The State of the Concrete Repair Industry, and a Vision for its Future

By Peter H. Emmons and Douglas J. Sordyl

The concrete repair, protection, and strengthening industry is driven by deterioration of, damage to, and defects in concrete structures along with changes in use and code requirements. Over 500 million yd^3 of concrete are placed every year in the U.S. Much of the concrete is custom-made for almost every job, using local materials of varying quality, some designs that are not standard, and accelerated construction processes that sometimes sacrifice quality in the interest of meeting a schedule. The annual cost to owners for repair, protection, and strengthening is estimated between $18 to $21 billion in the U.S. alone. The result is a repair industry that supports engineers, architects, equipment suppliers, material manufacturers, researchers, educators, testing companies, contractors, and lawyers. The explosive growth of the industry in the past 25 years has resulted in the need for many improvements in materials, design practices, installation procedures, contracting processes, QA/QC procedures, education, and more. These improvements are needed to improve service life and reduce costs and conflicts.

Cost of Repair, Protection, and Strengthening of Concrete in the U.S.

In the U.S., we consume over 100 million metric tons of cement, with a large portion being used for the production of concrete. It is estimated that over 500 million yd^3[*] of concrete (almost 2 yd^3 per person) are installed each year to support the U.S. infrastructure. The volume of in-place concrete is estimated at 9 billion yd^3[†] (32 yd^3 per person). Most of this concrete is older than 20 years. Concrete, even if exposed to freezing-and-thawing cycles, carbonation, chlorides, and other aggressive chemicals, can have a useful life of 50 years or longer. More recent developments in the use of low-permeability concrete mixtures, proper use of air entrainment, epoxy-coated reinforcement, protective coatings, and corrosion-reducing admixtures have greatly increased the service life of concrete structures beyond 30 years. However, some concrete structures being built today may require repairs after as few as 5 years of service. The original design and construction of these structures did not take advantage of these technologies, instead often emphasizing low first cost. More efficient designs may be less tolerant of workmanship and design errors, and fast-track construction methods may make it more difficult to incorporate the quality needed for a long service life. As a result, some new structures, in spite of durability enhancements, undergo early-age deterioration and require repair (Table 1.3). Likewise, repairs intended to extend the service life of structures often fail prematurely due to the improper use of repair materials.

It is estimated that the total cost for repair, rehabilitation, strengthening, and protection (including waterproofing) of the concrete structures in the U.S. is $18 to $21 billion a year (Table 1.3). Assuming there are 9 billion yd^3 of concrete in these structures, the annual cost is between $2.00 and $2.33 per yd^3 of in-place concrete.

A UNIFIED INDUSTRY VISION

What is Vision 2020?

In 2004, concrete repair industry leaders came together to develop an industry-wide strategic plan (Vision 2020). The Strategic Development Council (SDC), an inter-industry development group dedicated to supporting the concrete industry's strategic needs, facilitated Vision 2020 at the request of the concrete repair and protection industry.

The purpose of Vision 2020 was to establish a set of goals to improve the efficiency, safety, and quality of concrete repair and protection activities. By focusing on the most important industry goals, it is hoped that the repair industry will achieve these goals faster than if the industry is left to evolve on its own. The focus on goals for repair is also related to the major issue of sustainability, because extending the useful life of existing installations is a key factor in producing a sustainable environment. Over 100 industry leaders, including contractors, engineers, material manufacturers, researchers, educators, owners, and industry association executives participated in focused workshops to define the most

[*]PCA reports 75% of concrete is ready mixed concrete.

[†]PCA reports cement and concrete usage from 1930. This is the basis for estimating that 15 billion yd^3 were placed since then. The 9 billion yd^3 estimate is based on an assumption that 60% is still in place.

