

PROPIEDADES MECÁNICAS Y FÍSICAS DE 32 ESPECIES DEL PERÚ

ESPECIE	Densidad Básica gr/cm ³	Contracción Volumétrica %	Relación T/R %	Contracción Tangencial %	Contracción Radial %	Módulo de Elasticidad en flexión (tn/cm ²)	Módulo de Ruptura en flexión (kg/cm ²)	Compresión Paralela (kg/cm ²)	Compresión Perpendicular (kg/cm ²)	Corte paralelo a las Fibras (kg/cm ²)	Dureza de lados(kg/cm ²)	Tenacidad (Kg.m)
AGUANO MASHA	0.70	9.90	1.70	6.49	3.81	139	1102	547	127	127	1052	5.90
ALMENDRO	0.65	13.80	2.20	9.61	4.38	133	685	248	67	94	606	-
ANA CASPI	0.70	10.60	1.52	6.40	4.20	111	856	453	85	115	718	4.08
ANDIROBA	0.54	12.10	2.80	8.00	3.90	119	724	289	51	86	399	-
AZUCAR HUAYO	0.62	1.20	2.20	7.30	3.30	150	1300	700	80	180	955	3.50
BOLAINA BLANCA	0.41	10.75	1.60	5.50	3.50	98	507	271	51	51	303	0.98
CACHIMBO	0.59	12.10	1.50	7.58	4.96	131	735	342	66	84	468	3.90
CAOBA	0.43	8.80	1.70	5.54	3.17	94	524	240	58	68	298	1.90
CAPIRONA	0.76	15.00	1.80	9.00	5.00	-	723	344	47	87	425	2.00
CASHO MOENA	0.51	11.90	2.40	8.68	3.68	118	581	278	47	76	363	3.00
CATAHUA	0.41	9.00	2.10	5.81	3.43	68	401	126	28	51	236	2.00
CEDRO	0.42	10.50	2.30	7.00	3.10	72	395	104	33	58	273	13.00
CHIMUCUA	0.71	14.50	2.20	10.30	4.78	160	898	373	77	111	761	3.80
CHONTAQUIRO	0.74	10.60	1.50	6.10	4.10	148	997	459	115	149	915	2.90
CONGONA	0.68	12.40	1.60	8.13	4.96	117	785	365	75	109	720	3.60
COPAIBA	0.61	10.70	2.00	7.04	3.43	112	736	268	74	99	587	3.40
COPAL	0.70	11.70	2.17	7.64	3.53	147	734	229	69	103	517	2.48
CUMALA	0.45	13.40	2.40	9.87	4.45	106	447	185	37	52	212	0.90
CUMALA BLANCA	0.45	13.40	2.40	9.87	4.45	106	447	185	37	52	212	0.90
DIABLO FUERTE	0.53	9.00	1.90	6.15	3.22	99	580	251	57	86	425	2.80
ESTORAQUE	0.78	9.97	1.56	6.52	4.16	175	1340	714	130	163	1143	6.60
EUCALIPTO	0.57	22.40	2.30	2.30	6.90	122	678	232	50	91	510	4.90
HIGUERILLA	0.40	8.92	2.20	6.75	3.43	94	403	209	31	47	136	3.50
HUACAMAYO CASPI	0.65	13.00	2.50	9.90	4.00	131	829	321	90	104	670	4.60
HUAYRURO	0.61	9.40	1.98	6.30	3.19	136	838	443	71	105	650	3.70
HUIMBA NEGRA	0.57	11.60	1.53	7.70	4.35	105	582	287	42	71	374	2.20
ISHPINGO	0.43	7.60	1.80	4.10	2.30	94	739	308	78	52	358	1.40
ITAHUBA	0.68	10.60	2.90	7.00	2.40	126	799	261	79	95	530	1.90
LAGARTO CASPI	0.56	9.40	2.10	9.00	4.30	111	734	213	62	88	403	2.30
LUPUNA MACHIMANGO BLANCO	0.28	10.70	1.50	9.01	3.10	47	232	109	17	28	120	1.10
MACHIN SAPOTE	0.72	12.90	1.50	8.25	5.44	133	923	357	102	106	834	5.10
	0.52	14.60	2.10	10.71	5.13	131	552	197	45	67	352	2.00

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MAQUISAPA ÑACCHA	0.29	7.96	2.77	6.28	2.20	52	278	159	12	35	156	1.40
MARUPA	0.36	8.60	2.38	6.95	2.91	76	427	159	33	57	204	1.60
MASHONASTE	0.56	9.40	2.10	6.30	3.00	139	926	536	76	100	690	2.90
MOENA AMARILLA	0.56	9.40	2.10	9.00	4.30	130	699	278	37	87	430	2.00
MOENA NEGRA	0.45	12.00	2.20	6.60	2.90	105	584	241	48	56	282	-
OJE BLANCO	0.36	8.60	2.90	6.40	2.20	63	456	52	35	43	167	0.54
OJE RENACO	0.43	7.55	2.64	5.56	2.11	-	-	-	-	-	-	-
OJE ROSADO	0.50	10.80	2.10	7.50	3.60	72	475	393	393	74	323	1.03
PALO AJO	0.49	13.40	1.60	7.80	4.90	83	406	83	35	49	411	-
PALO SANGRE NEGRO	0.72	7.40	1.90	4.80	2.70	188	1469	756	170	220	1090	5.30
PANGUANA	0.49	9.69	1.90	6.88	3.71	100	511	264	42	74	380	2.70
PASHACO	0.40	10.40	1.90	7.00	0.04	86	569	364	54	80	231	1.44
PUMAQUIRO	0.67	12.38	1.97	8.08	4.10	146	950	522	95	117	738	4.00
PUNGA	0.39	12.93	2.90	10.10	3.63	78	348	127	23	42	205	1.90
QUILLOBORDON	0.60	14.00	1.60	8.30	5.20	146	389	152	81	104	625	3.80
QUINA QUINA	0.74	14.20	2.07	10.01	5.08	164	897	363	100	110	795	5.10
QUINILLA COLORADA	0.87	15.80	2.50	11.01	6.76	184	1204	476	140	135	1090	6.60
REQUIA	0.60	14.90	1.81	10.14	5.59	154	750	384	67	93	579	3.60
SHIHUAHUACO	0.87	15.00	1.60	9.10	5.50		1286	672	150	145	1353	6.20
SHIRINGA	0.53	8.95	2.30	6.79	3.01	92	472	192	53	72	306	1.60
TAHUARI	0.92	13.85	1.56	8.88	5.69	198	1436	786	152	152	1043	6.50
TAMAMURI	0.53	12.50	1.40	6.90	5.10	140	874	345	80	115	596	2.90
TOPA	0.13	20.80	2.50	7.60	3.00	30	148	63	5	17	36	
TORNILLO	0.45	10.65	2.20	6.90	3.17	108	576	222	57	81	388	3.00
UBOS	0.35	10.00	2.33	7.44	3.18	80	400	204	25	54	199	1.70
UCHUMULLACA	0.69	15.30	1.60	9.98	6.35	134	837	308	84	106	706	4.40
UCSHAQUIRO BLANCO	0.38	9.80	2.00	6.60	3.40	110	699	391	64	81	308	2.28
ULCUMANO	0.53	9.00	2.00	6.15	3.22	99	580	302	57	86	425	2.80
VILCO COLORADO	0.41	11.00	2.80	8.20	2.80	119	713	386	64	35	381	2.50
YACUSHAPANA	0.73	12.40	1.76	8.70	5.10	127	767	336	78	91	528	3.90
YANCHAMA	0.44	10.80	10.50	7.00	4.46	79	500	288	36	69	283	1.90
ZAPOTE	0.43	11.80	2.35	8.97	3.81	89	488	239	40	55	272	2.10

USOS POSIBLES PARA ESPECIES MADERERAS AGRUPADAS SEGÚN LA R.N.E.

A	HUACAPU	Minuartia guianensis Aubl	Loreto.	Es empleada en estructuras como vigas, columnas, pilotes, puntales, puentes, durmientes y en la fabricación de parquet.
	PUMAQUIRO	Aspidosperma macrocarpon	Se extiende en todo el norte de América del Sur, de la amazonía central y occidental.	Machimbrados, pisos, durmientes, muebles, estructura pesada, carrocerías, artículos deportivos.
	QUINILLA COLORADA	Manilkara bidentata		Carpintería de obras, interiores, piezas torneadas, muebles, encofrados.
	SHIHUAHUACO MARRON	Coumarouna odorata Aubl	Loreto, San Martín y Ucayali.	Pisos/durmientes, estructuras, machihembrados.
B	AGUANO MASHA	Paramachaerium sp	Ucayali, Loreto, Cusco, Junín y Madre de Dios.	Pisos, laminados, molduras, estructuras.
	ANA CASPI	Apuleia molaris	Loreto, Ucayali, Madre de Dios y San Martín.	Carrocerías, estructuras pesadas, durmientes, pisos.
	CACHIMBO COLORADO	Cariniana domestica	Huánuco, Loreto, Madre de Dios y Ucayali.	Estructuras, Molduras, Laminados, Carpintería de obras
	CAPIRONA	Calycophyllum spuceanum	Amazonas, San Martín, Huánuco, Loreto, Madre de Dios y Ucayali.	Pisos, tarugos/molduras, estructuras.
	HUAYRURO	Ormosia sp	Loreto y Ucayali.	Estructuras, muebles/molduras. Pisos/laminados, carpintería.
	MANCHINGA	Brosimum alicastrum		Estructuras, pisos, decoración, enchapes decorativos.
C	BOLAINA BLANCA	Guazuma crinita	Amazonas, Huánuco, Junín, Loreto, Madre de Dios, Pasco, San Martín y Ucayali.	Traslapados, paletas/embalaje, molduras, fósforos.
	CATAHUA AMARILLA	Hura crepitans	Loreto (Iquitos, Yurimaguas), Huánuco (Tingo María), Ucayali (Pucallpa), San Martín (Tarapoto).	Laminado/embalaje, carpintería muebles.
	COPAIBA	Copaifera sp.	Loreto y Ucayali	Muebles/molduras, encofrados/triplay, carpintería.
	DIABLO FUERTE	Podocarpus sp.	Cajamarca, Pasco, Junín, Apurímac, Puno y Cusco.	Muebles, Construcciones, Carpintería, Ebanistería, Cajonería, Encofrado
	LAGARTO CASPI	Calophyllum brasilense camb.	Yurimaguas, Iquitos, Pucallpa, entre otros.	Construcciones, estructuras, carpintería, mueblería en general.
	MASHONASTE	Clarisia racemosa		Construcción naval, estructuras durmientes, carrocería, pisos.
	MOENA AMARILLA	Aniba amazonica	Iquitos, Yurimaguas, Pucallpa, Tornavista, Huánuco y Tingo	Molduras, muebles, construcciones, carpintería.
	MOENA ROSADA	Ocotea Bofo		
	PANGUANA	Brosimum utile ssp	Huánuco, San Martín, Loreto y Ucayali.	Carpintería de interiores, estructuras livianas, laminado/molduras.
	PAUJILRURO BLANCO	Pterygota amazonica	Loreto, San Martín y Ucayali.	Estructuras muebles.
	TORNILLO	Cedrelinga catenaeformis	Iquitos, Huánuco y Cuzco.	Pisos, estructuras, armaduras, vigas, columnas, carpintería de interiores.
	UTUCURO	Septhoteca tesmanii		Carpintería de obra, estructuras livianas, molduras.
	YACUSHAPANA	Terminalia oblonga	Amazonas, Cuzco, Huánuco, Junín, Loreto, Madre de Dios, Pasco, Ucayali.	Pisos, construcción, durmientes, machihembrados.

Fuente: Camara nacional forestal.

Fuente: Compendio de Información de 64 especies madereras en el Perú. Confederación Peruana de la Madera. CPM

ACELERACIONES MÁXIMAS REGISTRADAS EN EL ENSAYO

FASE	1			2			3		
	Máx	Mín	Abs	Máx	Mín	Abs	Máx	Mín	Abs
A0 (g)	0.165	-0.229	0.229	0.365	-0.496	0.496	0.641	-0.903	0.903
A1 (g)	0.203	-0.258	0.258	0.399	-0.520	0.520	0.714	-0.977	0.977
A2 (g)	0.288	-0.299	0.299	0.548	-0.566	0.566	0.873	-0.998	0.998
A3 (g)	0.503	-0.445	0.503	0.869	-0.762	0.762	1.075	-1.083	1.083
A4 (g)	0.230	-0.295	0.295	0.456	-0.520	0.520	0.764	-0.988	0.988
A5 (g)	0.360	-0.302	0.360	0.630	-0.691	0.691	0.995	-1.004	1.004
A6 (g)	0.607	-0.532	0.607	1.049	-0.965	0.965	1.277	-1.244	1.277

FACTOR DE AMPLIFICACIÓN DINÁMICO

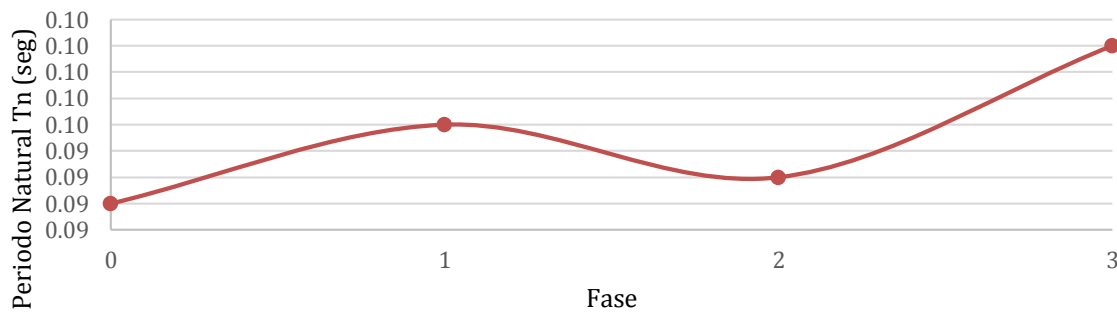
FASE	1	2	3
A0	0.229	0.496	0.903
A1	0.258	0.520	0.977
A2	0.299	0.566	0.998
A3	0.503	0.762	1.083
A4	0.295	0.520	0.988
A5	0.360	0.691	1.004
A6	0.607	1.049	1.277
Amax	0.607	1.049	1.277
FAD	2.655	2.113	1.414

**VARIACIÓN DEL AMORTIGUAMIENTO, PERIODO Y FRECUENCIA PARA LOS
SENSORES MÁS REPRESENTATIVOS (A4, A5 Y A6)**

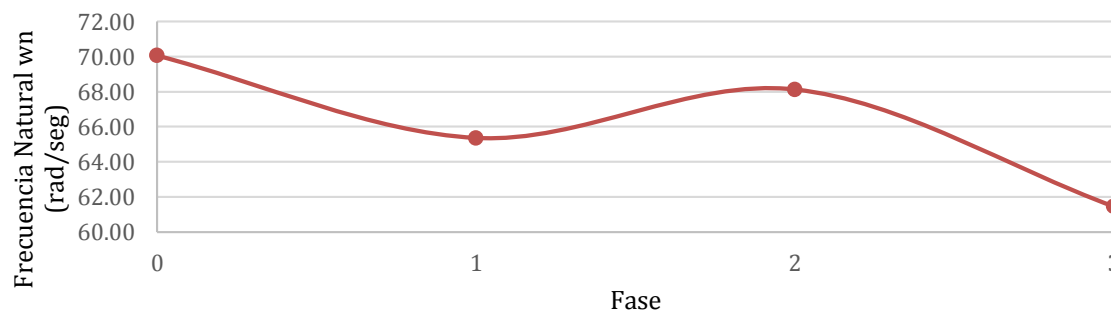
TECHO PISO 1 (A4)				
Fase	Fase 0	Fase 1	Fase 2	Fase 3
$\xi(\%)$	6.09	3.65	4.06	3.43
Td(seg)	0.09	0.10	0.09	0.10
$\omega d(\text{rad/seg})$	69.92	66.31	66.07	61.41
$\omega n(\text{rad/seg})$	70.05	65.36	68.12	61.45
Tn(seg)	0.09	0.10	0.09	0.10

"Variación del Amortiguamiento" Techo piso 1- A4

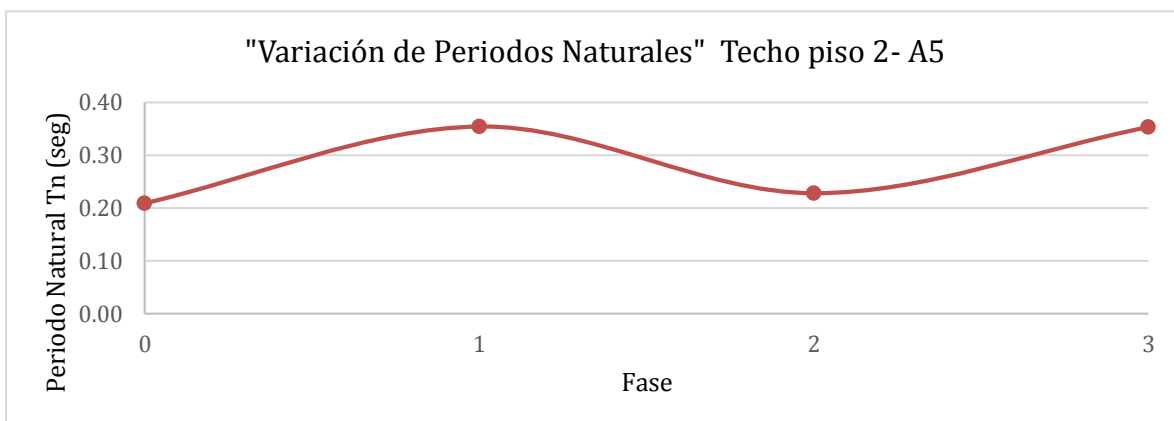
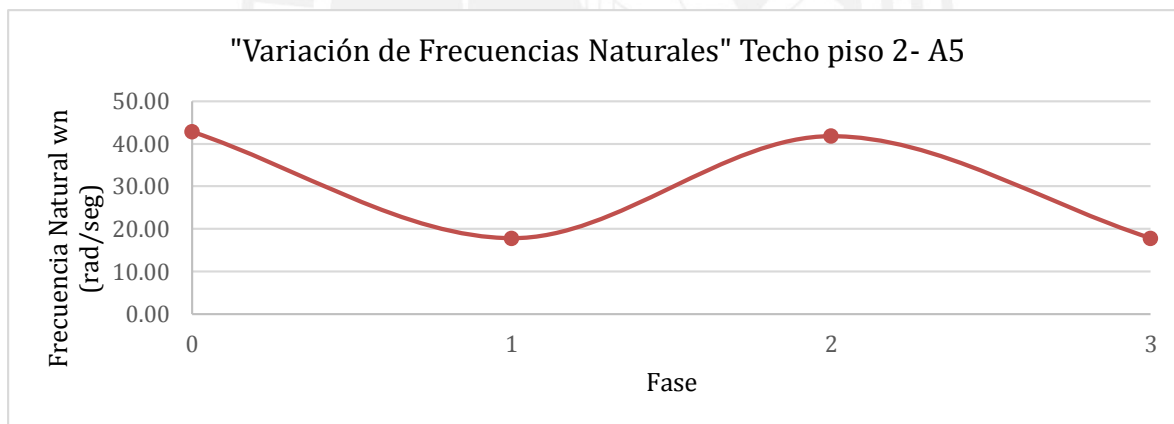
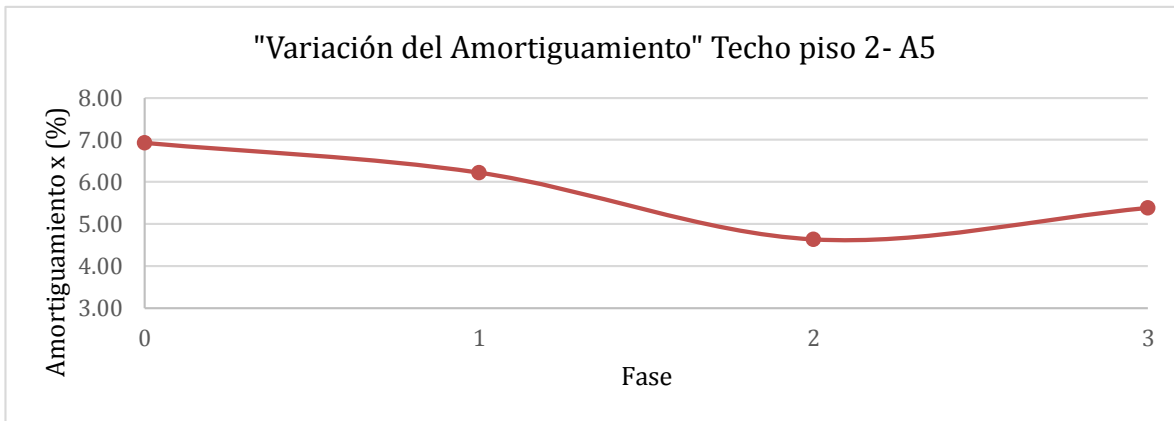
"Variación de Periodos Naturales" Techo piso 1- A4



