

ENGINEERS –PRE-EMINENT IN SOCIETY



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Engineers. Who are they? Are they a special breed? How did they become engineers? Who do they serve? Who, if anyone, do they guide? What is their purpose? What is their status in society?

These questions have been asked many times and have been answered too. Yet, there indeed is a need to revisit them, particularly as the context keeps changing as befitting a growing society.

Let us define engineering as opposed to science. A wise man once said, "The scientist seeks to understand what is; the engineer seeks to create what never was." Let this be our starting premise – engineers are creators. That is, engineering is undergirded by creativity. Sure, engineers are not in the same mold as Picasso, Salvador Dali or Raja Ravi Varma. But, the same may be said in reverse too.

At the same time engineers are practical scientists. They would complete a job at the earliest practical opportunity and not wait indefinitely to meet an asymptotic line.

Engineering creativity does not allow unlimited freedom to explore – after all, in its analytical avatar, engineering is a reincarnation of science – but the canvas is large, indeed very large for an engineer's creativity to shine through and it is ever expanding.



This is the Kieler Horn Folding Bridge, conceived by an architect and realized by an engineer. The bridge has become a tourist attraction, pride of the locality and a tribute to the ingenuity of engineering. About every hour or so "the middle of the jetty ... swivels, pulls, flips, and folds..." to let ships pass under and to let pedestrians cross as required. Engineering is alive!

Engineers fulfil the dreams, ideas and imaginations of people, including engineers, to effect in reality. Consider Eiffel Tower, designed and built in 1889 by engineers of a company owned by engineer Alexandre Gustave Eiffel; in the face of constant adverse criticism by groups of architects of that time in France. Creation it is; and also the most visited monument in the world today.

Consider also the 1450ft Willis Tower, earlier known as Sears Tower, structurally designed by Fazlur Rahman Khan, pioneering the concept of "Bundled Tube" structure which revolutionized the building of skyscrapers. The concept has been used in many tall structures since then including the BurjKhalifa in Dubai)

There are countless examples of such innovations, ideas and concepts translated into reality for society to benefit for centuries. If one understands the background of various engineering creations one sees, it would not be possible to go unimpressed with the creativity disguised in them, be it the Jawaharlal Nehru Stadium in Delhi, Bandra-Worli Sea Link in Mumbai, the successful space missions of Chandrayaan and Mangalyaan, the cranes that dot the skyline in skyscraping building sites, the huge machines that operate in open-cast mines, the nuclear containment vessels and the control systems that govern the operation of the facility.

So, to answer the opening questions, engineers are rational and analytical artists, creating masterpieces that excite people while serving them and also expanding the scope of their profession. They indeed are a special breed for the simple reason they have defined what appears to be an oxymoron – rational artist.

How did engineers become engineers? Through education, of course. Engineering education, besides developing the mindset of rational, step-by-step thinking, must also invoke and nurture the creative spirit of the students. Is this happening in India? Perhaps not. We are into a particular mode of engineering education that appears not to be too keen in promoting the creative art of engineering. Why is this a point of argument in this discussion? The answer comes straight out of how we have defined an engineer, a rational artist, imbued with creativity.

Yes, we must focus on implementing projects, but as engineers we must also involve ourselves at the stages of conceptualization and planning so that a project can carry a holistic character. If you read about how the Mars Lander mission of NASA came about it becomes evident that comprehensive involvement of engineers in this mission from the first step contributed immensely in its astounding success.

Unfortunately the engineers are seldom inducted in the planning process with the result that, more often than not, the concept gets modified during implementation culminating in something at variance with the original perception.

Coming down to the real world in this regard, to a large extent how the Second Vivekananda Bridge metamorphosed from a government department driven project into one that became the curtain raiser for PPP mode of execution is a lesson in how an engineering

entrepreneur and engineer got involved and led the efforts in this transformation. A dream, of the people, came true.

If engineers learn how to conceptualize the product from the bare specifics offered at the induction of a project, they cannot but be ensured of its success. Engineers must be taught to lead the society by being involved in the process, from beginning to end. Here is where our engineering education maybe lacking. As we would see later, this might even be the causal factor in the perceived relegation of engineers in the eyes of society.

Engineers serve the society. That is an insipid statement, as it is expected that every citizen would serve society in whatever capacity, even as he serves himself. This is almost a direct take from Adam Smith who said that the baker does not bake bread for feeding the hungry but for earning his livelihood. But, in the context of engineering, it goes much deeper than that.

Engineers, because of the specialized training they get, are expected to guide the society even as they serve the community of which they are a part. It was 1964 and nature created havoc – washed away sections of the rail link between Rameswaram and the mainland across Palk Strait. Engineers were called in. The link was restored in 46 days even as the project was scheduled for 6 months. This is leadership and commitment by engineers to society and the country at large.



