

SESAM EXAMPLE

Boat Impact Analysis using GeniE and Usfos



Date: April 2025

Prepared by DNV - Digital Solutions

E-mail support: software.support@dnv.com

E-mail sales: software@dnv.com

© DNV AS. All rights reserved

This publication or parts thereof may not be reproduced or transmitted in any form or by any means, including copying or recording, without the prior written consent of DNV AS.



Contents

1	INTRODUCTION	4
1.1	Program Versions	4
2	BOAT IMPACT ANALYSIS - USFOS	4
2.1	Run Analysis and Export Usfos File	4
2.2	Opening Model in Usfos	7
2.3	Editing Control File	8
2.4	Run Boat Impact Analysis	10
2.5	Boat Impact Analysis Result and Output	11



1 INTRODUCTION

This example goes through steps to perform a boat impact analysis for an offshore fixed platform using the Sesam software suite.

Note: For this example, we assume that user is at least an intermediate to skillful GeniE users. The course contains topics related to opening, navigating, executing, and exporting operations inside GeniE program.

1.1 Program Versions

Below are the programs versions used to run this example:

- 1. GeniE 8.12.2
- 2. Sestra 10.19.0
- 3. Usfos 9.0.0
- 4. Wajac 7.13.0
- 5. Splice 8.2.1
- 6. Sesam Manager 6.7.0
- 7. Application Version Manager V3.1-01

2 BOAT IMPACT ANALYSIS - USFOS

Import **usfos_model.gnx** file into GeniE new workspace (either using Sesam Manager or directly in GeniE). This model is a completed model, prepared for the boat impact analysis in Usfos.

2.1 Run Analysis and Export Usfos File

Open activity monitor (ALT+D) and run the analysis. Note that boatimpact load combination is set as current load. The analysis should be completed without no error:

ACUN	vity Monitor				?	×
Dor	ne!			Start	Can	cel
Jour Activity	nal activity executions	Duration	Status	Generate Input		
P 901	1 - WavePileSoilAnalysis - Ana	26s				
BD	1.1 - Meshing (Always Rege	5s	Success			
	1.1.1 - Delete loads	0s	Success			
	1.1.2 - Generate loads	0s	Success			
	1.1.3 - Delete mesh	1s	Success			
	1.1.4 - Generate mesh	4s	Success			
9	1.2 - Wave Load Analysis, C	9s	Warnings	Yes		
9	1.3 - Pile Soil Analysis, Cond	12s		Yes		
	1.3.1 - Soil (Gensod)	2s	Success			
	1.3.2 - Sestra, Direct Anal	Os	Success			
	1 2 2 - Solice	10s	Success			
	1.5.5 - Spilce					
	1.3.4 - Sestra, Retracking	0s				

In GeniE, select BM25 at the boat landing:





Go to File > Export > Export to Usfos. Under the Output Tab, Boat Impact load combination should be automatically selected:

G Export to U	sfos							×
Save in:	GeniEActivity1	(~	G 🖻	• 📰 🏓		
Home Desktop Libraries	Name Backups GenieR temp WavePileSoi	ilAnaly	^ /sis			Date mod 8/04/202 8/04/202 8/04/202 8/04/202	difie 5 10 5 10 5 10 5 10 5 10	d :30 AM :29 AM :30 AM :30 AM
Network	File name: Save as type: npact Data Checks	GeniE Usfos	Activity1_ufo.fem Files (*fem)		-	~ ~	S	ave ancel
Export stru Export stru Export env Export env Indude Export Wa	uctural data 9 uctural loads 9 irronmental data 9 wind data and loads jac loads 9 9 1 1 1 1 1 1 1 1 1 1 1 1 1	, , ,	Prefix of Usfos file: Select analysis: Select combination Analysis control:	s: GeniE & W : M bo : Boat Join	Activity1 avePileSoil/ patimpact (mpact) at Modelling	control §?	> > >	85 85 85
 Export pile Export pile Use Spi Export sele Convert hi Split Usfos data 	-soil data 9? ice Output 9? ected loads only 9? inges to springs 9? ta: Alternative1	, ,	 85 	Usfos Ur Length Force Tempera	nits (FEM Ar m N ature del	nalysis Units)		



Change the analysis control from Push Over to Boat Impact. Leave everything else as default in the Output Tab.

Under the Boat Impact tab, select the impact beam, beam end, impact energy and direction of the impact. After that click "Update with Boat Impact Load" and boat impact load will be added under CUSFOS load case. Arrange the load case sequence accordingly.