TABLE 1.3 MARKET SEGMENT COSTS OF REPAIR

STRUCTURE	COST	DESCRIPTION
Bridges 	$8B*	**Decks, Superstructure Components, Substructure Components** There are 235,000 conventionally reinforced concrete and 108,000 prestressed concrete bridges. Corrosion and other related deterioration mechanisms make 15% of these bridges structurally deficient. Seismic retrofit may also be required because of changes in code requirements. Repair methods include surface repair systems, removal and replacement, protective coatings, membranes, pile jacketing, cathodic protection systems, strengthening systems, and crack repair.
Roadways 	$4B+† (Refer to second footnote for remaining market segments)	**Slab on Grade, Curb and Gutter, Sidewalks** Freezing-and-thawing deterioration, alkali-silica reaction attack, D-cracking, and abrasion are some of the deterioration mechanisms. Repair methods include remove and replace, slab subsealing, doweling, partial-depth repairs, overlays, and use of joint and crack sealants.
Piers and Wharfs 	$0.2B	**Piles, Bents, Decks** Exposure to chlorides and vessel impact are primary distress mechanisms. Repairs include cathodic protection, surface repair systems, jacketing, and protective coatings.
Buildings 	$2B	**Façades, Balconies, Plaza Decks, Exposed Concrete** Airborne chlorides, freezing-and-thawing cycles, and carbonation are some of the distress mechanisms that may be related to design and construction errors. Waterproofing failures are also common, and seismic retrofits may be needed. Repair methods include foundation waterproofing, plaza deck waterproofing, and replacement or repair of balconies.
Parking Structures 	$0.5 to 1B 18,000 structures in the U.S.	**Precast, Post-Tensioned, Cast in Place, Composite** Water leakage through cracks and joints, chloride ingress, and freezing-and-thawing cycles are common mechanisms that cause reinforcement corrosion, spalling, and other distress. Repair methods include waterproofing membranes, joint sealants to control water intrusion, strengthening systems to correct design and construction errors, surface repair systems for spalling damage, and slab replacement.
Locks and Dams 	$0.2B	**Locks and Dam Structures** Freezing-and-thawing cycles, abrasion /erosion, structural modifications, and leakage are some causes of distress. Repair systems include overlays, grouting, spall repair, component replacement, and strengthening with anchors.
Residential 	$0.3B	**Sidewalks, Driveways, Patios, Foundations** Freezing-and-thawing cycles, deicing agents, and soil settlement are some of the distress mechanisms. Basement leakage is also a problem. These may be accentuated by poor-quality materials or construction methods. Repair methods include remove and replace, slab jacking, overlays, surface repairs, waterproofing, and crack sealing.
Industrial Facilities 	$0.3B	**Foundations, Slabs, Structural Frames, Containments, Vessels, Tanks** Deterioration mechanisms include chemical attack and structural overloads that produce spalling, cracking, and disintegration. Repair methods include surface patching, coatings, liners, membranes, and strengthening systems.
Water Treatment 	$0.5B	**Tanks** Deterioration mechanisms include chemical attack, leaching, freezing-and-thawing cycles, and soil settlement that can cause cracking, leakage, spalling, and disintegration. Repairs may include surface patching, concrete replacement, crack injection, coatings, liners, and membranes.

*Source Cost of Corrosion Study NACE. †Market studies performed by Structural Group, Baltimore, Maryland.

TABLE 1.3 MARKET SEGMENT COSTS OF REPAIR CONTINUED		
Pipelines 	$1B	**Sewer Pipes, Pressure Pipes, Aqueducts, Canals, Tunnels** Deterioration mechanisms include chemical attack, erosion, abrasion, and soil settlement that can cause cracking or spalling. Repairs may include use of liners, coatings and membranes, overlays, spall repair, or specialized trenchless pipe rehabilitation technology.
Miscellaneous Structures 	$1B	**Stadiums, Runways, Chimneys, Towers, and Others** Freezing-and-thawing damage, thermal degradation, and aggressive chemicals are some of the deterioration mechanisms. Repairs can include remove and replace, surface repair, and applied surface treatments.

important industry issues and needs used to establish the goals in Vision 2020.

