

Speech/Voice Intelligibility
in
Life Safety Systems
based on NFPA 72, 2007

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March 18, 2009 – CFPI, Buellton, CA

Definition

3.3.211* Voice Intelligibility.

Audible voice information that is distinguishable and understandable.

Here's an example 

7.8.1.2* The sound pressure level, in dBA, of the fire alarm speaker appliance evacuation tone signals of the particular mode installed (public or private) shall comply with all the requirements in 7.4.2 (public) or 7.4.3 (private).

7.4.1.4* Where required, voice communications systems shall be capable of the reproduction of prerecorded, synthesized, or live (e.g., microphone, telephone handset, and radio) messages with voice intelligibility.

See A.7.4.1.4 for additional information

A.7.4.1.4

Voice intelligibility information in the annex cites IEC 60849 several times. It is basically looking for a common intelligibility scale (CIS) of 0.70; when displayed on an electronic monitoring device.

However, know that there are “other” methods acceptable to meet intelligibility based on the annex material referenced in A.7.4.1.4 and supported by IEC.

IEC is the International Electrotechnical Commission Standards.

7.4.1.6* Voice messages shall not be required to meet the audibility requirements of 7.4.2 (Public Mode Audible Requirements), 7.4.3 (Private Mode Audible Requirements), 7.4.4 (Sleeping Area Requirements), etc., but shall meet the intelligibility requirements.

See A.7.4.1.6 for additional information

Speech Intelligibility

Fast Food Services

Airline Terminals

Convention Center Show Floors

Fire Alarm Broadcasts

Hotels

High Rise Public Sector

Hospitals

Factors Affecting Intelligibility

Signal-to-noise ratio (volume)

Distance from the source

Source Directivity

Reverberation time (varied audible
device locations)

Reflections

Intelligibility Degradation

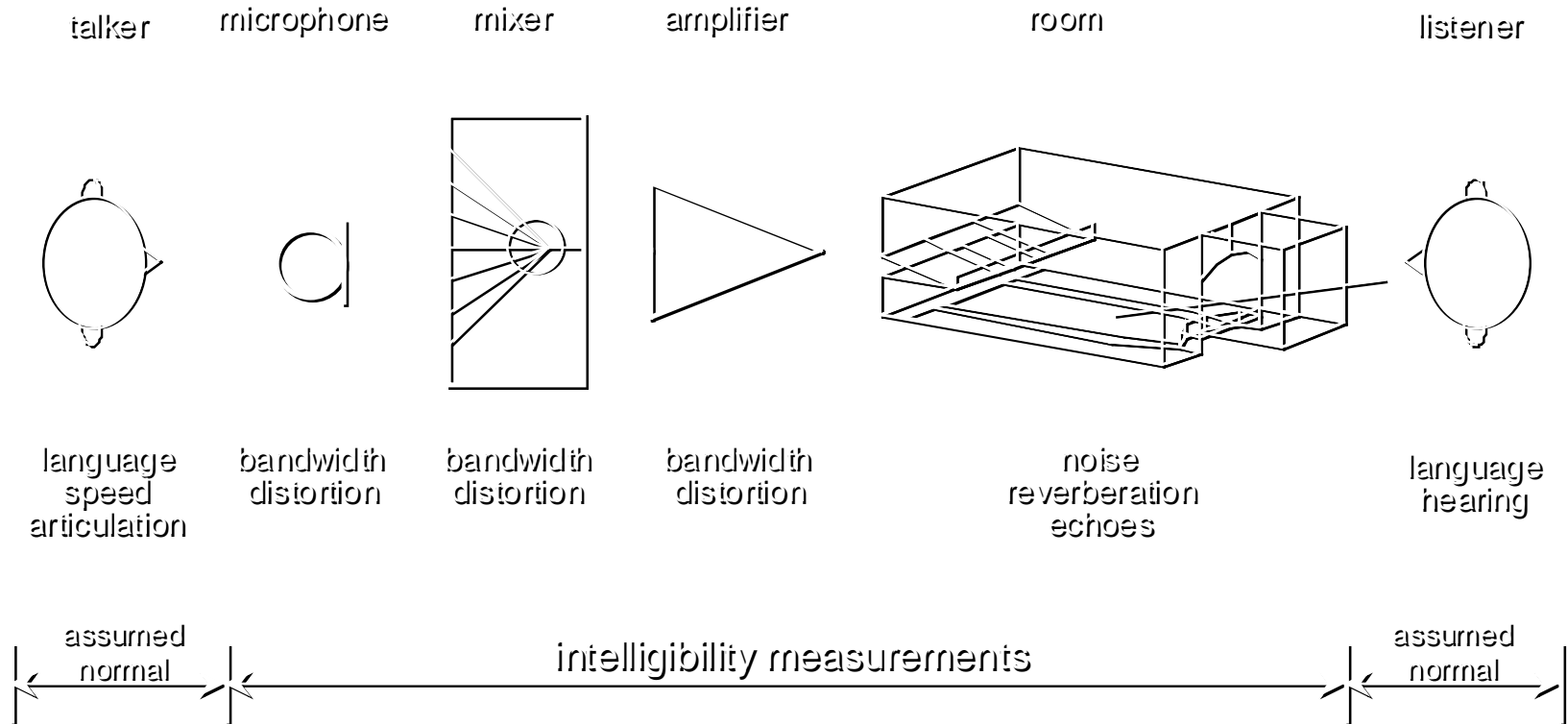
Speech consists of sounds broadly classified into vowels and consonants

