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### CAETS Forum, Session 3: noise transmission in buildings

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# **CAETS Forum, Session 3: Noise Transmission in Buildings**

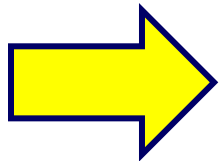
**Trevor Nightingale, John Bradley, Brad Gover,  
Berndt Zeitler, Stefan Schoenwald, David Quirt**

# Overview of talk

- Sound transmission through wall and floor/ceiling assemblies
- Sound transmission in buildings
- Ratings for multi-family residential buildings
- Issues for office/public buildings
- Gaps in knowledge, technical standards, and regulation/labeling

# Sound Transmission through separating wall and floor assemblies

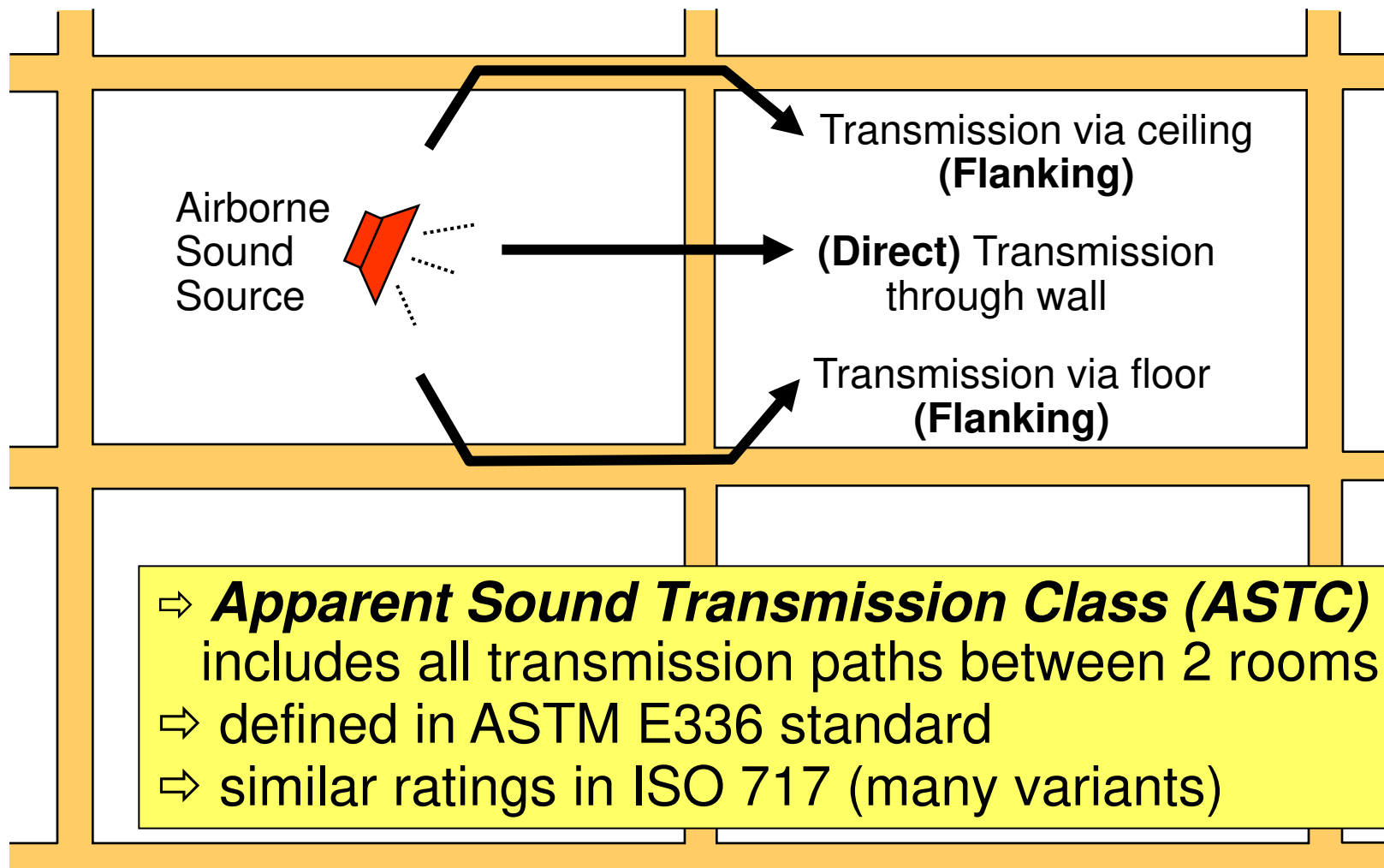
- Test standards refined, but minor terminology and technical differences between ASTM & ISO
- Extensive parametric studies ⇒ credible ratings for most common assemblies but data become misleading as products change
- Data scattered among many sites
- Limited “listings” for certified proprietary data