As part of the "visioning" process, each goal has been road-mapped to establish strategies and action plans. A major part of the road-mapping task was to critically examine the suggested dates by which completion of strategies related to the goals could be reasonably expected, and then to construct a timetable of goals. The timetable is needed because many goals are dependent on achieving other goals; thus the timetable will help to define the order in which goals must be achieved.

Industry leadership teams will use the Vision 2020 documents (Goals and Roadmaps) to guide industry activities by prioritizing efforts and resources to the established goals and action plans. Research and materials organizations will use the established needs to prioritize research and development projects. Contractors and engineers will use this document to better understand the current state of the concrete repair industry and develop ideas for implementation of industry-envisioned improvements. Owners will understand that we take our industry very seriously and will use these tools to help them understand their structures and continued investments in repair and protection.

Why Do We Need a Vision?

A vision provides a glimpse of the future state of the industry. If most key people in the repair industry believe that no improvements are necessary, and that there are no significant problems to solve, their vision will result in a future state of the industry no different than what we see today. That isn't the case. Repair industry leaders have spoken in the Vision 2020 workshops, and they envision a great need for improvement. These improvements include reducing repair mistakes, miscalculations, poor performance, and poor workmanship, and finding better repair methodologies that reduce costs while improving quality. This vision, and the goals related to achieving it, are the basis for moving forward and helping industry organizations, research establishments, and educational institutions to accelerate progress in the repair industry.

Unified Vision and Goals

The diverse concrete repair and protection industry recognizes the importance of a unified vision. In developing Vision 2020, leaders throughout the industry have described the desired state of the industry by 2020. They have identified potential breakthroughs in materials, equipment, industry cooperation, research and funding, professional practice, design methodology, environmental impact, workforce supply, and owner education. They realize that creating an accurate and attainable vision, establishing goals, and seeing the goals completed will require a strong effort, but they also believe this effort will significantly advance the industry by improving repair quality, reducing repair cost, and enhancing the safety of workers and the public. All of these results will enhance the image of the industry and encourage increased owner investment in repair and protection of their structures by providing a more cost-effective product.

Industry leaders have categorized Vision 2020 into 13 key goals, including 45 separate strategies. These are presented herein without order of preference.

1. *By the year 2010, the industry will have established mechanisms for industry cooperation to facilitate better and faster worldwide creation of concrete repair and protection technology and dissemination of information about the technology.*

   Advances in the repair industry won't be achieved by just one organization. The advances will require a worldwide effort involving many organizations and individuals. Closely coordinating the many organizations' activities will eliminate duplication of effort, improve sharing of resources, coordinate projects to eliminate conflicting recommendations, and improve the education of industry members.

   The repair and protection industry envisions:

a. Establishing a Repair and Protection Council made up of members from several associations

and institutes to monitor and manage Vision 2020 initiatives and the existing *Concrete Repair Manual* project, and to coordinate assignments of needed documents and educational programs. (By 2005.)

b. Developing a *Manual of Repair and Protection Practices*, which is the next step beyond the current *Concrete Repair Manual* (Second Edition)—a joint project of ACI, ICRI, The Concrete Society (CS), and Building Research Establishment (BRE). (By 2010.)

c. Identifying and developing more joint industry documents, thus accelerating the rate at which best practices are delivered to the repair industry. (Ongoing.)

2. *Develop and implement means of accelerating the process of document creation and dissemination within industry associations.*

Under current conditions, the time needed to produce or revise industry documents such as codes, specifications, and guides averages 8 years. Additionally, most industry documents are produced solely by volunteers on a part-time basis. The industry would be well served if more expedient methods were employed to produce and disseminate important industry guidance to the broad user community.

