CADAM - Stability drawing
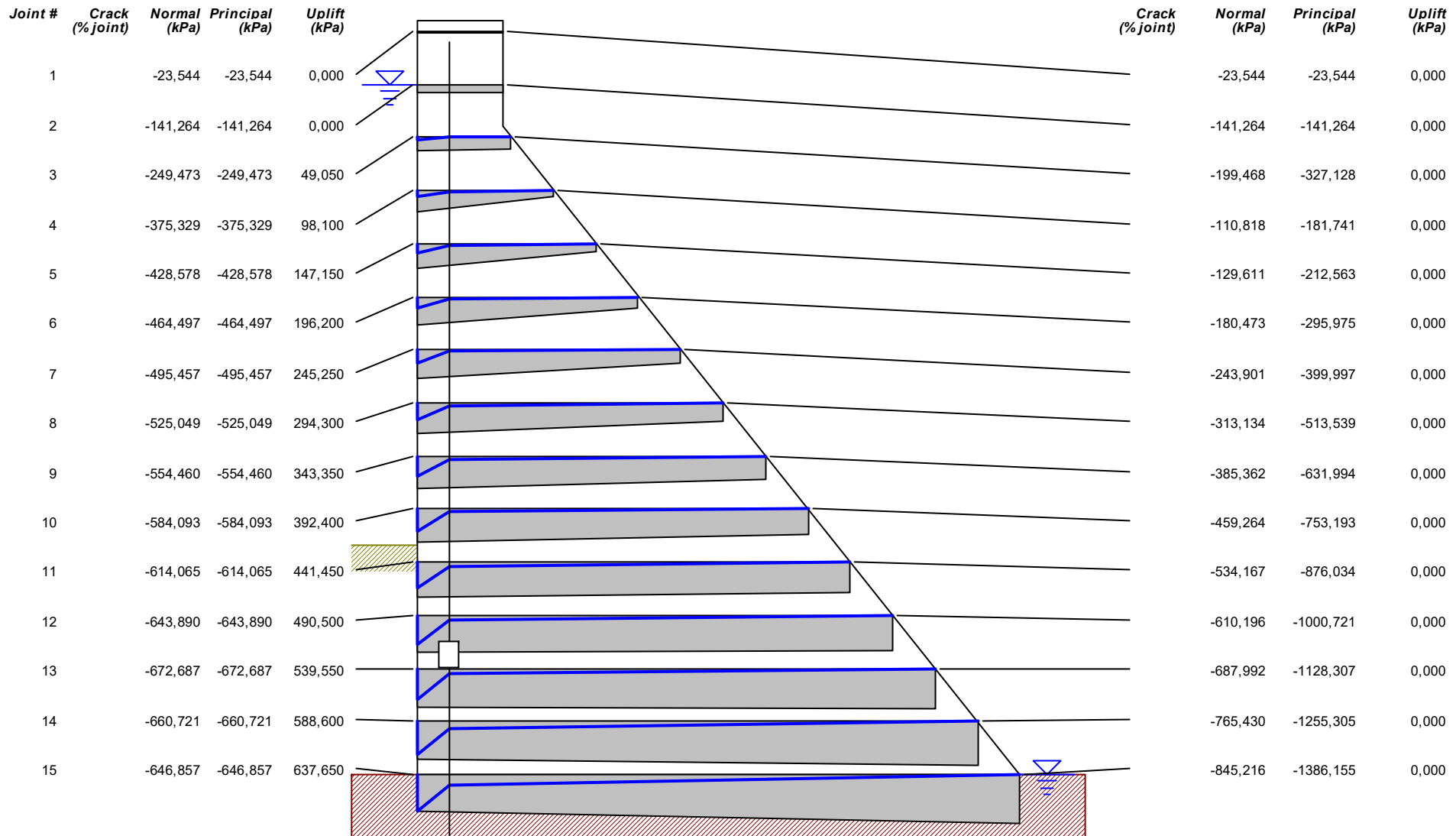
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Project:	TD4	**Dam location:**	FGG	**Analysis performed by:**	
Dam:	Example 1	**Date:**	30/11/2021	**Project engineer:**	Arthur Guillot - Le Goff
Owner:					

Usual combination (effective stress analysis)

Joint #	Crack (% joint)	Normal (kPa)	Principal (kPa)	Uplift (kPa)		Crack (% joint)	Normal (kPa)	Principal (kPa)	Uplift (kPa)
1		-23,544	-23,544	0,000			-23,544	-23,544	0,000
2		-141,264	-141,264	0,000			-141,264	-141,264	0,000
3		-249,473	-249,473	49,050			-199,468	-327,128	0,000
4		-375,329	-375,329	98,100			-110,818	-181,741	0,000
5		-428,578	-428,578	147,150			-129,611	-212,563	0,000
6		-464,497	-464,497	196,200			-180,473	-295,975	0,000
7		-495,457	-495,457	245,250			-243,901	-399,997	0,000
8		-525,049	-525,049	294,300			-313,134	-513,539	0,000
9		-554,460	-554,460	343,350			-385,362	-631,994	0,000
10		-584,093	-584,093	392,400			-459,264	-753,193	0,000
11		-614,065	-614,065	441,450			-534,167	-876,034	0,000
12		-643,890	-643,890	490,500			-610,196	-1000,721	0,000
13		-672,687	-672,687	539,550			-687,992	-1128,307	0,000
14		-660,721	-660,721	588,600			-765,430	-1255,305	0,000
15		-646,857	-646,857	637,650			-845,216	-1386,155	0,000

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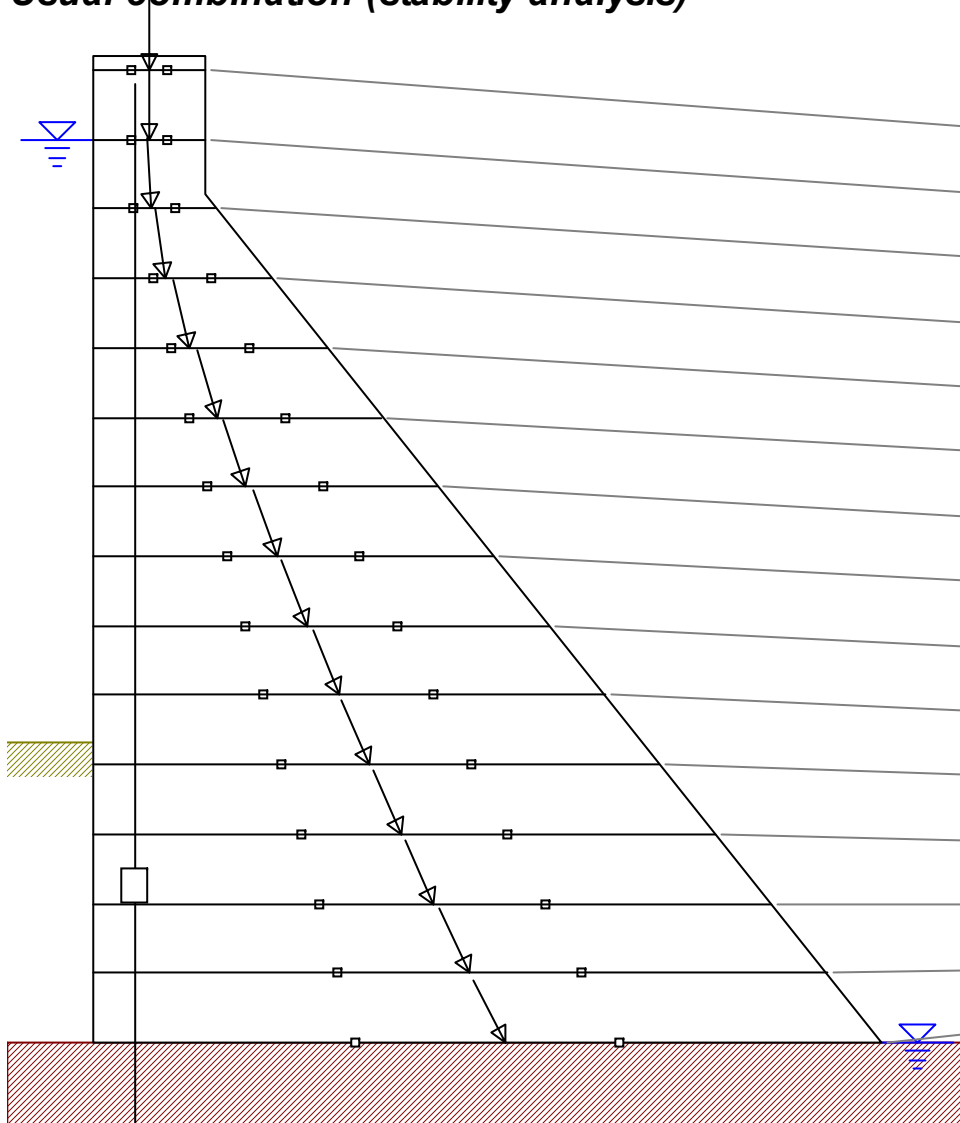
CADAM - Stability drawing

