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*The World's Premier Provider of Coke Drum Analysis and Assessment Services.
Fitness-For-Service * Finite Element Analysis * Structural Dynamics
Registered Engineering Firm in Texas No. 13858*

Mahmod Samman, Ph.D., P.E.

Licensed professional engineer, Texas # 82075

Specialized Expertise

- Analysis, assessment, troubleshooting, and repair of coke drums.
- Fitness-for-service assessment of fixed equipment.
- Finite element analysis.

Education

Ph.D. Engineering Mechanics, Duke University, 1991.

M.S. Structural Engineering, with Honors, King Saud University, Riyadh, 1987.

B.S. Civil Engineering, with Honors, King Saud University, Riyadh, 1985.

Employment

Houston Engineering Solutions, LLC:

President, 2011- present.

Stress Engineering Services, Inc.

Senior Associate, 1998 – 2011.

Associate, 1991 – 1998.

University of Houston

Lecturer, Department of Civil and Environmental Engineering, 1998-2000. (Taught a graduate-level course in finite element analysis on a part-time basis).

Duke University

Research Assistant, Transportation and Infrastructure Research Center, 1987 – 1991.

Professional Honors

- Fellow, American Society of Mechanical Engineers (ASME), 2009.
- Fulbright Scholar, U.S. Department of State, 2005.
- Young Engineer of the Year Award, City of Houston, 2000.
- National Internship Award, Leadership Development Initiative, ASME Council on Codes and Standards, 2000.
- Herbert Allen Award for “outstanding technical achievement by a young engineer”, South Texas Section, ASME, 1997.

Professional Affiliation

- Member, Joint ASME/API Fitness-For-Service Standard Committee (API-579/ASME-FFS)
- Member, API 934G and 934J Workgroups on coke drums.
- American Society of Mechanical Engineers (ASME) – Chairman, South Texas Section, 1999-2000; Assistant Vice President, Region X, 2003-2005.
- American Society of Civil Engineers (ASCE).

Patents

- US 10,913,899- Coke drum deheading valve and inlet, 2021.
- US 9,884,996– Bulge-Resistant Coke Drum, 2018.
- US 9,643,145– Pressure Vessel Restraint for Accommodating Thermal Cycling, 2017.
- US 8,905,260– Pressure Vessel Skirt for Accommodating Thermal Cycling, 2014.
- US 5,822,057 - System and Method for Inspecting a Cast Structure, 1998.

Coke Drum Experience

Dr. Samman is a renowned expert in the analysis, assessment, repair, and troubleshooting of coke drums. These large refinery pressure vessels experience significant bulging, cracking, tilting, vibrations, and failure of support bolts due to severe thermal and mechanical loads. He conducted pioneering investigations of degradation patterns, structural failures, and post-repair performance of coke drums. His work in this area has resulted in novel design improvements and the development of state-of-the-art assessment, repair, and life extension techniques that are widely used at refineries and upgraders around the world. He is a member of API 934G and 934J Workgroups on coke drums.

His contributions to this field include:

- Started the Coke Drum Forum – the international summit on mechanical integrity and reliability of coke drum, since 2020.
- Taught the only class on mechanical integrity of coke drums, since 2012.
- Developed a patented shell fabrication method for fatigue-resistant coke drums, 2018.
- Developed a patented fatigue-resistant skirt anchoring system for coke drums that accommodates thermal cycling and addresses anchor bolt failures, 2017.
- Developed a patented fatigue-resistant skirt for coke drums that accommodates thermal cycling and addresses common attachment weld failures, 2014.
- Managed four research programs for investigating the effectiveness of automated weld overlays in long-term repair of coke drum bulges. Conducted for three oil companies and one welding company, the research included full-scale fatigue testing of repairs, 2009-2014.
- Developed the Plastic Strain Index (PSI) - the state-of-the-art bulging assessment technique that is widely used around the globe, 2011.
- Developed the Bulging Intensity Factor (BIF) - the bulging assessment technique that was widely used between 2004 and 2011.
- Designed and analyzed the first retrofit of a set of coke drums that changed their skirts from welded to non-welded design, 2011.
- Developed and analyzed the then largest-scale long-term bulge repair in industry history (3,350 ft²), 2010.
- Designed and analyzed the first non-welded sliding skirt, 2002.

