

Book: 872 Page: 5961



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Register of Deeds
Riley County, Kansas
Book: 872 Page: 5961
Receipt #: 212002 Total Fees: \$102.00
Pages Recorded: 7
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**RESTRICTIVE COVENANTS AND CONDITIONS
PERTAINING TO LOTS IN
THE HIGHLANDS AT GRAND MERE, UNIT ONE
AN ADDITION TO THE CITY OF MANHATTAN,
RILEY COUNTY, KANSAS**

KNOW ALL PERSONS BY THESE PRESENTS THAT: The owners of lots One (1) through Twenty-Nine (29) inclusive, in The Highlands at Grand Mere, Unit One, an Addition to the City of Manhattan, Riley County, Kansas, do hereby adopt the following restrictions and covenants applicable to all the aforesaid lots in said addition and do hereby declare that the aforesaid lots in said addition shall be subject to the following covenants and restrictions, to wit:

SECTION I: USE OF LAND

None of said lots may be improved, used or occupied for other than residential purposes, and no duplex or apartment house, although intended for residential purposes, may be erected thereon. Any residence erected or maintained on any of said lots shall be designed for occupancy by a single family. All construction shall be new construction; no house, garage, or outbuilding shall be moved onto any lot including housing constructed elsewhere.

SECTION II: CONSTRUCTION AND LANDSCAPE PLAN REVIEW

Once the builder and/or architect and client have agreed upon a home design, the plans for original construction must be submitted to the developer for review and approval at:

Schultz Real Estate Development
Tim and Angela Schultz
4345 Rory Road
Manhattan, Kansas 66502
Email: aschultz@schultzconst.com

The plans must include the following:

1. An accurate site plan, drawn to scale (preferably 1" = 10') reflecting the proposed placements of the home, driveways, sidewalks, pool, patio, deck, retaining walls, etc.
2. Floor plans of each level of the home, clearly labeled, and including the square footage.
3. All elevations should be drawn to scale and windows, doors, chimneys, retaining walls, steps, railings, decks, and patios should be shown. Roof pitches and overall dimensions should also be reflected. Building material types should also be specified.
4. A landscape plan should be drawn to scale and incorporate the site plan elements including trees, other plant materials, drainage patterns, berms, retaining walls, and any landscape lighting.

SECTION III: PERMITTED HEIGHTS OF RESIDENCES

No residence erected on any of said lots shall be more than two stories in height.

SECTION IV: REQUIRED SIZE OF RESIDENCES

Any residence one story in height erected on any of said lots shall contain a minimum of 1,600 square feet of enclosed floor area.

Any residence two stories and one and one-half stories in height erected on any of said lots shall contain a minimum of 1,800 square feet of enclosed floor area, of which at least 1,100 square feet shall be on the first floor.

Any split-level, bi-level, or tri-level residence erected on any of said lots shall contain at least 1,800 square feet of enclosed area, of which no less than 1,300 square feet shall be at or above the garage floor level.

The words "enclosed floor area" as used herein shall mean and include in all cases areas on the first and second floors of the residence enclosed and finished for all-year residency, computed on outside measurements of residence, and shall not mean or include any areas in below grade basements, garages, porches, decks or attics.

SECTION V: FOUNDATIONS

Crawl space, full basement, and partial basements are allowed with an adequate drainage system and waterproofing provided around perimeter. No slab foundations will be permitted without written Developer approval prior to building permit being issued.

SECTION VI: BUILDING CONSTRUCTION

Building siding shall be of brick, stone, stucco, wood, Masonite, hardy cement siding, or any combination of the above with a minimum of twenty-five percent (25%) of the front elevation being masonry type finish, ie: brick, stone, stucco, EFIS, or only Centurion Stone product can be used for thin veneer. Homes shall be built according to the International Building Codes (IBC) with roof pitches of at least 5/12 and minimum 12" over hangs.

Cantilevered bump-outs (other than bay windows) that don't extend to grade, e.g. for fireplace vents, shall not be allowed.

All elevation views to have a maximum of three siding materials.

Siding and masonry type materials shall terminate or change at inside corners of home.

Trim all windows and shutters, if used, shall fit windows.

All deck columns must be a minimum of 12 inches square or 12 inches in diameter. A minimum of 6 x 6 columns may be used on a single level deck if extended from masonry bases that are a minimum of 24 inches square and 32 inches in height. On a multi-level deck, a minimum 6 x 6 posts may be used if extended from a minimum 24" square masonry column that is extended to the bottom of the main level deck.

SECTION VII: GARAGES

Said lots shall have a minimum double car garage with minimum width of twenty feet (20'). Side entry garages are required on all lots that share a boundary with the golf course.

All garages shall be constructed as part of, or attached to, the house by an enclosed walkway. For the purposes of these covenants, split level, bi-level, and tri-level homes, as well as two story homes, may have the garage below living space.

SECTION VIII: MAILBOXES

Mailboxes shall meet the Grand Mere Design Standard Specifications for one of three types of mailboxes as described on Attachment A.

SECTION IX: SIDEWALKS

Sidewalks are required on one side of street as per plat. Purchaser of lot is responsible for the sidewalk on lot as per City of Manhattan requirements.

SECTION X: LANDSCAPE

Lots 9 and 11 - 20, inclusive, and 27 - 29, inclusive, yards are to be planted and maintained to the lot lines.

On lots 1 - 8, inclusive, and lot 10, and 21 - 26, inclusive, yards are to be planted and maintained from the street to a point at the rear of the home where yard would easily blend back into the native grasses, using owner's best discretion of where this point is located.

All disturbed areas, on all lots, during the building process shall be planted.

All maintained yard area must have an underground irrigation system.

Landscape must include four (4) trees, two (2) in front of home and two (2) in rear of home, having a diameter of at least 2 ½" caliper.