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Project:	TD4	Dam location:	FGG	Analysis performed by:	
Dam:	Example 1	Date:	30/11/2021	Project engineer:	Arthur Guillot - Le Goff
Owner:					

Usual combination (stability analysis)

Joint #	SSF (peak)	SSF (residual)	OSF (U/S <-)	OSF (-> D/S)	USF	Normal (kN)	Shear (kN)	Moment (kN·m)	Res. Pos. (% joint)
1	> 100	> 100	> 100	> 100	> 100	-188,4	0,0	0,0	50,000
2	> 100	> 100	> 100	> 100	> 100	-1130,1	0,0	0,0	50,000
3	28,747	23,006	42,655	10,633	19,644	-1975,3	122,6	-322,7	48,144
4	11,147	9,059	26,346	6,765	13,893	-3111,3	490,5	-3611,5	40,932
5	7,285	6,068	23,399	5,260	12,545	-4688,8	1103,6	-7031,7	41,073
6	5,731	4,883	22,862	4,502	12,173	-6707,7	1962,0	-10240,0	42,661
7	4,918	4,271	22,935	4,058	12,126	-9168,0	3065,6	-12893,1	44,329
8	4,427	3,905	23,168	3,772	12,205	-12069,8	4414,5	-14647,6	45,786
9	4,100	3,663	23,428	3,574	12,336	-15413,1	6008,6	-15160,1	47,001
10	3,869	3,494	23,676	3,429	12,485	-19197,8	7848,0	-14087,4	48,006
11	3,695	3,366	23,898	3,320	12,636	-23423,9	9937,4	-11083,4	48,840
12	3,541	3,250	24,101	3,233	12,784	-28091,5	12343,0	-5635,5	49,552
13	3,402	3,143	24,294	3,158	12,925	-33200,6	15086,2	3037,4	50,187
14	3,192	2,960	16,736	2,868	9,727	-37650,4	18167,1	24326,0	51,224
15	3,014	2,804	13,284	2,652	8,015	-42374,9	21585,6	53329,6	52,216
	3,000	1,500	2,000	2,000	1,200				

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Project:	TD4	**Dam location:**	FGG	**Analysis performed by:**	
Dam:	Example 1	**Date:**	30/11/2021	**Project engineer:**	Arthur Guillot - Le Goff
Owner:					

Flood combination (effective stress analysis)

Joint #	Crack (% joint)	Normal (kPa)	Principal (kPa)	Uplift (kPa)		Crack (% joint)	Normal (kPa)	Principal (kPa)	Uplift (kPa)
1		-13,581	-13,581	9,810			-23,697	-23,697	0,000
2		-66,769	-66,769	58,860			-184,857	-184,857	0,000
3		-57,588	-57,588	107,910			-362,458	-594,431	0,000
4		-158,838	-158,838	156,960			-304,685	-499,683	0,000
5		-197,597	-197,597	206,010			-341,252	-559,653	0,000
6		-224,054	-224,054	255,060			-403,598	-661,900	0,000
7		-248,367	-248,367	304,110			-475,042	-779,068	0,000
8		-273,039	-273,039	353,160			-550,183	-902,300	0,000
9		-298,664	-298,664	402,210			-626,945	-1028,190	0,000
10		-325,295	-325,295	451,260			-704,435	-1155,273	0,000
11		-352,828	-352,828	500,310			-782,247	-1282,885	0,000
12		-380,633	-380,633	549,360			-860,683	-1411,520	0,000
13		-407,728	-407,728	598,410			-940,503	-1542,425	0,000
14		-394,311	-394,311	647,460			-1019,667	-1672,253	0,000
15		-379,194	-379,194	696,510			-1100,942	-1805,544	0,000

