP OF ESCALATOR PARTS  
FIGURE 3089B**

*Scaled Composite of 5'9" Male Anthropometric Sketch on escalator illustrates relative position of Hand to rail with the side of the foot at the end of the walking surface.*

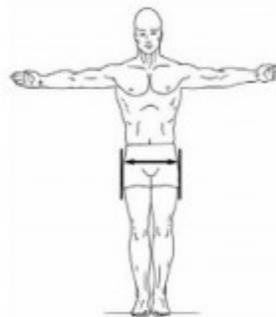
## Forearm-Forearm Breadth

FEMALE N = 2208			MALE N = 1774		
Centimeters	Mean	Inches	Centimeters	Mean	Inches
46.85	18.44		54.61	21.50	
3.47	1.36		4.36	1.72	
60.90	23.98		72.52	28.54	
37.30	14.69		39.90	15.71	
Percentiles			Percentiles		
39.42	1 <sup>st</sup>	15.52	45.12	1 <sup>st</sup>	17.76
40.24	2 <sup>nd</sup>	15.84	46.17	2 <sup>nd</sup>	18.18
40.76	3 <sup>rd</sup>	16.05	46.84	3 <sup>rd</sup>	18.44
41.47	5 <sup>th</sup>	16.33	47.74	5 <sup>th</sup>	18.80
42.58	10 <sup>th</sup>	16.76	49.16	10 <sup>th</sup>	19.35
43.33	15 <sup>th</sup>	17.06	50.13	15 <sup>th</sup>	19.74
43.94	20 <sup>th</sup>	17.30	50.91	20 <sup>th</sup>	20.04
44.47	25 <sup>th</sup>	17.51	51.59	25 <sup>th</sup>	20.31
44.94	30 <sup>th</sup>	17.69	52.21	30 <sup>th</sup>	20.56
45.39	35 <sup>th</sup>	17.87	52.79	35 <sup>th</sup>	20.79
45.82	40 <sup>th</sup>	18.04	53.35	40 <sup>th</sup>	21.00
46.24	45 <sup>th</sup>	18.20	53.90	45 <sup>th</sup>	21.22
46.66	50 <sup>th</sup>	18.37	54.45	50 <sup>th</sup>	21.44
47.08	55 <sup>th</sup>	18.54	55.00	55 <sup>th</sup>	21.65
47.52	60 <sup>th</sup>	18.71	55.56	60 <sup>th</sup>	21.88
47.98	65 <sup>th</sup>	18.89	56.16	65 <sup>th</sup>	22.11
48.47	70 <sup>th</sup>	19.08	56.79	70 <sup>th</sup>	22.36
49.01	75 <sup>th</sup>	19.30	57.47	75 <sup>th</sup>	22.63
49.63	80 <sup>th</sup>	19.54	58.25	80 <sup>th</sup>	22.93
50.37	85 <sup>th</sup>	19.83	59.16	85 <sup>th</sup>	23.29
51.33	90 <sup>th</sup>	20.21	60.32	90 <sup>th</sup>	23.75
52.84	95 <sup>th</sup>	20.80	62.06	95 <sup>th</sup>	24.43
53.87	97 <sup>th</sup>	21.21	63.18	97 <sup>th</sup>	24.87
54.66	98 <sup>th</sup>	21.52	64.00	98 <sup>th</sup>	25.20
55.95	99 <sup>th</sup>	22.03	65.27	99 <sup>th</sup>	25.70



