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- **Senior Environment Specialist with the World Bank’s Global Environment Department and Country Coordinator on Environment Risk Management for India.**
- In more than 25 years of professional experience, led several sustainability initiatives and helped mainstream environment, health and safety aspects into policies and programs across major sectors – Transport, Water, Urban, Disaster Management, Health, and Education.
- Worked across countries in South Asia and Africa along with many global assignments with operational experience covering environmental risk assessment, planning, management, promoting nature-based solutions, capacity building, managing biodiversity issues, enhancing resilience, and advancing environmental education.
- Represents the World Bank on many committees with mandates on Environment Management and Climate Resilience and is a part of National Think Tank on Geo-spatial Technologies.
- Delivers training programs in several institutions, including at Indian Institutes of Management (IIMs), International Association for Impact Assessment (IAIA) and other environment, engineering, and industry associations.
- Serves as a jury member on Green and Safety forums/initiatives, including those of Govt. of India.

This Presentation ...

- A. Key Concerns to be addressed during Design Stage**
- B. What should be done during Construction Stage ?**
- C. Precautions/Measures to be taken during Operation Stage**

A. What can be done during Design Stage?

1. Wider spans to avoid contact with waterways/water bodies (or limit the footprint to the possible extent) – helps from hydrological perspective, climate resilience/extreme event perspective and limits the impact on sensitive aquatic populations



What can be done during Design Stage?

2. Considerations to ensure wildlife movement (terrestrial) is not obstructed/affected when located in/near sensitive natural environments.



What can be done during Design Stage?

4. Leverage bridge engineering designs/techniques that make structures lighter – this too reduces environmental footprint.
5. Choice of materials - longer design life for asset and environmental sustainability
6. Health and safety features from a user’s perspective (noise barriers, pedestrian walkways and crossings, lighting, protection works, scour protection, signage, railings, expansion joints)
7. Promote modern equipment/machinery to be used on site - as part of the design process.



Some Advantages of Steel Bridges

- a) **Light/er weight** (less loading on sub-structure)
- b) **Quality Control**
- c) **Long span lengths**
- d) **Speed of construction**
- e) **Service Life**
- f) **Versatility**
- g) **Recycling**
- h) **Reusability**



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Noise and Visual Barriers ... for different purpose



What can be done during Design Stage?

8. Clear detailing of construction methodology, sequencing and scheduling, including requirements on health and safety
9. Ensure that technical and EHS requirements are well reflected in the Bidding Documents
10. Calculate the environment/ecological/GHG footprint – can be used for leveraging carbon or green bond market



Bridge Design Aesthetics / Creating Iconic Structures (but not without considering Public Amenities, Safety Ecological Values)

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Bridge Design Aesthetics and Tourism Values (but not without considering Public Amenities, Safety Ecological Values)

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**Preserving (and Creating)
Tangible Cultural Heritage**