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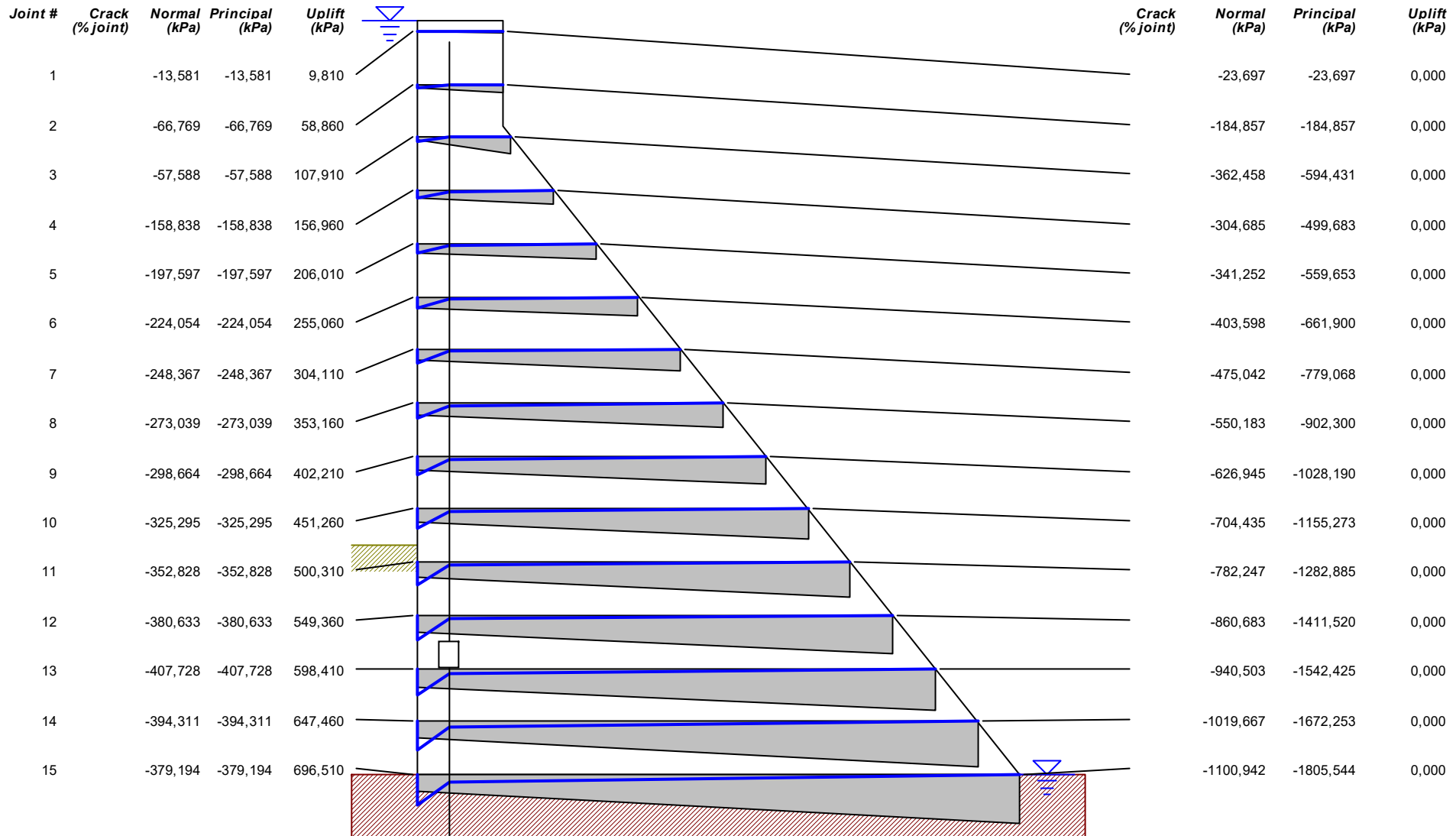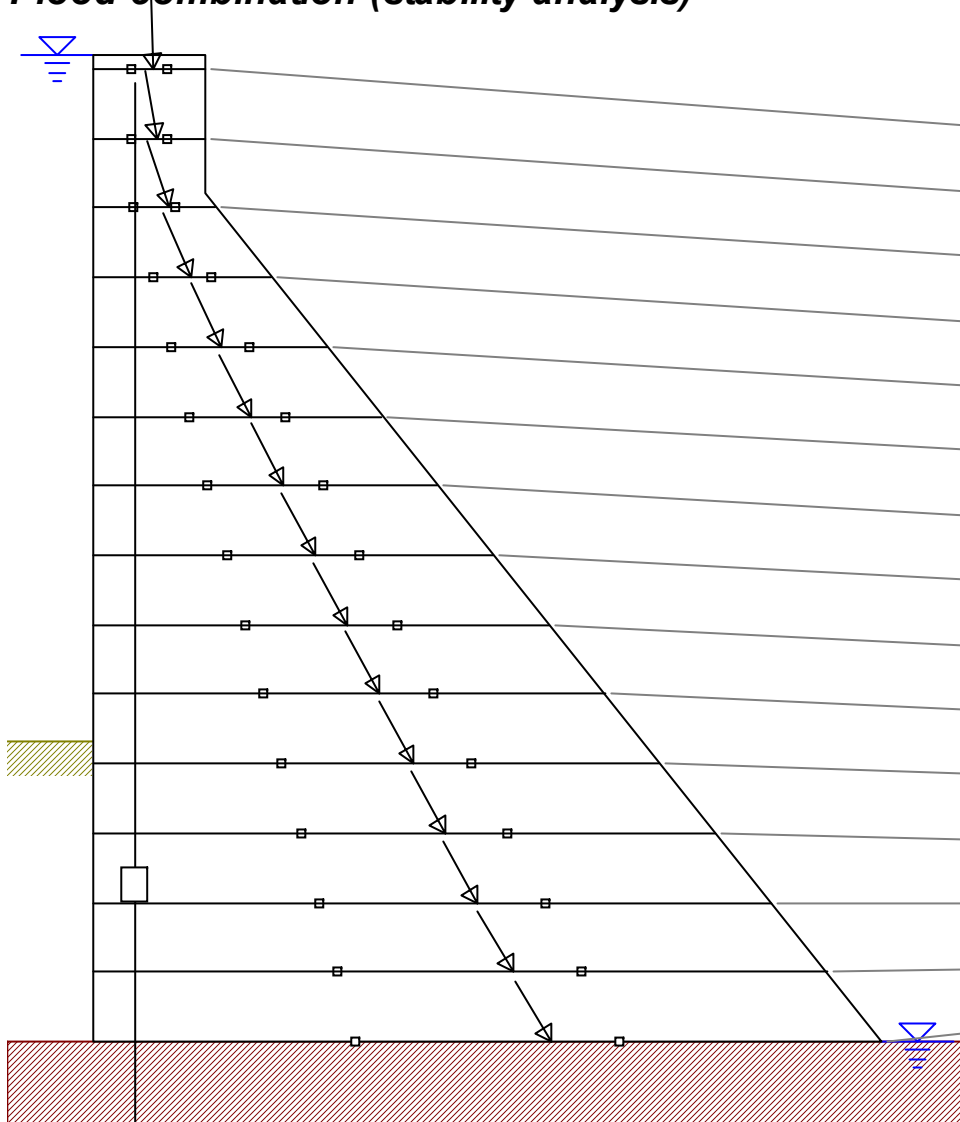| Project:	TD4	Dam location:	FGG	Analysis performed by:	
Dam:	Example 1	Date:	30/11/2021	Project engineer:	Arthur Guillot - Le Goff
Owner:					

Flood combination (stability analysis)

Joint #	SSF (peak)	SSF (residual)	OSF (U/S <-)	OSF (-> D/S)	USF	Normal (kN)	Shear (kN)	Moment (kN·m)	Res. Pos. (% joint)
1	> 100	43,416	7,216	3,572	4,800	-149,1	4,9	54,0	54,523
2	11,765	8,140	22,378	4,021	9,143	-1006,5	176,6	629,8	57,822
3	5,633	4,447	23,850	2,629	8,929	-1848,2	593,5	1967,4	62,097
4	4,189	3,374	21,385	2,602	8,683	-2966,5	1255,7	1991,3	55,244
5	3,610	2,988	21,473	2,528	8,961	-4526,3	2163,1	3378,8	54,443
6	3,313	2,812	22,010	2,482	9,363	-6527,6	3315,8	6473,2	54,768
7	3,139	2,718	22,561	2,457	9,779	-8970,3	4713,7	11617,9	55,222
8	3,026	2,663	23,036	2,445	10,171	-11854,4	6356,9	19156,2	55,611
9	2,948	2,629	23,431	2,439	10,531	-15180,0	8245,3	29431,5	55,911
10	2,891	2,607	23,756	2,438	10,856	-18947,0	10379,0	42787,2	56,137
11	2,847	2,591	24,025	2,439	11,150	-23155,5	12762,6	59569,0	56,305
12	2,800	2,568	24,256	2,440	11,414	-27805,5	15462,6	80290,0	56,445
13	2,751	2,540	24,464	2,440	11,654	-32896,9	18500,1	105731,0	56,586
14	2,630	2,437	17,356	2,296	9,052	-37329,0	21875,3	145282,6	57,371
15	2,524	2,346	13,923	2,181	7,589	-42035,8	25588,1	194044,3	58,127
	2,000	**1,300**	**1,100**	**1,100**	**1,100**				

