Use of Hydrodemolition for Concrete Removal in Unbonded Post-Tensioned Systems

Keywords: demolition; hydrodemolition; post-tensioning; repair.

Question
Should hydrodemolition be used to remove concrete when unbonded post-tensioned systems are exposed in the removal process?

Answer
Hydrodemolition is not recommended for concrete removal if there is a possibility that unbonded post-tensioned systems are within the concrete removal zone. Currently, the only viable method of concrete removal in this situation is concrete chipping using lightweight jackhammers or needle scalers.

Discussion
Hydrodemolition is one of many methods available for concrete removal on horizontal, vertical, and overhead surfaces. This technique uses very high-pressure water (20,000 to 40,000 psi [140 to 280 MPa]) to remove concrete. Hydrodemolition has some advantages over other methods, including speed. Based on available evidence,\textsuperscript{1,2} it does not cause significant microcracking or bruising of the concrete substrate, and it provides a good surface with partially exposed aggregate for amplitude usually in excess of 1/4 in. (6 mm) to bond new concrete on.

Although hydrodemolition will not physically damage steel tendons, it is not considered to be a viable concrete removal technique if there is a possibility of the high-pressure water coming into contact with tendons, anchorages, or both. Reasons that hydrodemolition is not considered to be a viable technique include:

- Hydrodemolition of post-tensioned concrete elements may cause a safety problem. It is potentially dangerous because it may accidentally undercut embedded anchors and result in explosive release of prestressing force;
- If any part of the tendon is exposed to high water pressure, water may penetrate into the tendon. The water jets will likely destroy the sheathing on the tendons, whether it is wrapped in paper, plastic, tubing, or extruded plastic. If the sheathing is damaged, the water has a direct path to the prestressing strand or wire, and corrosion may result; and
- Concrete repair projects commonly include replacement of post-tensioning strand. The water pressure used in hydrodemolition equipment can force slurry into the sheathing. When slurry and other debris exist within the sheathing, installation of a new strand becomes very difficult. When the new strand is pushed into the existing sheathing, debris within the sheathing builds up ahead of the advancing strand. This buildup of debris can cause the sheathing to rip and “ball up” in front of the leading edge of the strand. This scenario makes strand replacement very difficult and compromises the corrosion protection or sheathing over the prestressing steel.

More information can be found in ACI 423.4R.\textsuperscript{3}

Summary
During concrete removal around reinforcement, including unbonded post-tensioned systems, potential collateral damage to the repaired structure must be considered relative to future performance. Consequently, selection of the appropriate method of concrete removal is crucial. Hydrodemolition is not recommended for concrete removal if there is a possibility that unbonded post-tensioned systems are within the concrete removal zone.

References

Referenced Standards and Reports

Reported by ACI Committee 364

Fred R. Goodwin  
Chair

Majorie M. Lynch  
Secretary

Randall M. Beard  

John L. Hausfeld  

James E. McDonald
Benoit Bissonnette  

Ron Heffron  

William R. Nash
Christopher D. Brown  

Robert L. Henry  

Jay H. Paul
Douglas Burke  

Kal R. Indo  

K. Nam Shiu
Ryan Alexander Carris  

Charles J. Hookham  

Thomas E. Spencer
Benoit Bissonnette  

Ashok M. Kakade  

John A. Tanner
Brian Lee Cope  

James M. Kasper  

Valery Tokar
Boris Dragunsky  

Emory L. Kemp  

David A. VanOcker
Peter H. Emmons  

Keith E. Kesner  

Alexander M. Vaysbursd
Paul E. Gaudette  

Erick N. Larson  

Kurt F. von Fay
Timothy R. W. Gillespie  

John S. Lund  

James Warner
Zareh B. Gregorian  

Pritpal S. Mangat  

David W. Whitmore
Pawan R. Gupta  

Surendra K. Manjrekar

Consulting members

Robert V. Gevecker  

Dela Tharmabala
Stephen A. Johanson  

Robert Tracy
Howard H. Newlon Jr.  

William F. Wescott
Weilan Song

ACI TechNotes are intended for reference for the design and construction of concrete structures. This document is intended for the use of individuals who are competent to evaluate the significance and limitations of its content and who will accept responsibility for the application of the information it contains. The American Concrete Institute disclaims any and all responsibility for the accuracy of the content and shall not be liable for any loss or damage arising therefrom. Reference to this document shall not be made in contract documents.

ACI 364.7T-02 was adopted and published May 2002.

Copyright © 2002, American Concrete Institute.

All rights reserved including the rights of reproduction and use in any form or by any means, including the making of copies by any photo process, or by electronic or mechanical device, printed, written, or oral, or recording for sound or visual reproduction or for use in any knowledge or retrieval system or device, unless permission in writing is obtained from the copyright proprietors.

For additional copies, please contact:
American Concrete Institute, 38800 Country Club Drive, Farmington Hills, MI 48331
Phone: 248-848-3700, Fax: 348-848-3701,
www.concrete.org