

# Women in Civil Engineering in India

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## Abstract

The civil engineering profession in India is generally considered as the potentially male dominant profession. After various reforms during recent years for equality rights, there are increase in the number of women in civil engineering profession. The present study discusses the current scenario of female enrollment in various engineering field, factors affecting on the women for the selection of career as civil engineer, prospect for women in civil engineering field. The present study also include the discussion on various schemes of government of India to supports women in technical education field.

**Keywords:** civil engineering profession, female enrollment, future prospects

## INTRODUCTION

Civil engineering deals with the design, construction and maintenance of buildings and other infrastructure facilities like roads, bridges, canals, dams, airports, sewerage systems, pipelines and railways. The practice of civil engineering may have commenced between 4000 and 2000 BC in ancient Egypt, the Indus Valley Civilization and Mesopotamia. Until the modern time there was no clear distinction between civil engineering and architecture. In 1747, the first engineering school, the National School of Bridges and Highways was opened in France. The world's first engineering society, the Institution of Civil Engineers was founded in London in 1818. In India the development of professional consultancy was set up in 1954.

The socio-economic status of women in India were declining during ancient to medieval period. Many reformers have fought for the betterment of women in India for equality rights in terms of equal rights in education, equal pay, equal work, to have own property etc. Women in India now participate fully in areas such as education, sports, politics, media, art and culture, service sectors, science and technology. Shakuntala A Bhagat (1933-2012) was the first woman civil engineer in India who was engaged in research and development in bridge super structures. The current status of female enrollment in civil engineering courses, factors affecting on women to choose career in civil engineering profession, future prospects for women in civil engineering are discussed in following sections.

## CURRENT SCENARIO OF TECHNICAL EDUCATION IN INDIA

According to AISHE report 2015-2016[6], the enrolled female students in civil engineering in India was 19.09% for undergraduate program, 28.84% for post graduate program and 23.4% in PhD program as compared to total enrollment of students in civil engineering for respective levels. Fig. 1 indicates that on comparing other engineering branches lowest enrollment of female student in undergraduate program was in mechanical engineering while highest in information technology. The enrollment of female student in civil engineering undergraduate, post graduate and Ph.D. program was second lowest enrollment amongst popular engineering branches.

Fig. 2 indicate the scenario of enrollment female student in civil engineering during years 2013 to 2016.as per AISHE report [4][5][6] It can be observe that there is increase in the female enrollment in civil engineering at undergraduate and Ph. D level but rate of increase is very less i.e. for undergraduate level female enrollment was increased from 18.01% to 19.90% while for PhD level it was increased from 25.17% to 28.16%. The enrollment in post graduate courses in civil engineering was 29.9% in year 2013-2014 but it is 28.84% in the year 2015-2016.

