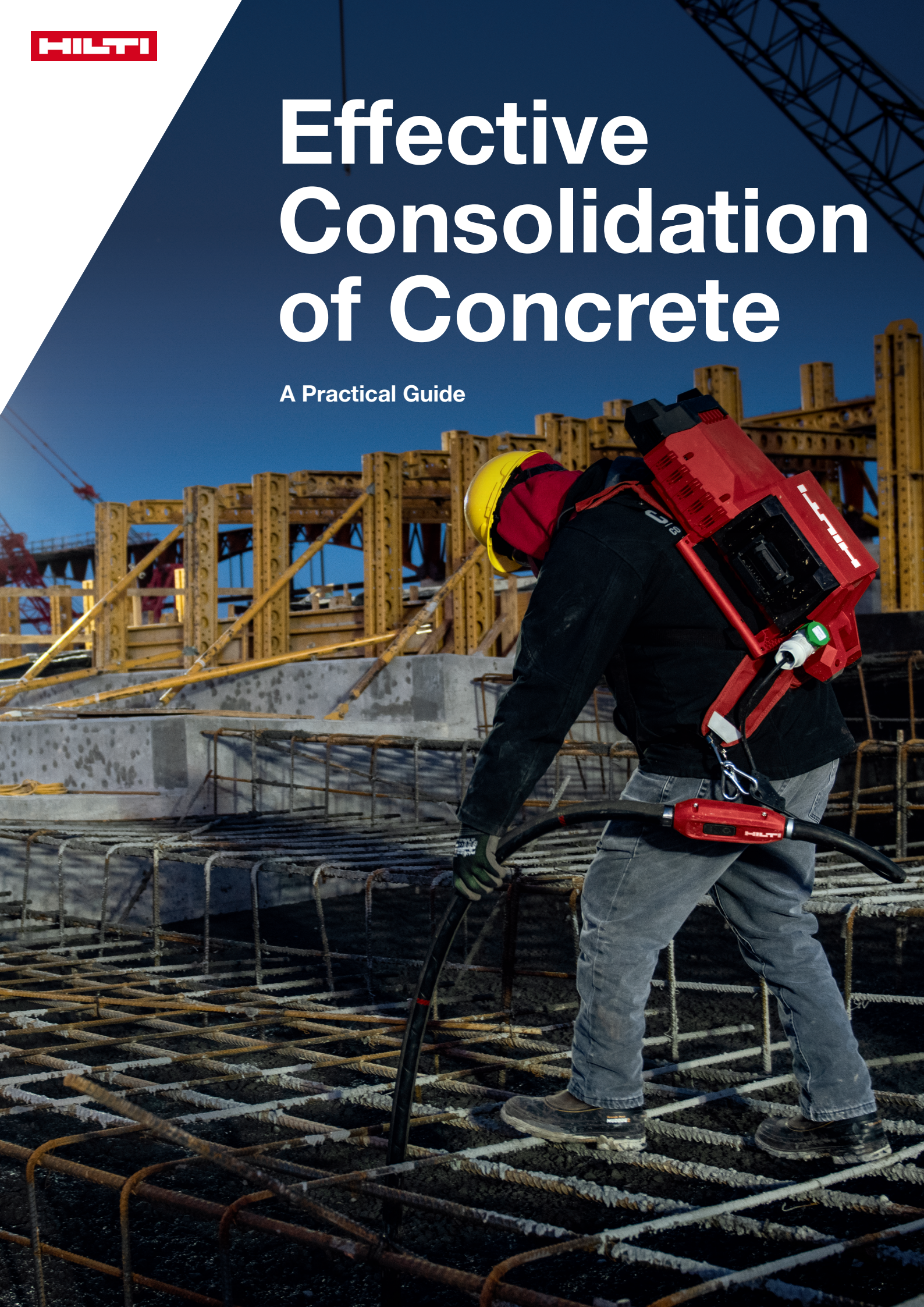
Effective Consolidation of Concrete

A Practical Guide



Introduction

Concrete consolidation is a critical process in the construction industry, crucial for producing high-quality concrete structures. This process involves the removal of entrapped air from freshly placed concrete, primarily through vibration. The effectiveness of consolidation depends significantly on the method and tools used, which directly impacts the concrete's strength, durability, and appearance.[1]

