

# FGI Guidelines for Healthcare Acoustic Design

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What is FGI?

# History of the FGI Guidelines

**1946** Hill Burton Act  
**1947** *General Standards*

**1987, 1992-93**  
*Guidelines for Design and Equipment of  
Hospital and Medical Facilities (AIA)*

1940

1950

1960

1970

1980

1990

2000

2010

**1974**

*Minimum Requirements of  
Construction and Equipment for  
Hospital and Medical Facilities*

**1998**

FGI formed

**2010**

Acoustics  
introduced

# Effects of noise in healthcare

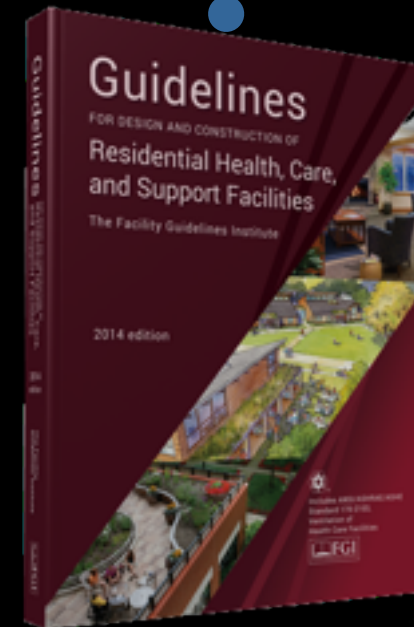
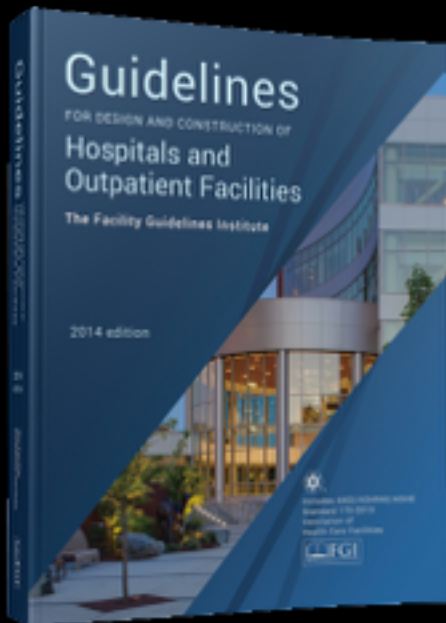
- ◆ Sleep disruption
- ◆ Increase of stress
- ◆ Increase of heart rate
- ◆ Decreased staff comfort
- ◆ Alarm Fatigue
- ◆ Increased medical errors

# What's new since 2010 FGI cycle

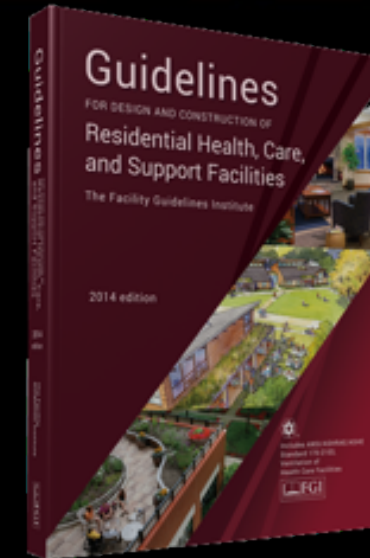
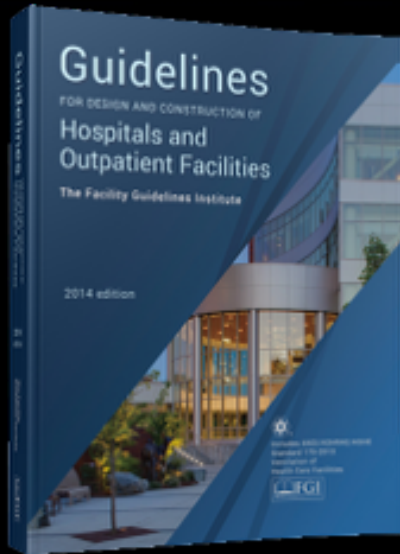
- Split into two documents:
  - Hospitals and Outpatient Facilities
  - Residential Health, Care, and Support Facilities
- Impacts of the ACA & HCAHPS survey
- Stated concern of Alarm Fatigue
- Safety Risk Assessment (SRA) – Includes Acoustics!
- Changes to relevant acoustical criteria tables

