AAVARTAN'19

VIGYAAN PROBLEM STATEMENTS

(Department of Civil Engineering)

1. Steel Structures

Concrete structural and shear wall cores require a long erection time because they are labor intensive require curing, require shoring and re-shoring. Steel structural floor system requires much lesser time for erection compared to that of concrete system. However, it was found that the structural depth of a steel system is often larger, requiring an increase in the building height to retain the same area of the rentable space. The increase in building height will also conflict with the wind tunnel test. **Can such a steel system be devised in order to retain the current height of the building?**

2. Removal of Arsenic

Arsenic may occur in both organic and inorganic forms in natural water. Organic forms of Arsenic in seldom are found in ground water. Long term exposure to arsenic in drinking water can cause can cause cancer in the skin, lungs and diabetics. Removal of Arsenic from ground water by electrochemical coagulation process.

3. Durability of Concrete

Concrete is a global material that underwrites commercial wellbeing and social development. There is no substitute that can be used and can rely on structural integrity. The major issue we face now a day is durability. A major concern of a concrete structure is how to get a robust and reliable structure in terms of costs, maintenance and repairs. The next question is how to specify requirements for these points? Can we rely on the existing codes or should we prescribe more details? Therefore, an update of the design method and durability related challenges are required.

Aim: To enhance the durability of concrete using various mineral and chemical admixtures.

4. Integrated Swine Manure System

The objective of this design project was to come up with an integrated swine manure system that incorporates the experimental technology of reverse osmosis to concentrate the nutrients present in the manure. One of the associated goals of the manure valorization on farm was to create a semi-close system that minimizes the input and output coming in and out of the farm.

5. Energy Efficiency

How much profit is there to gain in the energy efficient retrofit of existing residential buildings? In theory ,,, Bottom up models have already been developed that estimate the energy saving potential of the existing house stock, based on standard calculation methods with fixed used behavior. In practice, different energy efficiency projects show disappointing results: Real energy savings are generally lower than energy savings predicted with standard calculation method. Possible reason: The simplified models are not able to represent certain physical and behavioral aspects, which are typical when retrofitting dwellings.

Aim: Obtain an overview and reveal the importance of physical and behavioral aspects that are not incorporated in energy savings predicted with reference calculation models.

6. Managing Ground Water

Agricultural operations including animal and crop farming are important contributors to the depletion of water resource quality and quantity in every country. Agriculture represents approximately 40% of total country water demand, and irrigation is the largest consumptive water use. Agricultural operations have been identified by the Environmental Protection Agency as the leading source of water quality impairment to rivers and lakes.

While reliable quantification of specific water quality and quantity impacts is generally unavailable, the water resource research community agrees that the following crucial problems are directly relevant to agriculture:

- Agricultural groundwater removal generally exceeds the natural recharge rate.
- Groundwater over pumping causes irreversible land settling and loss of aquifer storage capacity.
- Surface water diversion contributes to downstream ecosystem deterioration.
- Agricultural non-pointsource pollution is an important contributor to water quality degradation.
- Artificially low water prices for agriculture promote water use inefficiency.
- Present United States water policies are insufficient to ensure future water supply security.

7. Effective Traffic Management

It is already a huge challenge for the Indian government to provide world-class roads, due to the sheer magnitude. To add to it, India has to spend almost around ₹20,000 to ₹30,000 crore on the maintenance of roads every year. The reason behind this is the increase in the private vehicle ownership and the overburdening of roads in all major cities of the country. The everyday struggle and effort of dodging traffic, pollution and rash drivers is the biggest cause of chronic stress and many physiological problems. Design a model where the traffic can be effectively managed.

8. Smart Villages – Integration of ICT to Existing Rural Infrastructure

Information and communications technologies (ICTs) have proved its vast potential for the benefit of mankind in various fields. Information and communications technologies (ICTs) are often used to assure the right to an education and learning, and have a potential to serve developing needs. The various researchers have recognized the potential of ICTs for rural development and it may play key role for the fast and sustainable development of rural India in coming years. Information Technology (IT) can make a difference in a developing country only, if it is designed in close collaboration with its users.

9. Recycled Concrete Aggregate

While Portland cement concrete is one of the most versatile building materials on earth and has facilitated industrial growth in the last century, it is also one of the biggest in terms of environmental impact. The concrete industry is consistently one of the most environmentally demanding industries. In comparison, aggregate conservation has been mostly limited to using recycled materials in non-structural applications such as sidewalks, bulk fills, erosion control, and roadway sub base even though the quality of the recycled material is often significantly higher than is required in these applications. This relates to the proposed work, which focuses on the increased use of recycled concrete aggregate (RCA) in civil infrastructure projects in the U.S., and more specifically the use of RCA in structural reinforced concrete building RCA can achieve the requirements for coarse aggregates in building construction; however, the variability in material properties and quality needs to be quantified and incorporated into design.

1. Little fundamental materials-level research exists on the effects of RCA on the mechanical (e.g., strength, stiffness, creep) properties of concrete. Furthermore, only a very small portion of the previous research in this area was conducted in the U.S., limiting the applicability of the findings for use domestically (due to differences in RCA properties and quality),
2. Even more limited previous work exists on the long-term service load and ultimate load behavior of reinforced concrete structures utilizing RCA.
3. As a result, no engineering guidelines/standards currently exist for the design and construction of reinforced concrete structures with significant levels of RCA.

10. Hydroelectric Power Generation

Considered one of the most efficient renewable sources of energy, hydropower is derived by capturing flowing water and converting it into electrical energy. The challenges that we are facing today are the cost of construction and maintenance of dams, power plants, and support infrastructure to produce the power, Land Use, Quality of Water, rate of evaporation of water, Greenhouse Gas Emissions, Geographical Limitations. Hydroelectricity does come with its set of challenges but most of these can be overcome with a little thoughtful planning. As mentioned above, hydroelectricity has far less adverse effects on our ecosystem as compared to other, mainly non-renewable, sources of energy. **Therefore, device a model where hydroelectricity can be systematically tapped into, to enable better and more sustainable development of societies worldwide and to create a better future for all of us**.

11. In-Situ Economical Techniques for Measuring Discharge of Water Body

Streamflow or volumetric flow rate/discharge is defined as the volume rate of flow of water (including any sediment or other solids that may be dissolved or mixed with it) (Buchanan and Somers, 1969). Hundreds of thousands of streamflow measurements are done every year. There are numerous methods for measuring volumetric flow rate/discharge and linear flow velocity in a water body. They can be done on a wide array of water body discharges, from still waters to floods. But in this context, your solution should be **a sustainable, accurate, in-situ, economical, discharge measuring techniques or devices.**