SEVENTH FRAMEWORK PROGRAMME

Capacities Specific Programme

Research Infrastructures

Project No.: 227887

SERIES

SEISMIC ENGINEERING RESEARCH INFRASTRUCTURES FOR EUROPEAN SYNERGIES

Work package [WP9 – TA5 LNEC]

SEISMIC PERFORMANCE OF MULTI-STOREY TIMBER BUILDINGS TUGraz building

- Final Report -

User Group Leader: Maurizio Piazza

Revision: Final

July, 2013

ABSTRACT

This document reports the outcome of the seismic test on the TUGraz building, the fourth in a total of four buildings included in the TIMBER BUILDINGS Project. This building is a cross laminated system (CTL). The goal of the tests was to assess the seismic performance of the building, panel elements and steel connectors, defined in terms of relative displacements and hold-down forces.

Keywords: Timber buildings, Shaking Table Test, Cross laminated system (CTL), steel connectors

ACKNOWLEDGMENTS

The research leading to these results has received funding from the European Union Seventh Framework Programme [FP7/2007-2013] under grant agreement n° 227887 [SERIES].

REPORT CONTRIBUTORS

LNEC	Alfredo Campos Costa
	Paulo Xavier Candeias
GRAZ UNIVERSITY OF TECHNOLOGY	Gerhard Schickhofer
	Georg Flatscher

CONTENTS

List of Figures

List of Tables

1 Introduction

This report presents the results of the experimental tests carried out in the LNEC 3D shaking table on a cross laminated system (CTL). The tests were carried out on February 20 and 21, 2013 on a three storey real scale building.

2 Description of the building and construction technique

Wood is a natural 'living' resource and shows high variability in physical characteristics between different types of wood and also within one type of wood. In principle, the mechanical behaviour of wood has to be classified as being inhomogeneous and anisotropic. To achieve a so-called 'homogenisation' of wood, it is often milled and – usually by bonding – reassembled. The resulting 'timber products' show more homogeneousness and, therefore, often have better mechanical properties compared to the original product wood [1].

The following description focuses on the timber product 'Cross Laminated Timber' (CLT). A more detailed explanation of the raw material wood is omitted.

In [1] a definition for CLT is given with:

„Als Brettsperrholz ... werden alle mehrschichtig verklebten, flächenhaften Holzprodukte verstanden, wobei die Faserlängsrichtung der aus Brettern bestehenden Einzelschichten rechtwinklig zueinander angeordnet sind. Der Querschnittsaufbau (Orientierung, Dicke und Festigkeitsklasse der Einzelschichten) ist zur Mittelebene symmetrisch.“

"The term Cross Laminated Timber ... refers to all layered, planar products of wood, wherein the fibre in longitudinal direction of the glued board layers are perpendicular to each other. The cross-sectional structure (orientation, thickness and strength class of the individual layers) is symmetrical to the median plane."

Other well-known nomenclatures for CLT are:

- BSP (German: BrettSperrHolz)
- KLH (German:KreuzLagenHolz) – also a name of a company
- X-Lam – used predominantly in Italy

2.1 BUILDUP, RAW MATERIAL AND PRODUCTION [2], [4]

2.1.1 Buildup

As shown at Figure 2.1, CLT consists of crosswise glued board layers. Due to this structure, the swelling and dwindling are locked and the mechanical properties are homogenised as explained above.

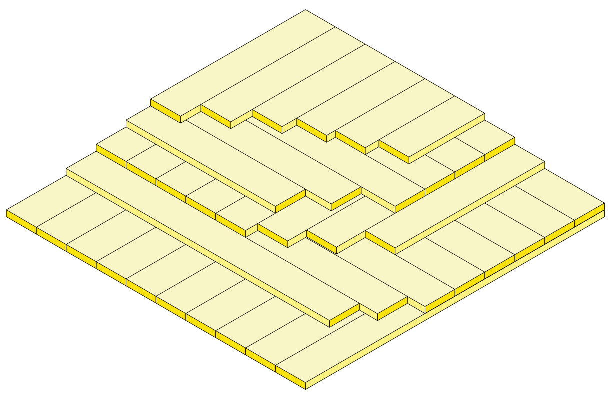


Figure 2.1: Layer composition of CLT [2]

2.1.2 Raw material

With regard to the raw material of CLT, long finger jointed spruce boards are used in general. The strength class which is used most presently is C24 (according to EN 338 [18]), while also lower strength classes can be used for inner layers (especially for the transverse planks). Single layers or whole CLT plates made of other types of wood (e.g. larch or different hardwood) are normally not available. However, it is possible to use them for some special purposes (in the context of higher strength classes or for optical reasons).

2.1.3 Production

The production of CLT slightly differs from company to company, but can be generally described in the following steps:

- preparation of raw material
- application of adhesive
- pressing of the CLT element (pressure of about 0,6 – 0,8N/mm² with mechanical machines and 0,1 N/mm² with vacuum machines)
- post processing (cutting, finishing, storage/loading)

CLT is produced up to a length of 16.0m and to a width of 4.0m. The thickness of these elements ranges from about 40mm to 300 m.

2.2 CODE STATEMENTS [2], [4]

CLT has already not been considered in the EN 1995-1-1:2009 [3]. Some statements to the material can be found in some national codes or annexes of EN (e.g. DIN 1052, SIA 265, ÖNORM B 1995-1-1:2010). As a consequence, presently the judicial basis for CLT is formed by national and European technical approvals.

2.3 MECHANICAL PROPERTIES [2], [4]

The use of CLT is restricted to the service classes 1 and 2 according to [3]. The mechanical properties depend on the technical approvals and cannot be presented here in a general way. But there are some comments to define strength- and stiffness classes of CLT corresponding to the used raw material.

It is also important to mention that, unlike bar-shaped timber products, rolling shear has to be considered for calculation and verification processes.

2.4 USE OF CLT [2], [4]

The specifications of CLT elements enable loading them in plane and perpendicularly to plane. Of course they can be used as wall-, slab- and roof elements. The usual span of 4-5m within normal loads of residential buildings can be solved with a five-layered CLT element and a thickness of about 150 mm. If higher stiffness- or load-carrying capacity is used as an alternative to the enlargement of the CLT element, a combination of CLT and GLT to a so-called ‘rip-plate’ is possible.

At present, CLT is mainly used for one- and multi storey residential buildings, but also some ‘special’ buildings, such as schools, bridges or administration buildings have been planned and already realised.

The high prefabrication of CLT-elements and the use of simple connection technique lead to the fast assembling of such solid timber constructions (STC). For example, a single family house can be assembled in a time span of one to three days (Figure 2.2).

Figure 2.2: Use of CLT for a single family house [source: holz.bau forschungs gmbh]

2.5 USED CONNECTION TECHNIQUE [2], [4]

As mentioned before, CLT is a large-sized, two-dimensional (2D) element and because of that a linear (1D) connection technique would be the logical consequence. Of course in practical terms single connections (1D) are used in general, but if the distance between them is adequate, they can be seen as continuous connections (especially screws).

2.5.1 Definition of joints

CLT joints can be differentiated regarding their positions within the building and the positions of the CLT elements to each other. Figure 2.3 shows a possible classification of the different joint types.

- type 1: joints between basement and CLT walls
- type 2: joints between CLT wall and CLT floor elements
- type 3: joints between two CLT walls or two CLT floors (parallel elements)

- type 4: joints between CLT walls (without parallel elements)

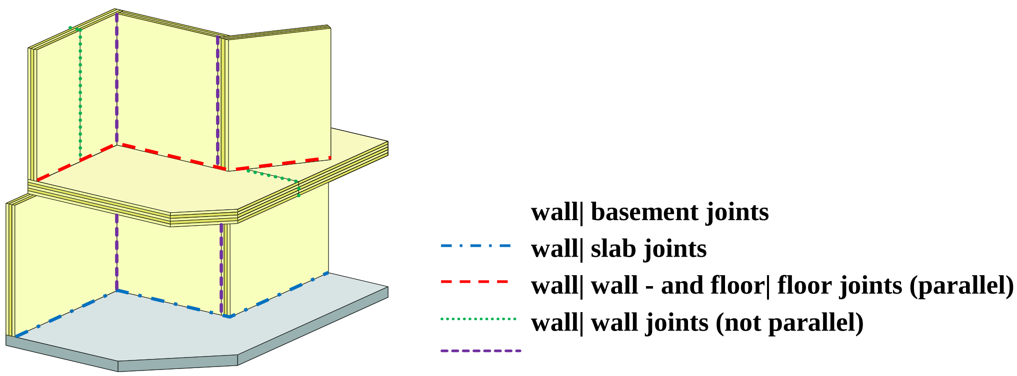


Figure 2.3: Joints in STC in CLT [5]

2.5.2 Types of connectors

Depending on the type of the joints, the loading (tension, shear, etc.) and the dimension of the load, different types of connectors can be used. The following sections show a brief overview of connectors and fasteners presently used in STC.

2.5.2.1 Fasteners

A huge number of connection types applied in timber engineering and, consequently, also for STC, use – at least partially – fasteners to fix them on the timber elements.
Typical fasteners in timber engineering are:

- nails,
- full and partial threaded screws as well as
- dowels and bolts.

At present, CLT constructions frequently use annual ring nails (in combination with system connectors) as well as fully and partially threaded screws (Figure 2.4). In contrast to other timber engineered constructions, dowel and bolt connections have just been used in a smaller range. Nevertheless, these fasteners may have a highly positive effect on load capacity, stiffness and ductility.

Figure 2.4: a) annual ring nails; b) fully threaded screws

2.5.2.2 Steel connectors / system connectors

Typical steel connectors or system connectors used in STC are (Figure 2.5):

- angle brackets,
- hold-downs and
- nail plates (or tie-downs).

Figure 2.5: a) & b) angle brackets; c) hold-down; d) tie down

Other available connection systems were developed especially for bar shaped timber constructions and have not (or seldom) been used for STC.

Besides the screws, the presented connection systems are mainly used in the context of the STC in CLT.

2.5.2.3 Special solutions

Of course the possibility of ‘special solutions’ is also given in STC in CLT – like in other construction types too - but these solutions have just been used for selected points.
Some of these connections are:

- in glued rods,
- threaded rods and
- special steel sections (e.g. T-profiles to carry shear loads, see Figure 2.6)

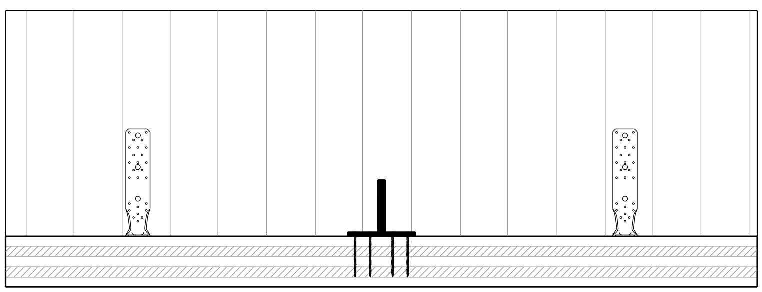


Figure 2.6: T-profile in steel to resist high shear loads (schematised sketch) [4]

2.6 EARTHQUAKE PERFORMANCE OF CLT CONSTRUCTIONS – PRESENT EXPERIENCE

Timber shows widely linear elastic characteristics with strong tendency for brittle failure. Hence, the connections in timber engineering have to be responsible for the used ductility – especially in case of an earthquake. Of course every timber construction has to fulfil these requirements. For example, Platform Frame Systems (PFS) especially use the connections between substructure (columns and beams) and planking (with OSB or gypsum plates) to ensure the needed ductility. In this case a high number of ‘small’ yielding points – because of the huge number of used fasteners (e.g. nails or clamps) – leads to sufficient ductile characteristics. With regard to CLT constructions it is not possible to activate ductility within the single CLT elements. Therefore,

the total ductility has to be ensured by the connections between the CLT elements. As a consequence, one main focus has to be on the connection technique in STC in CLT.[5]
Experience on earthquake design for CLT constructions has been gained since seven years. One of the first widespread researches on this topic was conducted in the 'SOFIE' project. This project as well as additional research work performed by other institutions produced results suggesting that the diaphragm stiffness of CLT elements can be set as being (more or less) rigid, while the connections are shifted to the centre of interest with regard to this field of research.

