How to Transform Failure into Success: Forensic Management

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Literature and experience suggest that while structures fail on a technical basis, the actual root cause of that failure is not solely a technical matter. This learning is common, and therefore systemic, within the practice of engineering. The corrective actions noted below suggest, in no intended order, those nontechnical matters that have driven a structure's success or failure. Failure may be defined as a project not meeting the objectives of its major stakeholders.

Whether new or retrofitted, a structure will be the outcome of a system of management. Structural engineering is one and only one part of that system. Perhaps the most unaddressed part of the system of management is the human side. Human Systems Engineering™ recognizes and includes, with the same attention to detail as applications dealing with the technical side, anticipatable people-driven issues at the project, organizational, and individual level. The role of each component of the system of management is not to optimize its part but to focus on the intended outcome for that system. The specifics that follow are translatable, fundamental parts of the system of management derived from the application of Forensic Management.

1. Prepare, update, and apply at the executive level, an accept/reject proposal checklist using the issues that follow. If you hear anyone on the proposal team use the words, "hope," "try our best," or "should," reject the proposal. It may be the best work you never get.
2. Confirm the level of owner/user planned participation in the design and construction phases of the work. Document the name of the individual who will speak for the client in project-related matters.
3. Consider the potential for parts of the structure to be used in unintended ways.
4. Validate the owners/users understanding of, and budget for redundant systems.
5. Identify those parts of the applicable codes that are not sufficient for the intended design. Obtain the owner/users agreement to include above minimum code parameters in the budget.
6. Establish an Engineering Review Panel (ERP) to validate the design interpretation of the architect's concept/schematic as well as critical points in the design and construction process. Examples might be for ERPs from Type 1 to Type 3, with Type 1 requiring a multidisciplinary review and travel to Type 3 requiring the review of appropriate documents and no travel.
7. Develop guidelines for a structural peer review for specific categories of structures (e.g., buildings under or over 3 stories).
8. Work with geotechnical engineers who have long-term experience in the project site area. Address types of clay, soil, and rock that may be in unique layering patterns.
9. Budget targeted external structural peer review at early critical design junctures.
10. Plan and conduct external structural engineering system peer reviews.
11. Do not accept the contract for design if you are not contracted through construction completion. The structural engineer's on-site presence for various phases of the work is nonnegotiable. A note in the specifications or on the drawings is not an acceptable substitution.
12. Do not attempt to contractually or informally relinquish all or part of your professional responsibility. The structural engineer of record cannot do so.
13. Do not accept inadequate time and/or budget as it will never be an acceptable explanation for unacceptable work. "I don't have the luxury of making detailed reviews." (Forensic Engineering Congress 2006).
14. Confirm the amount set aside by the owner in the budget for the contingent work during the design process and for construction.
15. Provide a visible process for early conflict identification and resolution that manages differences, disagreements, and the resolution/agreement communication process.
16. Establish a visible proactive process for the early facilitation of "unspoken opinions."
17. Set clear mutually agreeable guidelines for out-of-scope work within your firm's executive owner/user contract.
18. Within 24 hours of an assumed verbal agreement, confirm verbal changes in direction/agreement in writing to the client, contractor, and subcontractors.
19. Organize the project team for crisis management using a documented flow diagram and log of contact persons and contact information, accessible 24 hours per day, 7 days per week.
20. Check the contract(s) and eliminate the not-to-be-used words (i.e., "all," "every," "complete," "best," "highest," etc.).
21. Be specific about your right—not your obligation—to suspend work if invoices are not paid per the contract.
22. State that if the project work is delayed beyond a certain number of days, you reserve the right to renegotiate the fees for the work going forward.
23. Prepare, distribute, and discuss at the preconstruction meeting the submittal log/checklist process for submittals of concrete, steel, and other materials.
24. Develop a schedule and process for submittal review and requests for information (RFIs) that take into consideration submittal format, recording process, response and approval timing, physical submittals, number of copies, etc. Routine collaboration with the contracting entities will save the time and energy wasted in trying to manage an adversarial relationship.

