Plenary Paper: Understanding and Complying with the New York City Construction Noise Regulation

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New York City updated its construction noise regulation, effective July 1st 2007, in response to public desire to improve the quality of life in the city. In 2002, Mayor Michael Bloomberg initiated the first overhaul of the City's noise code in 30 years. After an extensive inclusive process involving the public, advocates, and industry representatives, an equitable new noise code was developed. The City's Department of Environmental Protection (NYC DEP) assembled a team of construction noise experts to assist in researching currently available noise control methods, establishing meaningful noise criteria, setting requirements for contractors to follow, imposing the concept of 'cure periods', and establishing reasonable fines for non-compliance. After several years of consensus building the new construction noise regulation was ready. The new regulation emphasizes proactive avoidance of construction noise by requiring contractors to develop Noise Mitigation Plans. Guidelines are also provided for mitigating particularly loud construction devices such as pile drivers, hoe rams, concrete saws, vac-trucks, and jackhammers. In the five years since its implementation the regulation has proven itself to be an effective means of controlling construction noise in the city. Contractors and design engineers are aware of the regulation and its requirements, and DEP inspectors are enforcing the regulation in the field. The number of citywide construction noise complaints has markedly reduced, and the NYC regulation has been widely praised in the media, professional societies, and guidance manuals as an exemplary regulation. This paper will describe the regulation's development process, technical considerations, legal standing and political compromises that went into drafting and approving the New York City Construction Noise Regulation, and describe its effectiveness post-implementation.

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1. PURPOSE AND NEED

Honk – bang – whir – whiz – roar – ding – beep – chug – boom – rattle – hum – screech – boom. These are the familiar sounds of any densely populated city, especially to those living in New York City. To many these sounds are taken in stride as simply being an unavoidable and inescapable consequence of life in the city. But does this truly have to be the case?

Excessive noise exposure, especially in this case from construction activities, can interfere with people's enjoyment of their lives, create annoyance and confusion, disrupt necessary activities such as sleeping, hinder students from learning, reduce property values, and even manifest physically in the form of elevated blood pressure, gastro-intestinal problems, stress and anxiety. Indeed, according to a 2006 neighborhood survey (shown in **Figure 1**) of New York City inhabitants conducted by an independent citizen's action committee, respondents indicated that *noise* was their number one concern for their quality of life[1].

Statistically, noise has been the number one complaint to New York City's 311 citizen service hotline, which in recent years could average nearly 1,000 calls a day. In 2006 NYC DEP continued to receive nearly 5,000 noise complaints per month as its portion of the overall complaints received by the 311 hotline. Clearly something had to be done.

Starting in 2002, Mayor Michael Bloomberg announced a special initiative named *Operation Silent Night*. This was a quality-of-life initiative that targeted areas of the City affected by loud and excessive noise. On October 2nd, 2002, the Mayor said *"Operation Silent Night aims to effectively fight and control the loud, excessive noise that plagues too many neighborhoods throughout the five boroughs. This coordinated, multi-agency initiative will specifically target those locations where noise adversely affects our everyday lives so New Yorkers may live, work, and enjoy the City in peace."* He also explained that the Department of Environmental Protection will be working to update the City's noise code to reflect a new set of issues and to vigorously enforce the code in those communities most often plagued by excessive noise *"to make the code more specific and to make enforcement more effective."*

On December 21st, 2005, the mayor praised the unanimous City Council vote that led to the historic passage of the revision of the Noise Code**.** He went on to say, *"The new code will make New York City a quieter place to live and work by decreasing excessive and annoying noise. The new code will specifically decrease noise from construction sites, motorcycles, 'boom cars', air conditioners and nightclubs by strengthening standards and implementing commonsense solutions."* He praised the collaboration between the City, the construction and nightlife industries, neighborhood groups and the City Council. On December 29th, 2005, the mayor signed the legislation overhauling the noise code in the presence of NYC DEP Commissioner Emily Lloyd, Deputy Commissioner Robert Avaltroni, Air & Noise Permits Director Gerry Kelpin, Assistant Counsel Charles Shamoon and other key NYC DEP staff.

To accomplish this ambitious goal the City would need to update its 30 year old noise regulation and develop new guidelines specifically intended to reduce construction noise citywide. While seemingly an idea that would appeal widely, the initiative was not without its critics. Change is often difficult, and people can be resistant to change, even when the overall goal would be an improvement in people's lives. These concerns can be even further magnified when there might be economic consequences associated with complying with the new regulation.