2.6.1 Project SOFIE [4], [7], [8], [9]

Due to the facts that the EN 1998-1 [6] has provided no definition or value for the behaviour factor q for CLT-constructions and the models for simulating earthquakes needed to be validated, research into this topic was conducted via the SOFIE project in 2006 and 2007 (by *CNR-IVALSA – Trees and Timber Institute, Italian National Research Council*). Beginning with wall tests and a pseudo-dynamic test on a single storey and ending with a shaking table test on a three storey building, it was able to collect a lot of information.
The three storey building was designed for peak ground acceleration (PGA) of 0.35g (maximum PGA for Italy) using a behaviour factor of q = 1.0. In this context it should be mentioned that the failure of one or more hold-downs was defined as the so-called 'near-collapse' criterion.
In the course of the shaking table test the earthquake impact – i.e. the ground acceleration – was increased continuously (from 0.15g up to 1.2g) and three more test configurations with different wall geometries were performed. Only at the highest PGA level and in the context of the last configuration the elected near-collapse criterion was met. On the subject of previous tests only minor repair works needed to be carried out (tightening hold-down anchor bolts, replacing screws in vertical joints between panels).
Based on the knowledge of the near-collapse acceleration, the design acceleration and the used q-value of 1.0 to design the building, a behaviour factor of q = 3.4 could be calculated (cf. [7]).
In the strict sense, this value applies exclusively to this construction and the tested earthquake situation, but with this investigation it was able to determine a preliminary guidance level for the behaviour factor of solid timber constructions in CLT with q = 3.0.
Furthermore, in 2007 an additional shaking table test was carried out on a seven storey building. The results of this test confirmed the determined behaviour factor (cf. Figure 2.7)

Figure 2.7: Tests in the context of the SOFIE project [8], [9], [10]

Additional research on cyclic- and earthquake performance of CLT constructions, which were (partly) based on the SOFIE project, can be found in [11], [12], [13], [14] or [15]. These investigations primarily deal with the specifications of single joints and single wall elements exposed to cyclic load as well as with numeric analyses of CLT constructions.

2.6.2 Research at Graz University of Technology

Research at the Graz University of Technology (TU Graz), Institute of Timber Engineering and Wood Technology, regarding the cyclic performance of CLT-buildings was structured in three steps: (i) single joint tests, (ii) tests on wall elements and (iii) shaking table tests on a three storey building on the basis of the SERIES project. The following sections will give a brief overview of these steps.

2.6.2.1 Tests on single joints

As a first step of the earthquake project a testing plan for single joints exposed to monotone- and cyclic loads were carried out, based on two master theses developed at the TU Graz in 2010

([4],[16]). Thus, presently used connection types, such as angle brackets, hold-downs and screws, were examined in different configurations concerning their characteristics while being exposed to load in shear and tension.

Figure 2.8: Single joint tests

In the course of these tests, CLT/CLT connections as well as some configurations with concrete or steel foundation combined with CLT (cf. Figure 2.8) were tested. First results of these tests can be found in [17].

2.6.2.2 Tests on single wall elements

Based on the single joint tests, the wall tests were planned and carried out at the University of Kassel (Germany) in summer 2012. The aim of these tests was to analyse the influence of various connections, vertical loads and wall geometries on the monotonic and cyclic performance of horizontally in-plane loaded CLT walls.

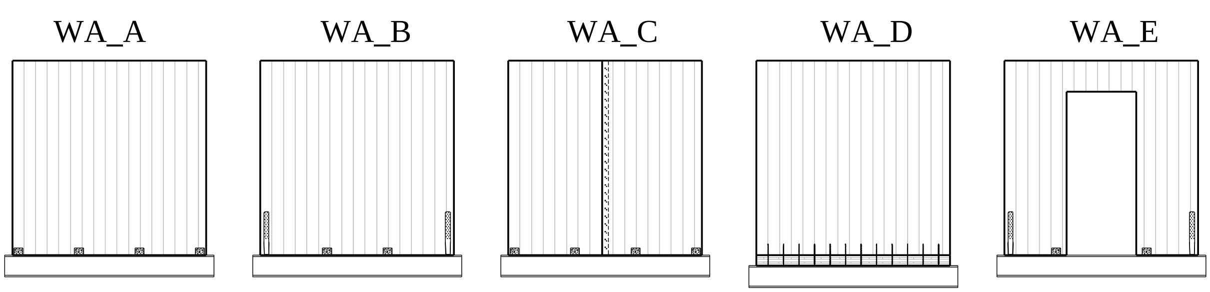


Figure 2.9: Configurations of wall tests

Figure 2.9 shows the five tested wall configurations, in which one monotone and at least one cyclic test of each configuration were performed according to ISO 21581 [18].

Focusing on a horizontally in-plane loaded wall, the total deflection can be divided into four different contributions – bending, shear, slip (translation) and rocking (rotation). While the first two contributions depend on the CLT element, the latter ones are especially based on the used connection technique (cf. Figure 2.10).

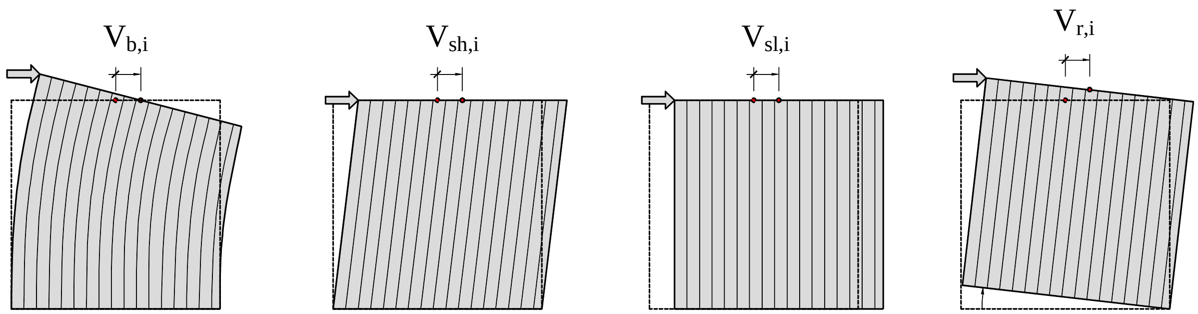


Figure 2.10: Contributions to the total deflection on a horizontally in-plane loaded wall element

Based on configuration A (four angle brackets) the contributions to the total deflection can be determined with:

- CLT (bending and shear): 5 % - 10 %
- slip (translation): 20 % - 25 %
- rocking (rotation): 65 % - 75 %

Even if the results of the contributing factors of slip and rocking are altering within the configurations – depending on the connection technique – the CLT-deformation is relatively small in the context of all configurations (not higher than 11%). Of course this statement excludes the results of configuration E, in which the door opening influences the CLT-deformation in an exorbitant dimension (CLT share 26÷43%).

Considering the test results, the leading role of the connection technique in CLT constructions can be confirmed. For more details see [5].

2.6.2.3 Shaking table tests on a three storey building

The third step in the earthquake project at the TU Graz was the herein described full-scale shaking table test on a three storey building (Figure 2.11).

Figure 2.11: Full-scale shaking table test on a three storey CLT building

2.7 TESTING SETUP

The design of the building was a solid timber construction (STC) in cross laminated timber (CLT) and it was assembled of three layered wall- and roof elements as well as of five layered floor elements. An important detail can be seen in the fact that no vertical joints were used. In other words, if there had been no door openings, the CLT wall elements would have been continuous.

The building itself had three floors with about 30m² per floor. The dimensions of the test object are 6.76m (in length) x 5.17m (in width) and 7.74m (in height). The CLT elements were assembled with conventional connections (screws, angle brackets and hold-downs) as well as with nail plates and some system connectors (SHERPA(R)).

Because of the high prefabrication and the fairly manageable connection technique, just five persons were needed to assemble the whole building in only three days. The following points will give detailed information about the geometry and the construction of this CLT test building.

2.7.1 Geometry of the test building

The basic geometry of the test building was determined by the University of Trento – the leading institution of the SERIES subproject ‘Seismic Performance of Multi-Storey Timber Buildings’. Of course all tested construction techniques had their own characteristics. However, on the subject of the horizontal plan, all four test buildings (platform frame buildings (two test objects), log house building and the solid timber construction) were identical. Concerning the vertical section, only the log house test differed from the other test buildings because it was a two storey building. Figure 2.12 shows the basic dimensions of the CLT-test object.

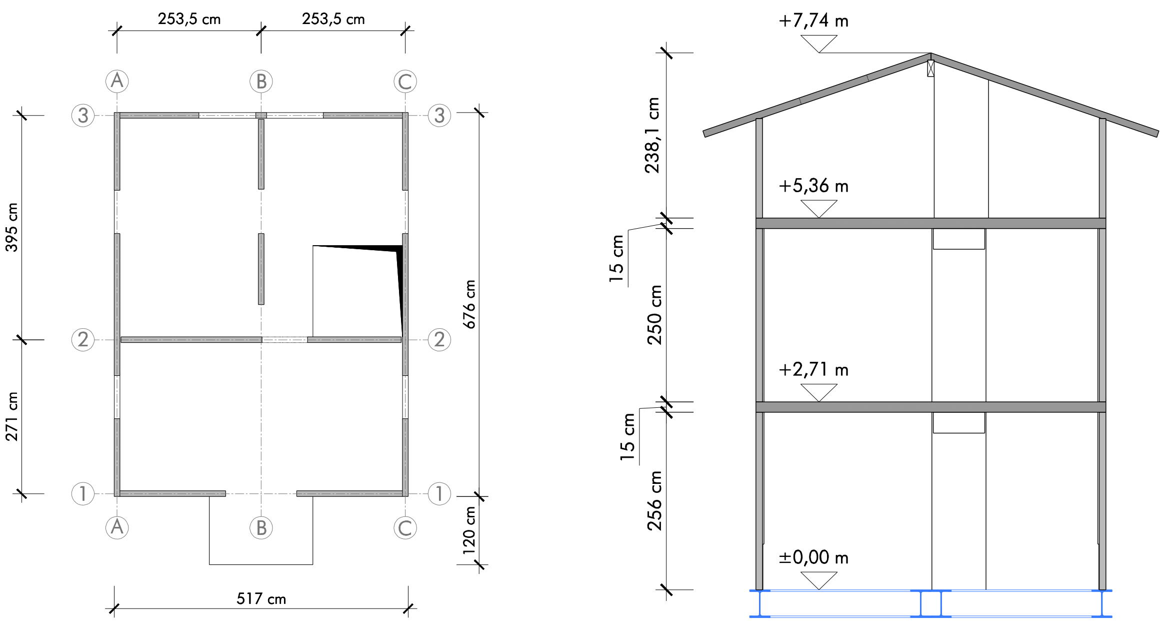


Figure 2.12: Horizontal plan (second floor) and vertical cross section

2.7.2 Used CLT elements

With the exception of the ridge purlin, all load carrying elements of the presented building are made of the timber product CLT.

Basically, the structural elements can be divided into three substructures:

- wall elements (CLT 3 layered 100mm 30-40-30)
- floor elements (CLT 5 layered 150mm 30-30-30-30-30)
- roof elements (CLT 3 layered 99mm 33-33-33)

With the exception of the inner layer of the floor elements, which was made of pine, all CLT elements were made of spruce (C 24).

The CLT elements were produced by the following companies:

- Haas – Fertigbau Holzbauwerke Ges.m.b.H & Co KG (floor elements)
- Hasslacher Holding GmbH (roof elements)

- Mayr-Melnhof Holz Holding AG (wall elements y-direction or transversal)
- Stora Enso Timber Bad St. Leonhard Ges.m.b.H. (wall elements x-direction or longitudinal)

2.7.3 Connection technique

As mentioned before, the basic material wood as well as the timber product CLT show a linear elastic behaviour and tend to brittle failure. Hence, all of the needed or wanted ductility has to be established by the connections. Due to this fact, one main focus of the herein presented project was the design of the connections design. Added to this, the attempt was to use connections which are in step with actual practice. As a consequence, innovative or special solutions were hardly used. These used connections can be defined as:

- angle brackets and nail plates
- hold downs
- screws and insular
- SHERPA(R) connectors.

