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Lessons Learned from Infrastructure Failures- The Importance of Good Design and Quality Control/Assurance

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Case #1: Bridge Collapse

- USAID has been working to improve the road safety and accessibility characteristics of a 190-kilometer road between two cities in order to foster economic growth in a country.
- The activity is included under a larger infrastructure services project (5 year IQC).
- A bridge constructed under the project collapsed in February 20, 2009 after a truck hit it.



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Why did it collapse?

- **Poor Design** (absence of appropriate reinforcement and bolts)
- **Poor QA/QC** (no independent construction supervision)



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Lessons Learned

Sticks to the basics:

- Good Design
- Good Construction
- QA/QC
- Separate the three



Case #2 Building Roof Failure

- A building was constructed for USAID in a conflict zone in 2004.
- The subject building had a double roof system, in which the upper roof was a sacrificial protection slab for blast loads or mortar attacks. The lower roof slab was designed to resist blast pressure.



Leaky Roof

- The roof leaked so in September 2008, the said USAID mission used sand infill and concrete tiles on the upper slab in order to stop the leaks.



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The upper protection slab collapsed onto the lower main slab of the roof on September 1, 2009. No one was injured, but the building was evacuated and closed.



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Why did it fail?

The addition of sand and pavers to the sacrificial protection slab caused the collapse. The slab was not designed to carry such loads.



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But what about the factor of safety? Are not most structural elements over designed?

- As part of the analysis, concrete cores were extracted from the upper and lower roof slabs, the walls, and the columns. Most samples did not meet design value. **Poor QA/QC.**



Lessons Learned

- Before you make a major change or amendment to a structure go back to the designer to make sure that is viable.
- Independent construction supervision is a must.



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Basic Principles of good construction

- Good Design
- Good Construction
- QA/QC
- Separate the three



Are these principles only relevant to large infrastructure?

- Gravity fed water systems where the water source is lower than the destination
- School buildings where there are no structural columns
- Concrete footpaths that disintegrates after the first significant rainfall event
- The water tank that collapsed and resulted in fatalities



Points to ponder

- Will a contract/grant to a well reputed organization guarantee quality?
- Acquisition versus assistance (separating soft/hard)
- Project Planning/Design – who should be involved?
- COTR/Activity Managers – who should be involved?
- M&E - who should be involved?



- **“You may never reach perfection but if you pursue it long enough, you may catch excellence”.**

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Edward Demming