Importance of Concrete Consolidation

Properly consolidated concrete not only enhances structural integrity but also helps ensure uniformity and strength. Without adequate vibration, concrete can harden with a honeycomb-like structure, leading to weaknesses, increased porosity, poor bonding with reinforcement materials, and an unattractive finish. Therefore, ensuring thorough vibration is essential to attain the desired properties of concrete, which are synonymous with robust and durable construction.

Source: [1] ACI 309R-96 Guide for Consolidation of Concrete

Current Practices and Their Challenges

Modern consolidation practices often involve gas and corded mechanical solutions, each presenting distinct challenges. Gas-powered tools are known to cause user fatigue due to poor weight distribution, they emit fumes, can be unreliable, and are generally loud, leading to a more uncomfortable work environment. Corded solutions pose trip hazards, are heavy, typically require two people to operate effectively, and are also loud.

Motor-in-head Solution

Hilti's cordless high-cycle, motor-in-head concrete vibrators help enable higher battery life and improved ergonomics, allowing for more productivity and safety on the jobsite. Our motor-in-head technology not only helps minimizes the strain on the user's back, it reduces vibration felt on the hands and body, and has less drop-off vibration when submersed into concrete versus flex shaft systems.

For tighter spaces or smaller pours, the NCV 4-22 Compact cordless concrete vibrator offers convenience and power, compatible with the Nuron 22V battery platform for seamless transition between tools, promoting a safer, more efficient jobsite.

How to Properly Vibrate Concrete

Proper vibration of concrete involves several best practices. It's crucial to note that when dealing with walls and deep columns, simply inserting the vibrator and expecting it to do the job adequately is a common misconception. Therefore, proper vibration entails several key steps. The concrete should be placed in layers not exceeding 20 inches in depth, compatible with the length of the vibrator head. The vibrator should be inserted vertically at uniform spacing to ensure thorough coverage without causing segregation. Operators must be well-trained to determine the appropriate vibration time and spacing for effective consolidation.[1]

NCV 10-22 Cordless Concrete Vibrator Technical Data

The effectiveness of an internal vibrator is primarily dependent on the head diameter, frequency (VPM), and amplitude, and centrifugal force. Hilti's NCV 10-22 meets all ACI specifications for properly consolidated concrete.

	Diameter of Head (in) 1.5			Diameter of Head (in) 1.75			Diameter of Head (in) 2.25		
	ACI Specifiations	Hilti NCV 10-22	Meets ACI Specs	ACI Specifiations	Hilti NCV 10-22	Meets ACI Specs	ACI Specifiations	Hilti NCV 10-22	Meets ACI Specs
Frequency / Vibration (vpm)	9,000-15,000	10,500-12,000	✓	8,500-12,500	10,500-12,000	✓	8,500-12,500	10,500-12,000	✓
Eccentric Moment (in* lb)	0.03-0.10	0.07	✓	0.08-0.25	0.12	✓	0.08-0.25	0.23	✓
Average Amplitude (in)	0.015-0.03	0.02	✓	0.02-0.04	0.03	✓	0.02-0.04	0.03	✓
Min. Centrifugal Force (lb)	100	204	✓	300	388	✓	300	714	✓
Max. Centrifugal Force (lb)	400	266	✓	300	506	✓	300	932	✓
Radius of Action (in)	3-6	4.5-7.5	✓	5-10	5.4-9	✓	5-10	6.9-11.5	✓

Source: [1] ACI 309R-96 Guide for Consolidation of Concrete

Best Whip for the Job

Hilti offers a wide selection of whips to fit a wide range of concrete vibration needs.