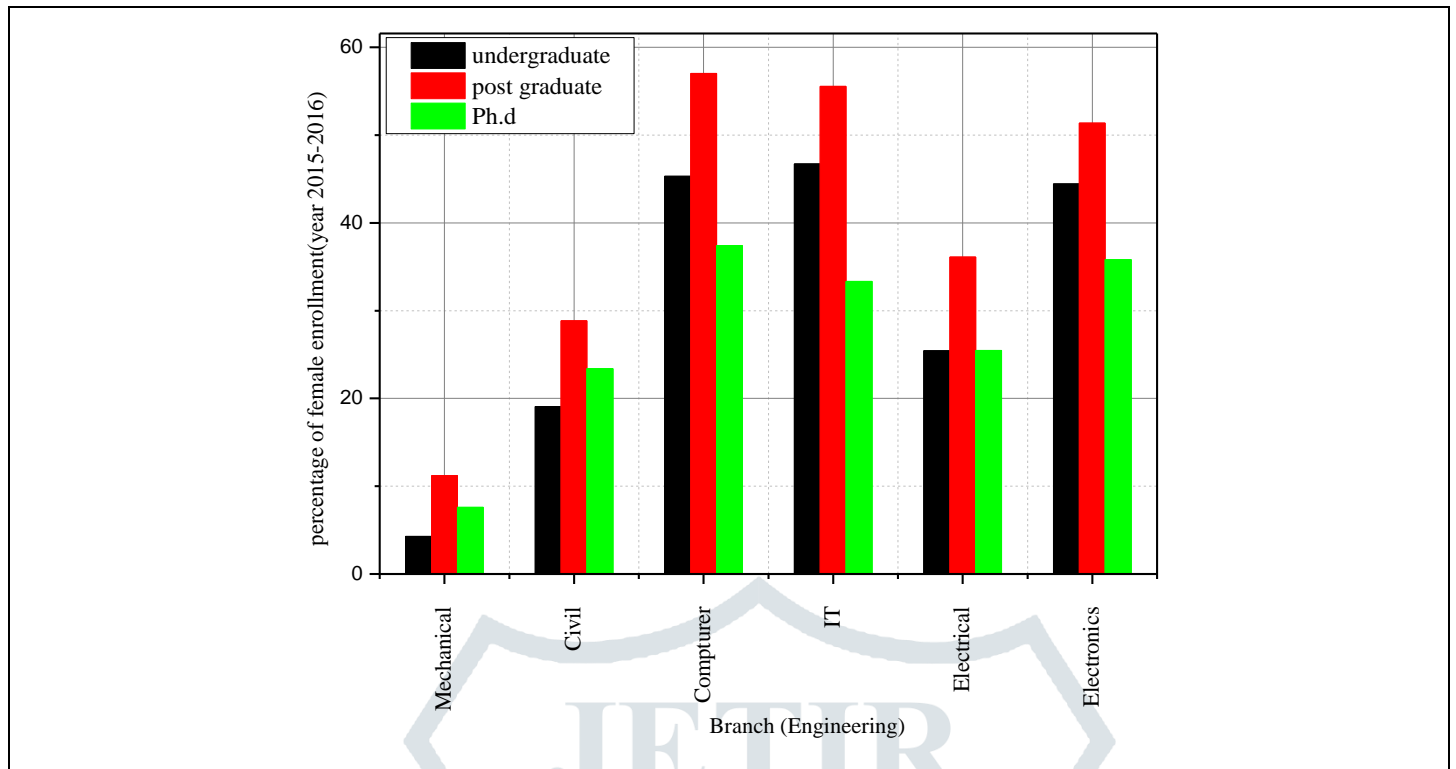


Fig. 1: Comparison of Branch Wise Enrollment of Female Student in Major Engineering Branches (AISHE Report 2015-2016)