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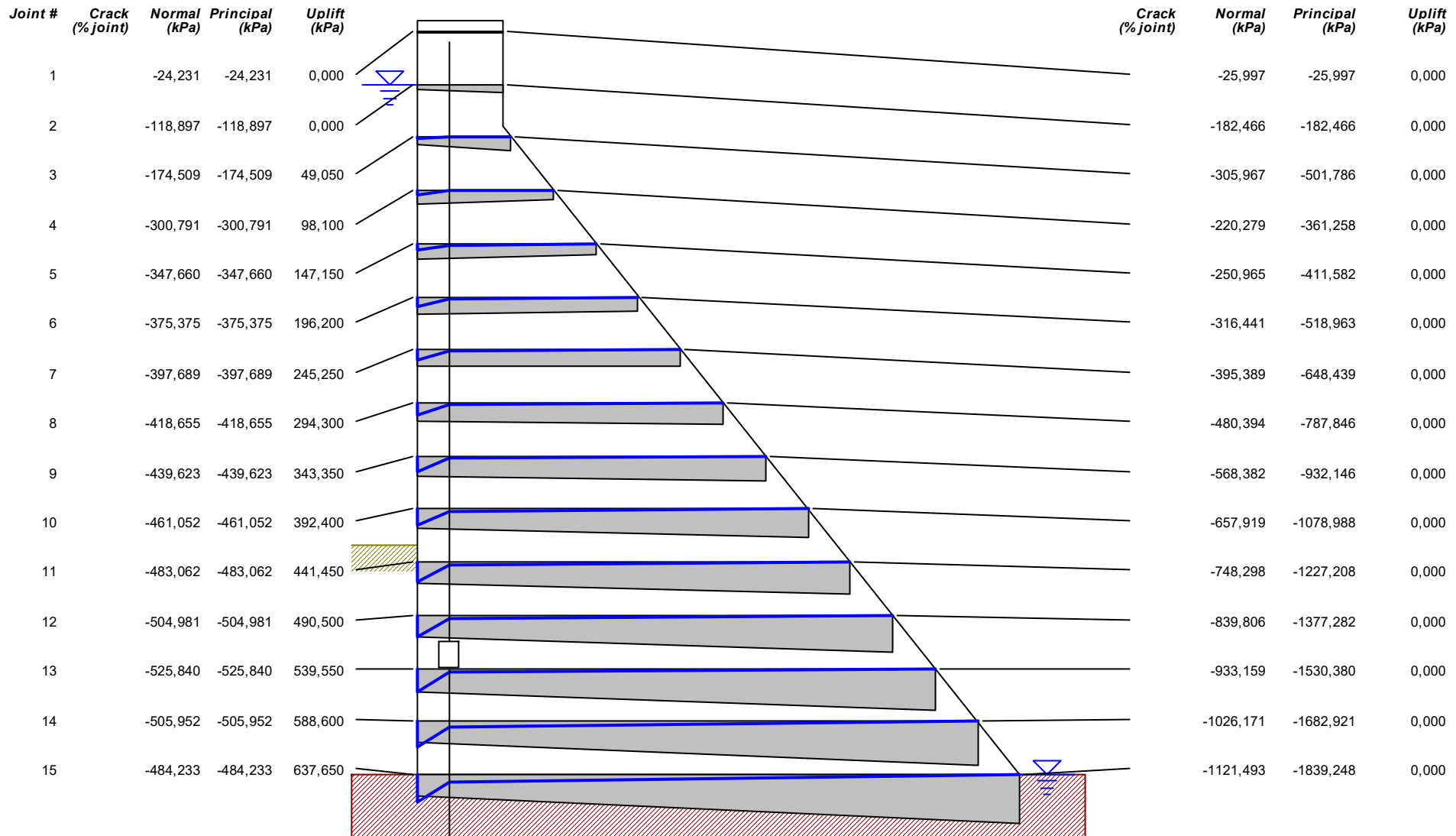| Project:	TD4	Dam location:	FGG	Analysis performed by:	
Dam:	Example 1	Date:	30/11/2021	Project engineer:	Arthur Guillot - Le Goff
Owner:					

Seismic #1 combination - Peak accelerations (stress analysis) (effective stress analysis)

Joint #	Crack (% joint)	Normal (kPa)	Principal (kPa)	Uplift (kPa)	Crack (% joint)	Normal (kPa)	Principal (kPa)	Uplift (kPa)
1		-24,231	-24,231	0,000		-25,997	-25,997	0,000
2		-118,897	-118,897	0,000		-182,466	-182,466	0,000
3		-174,509	-174,509	49,050		-305,967	-501,786	0,000
4		-300,791	-300,791	98,100		-220,279	-361,258	0,000
5		-347,660	-347,660	147,150		-250,965	-411,582	0,000
6		-375,375	-375,375	196,200		-316,441	-518,963	0,000
7		-397,689	-397,689	245,250		-395,389	-648,439	0,000
8		-418,655	-418,655	294,300		-480,394	-787,846	0,000
9		-439,623	-439,623	343,350		-568,382	-932,146	0,000
10		-461,052	-461,052	392,400		-657,919	-1078,988	0,000
11		-483,062	-483,062	441,450		-748,298	-1227,208	0,000
12		-504,981	-504,981	490,500		-839,806	-1377,282	0,000
13		-525,840	-525,840	539,550		-933,159	-1530,380	0,000
14		-505,952	-505,952	588,600		-1026,171	-1682,921	0,000
15		-484,233	-484,233	637,650		-1121,493	-1839,248	0,000

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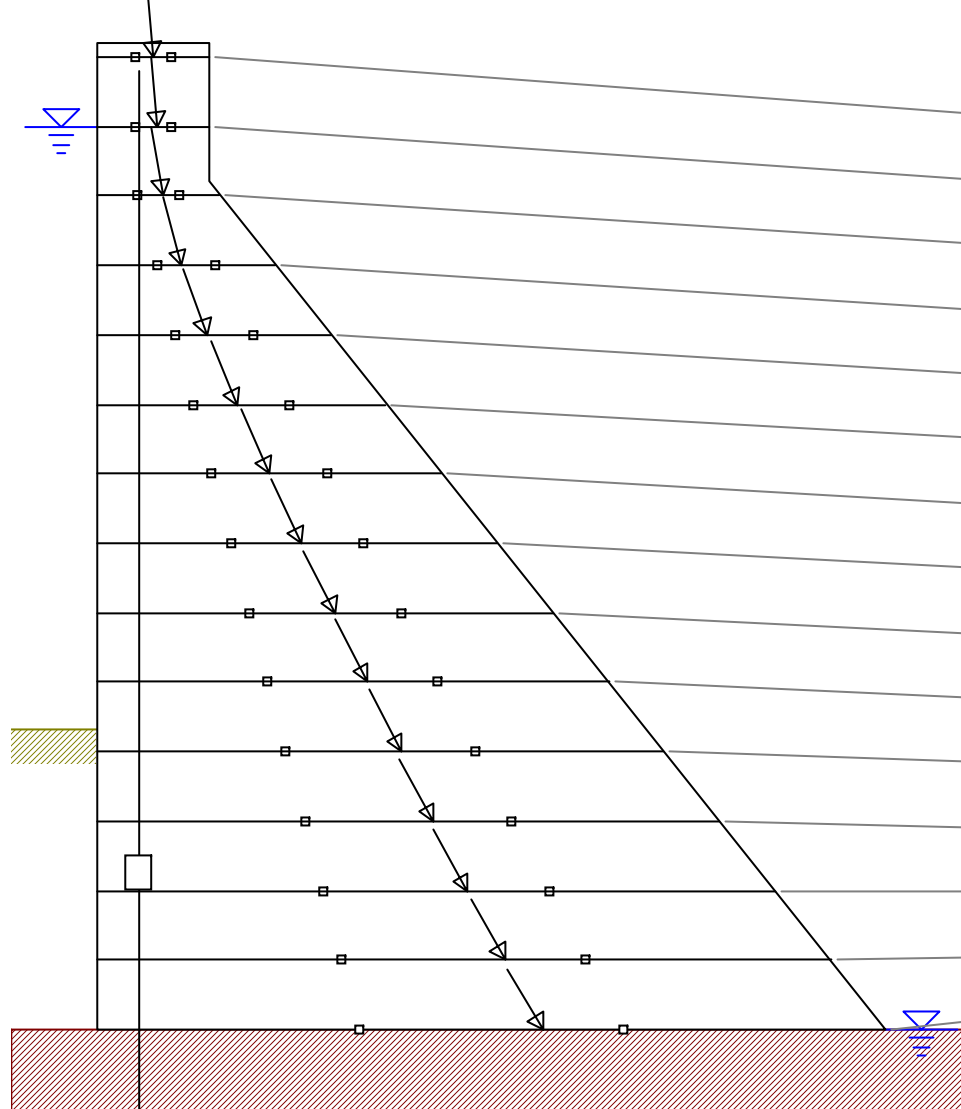| Project:	TD4	Dam location:	FGG	Analysis performed by:	
Dam:	Example 1	Date:	30/11/2021	Project engineer:	Arthur Guillot - Le Goff
Owner:					

Seismic #1 combination - Peak accelerations (stress analysis) (stability analysis)