The mayor assigned the task to the New York City Department of Environmental Protection (NYC DEP) to address the problem by updating the City's noise laws and developing source-specific mitigation solutions for construction equipment. The costs and consequences

associated with noise mitigation were to be carefully considered by NYC DEP as well, as were the potential impacts on contractors' and utilities' abilities to perform necessary work.

2. LEGAL OVERVIEW

On December 29th, 2005, Mayor Bloomberg signed Local Law 113 for the year 2005. The law amended the Administrative Code of the City of New York in relation to the Noise Control Code to provide a more practical and effective means of regulating construction noise. Specifically, the law established standards and procedures regarding construction noise management to reduce noise levels from construction, and established sound level criteria for specific noise sources. The law in section 24-219 of the Administrative Code also mandated the adoption of Rules prescribing noise mitigation strategies, methods, procedures and technologies that shall be used at construction sites whenever certain listed construction devices or activities set forth in the Rules are employed or performed.

The new regulation, which amends Title 15 of the Rules of the City of New York (RCNY) by adding a new **Chapter 28**, establishes (1) the requirement that contractors develop and implement Noise Mitigation Plans prior to performing construction work within the City, (2) describes acceptable work hours, (3) defines after-hour restrictions, (4) establishes construction equipment source emission noise limits, (5) provides guidelines for the use of noise mitigation barriers around work sites, and (6) describes concerns with particularly noisy construction equipment and provides examples of various equipment noise mitigation methods for the contractor to consider. The noise emission limits established in the new Rule apply to all generic types of construction equipment and are consistent with those found in the new Federal Highway Administration (FHWA) Guidelines[2]. NYC DEP will utilize the FHWA guidelines during complaint-based site inspections to determine which construction devices need further noise mitigation and will work with the contractor to achieve the improvement necessary.

Procedurally, upon receiving noise complaints from the public, NYC DEP noise inspectors will be dispatched to the site to review the contractor's Noise Mitigation Plan and to measure noise emissions from equipment on site. If a violation is found the contractor will be afforded a 'cure period' to achieve compliance. If the contractor does not feel that compliance is possible they can then file and seek approval of an Alternative Noise Plan within the spirit of the regulation to mitigate noise in a reasonable way.

The revised NYC DEP Noise Code and Construction Noise Regulation went into effect on **July 1st, 2007**.

