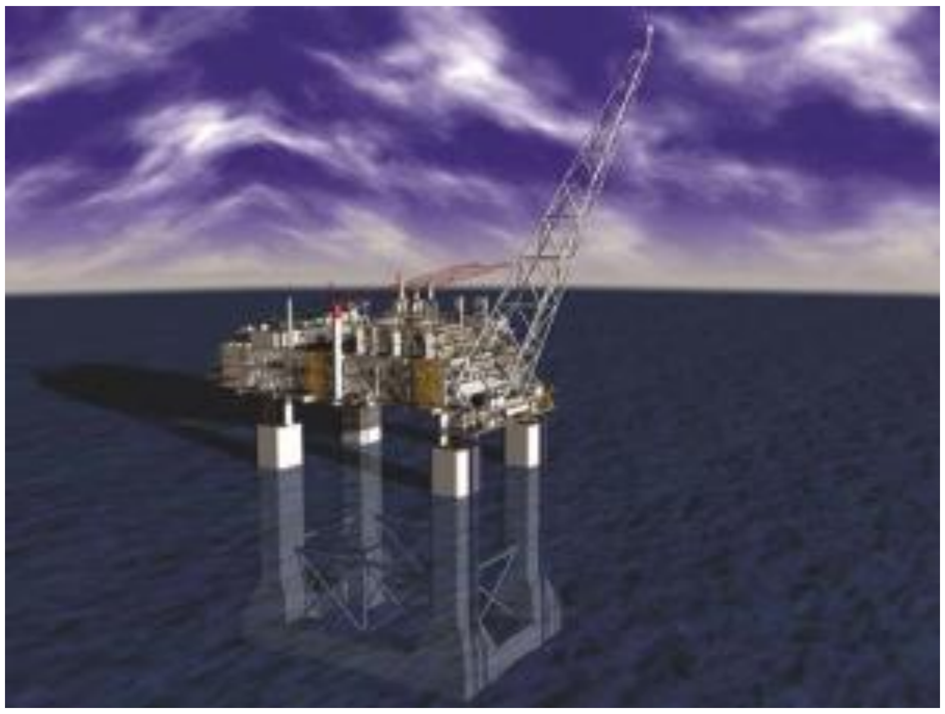
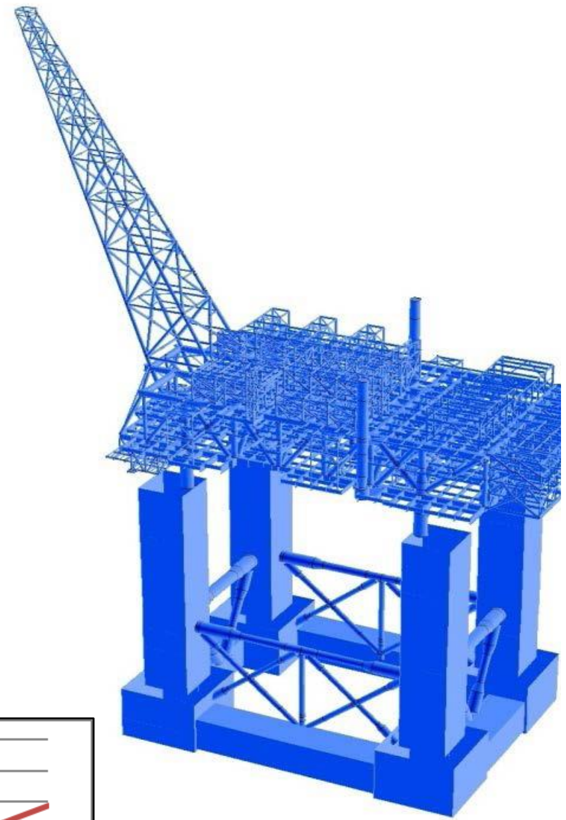
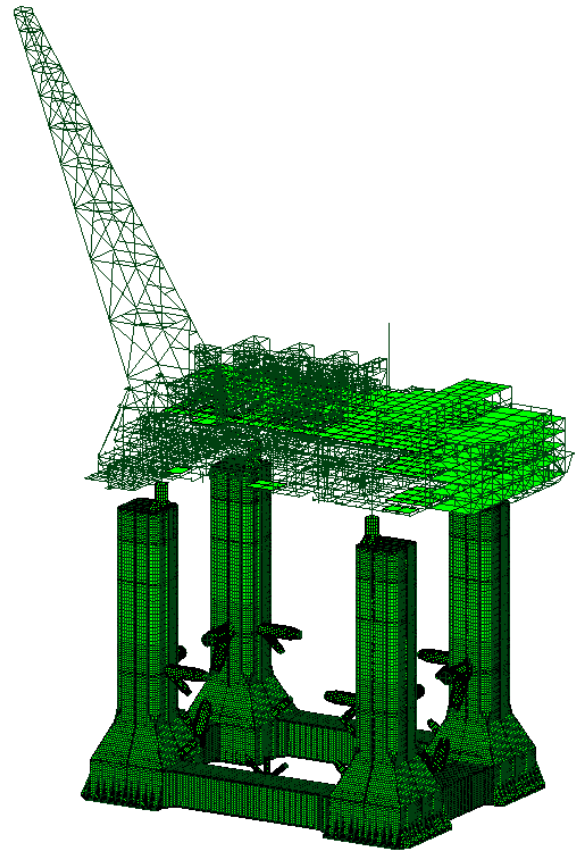
Hybrid SSI Analysis of Steel Gravity Structure