# 2014 FGI Guidelines: Two Books

*Guidelines for the Design and Construction of Health Care Facilities*



# 2014 FGI Guidelines: Two Books



- ◆ Part 1 - General Information
- ◆ Part 2 - Hospitals (Inpatient Care Facilities)
- ◆ Part 3 - Outpatient Care (Ambulatory/Urgent Care Facilities)
- ◆ Part 4 - Ventilation of Healthcare Facilities

Addresses new construction and renovation of nursing homes, hospice facilities, assisted living facilities, independent living settings, adult day care facilities, wellness centers, and outpatient rehabilitation centers

# Impacts of the ACA & HCAHPS survey

HCAHPS:

Hospital Consumer Assessment of Healthcare Providers and Systems

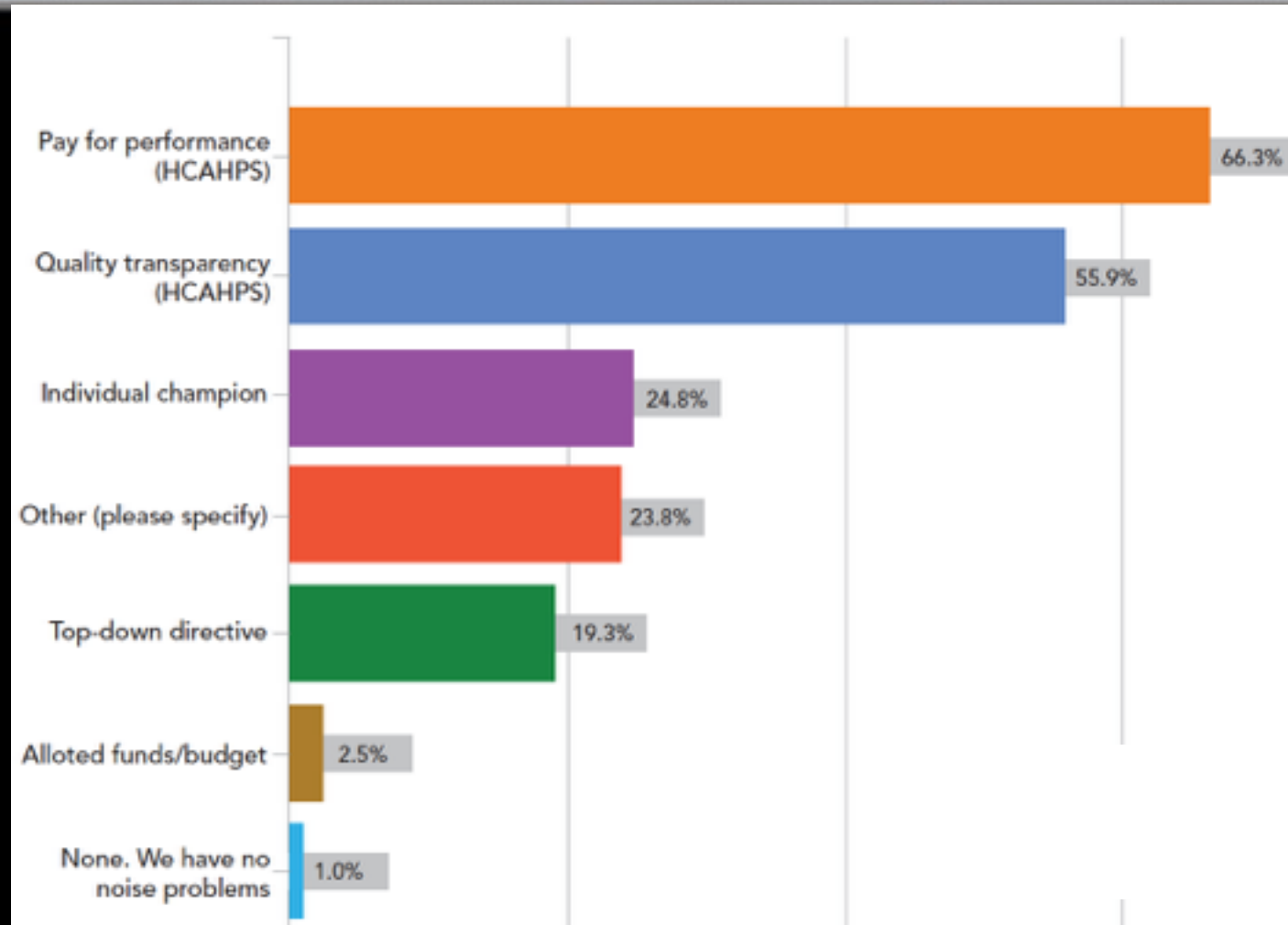
Value Based Purchasing seeks to reward hospitals for improving the quality of care by redistributing Medicare payments among them so that hospitals with higher performance in terms of quality receive a greater proportion of the payment than do the lower performing hospitals.

