

# SKYSCRAP

**TECHNICAL MAGAZINE**

**DEPARTMENT OF  
CIVIL ENGINEERING**

Meghnad Saha  
Institute of  
Technology



**Volume 3**  
**April 2020**

## VISION OF THE DEPARTMENT

To be a center of excellence in Civil Engineering keeping pace with rapidly changing technologies and global needs.

## MISSION OF THE DEPARTMENT

M1: To provide quality education in Civil Engineering through effective teaching learning process in a congenial academic environment.

M2: To serve the nation by providing professional Civil Engineering expertise.

M3: To promote research capability and innovative ideas in budding Engineers to address different emerging issues in Civil Engineering.

M4: To impart soft skills, leadership qualities and professional ethics amongst the young Engineers to handle real life projects with holistic concern for the society.

## HOD'S MESSAGE



It is a great pleasure to present Volume 3 of SKYSCRAP, the departmental magazine of the Civil Engineering Department, Meghnad Saha Institute of Technology.

Department of Civil Engineering has taken the COVID-19 lockdown period as an opportunity and challenge to take care of the students most in online teaching and engaged them in several co-curricular and social activities. Academicians from premium institutes and senior industry professionals from reputed core civil engineering companies could spare their valuable time in online webinars for enriching the knowledge of our students which otherwise would have not been possible.

Dear students, it is the time to regain your qualities and sharpen them. It also gives us an amazing chance to show our talent to the world through social media. As the problems the society faces are multi-dimensional, so must our efforts at combatting them. With this view in mind, our goal is to do research on challenging engineering problems and provide efficient engineering solutions in the various sub-disciplines of Civil Engineering. Let us join hands to make an energy-efficient sustainable environment to fight against COVID-19. I wish the very best for everyone involved.

## EDITORIAL COMMITTEE

AINDRILA PANDA (B.Tech 3<sup>RD</sup> YEAR)

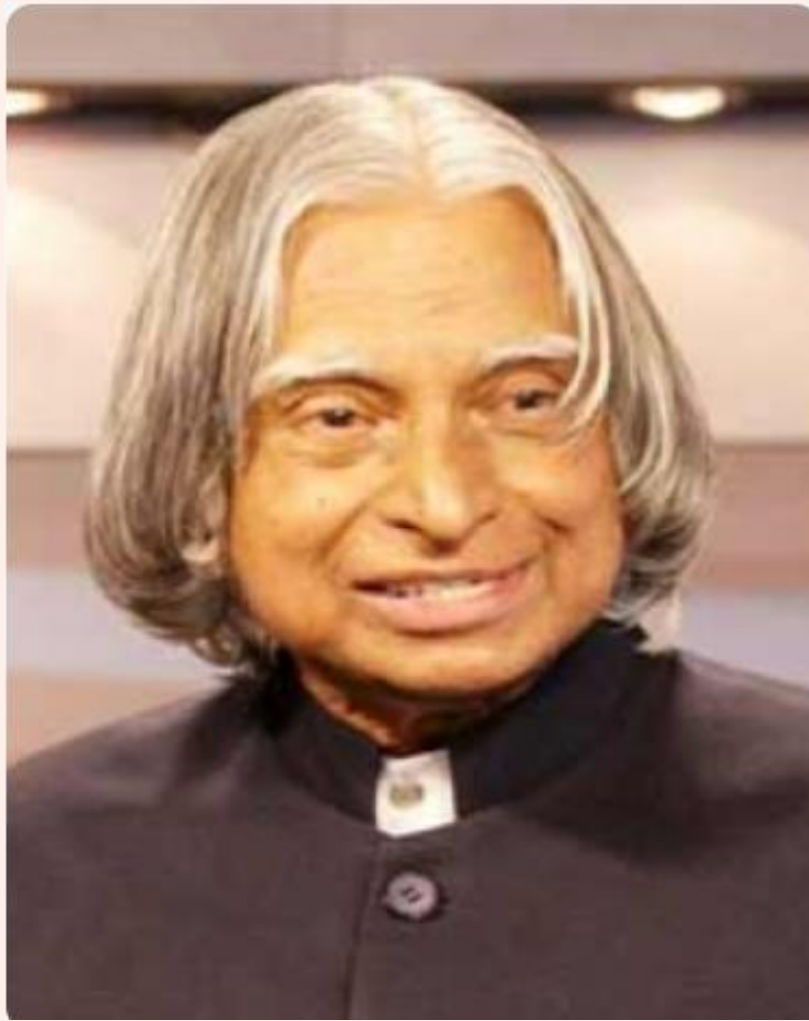
MASUM HAFIZ MOLLAH (B.Tech 3<sup>RD</sup> YEAR)