The repair and protection industry envisions:

a. Establishing corporate funding of specific projects and initiatives, possibly coordinating this with the Strategic Development Council's ATA program. (Ongoing.)

b. Establishing portals for the general public to access important industry knowledge, with funding by private sponsorship instead of selling specific documents. Fixconcrete.org is an example of this kind of portal. (By 2007.)

3. *Creating a repair/rehabilitation code to establish evaluation, design, materials, field and inspection practices that raise the level of performance of repair and protection systems, establish clear responsibilities and authorities for all participants, and provide the local building officials a means of issue permits. (By 2015.)*

Repair and protection practice varies widely, based on individual beliefs, understandings, experiences, and motivations. It is very difficult to define a current standard practice for many types of repairs. The current ACI 318 building code does not deal with repair and protection issues. Practitioners are left by themselves to do the best job they can. When repair and protection projects fail to deliver the intended results, damages, claims, and lawsuits result. Establishing a Code of Practice, especially on projects involving life safety, will give the practitioner proper design, material, and construction information. The Code of Practice can also provide a basis for defining standard industry practices. This effort will raise the whole industry to a higher level of performance.

The repair and protection industry envisions:

a. Establishing a focused team to create a project plan for a "Repair, Rehabilitation, and Protection Code." (By 2005.)

b. Creating a multi-part document that ultimately becomes a complete code. Parts may include:

- Categorized structure types/importance/service life/performance requirements
- Condition assessment/evaluation/inspection requirements
- Definitions of performance requirements for structures, repairs, and strengthening
- Definitions of considerations for structural safety during repair and strengthening
- Guidelines/standards for inspections of repairs and strengthening

4. *Develop performance-based guide specifications for specific and generic repair designs to improve specifications. (By 2010 and ongoing.)*

A performance-based specification should detail requirements for the work in accordance with the environment during installation of the repair and during service of the repaired element. Other specific criteria, such as shrinkage limits for repair materials, may also be identified. Such specifications *should not* provide instructions to the contractor on how to achieve these requirements. Many repair specifications are incomplete, ambiguous, and may establish a basis for claims, poor-quality performance, and increased costs. Too many specifications are created from product manufacturer's guide specifications. However, reluctance to embrace performance specifications is based on the fact that there are still few short-term tests that reliably predict long-term performance.

The repair and protection industry envisions:

a. Establishing a prioritized list of Guide specifications. (By 2006.)

b. Creating specifications outlining responsibilities and expected performances, QA and QC methods, and promoting the use of preconstruction mock-ups and field trials. (Ongoing after 2006.)

5. *Improve repair material design and performance to eliminate cracking, to carry structural loads, and to have set and cure properties established by the construction process.*

Surface repair materials often crack, may sag in vertical or overhead applications, or may set too quickly. Repair materials used in partial depth situations may not be effective in carrying loads because they shrink and cannot transfer

load to the substrate. Manufacturers are free to develop repair products that do not meet any standards or code requirements for many applications. Some ingredients in repair mortars, such as gypsum-based materials, can cause expansion during use in a wet environment and cause damage to the structure.

The repair and protection industry envisions:

a. Developing a selection guide of materials with defined test methods and commentary.
b. Developing and instituting a standardized data sheet protocol (in process). (By 2005.)
c. Identifying critical material/system properties required for specific applications, that is, compressive members for load-carrying needs. (By 2015.)
d. Identifying material properties and test methods necessary to predict long-term performance. (By 2012.)
e. Identifying and validating models to predict service life. (Ongoing through 2020.)
f. Incorporating appropriate requirements of repair materials into the "Repair Rehabilitation and Protection Code."