SECTION XI: RETAINING WALLS

Retaining walls may be stacked stone, poured concrete with a veneer of stone or brick or concrete block with a veneer of stone or brick. Plain concrete or block walls are not permitted. Exposed concrete cannot exceed a height of 12 inches above grade. Stacked interlocking wall systems are permitted, but should be the straight, split-faced style, similar to Versa Lok.

SECTION XII: FENCING

Enclosure fencing along property lines must be constructed of metal, picket style material, black in color. No chain link, wire, PVC, or wood panel materials are permitted.

SECTION XIII: MISCELLANEOUS SITE ISSUES

Underground pools are permitted. Above ground pools are not permitted.

No basketball goals shall be attached to any building. All basketball goals shall be free standing, and when located on a lot having a side entry garage shall be located behind the front building set back line shown on the applicable plat.

When located on a lot having a front entry garage, a goal may be within the front setback but back as far as practical.

One communication device similar to an 18" to 24" satellite dish is allowed. It shall be placed to not be visible from the public street. No devices such as towers, large communication dishes, or antennas are permitted.

SECTION XIV: OUTSIDE ANTENNAS AND SATELLITE DISHES

One (1) residential-sized satellite dish may be placed per unit, they must be ground-mounted and screened from public streets and neighboring houses as much as possible. No external radio, television, or other antennas of any kind or nature, or other device for the reception or transmission of radio, microwave or other similar signals, shall be placed or maintained upon the roof of any structure nor on any lot.

SECTION XV: FUEL TANKS PROHIBITED

No tank for the storage of fuel or anything else may be placed or maintained on any of said lots.

SECTION XVI: LIVESTOCK AND POULTRY PROHIBITED

No animals, livestock, or poultry of any kind shall be raised, bred or kept on any lot, except a reasonable number of commonly accepted household pets. No animals shall be kept, bred or raised within the Community for commercial purposes. In no event shall any domestic pet be allowed to run free away from its owner lot or so as to create a nuisance.

SECTION XVII: SIGNS PROHIBITED

No signs, advertisements, billboards, or advertising structures of any kind may be erected or maintained on any of said lots, provided, however, that permission is hereby granted for the erection and maintenance of not more than one advertising board on each lot or tract as sold and conveyed, with a residence built thereon, which advertising shall not be more than five square feet in total area or be more than three feet in height, and may be used for the sale and exclusive purpose of advertising for sale or lease of the lot or tract upon which it is erected. Developer will be allowed to erect and maintain a development sign.

SECTION XVIII: OUTBUILDINGS/ TEMPORARY STRUCTURES

No building, or other detached structure, shall be erected on any lot.

Any builder's structure/trailer constructed to facilitate the building of a house shall be removed within a reasonable length of time after the house is completed.

No residential structure previously used or constructed at another location shall be moved onto any lot.

Construction dumpsters to be kept on building lots and off the streets if possible.

SECTION XIX: NUISANCES

No noxious or offensive activity shall be carried on upon any lot, nor shall anything be done thereon which may become an annoyance or nuisance to the neighborhood. The landowner shall keep all weeds and grass mowed in compliance with the City of Manhattan code provisions.

SECTION XX: BOATS AND MOTOR VEHICLES

No boats, trailers, buses, motor homes, campers, or other recreational vehicles shall be parked or stored in or upon any public street or lot except within an enclosed garage. No vehicle shall be repaired (excepting minor repairs) or rebuilt on any public street or lot. The Master Association may remove, or cause to be removed, any unauthorized vehicle or other items prohibited hereby at the expense of the owner thereof in any manner consistent with law.

SECTION XXI: CLOTHES DRYING AREA

No portion of any lot shall be used as a drying or hanging area for laundry of any kind, it being the intention hereof that all such facilities shall be provided within the buildings to be constructed on each lot.

SECTION XXII: ANNEXATION OF ADDITIONAL PROPERTY

Additional real property may be annexed to and become subject to this Declaration as hereinafter set forth in this Article XXII at such time as the Developer may elect.

A Supplemental Declaration shall be a writing in recordable form which annexes Annexation Property to this Declaration and which incorporates by reference all of the covenants, conditions, restrictions, easements, and other provisions of this Declaration and shall contain such other provisions as are necessary to designate such property.

SECTION XXIII: DURATION OF RESTRICTIONS

These covenants shall run with the land and shall be binding upon all parties hereto and on all persons claiming under them for a period of twenty-five (25) years from the date these covenants are recorded, after which time said covenants shall be automatically extended for successive periods of ten (10) years unless an instrument signed by a simple majority of the then owners of the lots has been recorded agreeing to change said covenants in whole or in part, it being understood that an owner shall be entitled to cast as many votes as he/she may own lots in said addition.

SECTION XXIV: ENFORCEMENT

Enforcement shall be by proceedings at law or equity against any person or persons violating or attempting to violate any covenant either to restrain violation or to recover damages.

SECTION XXV: SEPARABILITY

Invalidation of any of these covenants by judgement or court order shall in no way affect any of the other provisions, which shall remain in full force and effect.

IN WITNESS WHEREOF, these restrictive covenants have been executed on this 28 day of December, 2017.

LO Land Company, LLC
A Kansas Limited Liability Company

Tim Schultz
Tim Schultz, Member

Angela Schultz
Angela Schultz, Member

STATE OF KANSAS
COUNTY OF RILEY

BE IT REMEMBERED, that on this 28 day of DECEMBER, 2017, before me, the undersigned, a Notary Public in and for the County and State aforesaid, came Tim Schultz and Angela Schultz, both members of LO Land Company, LLC, who are known to me to be the same persons who executed the foregoing instrument of writing, and duly acknowledge the execution of the same.

IN TESTMONY WHEREOF, I have hereunto set my hand and affixed my notaries seal on the day and year last above written.