Out	put E	Boat Impact Data Chec	ks											
(Boat I	Impact Load (BIMPACT/B	IMPDATA)											
	Fem N	Fem No Impact Beam Beam end Energy Direction												
	28 Bm25 R C End2 C 500 kJ 0.0 -1.0 0.0													
T	Static	Analysis (CUSFOS)												
	nLoad	ds nPostStp	MxPStp	MxPDis	_									
	10	100	0.1	1	U	pdate with	Boat Impa	ct Load						
			1	,			1							
		Loadcase	Fem No	cmb Fact	I Fact	mx Ld	n Step	min						
	1	Permanent_125m	23	1	0.1	1	100	0.01						
	2	wavewind1year0	25	1	0.1	1	100	0.01						
	3	wavewind1year37	26	1	0.1	1	100	0.01						
	4	BoatImpact	28	1	1	0	600	0.01						
	5	wavewind1vear90	27	1	0.1	1	100	0.01						
(Contr	ol Nodes (CNODES)												
	Fro	m beam(s)	Beam er	nd DOF	=	dFact								
		Bm25	 End1 	v 12	3	1	_							
						,								

Right mouse button clicks on the load case number to move up or move down in the sequence:

nLoad	ds	nPostStp	MxPStp	M
10		100	0.1	1
	Load	lcase	Fem No	cm
1	Perma	anent_125m	23	1
2	wavev	vind1year0	25	1
3	wavev	vind1year37	26	1
4	lwavov C	vind1voar90 Ouplicate row Delete row	27	1
Cont	N	Nove up		
Fre	N	Nove down		в
	N	Nove to botto		

The control nodes are automatically filled when we select BM25 in GeniE prior to export.



Under Data Checks tab, specify the acceptance value for beam length ratio, eccentricity ratio, soil thickness ratio and shell minimum angle. For more information about this, please refer to Release_Notes_for_Usfos_8-6 and 8-7.

sfos data checks (IL	LEGAL)			
Fill tool	Default	~	UsersRisk	
BeamLengthRatio:	0.001	✓ 8?	UsersRisk	<mark>8</mark> ?
EccentricityRatio:	10	✓ 83	UsersRisk	83
SoilThicknessRatio:	0.01	~ <mark>8</mark> ?	UsersRisk	83
ShellMinAngle:	5	√ 8?	UsersRisk	8?

Click SAVE and now GeniE will export the model into Usfos files. Once the process completed, go to File > Explore > Current Workspace and check for these files:

- 1- GeniEActivity1_control.fem (basic control file for push over analysis)
- 2- GeniEActivity1_ufo.fem (model file in Usfos format)
- 3- GeniEActivity1_ufo_load.fem (load file in Usfos format)

2.2 Opening Model in Usfos

In GeniE, go to Mesh & Analysis > Non-Linear Analsis (Usfos) and this will directly open Usfos Graphical User Interface (Xact) from GeniE.

Go to File > Open Usfos Model File and seach for GeniEActivity1_ufo.fem:





2.3 Editing Control File

Now we will use Usfos Analysis Control Edit feature to edit GeniEActivity1_Control.fem file. In Xact, go to Analysis > Usfos Analysis Control. Select the files accordingly and click Edit:

🕅 USFOS Analysis Control				>
Files			_	
Control: C:\DNVGL\Workspaces\Example_Boat_Landing\GeniEActivity1\GeniE/	Activity1_control.fem			Edit
Model: C:\DNVGL\Workspaces\Example_Boat_Landing\GeniEActivity1\GeniEA	Activity1_ufo.fem			Edit
(Optional): C:\DNVGL\Workspaces\Example_Boat_Landing\GeniEActivity1\GeniE/	Activity1_ufo_load.fem			Edit
Result: C:\DNVGL\Workspaces\Example_Boat_Landing\GeniEActivity1\res				
Editors		/		
1: Control 2: Model 3: (Optional)				
HEAD Model: GeniEActivityl Analysis: WavePileSoilAnalysis Exported from GeniE, Date: 08-04-2025, T	ime: 10:43:17			I
restart result print CSAVE 0 1 1				
Key Opt Value ILLEGAL BeamLength Accept 0.001				
ILLEGAL BeamLength UsersRisk ON ILLEGAL Eccentricities Accept 10.				
ILLEGAL Eccentricities UsersRisk ON				
ILLEGAL SoilThick Accept 0.01				
ILLEGAL SoilThick UsersRisk ON				
ILLEGAL ShellAngle Accept 5.				
' Shellkigle Oselskisk Ok				
nI.nade nDnetStn mvDStn mvDDi	e		-	
		(_	
Select Font		Save As	Save	Close
Output				
ommand line:				Apply
🛿 Output 🛛 🗹 Editors 🗌 Open *.out file 🗌 Always on top	Memory: 200	Run	Abort	Close

After clicking Edit, Editors will display the control file and editing can be done.

