

# Eminent Structural Engineer: Dr Mario Salvadori

(1907–1997)

Matthys Levy, Chairman Emeritus, Weidlinger Associates Inc., New York, USA

## Brief CV

- 19.03.1907: Born in Rome, Italy
  - 1930: PhD in Engineering, Univ. of Rome
  - 1933: PhD in Mathematics, Univ. of Rome
  - 1934–1938: Faculty in Univ. of Rome
  - 1938–1940: Worked for Lionel Train Company
  - 1942–1945: Worked on the Manhattan project
  - 1941–1991: Faculty in Univ. of Columbia
  - 1945–1960: worked as a Consultant, Partner, Chairman, and Honorary Chairman at Weidlinger Assoc. Inc. in New York City
  - 1976: He started teaching engineering to junior high school students at Harlem
  - 1978: Honorary Doctor of Science degree from Columbia
  - 1987: He founded the Salvadori Educational Centre on the Built Environment (Salvadori Centre)
  - 1991: Received the Pupin Medal for outstanding service to the nation in architecture and engineering
  - 1997: Received the Founders Award from the National Academy of Engineering
- 25.06.1997: Passed away at the age of 90.

**keywords:** Mario Salvadori; structural engineer; teacher; humanist.

When Mario Salvadori was born in Rome on March 19, 1907, the doctor warned Mario's parents that, because of his diminutive weight, the baby might not survive. Ninety years later,

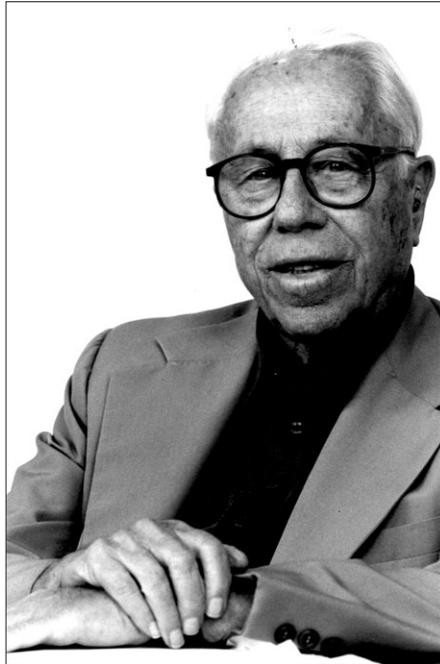


Fig. 1: Mario Salvadori

by marshalling an indomitable spirit, Mario was still teaching and writing (Fig. 1). Reared in Genoa and Spain, Mario hoped to become an orchestra conductor and when he was 18, he established Italy's first jazz band. As his father was an engineer, the young man was dissuaded from a musical career and instead earned two doctorates, one in mathematics and one in engineering.

## Adventurer

Always ready for adventure, Mario was an avid mountain climber. He was known in the mountaineering press as the "Lion of the Mountain" since he had opened 27 new routes in the Dolomites, in the process barely surviving a serious fall. Part of the challenge undoubtedly was his defiance of his father who often forbade him to climb, but who, in the end was justly proud of his son. Mario was always ready for a new adventure and in his

eighties; he and I had to visit the sculptor, Alexander Lieberman to look at a recent work being assembled in central Connecticut. I offered to fly there and meet him so that we could fly down to an airport close to his weekend house. It was a warm day and the air was not too stable. After we took off, Mario reminded me that I should not fly too high because the air would be too thin which was not good for his heart. That meant we had to fly in constant turbulence for the short 45 minutes we were in the air. But, although we were jostled about, Mario was a good sport and we landed safely, although on the second try because I was a little nervous ferrying such a critical passenger. When Mario alighted, he breathed a sigh of relief. He was somewhat green but glad to be alive.

## Teacher and Researcher

Following graduation from the University of Rome, Mario spent a year in London studying photoelasticity. During that time he came into contact with a number of refugees from Nazi Germany and came to realize that Mussolini's fascism was not far behind Hitler's and that it would be wise to leave Italy. Through the intervention of Enrico Fermi, the Salvadori family – Mario and his first wife Giuseppina were able to immigrate to the United States. After employment in a number of temporary jobs including serving as a production efficiency engineer for the Lionel Train Co., he was offered a substitute position at Columbia University in mechanical engineering. This soon became a permanent position in civil engineering when the war effort reduced the number of available instructors. Mario proved to be an inspired teacher and remained at Columbia for fifty years winning the prestigious award as 'best teacher' in 1962. His students never forgot the clarity and enthusiasm of

Mario's presentations and as they scattered around the world they remain his greatest advocates and his legacy. In 1965, Columbia's school of Architecture was in disarray so Mario stepped in and started a program in Architectural Technology, introducing new courses describing structural principles in totally qualitative terms without resorting to mathematics. The courses were supplemented with six films illustrating these principles through experiments and demonstrations. This "Structure in Architecture" program was a big hit and became the centerpiece of a popular new way to introduce the concepts of structure to the non-engineers and, became the basis for a book with the same title.