2.7.4 Angle brackets and nail plates

To deal with the horizontal shear forces and distribute them between the wall elements and the floor elements as well as the steel basement, angle brackets (AE116 | Simpson Strong Tie®) were installed exclusively. CNA annual ring nails ∅ 4.0x60mm and threaded rods ∅ 12.0mm were used as fasteners. For the connection between the wall element and the angle bracket 14 nails and for connecting the angle bracket with the floor 7 nails were used. The connection to the steel basement was established by two threaded steel rods.

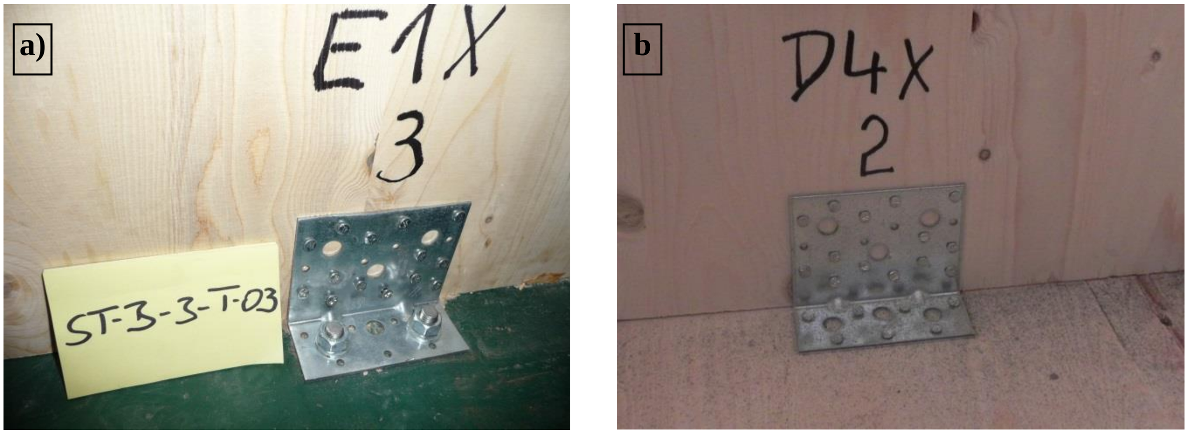


Figure 2.13: Angle brackets: a) CLT – steel frame; b) CLT – CLT

The nail plates were just used to connect the wall elements in the area of the floor opening and to connect the ridge purlin with the wall beneath.

Figure 2.14: Nail plates: a) wall – wall; b) ridge purlin – wall

2.7.5 Hold downs

To discharge the high tension loads at the end of the wall elements to the floor elements a hold down (HTT22 | Simpson Strong Tie®) was placed on each end of the CLT walls. To fix the hold down on the CLT wall, again CNA annual ring nails ∅ 4.0x60mm were used as fasteners (15 nails). The connection to the floor element was established by using a threaded rod ∅ 16.0mm and a counter plate (cf. Figure 2.15c). For the connection to the steel frame the counter plate was not necessary.

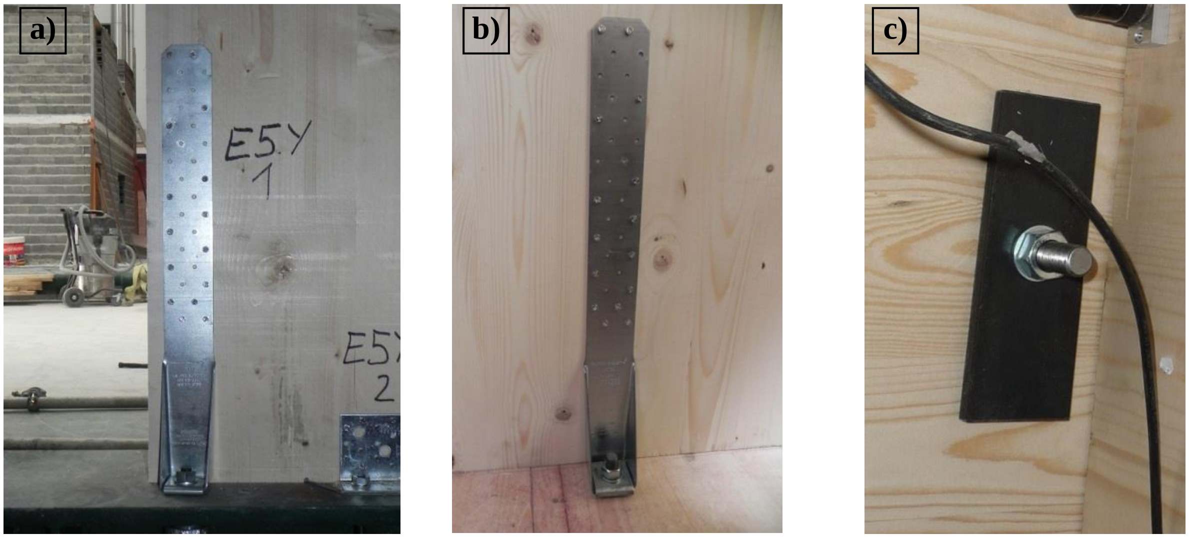


Figure 2.15: Hold-downs: a) CLT – steel frame; b) CLT – CLT; c) counter plate

2.7.5.1 Screws

For load carrying functions the following screws were used in this project:

- ∅ 8.0 mm x 300 mm fully threaded | countersunk head
- ∅ 8.0 mm x 220 mm fully threaded | countersunk head
- ∅ 8.0 mm x 220 mm partially threaded | round headed
- ∅ 6.0 mm x 140 mm fully threaded | cylinder head
- ∅ 6.0 mm x 80 mm fully threaded | cylinder head

2.7.5.2 Screw connection of CLT elements in plane

To connect step joints between roof and floor elements in plane only the ∅ 6.0mm screws were used. The relatively short distance between the single screws (100mm) depends on the needed high stiffness of these joints. The in-plane behaviour of the floor elements had to be as rigid as possible to realise the modelled distribution of the horizontal loads to the walls below. The additional lateral screw rows between the floor elements E2 and E3 as well as between O2 and O3 were needed as reinforcement against tension perpendicularly to the grain. All screws were inserted with an angle of 90° to the side face of the floor elements.

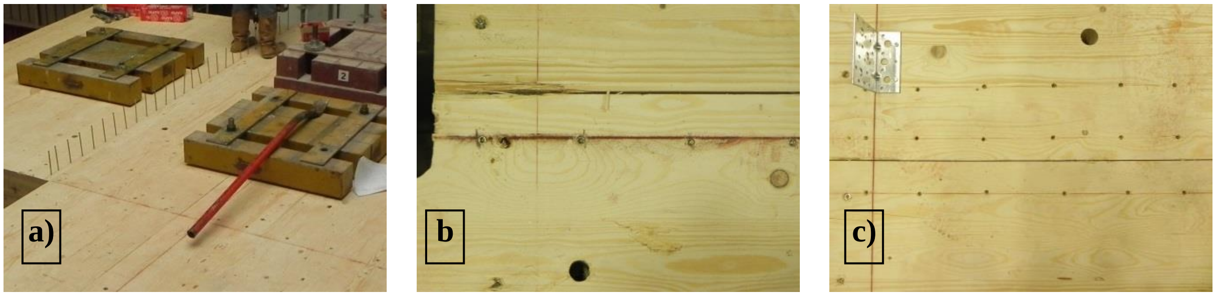


Figure 2.16: Screw connection of CLT elements in plane: a) drilling; b) single row; c) additional screw rows for reinforcement against tensions perp. to grain

2.7.5.3 Screwed connection of CLT elements out of plane

The screwed connections between CLT elements out of plane have to be divided into two parts - joints between wall- and floor elements as well as joints between wall- and wall elements. To connect the wall elements to each other ∅ 8.0x220mm screws (fully threaded as well as partially threaded) were used. As fasteners for the wall | floor joints the ∅ 8.0x300mm fully threaded screws were used.

Regarding both types of joints the screws were inserted with an angle of 10-15°. However, this angle was only based on visual judgement. The constant distance between the single screws was fixed with 200mm.

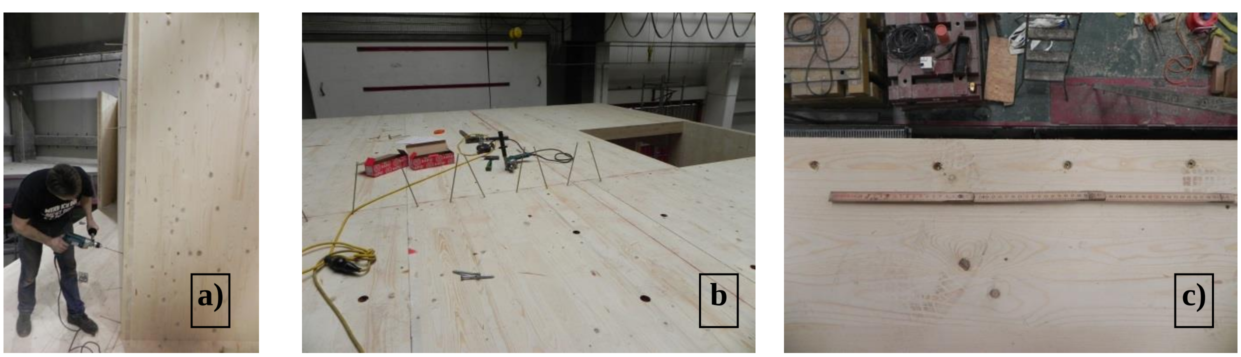


Figure 2.17: Screw connections out of plane: a) drilling; b) wall-floor joint; c) controlling of the screw distances

2.8 SHERPA(R) - CONNECTOR

To connect the lintels and the surrounding walls as well as jointing the outer walls with the inner walls, the SHERPA(R) - connector was used (first and second floor). This connector, which is usually made of aluminium, consists of two parts, which can be screwed to the CLT elements and pushed over a so-called dovetail connection into each other. These or equal connection types help to reduce the assembling time on building side, if the connectors are pre-assembled at the carpentry.

Of course these connectors cannot be used without prudence in dynamic tests because of their – mostly – different specifications in and against the insertion direction. This aspect in combination with the fact that there exist no representative analyses regarding the cyclic behaviour of the SHERPA(R) connector, lead to a severely limited use of this connection.

Figure 2.18: SHERPA(R) connector: a) assembling; b) wall - wall joint; c) lintel joint

2.8.1 Reduction of connections after the first test series

No visible damages were found after the first earthquake series (14 tests) with a maximal PGA of 0.5g. Hence, the installed connections were reduced with regard to upcoming tests. This reduction included about 50% of the shear connectors (angle brackets and nail plates) as well as all hold-downs of the outer walls at roof level. Instead of the removed hold-downs, angle brackets were installed (cf Figure 2.19b). No changes were made concerning the screwed joints.

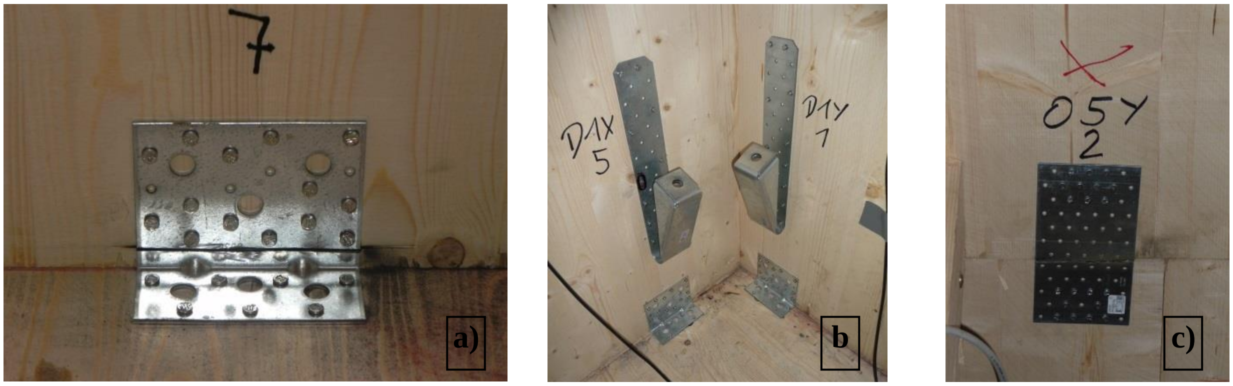


Figure 2.19: Reduction of connections: a) capped angle bracket; b) removed hold-downs and replaced angle brackets; c) capped nail plate

2.9 ADDITIONAL LOADS

It should be mentioned that it was impossible to construct walls and floors in the course of the conducted tests. However, the additional loads of the interior (screed, insulation, façade, roof covering, etc.) are generally very important factors on the subject of the behaviour of the building shaken by an earthquake. Hence, these loads were simulated with additional steel weights. The amount of these additional loads was determined by calculating the load of fictitious wall, floor and roof structures. Besides the additional dead loads, also the requested live loads (0.60kN/m² for this building) were taken into consideration.