Under CUSFOS command, exclude load case 25 and 26 using anastrophe (') at the beginning of the line. These are load cases for 1 year environment wave at 0^{0} and 37^{0} respectively. We want to run boat impact (load case 28) and then 1 year 90^{0} wave loading (load case 27):

cus	FOS	nLoads 10	nPostStp 100	mxPStp 0.1	mxPDis 1.	
•	Load	Case Id	lFact	mxLd	nStep	minStp
		23	0.1	1.	100	0.01
		25	0.1	1.	100	0.01
		26	0.1	1.	100	0.01
		28	1.	0.	600	0.01
		27	0.1	2.)	100	0.01

Change the max load to 2 for load case 27.



Linear element:

LIN_ELEM command is used to specify elements which should be linear. The development of plastic hinges is suppressed in all 3 nodes. In other words, elements that defined as linear will not go into plastic in push over analysis. This is often helpful for secondary and tertiary beams that do not contribute to the overall strength of the jacket system. In this example, topside, conductors and risers are defined as linear element:

LIN_ELEM 0 ELEMENT 125 126 127 128 129 130 131 132 133 134 135 136 LIN_ELEM 0 ELEMENT 137 138 139 140 141 142 143 144 145 146 147 148 LIN_ELEM 0 ELEMENT 149 150 151 152 153 154 155 156 157 158 159 160 LIN_ELEM 0 ELEMENT 161 162 163 164 165 166 167 168 169 170 171 172 LIN_ELEM 0 ELEMENT 173 174 175 176 177 178 179 180 181 182 183 184 LIN_ELEM 0 ELEMENT 185 186 187 188 189 190 191 192 193 194 195 196 LIN_ELEM 0 ELEMENT 197 198 199 200 201 202 203 204 205

Once the control file has been updated, save the file and now you are ready to run pushover analysis.

ា USFOS	S An	alysis Con	trol																		>
Files																					
Control:	C:\[ONVGL\Work	space	es\Exa	mple_	Boat_	Landir	ng\Ge	niEAct	tivity1	\GeniE	Activi	ty1_c	ontrol.fem						Edit	
Model:	C:\[ONVGL\Work	space	es\Exa	mple_	Boat_	Landir	ng\Ge	niEAct	tivity 1	\GeniE	Activi	ty1_u	fo.fem						Edit	
(Optional):	: C:\[ONVGL\Work	space	s\Exa	mple_	Boat_	Landir	ng\Ge	niEAct	tivity1	\GeniE	Activi	ty1_u	fo_load.fer	n					Edit	
Result:	C:\[ONVGL\Work	space	s\Exa	mple_	Boat_	Landir	ng\Ge	niEAct	tivity1	ves										
Editors																					
1: Contro	bl	2: Model	3:	(Optio	nal)																
Name GROUPD	Grou	ap 17 17		iPil Eler	n																
		1393		139	94 DE		1395		13	96		1397		1398	1399	1	400	14	13	1402	
		1417		141	18	1	1419		14	20	1	1421		1422	1423	1	424	14	25	1426	
		1429		143	30		1431		14	32	1	1433		1434	1435	1	436	14	37	1438	
		1441		144	12	1	1443		14	44	1	1445		1446	1447	1	448	14	49	1450	
		1453		145	54	1	1455		14	56	1	1457		1458	1459	1	460	14	61	1462	
		1465		146	66	1	1467		14	68	1	1469		1470	1471	1	472				
LIN_ELE	M 0	ELEMENT	125	126	127	128	129	130	131	132	133	134	135	136							
LIN_ELE	MO	ELEMENT	137	138	139	140	141	142	143	144	145	146	147	148							
LIN_ELE	MO	ELEMENT	149	150	151	152	153	154	155	156	157	158	159	160							
LIN FLE	MO	FLEMENT	172	174	175	176	177	178	179	190	101	192	193	184							
LIN FLF	MO	FLEMENT	185	186	187	188	189	190	191	192	193	194	195	196							
LIN_ELE	M 0	ELEMENT	197	198	199	200	201	202	203	204	205	Ĩ									1
																		_			
Select Font	t															Save	As	Sa	ave	Clo	se

Click Save.



2.4 Run Boat Impact Analysis

In Usfos Analysis Control, click Run to execute the boat impact analysis. In normal execution, Usfos analysis completed will be written in the output:

🗊 USFOS	Analysis C	ontrol												
Files														
Control:	C: \DNVGL \W	/orkspaces	Example_Bo	at_Landing\GeniE	Activity1\GeniE/	Activity1_cont	rol.fem						•	Edit
Model:	C: \DNVGL \W	/orkspaces	Example_Bo	at_Landing\GeniE	Activity1\GeniE/	Activity1_ufo.f	fem						•]	Edit
(Optional):	C: \DNVGL \W	/orkspaces	Example_Bo	at_Landing\GeniE	Activity1\GeniE/	Activity 1_ufo_	load.fem						•	Edit
Result:	C: \DNVGL \W	/orkspaces	Example_Bo	at_Landing\GeniE	Activity1\res									
Editors														
1: Control	2: Mode	el 3: (0	Optional)											
HEAD	M A: E:	odel: G nalysis xported	eniEActiv: : WavePile from Gen:	ityl SoilAnalysi: iE, Date: 08	s -04-2025, T	ime: 11:25	5:55							
CSAVE	restart 0	rest	ult p: 1 Opt	rint 1 Value										
ILLEGAL	Be Be	amLengtl amLengtl	h Accep h User:	sRisk (D1 DN									
ILLEGAL	Eccent:	ricitie	s Accepts User:	sRisk (D. DN									
ILLEGAL	S	oilThic	k Accep k User:	sRisk (D 1 DN									
ILLEGAL	Sh	ellAngl	e Accej	pt	5.									
'	Shi Shi	ellangi	e User:	SRISK (JN									
CUSFOS	nL	oads 10	nPostStp 100	mxPStp 0.1	mxPDi.	5								
· 1	load Case	Id	lFact	mxLd	nStep	minS	Stp							
		23	0.1	1.	100	0.0	.01							
		26	0.1	1.	10	0 0	0.01							
		28	1.	0.	600	0.	01							
•		27	0.1	2.	100	0.								
CNODES	nen	ods												
'	Node	Id	idof	dfact										
		66	1	1.										
		~~	-	÷.										
Select Font.)										Save As	Save	1	Close
Output														
27	18	1.611	0.970	2.469E-01	5.576E+06	75	YIELD	ENDI						
27	19	1.711	0.969	2.698E-01	6.109E+06	5000002	Sei 1	T						
						5000004	Soil	Lay13						
27	20	1.811	0.967	2.926E-01	6.672E+06									
27	22	2.000	0.964	3.362E-01	7.830E+06									
	== US	FOS	ANA	LYSIS	COMPL	ETED								
200 mil: Analysis Evit valu	lion word process	is succe termina	essfully a ated norma	llocated lly										
Result of	utput on	file "C	C:\DNVGL\W	orkspaces\Ex	ample_Boat_	Landing\G	eniEActi	vityl\re	s.raf"					
										-				
ommand line	2:													Apply
Output	Editors	Open	*.out file	Always on top					Memory: 200	÷	Run	Abort		Close



2.5 Boat Impact Analysis Result and Output

Open res.raf result file in Xact. This will open the graphical result for boat impac analysis. Check the Global Load vs Global Displacement graph as well as the plastic utilization of impacted beam at the boat landing:



For more information about how to use Xact in investigating the results file (res.raf), please refer to Xact user manual.

In boat impact analysis Usfos generates res.out file which among others, it printed out the crucial information about the total energy absorption throughout boat impact analysis. Open res.out file in editor (i.e Notepad ++) and check the total energy absorption:



Load step 28 / 64

 INCREMENTAL SOL	υтι	0 N =	
Model: GeniEActivity1 Analysis: WavePileSoilAnalysis Exported from GeniE, Date: 08-04-20	25 , T	ime: 11:25:55	
USFOS load combination no Load step no. Load increment scaled by new plastic hinge at midspan of element	=	28 64 19	
Load increment New load level Current stiffness parameter Solution accuracy parameter Determinant of tangential matrix Number of Negative Pivot Element Total energy absorbtion	= = = =	0.983 13.091 0.066 1.273*E-0000 3.550*E 5229 0 1.501*E 0000	06 94 06
Denting of the tube wall Ship indentation Dent deformation energy Ship deformation energy Structure deformation energy	= = =	1.428E-01 0.000E+00 1.219E+05 0.000E+00 3.774E+05	

Remember that we specify 500 KJ as the impact energy in this analysis example. The total absorbed ship impact energy here is 0.499 MJ. This would suggest that the boat landing could handle 500 KJ impact energy without having fracture member.

= 4.993E+05

Total Absorbed Ship Impact Energy

For more command in boat impact analysis, user can refer to Section 6.3.12 Ship Impact Analysis in Usfos User Manual.

About DNV

We are the independent expert in risk management and quality assurance. Driven by our purpose, to safeguard life, property and the environment, we empower our customers and their stakeholders with facts and reliable insights so that critical decisions can be made with confidence. As a trusted voice for many of the world's most successful organizations, we use our knowledge to advance safety and performance, set industry benchmarks, and inspire and invent solutions to tackle global transformations.

Digital Solutions

DNV is a world-leading provider of digital solutions and software applications with focus on the energy, maritime and healthcare markets. Our solutions are used worldwide to manage risk and performance for wind turbines, electric grids, pipelines, processing plants, offshore structures, ships, and more. Supported by our domain knowledge and Veracity assurance platform, we enable companies to digitize and manage business critical activities in a sustainable, cost-efficient, safe and secure way.