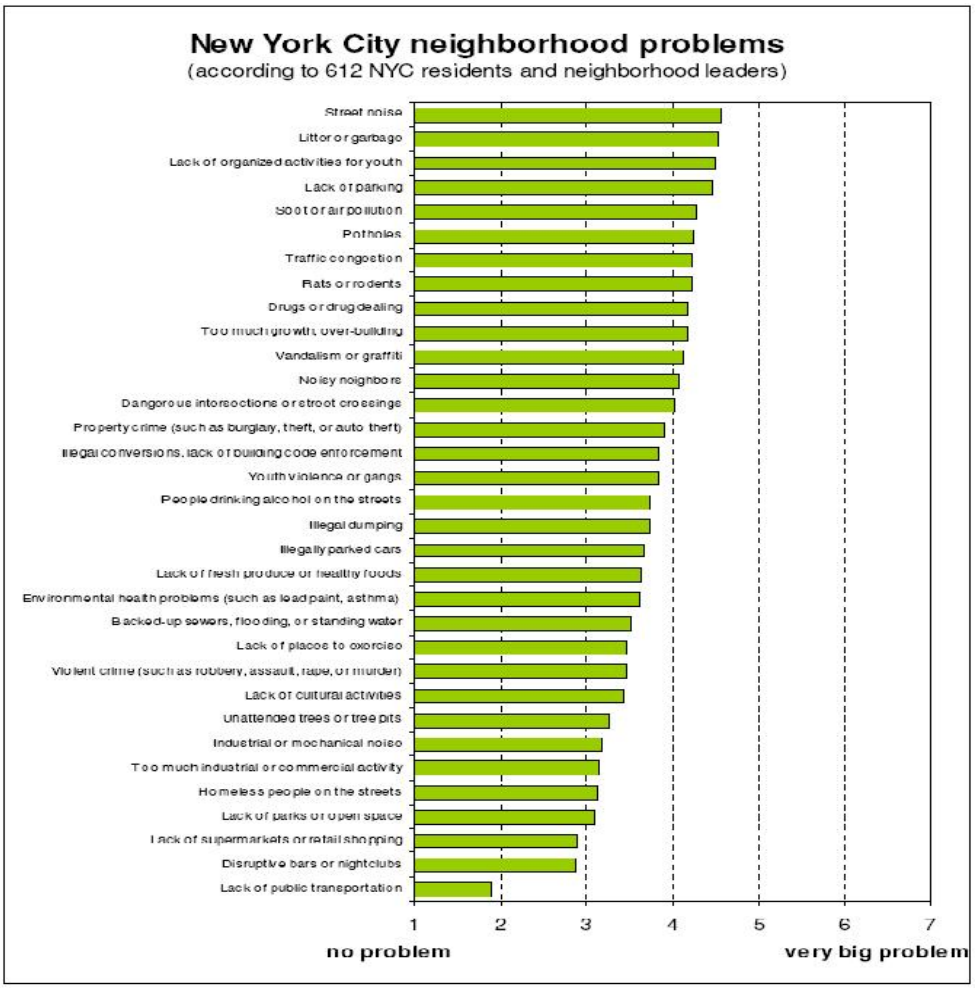

Figure 1: Summary Findings of Neighborhood Quality of Life Survey (Source: Citizens for NYC)

3. THE TEAM APPROACH

Collaboration was a key facet of the successful passage of the noise code legislation. NYC DEP conducted an all inclusive process. NYC DEP met with community boards and citywide advocates such as the League of the Hard of Hearing. The Department reached out to well-known experts in the noise mitigation field namely, Erich Thalheimer of Parsons Brinckerhoff (PB) and Eric Zwerling of Rutgers University. NYC DEP met with trade associations and leading business groups including the Real Estate Board, the Building Owners and Managers Group, the General Contractors Association, the Nightlife Association, the Restaurant Association, Heavy Equipment Contractors, Licensed Plumbers, Affordable Housing, Small Home Builders, and Unions. NYC DEP also included input from major City utilities including Keyspan, Verizon, Con Ed and Empire City Subway. The Department even went so far as to meet with food vendors such as Mr. Softie Ice Cream.

NYC DEP also met with its sister City agencies, especially those who where also involved in construction. NYC DEP met or consulted with the City Department of Design and

Construction, the Department of Transportation, the Department of Buildings, the Department of Health and Mental Hygiene, the Department of Consumer Affairs, the Department of Sanitation, and the Departments of City Planning and Small Business Services. Multiple meetings were held with these groups until they were satisfied with the draft regulation.

4. GOOD TIMING

The timing for updating New York City's construction noise regulation could not have been better. In nearby Boston, the Central Artery/Tunnel Project (The Big Dig) was nearing completion. Valuable, precedent setting lessons had been learned by Big Dig project staff from having successfully dealt with perpetual construction noise for well over a decade in a densely populated urban environment[3]. Concurrently, Federal Highway Administration (FHWA) was also updating their nearly 35 year old policy and prediction model regarding construction noise[2].

The FHWA team consisted of construction and noise mitigation experts who were synthesizing the lessons learned from dozens of construction projects nationwide. Indeed at the time, the subject of construction noise was getting more public attention and research focus by professional societies and industry experts[4]. With modern communications, networking and the Internet, residents and regulators alike were sharing their experiences managing construction noise from projects large and small.

NYC DEP arranged for several information presentations featuring noise engineers from the Big Dig to explain the strategies and methods with which their project dealt with construction noise. Attendees to these information sessions included members from the General Contractors Association (GCA) and NYC DEP's sister construction agencies including the Department of Design and Construction and the Department of Transportation.

5. REGULATION STRATEGY

The new regulation's overall strategy is to *proactively avoid* as much construction noise as possible, yet retain NYC DEP's ability to *react and enforce* the new rules in the event construction noise conditions warranted. However, as with all legislation, there must be room for compromise because construction operations must be allowed to continue for the growth and betterment of the City. It was equally important to avoid causing an undue economic burden for contractors so that they would be more willing to implement and adhere to the new regulation.