6. *Develop environmentally and worker friendly repair methods, equipment, and materials that will greatly reduce the adverse effects on workers, the public and the earth's ecosystem.*

Repair processes produce many by-products that adversely impact the environment. Almost any tool interacting with existing concrete produces particulate materials (dust) that may become airborne unless they are contained. These airborne particles contain the base ingredients of the concrete and, in the case of sandblasting, the abrasives used in the process. Silica-bearing aggregates are commonly used in concrete. Crystalline silica inhaled over a long period of time may cause respiratory illness. Properly worn safety gear will eliminate inhaled dust. Concrete removal is currently done by pneumatic, electric, high-pressure water and hydraulic removal tools. For most jobs, the tools are hand-held, resulting in repetitive motion/vibration to the worker's body. In addition, the impacting of concrete results in excessive noise generation. Current personal safety gear, properly worn, will reduce both the vibration and noise impact to the body, but will not eliminate it totally.

The repair and protection industry envisions:

a. Developing specifications for particulate management. (By 2010.)
b. Establishing a means for identifying, tracking, and disseminating environmental concerns. (By 2007.)
c. Promoting development of demolition equipment that is quiet, dust-free, and has low impact on the body. (By 2012.)
d. Developing a series of industry safety guides. (By 2008.)

7. *Develop a means for predicting repair system performance to help ensure the use of proper materials, design details and installation methods based upon predictive models validated by experience.*

Repairs have been performed successfully and unsuccessfully for many years. Within each project lies important feedback for future projects. Learning from what works and what does not work would ultimately eliminate most repair failures. We do not have an effective way to document a project's successes and challenges, thus we miss the greatest opportunity to learn and improve. There is no formula in our business that spells out how systems will perform given a particular service environment. Success is either individual wisdom or simply luck.

The repair and protection industry envisions:

a. Establishing an infrastructure for collection of projects detailing historical performance, combining experiences of U.S., Europe, and Asia. Establishing a motivation for contributing. (By 2008.)
b. Developing forums to share experiences of both successes and challenges. Creating a "what went wrong" guide for solutions. (By 2009.)
c. Developing a monitoring (observation) protocol for repaired structures to properly compare project results. (By 2008.)
d. Developing a protocol for the development of models to estimate the service life of repairs. (By 2008.)

8. *Develop and implement a strategic research plan for the repair industry.*

At any one time, research in many areas affecting concrete repair and protection is underway. Hundreds of projects involve thousands of people and millions of dollars in seeking to accomplish research tasks. Industry leaders view many of the projects as unimportant or not relevant to what the industry needs. Some projects are duplications of current or past work. Most research is conducted in university settings and results may not transfer to field situations. There are no lists that establish what the industry deems important.

The repair and protection industry envisions:

a. Establishing a group to develop and maintain the plan—Strategic Research Council. (By 2006.)
b. Identifying the pertinent research previously done. (By 2006.)

c. Identifying current research. (By 2007.)
d. Developing a list of research needs. (By 2007.)
e. Identifying and obtaining research funding in accordance with the strategic research plan (By 2008.)

9. *Increase the number of material-, engineering-, and construction-related professionals interested in and skilled in repair and protection practice to support the growing need for evaluation, design, new materials, and construction professionals.*

Current interest in choosing a career in repair and protection is very low. Very few schools have courses that introduce or prepare the student for the industry. Where courses and interested professors exist, such as the University of Texas at Austin, the University of Illinois, Middle Tennessee State University, Georgia Tech, and the University of Missouri-Rolla, students make their way into the industry with excitement and passion.

The repair and protection industry envisions:

a. Increasing awareness and the number of career opportunities. (By 2006.)
b. Developing education materials for universities. (By 2007.)
c. Promoting educational/training materials for trade and technical schools. (By 2010.)
d. Recruiting schools to offer courses, increasing participation from the current six schools to 20 schools. (By 2008.)
e. Developing training programs to enhance quality and skill of existing personnel in industry. (By 2010.)