Joint #	SSF (peak)	SSF (residual)	OSF (U/S <-)	OSF (-> D/S)	USF	Normal (kN)	Shear (kN)	Moment (kN·m)	Res. Pos. (% joint)
1	49,213	15,234	> 100	85,333	> 100	-200,9	18,8	9,4	50,586
2	20,897	15,234	> 100	14,222	> 100	-1205,5	113,0	339,0	53,516
3	10,025	8,129	51,522	4,914	20,954	-2114,1	371,4	848,3	54,560
4	6,215	5,115	32,476	4,205	14,819	-3334,9	931,2	-1099,3	47,425
5	4,754	4,005	28,668	3,678	13,381	-5028,5	1793,2	-2274,3	47,308
6	4,044	3,480	27,704	3,350	12,984	-7194,9	2952,6	-2124,8	48,580
7	3,638	3,187	27,513	3,138	12,934	-9834,2	4406,3	-117,9	49,952
8	3,380	3,005	27,560	2,993	13,019	-12946,3	6152,4	4267,4	51,145
9	3,203	2,883	27,680	2,891	13,158	-16531,3	8189,5	11543,7	52,129
10	3,076	2,796	27,814	2,815	13,317	-20589,1	10516,4	22217,1	52,932
11	2,979	2,730	27,944	2,757	13,479	-25119,7	13140,3	36793,5	53,590
12	2,887	2,665	28,070	2,710	13,636	-30123,2	16141,5	56000,6	54,150
13	2,803	2,603	28,200	2,669	13,787	-35599,6	19529,9	80833,8	54,653
14	2,660	2,479	19,370	2,477	10,375	-40448,1	23301,4	120857,4	55,659
15	2,538	2,372	15,334	2,329	8,549	-45602,6	27453,8	171329,3	56,614
	1,300	1,000	1,100	1,100	1,100				

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Project:	TD4	**Dam location:**	FGG	**Analysis performed by:**
Dam:	Example 1	**Date:**	30/11/2021	**Project engineer:** Arthur Guillot - Le Goff
Owner:				

Seismic #1 combination - Sustained accelerations (stability analysis) (effective stress analysis)

Joint #	Crack (% joint)	Normal (kPa)	Principal (kPa)	Uplift (kPa)		Crack (% joint)	Normal (kPa)	Principal (kPa)	Uplift (kPa)
1		-23,887	-23,887	0,000			-24,770	-24,770	0,000
2		-130,081	-130,081	0,000			-161,865	-161,865	0,000
3		-211,991	-211,991	49,050			-252,718	-414,457	0,000
4		-338,061	-338,061	98,100			-165,548	-271,499	0,000
5		-388,120	-388,120	147,150			-190,288	-312,072	0,000
6		-419,938	-419,938	196,200			-248,457	-407,469	0,000
7		-446,575	-446,575	245,250			-319,645	-524,217	0,000
8		-471,854	-471,854	294,300			-396,763	-650,692	0,000
9		-497,043	-497,043	343,350			-476,871	-782,069	0,000
10		-522,575	-522,575	392,400			-558,591	-916,089	0,000
11		-548,566	-548,566	441,450			-641,231	-1051,620	0,000
12		-574,439	-574,439	490,500			-725,000	-1189,000	0,000
13		-599,266	-599,266	539,550			-810,574	-1329,342	0,000
14		-583,340	-583,340	588,600			-895,799	-1469,111	0,000
15		-565,549	-565,549	637,650			-983,353	-1612,699	0,000

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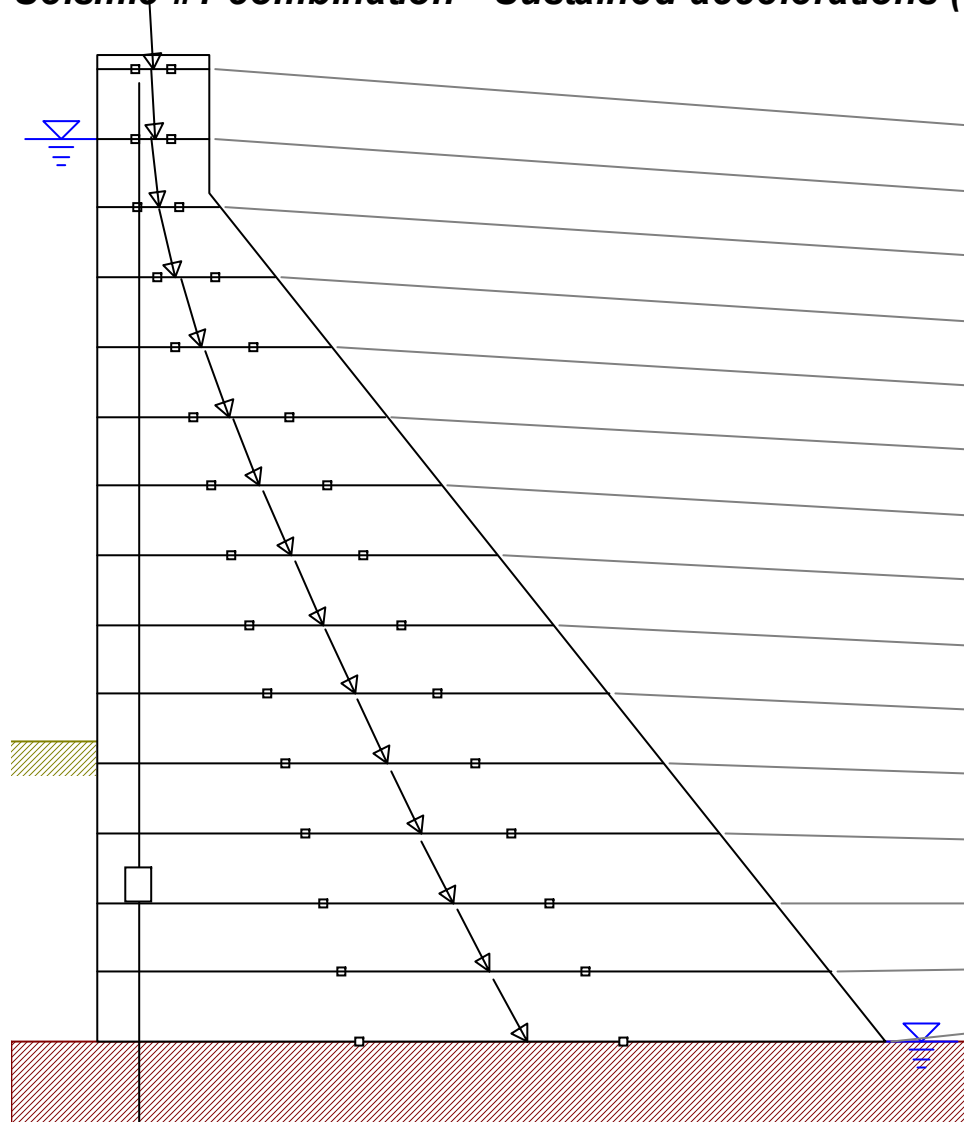| Project:	TD4	Dam location:	FGG	Analysis performed by:	
Dam:	Example 1	Date:	30/11/2021	Project engineer:	Arthur Guillot - Le Goff
Owner:					

Seismic #1 combination - Sustained accelerations (stability analysis) (stability analysis)

