

PLANT CERTIFICATION— A PROGRAM OF MERIT IN THE PRESTRESSING INDUSTRY

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The rapid growth in the use of precast, prestressed concrete has created many changes in the construction industry. Growth, change, new products, new applications, and new markets typify the prestressed concrete industry, an important newcomer in construction. Today, precast, prestressed concrete products are available in many sizes and shapes, and serve not only in the structural system but also utilize their attractive appearance for esthetic purposes. Structural precast concrete has grown out of the small, job-shop operations of just a very few years ago, to where it is now supplying major components for projects of every size, type and description and, in many cases, even supplying the entire job both structurally and architecturally.

The moral and legal obligations of the industry have increased with this growth. It behooves all members, the small, independent local producer, as well as the large, sophisticated plant or multi-plant operation, to properly equip their plants and staff their operations to meet the demand of this new responsibility. Proj-

ect owners, through their designated architect-engineer representatives, need and expect quality products at competitive prices.

This situation is not new to the business of construction. Other industries have successfully established self-inspection programs. Those that have, helped build the confidence of the architect, engineer and owner in their product and in the ability of their industry to successfully furnish quality products on a truly competitive basis.

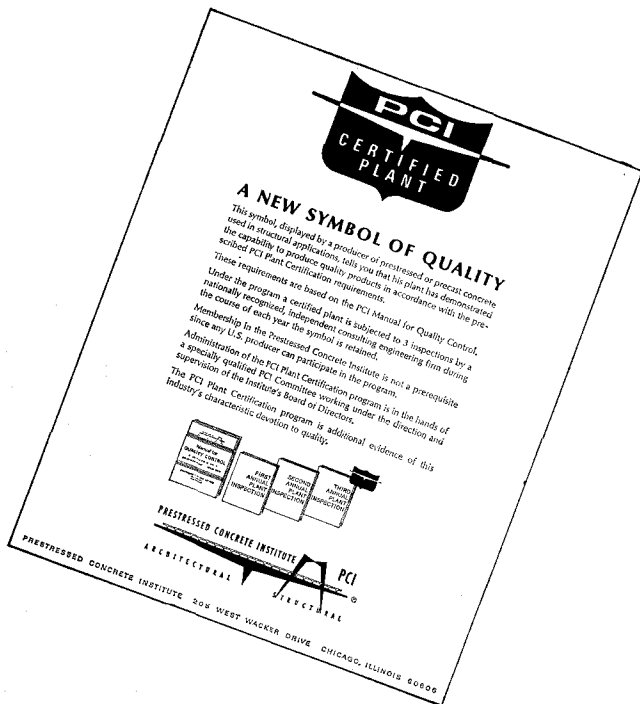
With these important challenges before it, the Prestressed Concrete Institute decided, some years ago, to prepare a quality control manual as a guide for manufacturers of precast, prestressed concrete products. When this valuable document was completed, the prestressing industry was in an excellent position to organize an inspection-certification program based on the manual's criteria and offer it to all producing plants whether or not they were members of the Prestressed Concrete Institute.

The ultimate goal of this or any other meaningful certification program is to convince the architect and

In January of 1967, a group within the Prestressed Concrete Institute voluntarily subscribed to a Plant Certification Program. At the end of the first year's inspections, 35 plants exhibited the required capability to produce quality structural precast and prestressed products and the announcement (below) unveiled the program to the building industry.

engineer, and through them the project owner and all other potential user groups, that the product they specify is of a quality and standard that will ensure satisfactory performance. An industry's concern with

quality and high standards of production can best be achieved by a thorough plant inspection program, with inspections on a frequent basis, so that the expression "A Certified Plant" has real meaning to the users



of that industry's products.

The certification program that was launched in the prestressing industry attests to plant capability to make and provide quality products. It does not inspect and certify the product. However, the inspections become deeply involved in materials, processes, and company organization and thereby more nearly ensure the ability to deliver a uniformly high quality product.

The program was carefully tailored so as not to require any plants, including the smallest, to purchase equipment or add personnel to such an extent that an uneconomical operation results. Statements by producers in the program clearly confirm this.

PROGRAM PLAN

By late 1966 the Plant Certification Program had been formalized by the PCI Plant and Production Certification Committee (the committee name was later changed to Plant Certification Committee). Agreement was reached that every plant of a participating multiple-plant company must be included in the program except those that make only architectural precast concrete or bridge units. A quality control manual for architectural precast concrete is being written by a subcommittee of the Plant Certification Committee and, after it is published, an architectural inspection program will be added to the present program. At such time the architectural precast plants of multiple-plant companies in the program will automatically be included. All other architectural precast producers will be invited to join.

Inspection procedures and a tentative budget were developed. Interviews were held to choose an in-

dependent engineering firm for the inspections. Following presentations of inspecting methods and grading systems by three engineering firms, Ross H. Bryan, Inc. was selected as the inspecting agency.