10. *Develop selection processes, contractual agreements, procurement methods and relationship arrangements (partnering) that will greatly reduce conflicts, rework, claims, and lawsuits resulting from disagreements among contractors, general contractors, engineers and owners.*

Successful repair and protection projects are a result of the owner, engineer, and contractor establishing and maintaining healthy, cooperative relationships with realistic expectations that are understood by all parties. The success of all repair projects is the result of the combined experience, attitudes, and wisdom of the project team. Selecting the lowest bidder for repair design or construction services often fails to produce the best value because the most qualified bidders aren't chosen. This can cause a claim-oriented process to develop where relationships are tested, corners are cut, and feelings and reputations damaged. Many bidding processes initiated by owners or their agents produce one-sided agreements that place

most, if not all, risks on the engineer and contractor. These types of arrangements cause relationships to be strained and future opportunities to be lost. The repair and protection industry envisions:

a. Developing standard warranty and indemnification language that will offer clear motivation to the material supplier and contractor to perform in alignment with owner interests, yet not be excessive. (By 2008.)
b. Developing an owner guide for design-build procurement bringing both speed and innovation to cost-effective solutions. (By 2012.)
c. Developing a guide for project partnering arrangements. (By 2012.)
d. Developing standard templates for contracts and subcontracts that are fair to all parties in the contract. (By 2008.)
e. Developing guidelines for prequalifying engineers and contractors to improve repair project performance, cost effectiveness, and project safety. (By 2007.)

11. *Develop facility owner education that will promote awareness of the effects of deterioration and the means to reduce the risks while protecting their investments.*

Many owners do not fully appreciate the structures that support activities within a building. A lack of education and a basic understanding of materials and structures by owners can lead to unpleasant surprises and unforeseen risks of a failure. Some examples are: changing the use of the building and thus increasing live loads, or using aggressive chemicals that can deteriorate even good quality concrete.

The repair and protection industry envisions:

a. Developing guides for owners to support life-cycle cost investments in maintenance that include flowcharts and decision trees. (By 2012.)
b. Developing an owner's guide to inspection and maintenance of facilities. (By 2012.)
c. Promoting the new ASTM standard for façade inspection. (By 2005.)

12. *Develop improved means and methods for accurate and thorough condition assessment.*

The success of all repair projects is dependent on the completeness, accuracy, and logic of the condition assessment. Planning for many projects fails to address underlying causes, and therefore shortens the repairs' useful life. For many projects, underestimates or overestimates of the quantities of repairs needed cause cost overruns and contractor claims.

The repair and protection industry envisions:

a. Developing an industry standard for condition assessment and reporting. (By 2008.)
b. Improving scope and quantity estimating to improve accuracy.

The Strategic Development Council (SDC) thanks the dedicated, hardworking, and visionary individuals who participated in the development of Vision 2020 to clearly outline what the repair, protection, and strengthening industry would like their industry to be in the year 2020—a view into the not-so-distant future. A special thanks goes to Peter Emmons, Chair of SDC during this process, whose leadership made this project possible.

"Vision 2020: A Vision for the Concrete Repair, Protection and Strengthening Industry" is the culmination of the efforts of these individuals who participated in the visioning workshop in Chicago, Illinois, in 2004, and the Roadmap 2020 workshops in Sedona, Arizona, in May 2005 and Baltimore, Maryland, in September 2005. Vision 2020 was made possible by the support that individual companies within the concrete repair protection and strengthening industry provided.

The endorsing organizations make this truly an industry-wide vision:

- American Concrete Institute (ACI)
- American Shotcrete Association (ASA)
- American Society of Concrete Contractors (ASCC)
- BRE (formerly the British Research Establishment)
- The Concrete Society
- International Concrete Repair Institute (ICRI)
- NACE International (formerly National Association of Corrosion Engineers)
- SSPC: Society for Protective Coatings
- Sealant, Waterproofing and Restoration Institute (SWR Institute)

These organizations represent their members who are interested in improving and advancing the repair, protection, and strengthening industry and look forward to the introduction of technology that will accelerate such improvements.

c. Developing structural health monitoring systems that continuously measure corrosion potential as an aid in predicting when maintenance and/or repairs will be needed. (By 2007.)
d. Developing improved nondestructive diagnostic systems, similar to ultrasound, that can produce three-dimensional imaging of existing concrete including items such as multi-layered reinforcement placement (By 2006) and internal defects such as voids and cracks. (By 2012.)