vowels: a, e, i, o, and u

combinations like ba, pa, da, ta, ga contain consonant sounds

Degradation in intelligibility is directly proportional to loss of consonants.

Other Factors Degrading Intelligibility



Talker-to-Listener Transmission path
(Assumes talker speaks same language as the listener)



Intelligibility Degradation

Louder is not necessarily better

Higher Reflections

More Intense Reverberation

Reception from Audibles further away

Delayed transmissions only help when facing common source

Intelligibility Testing

Subject Based Method

Variables in people



Difficult, tedious, non repeatable

Inaccurate

Quantitative

Speech transmission index (STI)

Considers Signal and Background Noises

Intelligibility Testing

Common Intelligibility Scale (CIS)

IEC developed to establish a common value

0-10 = 0-100% spoken word understood

Charts amount of Modulation preserved in transmission of speech

Intelligibility Testing

CIS of 0.70 (80% word intelligibility)

0.50 on STI Scale

Standard non-emergency sound system
is not acceptable

High Intelligibility is not necessarily high
fidelity

Standard telephone 300-3000 Hz / 100%
intelligible

Fire alarm speakers are low fidelity but will convey
messages effectively

STI-CIS 30 Speech Intelligibility Analyzer



Covered by Bose® patents issued and/or pending

STI-CIS™ Intelligibility analyzer

Based on the Speech Transmission Index method
this accounts for all factors affecting intelligibility

Measures CIS and dBA

Requires no connection to the fire alarm control

Automatic error detection

Measures a developed custom excitation signal

Seven Octaves from 125 Hz to 8 kHz

STI-CISTM Intelligibility analyzer



Test signal to be transmitted through the system

OOOOOPS !!!