## EDITORIAL

Technology is advancing at lightning speed giving birth to innovations that are redefining a lot of what we do. Consequently, technical and creative skills are undergoing a massive reconfiguration. Therefore, there is an urgent need to fashion some amount of insight out of the variety of ideas being disbursed. The third edition of SKYSCRAP is a welcome addition to the body of work that allows a new vision to filter in. Best wishes to the Civil Engineering Department of Meghnad Saha Institute of Technology in this endeavour.

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*I firmly believe that unless one has tasted the bitter pill of failure, one can not aspire enough for success.*

*- A. P. J. Abdul Kalam*

## GLOBAL WARMING AND ITS EFFECTS ON CIVIL ENGINEERS

Global warming, the gradual increase in the Earth's average surface temperature caused by human activities, has significant implications for civil engineers. The effects of global warming can be seen in many areas, including sea level rise, increased frequency and severity of extreme weather events, and changes in precipitation patterns.

Sea level rise, caused by the thermal expansion of seawater and the melting of glaciers and ice sheets, poses a significant threat to coastal infrastructure. Civil engineers must consider sea level rise when designing and building structures such as seawalls, levees, and flood protection systems. They must also consider how to retrofit existing infrastructure to withstand the increased risk of flooding and storm surge.

Extreme weather events, such as hurricanes, tornadoes, and floods, are becoming more frequent and more severe as a result of global warming. Civil engineers must design infrastructure to withstand these events, and also consider how to minimize the damage caused by them. This may include designing buildings that are more resistant to high winds and floods, and developing early warning systems to help communities prepare for severe weather.

Changes in precipitation patterns, including increased frequency of droughts and heavy rainfall, also have significant implications for civil engineers. Droughts can lead to water shortages, while heavy rainfall can cause flooding. Civil engineers must design infrastructure to withstand these changes, including water storage

and distribution systems, and drainage systems.

In addition to the effects on infrastructure, global warming also has implications for transportation. Rising temperatures can cause roads and bridges to expand and contract, leading to cracking and deterioration. Civil engineers must also consider the effects of global warming on transportation infrastructure, such as designing roads and bridges that can withstand the increased stress caused by high temperatures.

In conclusion, global warming has significant implications for civil engineers, who must consider the effects of rising temperatures and changing weather patterns when designing and building infrastructure. They must also be prepared to retrofit existing infrastructure to withstand the increased risk of flooding, storm surge, droughts, and heavy rainfall. Civil engineers play a critical role in protecting communities and infrastructure from the impacts of global warming and in making our built environment more sustainable.

Prasenjit Sanyal  
Assistant Professor

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## EVACUATION PATTERNS IN HIGH RISE BUILDINGS

High-rise buildings, due to their height and large population, pose unique challenges in terms of emergency management and evacuation planning. In the event of an emergency such as a fire, earthquake, or other disaster, it is critical to ensure the safe evacuation of all occupants within a reasonable time frame. To achieve this, it is important to understand the evacuation patterns of high-rise buildings and the factors that influence them.



A recent study conducted by a team of experts analyzed the evacuation behavior of occupants in high-rise buildings during emergency situations. The study found that occupants in high-rise buildings tend to evacuate along the nearest available exits, rather than using the stairs. This behavior is often influenced by the perception of safety and the availability of exits, and can have a significant impact on the evacuation time and the overall safety of occupants.

The study also revealed that occupants in high-rise buildings often experience confusion and disorientation during the evacuation process, making it difficult for them to find the nearest exits and follow evacuation routes. This highlights the importance of clear and visible signage and effective communication systems, which can help to guide occupants to safety during an emergency.

