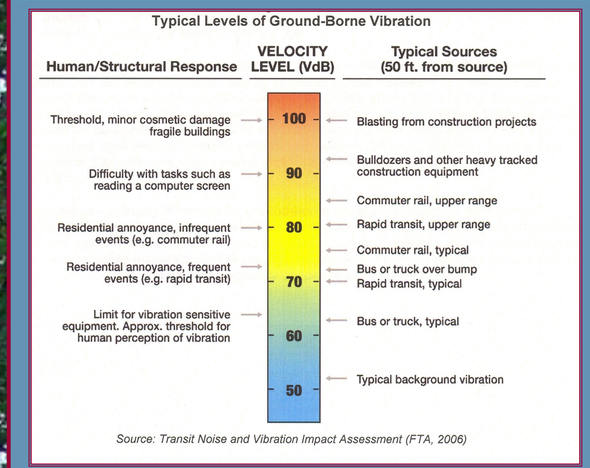
GROUND VIBRATIONS FROM CONSTRUCTION EQUIPMENT

Seismograph

THE RESEARCH:

NHDOT researchers developed a Construction Vibration Impact Assessment procedure to monitor the impact of construction-induced vibrations at project sites. The procedure enables assessments to be conducted for each type of vibration-producing activity anticipated during a project in relation to various types of structures and vibration-sensitive operations in the vicinity.



IMPLEMENTATION

As a result of the research, vibration assessments are conducted to compare different construction activities at the same site, or the potential impact of an activity at one site versus the same activity at another site. Data are collected, stored and tracked in a database which allows for development of preliminary cost estimates for vibration monitoring services and provides a resource for decision-making. Changes have been implemented in the 2010 Standard Specifications for Road and Bridge Construction under Section 211.

NON-BLASTING CONSTRUCTION ACTIVITIES INVESTIGATED

Vibratory Compaction
Excavation
Rock Splitting / Hoe-Ram
Sheet Pile Driving
Pavement Breaking
Demolition
Track Mounted Vehicles
Heavy Construction Traffic

CONSTRUCTION VIBRATION IMPACT ASSESSMENT

Category	1 Point	3 Points	9 Points	27 Points	81 Points
1 Type of Construction Equipment and Activity Energy Input from Activity	Hand tools Jack hammer Tampers Small plate compactors	Excavation with backhoe Heavy wheeled vehicles	Vibratory roller Tracked equipment on pavement Hoe ramming	Pile driving Pavement breaker	Dynamic compaction Drop ball
2 Attenuation (Decay) of Peak Particle Velocity (See Soil Density Table)	Very loose non-cohesive soil Very soft to soft cohesive soil	Loose non-cohesive soil Medium stiff cohesive soil	Medium dense non-cohesive soil Stiff cohesive soil	Dense non-cohesive soil Very stiff cohesive soil	Very dense non-cohesive soil Hard cohesive soil
3 Displacement Densification & Settlement at Structure (See Soil Density Table)	Very dense non-cohesive soil Hard cohesive soil Bedrock	Dense non-cohesive soil Very stiff cohesive soil	Medium dense non-cohesive soil Stiff cohesive soil	Loose or very loose unsaturated non-cohesive soil Medium stiff cohesive soil	Very loose saturated non-cohesive soil Very soft to soft-cohesive soil
4 Distance from Vibration Source	Over 100 feet (over 30 meters)	75—100 feet (23—30 meters)	50—75 feet (15—23 meters)	25—50 feet (7.5—15 meters)	25 feet or less (7.5 meters or less)
5 Type of Vibration	Single isolated event	Intermittent and random impact	Steady-state, continuous impact	Numerous multiple impacts	Continuous impact
6 Duration of Construction Activity	5 minutes or less	Longer than 5 minutes to 1 hour	Longer than 1 hour to one day	Longer than one day to one week	Longer than one week
7 Type of Structure	Reinforced concrete structure (i.e. bridge) Structures with deep foundation	Reinforced concrete structure with shallow foundation	Private residences or commercial structures with drywall	Private residences or commercial structures with plaster walls	Historic or fragile structures
8 Condition and Age of Structure	Excellent condition No visible cracks Less than 10 years old	Good condition Minor hairline cracks 10 to 20 years old	Fair condition Many cracks Constructed after 1950	Fair condition Many cracks Constructed prior to 1950	Poor condition Over 100 years old
9 Vibration Sensitive Equipment or Manufacturing Process	No vibration sensitive equipment or processes Private residence	Home office	Small business Bank or store with computers	Large business with sensitive equipment Dentist or doctor office	Medical research lab Hospital Highly sensitive manufacturing
10 Sensitivity of Population	Rural area with few single family residences	Urban area with multiple single family residences	Urban area with apartment house(s)	Business Store	Hospital Nursing home

Soil Apparent Density and Consistency Table

Non-Cohesive Soil		Cohesive Soil	
Apparent Density	Blows/foot	Consistency	Blows/ foot
Very Loose	0 to 4	Very Soft to Soft	0 to 4
Loose	5 to 10	Medium Stiff	5 to 8
Medium Dense	11 to 24	Stiff	9 to 15
Dense	25 to 50	Very Stiff	16 to 30
Very Dense	50+	Hard	30+

Construction Vibration Impact Table

Impact Assessment	Point Total	Correction Factor
High Impact	400 or greater	2.0
Moderate Impact	200 to 399	1.5
Low Impact	Less than 200	1.0

Blows/foot – Standard Penetration Test (SPT)
N-value (N_{60}) results shown on a test boring log
(Values not corrected for hammer type or overburden stress)

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New Hampshire DOT Department of Transportation
RESEARCH