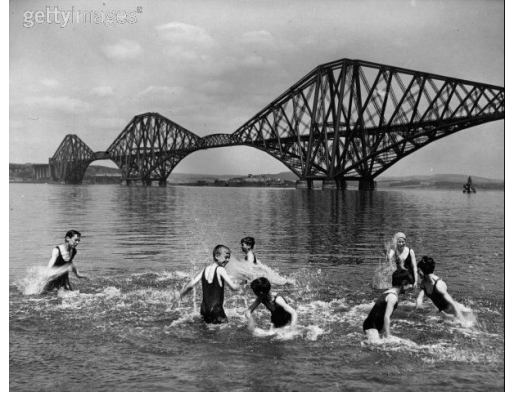
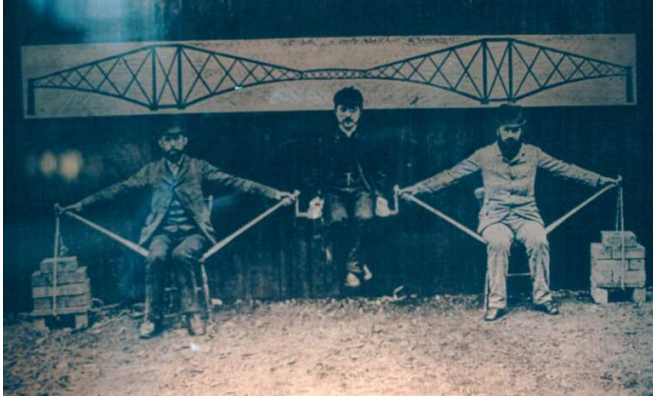
Let us also look at what happened in the aftermath of the Bhuj earthquake. The codes that engineers use in engineering became very stringent, demanding details that were not in the cards up until then. These measures ought to be looked at in two different ways.

One, the profession implicitly admitted that the then extant codes were not up to scratch. Continuous improvement was perceived as basic duty of the engineer; the demand arising from within the profession itself. The code was further rationalized and strengthened.

Two, there were murmurs from the construction industry that such tightening of the codes may make scrupulous engineers vulnerable at the hands of a few unscrupulous ones; a valid concern and this must be taken as a clarion call for the profession to wake up the sleeping community.

But this wakeup call must be clarity personified. It is this lack of clarity, in the language the general public can understand, that led to six seismologists being incarcerated (though all but one was subsequently exonerated) in the famous L'Aquila earthquake case in Italy.

Coming to the language in which engineers should speak to the society, there really can be no better example than how the engineer convinced the public body of the feasibility and safety of the iconic Firth of Forth Bridge. Just two images will make the case and rest it too.



We must see the above in terms of

serving as well as guiding the society.

But, engineers are also humans, after all. As human qualities, good and bad, permeate through all strata of society there are instances of engineers falling prey to the songs of sirens, like greed, jealousy, unethical gaming of the system and others. A professional body, in one of the developed countries, once received a letter for interpreting a particular clause of a code. Later it became clear that the interpretation offered was in the interest of a company with high-level ties to the professional body and against that of a smaller company – a classic case of conflict of interest and the Supreme Court of the country ordered the professional body to pay reparations.

Obviously the above incidence is not to the credit of the profession. Yet, it does illuminate that practicing professionalism demands that one wades carefully through the waters. If nothing else, this incident proved that engineers are part and parcel of society. It is perhaps impossible to claim that the above is a one-off incidence. But what we must remember is the Engineering ethics; yes, this must be one of the founding pillars of what defines an engineer.

Engineers serve multiple purposes in the cause of society. First, they promote rational analysis imbued with practicality. Second, they cater to the demands of society. Third, engineers look forward, always thinking, "How to do this better?" This could have an effect on the society, if only the society had been prepared to receive the message. This process of preparation is also a mode of serving society. Fourth, engineers protect society, many times after the fact but sometimes proactively. Addressing climate change and developmental concerns, say, conceptualizing, designing, constructing and operating a solar chimney.

To err is human and engineers are not an exception. But, the profession has internal checks and balances that take it forward. The benefits of admitting one's mistakes is a big lesson engineers impart to society. Of course, overarching all of the above, engineers create. This role goes unacknowledged for the most part.

It is time to wonder about the status of engineers in society. Sometimes in the past, engineers were admired across all levels of society. It is not the case now. What caused this transformation?

Perhaps engineers contributed to it. Take the case of Krishna Raja Sagara (KRS) across the River Kaveri. We celebrate it as the creation of Sir Mokshagundam Visvesvaraya.



That word creation! The dam was "created". Now, who "created" the Bandra-Worli Sea Link? We do not think of it but take it for granted.



No, it was merely designed and built. No one associates "creation" with a bridge these days. Note the change in the perspective. In "creation", he who creates, engineers, is put on a pedestal. In "designing and constructing", the engineer becomes a mere worker. In our hierarchical society, does anyone care about workers? Engineers do the job and take home the salary. There is no "vision" associated in this endeavor.

To get society to glorify engineering, engineers have to become visionaries. They should avoid being risk-averse, within the constraint of time, space and economy, yet follow the professional standards. This ties in well with the idea that engineers are creators but unlike artists, they are constrained by their profession and perceived duty to society. The unwanted, undeserved relegation of engineers in society hierarchy must be righted

immediately. How to do it is a major topic in its own right and we would do better to avoid discussing it here.

To conclude, engineers are creators. They become so by the dint of their efforts—education, professional practice, and research – institutionally supported. They serve the society in myriad of ways. Impart pride to the society through their eye-popping accomplishments. And, they lead the society too, showing what can be achieved. The dual mandate, to be a worker and be a leader too, is a knife-edge balancing act. Engineers have to perfect their skills in this.

Engineers must work towards projecting themselves to society in two distinct ways – a productive member of society while leading it.

They are, thus, part of, yet distinct and pre-eminent.