To improve the evacuation procedures in high-rise buildings, building owners and managers are encouraged to take appropriate measures such as installing clear and visible signage, improving communication systems, and conducting regular evacuation drills. These measures can help to ensure that occupants are aware of the evacuation routes and procedures, and can safely evacuate the building in the event of an emergency.

In conclusion, the evacuation patterns of high-rise buildings are a critical consideration in emergency management and evacuation planning. Understanding these patterns and the factors that influence them can help building owners and managers to improve the evacuation procedures and ensure the safe evacuation of all occupants in the event of an emergency. By taking appropriate measures to ensure the safety and well-being of all occupants, building owners

and managers can contribute to the protection of human life and property during times of crisis.

Saurav Pal  
Assistant Professor

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## WATER QUALITY MANAGEMENT OF ROOFTOP RAINWATER HARVESTING SYSTEM

Rooftop rainwater harvesting is a sustainable method of collecting and storing rainwater for various purposes such as irrigation, toilet flushing, and laundry. This system is becoming increasingly popular due to its potential to conserve water resources, reduce water bills, and improve water security. However, the water quality of the harvested rainwater is an important consideration in the management of rooftop rainwater harvesting systems.

The quality of the harvested rainwater is influenced by several factors such as the type of roof material, the location of the collection system, and the surrounding environment. For example, metal roofs are less likely to contaminate the rainwater compared to asphalt roofs, which can release chemicals and pollutants into the rainwater. Additionally, the surrounding environment can also affect the water quality, for example, areas close to industrial and commercial activities are more likely to have contaminated rainwater.

To ensure the water quality of the harvested rainwater, several measures should be taken in the management of rooftop rainwater harvesting systems. These include:

Regular inspection and maintenance of the roof and collection system to ensure

that they are free of any contaminants or pollutants.

Use of first flush diverters to flush out any initial pollutants from the roof before they enter the collection system.

Filtration of the harvested rainwater using appropriate filtration systems such as sand filters, activated carbon filters, and UV sterilizers.

Regular monitoring of the water quality to ensure that it meets the required standards for the intended use.

Proper storage of the harvested rainwater in clean and covered containers to prevent contamination.

Regular cleaning of the collection and storage systems to maintain their efficiency and prevent the growth of algae and other contaminants.

In conclusion, the water quality of the harvested rainwater is an important consideration in the management of rooftop rainwater harvesting systems. By taking appropriate measures to ensure the quality of the harvested rainwater, the system can be used safely and sustainably for various purposes. Regular inspection, maintenance, and monitoring of the system can help to ensure that the water quality meets the required standards and contributes to the conservation of water resources.

Aveek Ray  
Assistant Professor

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## REPLACEMENT OF RIVER SAND BY WASTE FOUNDRY SAND IN PAVER BLOCKS

Paver blocks are a popular construction material used in the paving of sidewalks, driveways, and other outdoor surfaces. They are typically made of a mixture of cement, sand, and aggregate. River sand is commonly used as the sand component in paver blocks, however, its excessive extraction has led to

environmental degradation and the depletion of sand reserves.

Waste foundry sand is a byproduct of metal casting industries, and it can serve as a suitable alternative to river sand in the production of paver blocks. Waste foundry sand is composed of silica and is free of impurities, making it an ideal replacement for river sand. In addition, the use of waste foundry sand in paver blocks has several advantages, including:

**Environmental benefits:** The use of waste foundry sand in paver blocks helps to reduce the amount of waste generated by the metal casting industries and the demand for river sand, which can contribute to the preservation of river ecosystems.

**Cost savings:** Waste foundry sand is often available at a lower cost compared to river sand, making it a more cost-effective alternative.

**Improved mechanical properties:** The high silica content of waste foundry sand can contribute to the strength and durability of paver blocks. Research has shown that the use of waste foundry sand in paver blocks can improve the compressive strength, flexural strength, and abrasion resistance of the blocks.

**Enhanced sustainability:** The use of waste foundry sand in paver blocks promotes the concept of circular economy and helps to reduce the amount of waste that ends up in landfills.