Engineering Experience

Dr. Samman is a member of API 934G and A934J on coke drums as well as the Joint ASME/API Fitness-For-Service Standard Committee that writes the API 579 / ASME FFS Standard. He has conducted numerous Level 3 assessments of defects such as cracks, metal loss, bulges, dents, and fatigue damage in a variety of pressure equipment. He also performed reverse engineering of undocumented pressure vessels with unknown defects to determine proper operating conditions and provide certification to regulatory agencies. He taught courses and presented seminars on the topic.

Research Experience

Dr. Samman led and participated in several research projects:

- Suncor, Petrobras, Reliance, and CIMS (separate research projects) – Fatigue testing, material characterization, and modeling of automated weld overlays for long-term bulge repairs of coke drums, Principal Investigator, 2009-2014.
- American Gas Association, “Design guidelines for high-pressure pipe fittings”, Researcher, 1996.
- National Science Foundation, “Roughness characterization of drilled bores using laser scanning”, SBIR Phase 1, Principal Investigator, 1995.
- Department of Health and Human Services, “Analysis of medicine bottle closures”, SBIR Phase 1, Researcher, 1995.
- Federal Highway Administration, “Detection of defects in drilled shafts- Prototype development”, SBIR Phase 2, Principal Investigator, 1994.
- Federal Highway Administration, “Detection of defects in drilled shafts”, SBIR Phase 1, Principal Investigator, 1993.
- Pennsylvania Department of Transportation, “Detection of degradation in highway bridges”, Graduate Researcher, 1987-1990.

Publications

1. Samman, M. and Kaye, A. (2018) “A Non-Bolted Restraint For Coke Drums”, Proc. Pressure Vessel and Piping Conference, ASME, PVP2018- 84734.
2. Samman, M. and Ajmera G.(2018) “Performance of Bulges after Weld-Overlay Repairs”, Pressure Vessels & Piping Conference, ASME, PVP2018- 84736.
3. Samman M. and Doerksen, B. (2017) “The Significance of Coke Resistance in Coke Drum Failures.” Proc. Pressure Vessel and Piping Conference, ASME, PVP2017-65060.
4. Du Plessis, P. and Samman M. (2017) “A Successful Strategy for Managing the Mechanical Integrity of Coke Drums.” Proc. Pressure Vessel and Piping Conference, ASME, PVP2017-65066.
5. Samman M. (2016) “Bulging Patterns of Coke Drums.” Proc. Pressure Vessel and Piping Conference, ASME, PVP2016-63812.
6. Samman M. (2016) “Anchor Bolt Failures in Coke Drums.” Proc. Pressure Vessel and Piping Conference, ASME, PVP2016-63813.
7. Samman M. and Samman, M. (2014) “Stress Analysis of Bulges in Cylindrical and Oval Pressure Vessels.” Proc. Pressure Vessel and Piping Conference, ASME, PVP2014-28138.
8. Samman, M., Tinoco, E. B., and Marangone, F. C. (2014) “Comparison of stress and strain analysis techniques for assessment of bulges in coke drums.” Proc. Pressure Vessel and Piping Conference, ASME, PVP2014- 28139.