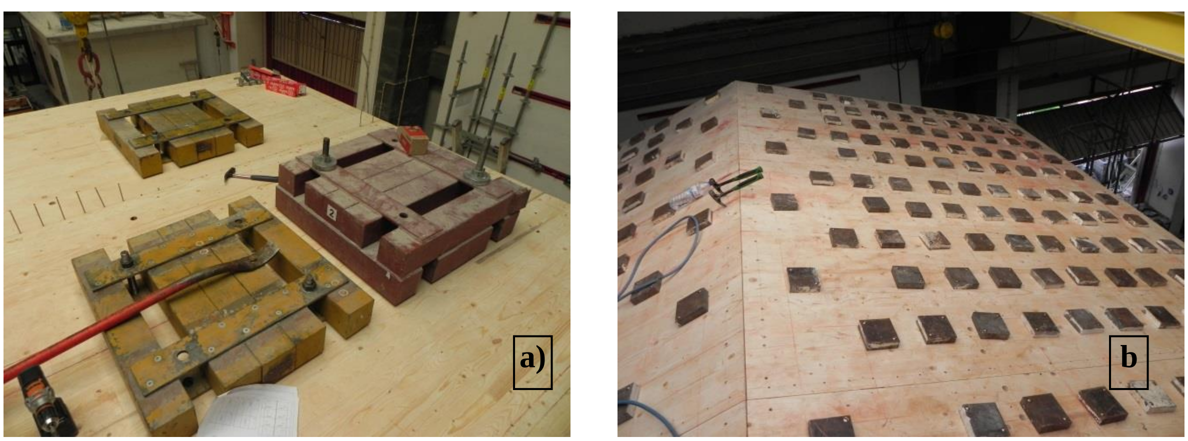


Figure 2.20: Additional loads: a) floor; b) roof

2.9.1 Fictitious structures

The following images show the defined floor and wall structures. It is important to mention that not only a practice-oriented approach could be taken into account in the context of the design of these structures, but also the maximum capacity of the shaking table (about 40t). Figure 2.21a shows the structure of the floor leading to an additional load of 1.24kN/m² (without CLT). The weight of the walls (0.18kN/m² without CLT) is based on the structure shown in Figure 2.21b. The assumed roof load of 0.47kN/m² and the supposed specific weight of CLT (4.8kN/m³) complete the assumed load of the CLT test building.

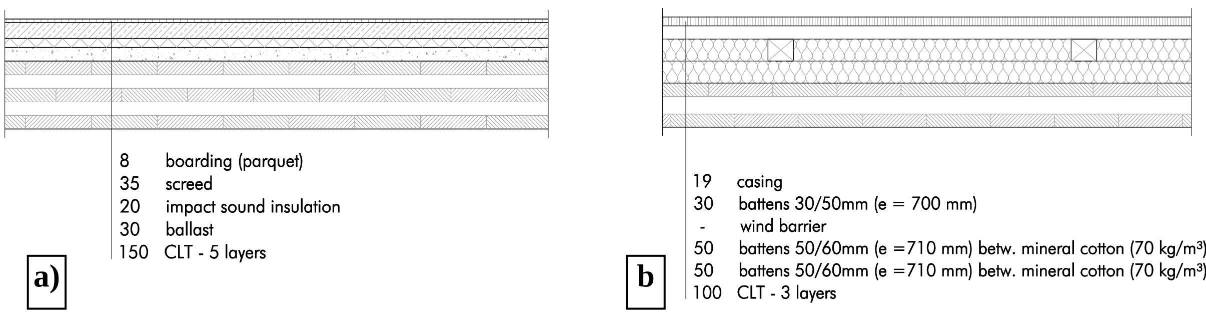


Figure 2.21: Fictitious structures: a) floor structure; b) wall structure

2.9.2 Used additional loads

According to the structures and assumed loads mentioned above, it was able to determine the following additional loads (cf. Table 2.1).

Table 2.1 - Additional loads

	calculation [kN]	used [kN]
dead load | construction	163.5	163.5
additional load first floor	72.1	72.0
additional load second floor	59.9	60.0
additional load roof	30.5	27.7
steel basement	80.0	80.0
	405.9	**403.15**

In the course of laboratory tests light (7.10kg) as well as heavy (600kg and 1200kg) additional weights were used in the form of steel elements. These elements were placed as smoothly as possible on the roof and floors (cf. Figure 2.22).

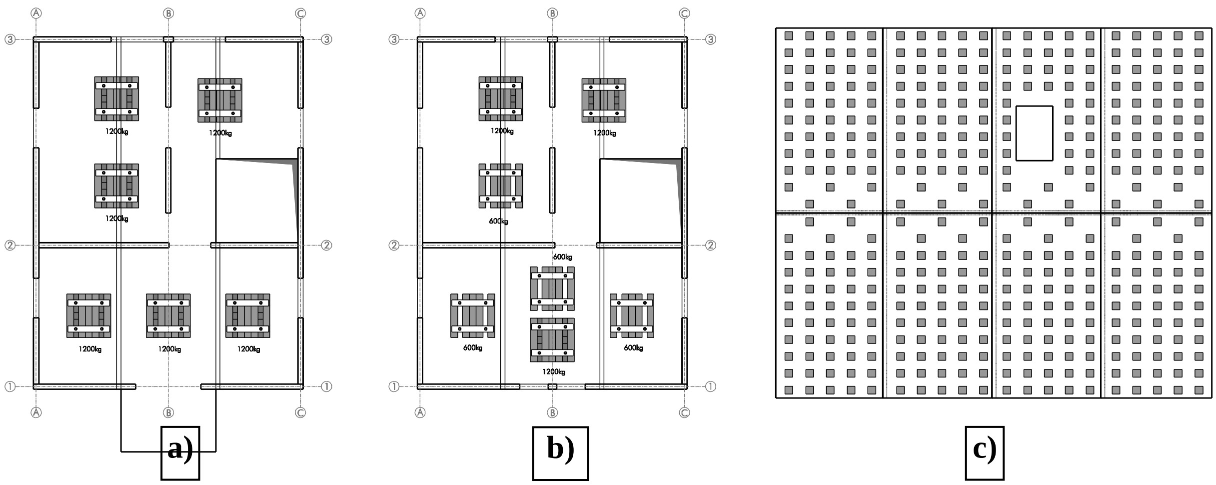


Figure 2.22: Arrangement of the additional loads: a) second floor; b) third floor; c) roof

3 Building instrumentation

An essential part of every test is the performance of measurements. Without this component no information about the specifications of the building examined in the test – visually noticeable effects excepted – is able to be obtained.

Especially in the context of scientific experiments, such as the herein presented shaking table test, the crucial importance of instrumentation has to be emphasised. As a consequence, about 86 sensors for load, displacement and measuring acceleration were installed in and on the test building [19].

3.1 POSITION OF MEASURE POINTS

Basically the instruments were installed in the same positions as they had been used for the PFS buildings in the SERIES project. The reasons for this can be regarded in (i) the substantial experience gained by the Italian researchers concerning the measurement of such tests and (ii) the better comparability of the test results in the course of using the same measure points. The positions of the different sensors are presented in Figure 3.1.

The following sensors were used for the CLT shaking table test:

- 41 units acceleration sensors
- 16 units load cells (load sensors)
- 19 units LVDT's (displacement sensors) – 11 units for vertical deformations, 4 units for horizontal deformations and 4 units for horizontal inter-storey drift)
- 5 units optical sensors for measuring the total deflection of the different floors (transverse and longitudinal direction)

As a consequence, data of 79 sensors can be used in total for evaluating the characteristics of the CLT building in the course of the shaking table tests.

Differing from the platform frame building, the walls E_2_X and O_2_X of the CLT building were equipped with more sensors. The reason for this can be seen in the expected high loads of these walls in the course of performing the test.

Because of the used SHERPA(R) connectors in the wall joint O_4_Y | O_5_X, an additional instrument was used.

Figure 3.1 shows an overview of the measurement and Table 3.1 through Table 3.5 summarise the list of all the sensors used in the seismic tests and their designations, measured quantity and type of units.

Figure 3.1: Overview of the measurement

Table 3.1 – List of sensors in the shaking table

Channel	Name	Location	Type	Units
1	DISP MESA TRANS	Shaking table (ST) motion control	Displacement	mm
2	DISP MESA LONG			
3	ACC MESA TRANS		Acceleration	mg
4	ACC MESA LONG			

Table 3.2 – List of accelerometers

Channel	Name	Location	Units
15	ACC_L1_A1_Y_SE_T	Southeast wall, 1st level	mg
16	ACC_L1_A1_X_SE_L		
17	ACC_L1_C1_Y_NE_T	Northeast wall, 1st level	
18	ACC_L1_C1_X_NE_L		
19	ACC_L1_C2_Y_N_T	North wall, 1st level	
20	ACC_L1_C2_X_N_L		
21	ACC_L1_C3_Y_NW_T	Northwest wall, 1st level	
22	ACC_L1_C3_X_NW_L		
23	ACC_L1_B3_Y_W_T	West wall, 1st level	
24	ACC_L1_B2_Y_I_T	Inside wall, 1st level	
25	ACC_L1_A3_Y_SW_T	Southwest wall, 1st level	
26	ACC_L1_A3_X_SW_L		
27	ACC_L1_A2_Y_S_T	South wall, 1st level	
28	ACC_L1_A2_X_S_L		
29	ACC_L2_A1_Y_SE_T	Southeast wall, 2nd level	
30	ACC_L2_A1_X_SE_L		
31	ACC_L2_C1_Y_NE_T	Northeast wall, 2nd level	
32	ACC_L2_C1_X_NE_L		
33	ACC_L2_C2_Y_N_T	North wall, 2nd level	
34	ACC_L2_C2_X_N_L		
35	ACC_L2_C3_Y_NW_T	Northwest wall, 2nd level	
36	ACC_L2_C3_X_NW_L		
37	ACC_L2_B3_Y_W_T	West wall, 2nd level	
38	ACC_L2_B2_Y_I_T	Inside wall, 2nd level	
39	ACC_L2_A3_Y_SW_T	Southwest wall, 2nd level	
40	ACC_L2_A3_X_SW_L		
41	ACC_L2_A2_Y_S_T	South wall, 2nd level	
42	ACC_L2_A2_X_S_L		
43	ACC_RL_A1_Y_SE_T	Southeast wall, roof level	
44	ACC_RL_A1_X_SE_L		
45	ACC_RL_C1_Y_NE_T	Northeast wall, roof level	
46	ACC_RL_C1_X_NE_L		
47	ACC_RL_C3_Y_NW_T	Northwest wall, roof level	
48	ACC_RL_C3_X_NW_L		
49	ACC_RL_B3_Y_W_T	West wall, roof level	
50	ACC_RL_B2_Y_I_T	Inside wall, roof level	
51	ACC_RL_B2_X_I_L		
52	ACC_RL_A3_Y_SW_T	Southwest wall, roof level	
53	ACC_RL_A3_X_SW_L		

Table 3.3 – List of the Hamamatsus sensors

Channel	Name	Location	Units
5	DISP_L2_SE_X_T	Southeast wall, 2nd level	mm
6	DISP_L2_SE_Y_L		
7	DISP_L1_SE_X_T	Southeast wall, 1st level	
8	DISP_L1_SE_Y_L		
9	DISP_L2_NW_X_L	Northwest wall, 2nd level	
10	DISP_L2_NW_Y_T		
11	DISP_L1_NW_X_L	Northwest wall, 1st level	
12	DISP_L1_NW_Y_T		
13	DISP_RL_NW_X_L	Northwest wall, roof level	
14	DISP_RL_NW_Y_T		