	Basic information			Key applications							Item information	
	Head diameter	Whip length	Weight	Deck and flatwork	Shallow footings	Deep footings	Curbs	Walls and columns	Concrete yards – small elements	Concrete yards – large elements	Item name	Item no.
IP 67 classification – Protection against short periods of immersion while under pressure												
Motor in head/high frequency concrete vibrating whips for NCV 10-22	1 ½" / 38 mm	5 ft. / 1.5 m	9.5 lb / 4.3 kg	■	■		■		■	■	NCV 38 × 1500-1.5 × 5	2363254
	1 ½" / 38 mm	10 ft. / 3 m	11.7 lb / 5.3 kg	■	■		■		■	■	NCV 38 × 3000-1.5 × 10	2363255
	1 ½" / 38 mm	16 ft. / 5 m	14.8 lb / 6.7 kg	■	■		■	■	■	■	NCV 38 × 5000-1.5 × 16	2363256
	1 ¾" / 45 mm	5 ft. / 1.5 m	12.1 lb / 5.5 kg	■	■		■		■	■	NCV 45 × 1500-1.75 × 5	2363257
	1 ¾" / 45 mm	10 ft. / 3 m	14.3 lb / 6.5 kg	■	■	■	■	■	■	■	NCV 45 × 3000-1.75 × 10	2363258
	1 ¾" / 45 mm	16 ft. / 5 m	17.4 lb / 7.9 kg	■	■	■	■	■	■	■	NCV 45 × 5000-1.75 × 16	2363259
	2 ¼" / 58 mm	5 ft. / 1.5 m	17.9 lb / 8.1 kg	■	■	■	■		■	■	NCV 58 × 1500-2.25 × 5	2352701
	2 ¼" / 58 mm	10 ft. / 3 m	21.4 lb / 9.7 kg	■	■	■	■	■	■	■	NCV 58 × 3000-2.25 × 10	2352702
	2 ¼" / 58 mm	16 ft. / 5 m	26.2 lb / 11.9 kg	■	■	■	■	■	■	■	NCV 58 × 5000-2.25 × 16	2352703

■ recommended ■ use possible □ not recommended

Summary Points

Proper concrete consolidation is essential for constructing durable and aesthetically pleasing concrete structures. Current practices using gas and corded vibration equipment face several issues that can affect the health and efficiency of workers. Motor-in-head vibrators offer improvements in ergonomics, power efficiency, and battery life. Choosing the right equipment and employing correct vibration techniques are crucial for optimal concrete consolidation. By selecting the appropriate equipment, the construction industry can achieve superior concrete consolidation outcomes.

Boost your Productivity

Hilti's cordless concrete vibrators help elevate safety standards on construction sites by reducing the risks associated with gas-powered tools and tangled electric cords. This cordless design reduces trip hazards for a safer workspace.

Boosting Productivity on Site

The days of searching for gas refills or power outlets are over. Our concrete vibrators are designed for maximum uptime for increased productivity. You can move freely, focusing on the task without interruption, so jobs can be completed faster with less hassle.

Reducing Physical Strain

The smart design of Hilti concrete vibrators, featuring whips that direct vibration away from the operator, helps minimize physical strain. This focus on operator comfort helps reduce fatigue and long-term health issues, making concrete consolidation a less daunting task.

The NCV 10-22 Battery-powered concrete vibrator offers:

Power-packed performance.
No compromise on the power, our concrete vibrators can go head-to-head with corded and gas models.

Goes the distance.
Battery endurance to take you through the day—minimize downtime.

Designed for builders.
Every Hilti tool is crafted with the user in mind—smart design, balance, and less vibration means longer work with less fatigue.

Clean air, clear head.
Zero emissions mean a healthier workspace.

Instant on.
No pull starts, no warm-up times, just press and go to speed up tasks without compromising on quality.

One system for all.
Part of Nuron's 22V battery platform—swap, click, and power a range of tools.

Built tough.
Ready for tough jobsite conditions, with quality and durability that's pure Hilti.

WHD • 04/24

Click to discover more about the NCV 10-22 or request a demo.

Sources

1. **ACI 309R-96 Guide for Consolidation of Concrete:** https://www.concrete.org/publications