



**Excessive Noise Level Measures
in a Large Metropolitan Subway
System**

AMERICAN SPEECH-LANGUAGE HEARING ASSOCIATION (ASHA)
CONVENTION

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Presentation Outline

- Introduction
 - Noise Induced Hearing Loss (NIHL)
 - Subways as a source of excessive noise
- Study design
 - Pilot study of noise subway environment noise levels
 - Sampling strategy
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- Conclusions



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Introduction

NIHL- as an occupation health hazard

- Leading health problem in industrial societies
- 15-30 million workers believed to be exposed
- OSHA set standards (1910.95) in 1996 for exposure at:
 - 85dB for an 8 hour Time Weighted Average (TWA)
 - 100dB for 2 hours
 - 115dB for 15 minutes per day
 - **NO EXPOSURE PERMITTED ABOVE 140dB!!**
- Cost is \$800 million/year in workers compensation costs alone
- Columbia's research team was approached by the union representing the subway workers to investigate NIHL

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Subways as a Source of Excessive Noise


- In the U.S., there are 14 different subway systems, with over 350,000 subway workers and 33 million riders on an average weekday
- Secondary to multiple metal work processes including grinding, cutting, steel on steel, and braking, significant noise is produced
- Environment: underground amplifies the sounds source
- Aging infrastructure, but increasingly utilized as the urban environment expands

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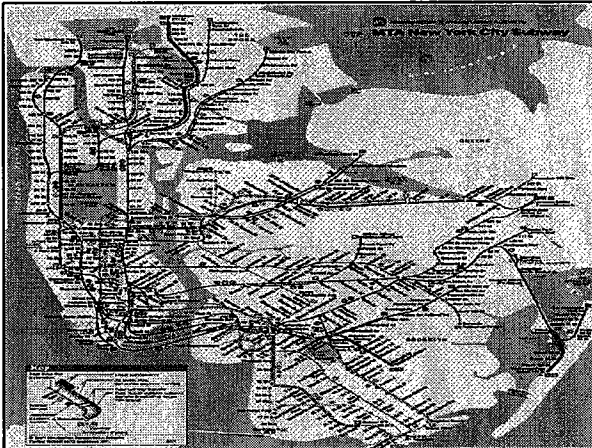
NYC Subway System Facts

- 67,000 subways workers
- 24/7 service
- Aging structure, system built in 1904.
- Over 500 cars in use, some over 25 years old.
- 2,000 miles of tracks across NYC's 5 boroughs
- 4 million riders each weekday, for over 7 million rides per day or 2 billion rides a year



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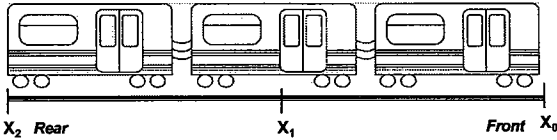
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Study Design

An independent review of subway noise has never occurred in the NYC subway system. The MTA last reviewed noise levels in the late 1970's

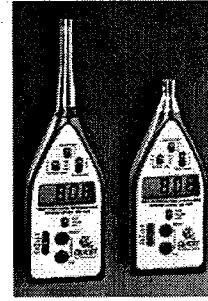
- Pilot study was conducted to determine an environmental sampling strategy
- Sampling strategy was based on union suggestion, personal experiences, and historical data
- Samples were collected at platform level, inside cars, and street levels as a comparison.



Study Design

Equipment used was an A-level Quest 1200 Sound Level Meter (calibrated daily)

- Samples were taken throughout the day from morning (8:00am) to evening rush hour (7:45pm)
- Multiple samples were taken, but not of the same exact train as the subway system is fluid.
- Simple statistics were used to obtain means, medians, ranges, and acquire a "snap-shot" of the subway environment



Results



Sample:

- 376 total samples; 57 different platforms; 17 different subway stations in 4 boroughs.
- 22 inside car measures were taken involving 5 different train lines.
- 10 measures at various bus stops were taken.

Results

On platform:

- Sound level measures ranged from 60 – 140dB
- The mean was 86dB
- The length of time for the sampling ranged from 20 seconds to 90 seconds, with a mean of 34 seconds

Inside car:

- Sound level measures range 84 - 112dB (impulse)
- Mean was 96dB

On the street level (bus stops):

- Sound level measures ranged from 76dB - 89dB
- Mean was 84dB

Conditions Affecting Levels

PLATFORMS:

- Multiple trains entering and leaving the station at the same time
- Squeaking brakes
- Curvature of the tracks
- Air brakes, train horn
- Music in the station

INSIDE CARS:

- Express trains passing

STREET LEVEL:

- Emergency sirens
- Garbage trucks idling
- Buses stopping

PLATFORM LOCATION:

- The platform location with the highest mean noise level (87 dB) was the middle of the platform (X_1)
- The location with the lowest mean noise level (85 dB) was at front of the train (X_0)
- Peaks were greatest at the rear of the platform.
- The mean (upper quartile) for the rear of the platform was 102.4 dB

Conclusion

- Noise levels exceeded the OSHA limit for workers
- Highest noise levels were noted inside of cars (96dB)
- Street level noise was above acceptable levels
- Health effects of unacceptably high levels of noise have been shown to affect mental health, cardiovascular system, sleep, job performance, stress/workfatness (hormones)
- The adverse effects of a noise induced hearing loss is well established
- Recommendation:
 - Rides should use Personal Protective Equipment (PPE), worker PPE standards should be strictly reinforced.
 - Complete a simple risk assessment tool (i.e., Ten Ways To Recognize Hearing Loss, <http://www.nidcd.nih.gov/health/hearing/10ways.asp>), and;
 - Consult with an audiologist as needed.
- Organizational: sound muffling, sound absorbing, improved subway car and track maintenance
- For workers: assessment of risk through frequent formal audiological testing, environmental testing/monitoring and cumulative exposure assessment via dosimeters



Audience Questions

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