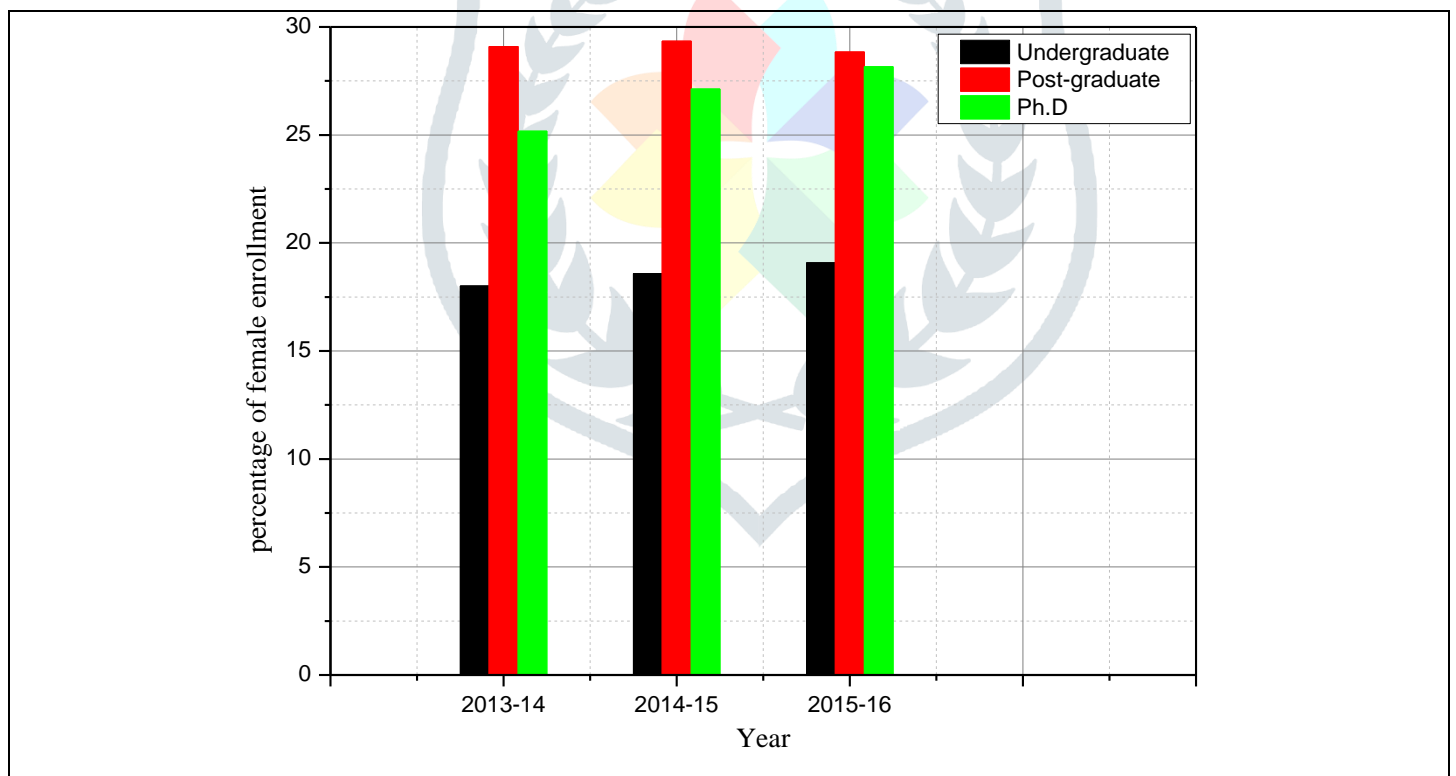


Fig. 2 : Overview of Enrollment of Female Student in Civil Engineering During Three Years(2013 to 2016)

Looking to the above scenario of technical education in India, it can be observed that in spite of being one of the highest paying and fast growing infrastructure field, the Indian women do not choose the civil engineering as professional career. The some of the factors governing selection of career as civil engineer for women are discussed in detail below.

## FACTORS AFFECTING WOMEN TO CHOOSE CIVIL ENGINEERING PROFESSION

### Male Dominated Field

The main perception of work of civil engineer is site work which is generally considered as male dominant. However it is important to note that in urban infrastructure the site work is performed by female labourers. Around 16% of the India's working population depends on building construction for its livelihood and one third of them are female [1].

### Lack of Inspiration

Inspiration for any profession would come from any successful stories, personalities to emulate, interaction with successful personality. As there are very few women taking up civil engineering to continue as their career, there is lack of inspirational stories. Women are not actively involved in membership of professional bodies or civil engineering forums, so direct interaction with women working in the field of civil engineering is not available.

### Lack of Societal Support

Reviewing the Indian family systems, the main work of women concentrated on household chores. As civil engineer any one has to work for long hours, travel to different site etc. It is difficult for women to think about work for long hours, travelling long distances etc. due to their family responsibilities. Family members and their life-partners have been responsible to inspire or inculcate the women to work as civil engineer.

### Inappropriate Infrastructure and Facilities

India construction site does not have proper sanitation facilities. Instead of thinking it as an extra liability, the sanitation conditions need to be improved on the construction site for women employees to make use at ease. Even though, there are different regulations and standard which are applied for construction sites, sanitary regulations need to be adhered too.

### Work Timings

It is easy to work in different engineering disciplines due to the flexibility in terms of work timings. The construction industry needs to be more organized in terms of flexible work timings.

## FUTURE PROSPECT FOR WOMEN IN FIELD OF CIVIL ENGINEERING

### Highly Paid Job and Fast Growing Field

Now a days the government focus on the development of infrastructure facilities like roads and bridges, dams, urban infrastructure in India by various government scheme like Smart city, AMRUT( Atal Mission for Rejuvenation and Urban Transformation), HRIDAY (Heritage city Development and Augmentation Yojana[3]. These increase work opportunities for civil engineering professionals. Civil engineering profession is also best paid job worldwide. So in spite of considering the civil engineering as male dominate field, Indian women can also contribute their best for development of country.

### Construction Management and Planning

The project management is one of the major part of civil engineering. Women can work in project management task. To achieve profitability and success in construction project the time management is key tool for any company. Henderson et al. (2013)[2] concluded that the business organizations are in a unique historical position to uplift their project management capacity and overall leadership talent through developing and promoting their women project managers.

### Structural Engineer

The structural engineering division covers the design and analysis of building, roads, bridges etc. The construction site near by the urban are can be managed by women and now a days most of designing and analysis work are carried out with help of software like STAAD, ETABS, SAP2000 etc. within office only. So it becomes easy for women to work as structural engineer.

### Geotechnical Engineer

Soil and rock supporting civil engineering systems are investigated by geotechnical engineer using field or laboratory testing methods. They determine the relevant physical/ mechanical and chemical properties of soil and rock, evaluate stability of natural slopes and assess risk posed by site conditions. They also deals with design and analysis of foundations, retaining walls and other structures using software like PLAXIS, FLAC etc. All these include major office work and few site visits.

### Transportation Engineer

The planning, design, construction, maintenance and operation of transportation facilities like airport, highway, railroad etc. covered under transportation engineer. Women can also contribute to all these task due to digitalization of all work.

### Water Resources Engineer

The design and construction of hydraulic structures like dams, canals and water distribution systems etc. are carried out by water resources engineer. The design of such facilities can be done using various software. The women can deal with design part, the construction part can be handle by construction engineer.

### Research and Development

One of the best career option for women is working as scientist at research and development institutions. In civil engineering field women scientist can carry out research work for new innovative materials, various innovative construction techniques etc.

