ROBERT HIDEY ARCHITECTS

ACOUSTICS IN RESIDENTIAL PROJECTS

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ACOUSTICS IN RESIDENTIAL PROJECTS

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COURSE DESCRIPTION

This presentation will focus on the acoustics in residential projects (single or multifamily). The beginning covers peoples' perception of sound and privacy, followed by the 4 typical acoustical concerns for these residences.

The topics highlight how the architectural design influences these acoustical factors to benefit the occupants' sense of comfort and privacy and how the design can be enhanced to provide improved acoustical conditions.

LEARNING OBJECTIVES

01 **Identify the 4 primary factors that influence people's perception of sound and privacy.**

02 **Discuss the 4 typical acoustical topics and concerns for residential projects.**

03 **Compare how typical constructions may complement or conflict with acoustical objectives.**

04 **Explain how to modify designs to enhance acoustical performance for improving occupant comfort and enjoyment of their residence.**

ACOUSTICS IN RESIDENTIAL PROJECTS – INTRO

01 **People's Perception of Sound and Privacy**

02 **Exterior Noise Isolation**

03 **Interior Sound Isolation**

04 **Equipment Noise Levels**

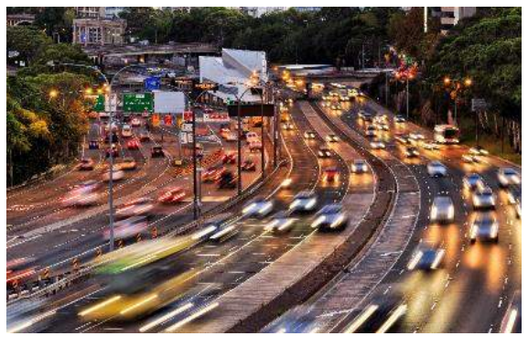
05 **Interior Room Acoustics**

01

FACTORS THAT INFLUENCE PEOPLE'S PERCEPTION OF SOUND AND PRIVACY

Four factors of how our perception of sound is influenced by various conditions

FOUR PRIMARY FACTORS THAT AFFECT PEOPLE'S SENSE OF SOUND PRIVACY



Loudness

- Plays a significant role in our perception of the intrusive sound
- Often a factor that we as designers do not control (exterior noise, neighbors, occupants, etc.)

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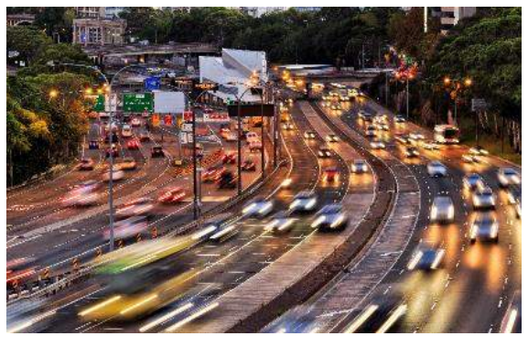

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Day-night average sound level – L_{DN}

Community Noise Equivalent Level – CNEL

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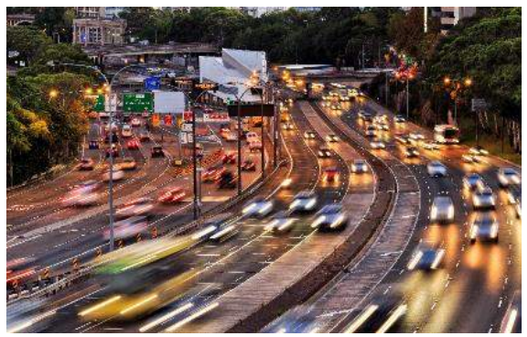

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Isolation of Construction

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- Impact isolation
- Most significantly influenced by designers
- Building Code requirement (multi-family)

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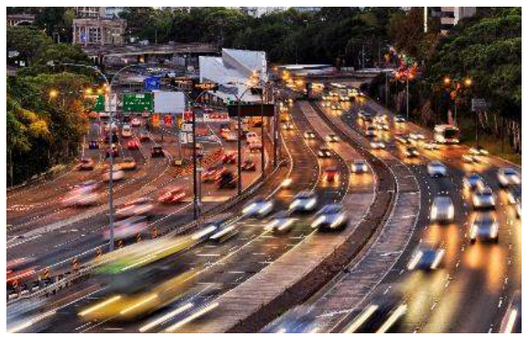

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Sound Transmission Class – STC (laboratory)

Outdoor-Indoor Transmission Class – OITC (laboratory)

Noise Isolation Class – NIC (field)

Apparent Sound Transmission Class – ASTC (field)

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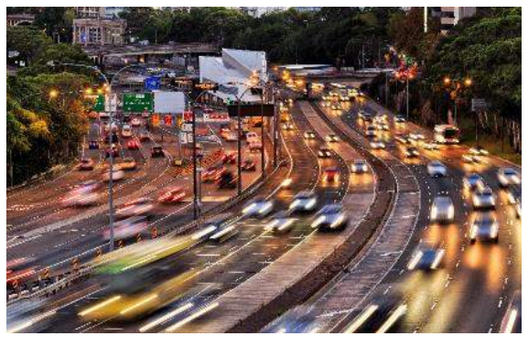