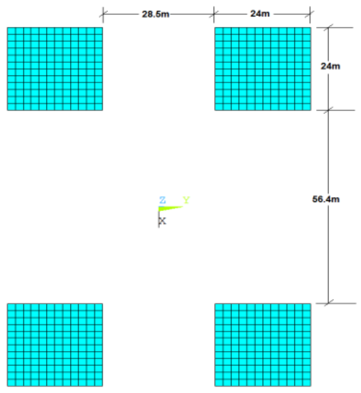


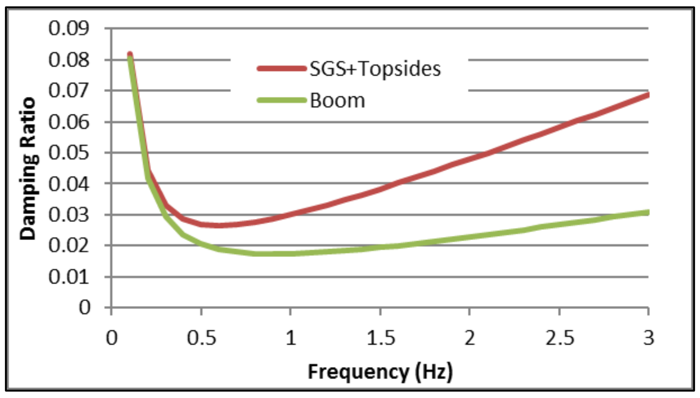


SACS Model

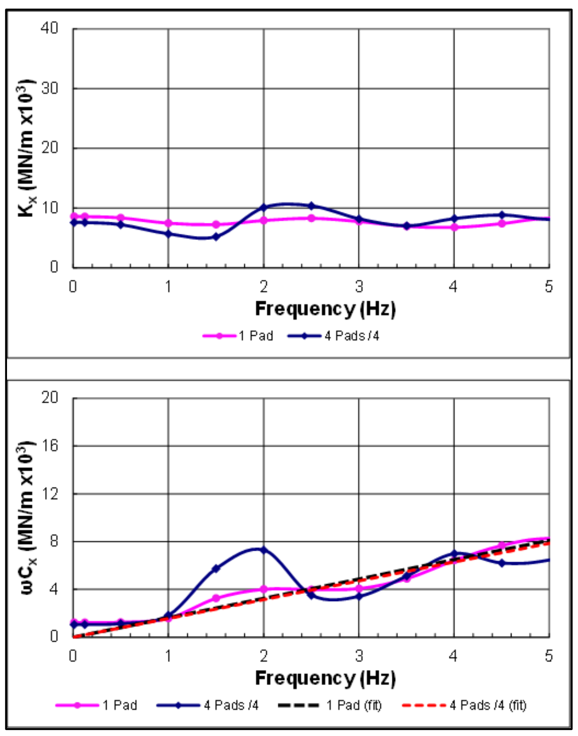


MTR/SASSI Model

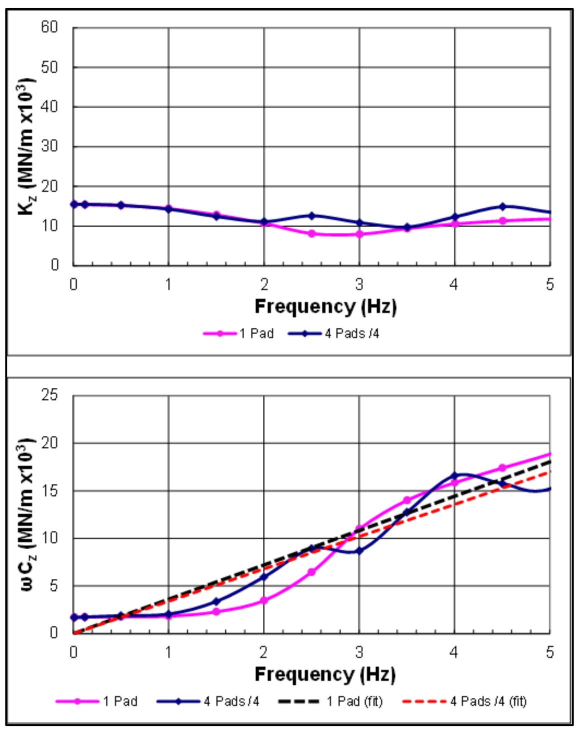




Single-Pad Foundation KC



Four-Pad Foundation KC



Global Foundation Demand	MTR/SASSI URUS Layered	MTR/SASSI URUS with KC	SACS URUS with K RSA	ANSYS URUS with KC THA	SAP2000 URUS KC THA
Base Shear - x (kN)	238,009	248,883	248,000	215,600	246,703
Base Shear - y (kN)	219,733	228,802	261,000	219,600	224,546
Axial Force - z (kN)	128,497	125,435	128,000	103,000	114,597
Overturning Mxx (kN-m)	6,636,911	6,975,768	5,630,000	6,345,000	6,444,443
Overturning Myy (kN-m)	4,686,992	4,501,944	4,930,000	4,343,000	4,378,367
Twisting Mzz (kN-m)	1,304,479	1,312,956	NC	1,102,000	1,483,195

Industry standard methods of analysis were used to calculate SSI effects. The objective was to compare the results from various methods and to highlight the advantages and limitations of each method. For benchmarking MTR/SASSI was used to analyze a detailed 3D model of the SGS plus Topsides on layered soil. The layered soil was then replaced by equivalent foundation springs (K) and damping (C) which was attached to the same SGS model used in benchmark calculations. Different software implements damping and dynamic solution approach in different ways. SACS uses modal damping and response spectrum method, CAP uses Rayleigh damping and direct integration, SAP2000 and ANSYS use composite modal damping and modal superposition.

Total base shear, overturning moment, critical member forces and maximum accelerations were compared for each of the analysis methods. SSI resulted in significant reduction in seismic demands. While it was possible to get reasonable alignment using different analysis methods, this was only possible after calibrating KC foundation model with software that rigorously implements SSI effects. When simplified SSI models are used in detailed design without alignment, unconservative structural response may result.