-Source: US Dept. of Health and Human Services

# Value-Based Purchasing

- ◆ Hospitals are required to implement and report HCAHPS to receive full Medicare payment
- ◆ Patient Protection and Affordable Care Act of 2010:
  - Federal payments based on Value-Based Purchasing (VBP)
  - Evaluates *performance* of HCAHPS scores

# Catalyst for addressing noise?



# Alarm Fatigue

- 2011: The Joint Commission and FDA identified alarm fatigue as a top priority in hospitals
- Can lead to:
  - Willful deactivation of alarms
  - Increased error rates
  - Disorientation distraction and elevated stress
  - Patients: Loss of sleep, heightened anxiety and increased sedative use

Source: 2014 FGI Guidelines

# Safety Risk Assessment

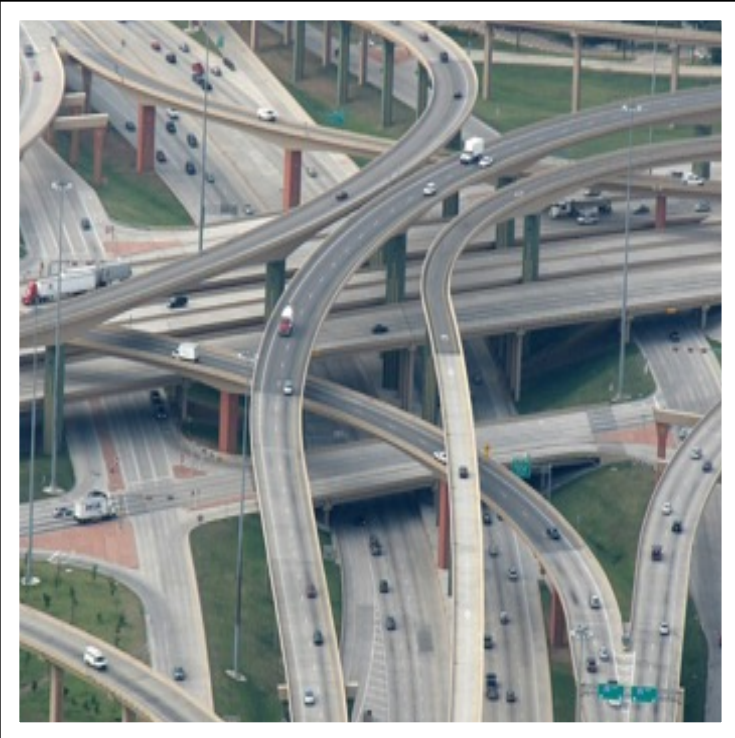
- Document that works to evaluate and mitigate potential causes of adverse safety events in healthcare facilities due to the built environment
- Acoustics have been formally identified as a life-safety issue

# Six Categories of Acoustical Criteria

1. Site exterior noise
2. Acoustic finishes
3. Room noise levels
4. Sound isolation
5. Speech privacy
6. Building vibration