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Quantified by:

Impact Insulation Class – IIC (laboratory)

Impact Sound Rating – ISR (field)

Apparent Impact Insulation Class – AIIC (field)

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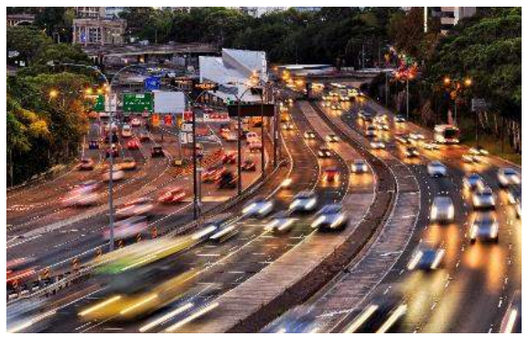

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Background Sound

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- Moderate levels can be helpful (fan noise)
- Counter intuitive

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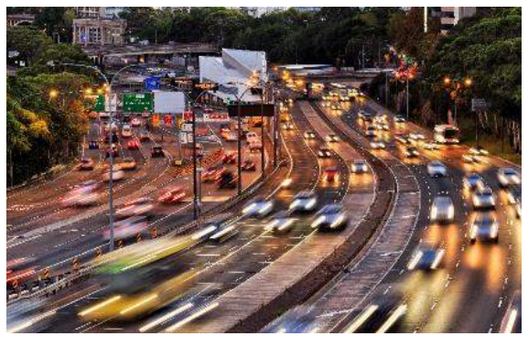

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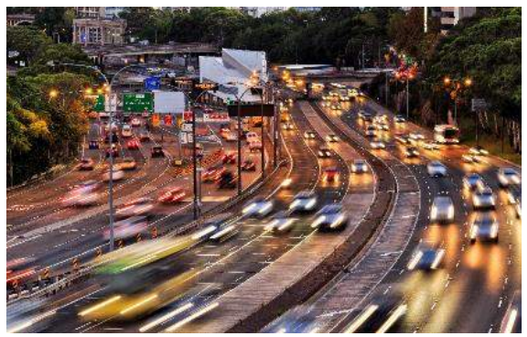

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Personal Sensitivity

- Relates to past experience, financial considerations, other factors
- Unique to individuals
- Difficult to predict or change

02

EXTERIOR NOISE ISOLATION

Selection of facades: How thermal isolation and acoustics work together or possibly conflict

EXTERIOR NOISE ISOLATION

Thermal Insulation can benefit Acoustics

- **Air sealing** – Sound travels through the air; stop airflow to stop that path of sound.
- **Porous Insulation** – Mineral fiber, fiberglass, cellulose, and natural fibers are effective sound absorbers
- **Separated framing/glazing** – Isolates the structureborne transmission paths (double studs, resilient elements, storm panes, etc.)

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Potential Conflicts

- **Using only foam insulations on the exterior** – okay for quiet, rural sites, but possibly inappropriate for louder, urban sites;
- **Foam insulations perform poorly for acoustics** – Closed cell foams absorb little sound, have little mass and stiffen structures, all factors that are not helpful for improved sound isolation
- **Triple Glazing** – The additional pane in the middle reduces the sound isolation (performs similarly to double panes)

03

INTERIOR SOUND ISOLATION

The factors that help typical residential design achieve improved acoustical isolation

INTERIOR SOUND ISOLATION

Factors for improved sound isolation

- **Sealant** – Constructions need to be airtight!
- **Mass** – Additional layers of GWB; gypcrete (floors)
- **Insulation** – mineral fiber, fiberglass, cellulose or natural fibers
- **Resilient/separated constructions** – isolate the structureborne paths by using resilient clips, double studs, isolated ceilings, etc.
- **Laminated drywall** – similar to laminated windows; good for some additional sound reduction, but need to do the previous items properly first.
- **Impact isolated flooring** – Hard surfaces require an impact isolating underlayment to minimize transmission of foot steps

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Difference in modern residences

- **Potentially quieter background sound** – residents in modern homes might perceive the isolation as less effective, only because they hear the transmission more effectively

04

EQUIPMENT NOISE LEVELS

Conceptual noise control for building equipment noise

REDUCING BUILDING EQUIPMENT NOISE LEVELS

Similar to traditional homes

- **Locate equipment away from sensitive areas** – bedrooms, living rooms, etc.
- **Select quiet equipment** – Low fan speeds, VRF systems, etc.
- **Isolate the equipment from the structure** – even quiet equipment (VRFs included) produce vibrations that can transmit effectively to other spaces, if not isolated. Use springs or rubber elements as necessary.

REDUCING BUILDING EQUIPMENT NOISE LEVELS

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- **Isolate the equipment from the structure** – even quiet equipment (VRFs included) produce vibrations that can transmit effectively to other spaces, if not isolated (walls/ceilings can act like loudspeakers). Use springs or rubber elements as necessary to reduce transmission.