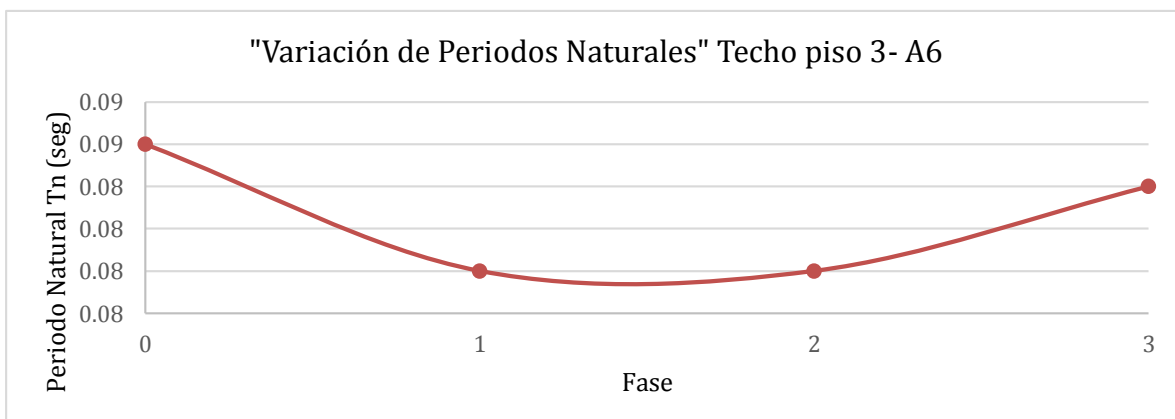
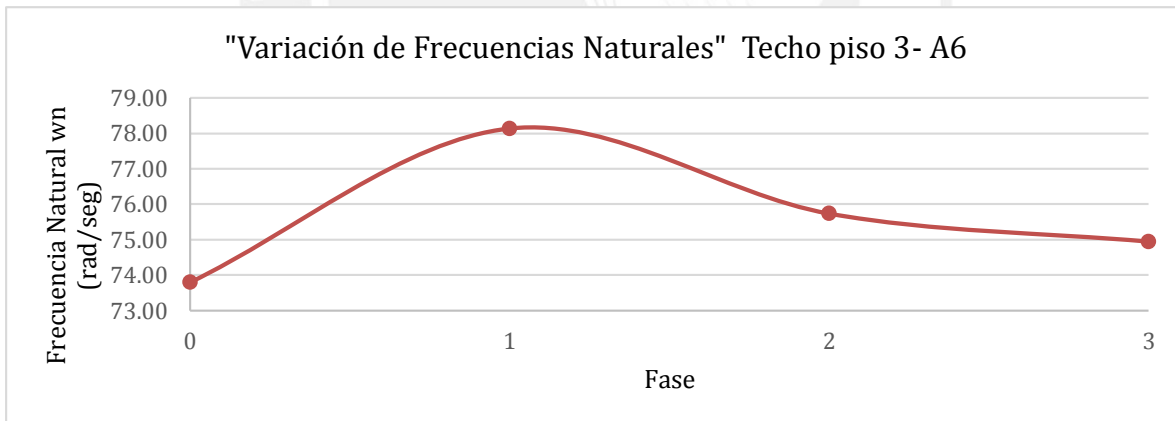
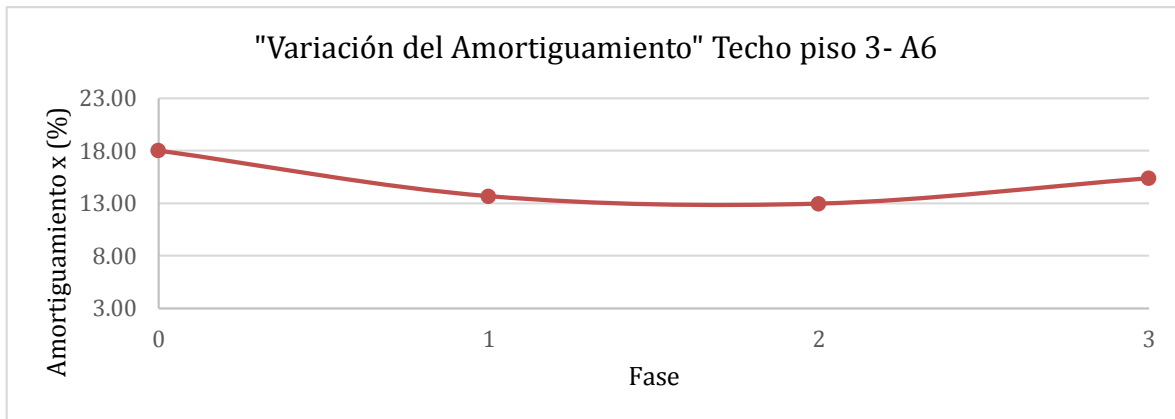
"Variación de Frecuencias Naturales" Techo piso 1- A4



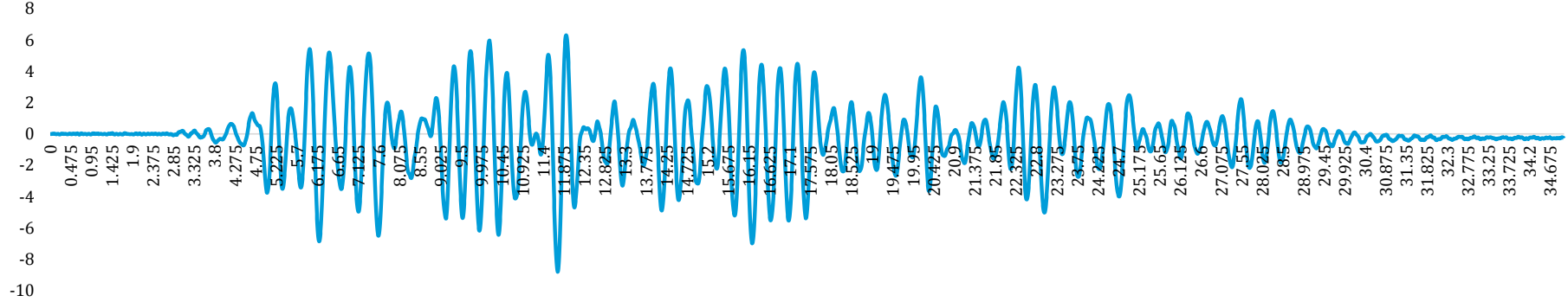
TECHO PISO 2 (A5)				
Fase	Fase 0	Fase 1	Fase 2	Fase 3
$\xi(\%)$	6.93	6.22	4.63	5.38
$T_d(\text{seg})$	0.21	0.36	0.23	0.35
$\omega_d(\text{rad/seg})$	42.74	17.72	41.74	17.76
$\omega_n(\text{rad/seg})$	42.83	17.76	41.78	17.79
$T_n(\text{seg})$	0.21	0.35	0.23	0.35



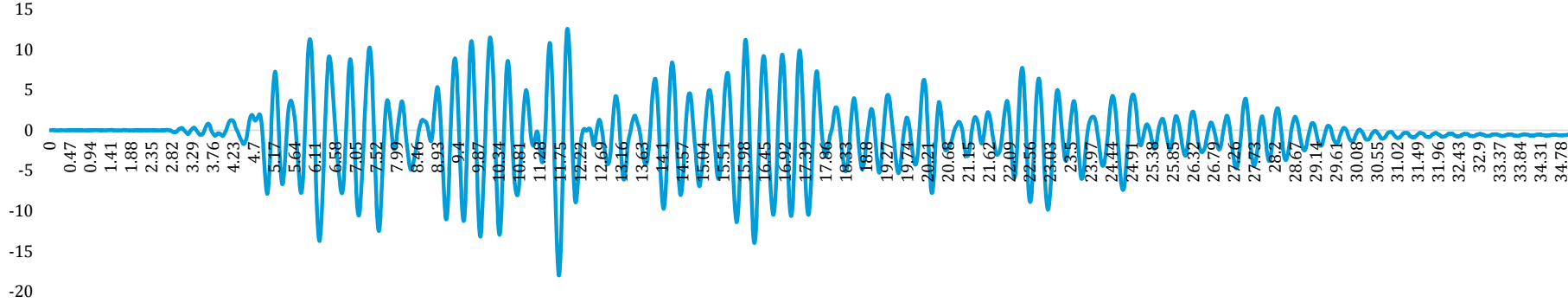
TECHO PISO 3 (A6)				
Fase	Fase 0	Fase 1	Fase 2	Fase 3
$\xi(\%)$	18.00	13.66	12.95	15.37
$T_d(\text{seg})$	0.09	0.08	0.08	0.09
$\omega_d(\text{rad/seg})$	72.49	77.38	75.07	74.05
$\omega_n(\text{rad/seg})$	73.79	78.13	75.73	74.94
$T_n(\text{seg})$	0.09	0.08	0.08	0.08



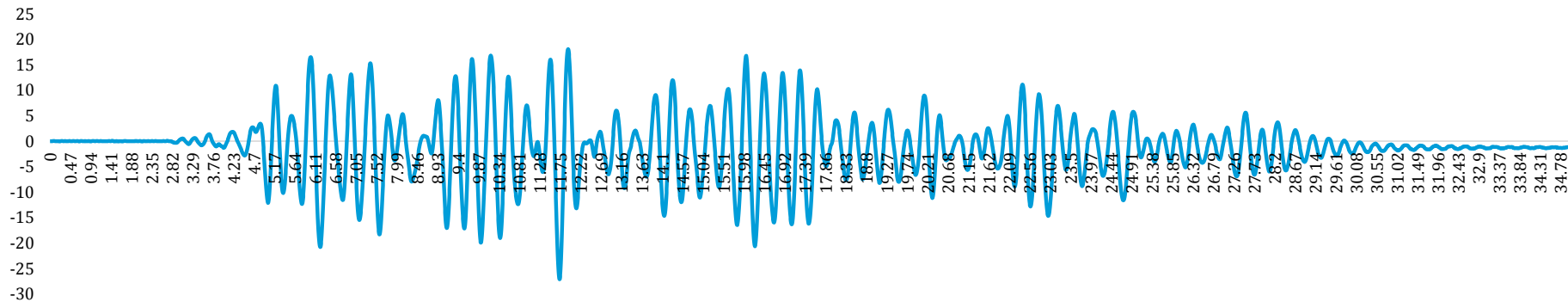
Desplazamiento Dr1 y Dr2 (Techo 1)-vs- Tiempo (FASE 1)

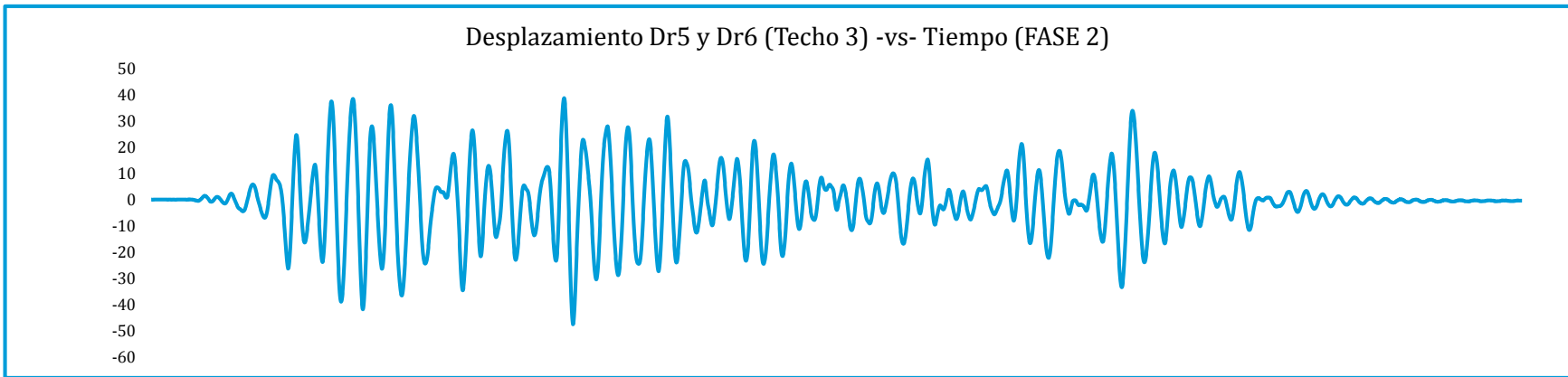
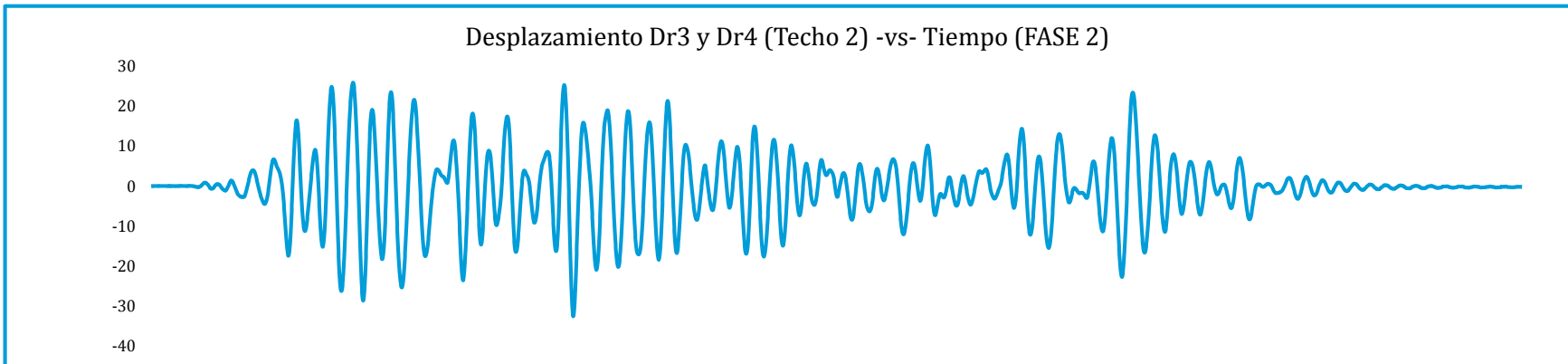
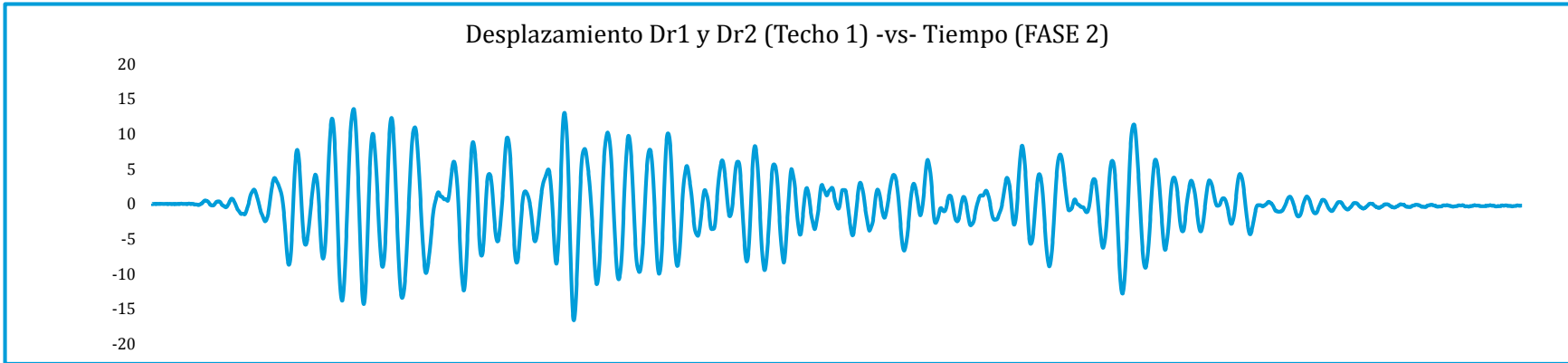


Desplazamiento Dr3 y Dr4 (Techo 2)-vs- Tiempo (FASE 1)

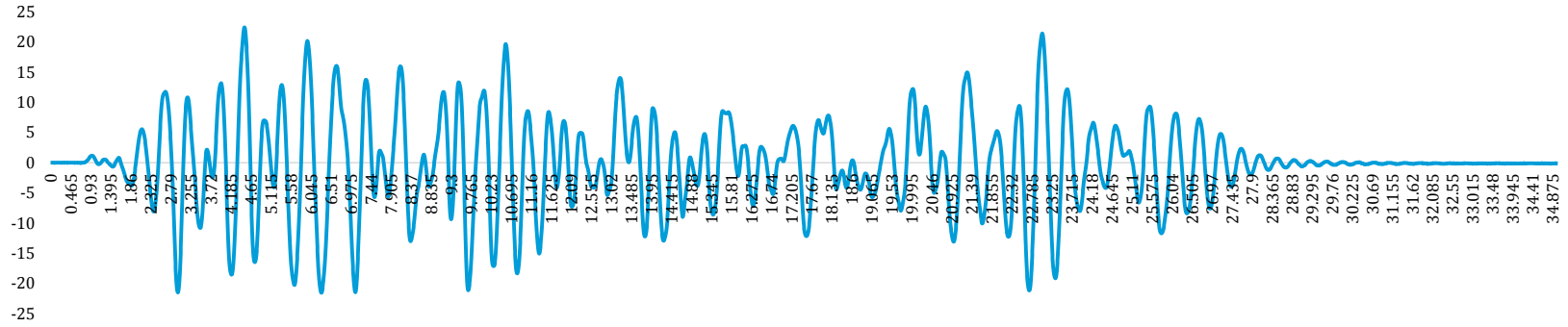


Desplazamiento Dr5 y Dr 6 (Techo 3)-vs- Tiempo (FASE 1)