### The Bomb and Pacifism

In 1943, while at Columbia, Mario was asked to participate in a classified project that he only learned later was the Manhattan Project to develop a nuclear bomb. Mario's participation was purely technical in nature, and dealt with only one of the components of the ancillary structures, not with the bomb itself. It did, however, present him with a conundrum since, although he supported the defeat of fascism, he was basically a pacifist. He had no conflict, however, in the 1960s, when during the Vietnam War and in support of his moral convictions, he actively participated in protests against the war and supported nuclear disarmament.

Life was precious to Mario because, as he said, his diminutive size at birth did not augur well for a long life. From the day I met him in 1954 to the spring of his death, he kept reminding me of his mortality, all the while living life as if he were immortal. In his long life he was not satisfied with one career, but had many.

### Consulting Engineer

In 1955, Mario started a new phase of his multi-careered life when he first met and later joined with Paul Weidlinger to establish one of the leading consulting engineering firms in the country. Several of his former students joined him as the firm grew. At first, he specialized in the design of concrete thin shell structures and structures to survive a nuclear attack. The scope of the consulting practice soon included

work in forensic engineering and the design of major structures. He continued as a principal in the firm until his retirement in 1992.

While still at Columbia University and continuing through the rest of his career, Mario was involved in forensic investigations that often led to court appearances as an expert. Mario found forensic work to be both challenging and an opportunity to expand his natural ability as a teacher to the courtroom. A natural showman, he loved to spar with attorneys who tried to trip him up and often used Newton as his justification for an opinion. In one case, early in his career, he was asked to evaluate whether an individual had committed suicide by jumping out of a high rise window or whether he fell accidentally. By invoking the laws of physics he was able to demonstrate the difference between a free fall with only vertical velocity or a jump that involved horizontal velocity as well. Knowing where the body landed he proved that the fall was accidental and earned the gratitude of the widow who was able to collect her husband's insurance policy. That case became a landmark and has been cited in similar situations thereafter.

A supremely ethical individual, Mario was always careful to inform potential forensic clients that he was only concerned with the truth of a situation even if it were to damage the client's case. In such cases Mario would recuse himself rather than cause his client embarrassment.

As a structural consultant, Mario was first sought out as an expert in shell design. His friend Pier Luigi Nervi asked him to prepare the final design for the St Louis Priory (*Fig. 2*) for which Nervi had proposed a concept. This proved to be the first of many concrete shell structures for which Mario developed a detailed design. As many of his architectural students

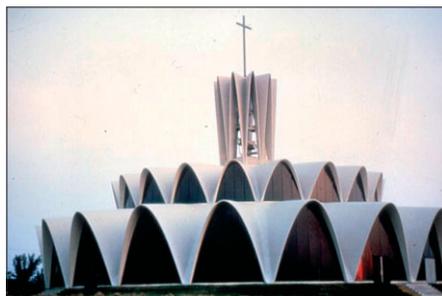


Fig. 2: St. Louis Priory

began their own practice, they turned to Mario to provide the engineering expertise for their structures. Over the years, Mario designed, among others, the Hopkins Center at Dartmouth College, and the Long Library at Columbia Presbyterian Hospital. He was also sought out as a consultant on dynamics and vibration of structures which led him to work with Paul Weidlinger on the design of structures to resist the effects of nuclear blasts. As this line of work was in conflict with Mario's pacifist leanings, he discontinued working on such projects.