It is important to note that the use of waste foundry sand in paver blocks requires proper characterization and testing to ensure that it meets the required standards for use in construction. The waste foundry sand should be thoroughly cleaned and processed to remove any impurities or contaminants.

Soumya Roy  
Assistant Professor

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## RIVER TRAINING WORKS BY USING COMPUTER APPLICATION

River training works are important measures to prevent river erosion, improve water flow and preserve river banks. The traditional methods of river training include the construction of various structures like groynes, bank protection works and channelization. However, with the advancement of technology, computer applications have made it easier to plan, design and monitor river training works.

One such computer application is Geographic Information System (GIS) which is used for the analysis and management of river geospatial data. GIS can be used to store, retrieve, analyze and display spatial data to understand the morphology of the river and its environment. This information can be used to identify areas prone to erosion and to plan the most appropriate river training measures.

Another computer application used in river training works is hydraulic modelling software. This software can simulate the flow of water in a river, allowing engineers to predict the effects of different river training measures. For example, hydraulic modelling can be used to evaluate the effectiveness of bank protection measures and to determine the required dimensions of groynes to control the flow of water.

Computer-aided design (CAD) software can also be used to create detailed design drawings of river training works. This software allows engineers to visualize the design of river training structures and to evaluate their effectiveness in preventing erosion and controlling the flow of water. Furthermore, CAD software can also be used to create 3D models of the river and its surroundings, which can be used to

evaluate the impact of river training measures on the local environment.

In conclusion, computer applications play a significant role in the planning, design, and monitoring of river training works. They allow engineers to analyze and visualize the complex hydrodynamic processes in rivers and to design effective river training measures. By using computer applications, river training works can be more efficient, cost-effective, and sustainable, leading to improved river management and preservation of river ecosystems.

Animesh Sen Sharma  
Technical Assistant

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## UTILIZATION OF RED MUD IN CIVIL ENGINEERING

Red mud is a waste product generated from the production of aluminum via the Bayer process. It is a mixture of iron, aluminum, titanium, and other metallic oxides, as well as sodium hydroxide and residual bauxite. This material is considered to be a significant environmental hazard due to its high alkalinity, high heavy metal content, and low biodegradability.

However, researchers have been exploring the utilization of red mud in civil engineering as a construction material. There are several potential benefits of using red mud in construction, including:

**Reduced waste:** Red mud is a waste product that is generated in large quantities, so utilizing it as a construction material can help to reduce the amount of waste that ends up in landfills or the environment.

**Increased sustainability:** Using red mud in construction materials can reduce

the need for other raw materials, which can have a positive impact on the environment and promote sustainable development.

**Improved mechanical properties:**

Research has shown that red mud can be used to produce lightweight and durable construction materials. For example, red mud has been used to produce lightweight concrete, which has improved thermal insulation and fire resistance compared to traditional concrete.

**Enhanced durability:** The high content of iron and aluminum in red mud can contribute to the durability and longevity of construction materials. For example, red mud has been used in the production of corrosion-resistant coatings for steel and concrete.

In conclusion, the utilization of red mud in civil engineering can have numerous benefits, including reduced waste, increased sustainability, improved mechanical properties, and enhanced durability. While more research is needed to fully understand the potential of red mud as a construction material, it offers a promising solution to the problem of waste management in the aluminum production industry.

Rounak Isor

Technical Assistant

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## STUDIES ON GEOTEXTILES REINFORCED SOIL FOR PAVEMENTS

Geotextiles are permeable geosynthetic materials that have been used increasingly in recent years to reinforce soil in pavements and other infrastructure projects. The aim of geotextile reinforcement is to improve the

performance of the soil by increasing its shear strength and reducing its deformation. The use of geotextiles has been shown to result in improved pavement performance, increased service life, and reduced maintenance costs.

The purpose of this essay is to present a comprehensive overview of recent studies on geotextile-reinforced soil for pavements. The focus of the essay will be on the mechanisms of geotextile reinforcement, the properties of geotextiles, and the various types of geotextiles used for soil reinforcement in pavements.