My Commission Expires

Paxton Lemoine
Notary Public

Attachment A

Mailboxes shall meet the specifications of one of the following three types:

Type One - Mailbox Column:

- i. Maximum height: 58"
- ii. Maximum width: 24"
- iii. Faced with brick, stone, or stucco

Type Two - Mailbox Column and light fixture on top of column

- :
- i. Maximum height 78", including light fixture
 - ii. Maximum width: 24"
 - iii. Faced with brick, stone, or stucco

Type Three – Grand Mere Mailbox and Post

- i. Standard as provided in the Grand Ridge Townhomes
- ii. Maximum height: 56"
- iii. Can be ordered from Custom Home Accessories, Inc. 916-635-0231

Type One



Type Two



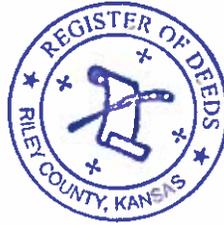
Type Three



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Debra J. Register
Register of Deeds
Riley County, Kansas
Book:870 Page:3891
Receipt #: 207316 Total Fees: \$60.00
Pages Recorded: 4
Date Recorded: 05/16/2017 1:40:19 PM

**NINETEENTH SUPPLEMENTAL DECLARATION TO
DECLARATION OF EASEMENTS, COVENANTS, CONDITIONS
AND RESTRICTIONS FOR THE GRAND MERE PROPERTY
RESIDENTIAL DISTRICT MASTER ASSOCIATION**

THIS NINETEENTH SUPPLEMENTAL DECLARATION is made and entered into on this 3rd day of May, 2017, by Grand Mere Development, Inc., a Kansas Corporation (herein called Developer); and by the LO Land Company, LLC, (herein called The Highlands at Grand Mere Developer).

WITNESSETH:

WHEREAS, Developer has placed of record a Declaration of Easements, Covenants, Conditions and Restrictions for the Grand Mere Property Residential District Master Association recorded on November 17, 2015 beginning at Book 864 at Page 6589 in the Office of the Register of Deeds of Riley County, Kansas (the Declaration); and

WHEREAS, in Article XIV of the Declaration, Developer reserves the right to annex additional real property and make it subject to the Declaration; and

WHEREAS, over the years Developer has placed of record Supplemental Declarations annexing additional real property at the following locations in the Office of the Register of Deeds of Riley County, Kansas:

Book 799, Page 8010; Book 802, Page 5675; Book 821, Page 2975; Book 842, Page 2223; Book 848, Page 533; Book 856, Page 4822; Book 856, Page 7165; Book 857, Page 7022; Book 860, Page 4154; and Book 861, Page 410; and Book 861, Page 888; and Book 861, Page 1401; and Book 861, Page 3314; and Book 861, Page 8168; and Book 862, Page 1448; and Book 865, Page 5046; and Book 865, Page 6150, and Book 869, Page 7883.

WHEREAS, Developer and The Highlands at Grand Mere Developer desire to annex certain additional real property, and to make it subject to the Declaration upon the terms hereinafter set forth;

* the City of

NOW, THEREFORE, Developer for the purpose as set forth in the Declaration, declares that the Described Property situated in Manhattan, Riley County, Kansas, and more particularly described as Lots 1 through 29, The Highlands at Grand Mere Addition, Unit 1, and Lots 75A through 81B, Prairie Village at the Highlands, Unit 1, are hereby annexed and made subject to the Declaration and the jurisdiction of the Master Association, and said Described Property shall hereafter be held, transferred, sold, conveyed, leased, occupied and used subject to the covenants, conditions, restrictions, easements and other provisions set forth in the Declaration, all of which run with the land and be binding upon all real estate within the Described Property, and all parties having or acquiring any right, title or interest in or to any real estate within said Described Property or any part thereof, shall inure to the benefit of and be a burden upon each Owner and each Member of the Master Association.

1. All of the capitalized terms used in this Nineteenth Supplemental Declaration shall have the meanings given them in the Declaration, unless otherwise herein defined.

2. All of the covenants, conditions, restrictions, easements and other provisions of the Declaration, are hereby made applicable to the Described Property and are made a part hereof by this reference.

3. Upon recording of this Nineteenth Supplemental Declaration, the Described Property shall be a part of the Master Association for all intents and purposes of the Declaration and all of the Owners of Lots in the Described Property shall automatically be Owners in accordance with the terms of the Declaration, and this Declaration.

4. The Declaration, as herein supplemented, shall continue in full force and effect in accordance with the terms thereof.

IN WITNESS WHEREOF, the Developer, and The Highlands at Grand Mere Developer have caused this Nineteenth Supplemental Declaration to be duly executed.

GRAND MERE DEVELOPMENT, INC.

By: Mary L. Vanier
Mary L. Vanier, President

DEVELOPER

ACKNOWLEDGMENTS

State of KANSAS, County of RILEY, ss:

On this 3rd day of May 2017, before me, a notary public, personally appeared Mary L. Vanier to me known to be the person who executed the foregoing instrument and acknowledged that she executed the same as her free act and deed, and that said Mary L. Vanier further declared that she is the President of Grand Mere Development, Inc., a Kansas corporation, and the execution thereof was authorized on behalf of the corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year last above written.

Lesli J. Wiese
Notary Public

My appt. expires: 08-18-2018



**THE HIGHLANDS AT GRAND MERE DEVELOPER
LO LAND COMPANY, LLC**

By: Tim Schultz
Tim Schultz, Member

ACKNOWLEDGMENTS

State of KANSAS, County of RILEY, ss:

On this 17 day of MAY 2017, before me, a notary public, personally appeared Tim Schultz, to me known to be the person who executed the foregoing instrument and acknowledged that he executed the same as his free act and deed, and that said Tim Schultz further declared that he is a member of LO Land Company, LLC, a Kansas Limited Liability Company, and the execution thereof was authorized on behalf of the Corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year last above written.