### Author and Humanist

Changes took place in Mario's personal life during the late fifties. He divorced his first wife and married Carol, becoming a father to her son, Michael, as well as his own, Vieri. A perpetual humanist, Mario was not only a pianist of modest talent but a translator into Italian of his beloved Emily Dickinson. He also lent his special insight into the understanding of Joyce's 'Ulysses' (Upon his death, Umberto Eco eulogized him as a poet as well as an engineer). His ability to clearly present ideas in the classroom translated to paper – when he started the first of what were to become fifteen books including five on mathematics and ten on structures. The last books were specifically directed to a lay audience and especially to young

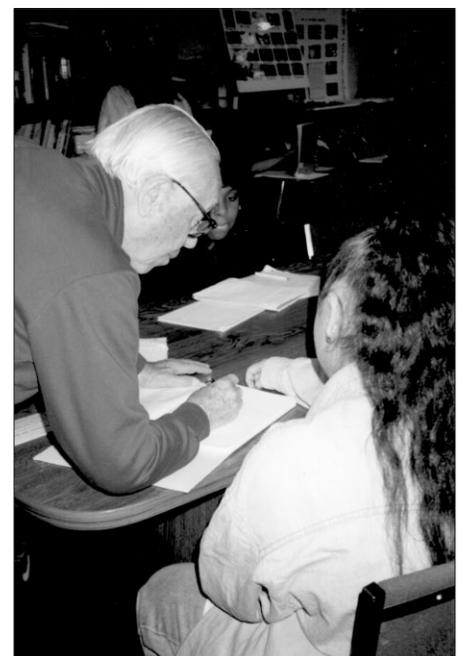


Fig. 3: Mario helping a student

people with whom Mario developed a special bond (Fig. 3). I was privileged to co-author five of his books including “Why Buildings Fall Down” which has remained popular to this day and a children’s book, “Earthquake Games”.

## Honors

Of his many honors Mario often said, if you lived long enough, you will be rewarded because they, that is all the various institutions, will run out of people to whom to give them. He was, of course honored by many institutions including receiving the Topaz medal from AIA in 1993 and in the same year, the Herbert Hoover Medal from the United Engineering Societies. Columbia University also recognized him with the Pupin Medal. He was awarded a doctorate Honoris Causa from Columbia University and The New School for Social Research and a Doctor of Humane Letters

from Lehman College. He was a member of the National Academy of Engineers that in 1997 awarded him their Founders Award given for accomplishments that benefited the people of the United States. Apart from membership in numerous technical societies, he was an honorary member of both ASCE and AIA and a Fellow of the New York Academy of Sciences.

## A New Direction

Starting in 1976, Mario began teaching a course on “Why Buildings Stand Up” to junior high-school children in East Harlem. This started him on a new career that involved motivating young people through a hands-on understanding of the built environment. He achieved tremendous success at explaining complex structural concepts by using real world examples of how bridges and skyscrapers are built. Eventually, the methodology was



Fig. 4: Mario teaching children about structures

formalized into a curriculum and Mario taught teachers and developed a manual that outlined the approach. Today, the Salvadori Center is an important non-profit center that continues to promote and expand the methodology that Mario pioneered. The ‘kids’ became his passion and Mario continued teaching them till the end. Had he not died on June 25, 1997, he would certainly still be demonstrating his bag of toys to his “kids” who loved him so much (Fig. 4).

## Advertisement

### Seminar on Advanced NDT Techniques for Concrete Structures

Sunday May 20, 2007 - 8:00 to 16:00

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Presentations and demonstrations by:

Mr. Claus G. Petersen, Germann Instruments A/S

Mr. Geoffrey Kurgan, Federal Highway Administration

Dr. Nicholas J. Carino, Consultant

Dr. A. Moczko, Wroclaw Technical University

#### Program

8:00 – 9:00	Registration
9:00 – 10:00	Evaluation of reinforcement corrosion
10:00 – 10:45	Air-void analysis
10:45 – 11:15	Coffee Break
11:15 – 12:15	Maturity and pullout testing
12:15 – 13:00	Comparative study of in-place strength methods
13:00 – 14:00	Lunch
14:00 – 15:00	Impact-echo method
15:00 – 16:00	Impulse-response method
16:00 –	Equipment display

**Registration fee:** €50 (€20 for students) payable on-site.

Seminar will include lectures on the principles of the methods followed by demonstrations of test equipment.

Delegates will receive copies of the presentations, a comprehensive equipment catalog, and lunch.

Seminar precedes the **Ninth CANMET/ACI International Conference on Fly Ash, Silica Fume, Slag and Natural Pozzolans in Concrete**. Information can be found on [www.canmet.org](http://www.canmet.org)

To make your reservation for the 1-day NDT seminar, please reply before May 10<sup>th</sup> 2007 to:

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