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25. Using issues from past projects, facilitate early dialogue between the architect, engineer, contractor and owner/client such as the communication process, payment requests, submittal process, change orders, and RFIs.
26. Engage the architect, vendor, supplier, fabricator, erector, and contractor early to establish an environment of collaboration, communication, and cooperation.
27. Initiate and sustain a collaborative-design approach early in the design phase that will allow various disciplines to "design out" complexity during construction.
28. Do not seek shelter under the language of your review stamp. Administrate contractor and vendor submittals in a timely and consistent fashion. Set up a submittal review team within the structural design group to facilitate the review and approval process, and assure that the proper level of discipline resource is being utilized for review and approval.
29. Document and discuss the process flow diagram for interdependencies such as the transfer of CAD drawings for rebars, connections, and other supplier/vendor estimation and detailed design applications.
30. Document and validate for each discipline and the project those accountable to deliver and the boundaries of their authority.
31. Assign a project CADD coordinator to review, discuss, and determine the project-specific requirements for the effective transfer and acceptance of electronic files to/from other entities on the project.
32. Establish and monitor the use of certified special inspections personnel.
33. Identify external interrelationships and coordination expectations.
34. Institute an anonymous project feedback evaluation process, and report the feedback to the participants.
35. Collaborate the timing of internal project audits at the 15, 30, and 60% complete phases and focus on conformance to plan.
36. Be wary of contractors who bury you in shop drawings, change orders, and requests for information. Assert your concerns early and loudly.
37. Check the working experiences of other project team members along with your team's members.
38. Identify competency levels and provide training.
39. Search for someone doing something good and thank her/him in front of colleagues.
40. Investigate the basis of each project entity's recognition and reward system.
41. Develop and obtain project team buy-in to a project closeout checklist. Craft the project closeout checklist within the first 5% of the project's life.
42. Develop your standards of structural engineering practice for specific experience in your geographies (e.g., 90% of buildings 3-stories and under are constructed by small contractors).
43. Develop and update a practice guide for the investigation of failures and the resolution of claims. Include strategies to inform your employees, client/owner, project entities, and the public.
44. Establish and maintain a routine (nonincident triggered) business relationship with critical team members (i.e., owner/user, subconsultants, discipline managers).
45. Establish a project communication process that addresses the needs and expectations of project stakeholders. Consider the following categories of project stakeholders (Institute for Regulatory Science website. ⟨www.Nars.org/prformsframe.htm⟩).
    - **Personally impacted stakeholders (PI):** This group consists of individuals whose lives are directly impacted by the action under consideration.
    - **Administratively impacted stakeholders (AI):** This group consists of elected, appointed, or employed individuals who must ensure that the action under consideration is prepared, reviewed, approved, or implemented in accordance with applicable laws, regulations, permits, licenses, or agreements.
    - **Generally concerned stakeholders (GC):** This group includes individuals who, by virtue of their personal philosophies, beliefs, or ideologies, are interested in or concerned about the action under consideration.
    - **Process concerned stakeholders (PC):** Members of this group are concerned over the appropriate role of the other three groups of stakeholders in the decision process.

Human Systems Engineering™was developed by the author as part of the research required for preparation of a Ph.D. dissertation. The author likens it to a basic lesson learned when taking the undergraduate course "Indeterminate Structural Analysis." As recalled, first one must recognize he or she is addressing a structure that is not simple. Next, to approach a solution, one must assume that components of that complex system are simple, so that various analyses can be made. Then, when ready to compile the simple solutions back into the model, one makes corrections/adjustments (i.e., the ubiquitous "k" factor) to their design, recalling the starting point: the design of an indeterminate structure. So it is with Human Systems Engineering™.

That's my opinion; I welcome yours.

References

Forensic Engineering Congress. (2006). "Comment from podium." *4th Forensic Engineering Congress*, ASCE, Cleveland.