Paxton LeMoine
Notary Public

My appt. expires:



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Debra J. Register
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Riley County, Kansas
Book: 870 Page: 3895
Receipt #: 207318 Total Fees: \$46.00
Pages Recorded: 3
Date Recorded: 05/16/2017 1:40:28 PM

DECLARATION OF EASEMENT

THIS DECLARATION OF EASEMENT is made effective as of the 11 day of May 2017, by LO Land Company, LLC ("Declarant");

WITNESSETH:

WHEREAS, Declarant is the owner of the land described on Exhibit "A", attached hereto, which land is adjacent to Colbert Hills Golf Course in the City of Manhattan, Riley County, Kansas (which land is herein called the "Adjacent Land"); and

WHEREAS, the Colbert Hills Golf Course, located in the City of Manhattan, Riley County, Kansas, which is more fully described as Colbert Hills, Unit 4 (the "Golf Course Property") is currently owned by the Kansas State University Golf Course Management and Research Foundation, a Kansas not-for-profit corporation ("Golf Course Owner"); and

WHEREAS, Declarant and Golf Course Owner desire that those persons playing golf on the Golf Course Property, whether members, guests, licensees, invitees or otherwise (which persons are herein called "Golfers") have the right that golf balls struck by Golfers can come over and on such Adjacent Land and that no claim for damages will be brought based on these activities.

NOW, THEREFORE, in consideration of the foregoing premises, Declarant hereby declares, creates and establishes the following rights and easements with respect to the Adjacent Land and the Golf Course Property:

1. Declarant hereby creates, reserving to itself and granting to the Golf Course Owner for the benefit of Golfers, the non-exclusive right and easement allowing golf balls hit by any Golfers using the Golf Course Property to come over on the Adjacent Property. The foregoing easement shall not relieve Golfers using the Golf Course Property of any liability they may have for property damage or personal injury resulting from the entry of golf balls or Golfers on any Adjacent Property.

2. The Declarant and the Golf Course Owner, and any successor in title to the Golf Course Property, and any agents, servants, employees, directors, officers, affiliates, representatives, receivers, subsidiaries, predecessors, successors and assigns of any such party, shall not in any way be responsible for any claims, damages, losses, demands, liabilities, obligations, actions or causes of action whatsoever, including, without limitation, actions based on: (a) any invasion of the Adjacent Property owner's use or enjoyment of the Adjacent Property; (b) any claimed improper design of the Golf Course Property; (c) the level of skill of any Golfer (regardless of whether such Golfer has the permission of the management to use the Golf Course Property); or (d) trespass by any Golfer on the Adjacent Property; that may result

from property damage or personal injury from golf balls (regardless of number) hit onto the Adjacent Property, or from the exercise by any Golfer of the easements granted hereby.

3. The rights, easements, benefits and obligations hereunder shall create servitudes upon the Adjacent Property for the benefit of the Golf Course Property, which benefits and servitudes shall run with the land. The terms of this Declaration shall be binding upon and inure to the benefit of the owners of the Adjacent Property and their successors and assigns, the Declarant and its successors and assigns, the Kansas State University Golf Course Management and Research Foundation, its members, guests, licensees or invitees, and its successors and assigns, as owner of the Golf Course Property.

4. No extinguishment of the rights and easements created herein shall result or be deemed to result by reason of the ownership of all or any part of the Golf Course Property and all or any part of the Adjacent Property by the same party, by different parties or by reason of any other circumstances, unless such extinguishment shall have been specifically consented to by the Golf Course Owner. The rights and easements created herein shall continue and not be extinguished or terminated.

IN WITNESS WHEREOF, Declarant has caused this Declaration of Easement to be duly executed and made effective as of the first day above written.

LO Land Company, LLC

By: Tim Schultz
Tim Schultz, Member

STATE OF KANSAS, COUNTY OF RILEY, ss:

On this 11 day of May, 2017, before me, a Notary Public in and for said County and State, personally appeared Tim Schultz, known to me to be the person who executed the foregoing instrument and who, being duly sworn by me, did depose and say that he is a member of LO Land Company, LLC, and that he executed the foregoing instrument on behalf of said corporation, and such person duly acknowledges the execution of the same to be the act and deed of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my seal the day and year last above written.

Paxton Lemoine
Notary Public

My appointment expires



EXHIBIT "A"

A tract of land in the Southwest Quarter of Section 34, Township 9 South, Range 7 East of the 6th Principal Meridian*, in Riley County, Kansas, described as follows:

** situated in the City of Manhattan,*

Lots 1 through 29 of The Highlands at Grand Mere, Unit 1; and

Lots 75A through 81B of Prairie Village at The Highlands, Unit 1.

**FORT RILEY, KANSAS
AREA OF MILITARY IMPACT
REAL ESTATE DISCLOSURE FORM**



LO Land Company, LLC, owner of the property legally described below, hereby certifies that said property is situated within the Land Use Planning Zone or Noise Zone II of Fort Riley and that said property may therefore be exposed to periodic low-level military aircraft over-flights, large artillery noise, small arms noise, and impacts associated with other military training activities. Stone Pointe Land Company, LLC further acknowledges receipt of the "Recommended Sound Attenuation Techniques for Residences in the Land Use Planning Zone and Noise Zone II Surrounding Fort Riley, Kansas", attached hereto as Exhibit A, which outlines methods for reducing the impact of the Fort Riley noise on new and existing residences.

Legal Description: Lots One (1) through Twenty-Nine (29), inclusive, in The Highlands At Grand Mere, Unit One, an Addition to the City of Manhattan, Riley County, Kansas.



LO Land Company, LLC
Angela Schultz, Authorized Member

5/22/17

Date

STATE OF KANSAS)
SS:
COUNTY OF RILEY)

Before me, the undersigned, a Notary Public in and for said County and State, and on this 22 day of May, 2017, personally appeared Angela Schultz, Authorized Member of LO Land Company, LLC, known to be the identical person who executed the within and foregoing instrument and acknowledged to me that they executed the same as their free and voluntary act and deed for the uses and purposes therein set forth. Witness my hand and official seal the day and year above set forth.