9. Samman, M. (2013) "Designing Balcony Railings for Windy Vibrations." The Construction Specifier, The Construction Specifications Institute, April issue, 54-59.
10. Samman, M. and Du Plessis, P. (2007) "The Bulging Intensity Factor (BIF) - A technique for assessing the bulging severity of coke drums." Proc. 2007 NPRA Reliability & Maintenance Conf., RMC-07-100, National Petrochemical & Refiners Association, Houston, TX.
11. Samman, M. M. (2001) "A hybrid analysis method for vibration signals based on neural networks and pattern recognition techniques." Journal of Vibration and Acoustics, American Society of Mechanical Engineers, 123(1) 122-124.
12. Samman, M. M. (1998) "Interpretation of Digital Signals Using Hybrid Neural Networks and Pattern Recognition Techniques." Chapter 5 in Artificial Neural Networks for Civil Engineers: Advanced Features and Applications, edited by Flood, I., and Kartam, N., The American Society of Civil Engineers.
13. Samman, M. M., and Pinto, F. W. (1998) "Structural Vibrations: Assessment and Troubleshooting", Vibrations, The Vibrations Institute, 14(2) 9-11.
14. Meyers, B., and Samman, M. M. (1998) "Fiberoptic inspection at work in New Mexico", Foundation Drilling, International Association of Foundation Drilling, 39(5)16-20.
15. Samman, M. M. and O'Neill, M. W. (1997) "Concretoscopy, A new technique for inspection of concrete structures", Concrete International, American Concrete Institute, 19(10) 63-66.
16. Samman, M. M. and O'Neill, M. W. (1997) "Fiberoptic inspection of drilled shafts", Foundation Drilling, International Association of Foundation Drilling, 36(7) 16-19.
17. Samman, M. M. (1997) "Structural Damage Detection Using the Modal Correlation Coefficient", IMAC-XV, Proceedings of the 15th International Modal Analysis Conference, Society for Experimental Mechanics, Orlando, FL, 627-630.
18. Samman, M. M. and O'Neill, M. W. (1997) "The Reliability of Sonic Testing of Drilled Shafts", Concrete International, American Concrete Institute, 19(1) 49-54.
19. Samman, M. M., and O'Neill, M. W. (1997) "An Exercise in Seismic Testing of Drilled Shafts for Structural Defects", Foundation Drilling, International Association of Foundation Drilling, 36(1) 11-17.
20. Samman, M. M. (1997). "Concretoscopic Inspection of Concrete Structures", Abstracts of the 22nd Southwest Geotechnical Engineers Conference, Santa Fe, NM.
21. Samman, M. M. and Biswas, M. (1996). "Three-Dimensional Finite Element Analysis of Stress Wave Propagation in a Defective Drilled Shaft", Proceedings of the Third Conference on Nondestructive Evaluation of Civil Structures and Materials, Boulder, CO, 515-524.
22. Samman, M. M. (1996). "A Modal Correlation Coefficient for Detection of Kinks in Mode Shapes", Journal of Vibration and Acoustics, American Society of Mechanical Engineers, 118(2) 271-272.
23. Fowler, J. R., Alexander, C., and Samman M. M. (1996). "Design Guidelines for High Pressure Pipe Fittings", Proceedings of the Energy Week Conference, American Society of Mechanical Engineers & American Petroleum Institute, Houston, TX, II, 99-110.
24. Samman, M. M. and Erbatur, H. F. (1995). "Steel Ratios for Cost Optimum Reinforced Concrete Beams", Building & Environment, Elsevier Science Ltd., 30(4) 545-551.
25. Samman, M. M. and Biswas, M. (1994). "Dynamic Testing for Nondestructive Evaluation of Bridges. I: Theory", Journal of Structural Engineering, American Society of Civil Engineers, 120(1) 269-289.