The Prestressed Concrete Institute Board of Directors approved the program with the stipulation that a minimum of 25 companies must voluntarily join the program initially to indicate its general acceptance. The program was then offered to all structural precast, prestressed concrete producing plants, whether members of the PCI or not. A total of 26 companies, operating 35 plants, subscribed to a two-year contract starting January 1, 1967.

The estimated cost of three annual inspections was placed at \$3,500 per company with an additional \$1,200 for each plant any company had in addition to its parent plant. By PCI Board of Director's decision the program is self sustaining. Operating funds are entirely independent of the Prestressed Concrete Institute budget. However, the program is administered by the PCI with the guidance of the Plant Certification Committee.

The following type of plaque was presented to all companies after they had successfully passed their inspections in late 1967, thus attesting to their capabilities as a certified plant.

INSPECTIONS

The Plant Certification Program requires three inspections during each one-year period, consisting of an in-depth inspection and two spot inspections.

The in-depth inspection is scheduled in advance to coincide with a period of maximum plant activity. It covers a minimum of two days, and may extend into the third day, de-



pending upon the type of operation. All phases of the plant operation are observed. The inspection checks aggregate stockpiles and concrete mixing, placing and transporting. Tensioning and detensioning of beds, curing procedures and temperature controls, stripping, stockpiling and checking of product are among the items which are carefully observed. In addition to plant procedures, office practice is reviewed including engineering, shop drawings, and record keeping for cylinder tests, curing temperatures, materials tests, and calibrations.

The two annual spot inspections are not announced in advance. These inspections generally are for one-and-a-half days and their purpose is to note any variations in procedure or materials from previous inspections, any changes in products or plant facilities which may have been made since the last report, and to observe the plant operation under different weather conditions.

At the completion of each inspection, the inspector holds a conference with the plant management to discuss plant procedures which may adversely affect the grade and to rec-

ommend improvements. At this time, the previous written report is reviewed.

GRADING

Grading of plants is based on the five divisions of the Manual for Quality Control. Each division has a weighted percentage (see chart) which is used to determine the final plant grade: Division No. I, prestressing, and Division II, concrete,

WEIGHTED CHECK LIST (EXHIBIT 1)		
DIVISION I..... PRESTRESSING ----- 20%		
Section 1. Stressing Requirements	30	
2. Pre and Post Tensioning	40	
3. Detensioning	30	
	<u>100</u>	100%
DIVISION II CONCRETE-----20%		
Section 1. Concrete Mixtures	20	
2. Batching and Mixing	30	
3. Placing Concrete	10	
4. Curing Concrete	30	
5. Finishing	10	
	<u>100</u>	100%
DIVISION III MATERIALS ----- 10%		
Section 1. Tendons and Anchorages	30	
2. Concrete Materials	50	
3. Reinforcing Steels	20	
	<u>100</u>	100%
DIVISION IV.....CONSTRUCTION AND SAFETY ----- 10%		
Section 1. Plants and Construction Practices	60	
2. Safety	40	
	<u>100</u>	100%
DIVISION VQUALITY CONTROL ----- 40%		
Section 1. Objectives and Methods	25	
2. Personnel	25	
3. Testing	25	
4. Inspection and Records	15	
5. Dimensional Tolerances	10	
	<u>100</u>	100%

each has a percentage of 20. Division No. III, materials, and Division No. IV, construction practice and safety, each has 10 percent. Division V is on quality control and has a weighted percentage of 40.

In addition to the above weighted averages, each division in turn has sections carrying various weighted percentages in accordance with their importance to the finished product. Each section has approximately ten separate gradable items.

Inspection comments are tape-recorded as the inspector moves about the plant, yard and office. They are then transcribed and regrouped under the appropriate sections of the check list, and furnished as a part of the report. Whenever a grade of less than 85 is reported for an item the reason is given on the report sheet.

A product check is made of all items on the yard, with special attention given to any curing and stripping cracks, weld and bearing plates, formed and finished surfaces, camber variations and dimensional

tolerances. These check sheets are also furnished as a part of the report.

The summary grade sheet (see sample) shows the grade which the plant has received in each division and the final plant grade. This sheet also lists the recommended improvements that are considered necessary to raise the grades of the various divisions.

REQUIREMENTS FOR CERTIFICATION

In order to become and remain a certified plant, a grade of 70 or more must be achieved in each division and the total overall grade must be 80 or higher. A plant receiving a grade of less than 70 in any one division, or an overall grade of less than 80, will be placed on probation. A plant receiving a probation grade on two consecutive inspections will automatically be de-certified.

A plant receiving a grade below 60 in any one division, or an overall grade below 70, will be de-certified immediately.