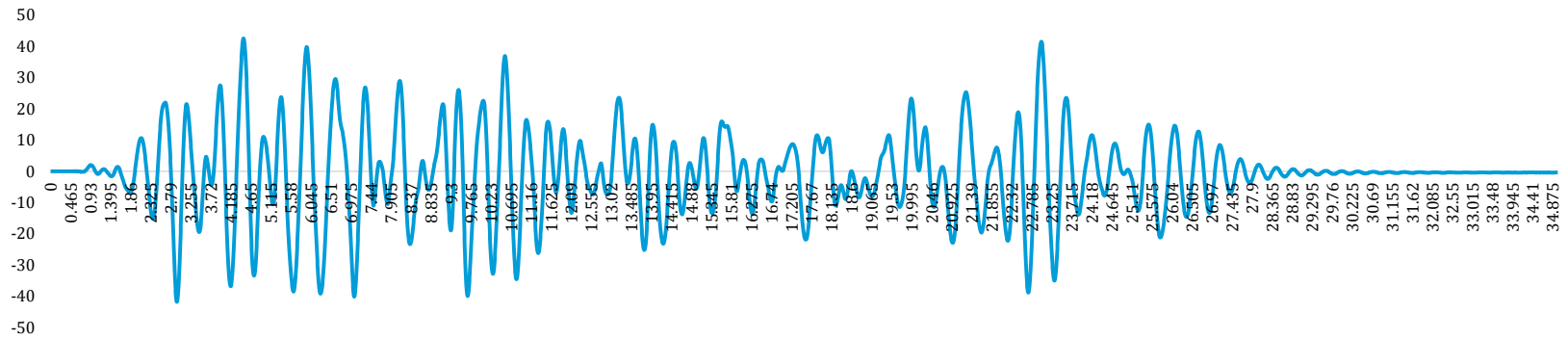




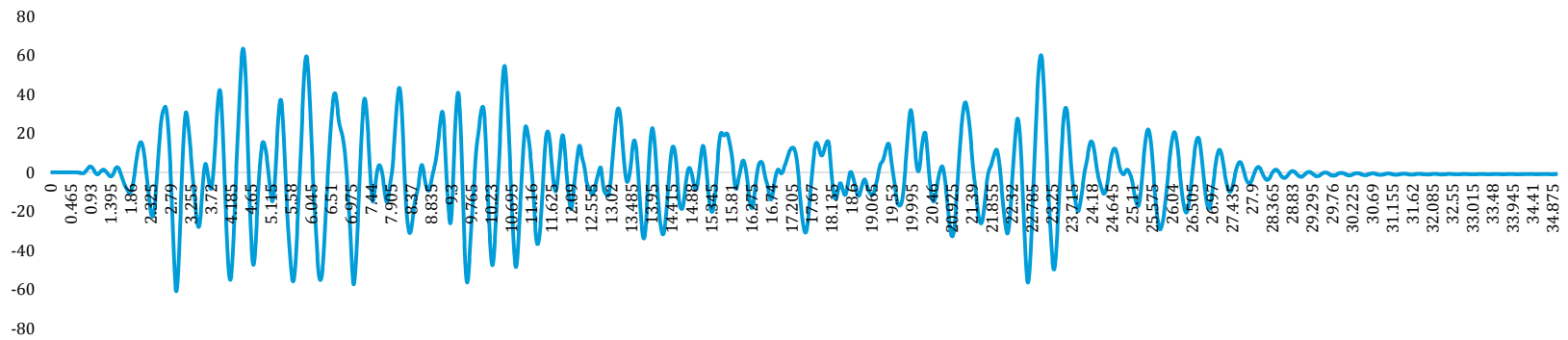
Desplazamiento Dr1 y Dr2 (Techo 1) -vs- Tiempo (FASE 3)



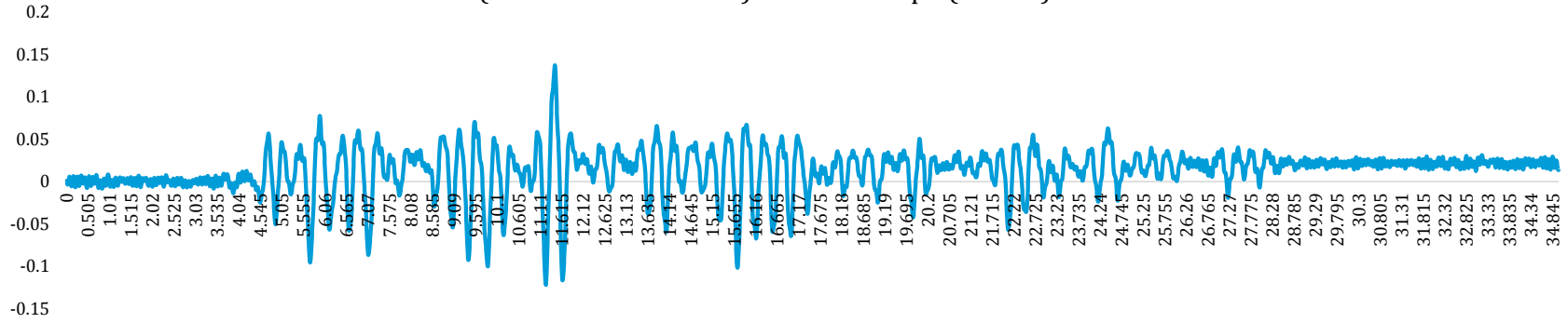
Desplazamiento Dr3 y Dr4 (Techo 2) -vs- Tiempo (FASE 3)



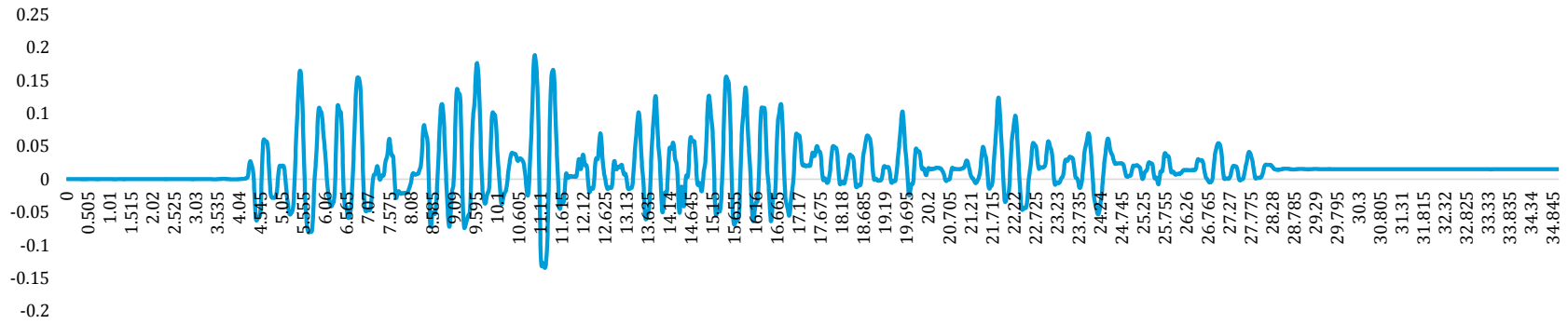
Desplazamiento Dr5 y Dr6 (Techo 3) -vs- Tiempo (FASE 3)



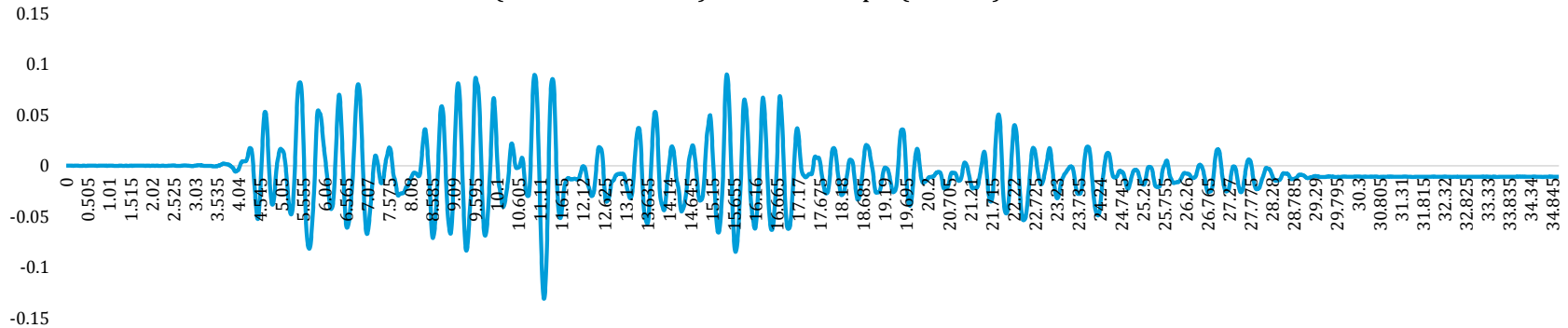
Deslizamiento Horizontal (Base 1 - Cimentación) D7 -vs- Tiempo (FASE 1)

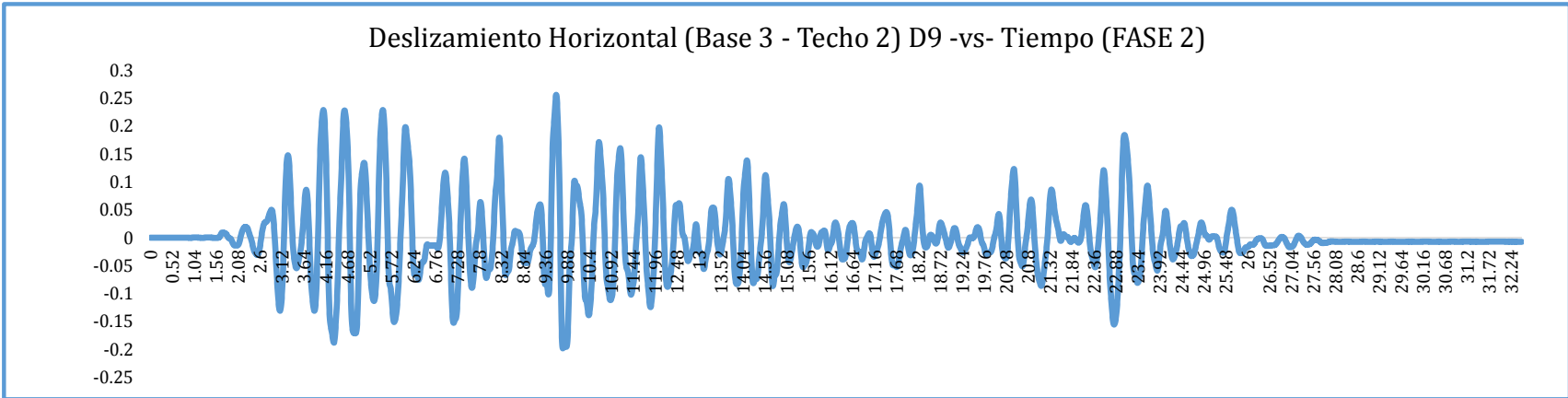
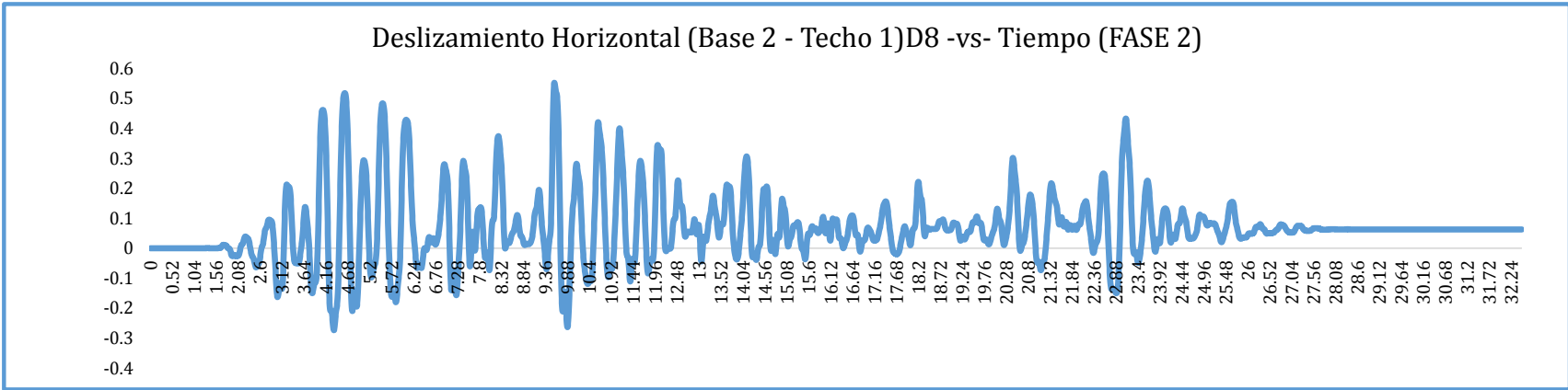
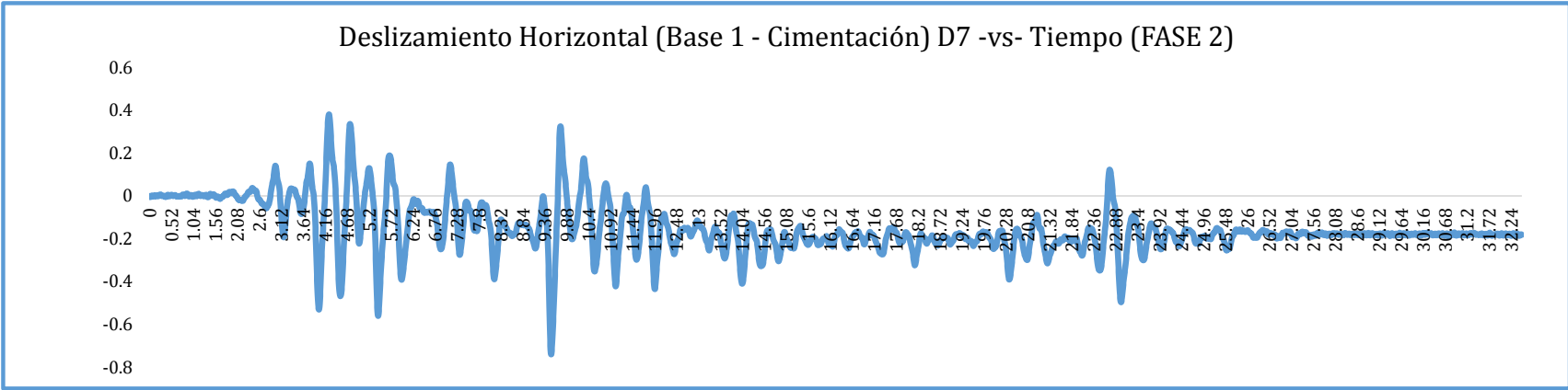


Deslizamiento Horizontal (Base 2 -Techo 1)D8 -vs- Tiempo (FASE 1)

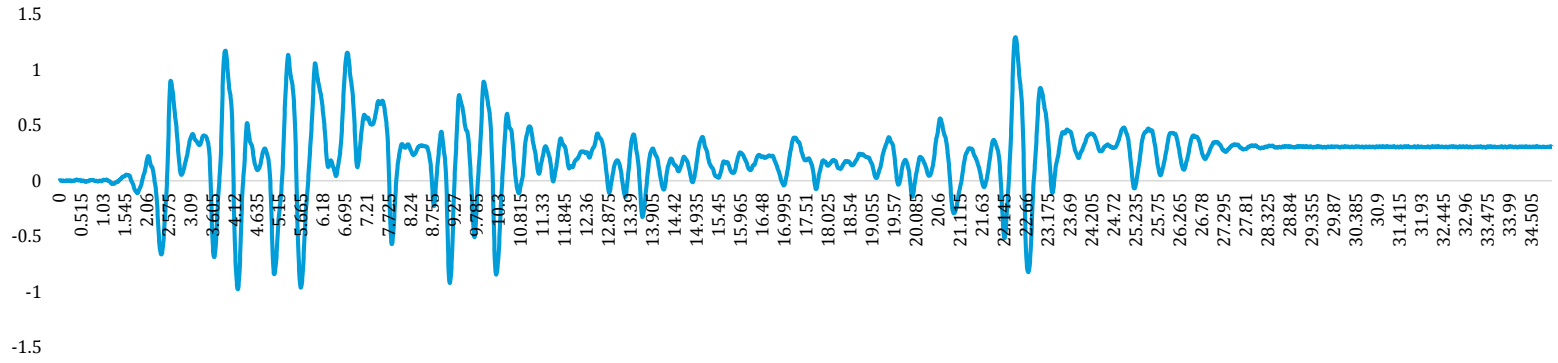


Deslizamiento Horizontal (Base 3 - Techo 2)D9 -vs- Tiempo (FASE 1)

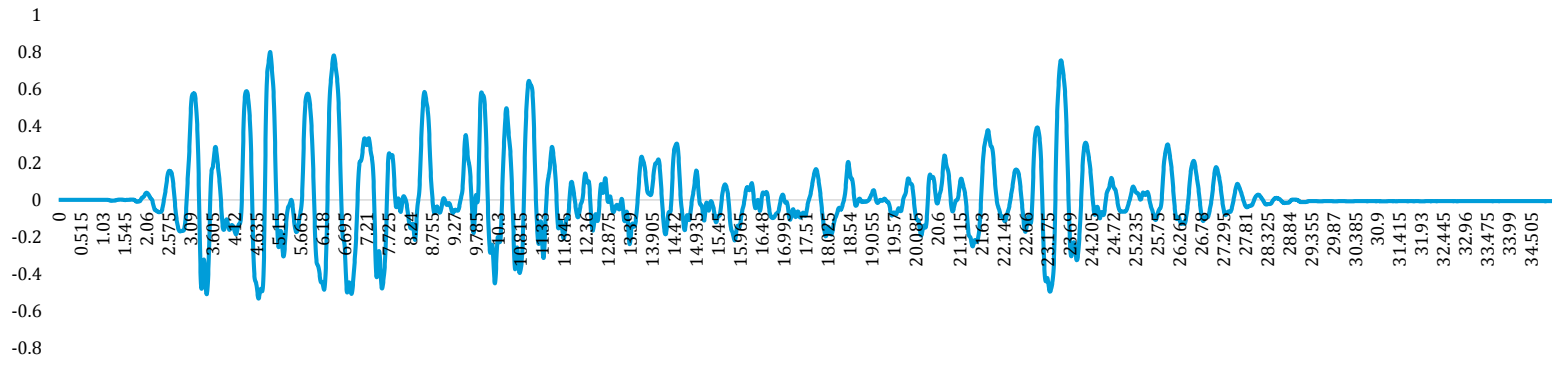




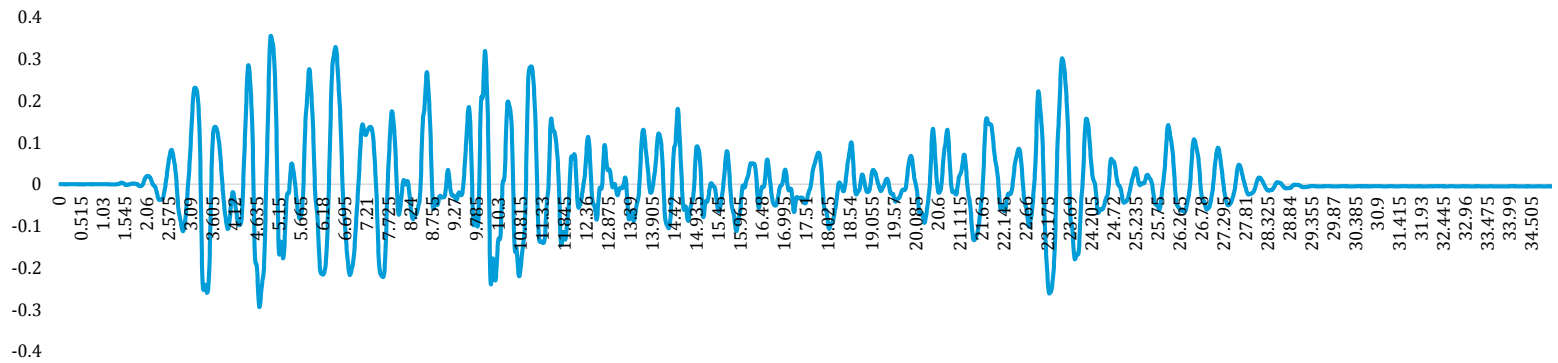
Deslizamiento Horizontal (Base 1 - Cimentación) D7 -vs- Tiempo (FASE 3)