**Learning from Past
(including reasons for
failure of structures)**

and

**Creating/Replicating Good
Practices**

Creating Resilient Structures and using Structures for Resilience

Protecting fragile
ecosystems/sensitive
physical environment



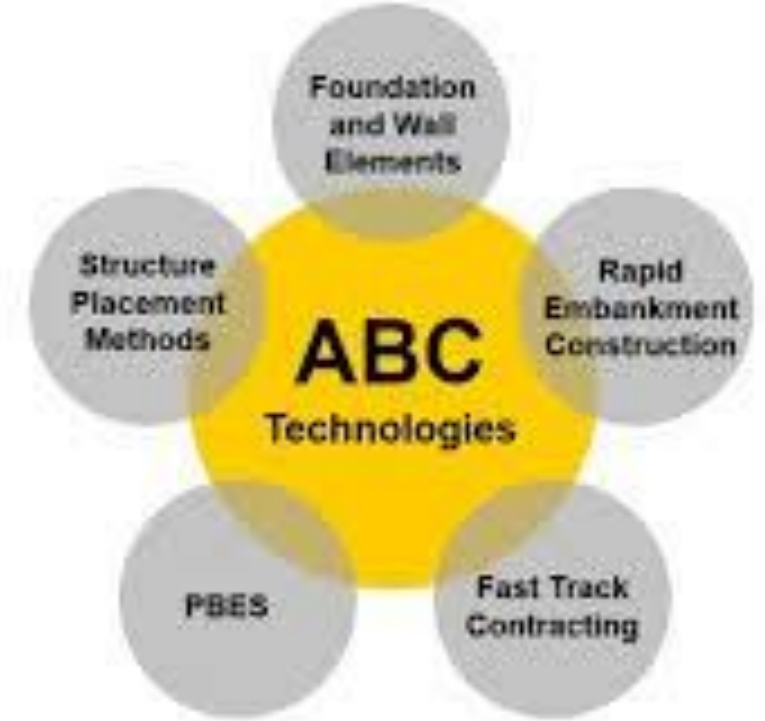
Issue of Bridge/Structure Alignment and Approach Roads

- Fractured/disconnected approach in planning and design
- Affects already fragile slopes
- Landslide/slips
- Turning radius, specially when the segment has strategic importance
- Impact on properties
- Non-effective/weak land use control



B. What needs to be done during Construction Stage?

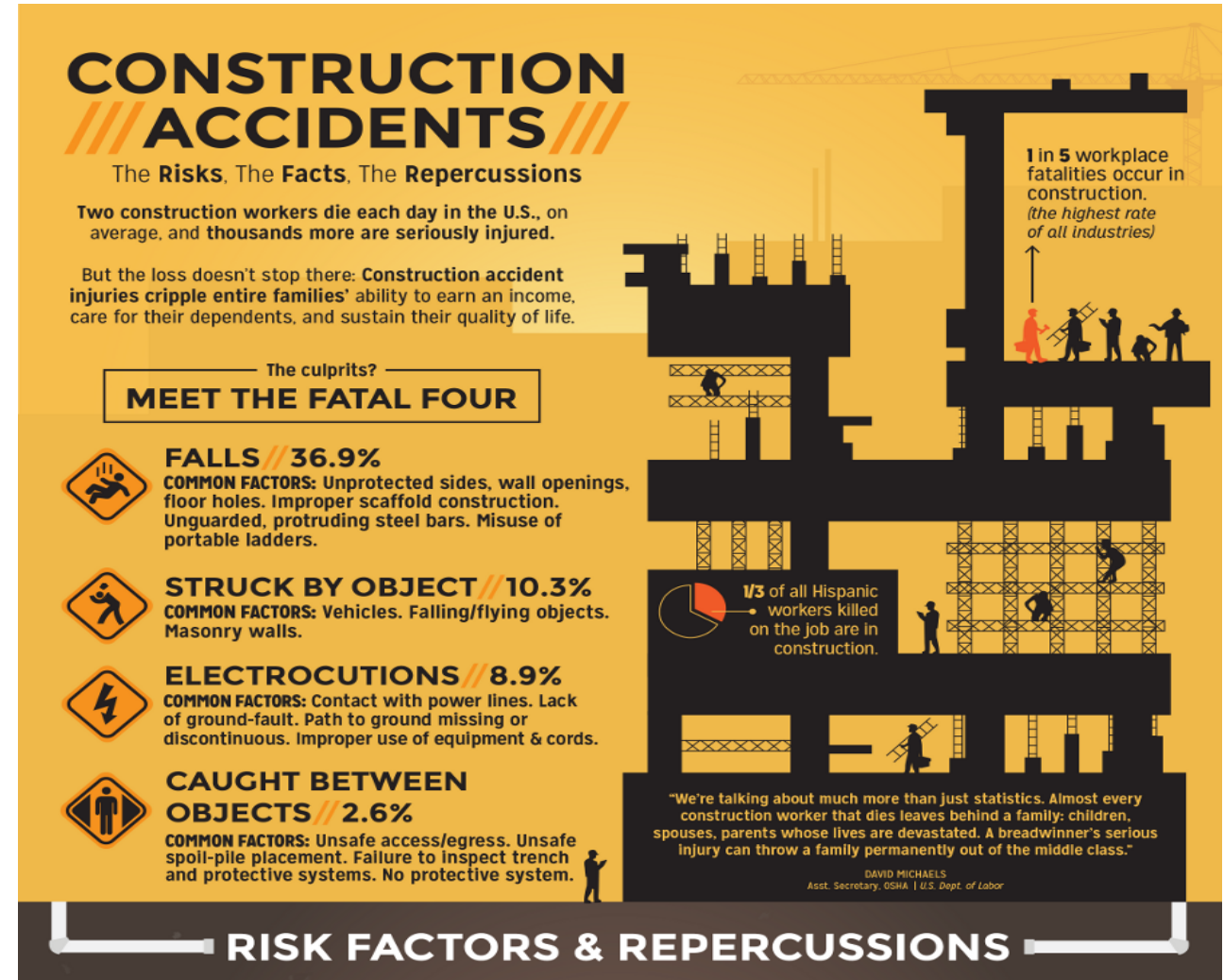
1. Use of Accelerated Bridge Construction (ABC) can significantly limit risks and impacts on environment, especially when working over waterways or near ecological and socially sensitive areas.
 - Include use of prefabricated bridge elements and systems - make construction less disruptive to the areas surrounding work zones as work is done off site in controlled spaces
 - Far less disruptive than doing complete, end-to-end construction work on the actual bridge site.