Table 3.4 – List of LVDT sensors

Channel	Name	Location	Units
54	LVDT_V10_E5Y	South wall, RC level	mm
55	LVDT_H05	North wall, RC level	
56	LVDT_H03	East wall, RC level	
57	LVDT_IID02	Internal Inter-storey drift, inside wall	
58	LVDT_H04	East wall, 1st level	
59	LVDT_H07	North wall, 1st level	
60	LVDT_IID04	Internal Inter-storey drift, inside wall	
61	LVDT_IID01	Internal Inter-storey drift, North wall	
62	LVDT_IID03	Internal Inter-storey drift, North wall	
63	LVDT_V02_E5X	West wall, RC level	
64	LVDT_V03_E2X	East wall, RC level	
65	LVDT_V04_E2X	East wall, RC level	
66	LVDT_V01_E5X	West wall, RC level	
67	LVDT_V07_E5Y	South wall, RC level	
68	LVDT_V16_O4Y	North wall, 1st level	
69	LVDT_V11_E2X	East wall, 1st level	
70	LVDT_V12_E2X	East wall, 1st level	
71	LVDT_V13_O2x	East wall, 2nd level	
72	LVDT_V14_O2X	East wall, 2nd level	

Table 3.5 – List of the hold-down load cells

Channel	Name	Location	Units
73	LC_01_E5x_SW	Hold down load cell, Southwest corner	kN
74	LC_02_E2x_E	East wall	
75	LC_03_E5x_NW	Hold down load cell, Northwest corner	
76	LC_16_E2x_NE	Hold down load cell, Northeast corner	
77	LC_05_E3y_INTERIOR	Hold down load cell, inside wall	
78	LC_06_E3y_INTERIOR	Hold down load cell, inside wall	
79	LC_07_E4y_INTERIOR	Hold down load cell, inside wall	
80	LC_08_E4y_INTERIOR	Hold down load cell, inside wall	
81	LC_09_E5y_N	Hold down load cell, North wall	
82	LC_10_E5y_NE	Hold down load cell, Northeast wall	
83	LC_11_E1y_SE	Hold down load cell, Southeast wall	
84	LC_04_E1y_S	Hold down load cell, South wall	
85	LC_13_E3x_S	Hold down load cell, South wall	
86	LC_14_E3x_N	Hold down load cell, North wall	
87	LC_15_O2x_NE	Hold down load cell, Northeast wall	
88	LC_12_O2x_E	Hold down load cell, East wall	

3.1.1 Displacement and load sensors

The displacement transducers (LVDT) were installed to measure the uplift and the sliding as illustrated in Figure 3.2 and Figure 3.3.

Figure 3.2: Sensors on the longitudinal

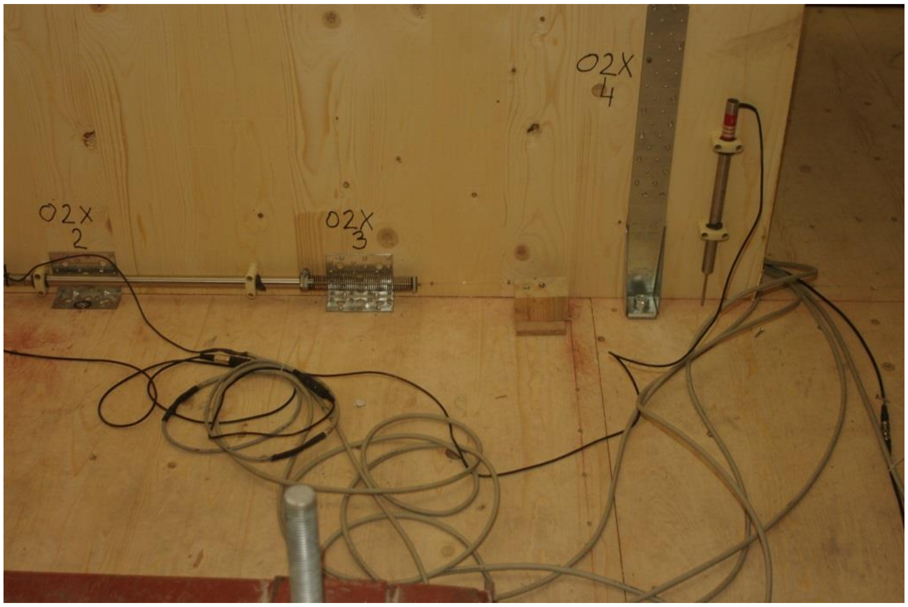


Figure 3.3: Wall uplift and sliding

The tensile load on the hold downs elements were measured by load cells. The annular LC was installed under the upper steel flanges of the foundation (Figure 3.4). Those sensors measure the variation of the tensile force in the hold-down elements due to the rocking effect (overturning moment).

Figure 3.4: Details of annular load cells

3.1.2 Acceleration sensors

Acceleration measurements were made with unidirectional accelerometers placed at different levels in structures and on the shaking table. The acceleration measurements on the building were recorded for horizontal directions only.

A total of 39 accelerometers were placed inside the building. on the first floor (channels 15 to 28 of Table 3.2), second floor (channels 29 to 42 of Table 3.2) and roof (channels 43 to 53 of Table 3.2). Figure 3.5 to Figure 3.7 show the location of the accelerometers in the different levels of the building.

Figure 3.5: Detail of the accelerometers placed inside the building

Figure 3.6: Detail of the accelerometers placed on the wall

Figure 3.7: Several accelerometers placed on the monitored room

3.1.3 Optical acquisition systems

The absolute displacement of the building during the tests was measured by Hamamatsu optical device to acquire the displacement of the building at the first, second and roof levels. All the levels were monitored in the NW and SE corners. A general view showing the tower to place the Hamamatsu cameras is presenting in Figure 3.8.

Figure 3.8: Support for the Hamamatsu cameras

4 Seismic testing plan

The seismic tests were carried out in two consecutive days. In the first day (2013-02-20) the initial test procedure using the 1979 Montenegro earthquake records [19] as target was carried out with the original building test setup (Table 4.1). For the second day (2013-02-21) the building was weakened by removing some of the connectors between the walls and floor panels. With this new test setup the previous test procedure was repeated (Table 4.2). Afterwards a new test procedure was carried out now with the 2011 Tohoku earthquake records [19] as target (Table 4.3). In all cases the signals were imposed with increasing amplitudes until the corresponding targets were achieved.

Table 4.1– TUGraz building 1st day (2013-02-20) test procedure (target: 1979 Montenegro earthquake)

Test	Drive	Target [g]	Video
	Dynamic Identification (CAT00)		
01	0	0.07	Test_007_01
02	1	0.07	Test_007_02
03	2	0.07	Test_007_03
	Dynamic Identification (CAT01)		
	Dynamic Identification (CAT02)		
04	2 (repeat)	0.07	Test_007_04
05	3	0.07	Test_007_05
06	4	0.15	Test_015_01
07	5	0.15	Test_015_02
08	6	0.15	Test_015_03
	Dynamic Identification (CAT03)		
09	7	0.28	Test_028_01
10	8	0.28	Test_028_02
11	9	0.28	Test_028_03
	Dynamic Identification (CAT04)		
12	10	0.50	Test_050_01
13	11	0.50	Test_050_02
14	12	0.50	Test_050_03
	Dynamic Identification (CAT05)		

Table 4.2– TUGraz building 2nd day (2013-02-21) test procedure (target: 1979 Montenegro earthquake)

Test	Drive	Target [g]	Video
	Dynamic Identification (CAT06)		
15	0	0.07	Test_007WM_01
16	1	0.07	Test_007WM_02
	Dynamic Identification (CAT07)		
17	2	0.15	Test_015WM_01
18	3	0.15	Test_015WM_02
19	4	0.15	Test_015WM_03
	Dynamic Identification (CAT08)		
20	5	0.28	Test_028WM_01
21	6	0.28	Test_028WM_02
22	7	0.28	Test_028WM_03
	Dynamic Identification (CAT09)		
23	8	0.50	Test_050WM_01
24	9	0.50	Test_050WM_02
25	9 (repeat)	0.50	Test_050WM_03
26	10	0.50	Test_050WM_04
	Dynamic Identification (CAT10)		

Table 4.3– TUGraz building 2nd day (2013-02-21) test procedure (target: 2011 Tohoku earthquake)

Test	Drive	Target [%]	Video
	Dynamic Identification (CAT11)		
27	0	100	Test_Tohoku_01
28	1	100	Test_Tohoku_02
29	2	100	Test_Tohoku_03
	Dynamic Identification (CAT12)		
30	3	200	Test_Tohoku_04
31	4	200	Test_Tohoku_05
32	5	200	Test_Tohoku_06
	Dynamic Identification (CAT13)		

A grand total of 32 seismic tests, plus 14 intermediate dynamic identification tests, were carried out with the TUGraz building.

5 Analysis of the results

The most relevant results are presented in the following sections. Annex I presents the time histories recorded during the seismic tests TEST007_05 and TEST050_03. The maximum simultaneous values calculated for the seismic tests TEST007_05, TEST015_03, TEST028_03 and TEST050_03 and the dynamic identification for the same seismic tests are shown in Annex II. The LNEC-SPA software [20] and MathCad [21] sheets developed at the Earthquake Engineering and Structural Dynamics Division (NESDE) of LNEC were used to process the results.

5.1 SHAKING TABLE FIDELITY (COMPARISON OF REFERENCE AND ACHIEVED INPUT MOTIONS)

The following figures show the response spectra for the seismic tests TEST007_05, TEST015_03, TEST028_03 and TEST050_03 for the two horizontal directions that represent the final tests in each stage. In each direction is given: i) the input reference signal; and ii) the achieved motion which is the signal recorded on the shaking table.