### Mechanisms of Geotextile Reinforcement:

Geotextile reinforcement works by improving the interaction between soil and pavement layers. The geotextile acts as a mechanical interlayer that separates the soil from the pavement, preventing direct contact between the two materials. This reduces soil-pavement friction, which leads to reduced deformation and improved shear strength of the soil.

In addition, geotextiles can also improve soil strength by increasing the soil's internal friction angle. This occurs because the geotextile provides a surface for soil particles to adhere to, which enhances soil-soil friction and increases the soil's resistance to deformation.

### Properties of Geotextiles:

The properties of geotextiles are important factors that determine their effectiveness as soil reinforcement materials. The most important properties include permeability, strength, and stiffness.

Permeability is the ability of geotextiles to allow water to flow through them, which

is important for drainage and reducing soil erosion. Strength is the ability of geotextiles to resist tearing and puncturing, while stiffness is the ability of geotextiles to resist deformation.

#### **Types of Geotextiles:**

There are several types of geotextiles used for soil reinforcement in pavements, including woven and non-woven geotextiles, and geogrids. Woven geotextiles are made from woven fibres and are commonly used for soil reinforcement due to their high strength and low permeability. Non-woven geotextiles are made from randomly-arranged fibres and are often used for drainage applications due to their high permeability.

Geogrids are grid-like structures made from polymer materials that are used to reinforce soil. Geogrids are particularly effective in increasing soil shear strength and reducing soil deformation.

Keya Biswas  
(B.Tech 3<sup>rd</sup> Year)

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## **STABILIZATION OF SOFT SOILS USING INDUSTRIAL WASTES**

Stabilization of soft soils using industrial wastes is a cost-effective and environmentally friendly solution to the problem of weak and compressible soils. Soft soils, such as silt and clay, are often found in coastal regions, river deltas, and other areas where high levels of organic matter are present. These soils have a low bearing capacity and are prone to settling, making them unsuitable for construction purposes. By using industrial wastes, such as fly ash, slag, and other by-products, to stabilize soft soils, engineers can create a more cost-effective and environmentally responsible solution.

Fly ash, for example, is a by-product of coal-fired power plants and is a commonly used stabilizing agent for soft soils. It is rich in silica, alumina, and iron oxides, which improve the soil's strength and stability. The addition of fly ash to soft soils can increase their bearing capacity, reduce their compressibility, and improve their drainage characteristics. This results in a more stable soil structure that can support the construction of buildings, roads, bridges, and other structures.

Slag, a by-product of the iron and steel industry, is another material that can be used to stabilize soft soils. Like fly ash, slag is rich in silica, alumina, and iron oxides, making it an effective stabilizing agent. The addition of slag to soft soils can improve their strength, stability, and resistance to settling, allowing for the construction of structures in areas where soft soils are present.

In conclusion, stabilization of soft soils using industrial wastes is a cost-effective and environmentally friendly solution to the problem of weak and compressible soils. By using materials like fly ash and slag to stabilize soft soils, engineers can create a more sustainable and responsible solution that benefits both the environment and the construction industry. This method is easy to implement, and its cost-effectiveness makes it accessible to a wider range of people and projects, making it an important tool for the construction of structures in areas where soft soils are present.

Saurav Pal  
Assistant Professor

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## INDIA'S FIRST UNDERWATER TUNNEL: KOLKATA'S EAST-WEST CORRIDOR

Kolkata, India's City of Joy, is being seen as the country's first underwater rail tunnel started to run on February 13, 2020. The said train is a metro line, runs between Salt Lake Sector V and Howrah, which is known as the East-West Corridor in Kolkata with the stretch of 16.6 km and 12 stations, six of which are under the ground, while the remaining six metro stations are on elevated tracks. The underground metro stretches from Phoolbagan station up to Howrah Maidan, and has a total of six stations in between, including Phoolbagan, Sealdah, Esplanade, Mahakaran, Howrah, and Howrah Maidan.

The companies responsible for constructing the country's first tunnel under the Hooghly River for establishing metro link between Howrah and Kolkata are Afcons Trans Tunnelstroy and Kolkata Metro Railway Corporation Ltd.