# Site Exterior Noise

Road Noise



Helipad Noise



Mechanical Noise



# Site Exterior Noise (moved to body)

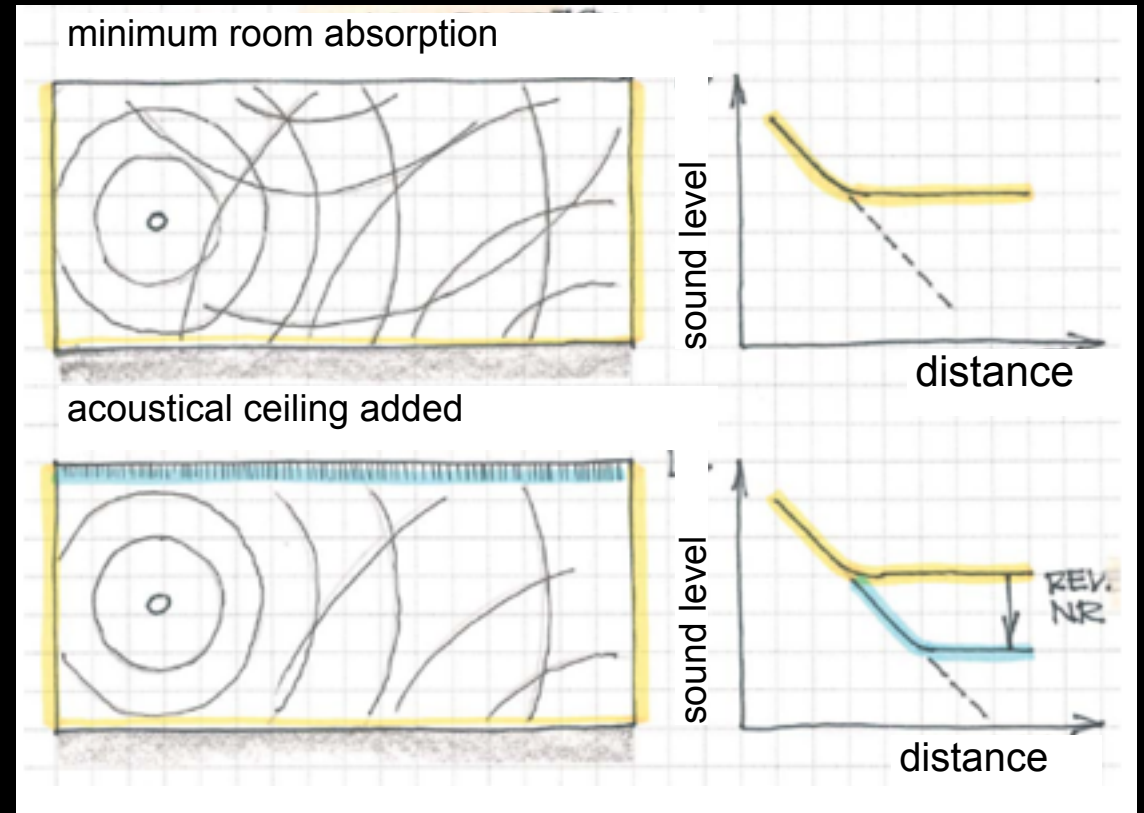
| Category  | A       | B        | C           | D       |
|---|---------|----------|-------------|---------|
| Description                                       | Minimal | Moderate | Significant | Extreme |
| DNL (Ldn)   | <65     | 65-69    | 70-74       | ≥75     |
| Shell Composite <b>OITC*</b> (OITC <sub>C</sub> ) | 25      | 30       | 35          | 40      |
| Exterior Equipment (dBA)                          | 45      | 50       | 55          | 60      |

\*non sensitive spaces (e.g., corridors, atriums, stairwells) may be reduced by 10 dB but should be no less than OITC<sub>C</sub> 25

# Acoustic Finishes

## Issues:

- Sound Absorption
- Aesthetics
- Green Design
- Robustness
- Cleanable



# Acoustic Finishes

## Hospitals and Outpatient Facilities

| Space                  | Minimum $\alpha_{avg}$ |
|------------------------|------------------------|
| Private patient        | 0.15                   |
| Multi-bed patient      | 0.15                   |
| Corridor               | 0.15                   |
| Medication safety zone | 0.15                   |
| Waiting area           | 0.25                   |
| Atrium                 | 0.10                   |
| Physician's office     | 0.15                   |
| Treatment room         | 0.15                   |
| Operating Room         | 0.10 (appendix)        |