For these reasons NYC DEP carefully crafted the new regulation to ensure that the required noise mitigation measures were both reasonable and feasible. In these regards the lessons learned from other large construction projects were particularly useful. Specific noise mitigation rules were developed for each generic type of noisy construction equipment based on mitigation methods that had proven to be effective on these other projects. In this manner contractors could not argue the feasibility aspects of the regulation. However, the reasonability (i.e. cost) issue remained a prime concern as NYC DEP continued to work in close coordination with potentially affected contractors and utilities.

6. REGULATION SPECIFICS

The regulation governs how contractors will need to implement plans and take actions to reduce construction noise. Specific requirements contained in the regulation are as follows:

A. Noise Mitigation Plan

- Contractors will need to develop, and post conspicuously for inspection and review, a suitable Noise Mitigation Plan detailing the steps and mitigation measures they will use to control construction noise. NYC DEP will allow for Alternative Noise Mitigation Plans and Utility Noise Mitigation Plans for special purposes.

B. Required General Noise Mitigation Measures

- Contractors will certify that all the equipment used on site will comply with noise emission limits (see **Table 1**) recently promulgated by FHWA[2] in which specific Lmax limits in dBA,slow at 50 feet are provided for generic types of equipment. If noise complaints are received, NYC DEP inspectors will measure and evaluate noise emissions from the contractor's equipment to ensure compliance with the FHWA guidelines. If necessary NYC DEP will allow a 'cure period' for the contractor to comply.
- All devices must be equipped with appropriate mufflers and silencers.
- Housing doors on equipment will be shut during operations, and the equipment will operate at the lowest possible power level.
- Portable small equipment, such as generators, pumps, and compressors, will be covered with a noise enclosure.
- New construction vehicles, as of model year 2008, will be outfitted with quieter-type manually-adjustable or automatically-adjustable backup alarms.
- A 15-foot tall noise barrier or curtain system will be used around the perimeter of the job site when the site is within 200 feet of a receptor. The contractor will need to ensure that the barriers are free of any gaps and are well maintained to be effective.
- The contractor will ensure that laborers in the field have been trained with respect to the new regulation and to minimize noise emissions while working on the job site.
- The contractor will coordinate and cooperate with nearby noise sensitive receptors in an effort to avoid as much disturbance as possible.
- Normal hours for construction will be 7:00 AM to 6:00 PM. The contractor will be able to work during after-hours providing that NYC DEP concurs with the contractor's Noise Mitigation Plan for after-hours operations.

C. Construction Devices and Activities

- Specific noise mitigation requirements and suggested additional mitigation options are provided for five general categories of particularly noisy construction equipment, including:
    - Impact Devices – e.g. pile drivers, jackhammers, hoe rams, and blasting
    - Earth Moving Equipment – e.g. vacuum excavators
    - Trucks and Vehicles – e.g. dump trucks
    - Stationary Equipment – e.g. cranes, auger drill rigs, street plates, backup alarms
    - Manually Operated Equipment – e.g. concrete saws

D. Perimeter Barriers, Temporary Barriers, and Noise Curtains

- Noise barriers or curtain systems will be required around the perimeter of work sites when working within 200 feet of a receptor. Barriers/curtains must be made of noise-resistant material sufficient to achieve a Sound Transmission Class (STC) rating of STC 30 or greater, break the line-of-sight between the noise source(s) and the receptor(s), and be erected to a height of at least 15 feet tall. Barriers/curtains can be made of any suitable material such as wood, plastic, Plexiglas, concrete, steel or earthen berms. Other materials and designs will be acceptable as well (See **Photos 1 and 2**).
- Portable 'noise tents' made from vinyl noise curtain material attached to three sides and the top of a metal frame will be used to form an enclosure to cover small noisy equipment and/or activities such as jackhammers (See **Photos 3 and 4**).

Table 1: NYC DEP Noise Regulation Equipment Noise Criteria (Taken from FHWA Roadway Construction Noise Model[2], RCNM, 2006)