Joint #	SSF (peak)	SSF (residual)	OSF (U/S <-)	OSF (-> D/S)	USF	Normal (kN)	Shear (kN)	Moment (kN·m)	Res. Pos. (% joint)
1	97,473	29,515	> 100	> 100	> 100	-194,6	9,4	4,7	50,302
2	40,841	29,515	> 100	27,556	> 100	-1167,8	56,5	169,5	51,815
3	14,672	11,822	47,089	6,643	20,299	-2044,7	247,0	262,8	51,461
4	7,916	6,476	29,411	5,147	14,356	-3223,1	710,8	-2355,4	44,291
5	5,719	4,791	26,034	4,304	12,963	-4858,6	1448,4	-4653,0	44,300
6	4,717	4,040	25,283	3,823	12,578	-6951,3	2457,3	-6182,5	45,724
7	4,163	3,632	25,224	3,525	12,530	-9501,1	3736,0	-6505,6	47,239
8	3,817	3,381	25,364	3,326	12,612	-12508,1	5283,5	-5190,2	48,559
9	3,583	3,213	25,554	3,185	12,747	-15972,2	7099,1	-1808,5	49,655
10	3,415	3,094	25,745	3,082	12,901	-19893,5	9182,2	4064,5	50,555
11	3,287	3,004	25,921	3,004	13,057	-24271,9	11538,8	12854,6	51,298
12	3,170	2,919	26,086	2,940	13,210	-29107,4	14242,2	25181,9	51,931
13	3,064	2,838	26,247	2,885	13,356	-34400,1	17308,0	41934,8	52,498
14	2,893	2,690	18,053	2,652	10,051	-39049,3	20734,2	72590,6	53,521
15	2,747	2,562	14,309	2,475	8,282	-43988,8	24519,7	112328,1	54,496
	1,300	1,000	1,100	1,100	1,100				

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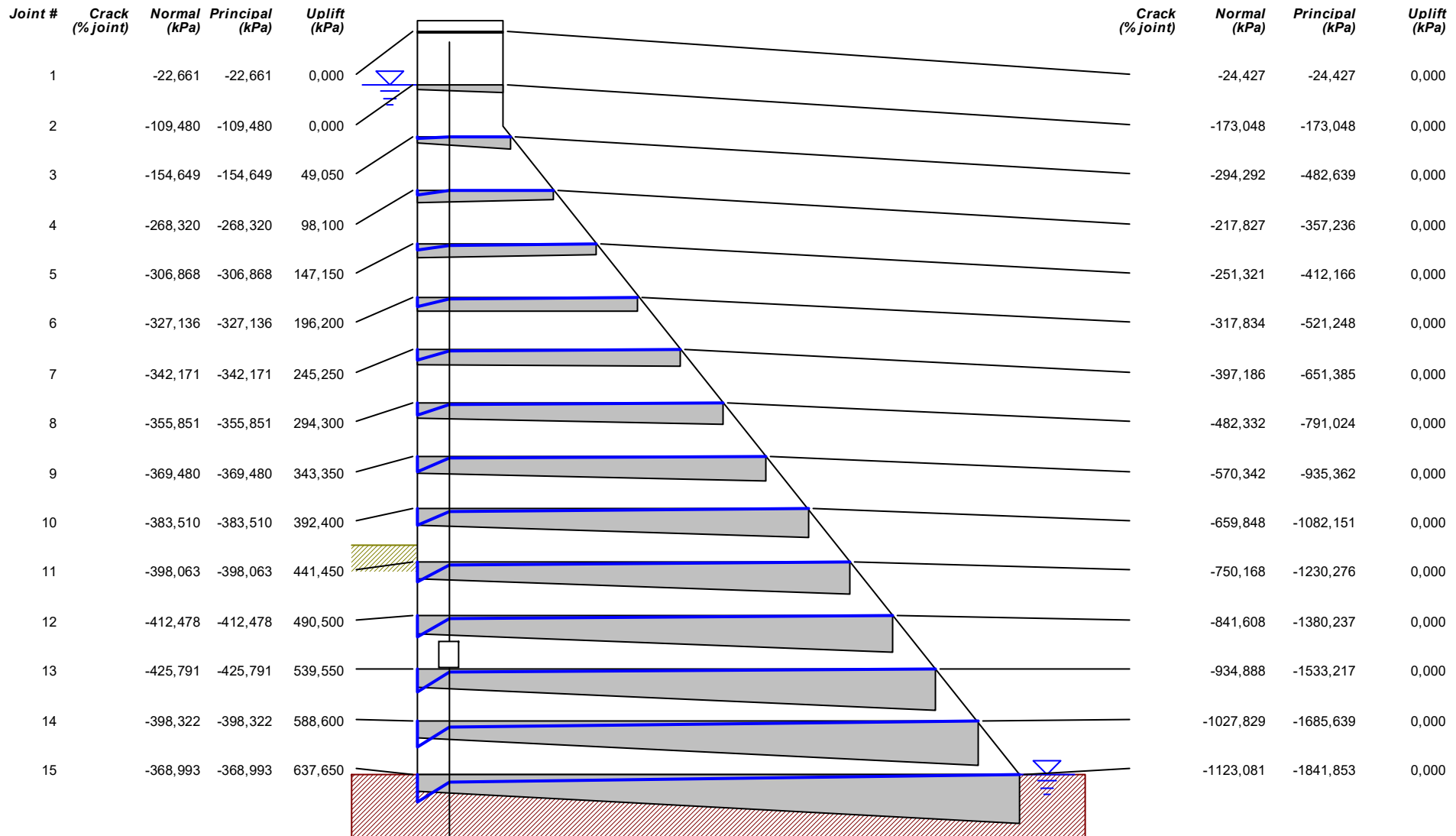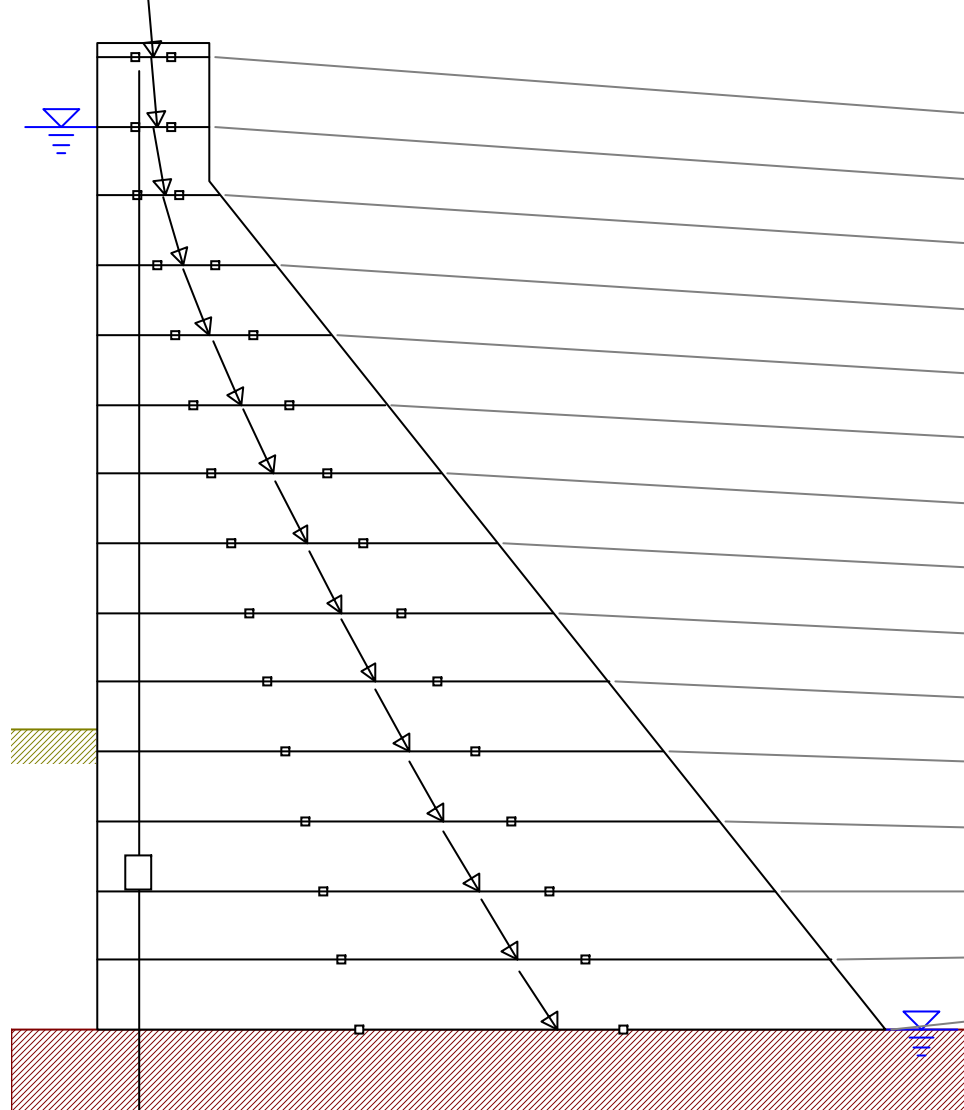| Project:	TD4	Dam location:	FGG	Analysis performed by:	
Dam:	Example 1	Date:	30/11/2021	Project engineer:	Arthur Guillot - Le Goff
Owner:					