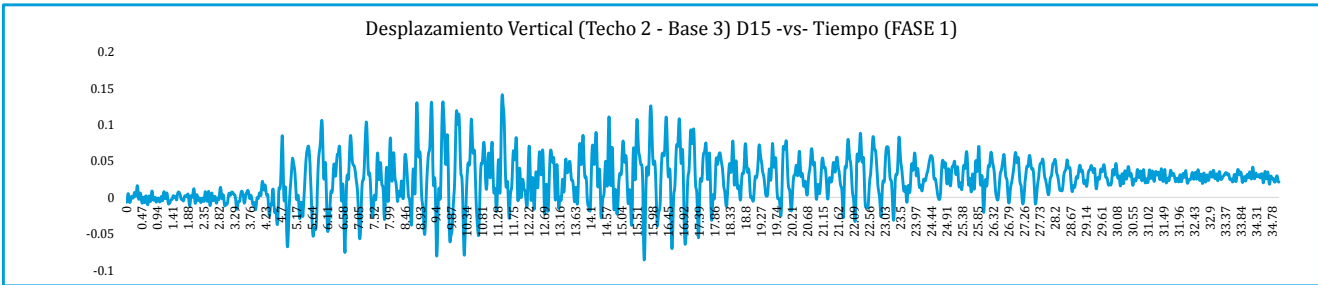
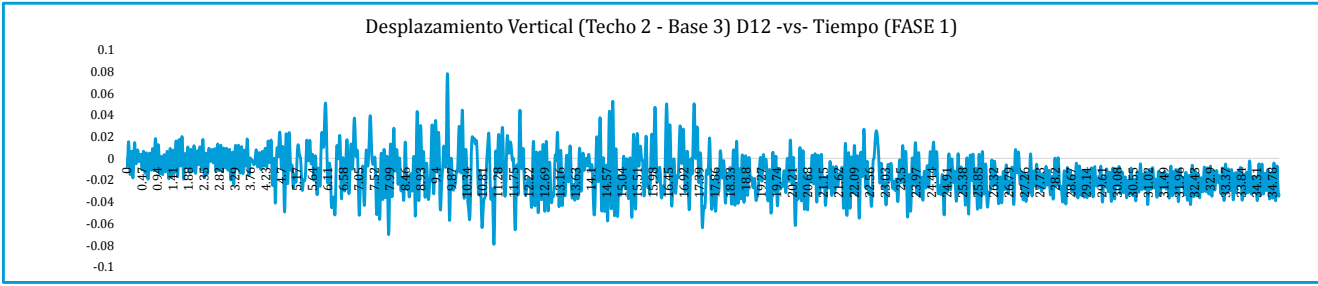
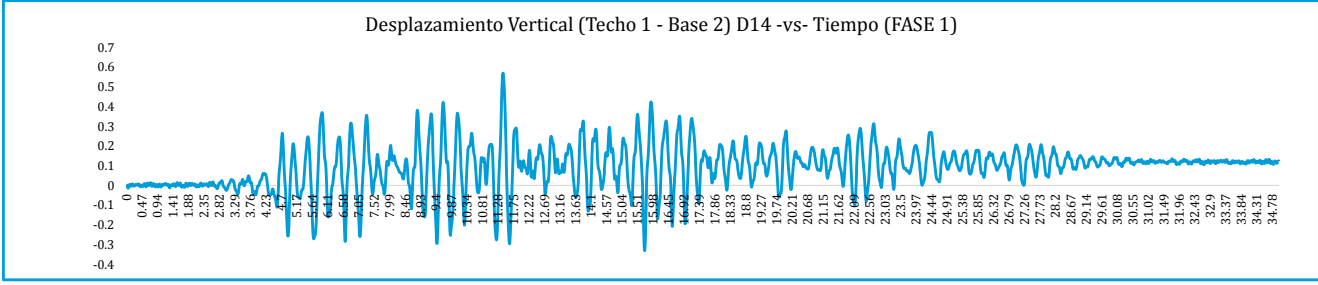
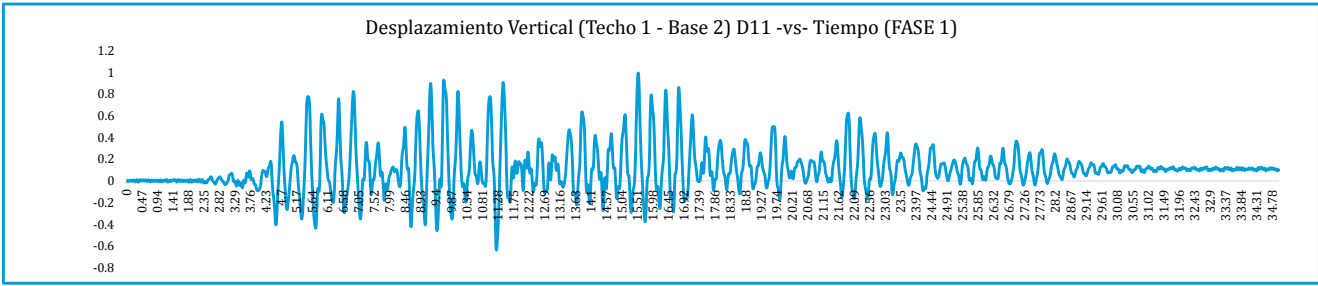
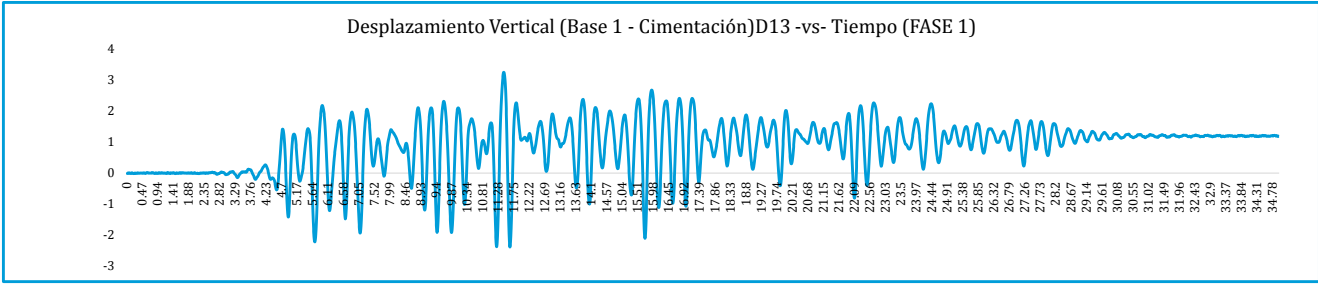
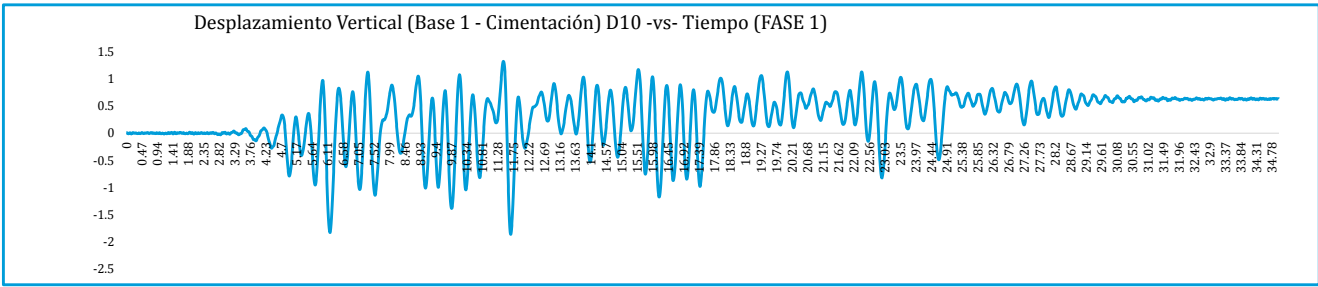


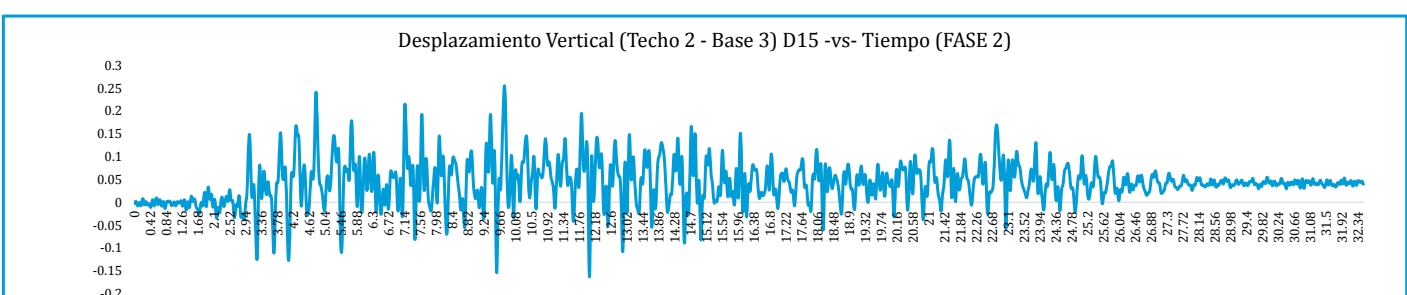
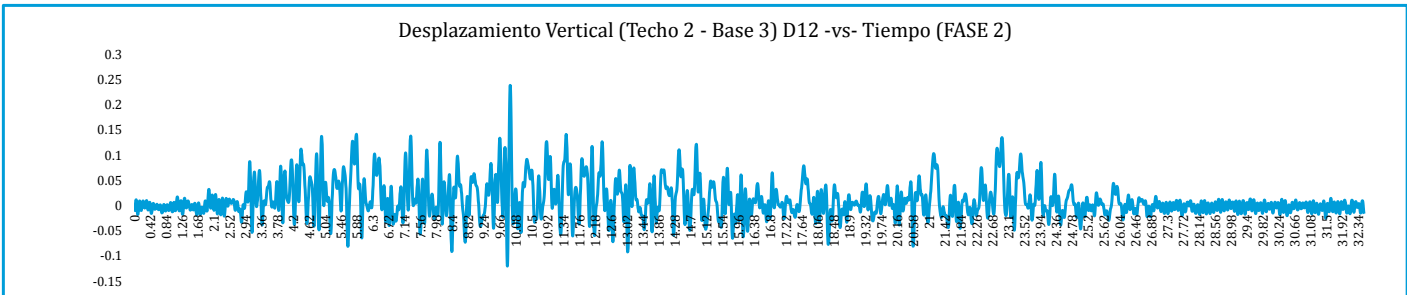
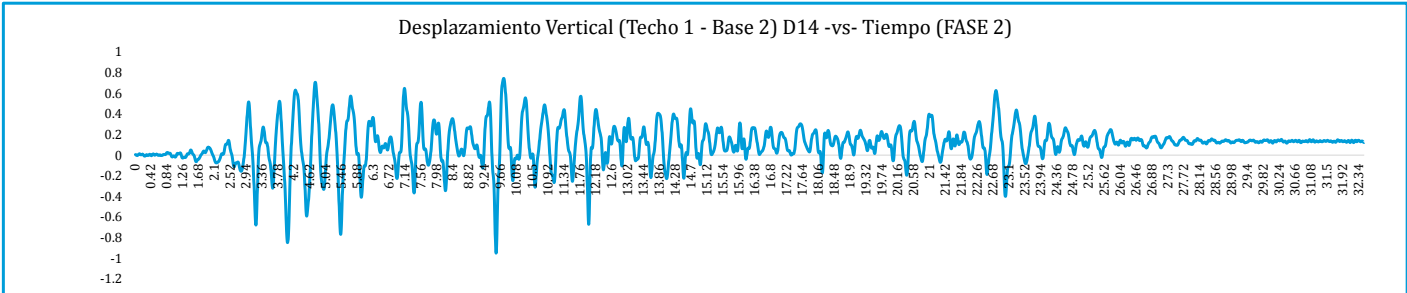
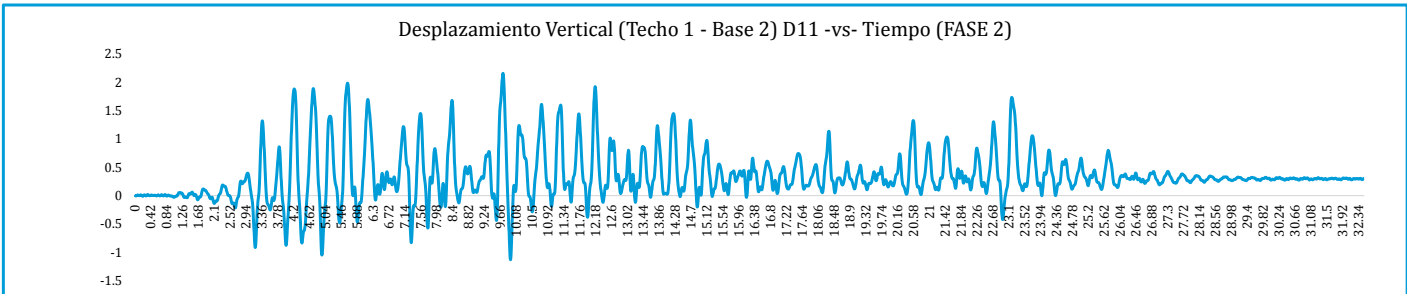
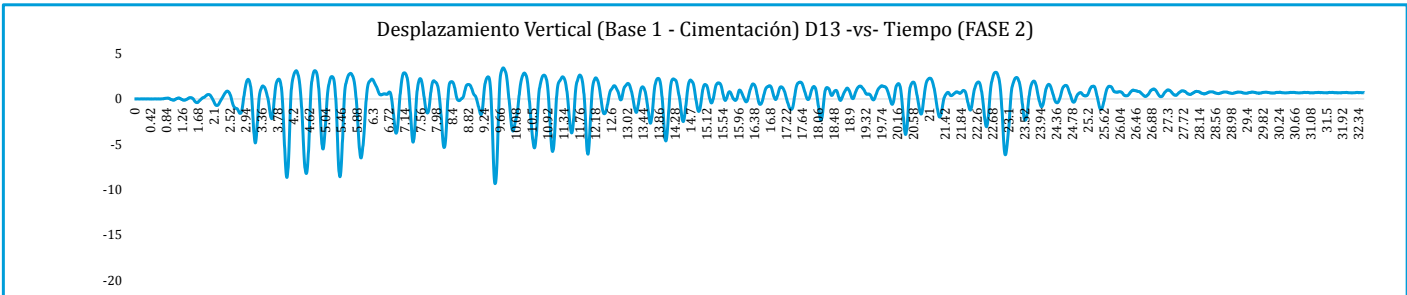
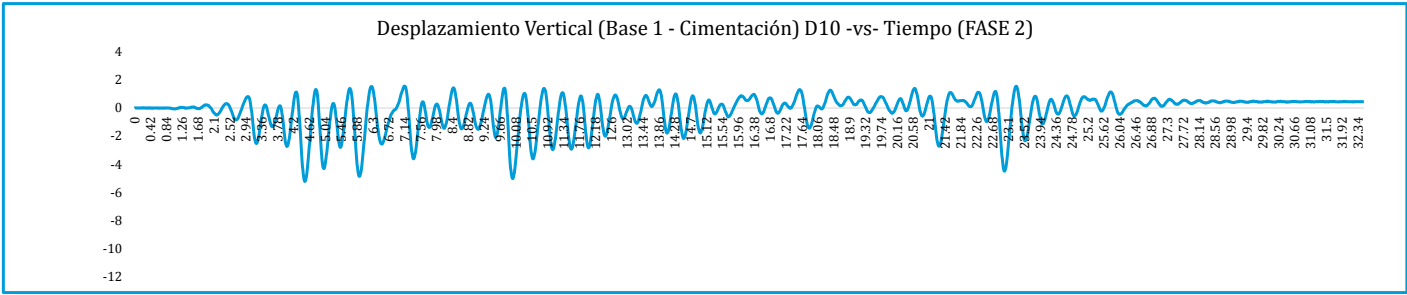
Deslizamiento Horizontal (Base 2 - Techo 1) D8 -vs- Tiempo (FASE 3)



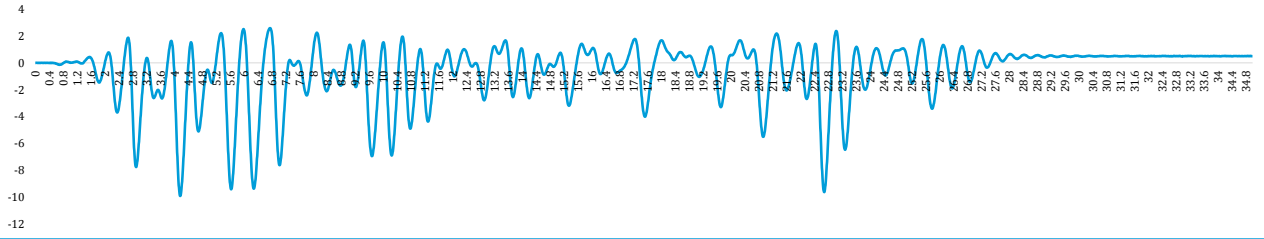
Deslizamiento Horizontal (Base 3 - Techo 2) D9 -vs- Tiempo (FASE 3)



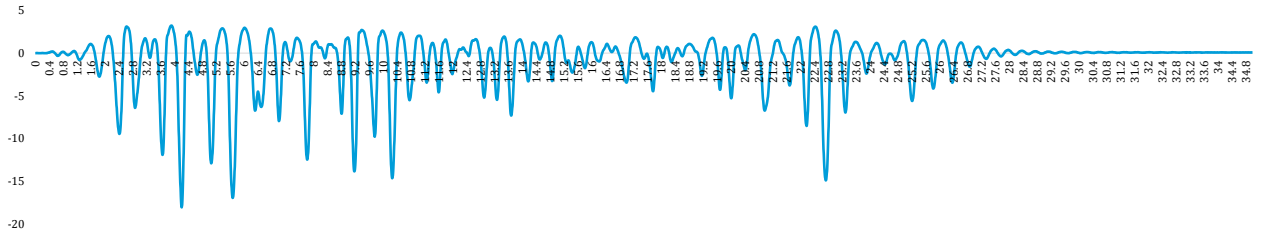




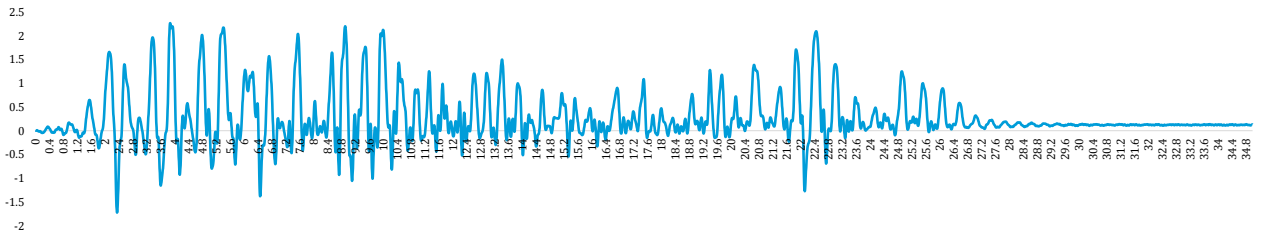
Desplazamiento Vertical (Base 1 - Cimentación) D10 -vs- Tiempo (FASE 3)