26. Samman, M. M. and Biswas, M. (1994). "Dynamic Testing for Nondestructive Evaluation of Bridges. II: Results", Journal of Structural Engineering, American Society of Civil Engineers, 120(1) 290-306.
27. Biswas, M., Samman, M. M., Pandey, A. K., and Bluni, S. A. (1994). "Modified Chain Code Computer Vision Techniques for Interrogation of Vibration Signatures for Structural Fault Detection", Journal of Sound and Vibration, Academic Press, 175(1) 89-104.
28. Samman, M. M. and Biswas, M. (1994). "Integrity Testing Of Drilled Shafts - A Computer Vision Approach", Proceedings of the International Conference on Design and Construction of Deep Foundations, U. S. Federal Highway Administration, Orlando, FL, 803-816.
29. Samman, M. M. (1994). "Effect of Partial Defects on Spectral Analysis of Reinforced Concrete Piles", Proceedings of the Spring Conference, American Society of Nondestructive Testing, New Orleans, LA, 192-194.
30. Samman, M. M. (1994). "An Age Old Test Is Saving Lives", Abstracts of the Spring Texas Section Meeting, American Society of Civil Engineers, Corpus Christi, TX.
31. Samman, M. M., Biswas, M., and Pandey, A. K. (1991). "Employing Pattern Recognition for Detecting Cracks in a Bridge Model", International Journal of Analytical and Experimental Modal Analysis, Society of Experimental Mechanics, 6(1) 35-44.
32. Pandey, A. K., Biswas, M., and Samman, M. M. (1991). "Damage Detection from Changes in Curvature Mode Shapes", Journal of Sound and Vibration, 145(2) 321-332.
33. Samman, M. M. (1990). Pattern Recognition Methods for Detection of Degradation in Bridge Structures, Ph.D. Dissertation, Department of Civil and Environmental Engineering, Duke University.
34. Biswas, M., Pandey, A. K., and Samman, M. M. (1990). "Modal Technology for Damage Detection of Bridges", in the book: Bridge Evaluation, Repair and Rehabilitation, edited by Nowak, A. S., Kluwer Academic Publishers, 161-174.
35. Biswas, M., Pandey, A. K., and Samman, M. M. (1990). "Diagnostic Experimental Spectral / Modal Analysis of a Highway Bridge", International Journal of Analytical and Experimental Modal Analysis, Society of Experimental Mechanics, 5(1) 33-42.
36. Biswas, M., Pandey, A. K., and Samman, M. M. (1990). "Methods for Recognition of Bridge Signatures", Handouts of the 69th Annual Transportation Research Board Meeting, Committee A2C05, Washington, D.C.
37. Biswas, M., Pandey, A. K., and Samman, M. M. (1990). "Detecting Incipient Failure in Bridges Through Spectral Analysis", Proceedings of the 4th Annual Workshop on Bridge Management Systems, Washington, D.C.
38. Samman, M. M. (1987). Optimal Design of Reinforced Concrete Beams, Master's Thesis, Department of Civil Engineering, King Saud University.
39. Samman, M. M., and Erbatur, H. F. (1987). "On Optimum Design of Reinforced Concrete Structures", Proceedings of Conference on Concrete and Concrete Structures, Riyadh.
40. Erbatur, H. F., and Samman, M. M. (1987). "Optimum Design of Reinforced Concrete Beams", Proceedings of CIVIL-COMP 87, the 3rd International Conference on Civil and Structural Engineering Computing, London, 245-248.
41. Samman, M. M. (1985). Optimality Criteria Methods for Optimum Design of Trusses, Bachelors Thesis, Department of Civil Engineering, King Saud University.