Notary Public



Date Commission Expires

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EXHIBIT A:

RECOMMENDED SOUND ATTENUATION TECHNIQUES FOR RESIDENCES NOISE ZONE II AND LUPZ SURROUNDING FORT RILEY, KANSAS

SOUND INSULATION IN RESIDENTIAL STRUCTURES

DEFINITION

Sound insulation refers to the use of acoustical related building materials for the reduction of noise for architectural abatement purposes. These materials apply to any areas of a structure that may be part of a sound transmission path including windows, doors, roof systems, ventilation, wall systems (exterior), and utility access points through a building envelope.

CHARACTERISTICS

The application of sound insulation techniques can involve existing and/or planned structures or buildings. Often the benefits for noise control, such as double pane windows have additional benefits in terms of energy conservation and reduced heat loss. The primary objective of sound insulation is to reduce the sound transmission through the building envelope (e.g., exterior wall, window, and roof system), thereby having lower interior noise levels.

Sound Attenuation Definitions

Exterior Wall Rating:

EWR is a single-number rating for exterior building elements (such as walls, windows, doors, etc.) and represents the effective sound transmission loss capability, in decibels, of each element. It differs from the STC rating in that it is based on aircraft noise rather than office noise spectra. For this reason, EWR is superior to STC for describing the sound-insulating properties of exterior wall elements exposed to aircraft noise. The EWR concept was developed by Wylie Laboratories and has been used extensively in studies of residential sound insulation. It is conceptually similar to the STC rating method. Like TL and SIC, the higher the EWR value, the better the noise reduction.

Noise Reduction:

The quantitative measure of sound isolation between spaces is called Noise Reduction (NR). The NR between two spaces, such as from the exterior to the interior of a dwelling, depends on the TL of the various components in the separating wall, the area of the separating wall, and the acoustical absorption in the receiving room. This value takes more into account than just the sound transmission characteristics of the wall material. Generally, values of NR are determined in one-third octave bands. A higher NR gives a lower noise level in the receiving room, indicating greater noise insulation.

Noise Level Reduction:

NLR is used to describe the reduction of environmental noise sources, such as aircraft. It is a single-number metric based on values of A-weighted noise reduction (NR). The greater the sound insulation in a wall, the lower the noise level in the receiving room, giving a higher NLR.

The NLR is useful because it is a simpler metric to use than NR; one number is easier to apply than a set of numbers in one-third octave bands. However some building materials and components are more effective at reducing low-frequency noise than other materials or components. Since aircraft noise contains a lot of low frequency sound, it is important to ensure that insulating materials and components perform well at low frequencies. NLR is a good indicator of overall wall performance but may not be appropriate when designing modifications for aircraft noise reduction, especially if a good NLR value disguises poor low frequency insulation.

Sound Transmission Class:

Since working with a series of one-third octave TL measurements can be cumbersome, a single number descriptor based on the one-third octave values has been developed. This rating method is called the Sound Transmission Class (STC). Like TL, the higher the STC rating for a construction method or component; the higher the sound insulation. Originally, STC ratings were developed as a single-number descriptor for the TL of interior office walls for typical office noise and speech spectra. Now, they are used, often incorrectly, for exterior walls as well. Most acoustical materials and components are commonly specified in terms of their STC ratings.

Sound Transmission Loss:

This is the physical measure, which describes the sound insulation value of a built construction system or component. It is a measure, on a logarithmic scale, of the ratio of the acoustic sound power incident on the tested piece to the acoustic sound power transmitted through it. The TL is expressed in decibels (dB). Generally, TL is measured as a function of frequency in one-third octave frequency bands. The higher the sound insulation, the less sound will be transmitted, resulting in a higher IL value. Values of TL are determined in acoustical laboratories under controlled testing methods prescribed by the American Society of Testing and Materials (ASTM).

Sound Insulation Objectives

The goal for residential sound insulation is to reduce the dwelling interior noise levels due to aircraft operations. Total "soundproofing" of the dwelling, such that aircraft operations are inaudible, is economically infeasible. Modest improvements over the existing characteristics (i.e. less than 5 dB) may not provide a noticeable improvement for the homeowner and hence are not cost effective. The ideal solution is to provide sound insulation, which lies between these two extremes.

Room Variations

The noise level of different rooms in a house depends on the absorption within the room, as well as on the noise entering from outside. Upholstered furniture, drapes, and carpeting absorb sound while hard surfaces do not. In addition, different categories of rooms vary on how predictable their sound environments are. Living rooms, for example, tend to be consistent from one house to another because they almost always have the same types of furnishings in them. Bedrooms vary because some are guest rooms with less furniture, and some have been converted to other uses. Kitchens tend to vary widely due to the use of different wall coverings, such as cabinets and appliances, or floor coverings, such as tile or carpet. These room variations act in addition to variation in exterior sound level and sound transmission through the outside wall.

Sound Insulation Concept

Sound Transmission

In order to effectively examine noise control measures for dwellings it is helpful to understand how sound travels from the exterior to the interior of the house. This happens in one of two basic ways: through the solid structural elements and directly through the air. Consider the sound transmission through a wall constructed with a brick exterior, stud framing, interior finish wall and absorbent material (insulation) in the cavity. The sound transmission starts with noise impinging on the wall exterior. Some of this sound energy will be reflected away and some will make the wall vibrate. The vibrating wall radiates sound into the airspace, which in turn sets the interior finish surface vibrating, with some energy lost in the airspace. This surface then radiates sound into the dwelling interior. Vibration energy also bypasses the air cavity by traveling through the studs and edge connections. Openings in the dwelling, which provide air infiltration paths through windows, vents, and leaks, allow sound to travel directly to the interior. This is a very common and often overlooked source of noise intrusion.

Flanking is a similar concept and usually refers to sound passing around a wall. Examples of common flanking paths include: air ducts, open ceiling or attic plenums, continuous sidewalls and floors, and joist and crawlspaces. The three different major paths for noise transmission into a dwelling are air infiltration through gaps and cracks, secondary elements such as windows and doors, and primary building elements such as walls and the roof.