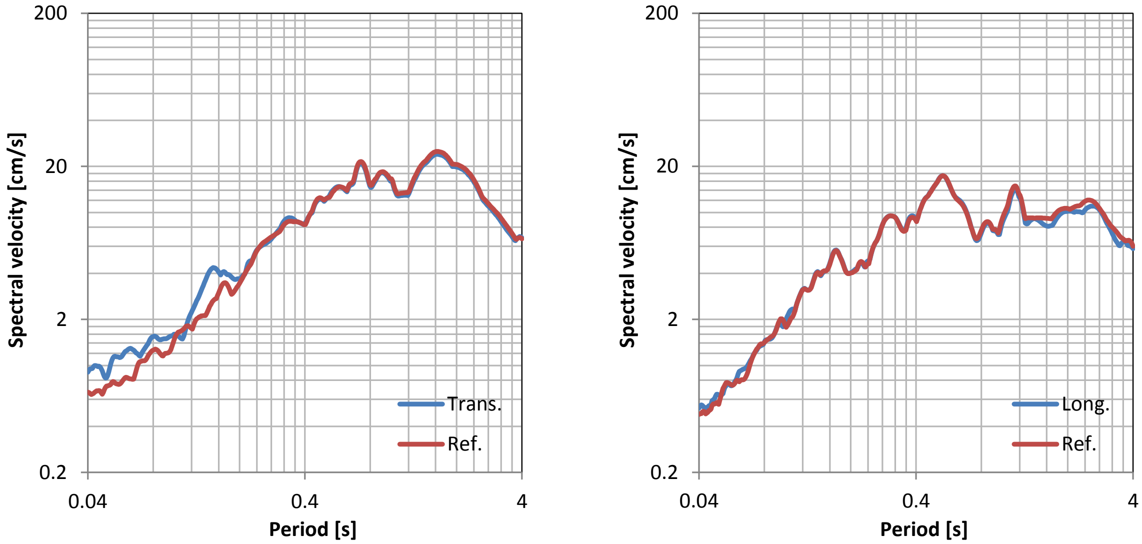


Figure 5.1: Response spectra for the reference and achieved signals, TEST007_05

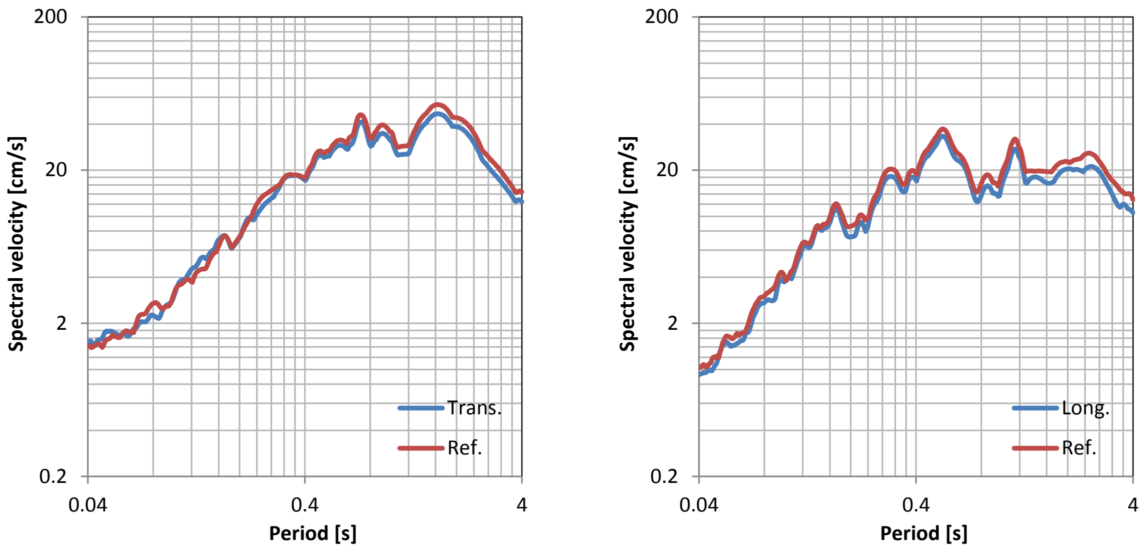


Figure 5.2: Response for the reference and achieved signals, TEST015_03

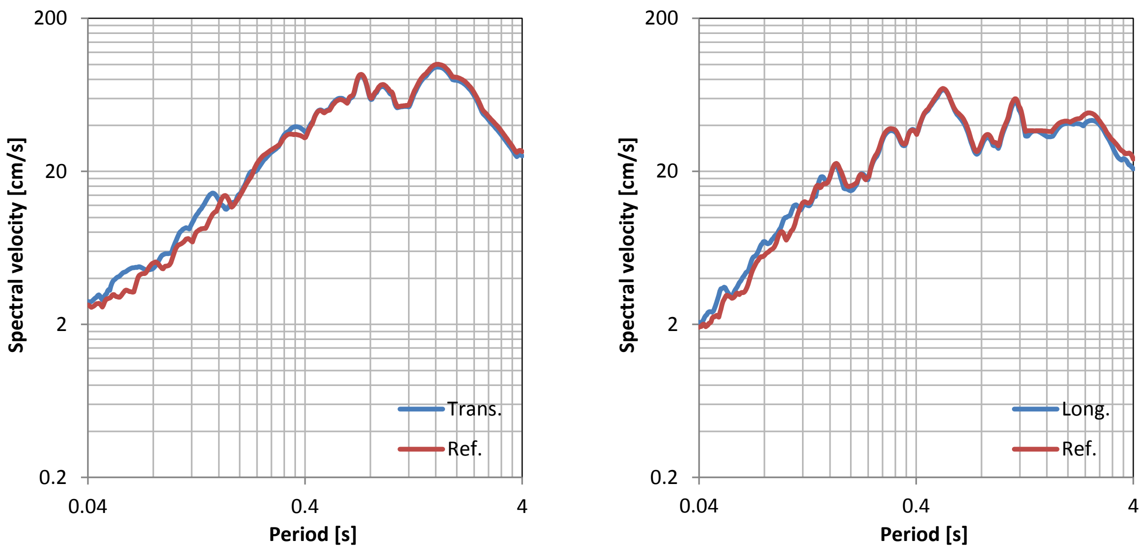


Figure 5.3: Response for the reference and achieved signals, TEST028_03

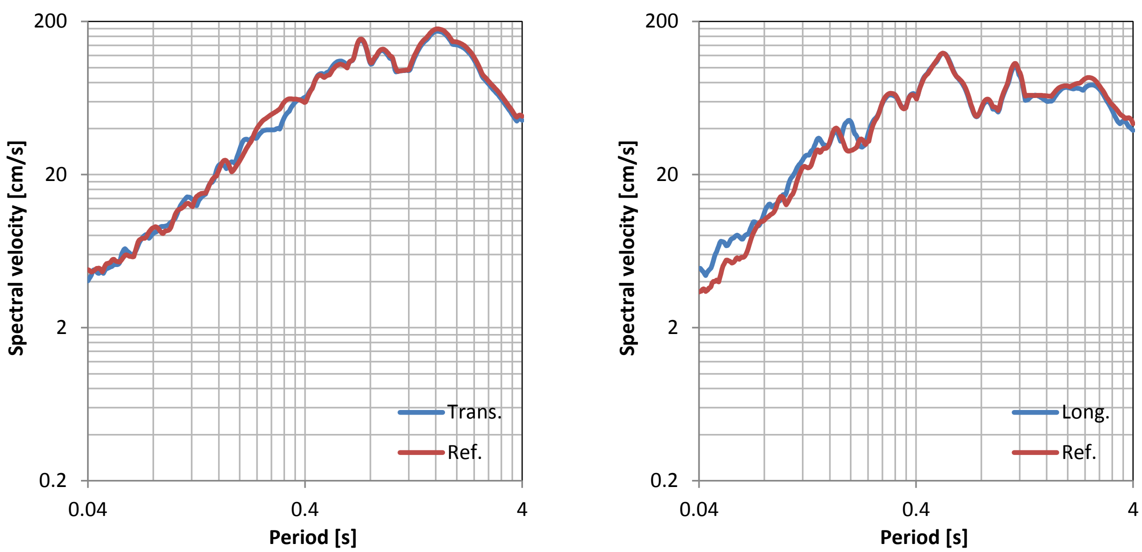


Figure 5.4: Response for the reference and achieved signals, TEST050_03

In the transverse and longitudinal directions are visible an excellent match between the reference and achieved signal in all the region of the spectra for the seismic tests.

5.2 BUILDING MOTIONS MAXIMUM AND SPECTRAL CONTENT GENERAL RESULTS

5.2.1 Processing of Results

The maximum acceleration values, the maximum simultaneous values on all uplifts, slippages, inter-storey displacement and hold down forces were measured by processing the data from the accelerometers, the LVDTs, the optical acquisition system and the load cells using MathCad [21] sheets developed for this purpose.

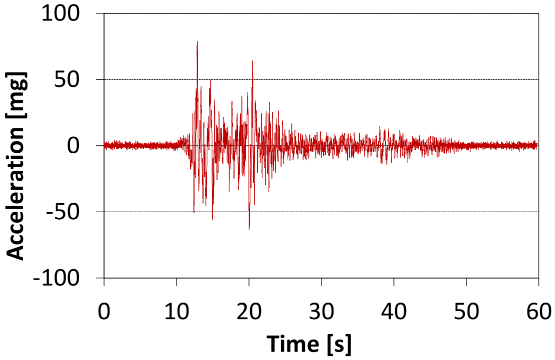
The tables with simultaneous values are read in the following way: each line contains the simultaneous values corresponding to the maximum of the channel in the main diagonal (background in grey). The maximum value in each channel is read directly from the table main diagonal. Only the data from tests TEST007_05, TEST015_03, TEST028_03 and TEST050_03 are presented in this section.

5.2.2 Acceleration

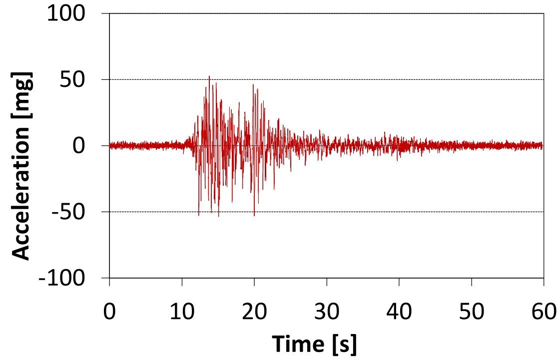
The maximum values recorded on the specimen during the tests TEST007_05, TEST015_03, TEST028_03 and TEST050_03 for the two horizontal directions are presented in Table 5.1.

Table 5.1 – Maximum values of acceleration for the TUGraz

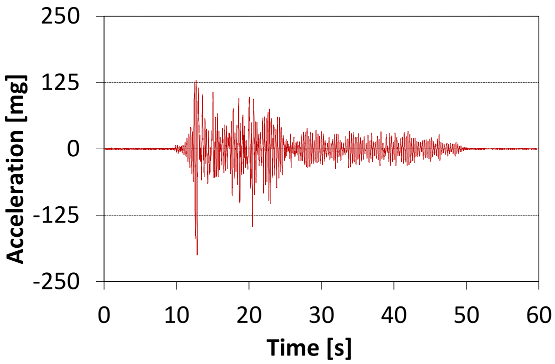
Designation	Test_007_05	Test_0157_03	Test_028_03	Test_050_03
	Max [mg]	Max [mg]	Max [mg]	Max [mg]
ACC MESA TRANS	78.99	141.57	300.58	460.50
ACC MESA LONG	53.58	109.70	228.88	561.63
ACC_L1_A1_Y_SE_T	142.37	222.91	424.15	605.26
ACC_L1_A1_X_SE_L	134.61	189.92	359.89	669.10
ACC_L1_C1_Y_NE_T	161.26	239.10	467.01	657.35
ACC_L1_C1_X_NE_L	133.94	191.42	347.61	620.12
ACC_L1_C2_Y_N_T	164.11	239.18	471.58	649.82
ACC_L1_C2_X_N_L	126.67	194.70	351.42	648.50
ACC_L1_C3_Y_NW_T	136.66	209.75	421.83	618.77
ACC_L1_C3_X_NW_L	128.21	187.12	351.42	744.05
ACC_L1_B3_Y_W_T	163.55	241.75	492.03	666.01
ACC_L1_B2_Y_I_T	176.87	254.61	473.39	N/A
ACC_L1_A3_Y_SW_T	140.39	218.62	424.77	647.08
ACC_L1_A3_X_SW_L	124.03	181.85	341.80	713.15
ACC_L1_A2_Y_S_T	140.52	221.93	422.49	611.87
ACC_L1_A2_X_S_L	129.74	190.76	361.53	688.83
ACC_L2_A1_Y_SE_T	170.57	288.47	517.42	749.68
ACC_L2_A1_X_SE_L	192.47	316.11	515.25	833.57
ACC_L2_C1_Y_NE_T	192.32	315.68	605.46	822.85
ACC_L2_C1_X_NE_L	191.56	316.43	519.73	825.66
ACC_L2_C2_Y_N_T	195.29	318.60	591.81	838.45
ACC_L2_C2_X_N_L	185.30	295.62	484.01	760.68
ACC_L2_C3_Y_NW_T	206.43	334.65	584.09	789.50
ACC_L2_C3_X_NW_L	184.05	267.56	438.31	754.69
ACC_L2_B3_Y_W_T	202.92	309.98	552.59	788.09
ACC_L2_B2_Y_I_T	187.32	306.23	571.88	828.79
ACC_L2_A3_Y_SW_T	163.54	273.14	486.35	758.12
ACC_L2_A3_X_SW_L	183.63	270.84	433.01	746.56
ACC_L2_A2_Y_S_T	168.59	286.19	511.25	784.15
ACC_L2_A2_X_S_L	188.19	297.81	480.25	796.89
ACC_RL_A1_Y_SE_T	183.05	335.02	634.33	884.76
ACC_RL_A1_X_SE_L	235.44	372.89	635.67	974.77
ACC_RL_C1_Y_NE_T	199.86	366.64	702.36	877.53
ACC_RL_C1_X_NE_L	239.28	386.56	629.11	986.20
ACC_RL_C3_Y_NW_T	195.11	360.14	684.71	857.10
ACC_RL_C3_X_NW_L	222.86	329.35	548.25	939.11
ACC_RL_B3_Y_W_T	207.12	374.36	718.97	911.95
ACC_RL_B2_Y_I_T	207.35	373.18	704.33	904.04
ACC_RL_B2_X_I_L	257.83	402.31	655.47	1031.50
ACC_RL_A3_Y_SW_T	182.74	330.12	631.59	873.22
ACC_RL_A3_X_SW_L	219.48	329.15	546.22	938.32