Equipment Description	Lmax Noise Limit at 50 ft, dBA, slow	Equipment Description	Lmax Noise Limit at 50 ft, dBA, slow
All other equipment > 5 HP	85	-- continued --	-- continued --
Auger Drill Rig	85	Grader	85
Backhoe	80	Horizontal Boring Hydraulic Jack	80
Bar Bender	80	Hydra Break Ram	90
Blasting	94	Impact Pile Driver (diesel or drop)	95
Boring Jack Power Unit	80	Insitu Soil Sampling Rig	84
Chain Saw	85	Jackhammer	85
Clam Shovel	93	Mounted Impact Hammer (hoe ram)	90
Compactor (ground)	80	Paver	85
Compressor (air)	80	Pickup Truck	55
Concrete Batch Plant	83	Pneumatic Tools	85
Concrete Mixer Truck	85	Pumps	77
Concrete Pump	82	Rock Drill	85
Concrete Saw	90	Scraper	85
Crane (mobile or stationary)	85	Slurry Plant	78
Dozer	85	Slurry Trenching Machine	82
Dump Truck	84	Soil Mix Drill Rig	80
Excavator	85	Tractor	84
Flat Bed Truck	84	Vacuum Excavator (vac-truck)	85
Front End Loader	80	Vacuum Street Sweeper	80
Generator (25 KVA or less)	70	Vibratory Concrete Mixer	80
Generator (more than 25 KVA)	82	Vibratory Pile Driver	95
Gradall	85	Welder	73

Photo 1. Plywood Barriers on Jersey Bases

Photo 2. Trailers as Noise Barrier

Photo 3. Noise Curtain Material

Photo 4. Noise Tent Enclosure

7. POINTS OF CLARIFICATION

Understandably, several questions have come to NYC DEP's attention with regard to implementation, interpretation and enforcement of the construction noise regulation. Questions are best addressed directly to Charles Shamoon (718-595-6546 or CharlesSh@dep.nyc.gov). Several of the more commonly asked questions are summarized in **Table 2** along with their answers for clarification.

Table 2. Common Questions and Answers

Question	Answer

What triggers NYC DEP to inspect or investigate noise from a construction site?	Noise Complaints - NYC DEP inspectors will respond to noise complaints and can order work stopped and/or initiate fine process.
Does the regulation apply to Federal and State projects, and other NYC agencies and utilities as well?	Yes, but Federal and State projects can claim exemption so an agreement to voluntarily comply is typically established.
Which 50-foot equipment noise limits contained in the regulation are the real limits, "Spec" or "Actual"?	Use the Spec limits - the Actual figures are provided for modeling and to show achievability.
Do all Noise Mitigation Plans need to be filed with, and approved by, NYC DEP?	No. Routine (daytime) noise mitigation plans do not need to be filed, but "after hours" (nighttime) or hardship alternative mitigation plans must be.
Are there additional construction noise limits contained in NYC's general noise code as well?	Yes. More details are provided about after hours work and Alternative Mitigation Plans. Noise should not exceed Ambient + 8 dBA Lmax when measured inside residences.

8. DEPARTMENT SUPPORT

It was not NYC DEP's intent to create unreasonable restrictions or to cause undue burdens for contractors. In fact NYC DEP was very careful to ensure that contractors and their representative groups were included in crafting the new regulation from the very beginning. While not every concern or objection could be resolved to their satisfaction, NYC DEP did reply to every comment received by these concerned parties. In most cases the Department's replies to the contractors included providing specific examples of how their mitigation concerns had been successfully overcome on other projects nationwide.

One example of NYC DEP's attempts to support contractors involves the use of readily available materials to act as noise barriers. As shown in **Photo 5**, typical shipping containers (Conex Boxes) were recommended by NYC DEP to a contractor working in the Bronx for use as a noise barrier while building a new water treatment plant. The work involved extensive rock drilling and pile driving. Shipping containers measure 20 feet long x 8 feet deep x 8 feet tall, so a 16 foot tall noise barrier can easily be made by double-stacking the boxes. Gaps between the boxes were filled with noise curtain material similar to the kind shown in **Photo 3**.

Another example involves NYC DEP's support and encouragement of a vendor to develop a prototype jackhammer muffler, as shown in **Photo 6**. In this case the muffler, made of a heavy vinyl cylindrical material with a special rubber collar around the bit, was tested by NYC DEP staff and was found to reduce noise emissions from various full-sized jackhammers by as much as 9 decibels. Interestingly, in this case the unmitigated jackhammer would have failed NYC DEP's new noise emission criterion of 85 dBA Lmax at 50 feet (see **Table 1**), but would have passed it with use of the new muffler.