Any plant which has been de-cer-

Summary Grade Sheet			
Plant	_____		
City	_____		
	Weight	Grade	
Division I	20%	80.4	
Division II	20%	79.7	
Division III	10%	90.3	
Division IV	10%	83.3	
Division V	40%	81.2	
Plant Grade		81.9	
Recommended Improvements:			
Inspectors should be instructed to closely check strand condition, and see that dirty strands are cleaned prior to pouring. Quality Control personnel should be instructed to bring problems encountered repeatedly to the attention of the engineers.			
Attention should be given to the problem of low concrete strengths. Mix design, mixing procedures, materials and curing, both for products and cylinders, should all be evaluated. An immediate first step should be a decrease in the water content of the mixes. Products such as joints, tees and double tees do not require a mix wetter than a 2-1/2" to 3" slump for satisfactory placement.			
Hold-down forces from strand deflecting should be evaluated for each new setup. Detensioning procedures should be adopted that will preclude the cracking of products. A procedure of cutting most, or all, of the deflected strand between all members prior to the release of hold downs is recommended. Some straight strands should be cut after the hold downs are released to guard against cracking at the hold down rod.			
Legend:		Inspected:	
N/G Not Gradable		Inspectors: R. Sawyer and H. Clark	
N/A Not Applicable			
N/O Not observed			

tified or placed on probation may request a special inspection, after making the necessary plant improvements. If the inspection is made in the routine schedule of inspections, no additional charge will be made, but if the inspection requires a special trip, an extra assessment will be made.

Any plant which has been de-certified may appeal to a special committee, composed of members of the PCI Plant Certification Committee. The decision of this appeal committee will be final.

FIRST YEAR OF OPERATION

During the first year of operation, a total of 35 plants earned certification under the Plant Certification Program.

During this period inspection personnel were trained, inspection and report forms developed, and inspection procedures established.

All inspections are made by qualified structural engineers, experienced in the design and production of precast, prestressed concrete. A total of four men were used in the certification program during the first year and three are now capable of making inspections and grading the plants with the required degree of uniformity. In order to obtain uniformity of grading by the various inspectors, a considerable amount of duplication in inspection and grading was required initially.

In spite of the extra time and expenses in the training and development period, the first year's operational costs have been lower than originally estimated. It is felt that future inspection costs may be even less as personnel become more familiar with their assignments.

Excellent cooperation has been received from the participating plants.

Management has indicated a sincere desire to improve the products; comments and criticisms made in the inspection reports have been well received and, where possible, action has been taken to make necessary improvements. Subsequent inspections have indicated noticeable and continual improvement of product quality capability.

FUTURE AIMS OF THE PLANT CERTIFICATION PROGRAM

The overall success of the Plant Certification Program is dependent upon the acceptance of and the demand for quality products by the construction industry for all of its markets. This requires universality, and one of the most significant aims of the Plant Certification Program must be to increase the number of participating plants.

Presently the program is established only for manufacturers in the United States. Adoption of a similar program in Canada is anticipated. Efforts will continue to convince precast, prestressed concrete manufacturers who are not enrolled to recognize the value of the Plant Certification Program and become a part of it.

All who have participated in the Plant Certification Program are in agreement that it must be continually up-graded and improved. This constitutes another major aim to be achieved through:

1. Constant communication between the subscribers to the program regarding the beneficial effects of the program upon their plant procedures.
2. The reaction and comments of architects, engineers and user agencies to the certification program as to whether the desired results are being achieved.

3. Communication with manufacturers not in the program to assess their questions and concerns.
4. Committee activity to constantly review the inner workings of the program, making needed changes and up-dating it as required to keep the program abreast of the increasing mechanization and technology which affects the industry.

The ultimate objective of the Plant Certification Program is to permit the architect and engineer to specify precast, prestressed concrete products for open bidding knowing that they can rely upon the ability of all manufacturers to produce a quality product.

MEANING OF PLANT CERTIFICATION

To the precast, prestressed concrete industry the Plant Certification Program signifies its growth and maturity. This program was conceived for the purpose of improving the industry's capabilities to produce quality prestressed concrete products both by present producers and by new manufacturers as they enter the field. The willingness of an industry to impose the proper restrictions and controls for this purpose has been demonstrated by this program.

To the certified prestressed concrete manufacturer this program indicates a greater potential volume because of increased customer confidence and use. The manufacturer is subjected to an impartial, candid evaluation of his equipment and his production and organizational abilities. During the course of this evaluation, and through the required adjustments in his operation, the manufacturer will be forced to look at his methods and procedures in great detail, resulting in changes that will improve and up-grade his production. The challenge of improving the inspection score will create teamwork by the plant's personnel, from the lowest laborer to the manager. It already has shown marked improvement in methods, finished products, and accident prevention.

To the construction industry the Plant Certification Program provides a positive means of ensuring the capability of a prestressed concrete manufacturer to produce a quality product.

To the architect and engineer, who carry the responsibility for the successfully completed job, this program provides a vital and useful tool to achieve that end when precast and precast, prestressed concrete products are included in the project.

Discussion of this paper is invited. Please forward your discussion to PCI Headquarters before July 1 to permit publication in the October 1968 issue of the PCI JOURNAL.