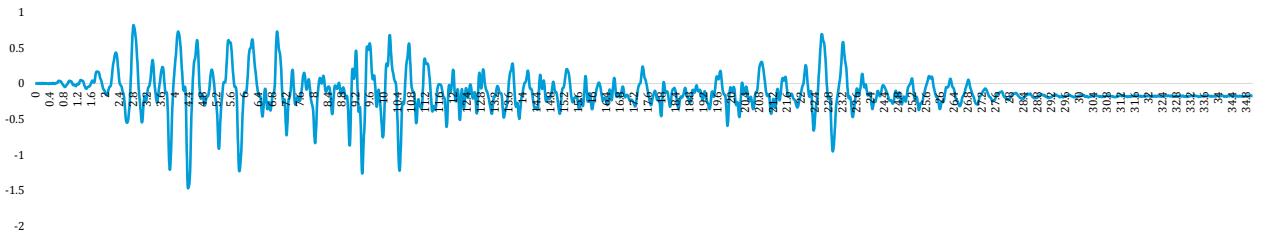
Desplazamiento Vertical (Base 1 - Cimentación) D13 -vs- Tiempo (FASE 3)



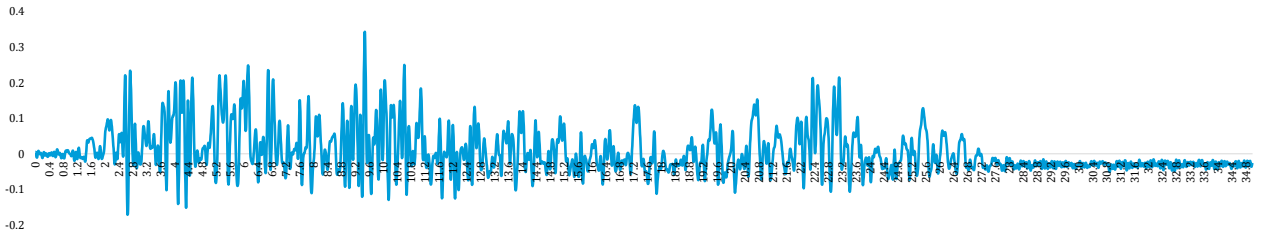
Desplazamiento Vertical (Techo 1 - Base 2) D11 -vs- Tiempo (FASE 3)



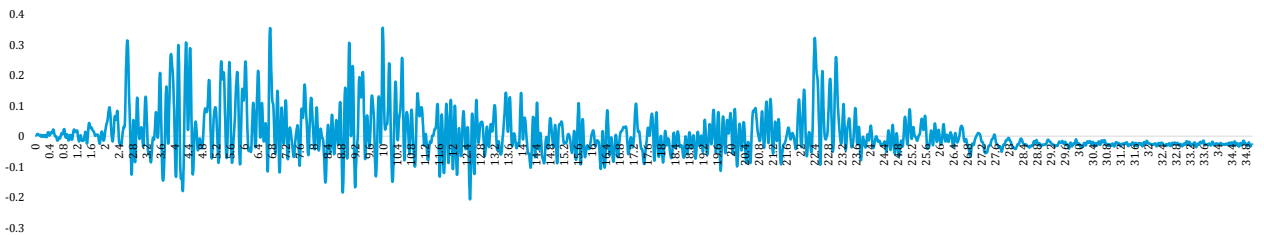
Desplazamiento Vertical (Techo 1 - Base 2) D14 -vs- Tiempo (FASE 3)

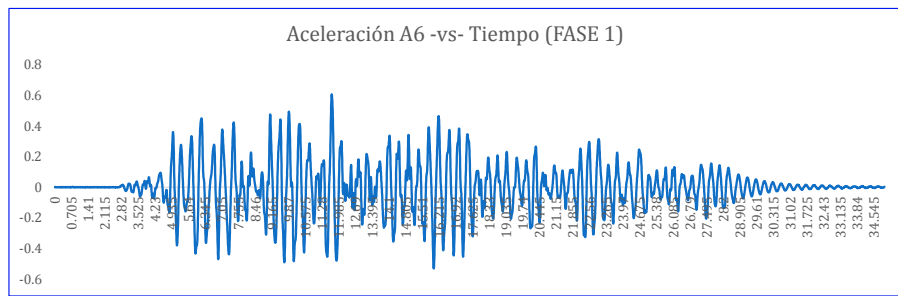
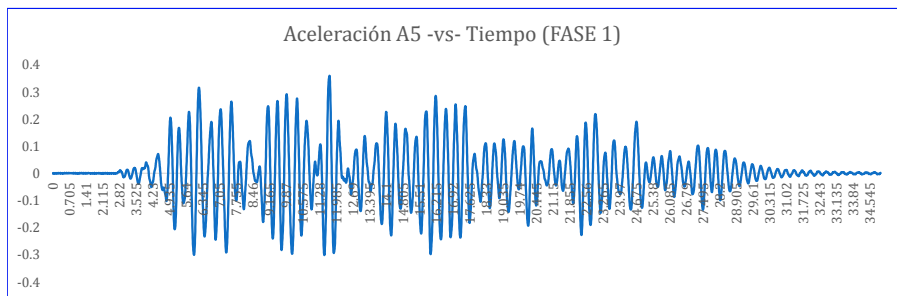
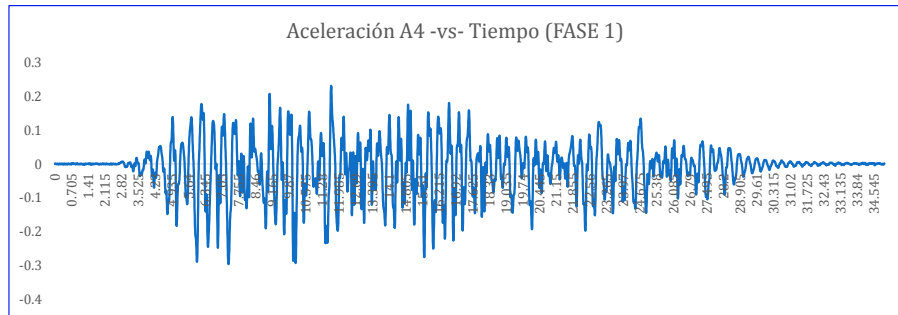
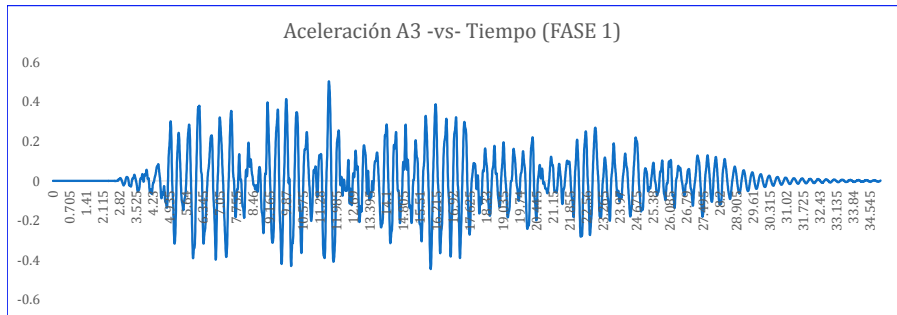
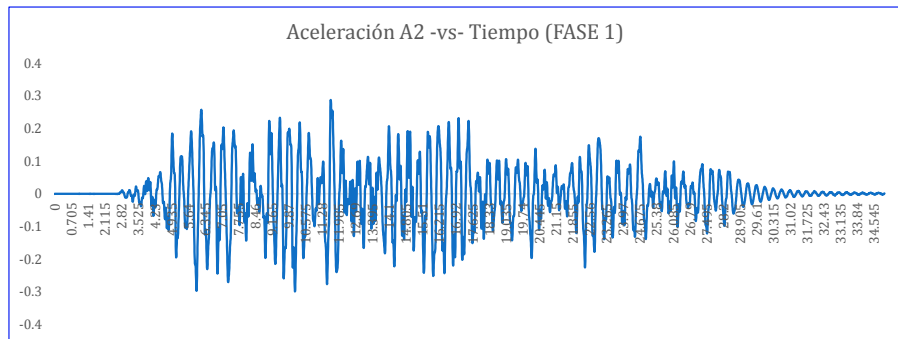
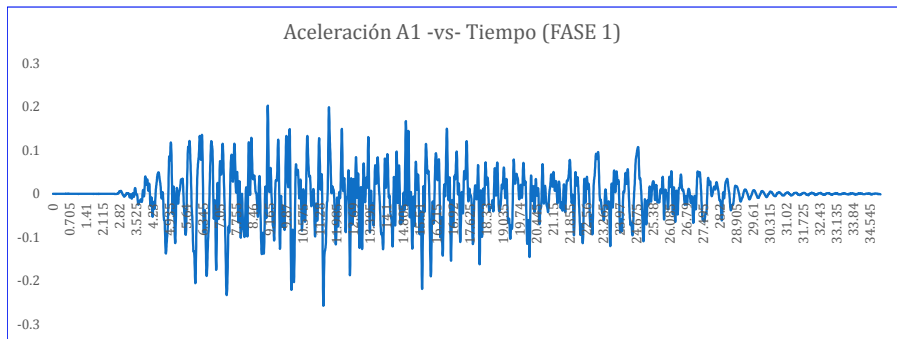
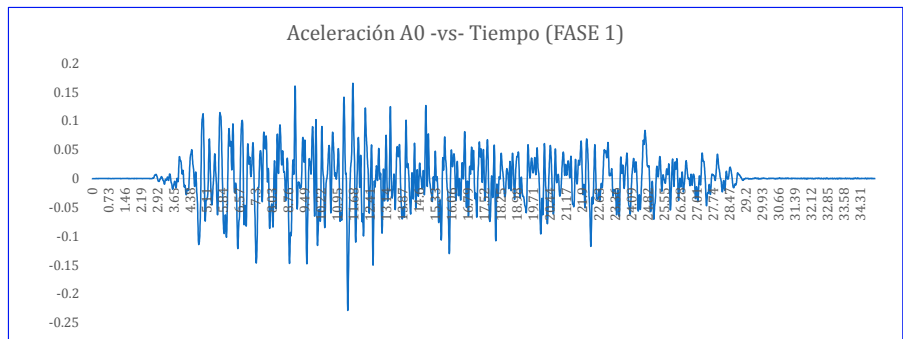


Desplazamiento Vertical (Techo 2 - Base 3) D12 -vs- Tiempo (FASE 3)

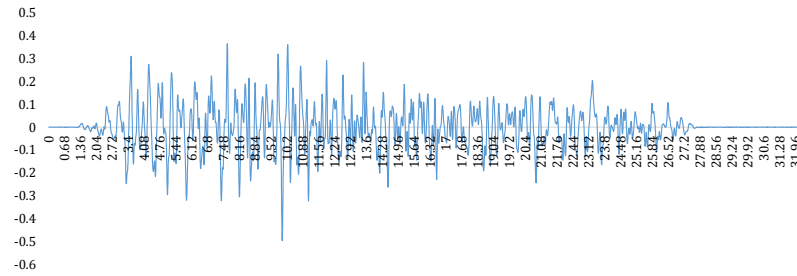


Desplazamiento Vertical (Techo 2 - Base 3) D15 -vs- Tiempo (FASE 3)

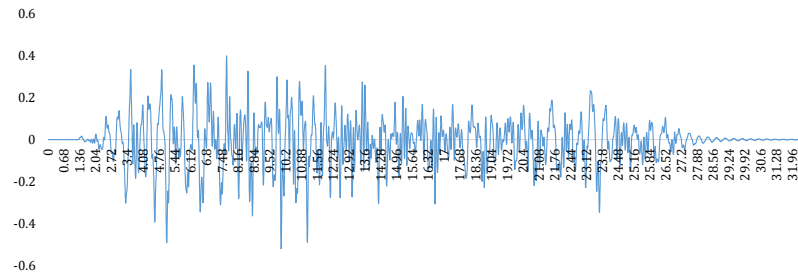




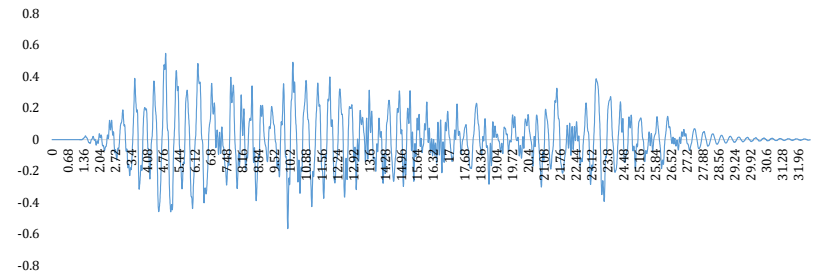
Aceleración A0 -vs- Tiempo (FASE 2)



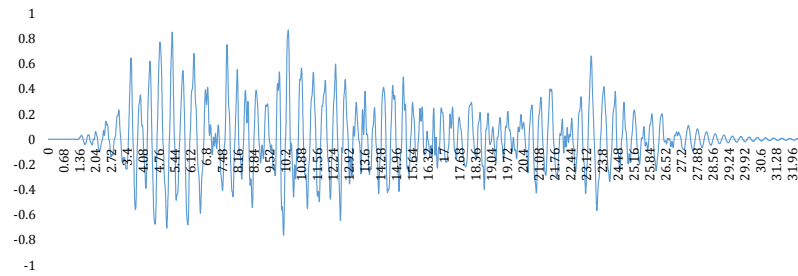
Aceleración A1 -vs- Tiempo (FASE 2)



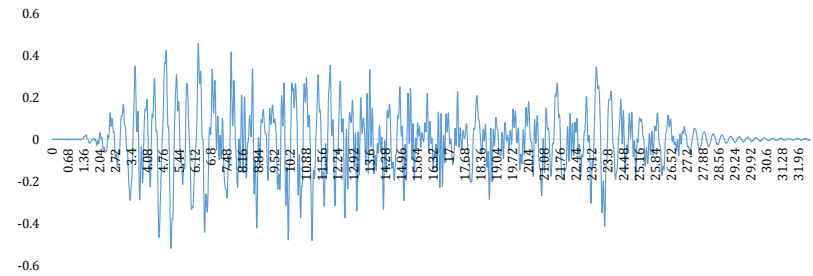
Aceleración A2 -vs- Tiempo (FASE 2)



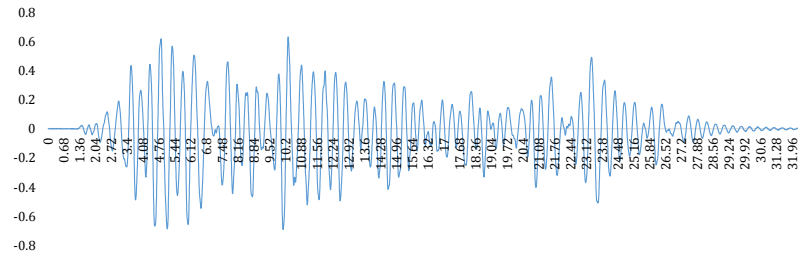
Aceleración A3 -vs- Tiempo (FASE 2)



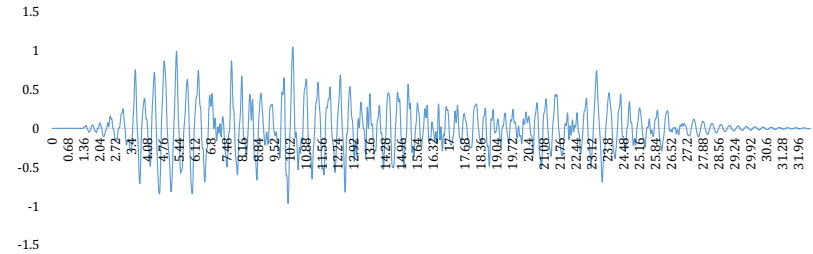
Aceleración A4 -vs- Tiempo (FASE 2)

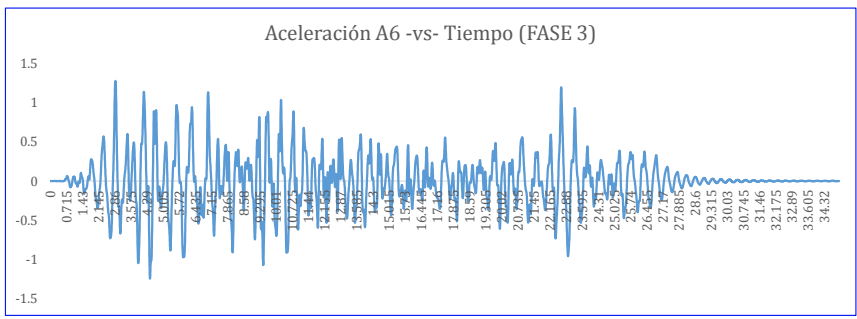
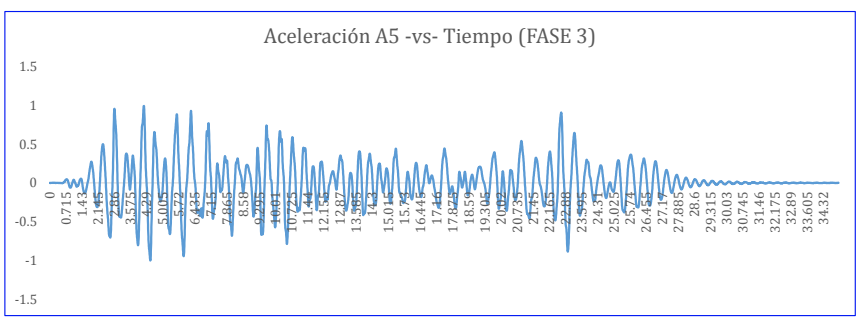
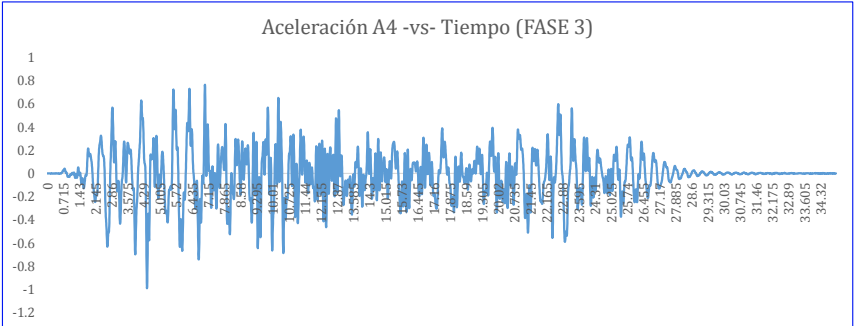
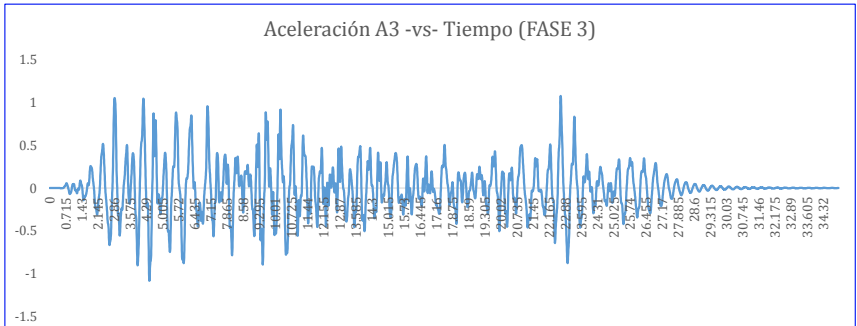
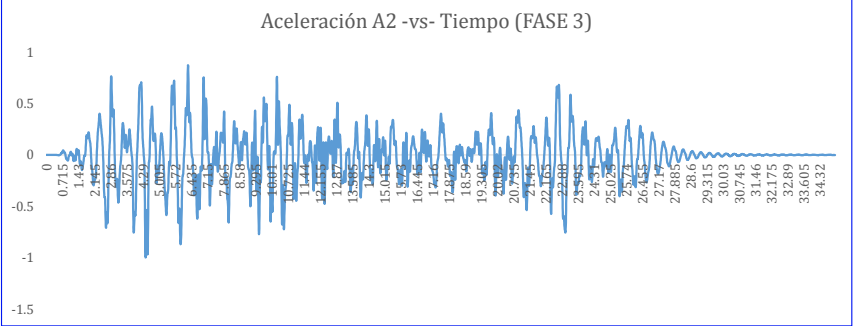
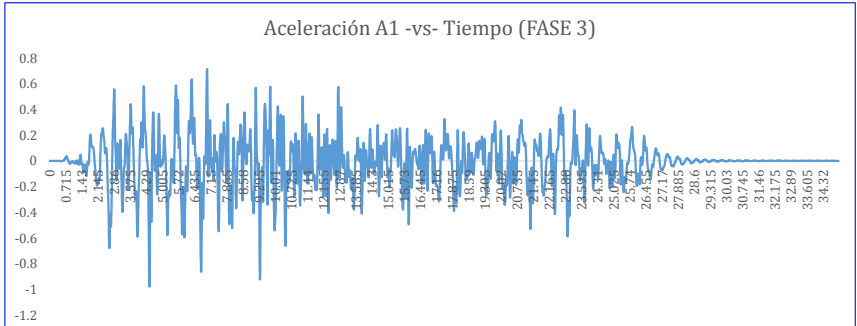
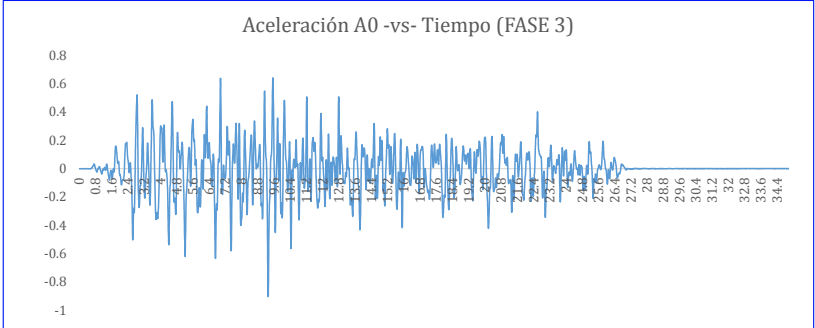