Low-frequency sound is most efficiently transmitted through solid structural elements such as walls, roof, doors, and windows. High frequencies travel best through the air gaps. Within these broad categories, different building materials have different frequency responses to sound and varying abilities to insulate against sound.

Reducing Transmitted Sound

The amount of sound energy transmitted through a wall, roof or floor can be limited in several ways. First, all air infiltration gaps, openings, and possible flanking paths must be eliminated wherever possible. This is the single most important, but occasionally overlooked, step in noise reduction. This includes keeping windows and doors closed and putting baffles on open-air vents.

Some materials reflect more of the incident sound, converting less of it into vibration energy. The mass of the exterior and interior panels influences how much sound will pass through them. The more mass a structural element has the more energy it takes to set it into vibration, so adding weight to a wall or ceiling by attaching a gypsum board layer will make the assembly pass less sound. Then, absorption in the air cavity and resilient mounting of interior finish panels can further reduce the sound transmitted to the room. The primary approaches for improving sound isolation are:

1. Elimination of openings and flanking paths (when accessible).
2. Improvement of windows and doors.
3. Massive construction (build a wall 3 feet thick and 40 feet high around the whole house).
4. Isolation of panel elements through separation or resilient mounting.
5. Absorption.

Problem Areas

Sound intrusion problems are commonly caused by:

1. Building construction components and configurations not providing sufficient sound insulation.
2. Structural elements, such as windows, doors, walls, roofs and floors chosen and combined in an unbalanced way so that some parts are much weaker sound insulators than others.
3. Unintended openings or sound-flanking paths caused by deterioration or improper installation of construction elements.

Balanced Acoustical Design

The most important, or controlling, sound paths must be identified in order to know how to construct or modify a dwelling to meet a specified noise criteria. The ideal sound insulation design would achieve a condition where all the important sound paths transmit the same amount of acoustical energy. This eliminates any weak links in the building's insulation envelope and is commonly referred to as a balanced acoustical design.

In most cases, after leaks and gaps are sealed, the windows are the controlling sound paths. Replacing them with acoustical windows typically does more to improve the sound insulation performance than any other architectural modifications. Once this is done the other elements may become important in meeting specific noise reduction goals. Exterior doors often require improved sound insulation. Ceilings and walls, which face the exterior, may require modification as well, particularly in the higher DNL noise zone.

New Versus Old

Dwellings can vary in their sound isolation performance. Generally, air infiltration, and therefore sound infiltration, around windows and doors tends to be worse for older dwellings. Inadequate or deteriorated weather-stripping and misaligned framing usually cause this. On the other hand, most of the older construction techniques and materials tend to be more massive than newer lighter-weight construction. As a result, many older buildings tend to perform better with regard to sound transmission through walls, roofs, and floors than do new houses. Homeowner modifications can also degrade the dwelling's sound insulation performance. Examples include home improvements such as skylights, whole-house attic fans, through-the-wall air conditioners, and solariums. In general, it is much more efficient, and cost effective, to take acoustic performance into account when designing and building a home at the start. Remodeling an already built home is more costly and time consuming than anticipating and building for good sound insulation.

While homes, which are well insulated thermally, often perform well acoustically, thermal insulation is not always a good indicator of sound insulation. Many thermal windows, installed in new construction or added as a homeowner upgrade provide little sound insulation when compared to walls or acoustical windows and are frequently the weak link in the building envelope. However thermal treatments usually eliminate air infiltration and may serve to improve the acoustical performance of a dwelling. Thermal insulation batts are often useful in the wall cavities and attic spaces to absorb some sound.

Most homes today are constructed using double pane windows. Although the windows perform well thermally, they usually do not perform well acoustically. The panes are separated by

approximately ½ inch of air space and thin panes of glazing are used. The thin panes of glazing allow for vibration and the vibrations are transmitted through the air space to the interior glazing and into the home.

Recommended Building Requirements

General:

- a. Brick veneer, masonry blocks, or stucco exterior walls shall be constructed airtight. All joints shall be grouted or caulked airtight.
- b. At the penetration of exterior walls by pipes, ducts, or conduits, the space between the wall and pipes, ducts, or conduits shall be caulked or filled with mortar.
- c. Window and/or through-the-wall ventilation units shall not be used.
- d. Operational fireplaces shall not be used.
- e. All sleeping spaces shall be provided with either a sound absorbing ceiling or a carpeted floor.
- f. Through-the-wall/door mailboxes shall not be used.

Exterior Walls:

- a. Exterior walls, other than as described below, shall have a laboratory sound transmission class rating of at least STC-44.
- b. Masonry walls having a surface weight of at least 40 pounds per square foot do not require a furred (stud) interior wall. At least one surface of concrete block walls shall be plastered or painted with heavy "bridging" paint.
- c. Stud walls shall be at least 4 inches in nominal depth and shall be finished on the outside with siding-on-sheathing, stucco, or brick veneer.
 - (1) Interior surface of the exterior walls shall be of gypsum board or plaster at least ½" thick, installed on the studs. The gypsum board or plaster may be fastened rigidly to the studs if the exterior is brick veneer or stucco. If the exterior is siding-on-sheathing, the interior gypsum board or plaster must be fastened resiliently to the studs.
 - (2) Continuous composition board, plywood or gypsum board sheathing shall cover the exterior side of the wall studs behind wood or metal siding. The sheathing and facing shall weigh at least 4 lbs. per square foot.
 - (3) Sheathing panels shall be butted tightly and covered on the exterior with overlapping building paper. The top and bottom edges of the sheathing shall be sealed.
 - (4) Insulation material at least 2 inches thick shall be installed continuously throughout the cavity space behind the exterior sheathing and between wall studs. Insulation shall be glass fiber or mineral wool.