Yet another example involves a *Noise Control Products & Vendor Guidance Sheet* which was prepared by NYC DEP to give to contractors to aid them in finding and selecting quieter-type equipment and materials for their job sites. It is important to note that contractors can use

any equipment they wish in New York City providing they comply with the equipment noise emission limits contained in the regulation; the guidance sheet does not represent an "approved" list of equipment. The guidance sheet was synthesized from confidential noise emission data provided by multiple equipment manufacturers. Only noise data that was collected via certified test methods, such as SAE J88 and J1805, EU 88/EC and 14/EC, ISO Standards 3744, 4872, 6395 and 2151, and ANSI Standards S12.23 and S12-51-57 were used in these comparisons.

An interesting consequence of having developed and published the *Noise Control Products & Vendor Guidance Sheet* is that heavy equipment manufacturers have expressed interest to be included on the list. There is clearly a perceived competitive advantage for them to be included on the list. The procedure for equipment to be considered for inclusion is fairly simple:

1. Have the equipment Lw or Lp determined in accordance with an accepted standard
2. Submit results to Charles Shamoon (NYC DEP) or Erich Thalheimer (PB)
3. The noise data will be rank ordered by Lw or Lp for similar equipment categories
4. The quietest several models will be featured on the Products & Vendor Guidance List

Photo 5. Conex Boxes as Noise Barrier

Photo 6. Prototype Jackhammer Muffler

9. POST-IMPLIMENTATION

So how effective has the new construction noise regulation been since becoming effective nearly five years ago? In brief, the new regulation has been widely praised within the media, professional societies and acoustical manuals. Media attention has been remarkable including scores of newspaper articles, television and radio announcements from all over the U.S. and places as far away as Britain, Canada, Israel, Russia, India, China and Australia.

While there are no noise measurement data upon which to draw any comparison before versus after the regulation went into effect, one measure to evaluate its effectiveness can be found in the number of noise complaints received by the City's 311 hotline. As shown in **Figure 2**, the number of construction noise complaints was rising rapidly through the early half of the last decade, reaching a maximum of approximately 25,500 complaints in 2007. In the years since the regulation was implemented in July 2007 the number of construction noise complaints has steadily decreased. There were 9% fewer complaints in 2008, 35% fewer complaints in 2009, and ***44% fewer construction noise complaints*** in 2010 relative to those received in 2007.