Coke Drum Seminars

- 1) Samman, M. (2020) “Mechanical Integrity and Reliability of Coke Drums”, One-day course, Coke Drum Forum 2020, Houston.
- 2) Samman, M. (2019) “Mechanical Integrity and Reliability of Coke Drums”, Two-day course, Coking.com Meeting, The Hague, Holland.
- 3) Samman, M. (2019) “Mechanical Integrity and Reliability of Coke Drums”, Two-day course, Coking.com Meeting, Galveston.
- 4) Samman, M. (2018) “Mechanical Integrity and Reliability of Coke Drums”, Two-day course, Coking.com Meeting, Valencia, Spain.
- 5) Samman, M. (2018) “Mechanical Integrity and Reliability of Coke Drums”, Two-day course, Coking.com Meeting, Galveston.
- 6) Samman, M. (2017) “Mechanical Integrity and Reliability of Coke Drums”, Two-day course, Coking.com Meeting, Budapest, Hungary.
- 7) Samman, M. (2017) “Mechanical Integrity and Reliability of Coke Drums”, Two-day course, Coking.com Meeting, Galveston.
- 8) Samman, M. (2016) “Mechanical Integrity and Reliability of Coke Drums”, Two-day course, Coking.com Meeting, Mumbai, India.
- 9) Samman, M. (2016) “Mechanical Integrity Management of Coke Drums”, Two-day course, Coking.com Meeting, Galveston.
- 10) Samman, M. (2015) “Mechanical Integrity Management of Coke Drums”, Two-day course, Coking.com Meeting, Manama, Bahrain.
- 11) Samman, M. (2015) “Mechanical Integrity Management of Coke Drums”, Two-day course, Coking.com Meeting, Galveston.
- 12) Samman, M. (2015) “Inspection, Assessment, and Life Extension of Coke Drums”, One-day course, API Inspection Summit, Galveston.
- 13) Samman, M. (2014) “Mechanical Integrity Management of Coke Drums”, Two-day course,
- 14) Samman, M. (2013) “Mechanical Integrity Management of Coke Drums”, Two-day course, Coking.com Meeting, New Delhi.
- 15) Samman, M. (2013) “Mechanical Integrity Management of Coke Drums”, Two-day course, Coking.com Meeting, Galveston.
- 16) Samman, M. (2012) “Mechanical Integrity Management of Coke Drums”, Two-day course, Coking.com Meeting, Fort McMurray.
- 17) Samman, M. (2012) “Mechanical Integrity Management of Coke Drums and FCCU”, Two-day course, Coking.com Meeting, Galveston.

Coke Drum Presentations

1. Samman, M. (2019) “Costly Lessons Learned from Inspection Pitfalls of Coke Drums”, RefComm, Galveston.
2. Samman, M. (2019) “Common Errors when Conducting Cracking and Bulging Inspections of Coke Drums”, API Inspection Summit, Galveston.
3. Samman, M. (2018) “Bulging Assessment of Coke Drums – a State-of-the-Art Review”, RefComm, Buenos Aires.
4. Samman, M. (2018) “Performance of Weld Overlay Repaired Coke Drums”, RefComm, Valencia, Spain.
5. Samman, M. and Kaye, A. (2018) “First Implementation of a Non-bolted Anchoring System for Coke Drums”, RefComm, Galveston.