# Acoustic Finishes

## Residential Health, Care, and Support Facilities

| Space  | Minimum $\alpha_{avg}$ |
|--|------------------------|
| Multi-Bed/multi-occupancy resident room            | 0.20                   |
| Corridor (public corridor in resident care areas)  | 0.20                   |
| Medication rooms                                   | 0.20                   |
| Multiple occupant resident care and activity areas | 0.20                   |
| Quiet Room   | 0.20                   |
| Office   | 0.15                   |
| Examination Room                                   | 0.15                   |

# New Spaces

## Hospitals and Outpatient Facilities

- Medication Safety Zone: a “critical area where medications are prescribed, ordered are entered into a computer or transcribed onto paper documents, or medications are prepared or administered”
- Operating Room: Recommended but not prescriptive

# New Spaces

## Residential Health, Care, and Support Facilities

- Quiet Room: Single resident room, “to accommodate care requirements for residents experiencing personal conflicts, agitation, episodic mental disturbances, or similar conditions that require a quiet or low-stimulation, positive distraction room”
  - Recommendations for quiet rooms usually also apply to private speech and hearing services rooms and private music therapy rooms

# Room Noise Levels

- FGI 2014 specifies room noise caused by building systems
- FGI 2014 presents only maximum noise criteria
- Rating Systems
  - A-weighted sound level
  - NC (Noise Criteria)
  - RC (Room Criteria)
  - RNC (Room Noise Criteria)



# Room Noise Levels Hospitals and Outpatient Facilities

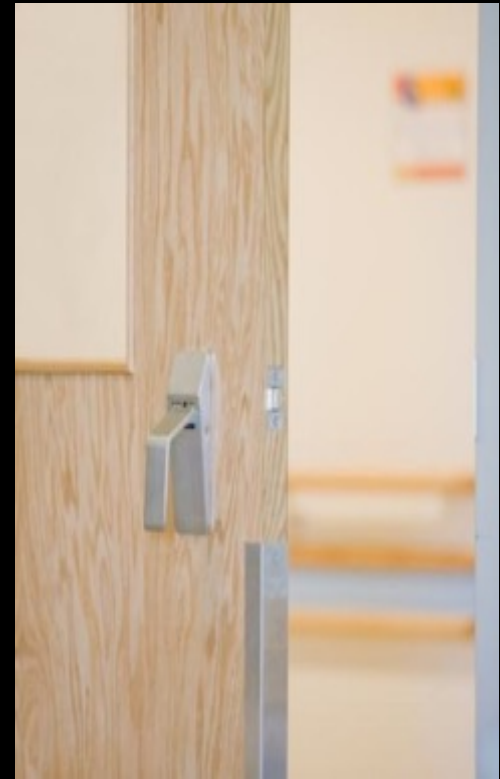
| Space                                | NC/RC(N)/RNC | dBA |
|--------------------------------------|--------------|-----|
| Patient and Exam rooms               | 40           | 45  |
| Corridor                             | 45           | 50  |
| Multiple Occupant Patient Care Areas | 45           | 50  |
| Operating Rooms*                     | 50           | 55  |
| Medication Safety Zones              | 40           | 45  |

# Room Noise Levels Residential Health, Care, and Support Facilities

| Space                                 | NC/RC(N)/RNC | dBA       |
|---------------------------------------|--------------|-----------|
| Resident rooms/dwelling units         | 40           | 45        |
| Medication rooms                      | 45           | 40 (typo) |
| Multiple occupant resident care areas | 45           | 50        |
| Corridors and community spaces        | 45           | 50        |
| Quiet room                            | 30           | 35        |

# Sound Isolation

- FGI 2014 sets forth minimum composite sound transmission class ( $STC_c$ ) performance
- FGI 2014 now allows  $\pm 2$  STC points based on testing accuracy & repeatability
- FGI 2014 specifies the composite STC performance of corridor walls excluding the door