Windows:

- a. Windows, other than as described in this section, shall have a laboratory sound transmission class rating of at least STC-33.
- b. Glass of double-glazed windows shall be at least ⅛" thick. Panes of glass shall be separated by a minimum ¾" air space.
- c. Double-glazed windows shall employ fixed sash or efficiently weather-stripped operable sash. The sash shall be rigid and weather-stripped with material that is compressed air tight when the window is closed so as to conform to an infiltration test not to exceed 0.5 cubic foot per minute per foot of crack length in accordance with ASTM E-283-65-T.

- d. Glass of fixed-sash windows shall be sealed in an airtight manner with a non-hardening sealant, or a soft elastomer gasket, or glazing tape.
- e. The perimeter of window frames shall be sealed airtight to the exterior wall construction with a sealant conforming to one of the following Federal Specifications: TT-S-00227, TT-S-00230, or TT-S-00153.
- f. The total area of glass of both windows and exterior doors in sleeping spaces shall not exceed 20% of the floor area.

Doors:

- a. Doors, other than as described in this section, shall have a laboratory sound transmission class rating of at least STC-33.
- b. Double door construction is required for all door openings to the exterior. Openings fitted with side-hinged doors shall have one solid-core wood or insulated hollow metal core door at least 1 $\frac{3}{4}$ " thick, separated by at least a 4-inch airspace from another door, which can be a storm door. Both doors shall be tightly fitted and weather-stripped.
- c. The glass of double-glazed sliding doors shall be separated by minimum $\frac{3}{4}$ " airspace. Each sliding frame shall be provided with an efficiently airtight weather stripping material.
- d. Glass of all doors shall be at least $\frac{3}{16}$ " thick. Glass of double sliding doors shall not be equal in thickness.
- e. The perimeter of doorframes shall be sealed airtight to the exterior wall construction.
- f. Glass of doors shall be set and sealed in an airtight, non-hardening sealant, or a soft elastomer gasket, or glazing tape.

Roofs:

- a. Combined roof and ceiling construction other than described in this section shall have laboratory sound transmission class rating of at least STC-44.
- b. With an attic or rafter space at least 6 inches deep, and with a ceiling below, the roof shall consist of closely butted $\frac{1}{2}$ " composition board, plywood, oriented strand board or gypsum board sheathing topped by roofing as required.
- c. If the underside of the roof is exposed, or if the attic or rafter spacing is less than 6 inches, the roof construction shall have a surface weight of at least 40 pounds per square foot. Rafters, joists or other framing may not be included in the surface weight calculations.
- d. Window or dome skylights shall have a laboratory sound transmission class rating of at least STC-33.

Ceilings:

- a. Gypsum board or plaster ceilings at least $\frac{1}{2}$ " thick shall be provided
- b. Glass fiber or mineral wool insulation at least 2 inches thick shall be provided above the ceiling between joists.

Floors:

- a. The floor of the lowest occupied rooms shall be slab on fill, below grade, or over a fully enclosed basement. All door and window openings in the fully enclosed basement shall be tightly fitted.

Ventilation:

- a. A mechanical ventilation system shall be installed that will provide the minimum air circulation and fresh air supply requirements for various uses in occupied rooms without the need to open any windows, doors, or other openings to the exterior.
- b. Gravity vent openings in attic snail not exceed code minimum in number and size. The openings shall be fitted with transfer ducts at least 3 feet in length containing internal sound absorbing duct lining. Each duct shall have a lined 90-degree bend in the duct such that the line of sight is interrupted from the exterior through the duct into the attic.
- c. If a fan is used for forced ventilation, the attic inlet and discharge openings shall be fitted with sheet metal transfer ducts of at least 20-gauge steel, which shall be lined with coated glass fiber 1 inch thick, and shall be at least 5 feet long with one 90 degree bend.
- d. All vent ducts connecting the interior space to the outdoors, except domestic range exhaust ducts shall contain at least a 10-foot length of internal sound absorbing duct lining. Each duct shall be provided with a lined 90-degree bend in the duct such that there is no direct line of sight through the duct from the venting cross section to the room opening cross section.
- e. Duct lining shall be coated glass fiber duct.
- f. Domestic range exhaust ducts connecting the interior space to the outdoors shall contain a baffle plate across the exterior termination, which allows proper ventilation. The dimensions of the baffle plate should extend at least one diameter beyond the line of sight into the vent duct. The baffle plate shall be made of the same material and thickness as the vent duct material.
- g. Building heating units with flues or combustion air vents shall be located in a closet or room closed off from the occupied space by doors.
- h. Doors between occupied space and mechanical equipment areas shall be solid core wood or 20-gauge steel hollow metal at least 1 $\frac{3}{4}$ " thick and shall be fully weather-stripped.

Methods for Exterior Wall Sound Insulation in New Homes

Typically, most wall construction consists of a 3 $\frac{1}{2}$ " stud cavity with studs spaced 16 inches on center, $\frac{1}{2}$ " gypsum drywall on the interior, $\frac{7}{16}$ " structural sheathing on the exterior and either siding or brick veneer as the finish on the exterior. Consider using the construction techniques below:

1. Increase the wall stud cavity to 5 $\frac{1}{2}$ ", spaced 24 inches on center. The increased depth of the stud cavity will allow for the installation of R-19 insulation.
2. When considering the type of insulation material, consider using cellulose insulation material. This material is of a higher density. The method of installation is a spray method that tends to completely fill the cavity without voids.
3. Prior to the installation of insulation material in the walls, seal all penetrations through the top and bottom plates. Remember if air can enter, so can sound. Seal all penetrations through the bottom plate with caulk. Seal all penetrations through the top plate with caulking materials meeting the requirements of ASTM E-136.
4. Increase the thickness of the interior wall finish from $\frac{1}{2}$ " to $\frac{5}{8}$ " gypsum wallboard.
5. Caulk around all openings through the drywall such as receptacles, switches, plumbing drains, etc.
6. Increase the thickness of the exterior sheathing material to $\frac{5}{8}$ " or thicker material.
7. Consider using brick veneer instead of siding material for the exterior finish. Insure at least a one-inch air space between the brick veneer and the siding.