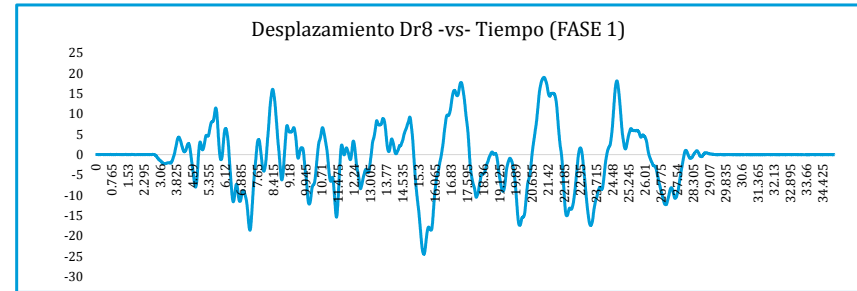
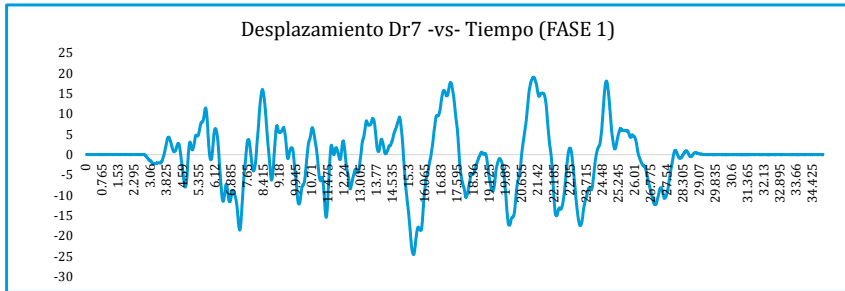
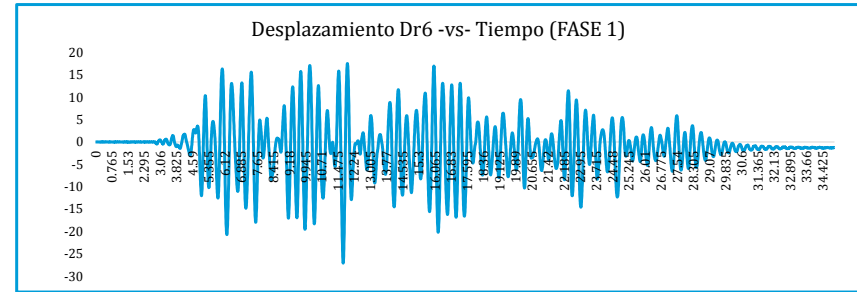
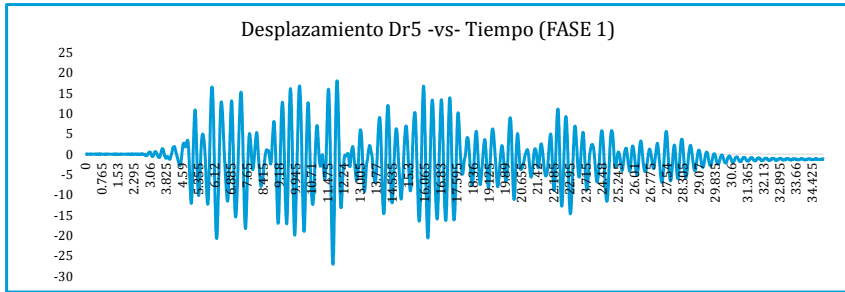
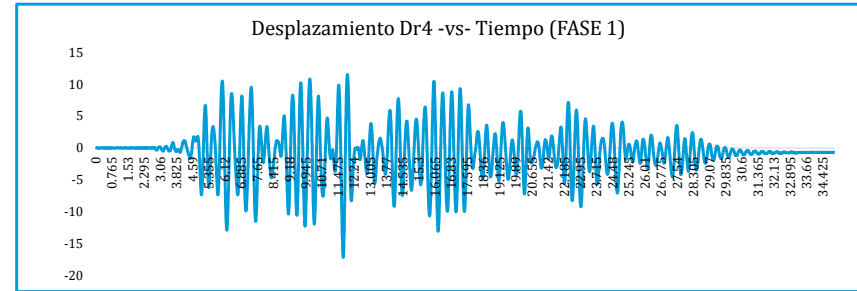
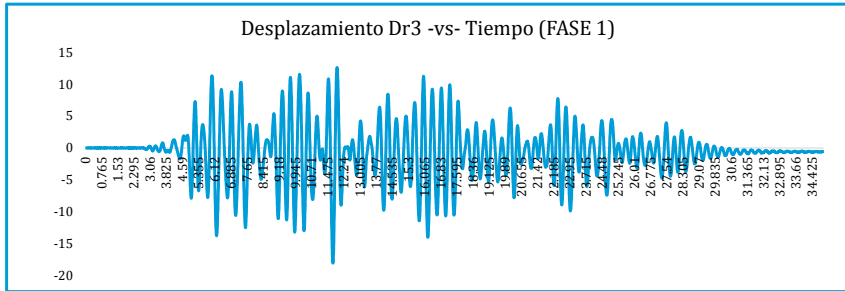
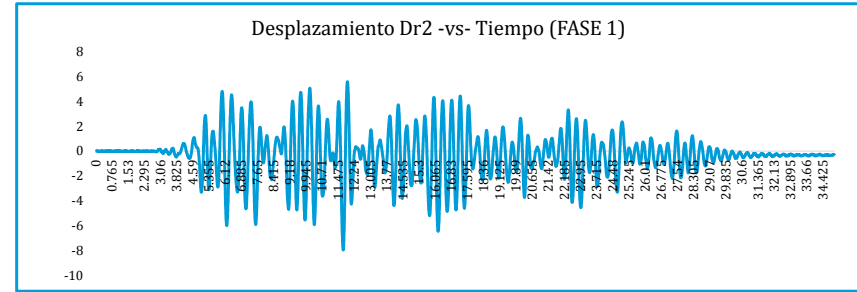
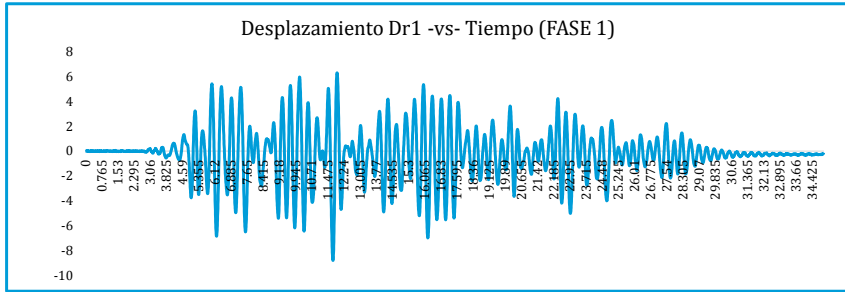
Aceleración A5 -vs- Tiempo (FASE 2)

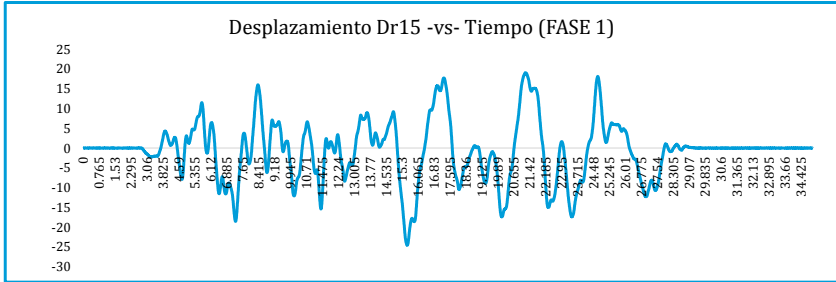
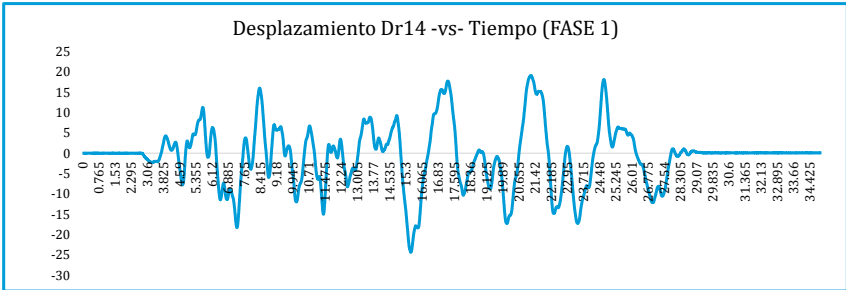
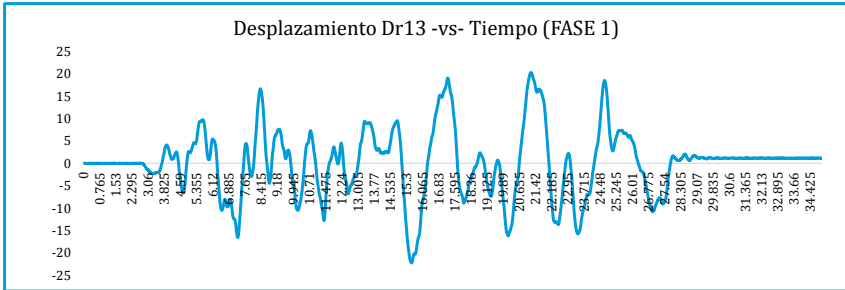
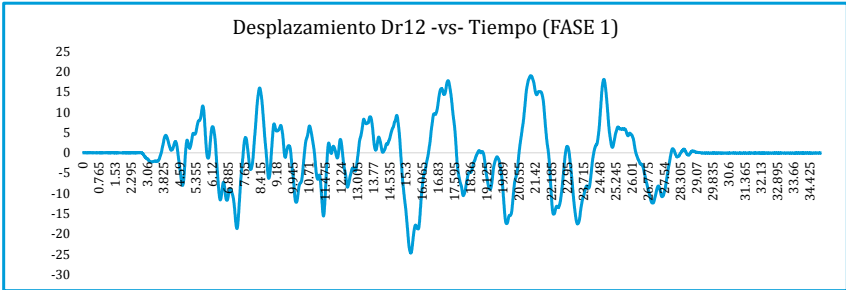
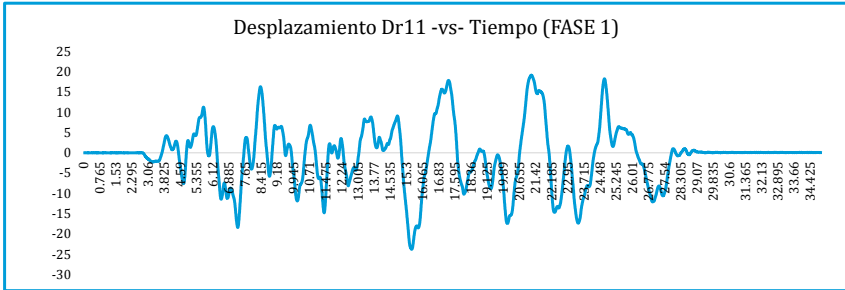
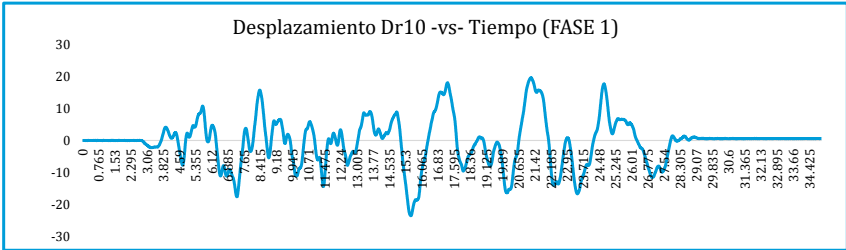
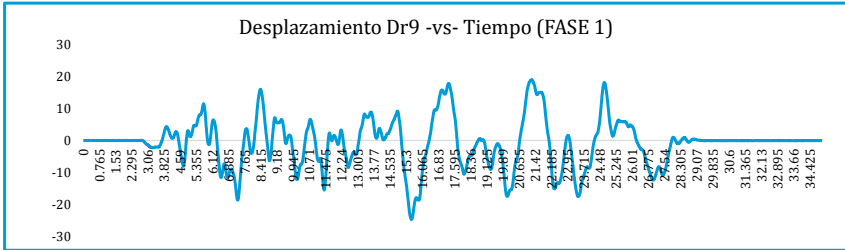


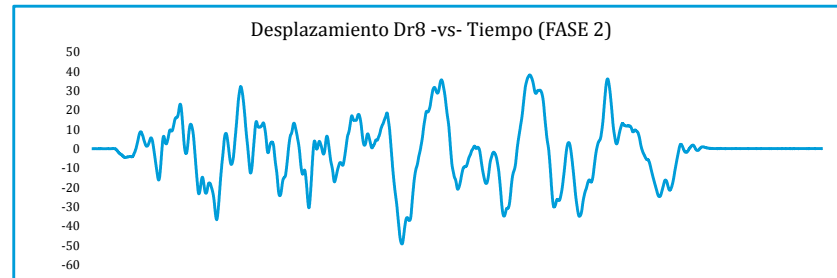
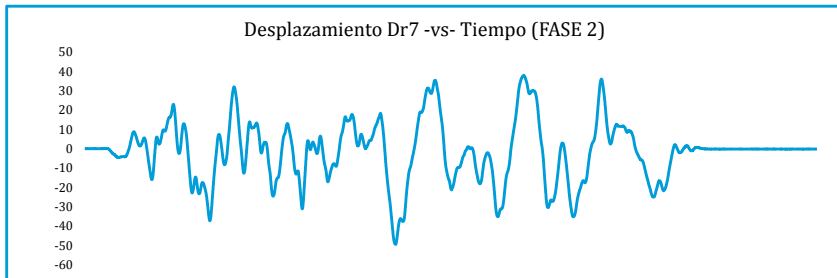
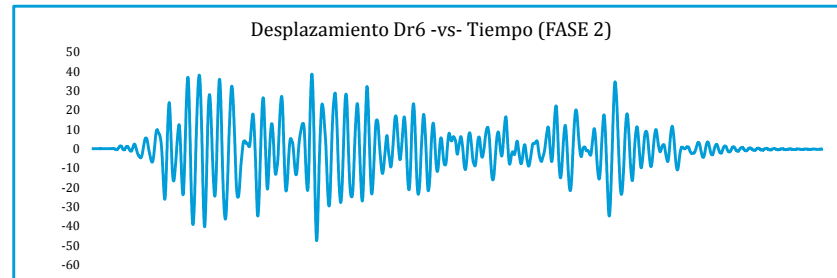
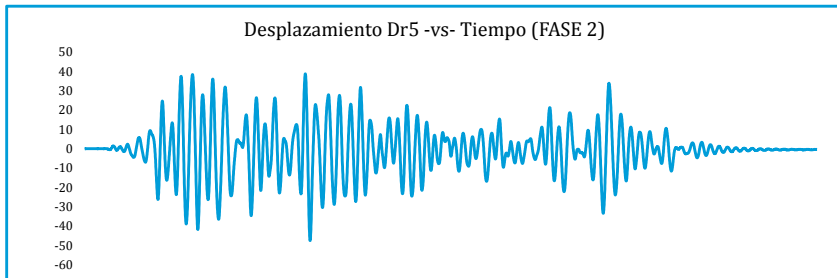
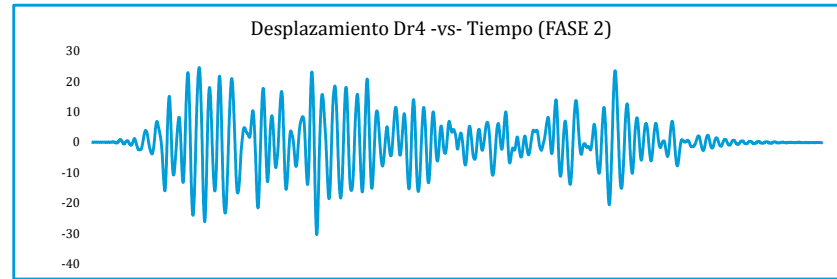
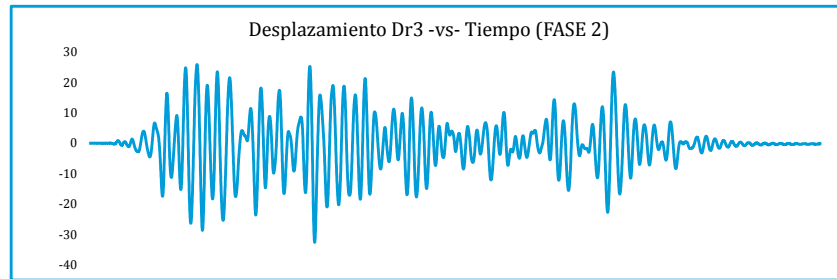
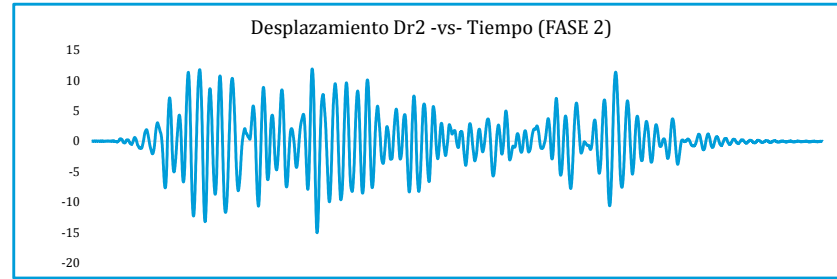
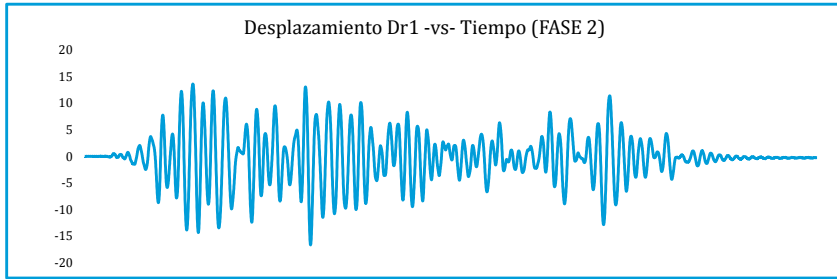
Aceleración A6 -vs- Tiempo (FASE 2)