## VARIOUS GOVERNMENT SCHEMES TO EMPOWER THE WOMEN IN FIELD OF CIVIL ENGINEERING

### Department Of Science and Technology

In area of science and Technology, a large number of well qualified women get left out of the science and technology (S &T) activities due to various circumstances which are usually typical to the gender. To address such issues department of science and technology (DST) launched “Women Scientists Scheme (WOS)” (Table 1) during 2002-2003[8]. The scheme is meant to encourage women in S & T domain, age group 25-57, preferably having break in career and not having regular employment, to explore possibility of re-entry into profession

*Table 1 : Details of Women Scientist Scheme*

Programme	Qualification	Amount of fellowship per month	Duration
Women Scientist Scheme A and B (WOS A) (WOS B)	M.Tech or equivalent degree	Rs. 40,000/-	Maximum three years
Women scientist scheme (WOS C)	M.Tech or equivalent degree	Rs. 20,000/-	One year

### Fellowship by Department of Science and Technology

#### *Indo U.S Fellowship for Women in STEMM*

Indo U.S Fellowship for Women in STEMM (Science, Technology, Engineering, Mathematics and Medicine) [9] is aimed to provide opportunities to Indian women scientist, Engineers & Technologist to undertake international collaborative research in premier institutions in U.S.A, to enhance their research capacities and capabilities in global perspective. The details of the scheme is indicated in Table 2.

*Table 2 : Details of Fellowship by Department of Science and Technology*

Programme	Qualification	Amount of fellowship per month	Duration
Indo U.S Fellowship for Women in STEMM	Pursuing Ph.D degree in Basic science, Engineering or Technology on full time basis or unemployed women with Ph.D degree	Fellowship includes monthly stipend, return airfare, health insurance, contingency, conference allowances	3 to 6 months

### AICTE Schemes

To give young women the opportunity to further her education and prepare for a successful future by empowering women through technical education, All India Council for Technical Education implemented a MHRD scheme (PRAGATI) [7] for the girls pursuing Technical Education. Two girls child per family with family income less than 8 lakh per annum during the preceding financial year are eligible for this scholarship. The details of scholarship schemes are indicated in Table 3.

#### *Tuition Fee Waiver for Girl Students:*

The AICTE has a scheme to encourage tuition fee waiver for girl students by providing incentives to Technical institutions in the form of sanctioning additional intake capacity up to 10% students, belonging to economically weaker sections, physically challenged categories and women. With this, the AICTE has also relaxed its norms for establishment of Technical Institutions exclusively for women.

**Table 3 : Details of Scholarship Scheme for Women by AICTE**

<b>Programme</b>	<b>Qualification</b>	<b>Amount of fellowship</b>	<b>Duration</b>
PRAGATI Scholarship Scheme for girls for Degree engineering	1 <sup>st</sup> year student of Degree engineering	Tuition fee of RS 30000 or actual whichever is less and Rs 2000 per month for 10 months as incidental charges each year.	4 years
PRAGATI Scholarship Scheme for Diploma engineering	1 <sup>st</sup> year student of Diploma engineering	Tuition fee of Rs. 30000 or actual whichever is less and Rs. 2000 per month for 10 months as incidental charges each year.	3 years

**Polytechnics for Girls**

As per AICTE, there are 168 polytechnics for women are operational at various stages.

**UGC Scheme****Fellowship by UGC[8]**

The UGC has initiated a scheme of Post-Doctoral Fellowship for Women to those candidates, who are unemployed holding Ph.D. degree in their respective subject areas with an aim to accelerate the talented instincts of women candidates to carry out the advanced studies and research.

**Table 4: Fellowship by UGC**

<b>Programme</b>	<b>Qualification</b>	<b>Amount of fellowship</b>	<b>Duration</b>
Post-Doctoral Fellowship for Women	Unemployed Ph.D. holder	(a) Rs. 38,800/ per annum and Rs 46,500/- per annum after two years (b) contingency (for books, journals and equipment ) Rs. 50,000/- per annum for five years	Five years

**SUMMARY**

Civil engineering is one of the fast growing field among all the engineering discipline. The contribution of women in civil engineering in India is still less as compared to involvement of women in other engineering field. It is widely observed that women in India is more engage with family responsibilities and cultural bonding. In such circumstances, they mostly prefer soft core engineering streams i.e. IT, Computers etc. and stay away from the field of civil engineering no matter the presence of potential prospects. The present study highlights few of such aspects affecting the women choosing the civil engineering as career profession. With all highlighted limitations, with help of fast urbanization, reduction in gender biases and various schemes of encouraging women to opt for civil engineering career, there are some improvement envisaged in the near future and it is likely that women in India may excel in the field of construction project management, structural engineering, research and development in field of civil engineering. Presently one of the mission of government of India is women empowerment. Women can take advantages of various schemes by government for their graduation, post-graduation and further research and development in field of civil engineering.

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