8. If siding is to be used, avoid using vinyl siding. Choose siding with a higher density such as Hardiplank, or wood siding. Install 30-pound felt between the siding and sheathing lapped 2 inches on horizontal joints and 6 inches on vertical joints.
9. If vinyl siding is a must, install ¼"-thick fanfold insulation board between the siding and sheathing.
10. Avoid large openings or breaks in continuity in the walls, such as large windows.
11. Install bathroom vent and kitchen hood vents on the side of the home away from the flight track. Make sure that vent terminations have an automatic closure on the end. Always use metal pipe for the vent pipe.

Methods for Improving Attic and Ceiling Sound Insulation in New Homes

1. Consider using energy trusses. Energy trusses allow for the installation of ceiling insulation to a full depth along the plate lines at exterior walls.
2. Install baffles on attic vents where practical.
3. Install acoustically absorptive material to a thickness equal to R-38 to the attic space to reduce reverberant sound level buildup. Apply material evenly throughout the attic space, taking care to keep it away from cave vents and openings. Consider the use of cellulose insulation. This material fills the cavity without leaving voids in the material and is of a higher density than fiberglass.
4. Install ½" gypsum board as the interior ceiling finish.
5. Caulk around all penetrations through the ceiling membrane such as light fixtures.
6. Avoid the use of "can-type — recessed light" light fixtures.
7. Avoid the use of true exposed wood beams on the ceiling. This creates a continuous path for sound through the ceiling structure.
8. Avoid the use of whole house exhaust fans in the ceiling.

Methods for Improving Floor Sound Insulation in New Homes

1. Install R-30 insulation batts between the joists.
2. Seal all penetrations through the floor assembly such as Heating and Air Conditioning supplies; exhaust ducts, such as down draft exhaust from dryers and ranges, etc.
3. Install foundation vents of the swing cover awning type instead of the horizontal slider type.
4. Consider a sealed crawlspace and insulate the foundation walls. If this method is chosen, caulk between the mudsill and the foundation.

Methods for Improving Window Sound Insulation in New Homes

1. The most effective method of reducing sound transmission by a window is by increasing thickness of the glass panes. Basically, thicker is better. Thicker glass tends to bend less, and therefore vibrates less when exposed to sound waves. Using 6mm glass combinations or laminated glass is the simplest, most cost effective method of reducing sound transmission.
2. When choosing windows for your new home remember windows are generally the weakest link in sound attenuation

3. Choose windows that are double-glazed with panes at least 3/16" thick. Windows shall be double glazed with panes at least 3/16" thick. Panes of glass should be separated by a minimum 1/2" airspace and should not be equal in thickness.
4. Double glazed windows should employ fixed sash or efficiently weather-stripped, operable sash. The sash shall be rigid and weather-stripped with material that is compressed airtight when the window is closed.
5. Glass should be sealed in an airtight manner with a non-hardening sealant or a soft elastomer gasket or gasket tape.
6. The perimeter of the window frames should be sealed airtight to the exterior wall construction with a sealant. The usual installation of windows employs stuffing the void between the window and framing with fiberglass insulation. The use of a sealant on top of the insulation material acts as an air infiltration barrier. Insulation by itself is not a good air infiltration barrier. Remember, if air can pass through, so can sound.
7. Avoid large picture windows and sliding glass doors on sides of the dwelling, which face the flight track.

Methods for Improving Door Sound Insulation in New Homes

1. Double door construction should be considered for all hinged door openings to the exterior. Such doors should be side hinged and shall be solid core wood or insulated hollow metal at least 1 3/4" thick separated by an airspace of at least 3 inches from another door, storm door. Both doors shall be tightly fitted and weather-stripped.
2. All doors shall be at least 3/16" thick. Glass of double sliding doors shall not be of equal thickness.
3. The perimeter of doorframes shall be sealed airtight to the exterior wall construction (framing). Stuff the gap between the doorframe and the framing with insulation and seal with a non-hardening caulk. Remember, if air can pass through, so can sound.
4. Glass in doors should be sealed in an airtight non-hardening sealant or in a soft elastomer gasket or gasket tape.

Methods for Improving Sound Insulation in Existing Homes

The best time to consider sound attenuation is during the construction of new homes. Retrofitting an existing home for sound attenuation can be costly. If one is considering retrofitting for sound attenuation, it is best done during a planned renovation project. As mentioned earlier in this guide, windows are generally the weakest link in sound attenuation. Some of the simpler and easiest ways to attain sound attenuation is by a combination of the following:

1. Add insulation in the attic to an overall R-Value thickness of R-38.
2. Caulk around all penetrations through the interior finishes (receptacles, light fixtures, plumbing drains, etc.).
3. Install single pane storm windows over existing single pane windows.
4. Install weather-stripping on all doors.
5. Employ any of the methods described in Methods for Improving Sound Attenuation in New Homes as the project allows.

Methods of Noise and Vibration Control in Residential HVAC Systems

1. Mount the motor/fan at grade level on factory-supplied vibration isolators to minimize vibration transmitted to the house.
2. If fans or other pieces of equipment are located in the attic, use mounting bases and vibration isolators to reduce structure borne noise and vibration transmission.
3. Install flexible duct connectors to limit vibration transmitted to the ductwork or the dwelling structure.
4. Use standard sheet metal ductwork in attics and crawlspaces. Ductwork is exposed to higher levels of aircraft noise in these spaces. Do not use flexible ductwork in attic spaces since it does not have as good sound-insulating properties as standard sheet metal.
5. Supply grilles in rooms should be of the opposed-blade type and be designed for low noise.
6. A duct sound trap (muffler) should be installed just inside the fresh-air inlet opening. The sound trap will reduce any aircraft noise that passes through this opening and will eliminate the possibility of aircraft noise being transmitted via the duct path.