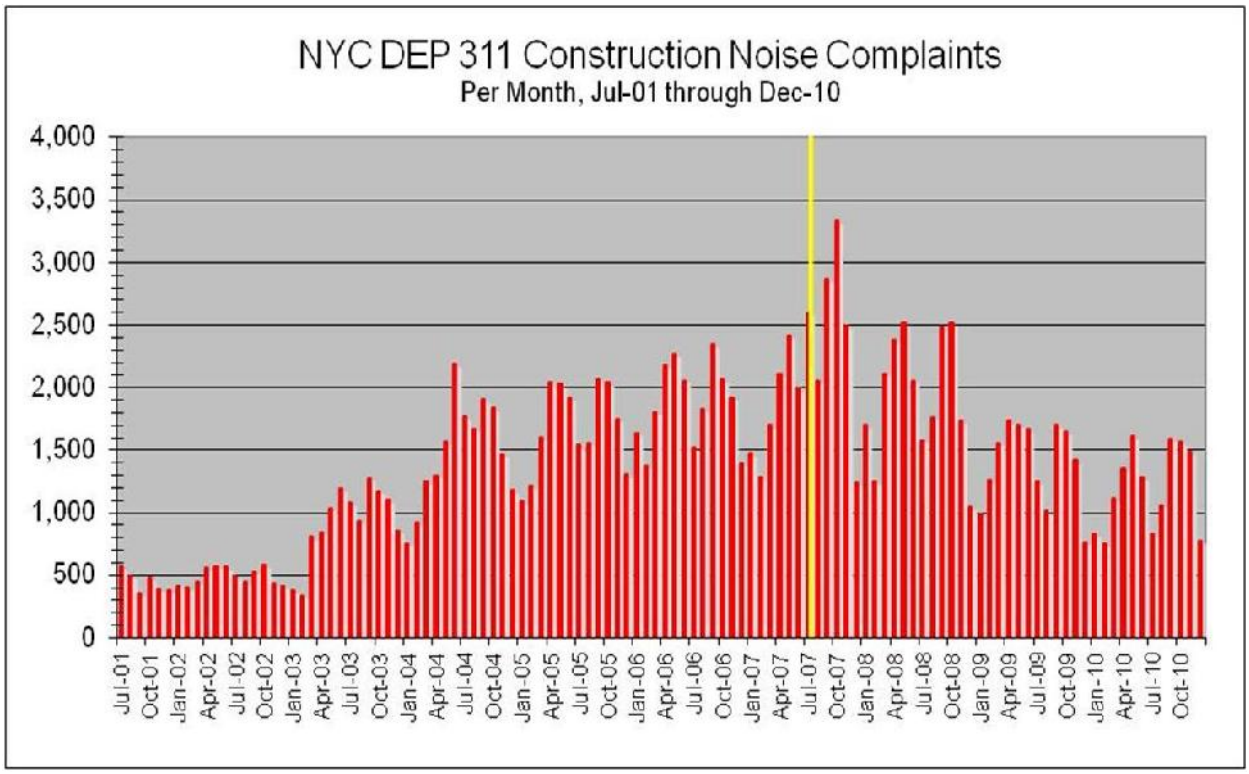

Figure 2. Construction Noise Complaints Before vs After Rule Implementation

10. PROMOTIONAL EFFORTS

NYC DEP has attempted to inform the public of the needs and requirements to comply with the construction noise regulation. The new regulation was mailed to likely interested parties such as general contractors, design and construction engineering firms, and architects. A dedicated page of NYC DEP's website was also established to provide and promote the regulation, which can be found at http://www.nyc.gov/html/dep/html/noise/index.shtml. And NYC DEP staff have participated and presented at numerous professional conferences including NoiseCon 2007[6], NHCA Workshop 2009, NIOSH Buy Quiet Workshop 2011, and now InterNoise 2012. And recently, due to strong interest, the NYC DEP construction noise regulation was presented live to attendees and via on-line webinar to construction professionals through the ACEC New York Chapter.

The NYC DEP construction noise regulation was also recently praised in the new comprehensive guidance document, *Technology for a Quieter America*, published by the National Academy of Engineering[7]. The regulation is described as being an exemplary attempt to manage construction noise in a large urban setting, as follows,*"…the [NYC DEP] law is a good starting point for upgrading existing laws or creating new ones."*

The NYC DEP regulation has also won several independent awards including:

- **2009 ACEC Silver Award** from the American Council of Engineering Companies
- **2010 Safe-In-Sound Award** from the National Hearing Conservation Association

11. LESSONS LEARNED

The NYC DEP construction noise regulation is very likely the most sweeping and grandest effort to date of any municipality trying to combat and control this challenge. It is therefore useful to review the lessons learned to date since the regulation went into effect back in July 2007. It is hoped that these lessons can pave the way for other municipalities to benefit from the experiences in New York City as they develop their own similar regulations.

1. First and foremost, *construction noise can be regulated*! There is no excuse to simply accept construction noise as an unfortunate necessity. A well framed regulation can balance the needs for construction to proceed with the needs of the community for peace and quiet.

2. Noise regulations require early *legislative cooperation*. It must be clearly defined which agency has jurisdiction to develop and enforce the regulation so that inter-department authority concerns can be minimized.

3. Extensive *dialog and consensus building* are essential. The lead agency should reach out and include as many potentially affected parties as possible. This might include legislators, contractors, builders, trade unions, professional societies, enforcement officials, and other municipal agencies and departments.

4. The regulations must be *technically correct and defensible*. Contractors will be held accountable to noise limits and restrictions contained in the regulations, therefore the regulation must be technical correct to insure fair and unambiguous enforcement. Also, no regulation can satisfy everyone, so there will undoubtedly be legal challenges to it.

5. An effective noise regulation must provide for *proactive avoidance with reactive ability*. The best form of noise control is to avoid producing the noise in the first place. This can be accomplished through carefully considered Noise Control Plans. However, regulations are only as effective as their enforcement, so the lead agency must be empowered, staffed and trained on how to properly enforce the regulations in the field.

6. There are *benefits to the community and laborers* alike. The NYC DEP construction noise regulation was developed in order to reduce noise in the community, however it is clear that quieter work practices, quieter equipment, and more conscientious job site conditions will reduce noise exposure for the laborers as well.

7. The noise regulation *has not hindered construction*. Noise regulations have a direct effect on the means, methods, schedule and costs that contractors use to build projects, so there was significant concern from the onset that this regulation should not adversely interfere with or hinder construction. Fortunately, NYC DEP has no evidence to date indicating this concern ever materialized.

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