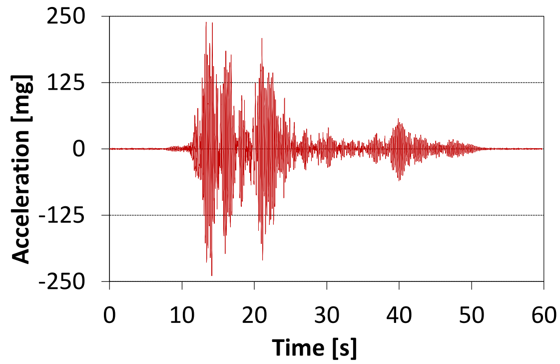
a) Shake table transverse acceleration



b) Shake table longitudinal acceleration

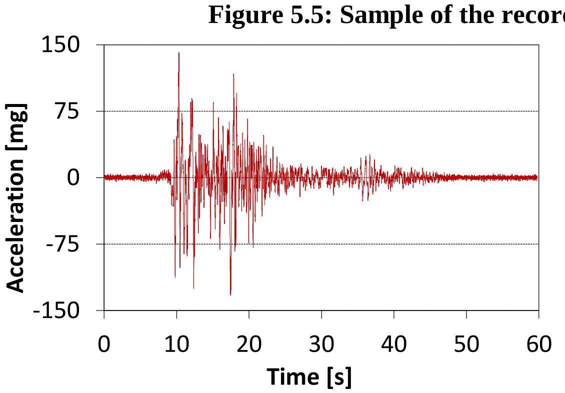


c) Roof level transverse acceleration (channel ACC_RL_C1_Y_NE_T)

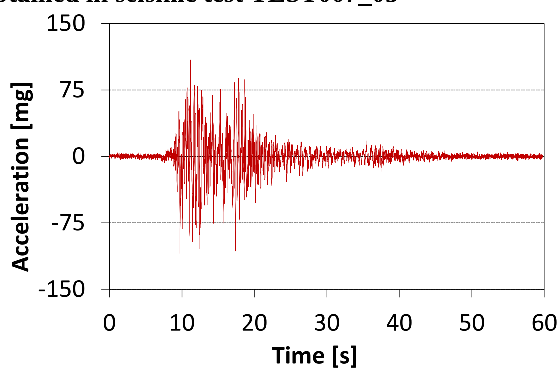


d) Roof level longitudinal acceleration (channel ACC_RL_C1_X_NE_L)

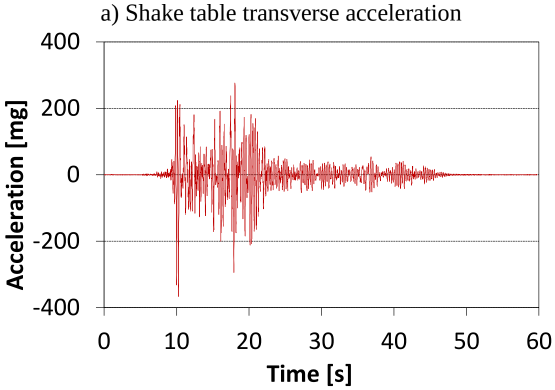
Figure 5.5: Sample of the records obtained in seismic test TEST007_05



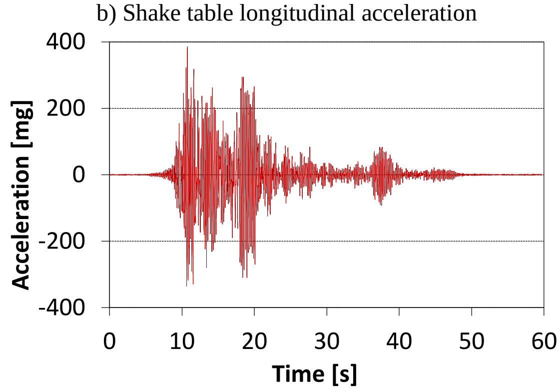
a) Shake table transverse acceleration



b) Shake table longitudinal acceleration

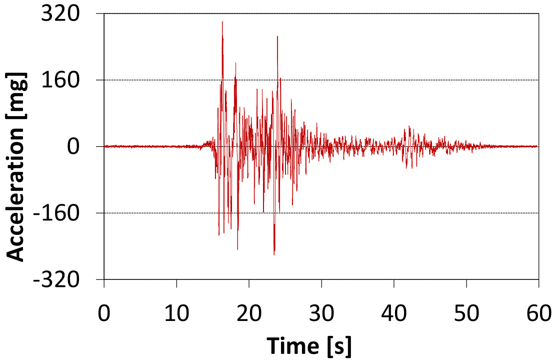


c) Roof level transverse acceleration (channel ACC_RL_C1_Y_NE_T)

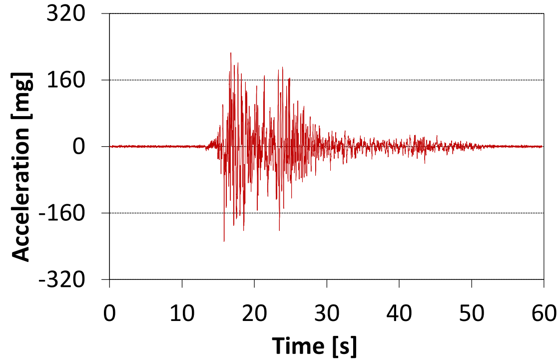


d) Roof level longitudinal acceleration (channel ACC_RL_C1_X_NE_L)

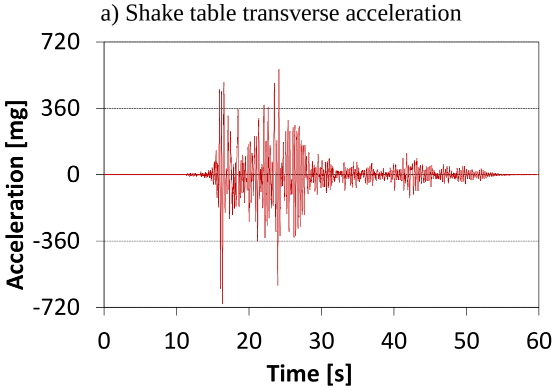
Figure 5.6: Sample of the accelerations records obtained in seismic test TEST015_03



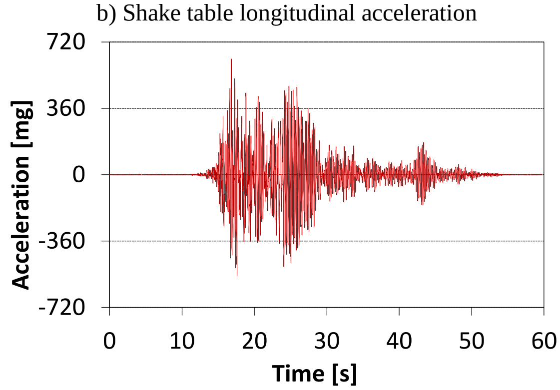
a) Shake table transverse acceleration



b) Shake table longitudinal acceleration

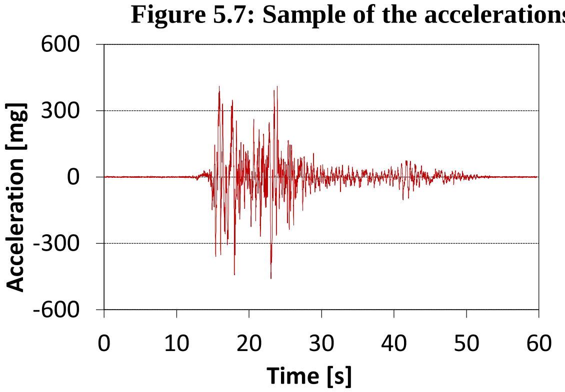


c) Roof level transverse acceleration (channel ACC_RL_C1_Y_NE_T)

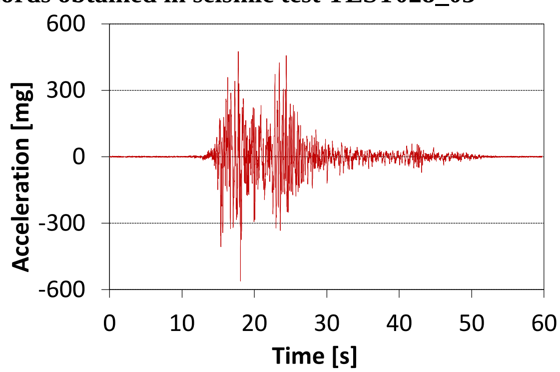


d) Roof level longitudinal acceleration (channel ACC_RL_C1_X_NE_L)

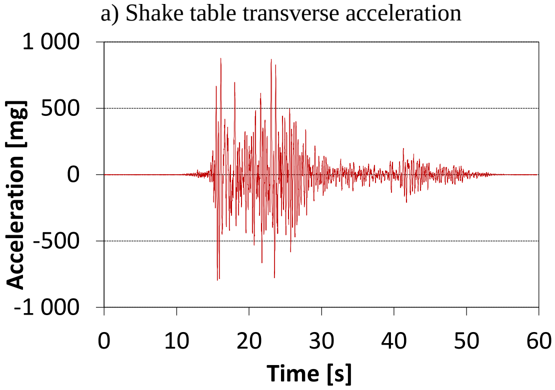
Figure 5.7: Sample of the accelerations records obtained in seismic test TEST028_03



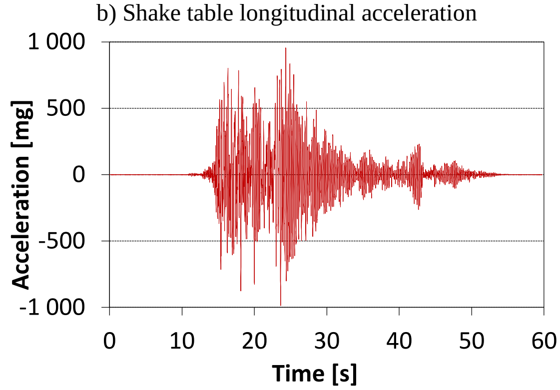
a) Shake table transverse acceleration



b) Shake table longitudinal acceleration



c) Roof level transverse acceleration (channel ACC_RL_C1_Y_NE_T)

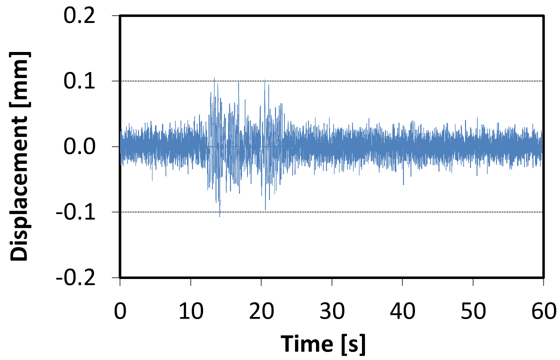


d) Roof level longitudinal acceleration (channel ACC_RL_C1_X_NE_L)

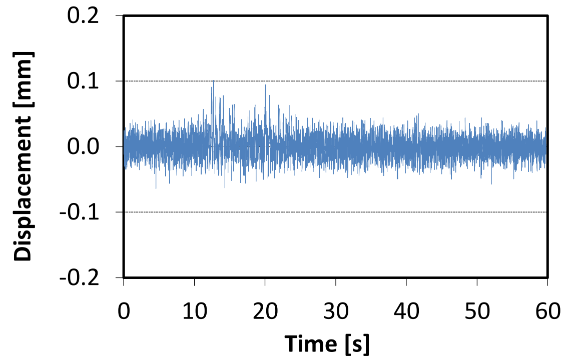
Figure 5.8: Sample of the accelerations records obtained in seismic test TEST050_03

5.2.3 Wall uplift

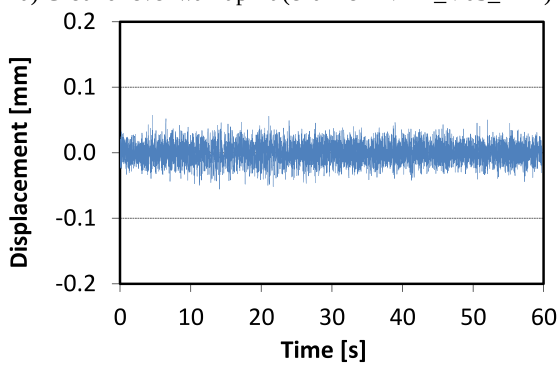
Figure 5.9 to Figure 5.12 show a small sample (four channels) of the ground and first level wall uplift displacements recorded in seismic tests TEST007_05, TEST015_03, TEST028_03 and TEST050_03.