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6. Safety of Workers – ENGINEERS included !



Falls are the leading cause of fatalities in the construction industry.



Did you know?

Falls from elevation account for more than one third of all deaths in construction





Safety Measures for Construction in/near water bodies/ways is another critical element of Bridge Works

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Risks related to
Material Handling
including its storage and lifting



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Non-provision, non or incorrect usage and lack of enforcement of Personal Protective Equipment



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Critical Element for Bridge Construction Works



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Securing Work Zones On and Off site – Controlled Access



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Worker as well as Community/
Public Safety Measures



Electrical Hazards

1. Contact with Power Lines
2. Lack of Ground Fault Protection
3. Equipment Not Used in Manner Prescribed



10,218 electrical-related fatalities

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Simple and effective
safety measures
but

Implementation /
enforcement ???





CONDUCT A RISK ASSESSMENT

Performing a thorough risk assessment can help you identify hazards at the site and address the measures you will take to reduce or eliminate their risks to employees.

Hierarchy of Controls



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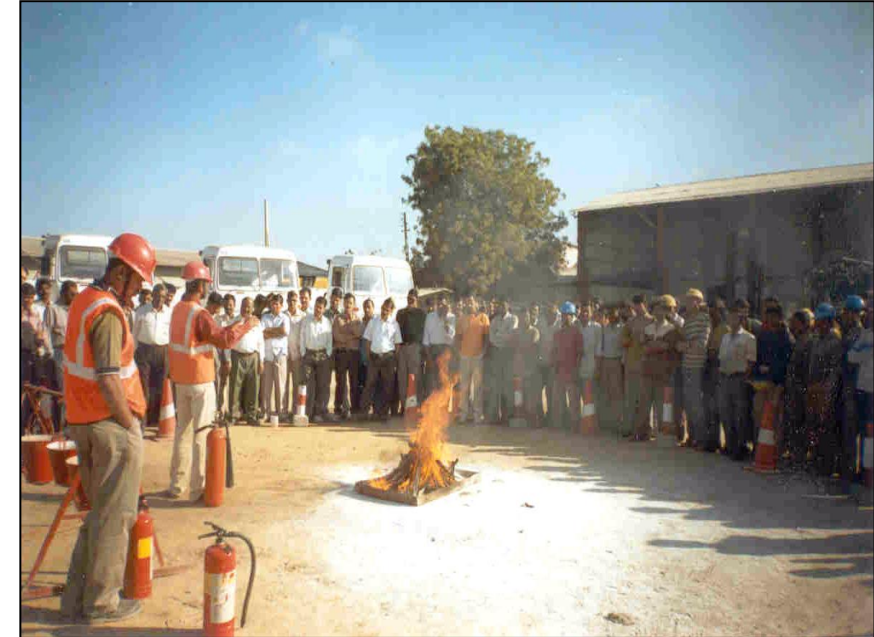
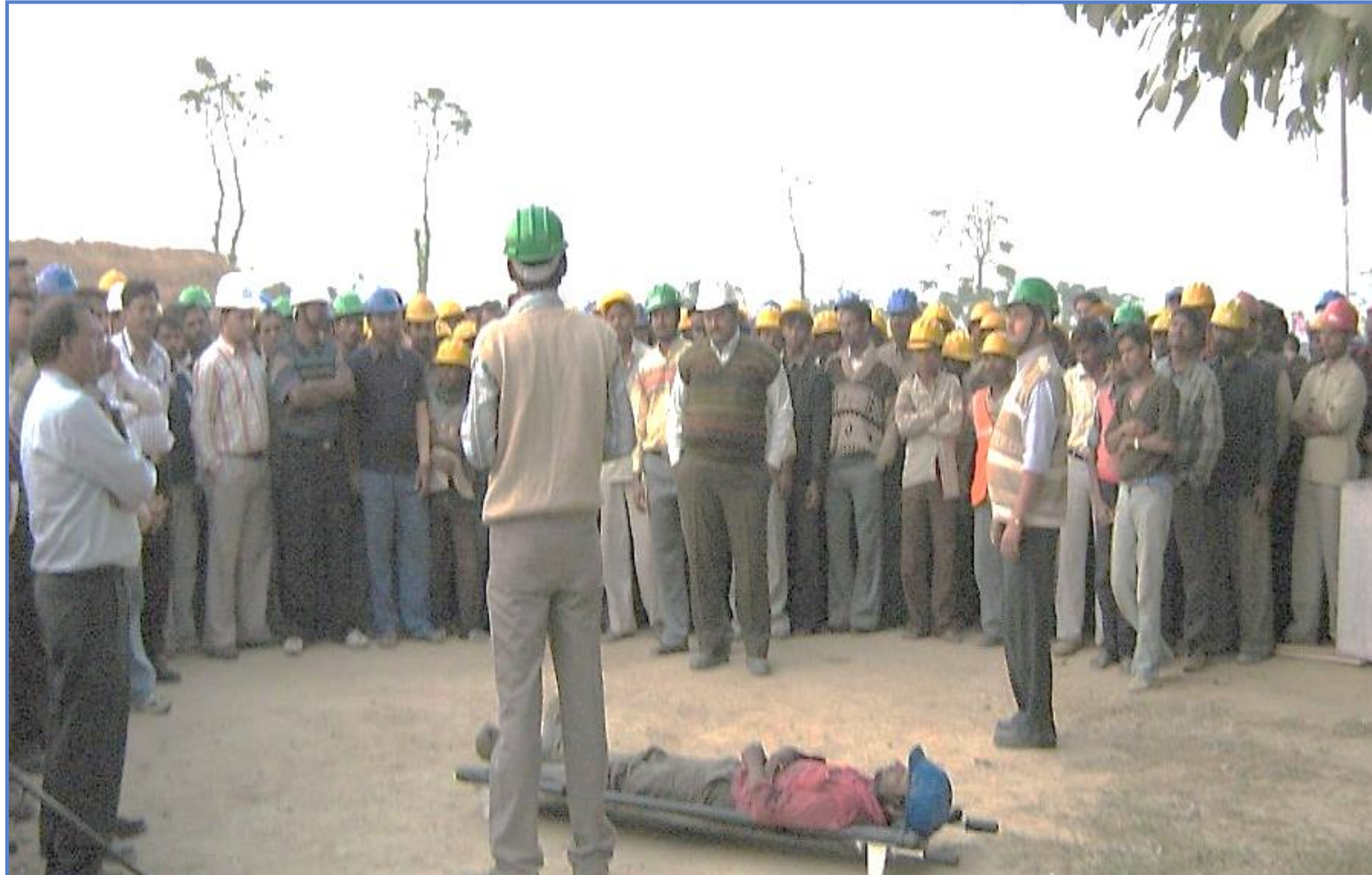


BEHAVIOR

One of the most fundamental approaches to safety is to instill safe behaviors in your workers.