STI-CISTM Intelligibility analyzer



Test signal to be transmitted through the system

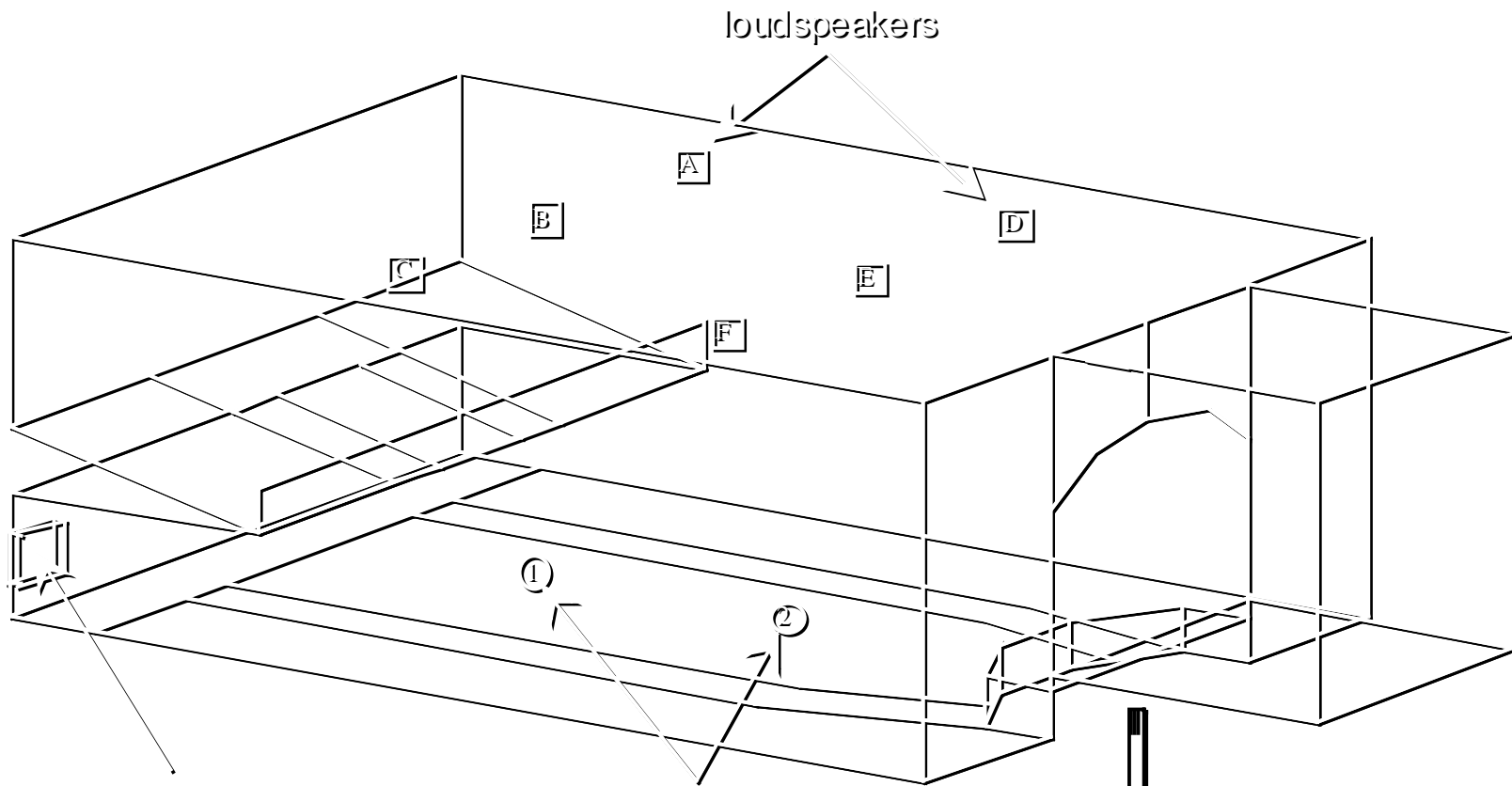
STI-CISTM Intelligibility analyzer



Test signal to be transmitted through the system

Scottie, do we have them yet?

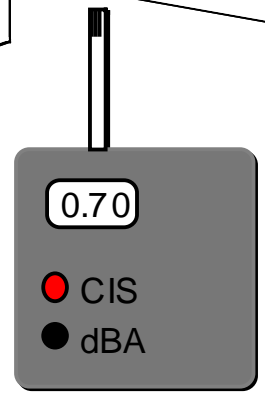




Excitation signal input
at fire alarm control panel

- stored in memory
- sent through aux input
- played through microphone

example
measurement
locations



Conclusions

There will be added costs

More may be better

Consideration at the time of building design

Consideration of potential background noises

When should systems be measured

More strict standards – more sophisticated devices

MORE LIVES SAVED!

Questions?

Bill Hopple, the original “code wienie”.

Accept no substitute.

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