## Hip Breadth

FEMALE N = 2208			MALE N = 1774		
Centimeters	Mean	Inches	Centimeters	Mean	Inches
34.27	13.49		34.18	13.46	
2.24	.88		2.03	.80	
42.00	16.54		41.60	16.38	
27.00	10.63		28.20	11.10	
Percentiles			Percentiles		
29.58	1 <sup>st</sup>	11.65	29.64	1 <sup>st</sup>	11.67
30.05	2 <sup>nd</sup>	11.83	30.18	2 <sup>nd</sup>	11.88
30.35	3 <sup>rd</sup>	11.95	30.51	3 <sup>rd</sup>	12.01
30.78	5 <sup>th</sup>	12.12	30.97	5 <sup>th</sup>	12.19
31.47	10 <sup>th</sup>	12.39	31.66	10 <sup>th</sup>	12.46
31.96	15 <sup>th</sup>	12.58	32.12	15 <sup>th</sup>	12.65
32.35	20 <sup>th</sup>	12.74	32.49	20 <sup>th</sup>	12.79
32.70	25 <sup>th</sup>	12.87	32.81	25 <sup>th</sup>	12.92
33.01	30 <sup>th</sup>	13.00	33.10	30 <sup>th</sup>	13.03
33.31	35 <sup>th</sup>	13.11	33.36	35 <sup>th</sup>	13.14
33.59	40 <sup>th</sup>	13.23	33.62	40 <sup>th</sup>	13.24
33.87	45 <sup>th</sup>	13.34	33.87	45 <sup>th</sup>	13.33
34.15	50 <sup>th</sup>	13.45	34.12	50 <sup>th</sup>	13.43
34.44	55 <sup>th</sup>	13.56	34.37	55 <sup>th</sup>	13.53
34.73	60 <sup>th</sup>	13.67	34.62	60 <sup>th</sup>	13.63
35.03	65 <sup>th</sup>	13.79	34.89	65 <sup>th</sup>	13.74
35.36	70 <sup>th</sup>	13.92	35.18	70 <sup>th</sup>	13.85
35.71	75 <sup>th</sup>	14.06	35.49	75 <sup>th</sup>	13.97
36.12	80 <sup>th</sup>	14.22	35.85	80 <sup>th</sup>	14.11
36.59	85 <sup>th</sup>	14.41	36.27	85 <sup>th</sup>	14.28
37.21	90 <sup>th</sup>	14.65	36.82	90 <sup>th</sup>	14.50
38.15	95 <sup>th</sup>	15.02	37.65	95 <sup>th</sup>	14.82
38.77	97 <sup>th</sup>	15.27	38.22	97 <sup>th</sup>	15.05
39.24	98 <sup>th</sup>	15.45	38.64	98 <sup>th</sup>	15.21
40.00	99 <sup>th</sup>	15.75	39.32	99 <sup>th</sup>	15.48



## Anthropometric Data

Apr 21, 2006 — TABLE OF CONTENTS. Anthropometric Data Point. Page #11 &amp; 19 Gordon, Claire C. et. al 1988

Anthropometric Survey of U.S. Personnel:

<https://multisite.eos.ncsu.edu/www-ergo-center-ncsu-edu/wp-content/uploads/sites/18/2016/06/Anthropometric-Detailed-Data-Tables.pdf>