The major complication of the project was Boring; "Rachna", a giant tunnel-boring machine (TBM), was brought from Herrenknecht AG plant in Schwanau, Germany; deployed to dig the underwater tunnel that runs a length of 502 metres under the river.

The first of its kind in the country, the metro train is said to be at par with the likes of Eurostar that connects London and Paris. It spans a total of around 16 km, with a part of it (around 10 km), running underwater in River Hooghly. While underwater, the train runs at a depth equivalent to a ten-storey building. The underwater stretch for the metro train will comprise twin tunnels, which are made of 1.4 m wide concrete rings. They have been further fitted with hydrophilic

gaskets to prevent water from entering the tunnels.

As per the Kolkata Metro Rail Corporation (KMRC), this is among the many "firsts" in the country with regard to railway development.

Also, it was estimated that this metro will play around one million passengers daily and will cut down the travel time between Salt Lake to Howrah from an hour to less than 30 minutes.

Further India's first underwater metro twin tunnel project in Kolkata, the East-West Metro, added another feather to its cap by getting India's deepest metro ventilation shaft on the banks of the Hooghly River at 43.5m depth equalling a 15-storey building. The ventilation shaft is crucial in underground Metro construction as it facilitates the evacuation of passengers from the tunnel to ground level in case of any emergency situation. The shaft is also used for air circulation, pumping air in and out of the air conditioning system, and ensuring the flow of air in the tunnels to prevent passengers from feeling suffocated. The ventilation shaft is also equipped to extract smoke in case a fire breaks out. The metro ventilation shaft located on the strand road is 43.5m deep having a diameter of 10.3m. The Kolkata Metro Line 2 (Line 2 or East-West Corridor) is rapid transit line of the Kolkata Metro that is eventually set to connect Teghoria with Howrah by going underneath the Hooghly River. In this process, Line 2 is set to be India's first underwater metro tunnel.

Priyabrata Guha

Assistant Professor

## CREATIVE CORNER

### SUDOKU

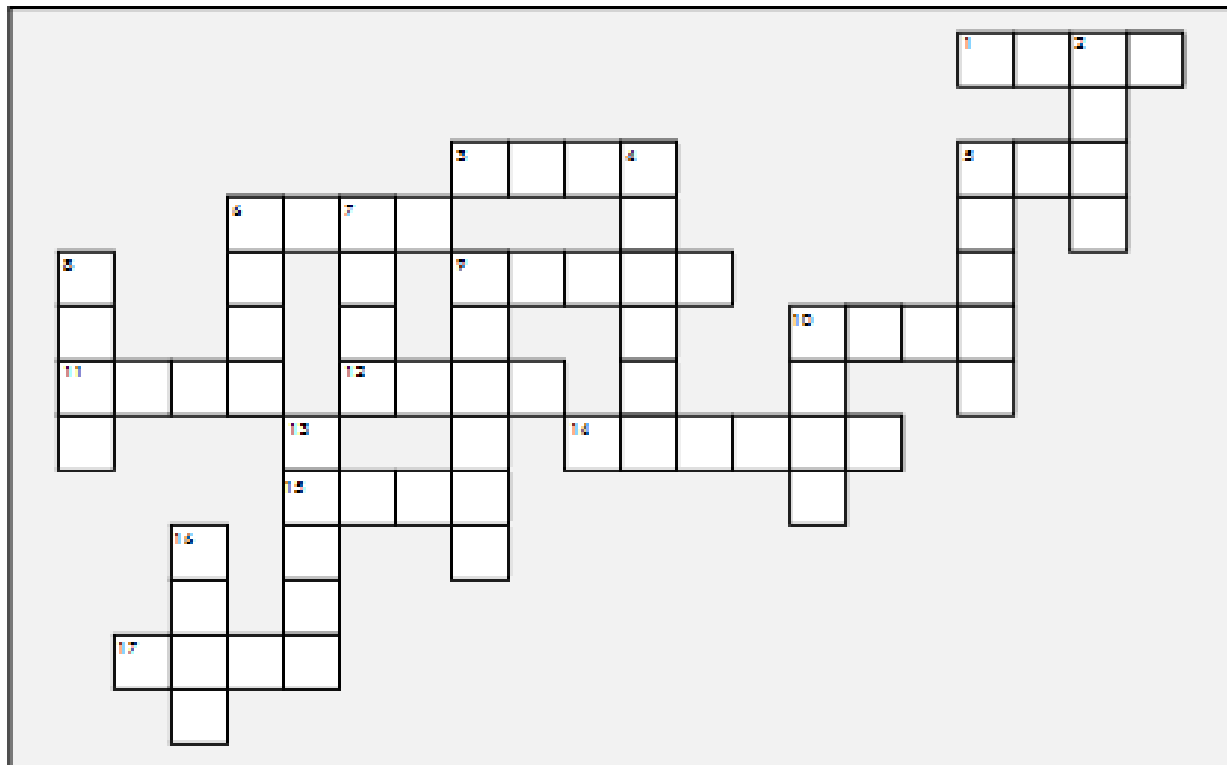
			2	6		7		1
6	8			7			9	
1	9				4	5		
8	2		1				4	
		4	6		2	9		
	5				3		2	8
		9	3				7	4
	4			5			3	6
7		3		1	8			