13. *Develop specific repair system needs for expanded use, efficiency, and failure reductions.* The repair and protection industry envisions:
a. Developing a heat-resistant adhesive for FRP systems that will provide an adequate fire rating for the installed system.
b. Developing coatings that are less sensitive to minor imperfections in concrete surfaces (such as bugholes) and can thus be used to lower surface preparation costs.

Where Does the Repair, Protection, and Strengthening Industry Go from Here?

Even as this version of Vision 2020 is published, the repair, protection, and strengthening industry has begun acting on specific activities to make this vision a reality. ACI has formed Committee 562, "Evaluation, Repair, and Rehabilitation of Concrete Buildings," whose mission statement is to "Develop and maintain Code requirements for evaluation, repair, and rehabilitation of existing concrete buildings."

ICRI is tackling several other Vision 2020 goals with the creation of new volunteer committees. New committees include the Environmental Health and Safety Committee, with a mission statement of "Develop and report information on environmental health and safety issues related to repair of concrete and masonry"; the Procurement Methods and Relationship Arrangements Committee, with a mission statement of "Develop and report information on selection processes, contractual agreements, and procurement methods that will minimize disagreements between contractors, engineers and owners"; and the Guide Specifications Committee, with the mission statement of "Create guide specifications based on ICRI guidelines" have now been formed. The SWR Institute also has ongoing activities relating to various Vision 2020 Goals.

With many organizations working on various goals, oversight is necessary. One of the first initiatives of Goal #1 was to establish a repair and protection council made up of members from several associations and institutes to monitor Vision 2020 initiatives, and to coordinate assignments of needed documents and educational programs. This occurred at the Spring 2006 SDC meeting, where the Vision 2020 Council was established, with Kelly Page, Executive Director of ICRI, as Chair.

It is exciting to see so many activities already taking place to fulfill the goals of Vision 2020. Many strategic plans fail, as once they are formed, they are put on the shelf and never looked at again. With the oversight of the Vision 2020 Council, the concrete repair industry's strategic plan will receive consistent monitoring and updating. With the entire concrete repair industry cooperating toward a unified vision, there is no doubt the industry will be greatly improved by the year 2020.

***Peter H. Emmons**, FACI, is President and CEO of the Structural Group. He is the Past Chair of the Strategic Development Council, Past President of ICRI, and Past Chair of ACI Committee 364, Rehabilitation. In 2000, he received ACI's Arthur R. Anderson Award for outstanding contributions to concrete technology and also was a co-recipient of the ACI Construction Practice Award.*

***Douglas J. Sordyl** is the Managing Director of the Strategic Development Council (SDC), and ACI's Managing Director of Industry Affairs. Sordyl received a bachelor's degree in civil engineering and a master's degree in engineering from the University of Detroit. Prior to joining ACI, Sordyl was employed by ARCADIS (formerly Giffels Associates) in Southfield, Michigan, for more than 30 years as a Structural Engineer, Assistant Structural Department Head, Project Manager, and, most recently, Assistant Director—Design and Technical Services, heading up technical services, project management, digital services, and information technologies. He holds professional engineering registrations in the state of Michigan and California. A long-time ACI member, Sordyl has served on ACI Committees 211, 301, and 302. He acted as Co-Chair for the ACI Spring 2002 Convention in Detroit, and was also a Board member and Past President of the ACI Greater Michigan Chapter. His other professional involvements include: charter member and Past President of the Structural Engineering Association of Michigan and member of the American Society of Civil Engineers, the American Institute of Steel Construction, and the Engineering Society of Detroit.*