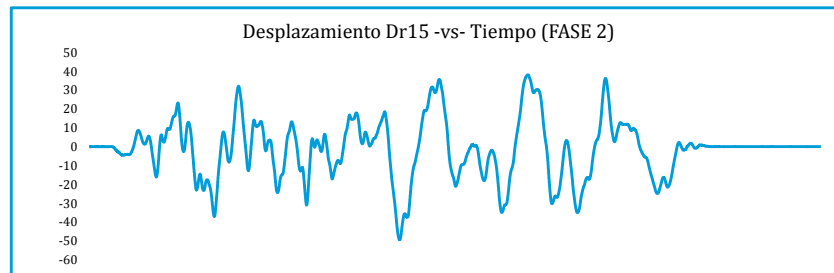
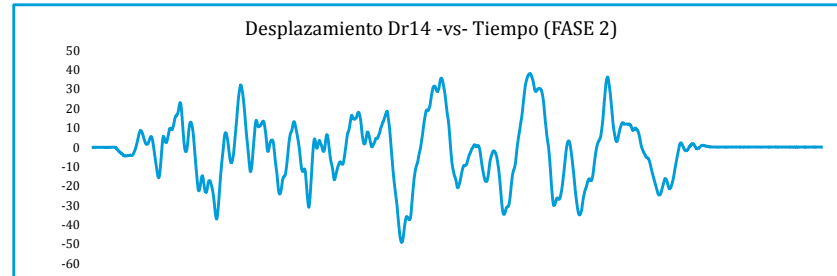
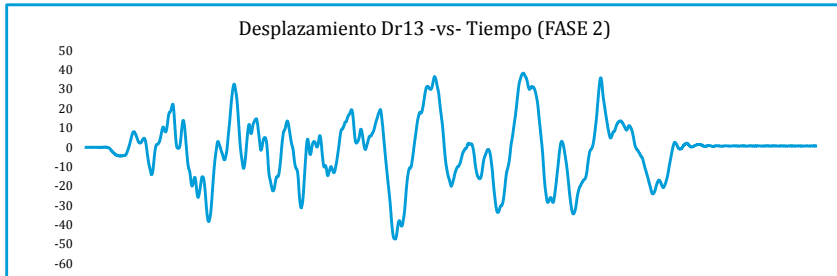
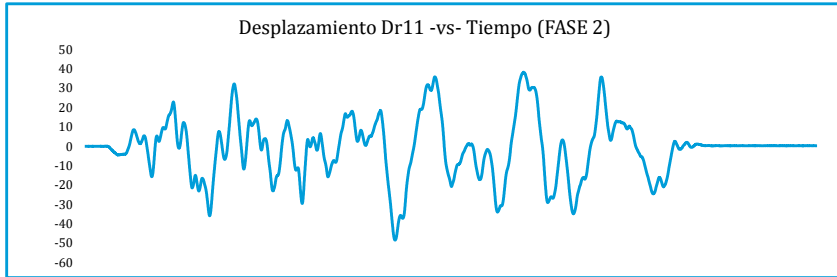


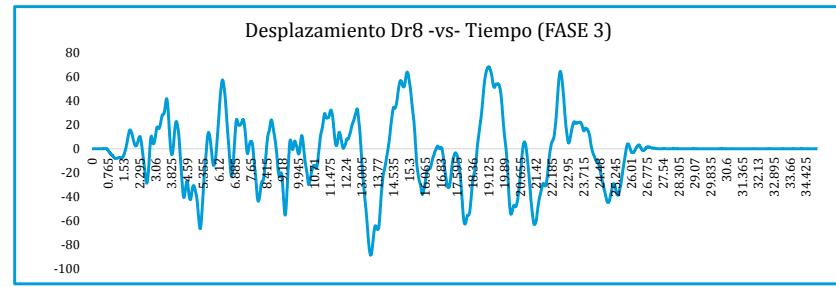
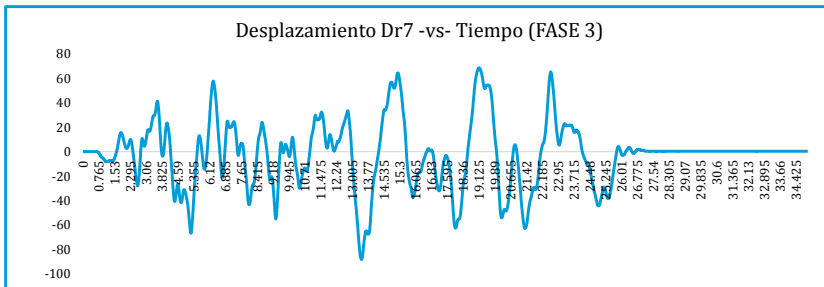
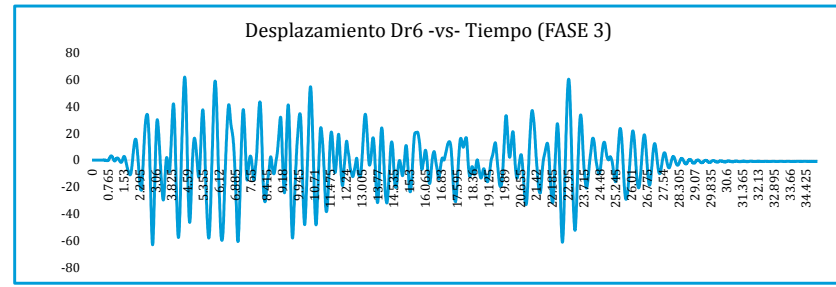
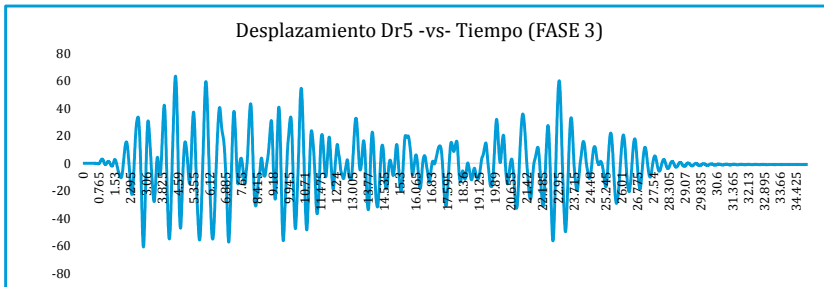
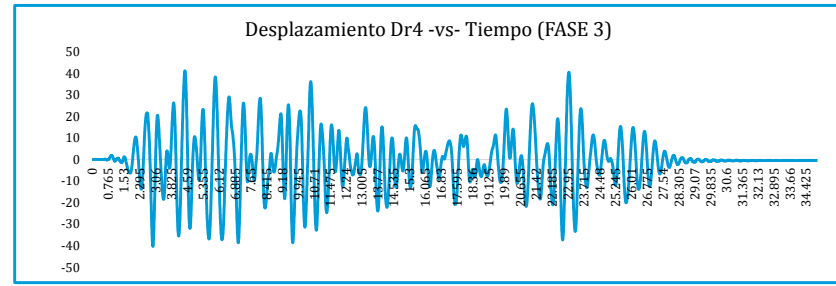
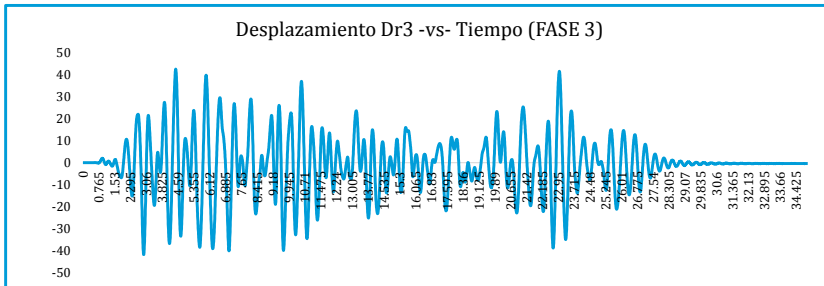
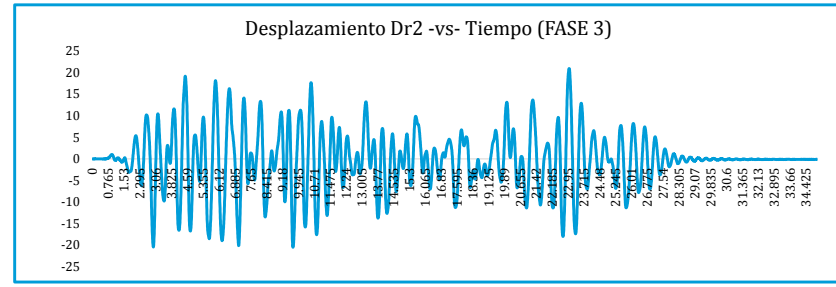
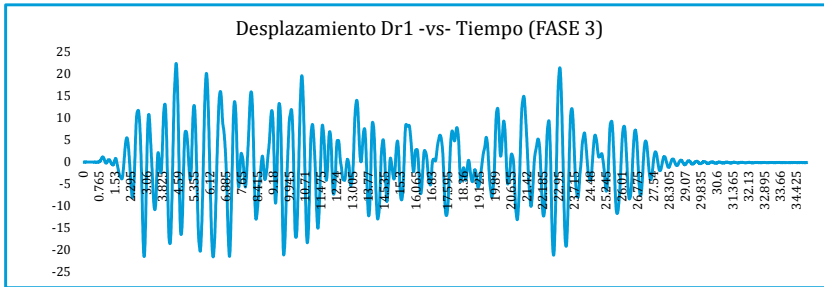


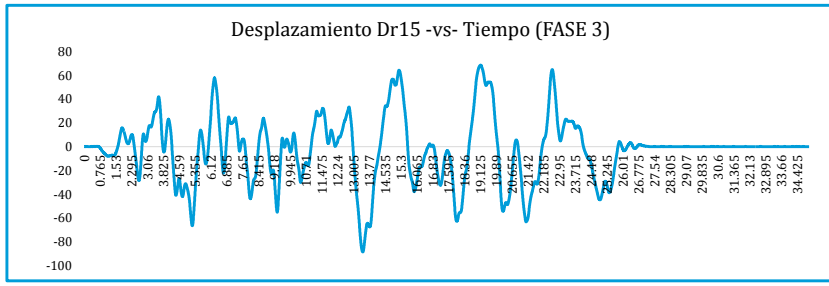
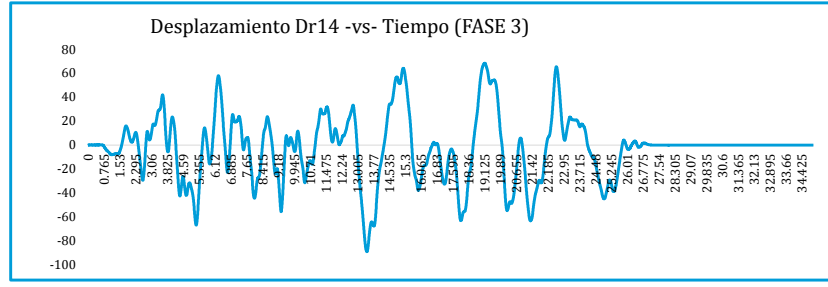
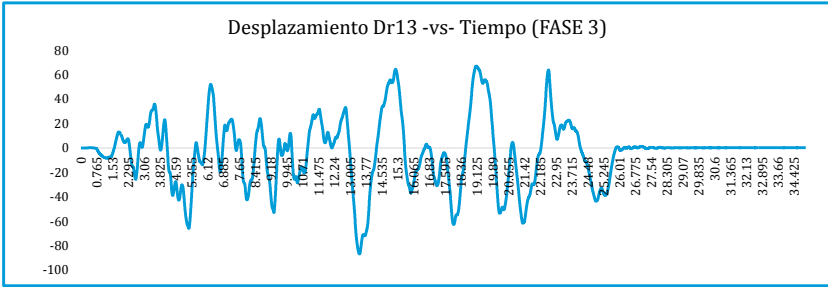
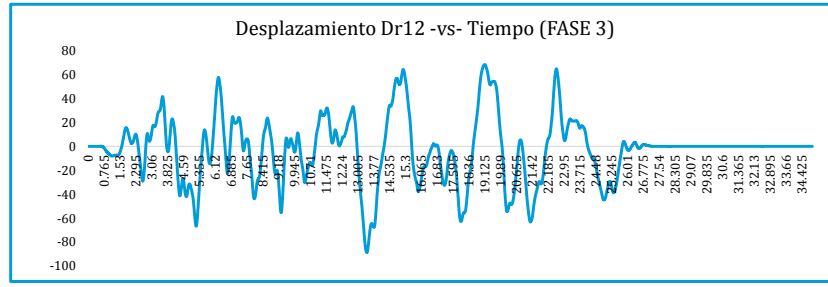
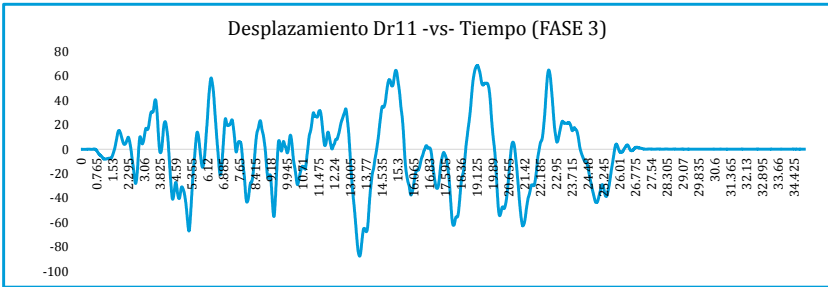
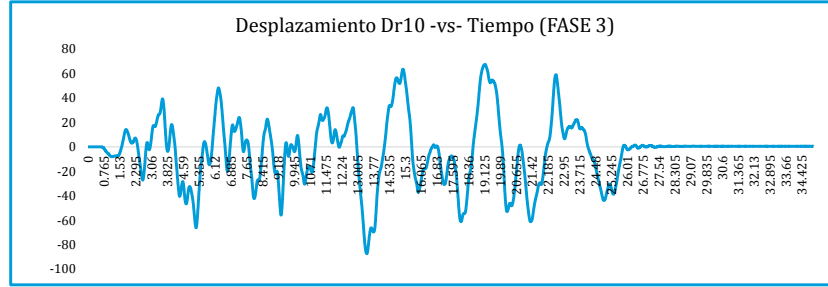
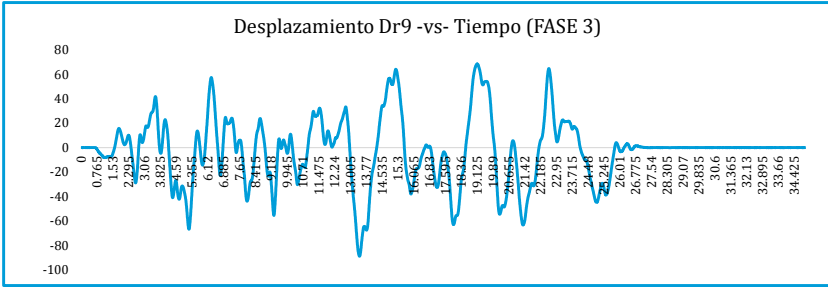


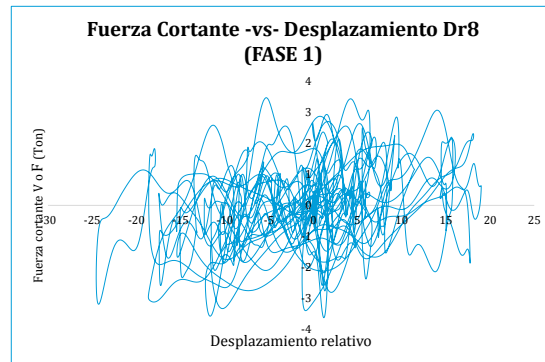
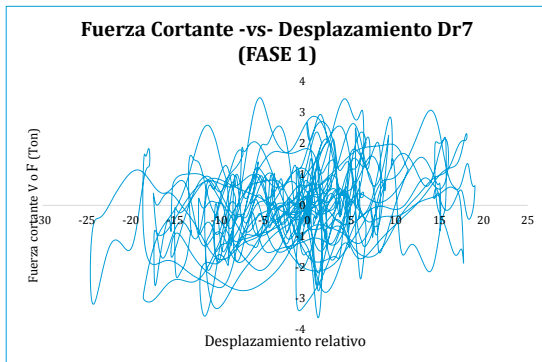
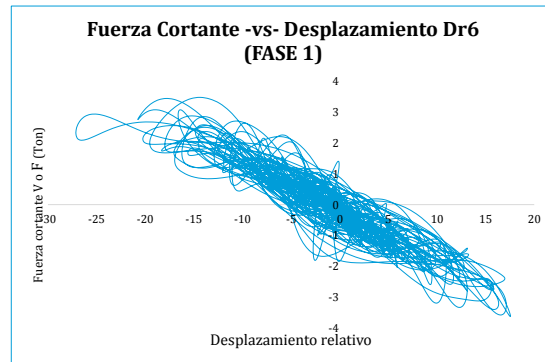
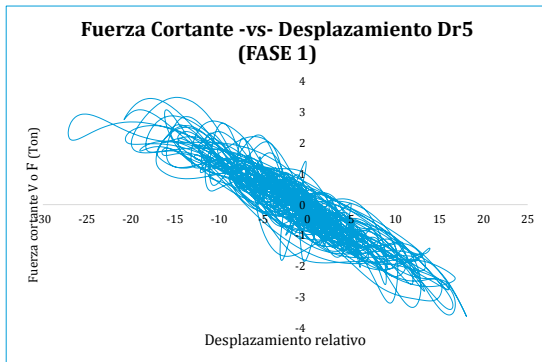
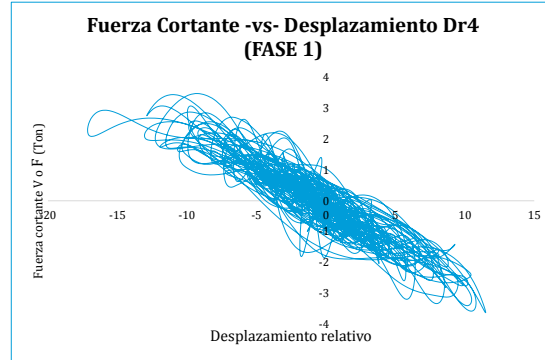
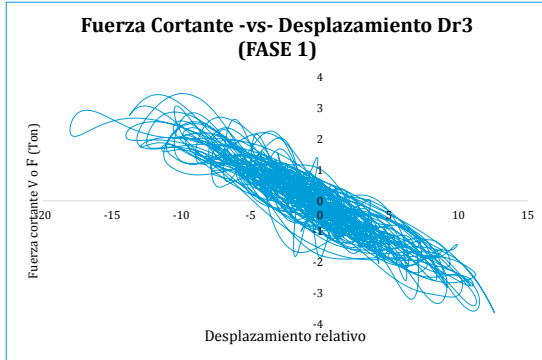
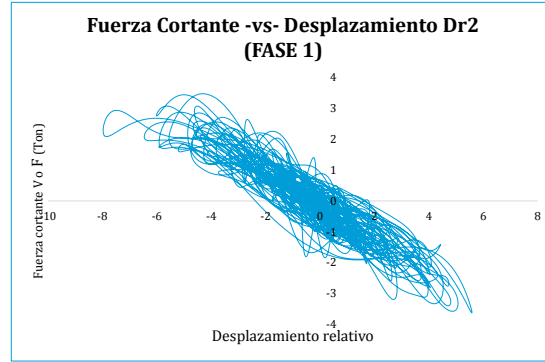
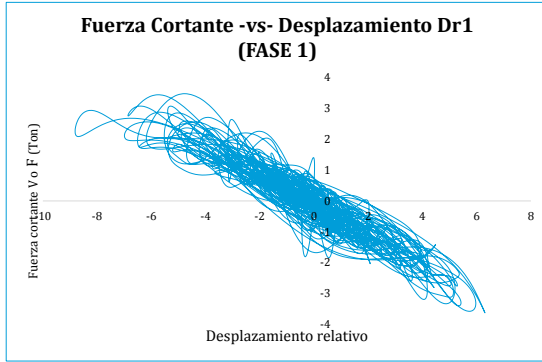