## SUDOKU Solution

4	3	5	2	6	9	7	8	1
6	8	2	5	7	1	4	9	3
1	9	7	8	3	4	5	6	2
8	2	6	1	9	5	3	4	7
3	7	4	6	8	2	9	1	5
9	5	1	7	4	3	6	2	8
5	1	9	3	2	6	8	7	4
2	4	8	9	5	7	1	3	6
7	6	3	4	1	8	2	5	9



## Crossword Puzzle



### ACROSS

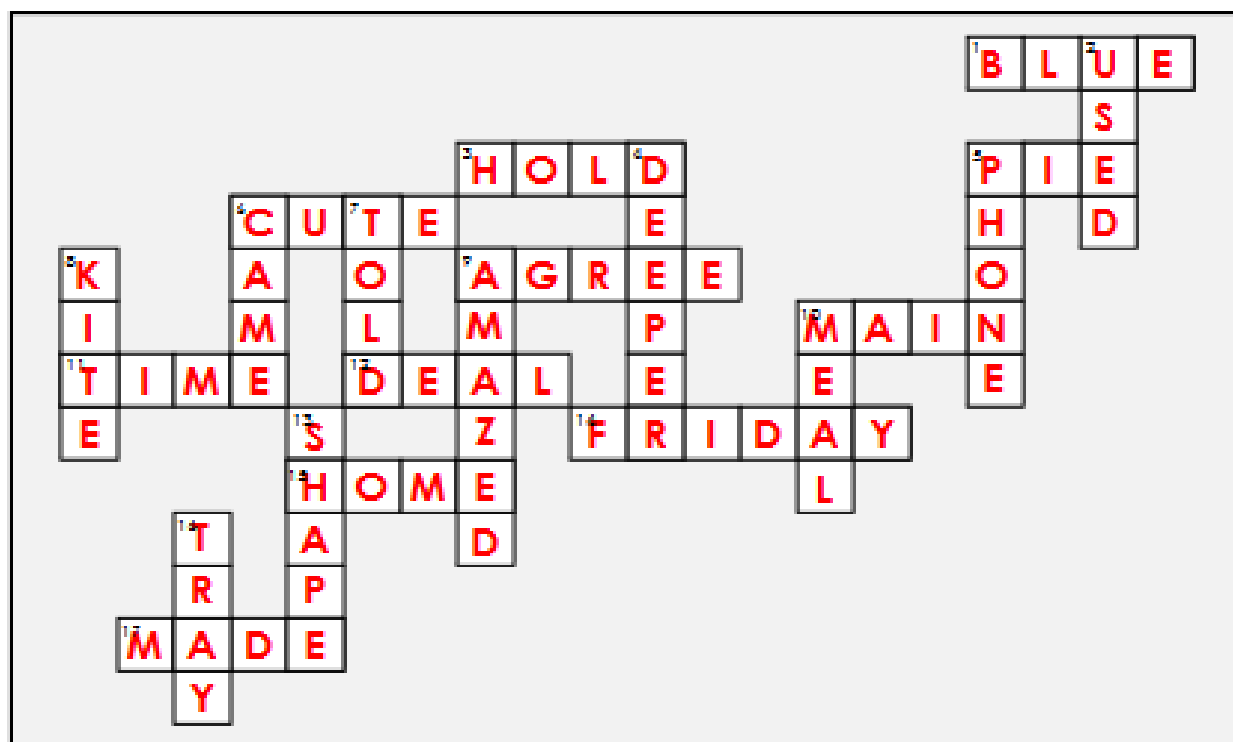
1. color of the sky
3. to put in your hands
5. apple and pumpkin are types of this
6. add an e to the word cut
9. unscramble: egear
10. unscramble: mnia
11. a clock tells you this
12. unscramble: lead
14. day before Saturday
15. where you live
17. She \_\_\_ her bed.