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**Periodic Awareness Sessions,
Drills, Health Check-ups and Daily
Toolbox Talks are necessary**

1. Project Information Boards
2. Permission to ‘locate’ camp/plant
3. Approval of the camp/plant lay-out
4. Traffic management/diversion plan/permission
5. First aid arrangements
6. Emergency Response Plan
7. Information to Stakeholder/Community in the vicinity
8. Debris Reuse/Management
9. Sensitization/Training to staff and workers
10. Pollution Monitoring

**Management
and
Mitigation Measures
to
avoid/minimize
risks and impacts
during construction**

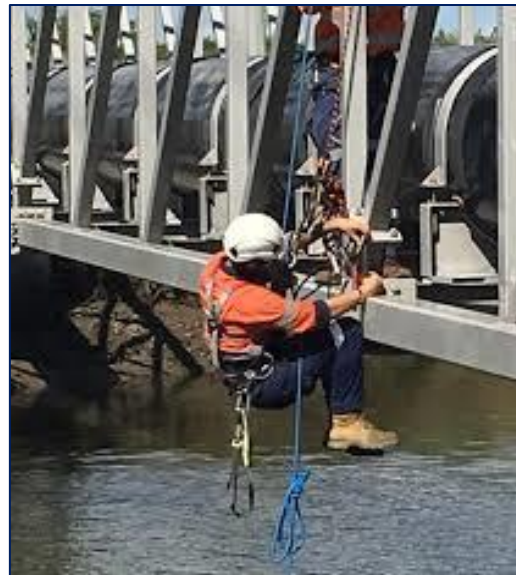
C. Precautions/Measures to be taken during Operation Stage

1. Timely and effective maintenance regime is **critical** for both asset preservation and safety
 - Reduces need for costly repair and rehabilitation
 - Prevents eroding of economic and social benefits of the asset
 - Ensures safety of the users
 - Minimizes risk of pollution and environmental damage



2. Safe Access to Hard-to-reach Sections of a Bridge for:

- Inspections
- Maintenance and
- Repair Work



3. Traffic Safety and Management

- Advance Warning for Road/Bridge Users
- Traffic Calming Measures
- Work zone Delineation – Barricading, Signage and Lighting
- Timing and sequencing of works
- Closure of the section and Diversion of Traffic, as needed



3. Protect Bird Nests and Roosts



Must Avoid:

- Modifying structures during active season
- Affecting egg incubation and juvenile rearing
- Downstream migration cycles of fish.
- Harming/hunting of by workers.
- Damaging trees/rare plant species/riparian habitat while accessing the site
- New bridges - designed with features that prevent birds from nesting.
- Existing structures - retrofitted with nets, special coatings and other measures that make it harder for birds to build nests on them.

4. Other Preventive and Maintenance Measures from EHS Perspective

- a) Periodic cleaning of decks, seats, caps, signage, safety features and splash zones
- b) Cleaning of bridge drainage systems
- c) Pollution prevention care during cleaning/lubricating expansion-bearing assemblies
- d) Pollution prevention and clean-up during sealing concrete decks or sub-structure elements.
- e) Vegetation control around the bridge
- f) Repairing any disturbed/damaged protection work
- g) Removing large debris from the water channel
- h) Re-painting of railings, curbs etc.
- i) Preventing/taking action on illegal mining on the upstream or downstream side.

Thank you

For more information, you can contact:

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