# Sound Isolation Hospitals and Outpatient Facilities

| Adjacency Combination |  | Minimum $STC_c$ |
|-----------------------|--|-----------------|
| Patient Room          | Patient Room (wall – same floor)         | 45              |
| Patient Room          | Patient Room (floor-to-floor)            | 50              |
| Patient Room          | Corridor (with entrance, doors excluded) | 35              |
| Exam Room             | Exam Room (no electronic masking)        | 50              |
| Exam Room             | Exam Room (with electronic masking)      | 40              |

# Sound Isolation Residential Health, Care, and Support Facilities

| Adjacency Combination       |   | Minimum $STC_c$ |
|-----------------------------|---|-----------------|
| Resident room/dwelling unit | Resident room/dwelling unit   | 45              |
| Resident room/dwelling unit | Community space   | 50              |
| Resident room/dwelling unit | Corridor (with entrance)  | 35              |
| Consultation room           | Multiple-occupant resident care and activity areas or public corridor | 50              |
| Consultation room           | Resident room/dwelling unit   | 50              |

# Speech Privacy

FGI 2014 specifies speech privacy criteria for closed and open plan spaces

## Privacy metrics

- Privacy Index (PI)
- Articulation Index (AI)
- Speech Intelligibility Index (SII)
- Speech Privacy Class (SPC)



# Speech Privacy Closed Plan

| Speech Privacy Goal | PI         | AI         | SII       | SPC        |
|---------------------|------------|------------|-----------|------------|
| Secure              | N/A        | N/A        | N/A       | ≥70        |
| Confidential        | ≥95%       | ≤0.05      | ≤0.10     | 60-69      |
| Normal              | 80-94%     | 0.06-0.20  | 0.11-0.25 | 52-59      |
| Defining Standard   | ASTM E1130 | ASTM E1130 | ANSI S3.5 | ASTM E2638 |

# Speech Privacy Open Plan

## Speech Privacy Goal

PI

AI

SII

SPC

Confidential

Special consideration required

Normal

80-94%

0.06-0.20

0.11-0.25

52-59

Marginal

60-79%

0.21-0.40

0.26-0.45

45-51

Defining Standard

ASTM E1130

ASTM E1130

ANSI S3.5

ASTM E2638

# Building Vibration

## Sources of Vibration:

- **Footfall**, MEP equipment and other equipment

## Controls

- Building stiffness, mass
- Vibration isolation of MEP and other equipment
- Minimize proximity of vibration and impact sources from sensitive *receivers* & activities



# Building Vibration Hospitals and Outpatient Facilities

| Space                                 | Footfall Vibration<br>Peak Velocity ( $\mu\text{in/s}$ ) |
|---------------------------------------|--|
| Patient Rooms and other Patient Areas | 6000   |
| Operating and other Treatment Rooms   | 4000   |
| Administrative Areas                  | 8000   |
| Public Circulation                    | 8000   |