Data available for common variants of most constructions, but some credibility issues

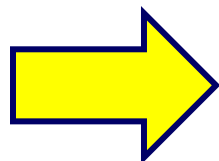


## Separating assembly not only path ...



# Sound Transmission in real buildings

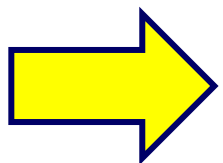
- Sound isolation (ASTC) between adjacent spaces lower than STC rating for separating partition, due to structure-borne (flanking) transmission
- North American codes focus on only the separating wall or floor, and most designers and regulators have been trained with this simplistic perspective
- International standards and regulations use rating like ASTC, focused on overall sound transmission



Potential to improve North American building codes by refocusing on the actual problem

# Sound transmission in real buildings (concrete and/or masonry structure)

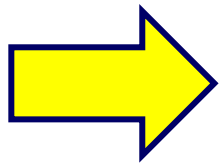
- Full suite of ISO standards established:
  - Conventional testing using ISO 140 series (becoming ISO 10140 series) for direct transmission through separating assemblies
  - ISO 140-16, ISO 10848 series, etc. to evaluate flanking subsystems
  - ISO 15712 series use results of above in well-validated SEA calculation of system performance (direct & flanking paths)
- Commercial software packages available



Design tools, technical standards, and supporting data all established for concrete/masonry buildings

# Sound transmission in real buildings (lightweight framed structure)

- Large part of multi-family housing market, especially in North America
- Performance not well-predicted by ISO 15712
- Preliminary design guide (based on extensive experimental studies at NRC, for most common wood-framed constructions)
- Knowledge gaps for some construction types: (lightweight steel-framed, lightweight with masonry)
- Software tools and more data under development

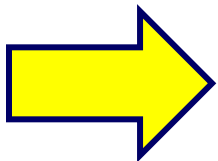


Design tools and supporting data for common lightweight constructions becoming available



# Metrics for airborne sources (residential context)

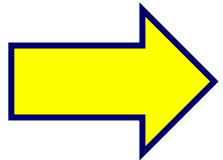
- In mid-1990's ISO “harmonized” European ratings into 16 measures in ISO 717 for separations (and similar sets for outdoor noise, impact noise)
- ASTM established STC in 1960's, recently added ASTC including flanking (resembles ISO rating  $R'_w$ )
- None of the 16 ISO ratings is significantly better for all common sounds, some are better for specific sources (*Park and Bradley, JASA, July & Sept. 2009*).
- Labeling schemes to market buildings with superior noise control  $\Rightarrow$  useful extension beyond codes



Many ratings, limited validation, little consensus

# Metrics for footstep impact sources (residential context)

- ASTM and ISO basic metrics established in 1960's
- Low frequency “thumping” for normal walkers on lightweight floors or for “children jumping” require modified or added rating:
  - Ratings added to ISO 717 in mid-1990's may deal with this (not well-substantiated)
  - Heavy/soft impact test and metric in national standards & codes for Japan and Korea

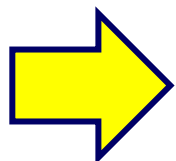


known problems, tentative solutions  
(little laboratory evaluation, less social survey data)

# Issues for office and public spaces

Speech intelligibility in specific contexts:

- Ensured speech security  $\Rightarrow$  new ASTM E2638 (offices, interview rooms, hospitals, etc.)
- Speech “privacy” in open plan offices



Special test procedures and metrics in ASTM standards meet obvious needs

# Summary

## Issues for research:

- Test method and metric for low frequency “thumping” sounds from footsteps & children
- Validate winners from proliferation of ratings for transmitted sound (airborne sources within buildings, outdoor sources, footstep sound)
- Fill gaps in flanking transmission data

## Issues for technical standards:

- Consensus to narrow to a few key ratings
- Establish common labeling schemes to supplement regulations
- Harmonize ISO and ASTM standards