Seismic #2 combination - Peak accelerations (stress analysis) (effective stress analysis)

Joint #	Crack (% joint)	Normal (kPa)	Principal (kPa)	Uplift (kPa)		Crack (% joint)	Normal (kPa)	Principal (kPa)	Uplift (kPa)
1		-22,661	-22,661	0,000			-24,427	-24,427	0,000
2		-109,480	-109,480	0,000			-173,048	-173,048	0,000
3		-154,649	-154,649	49,050			-294,292	-482,639	0,000
4		-268,320	-268,320	98,100			-217,827	-357,236	0,000
5		-306,868	-306,868	147,150			-251,321	-412,166	0,000
6		-327,136	-327,136	196,200			-317,834	-521,248	0,000
7		-342,171	-342,171	245,250			-397,186	-651,385	0,000
8		-355,851	-355,851	294,300			-482,332	-791,024	0,000
9		-369,480	-369,480	343,350			-570,342	-935,362	0,000
10		-383,510	-383,510	392,400			-659,848	-1082,151	0,000
11		-398,063	-398,063	441,450			-750,168	-1230,276	0,000
12		-412,478	-412,478	490,500			-841,608	-1380,237	0,000
13		-425,791	-425,791	539,550			-934,888	-1533,217	0,000
14		-398,322	-398,322	588,600			-1027,829	-1685,639	0,000
15		-368,993	-368,993	637,650			-1123,081	-1841,853	0,000

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Project:	TD4	Dam location:	FGG	Analysis performed by:	
Dam:	Example 1	Date:	30/11/2021	Project engineer:	Arthur Guillot - Le Goff
Owner:					

Seismic #2 combination - Peak accelerations (stress analysis) (stability analysis)

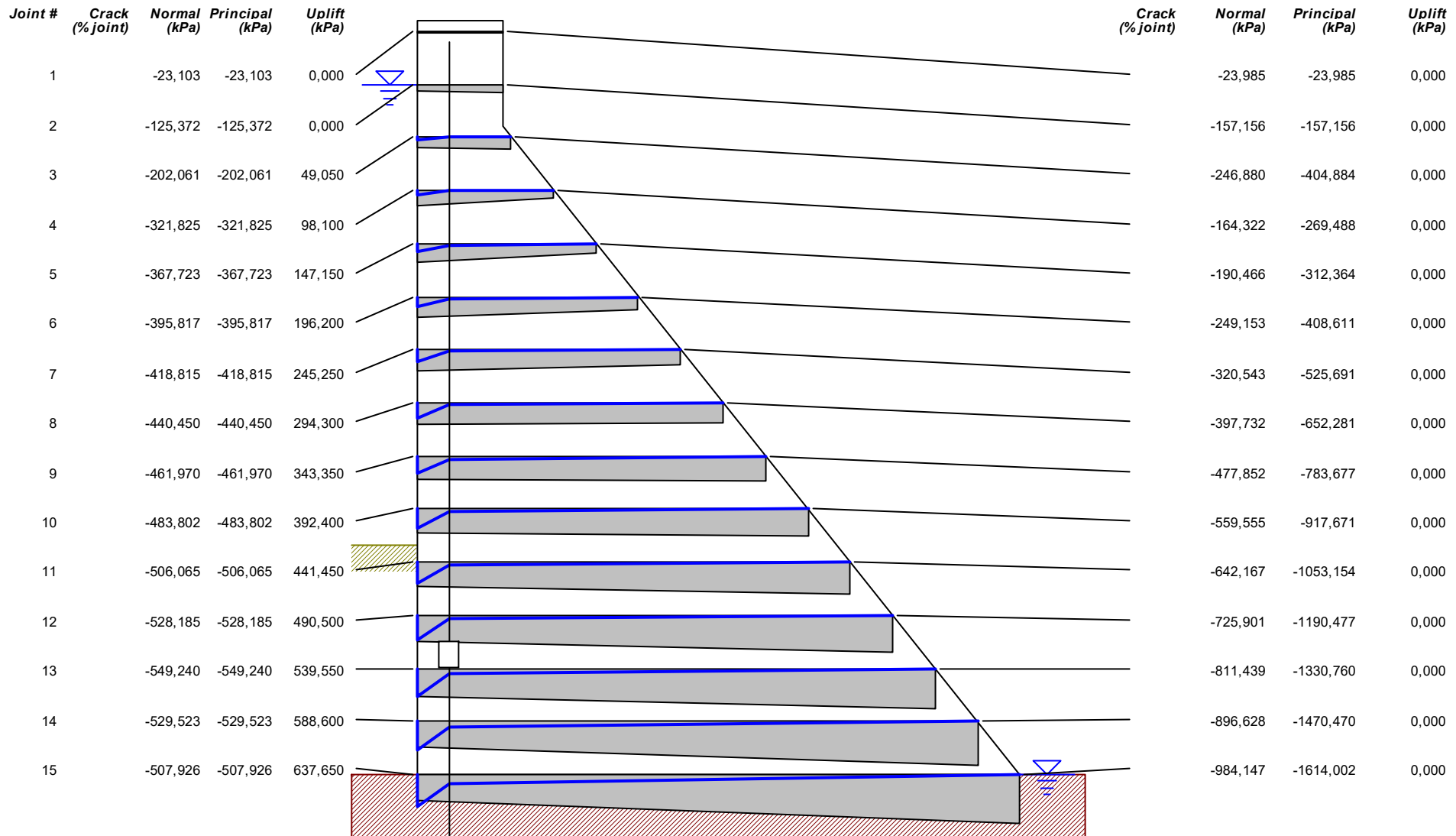| Joint #	SSF (peak)	SSF (residual)	OSF (U/S <-)	OSF (-> D/S)	USF	Normal (kN)	Shear (kN)	Moment (kN·m)	Res. Pos. (% joint)
1	48,260	14,281	> 100	80,000	> 100	-188,4	18,8	9,4	50,625
2	19,945	14,281	> 100	13,333	> 100	-1130,1	113,0	339,0	53,750
3	9,491	7,596	48,746	4,607	19,644	-1975,3	371,4	901,2	55,184
4	5,872	4,772	30,889	3,942	13,893	-3111,3	931,2	-689,4	48,269
5	4,484	3,734	27,363	3,448	12,545	-4688,8	1793,2	-1306,5	48,341
6	3,808	3,244	26,501	3,140	12,173	-6707,7	2952,6	-335,3	49,760
7	3,422	2,972	26,354	2,942	12,126	-9168,0	4406,3	2819,7	51,240
8	3,176	2,802	26,425	2,806	12,205	-12069,8	6152,4	8742,4	52,515
9	3,008	2,688	26,559	2,710	12,336	-15413,1	8189,5	18008,0	53,562
10	2,887	2,607	26,702	2,639	12,485	-19197,8	10516,4	31185,7	54,414
11	2,794	2,546	26,838	2,585	12,636	-23423,9	13140,3	48844,0	55,111
12	2,707	2,485	26,968	2,541	12,784	-28091,5	16141,5	71773,3	55,703
13	2,628	2,428	27,102	2,502	12,925	-33200,6	19529,9	101032,1	56,236
14	2,489	2,308	18,621	2,323	9,727	-37650,4	23301,4	146247,0	57,357
15	2,370	2,204	14,745	2,184	8,015	-42374,9	27453,8	202739,2	58,423
	1,300	*1,000*	*1,100*	*1,100*	*1,100*				

CADAM - Stability drawing

By Martin Leclerc, M. Ing.