# Building Vibration

## Residential Health, Care, and Support Facilities

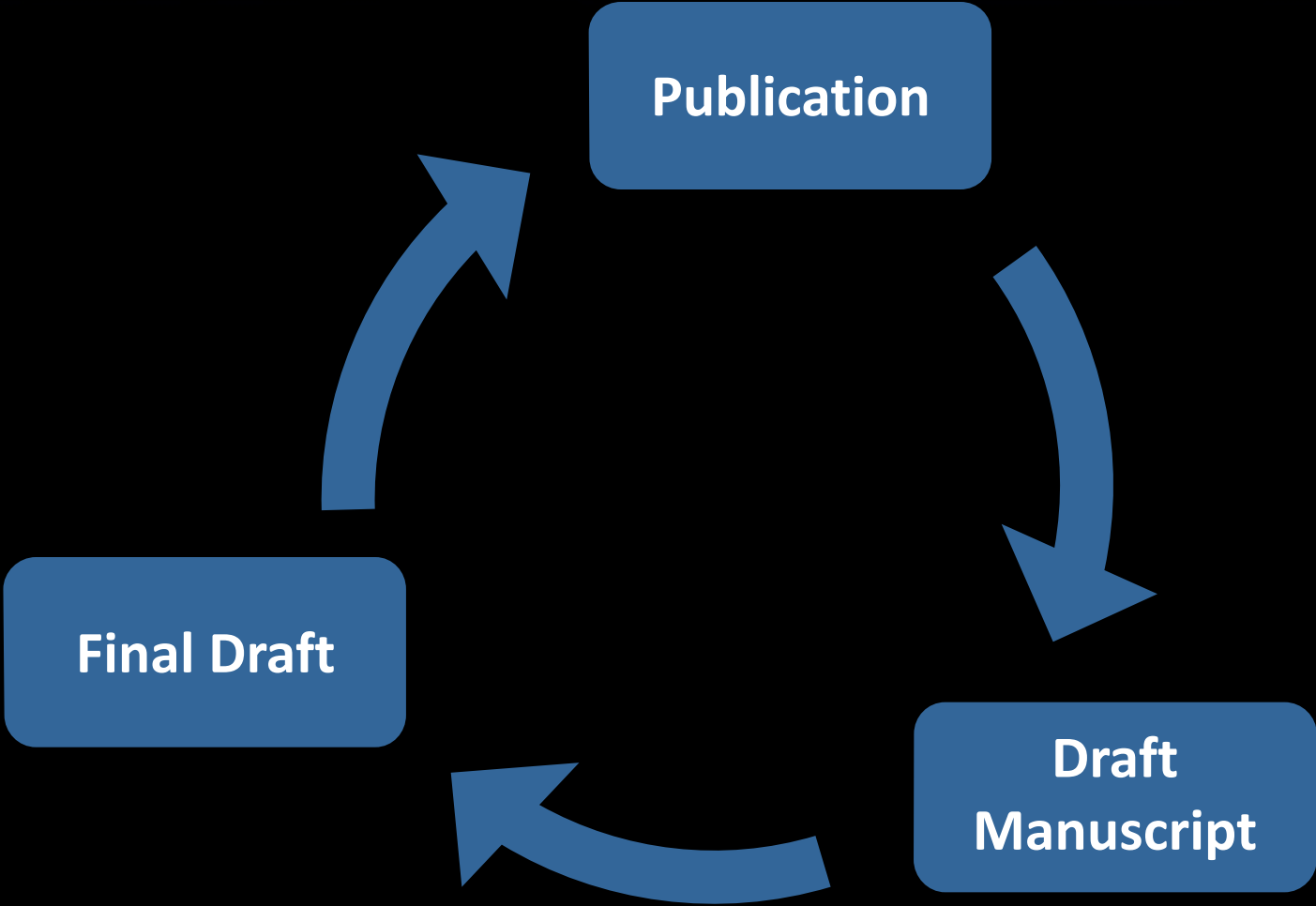
| Space  | Footfall Vibration<br>Peak Velocity ( $\mu\text{in/s}$ ) |
|--|--|
| Resident rooms, dwelling units, and other resident areas | 6000   |
| Examination rooms  | 6000   |
| Administrative Areas                                     | 8000   |
| Community circulation areas                              | 8000   |
| Quiet room   | 6000   |

# Revision Cycle

**Guidelines Revision Cycle (4 years):** Follows continual improvement process where material is beta-tested

**Health Guidelines Revision Committee (HGRC):** multidisciplinary consensus body

# Revision Cycle



# References

- [1] The Facility Guidelines Institute. Frequently asked questions about the Guidelines.
- [2] The Facility Guidelines Institute. The history of the FGI.
- [3] The Facility Guidelines Institute. Guidelines for Design and Construction of Hospitals and Outpatient Facilities. American Society for Healthcare Engineering of the American Hospital Association, Illinois, USA, 2014.
- [4] The Facility Guidelines Institute. Guidelines for Design and Construction of Residential Health, Care, and Support Facilities. American Society for Healthcare Engineering of the American Hospital Association, Illinois, USA, 2014.
- [5] U.S. Congress House of Representatives. Health insurance portability and accountability act of 1996. Public Law, 104 :191,1996.

**THANK YOU**  
*Any Questions?*