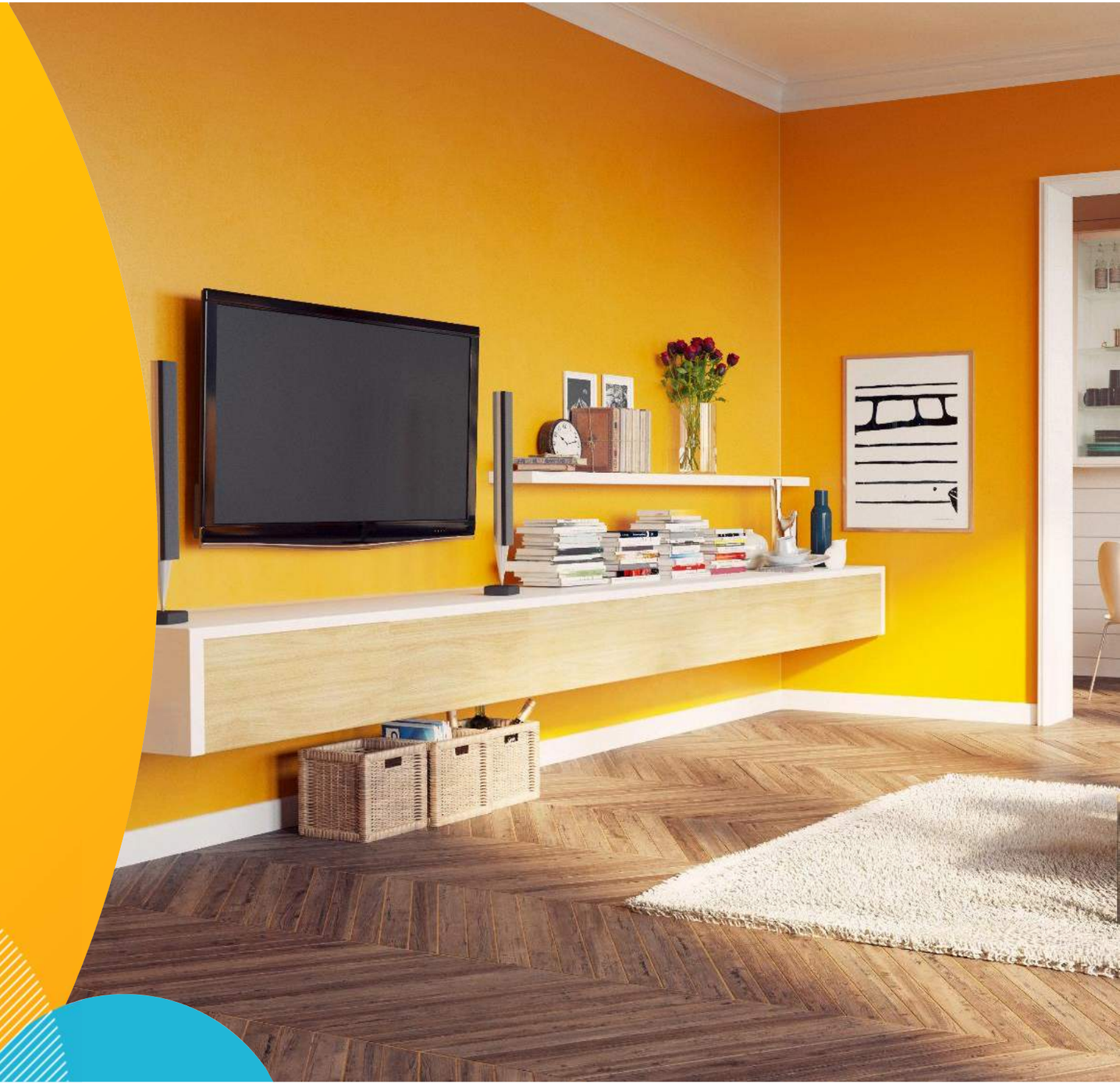
Difference in modern residences

- Possibly less HVAC equipment than older homes
- **Potentially quieter background sound** – residents might perceive the sound louder than if the equipment were in a traditional home

05

INTERIOR ROOM ACOUSTICS

Selection of finishes within the house to control the build up of noise for the occupants



ROOM ACOUSTICS

In traditional homes

- Hard surfaces reflect sound
- Large rooms can create excess acoustical liveliness that can be considered “noisy”
- Can select sound absorbing products that help to reduce this effect and control the “noisiness”
- Particularly important for “media rooms” or home theaters (the intent is to hear the sound of the media program, not the acoustics of the room!)

ROOM ACOUSTICS

In traditional homes

- Hard surfaces reflect sound
- Large rooms/tall ceilings can create excess acoustical liveliness that can be considered “noisy” when there are gatherings
- Can select sound absorbing products that help to reduce this effect and control the “noisiness”
- Particularly important for “media rooms” or home theaters (the intent is to hear the sound of the media program, not the acoustics of the room!)

Difference in modern residences

- Open concept results in rooms with taller ceilings and large volumes allow more reverberation and fewer barriers
- Quieter background sound may make this issue stand out more

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