NSERC / Hydro-Quebec / Alcan Industrial Chair on Structural Safety of Concrete Dams, École Polytechnique de Montréal, Canada

Project:	TD4	Dam location:	FGG	Analysis performed by:	
Dam:	Example 1	Date:	30/11/2021	Project engineer:	Arthur Guillot - Le Goff
Owner:					

Seismic #2 combination - Sustained accelerations (stability analysis) (effective stress analysis)

Joint #	Crack (% joint)	Normal (kPa)	Principal (kPa)	Uplift (kPa)	Crack (% joint)	Normal (kPa)	Principal (kPa)	Uplift (kPa)
1		-23,103	-23,103	0,000		-23,985	-23,985	0,000
2		-125,372	-125,372	0,000		-157,156	-157,156	0,000
3		-202,061	-202,061	49,050		-246,880	-404,884	0,000
4		-321,825	-321,825	98,100		-164,322	-269,488	0,000
5		-367,723	-367,723	147,150		-190,466	-312,364	0,000
6		-395,817	-395,817	196,200		-249,153	-408,611	0,000
7		-418,815	-418,815	245,250		-320,543	-525,691	0,000
8		-440,450	-440,450	294,300		-397,732	-652,281	0,000
9		-461,970	-461,970	343,350		-477,852	-783,677	0,000
10		-483,802	-483,802	392,400		-559,555	-917,671	0,000
11		-506,065	-506,065	441,450		-642,167	-1053,154	0,000
12		-528,185	-528,185	490,500		-725,901	-1190,477	0,000
13		-549,240	-549,240	539,550		-811,439	-1330,760	0,000
14		-529,523	-529,523	588,600		-896,628	-1470,470	0,000
15		-507,926	-507,926	637,650		-984,147	-1614,002	0,000

CADAM - Stability drawing

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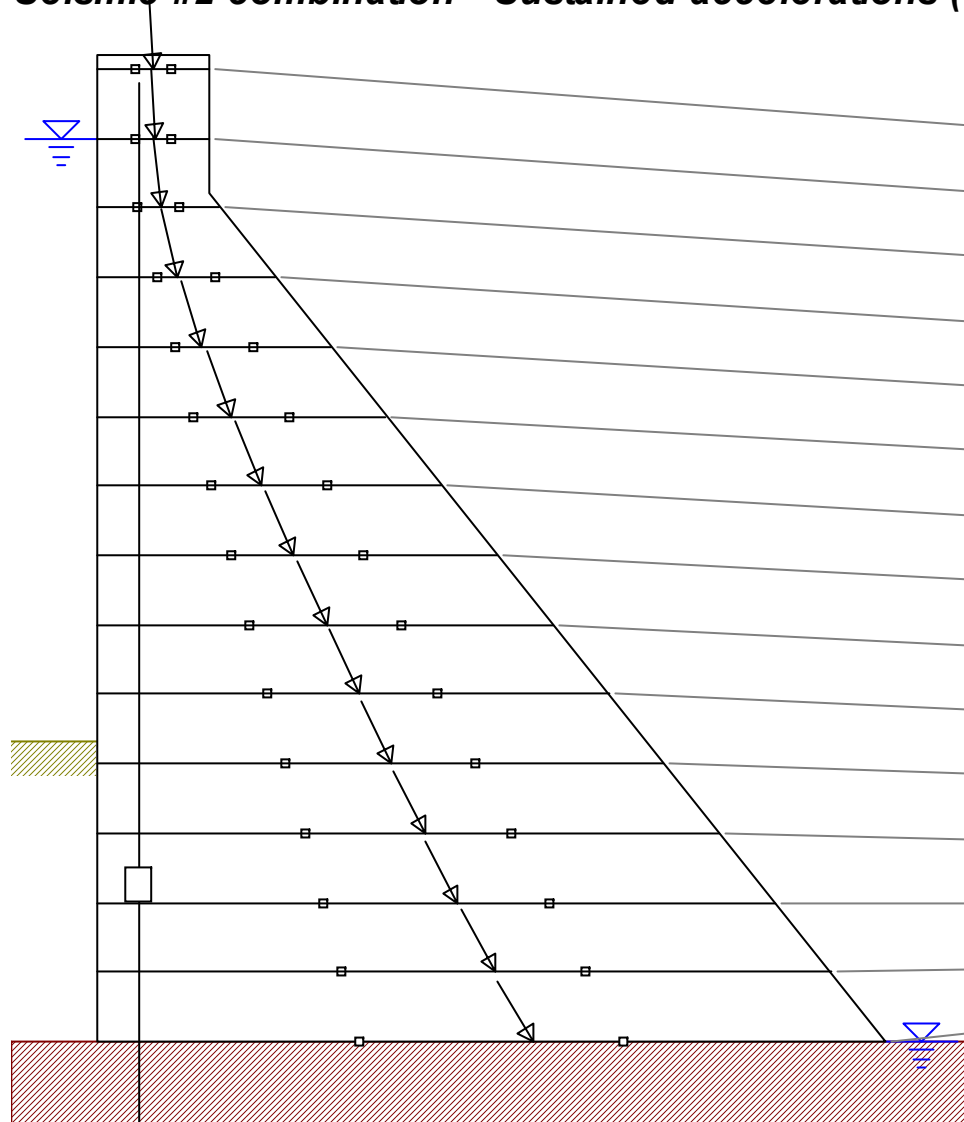| Project:	TD4	Dam location:	FGG	Analysis performed by:	
Dam:	Example 1	Date:	30/11/2021	Project engineer:	Arthur Guillot - Le Goff
Owner:					

Seismic #2 combination - Sustained accelerations (stability analysis) (stability analysis)

Joint #	SSF (peak)	SSF (residual)	OSF (U/S <-)	OSF (-> D/S)	USF	Normal (kN)	Shear (kN)	Moment (kN·m)	Res. Pos. (% joint)
1	96,521	28,563	> 100	> 100	> 100	-188,4	9,4	4,7	50,313
2	39,889	28,563	> 100	26,667	> 100	-1130,1	56,5	169,5	51,875
3	14,271	11,421	45,701	6,429	19,644	-1975,3	247,0	289,2	51,664
4	7,692	6,251	28,618	4,981	13,893	-3111,3	710,8	-2150,4	44,600
5	5,551	4,623	25,381	4,165	12,545	-4688,8	1448,4	-4169,1	44,707
6	4,576	3,898	24,682	3,700	12,173	-6707,7	2457,3	-5287,7	46,210
7	4,036	3,505	24,645	3,411	12,126	-9168,0	3736,0	-5036,7	47,785
8	3,699	3,263	24,797	3,218	12,205	-12069,8	5283,5	-2952,7	49,151
9	3,470	3,101	24,994	3,083	12,336	-15413,1	7099,1	1423,8	50,282
10	3,307	2,986	25,189	2,983	12,485	-19197,8	9182,2	8549,0	51,210
11	3,182	2,899	25,368	2,907	12,636	-23423,9	11538,8	18880,1	51,976
12	3,069	2,817	25,535	2,845	12,784	-28091,5	14242,2	33068,6	52,628
13	2,965	2,739	25,698	2,792	12,925	-33200,6	17308,0	52034,3	53,212
14	2,797	2,593	17,678	2,567	9,727	-37650,4	20734,2	85286,0	54,290
15	2,653	2,468	14,014	2,395	8,015	-42374,9	24519,7	128033,7	55,319
	1,300	1,000	1,100	1,100	1,100				

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