6. Du Plessis, P. and Samman, M. (2017) "Successful Reversal of Degradation in an Old Set of Coke Drums", Coking.com Meeting, Galveston.
7. Samman, M. (2017) "New Tools for Addressing Coke Drum Failures", API Inspection Summit, Galveston.
8. Samman, M. (2016) "Remaining life of coke drums", RefComm Meeting, Mumbai, India.
9. Samman, M. (2016) "New Inventions for Extending The Service Life of Coke Drums", Coking.com Meeting, Galveston.
10. Samman, M. (2015) "The Three Most Common Failure Modes in Coke Drums and What to Do about Them", Coking.com Meeting, Manama, Bahrain.
11. Samman, M., Stephens, C. Du Plessis, P., Yousif, J., Hine, J., and Gonzalez, J. (2015) "Fracture Mechanics Screening of Coke Drum Cracks", Coking.com Meeting, Galveston.
12. Samman, M., Williams, E., and Gemmel, G. (2015) "Structural Vessel Repairs Using Automated Weld Overlays", IPEIA Meeting, Banff.
13. Samman, M., Stephens, C. Du Plessis, P., Yousif, J., Hine, J., and Gonzalez, J. (2015) "Development of Crack Screening Guidelines for Coke Drums", IPEIA Meeting, Banff.
14. Samman, M., Tinoco, E. B., and Marangoni, F. C. (2014) "Bulging Assessment and Long-Term Repair of coke Drums", Coking.com Meeting, Rio de Janeiro.
15. Samman, M. and Jani, A. (2013) "The Largest-Scale Repair of Coke Drum Bulging in Industry History", Coking.com Meeting, New Delhi.
16. Samman, M., Tinoco, E. B., Marangoni, F. C., and Silva, H. (2013) "Bulging Assessment of coke Drums", Coking.com Meeting, Galveston.
17. Williams, E. and Samman, M. (2013) "Automated Weld Overlay Repairs of Large Damaged Equipment", API Inspection Summit, Galveston.
18. Samman, M. (2013) "Failure Modes and Inspection Needs of Coke Drums", API Inspection Summit, Galveston.
19. Schmidt, M. and Samman, M. (2012). "Repair and Retrofit of a Coke Drum Skirt Attachment Weld", Coking.com Meeting, Fort McMurray.
20. Haraguchi, M. I., Samman, M., Tinoco, E. B., Marangone, F. C., Silva, H.R., and Barcelos, G.C. (2012) "Coke Drums Inspection and Evaluation Using Stress and Strain Analysis Techniques", Rio Oil and Gas, Rio de Janeiro.
21. Samman, M. (2011) "Assessment of Bulging and Cracking in Coke Drums", Coking.com Meeting, Dusseldorf, Germany.
22. Samman, M. (2011) "Assessment of a Cracked and Distorted Skirt", Coking.com Meeting, Galveston.
23. Samman, M. (2011) "The Optimal Weld Repair - An Industry Test Program", Coking.com Meeting, Galveston.
24. Samman, M. and Du Plessis, P. (2011) "Inspection and Assessment of Coke Drum Bulging", API Inspectors Summit, Galveston.
25. Samman, M. and Du Plessis, P. (2010) "Assessment and Repairs of Bulges in Coke Drums", AFIAP Conference, ESOPE, Paris, France.
26. Samman, M. and Du Plessis, P. (2010) "Long-Term Repairs for Bulges", Coking.com Meeting, Galveston.
27. Du Plessis, P. and Samman, M. (2010) "Bulging Assessment and Repairs", Coke Drum Workshop, Houston.
28. Samman, M. (2010) "Future Outlook", Coke Drum Workshop, Houston.
29. Samman, M. (2010) "The Optimal Weld Repair", Coke Drum Workshop, Houston.

30. Samman, M. (2010) "Overview of Structural Failure Modes in Coke Drums", Coke Drum Workshop, Houston.
31. Samman, M. (2010) "Assessment of a Cracked and Distorted Skirt", Coke Drum Workshop, Houston.
32. Samman, M. and Du Plessis, P. (2009) "Assessment of Bulging Severity", Coking.com Meeting, Calgary.
33. Samman, M. (2009) "Vibration Testing and Troubleshooting of Coke Drums", Coking.com Meeting, Calgary.
34. Samman, M. and Du Plessis, P. (2009) "Assessment of Bulging Severity", Coking.com Meeting, Galveston.
35. Samman, M. (2009) "Vibration Testing and Troubleshooting of Coke Drums", Coking.com Meeting, Rio de Janeiro, Brazil.
36. Samman, M. and Du Plessis, P. (2009) "Assessment of Bulging Severity", Coking.com Meeting, Rio de Janeiro, Brazil.
37. Samman, M. (2008) "Review of Mechanical and Structural Failure Modes in Coke Drums", Coke Drum Workshop, Houston.
38. Samman, M. (2008) "Discussion of Path Forward and Plans for Joint Industry Projects", Coke Drum Workshop, Houston.
39. Samman, M. (2008) "Evaluating the Severity of Bulging Coke Drums", Technical Brief, BIC Magazine.
40. Du Plessis and P. Samman, M. (2006) "Assessment of bulging severity using the Bulging Intensity Factor (BIF)", Coke Drum Workshop, Houston.
41. Shah, R. and Samman, M. (2006) "Assessment of Bulging Severity in Coke Drums - Experience and Lessons Learned", CokingCokers Conference, Long Beach.
42. Samman, M. (2004) "The Bulging Intensity Factor (BIF) - A new method for inspection prioritization of coke drums", Coke Drum Workshop, Houston.