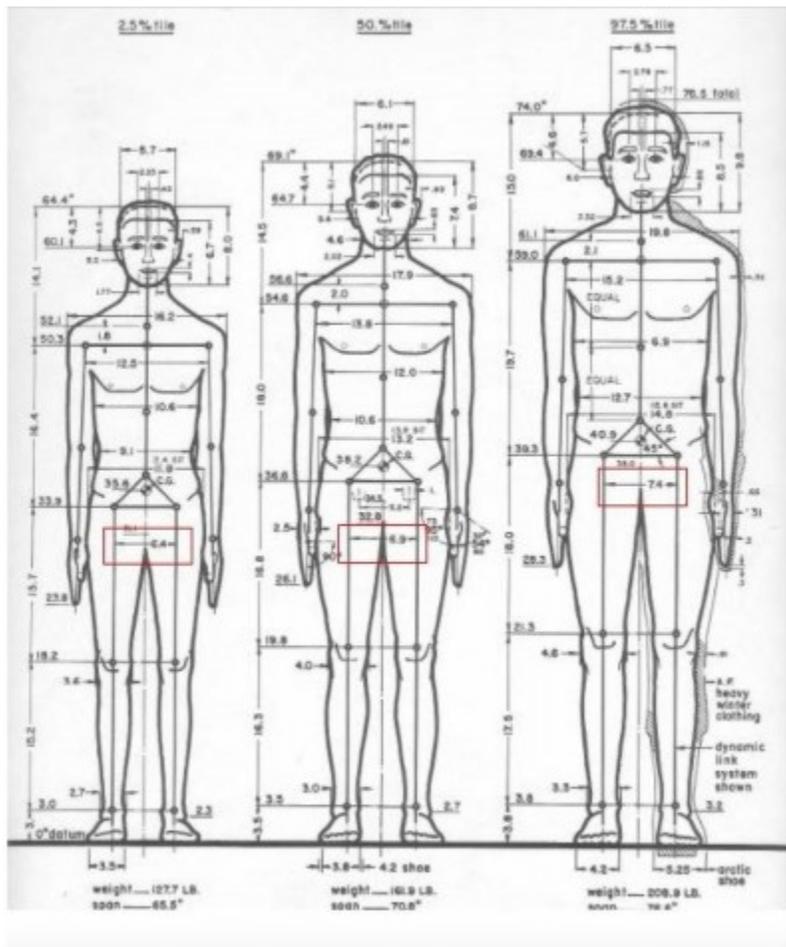
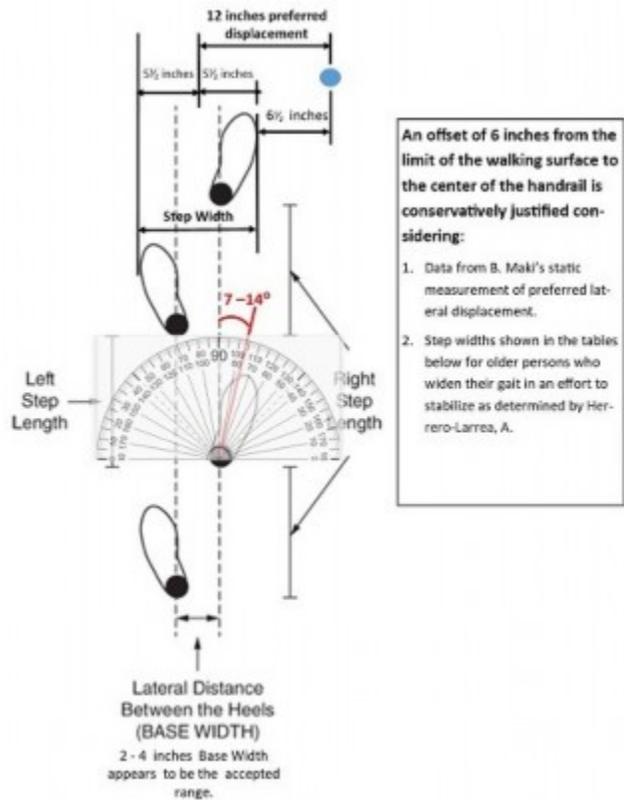
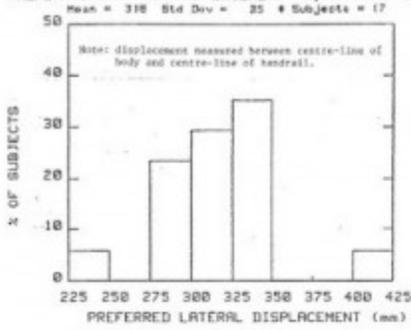


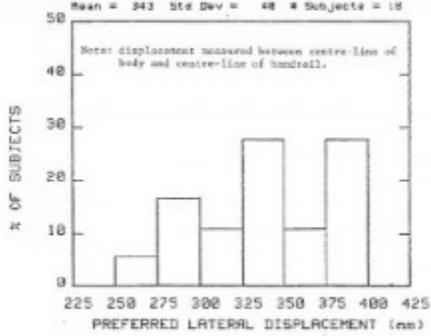
Illustration of only 1 inch range in stance dimension from 6.4 inches for 2.5 percentile to 7.4 inches for 97.5 percentile



PREFERRED LATERAL DISPLACEMENT YOUNG SUBJECTS 29



PREFERRED LATERAL DISPLACEMENT OLD SUBJECTS



Above Tables from:

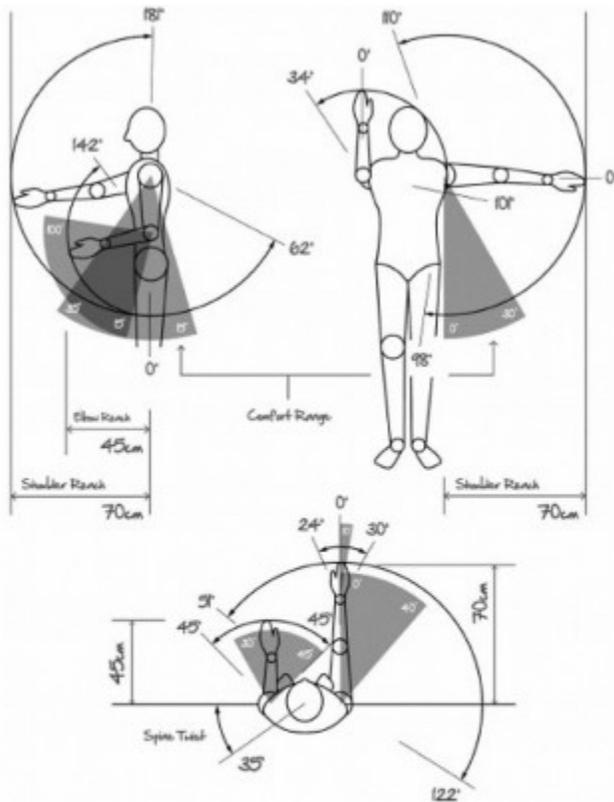
Biomechanical Assessment of Handrail Parameters with Special Consideration to the Needs of Elderly Users; B.E. Maki, G.R. Fernie, West Park Research, May 5, 1983. Prepared for the National Research Council of Canada.

2.

Step width		Mean	SD	Normal limits (95%)		Normal limits (99%)		n
65-79	Men 65-79	18	4.5	1.1	18	-1.6	21.6	71
	Women 65-79	9.4	3.8	1.9	17	-0.4	16.2	68
>79	Men >79	12.5	4.9	2.6	22.3	-0.3	25.2	98
	Women >79	11.4	4.5	2.4	28.5	-0.3	23.2	104
TOTAL (weighted)		18.3	4.37	1.6	19.0	-1	23.7	431

Above Table from:

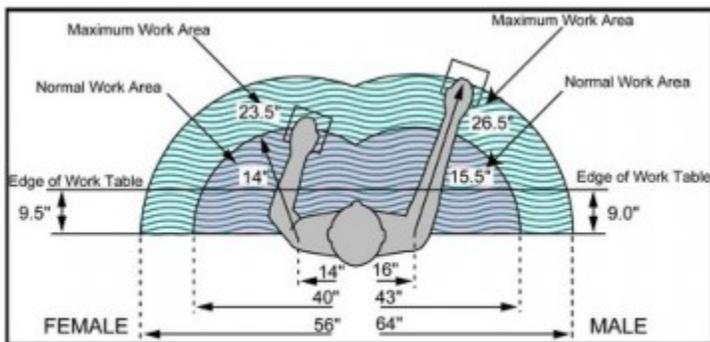
Herrero-Larrea, A., Miñarro, A., Narvaiza, I. et al. Normal limits of home measured spatial gait parameters of the elderly population and their association with health variables. *Sci Rep* 8, 13193 (2018). <https://doi.org/10.1038/s41598-018-31507-1>



Reach and rotation comfort zones of the average human based on charts developed by Dreyfuss & Tilley (2002).

Looker, Jed. (2015). Reaching for Holograms: Assessing the Ergonomics of the Microsoft™ Hololens™ 3D Gesture Known as the "Air Tap".

[https://www.researchgate.net/publication/284283876\\_Reaching\\_for\\_Holograms\\_Assessing\\_the\\_Ergonomics\\_of\\_the\\_Microsoft\\_Hololens\\_3D\\_Gesture\\_Known\\_as\\_the\\_Air\\_Tap/citation/download](https://www.researchgate.net/publication/284283876_Reaching_for_Holograms_Assessing_the_Ergonomics_of_the_Microsoft_Hololens_3D_Gesture_Known_as_the_Air_Tap/citation/download)



Reach range illustrations above clearly show that proposed 6 inch offset of the handrail beyond the extent of the walking surface is well within reason.