### DOWN

2. antonym for new
4. My pool is \_\_\_ than yours.
5. use this to call people
6. past tense of come
7. past tense of tell
8. has a tail and flies in the sky
9. surprised
10. breakfast is one of these
13. a triangle is this
16. put your lunch on this

## ANSWER KEY

### Crossword Puzzle



#### ACROSS

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### **Some of the important IS Codes for Reference:**

- IS 383 : 2016 – COARSE and FINE AGGREGATE for CONCRETE - SPECIFICATION
- IS 456 : 2000 -- PLAIN and REINFORCED CONCRETE - CODE of PRACTICE
- IS 800 : 2007 -- GENERAL CONSTRUCTION in STEEL - CODE of PRACTICE
- IS 875 (Part 1 - 5) – CODE of PRACTICE for DESIGN LOADS (OTHER THAN EARTHQUAKE) for BUILDINGS and STRUCTURES
- IS 1201 – 1220 : 1978 -- METHODS for TESTING TAR and BITUMINOUS MATERIALS
- IS 1343 : 2012 -- CODE of PRACTICE for PRESTRESSED CONCRETE
- IS 1622 : 1981 -- METHODS of SAMPLING and MICROBIOLOGICAL EXAMINATION of WATER
- IS 1893 (Part 1) : 2016 -- CRITERIA for EARTHQUAKE RESISTANT DESIGN of STRUCTURES -- GENERAL PROVISIONS and BUILDINGS
- IS 2386 (Part 1, 4 & 16) -- METHODS of TEST for AGGREGATES for CONCRETE
- IS 2502 : 1963 -- CODE of PRACTICE for BENDING and FIXING of BARS for CONCRETE REINFORCEMENT
- IS 2720 -- METHODS of TEST for SOILS
- IS 2911 – (Part 1 - 4) -- DESIGN and CONSTRUCTION of PILE FOUNDATIONS — CODE of PRACTICE
- IS 3025 -- METHODS of SAMPLING and TEST (PHYSICAL and CHEMICAL) for WATER and WASTEWATER
- IS 4986 : 2002 -- INSTALLATION of RAINGAUGE (NON-RECORDING TYPE) and MEASUREMENT of RAIN -- CODE of PRACTICE
- IS 4987 : 1994 -- RECOMMENDATIONS for ESTABLISHING NETWORK of RAINGAUGE STATIONS
- IS 5225 : 1992 -- METEOROLOGY - RAINGAUGE, NON-RECORDING - SPECIFICATION
- IS 6403 : 1981 -- CODE of PRACTICE for DETERMINATION of BREAKING CAPACITY of SHALLOW FOUNDATIONS
- IS 6512 : 1984 -- CRITERIA for DESIGN of SOLID GRAVITY DAMS
- IS 8009 – (Part 1 - 2) -- CODE of PRACTICE for CALCULATION of SETTLEMENTS of FOUNDATIONS
- IS 10262 : 2019 – RECOMMENDED GUIDELINES for CONCRETE MIX DESIGN
- IS 10500 : 2012 – DRINKING WATER — SPECIFICATION
- IS 13920 : 2016 -- DUCTILE DETAILING of REINFORCED CONCRETE STRUCTURES SUBJECTED to SEISMIC FORCES - CODE of PRACTICE