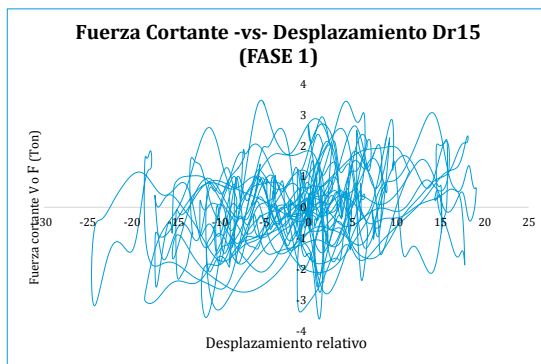
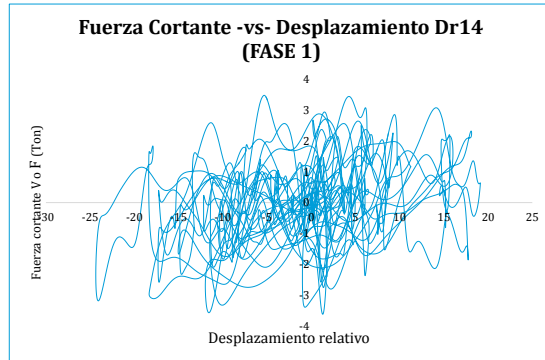
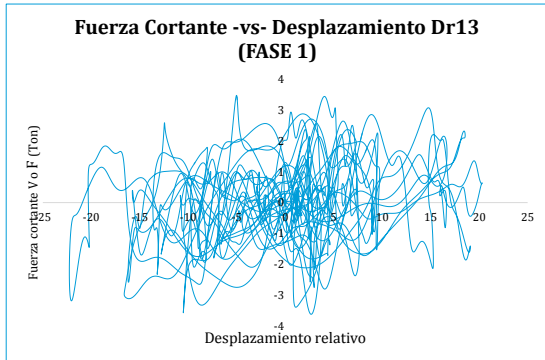
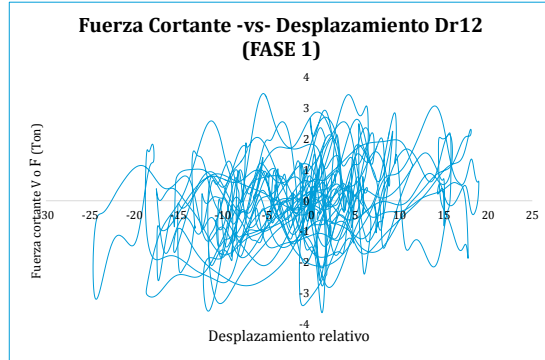
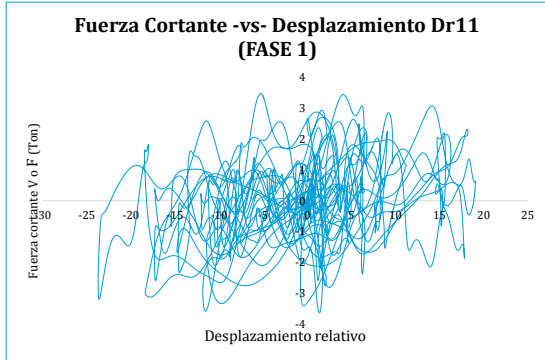
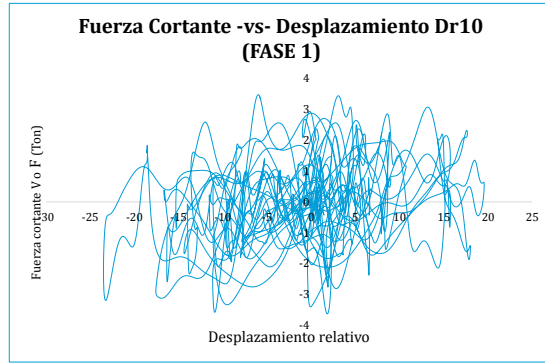
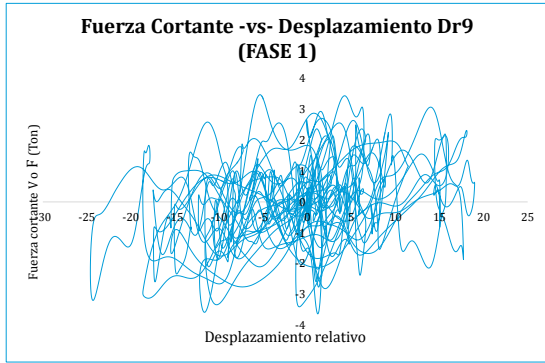


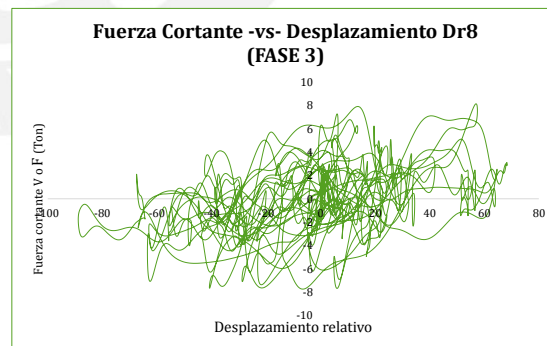
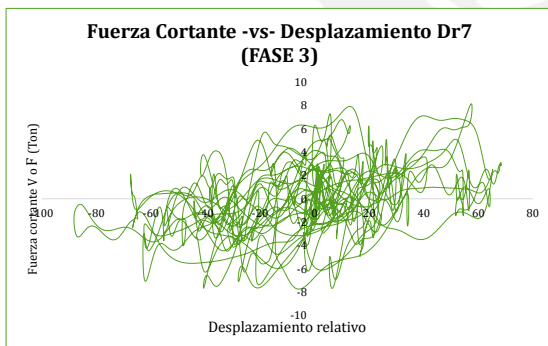
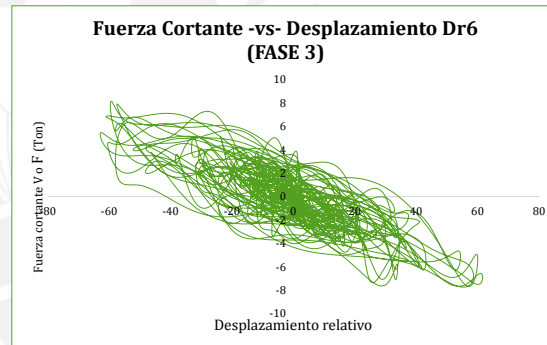
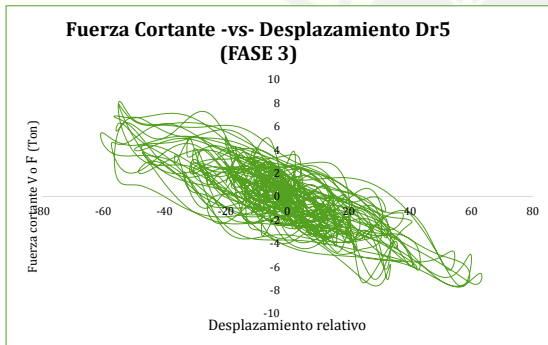
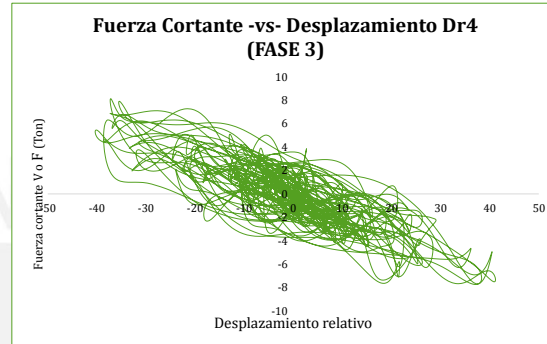
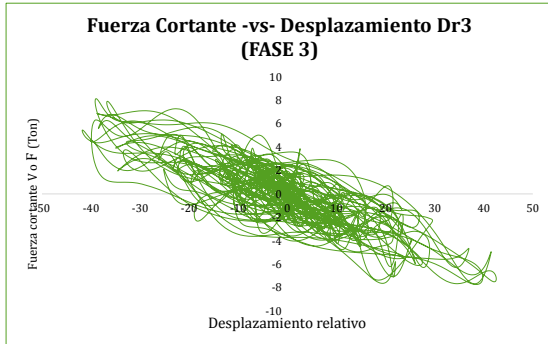
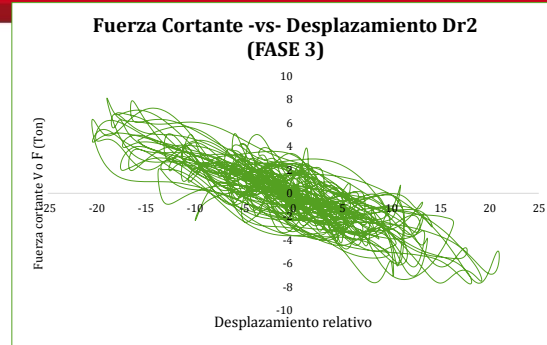
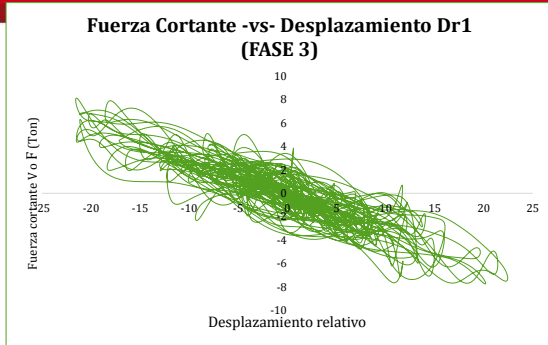


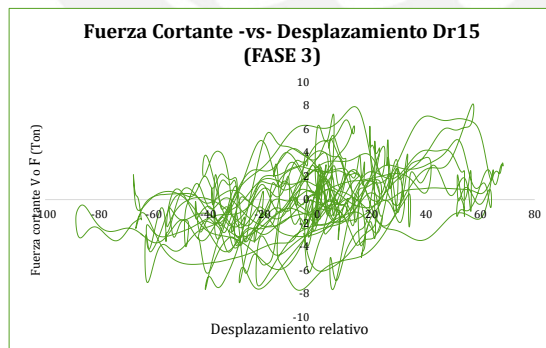
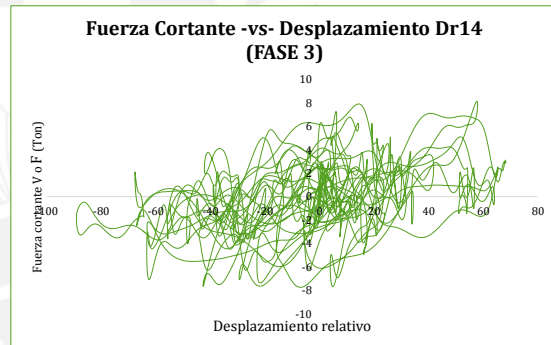
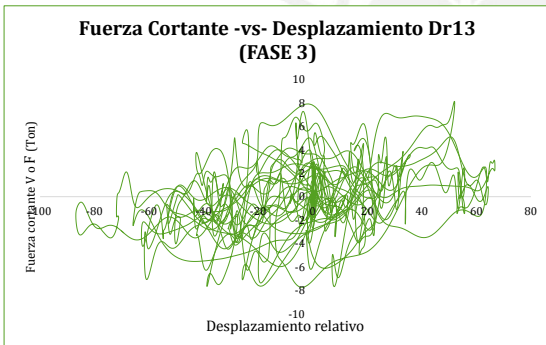
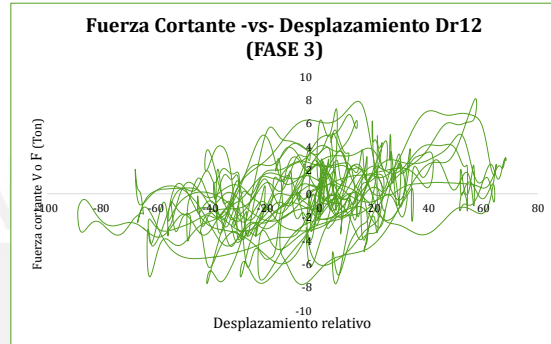
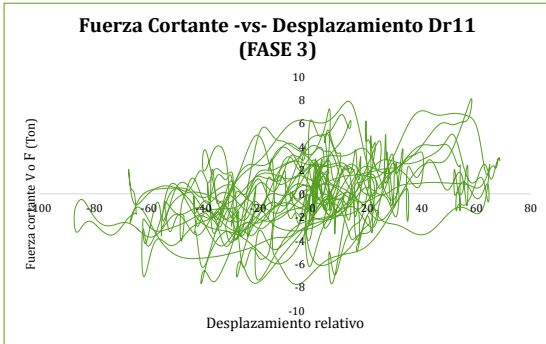
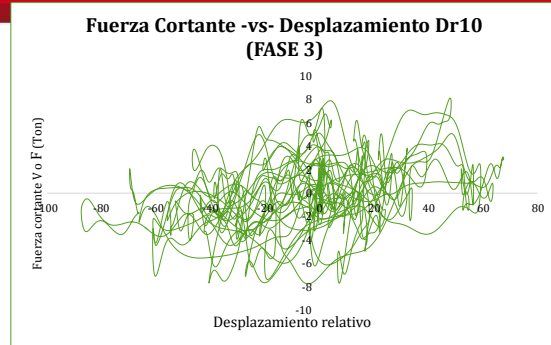
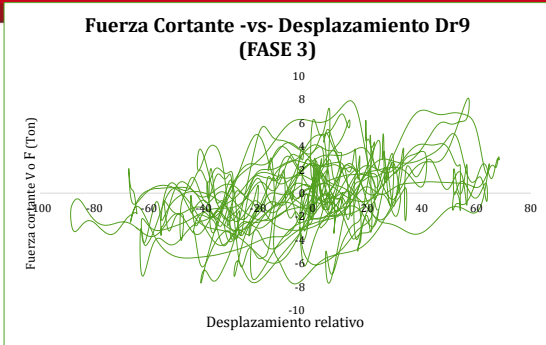




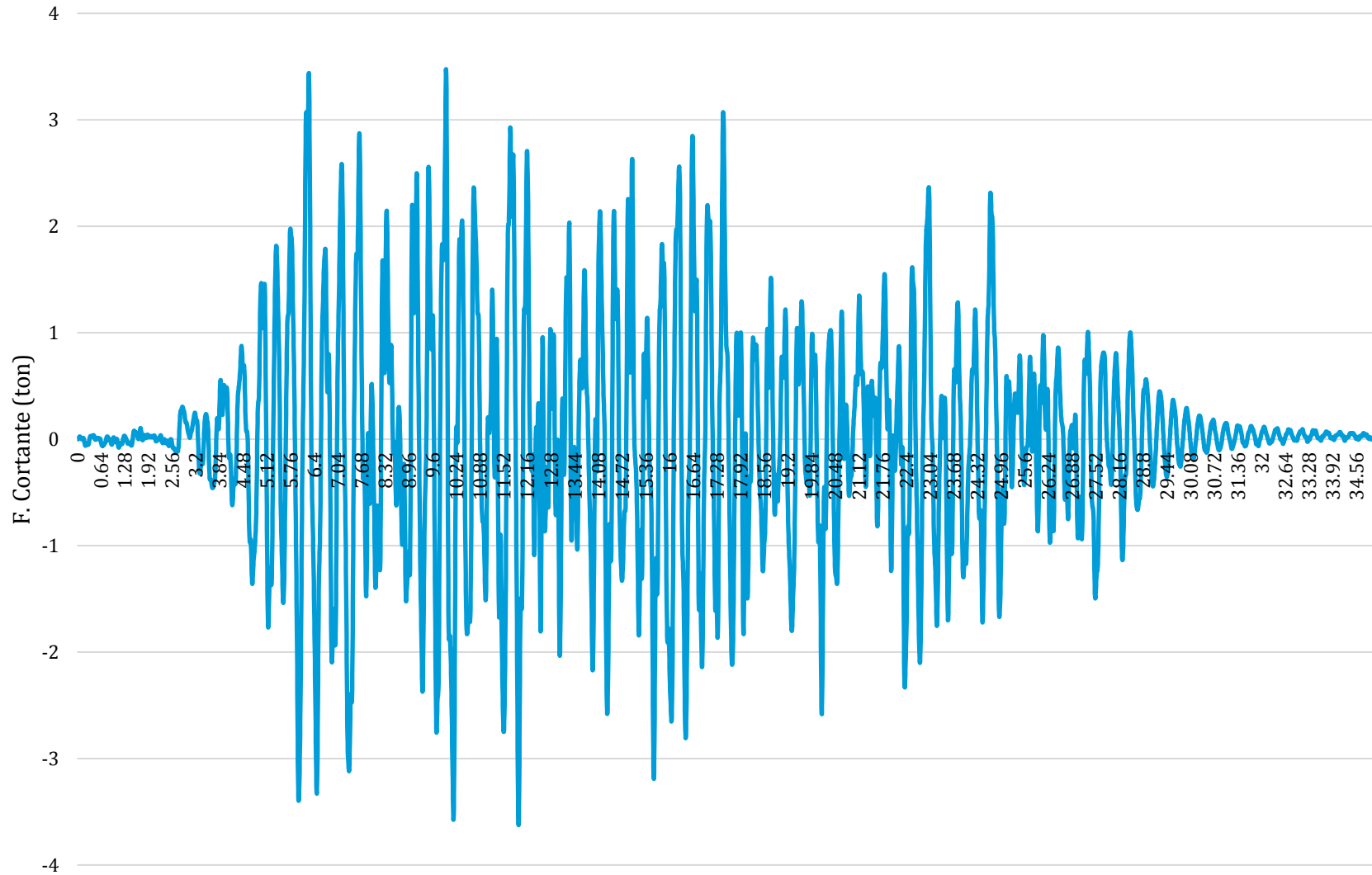








F. Cortante -vs- Tiempo (FASE 1)



F. Cortante -vs- Tiempo (FASE 2)