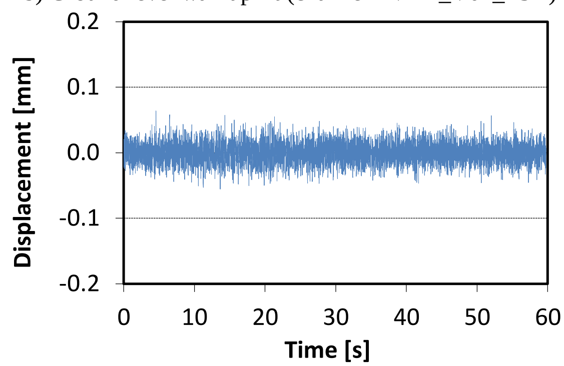
a) Ground level wall uplift (channel LVDT_V03_E2X)



b) Ground level wall uplift (channel LVDT_V01_E5X)

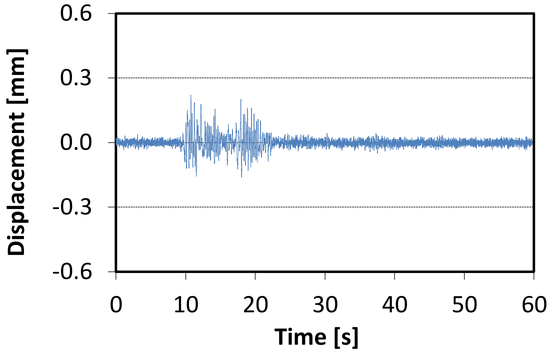


c) First level wall uplift (channel LVDT_V11_E2X)

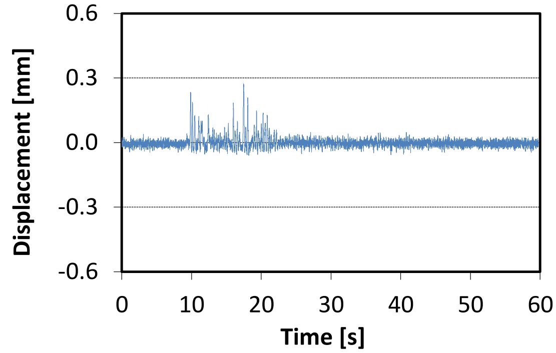


d) Second level wall uplift (channel LVDT_V13_O2x)

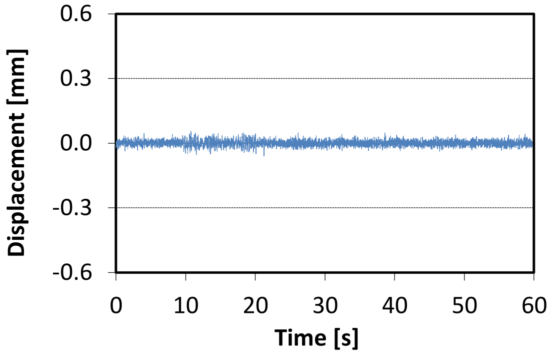
Figure 5.9: Sample of the wall uplift records obtained in seismic test TEST007_05



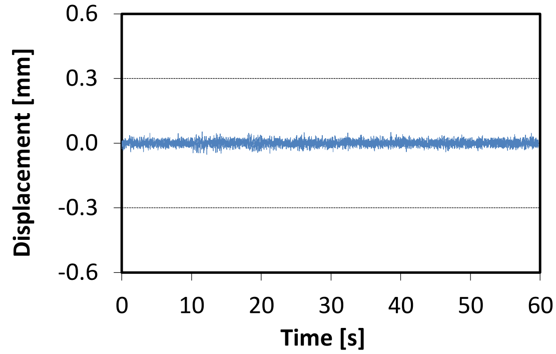
a) Ground level wall uplift (channel LVDT_V03_E2X)



b) Ground level wall uplift (channel LVDT_V01_E5X)

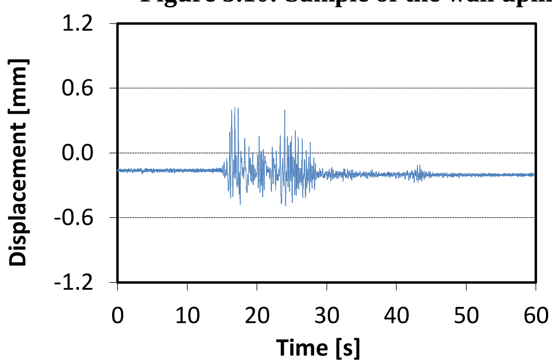


c) First level wall uplift (channel LVDT_V11_E2X)

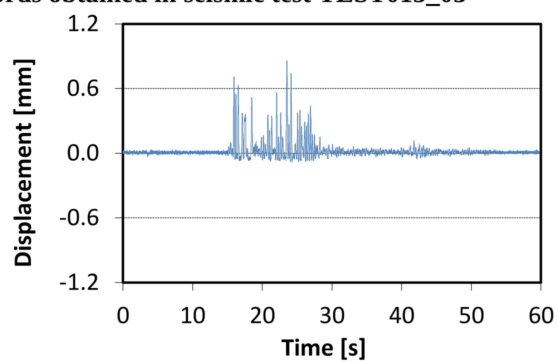


d) Second level wall uplift (channel LVDT_V13_O2x)

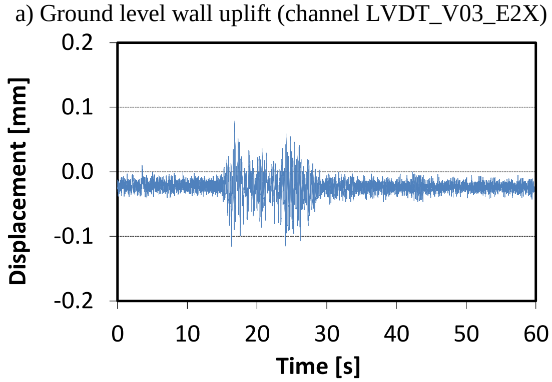
Figure 5.10: Sample of the wall uplift records obtained in seismic test TEST015_03



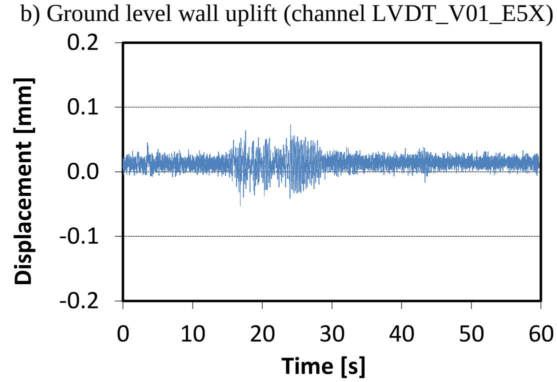
a) Ground level wall uplift (channel LVDT_V03_E2X)



b) Ground level wall uplift (channel LVDT_V01_E5X)

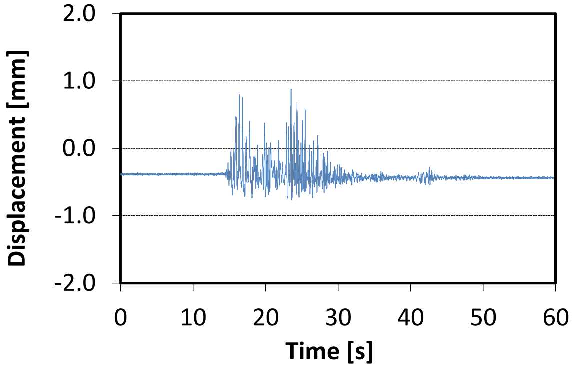


c) First level wall uplift (channel LVDT_V11_E2X)

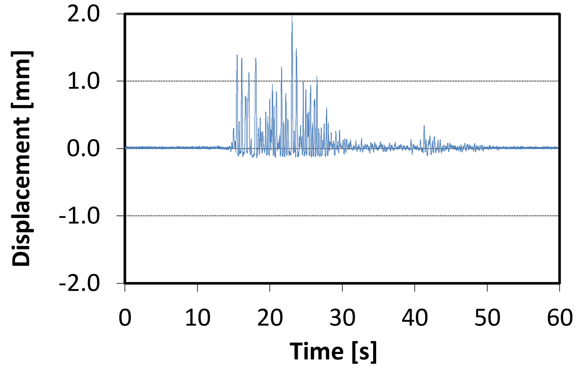


d) Second level wall uplift (channel LVDT_V13_O2x))

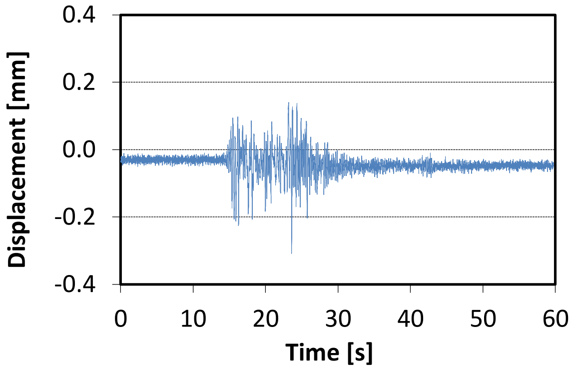
Figure 5.11: Sample of the wall uplift records obtained in seismic test TEST028_03



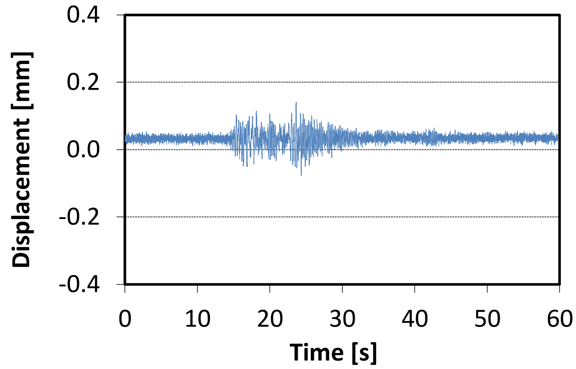
a) Ground level wall uplift (channel LVDT_V03_E2X)



b) Ground level wall uplift (channel LVDT_V01_E5X)



c) First level wall uplift (channel LVDT_V11_E2X)



d) Second level wall uplift (channel LVDT_V13_O2x)

Figure 5.12: Sample of the wall uplift records obtained in seismic test TEST050_03

The values of the maximum simultaneous on all wall uplifts were calculated and presented in Table 5.2 to Table 5.5**.** The highest value of wall uplifts measured in the test of 0.50g was 1.97mm and it was recorded at the wall 07_E5Y on the ground floor.

Table 5.2 – Maximum simultaneous values on all wall uplifts for seismic test TEST007_05

TEST007_05	V10_E5Y	V02_E5X	V03_E2X	V04_E2X	V01_E5X	V07_E5Y	V16_O4Y	V11_E2X	V12_E2X	V13_O2x	V14_O2X
V10_E5Y	0.04	0.01	0.01	0.05	0.01	0.01	0.01	0.00	0.03	0.02	0.01
V02_E5X	0.01	0.06	0.05	0.05	0.05	0.06	0.05	0.09	0.05	0.09	0.05
V03_E2X	0.00	0.05	0.05	0.06	0.06	0.07	0.06	0.13	0.06	0.12	0.07
V04_E2X	0.02	0.01	0.01	0.11	0.01	0.03	0.01	0.04	0.01	0.04	0.04
V01_E5X	0.00	0.05	0.05	0.06	0.06	0.07	0.06	0.13	0.06	0.12	0.07
V07_E5Y	0.00	0.03	0.02	0.03	0.03	0.10	0.03	0.06	0.02	0.06	0.01
V16_O4Y	0.00	0.05	0.05	0.06	0.06	0.07	0.06	0.13	0.06	0.12	0.07
V11_E2X	0.00	0.05	0.05	0.06	0.06	0.07	0.06	0.13	0.06	0.12	0.07
V12_E2X	0.00	0.05	0.05	0.06	0.06	0.07	0.06	0.13	0.06	0.12	0.07
V13_O2x	0.00	0.05	0.05	0.06	0.06	0.07	0.06	0.13	0.06	0.12	0.07
V14_O2X	0.00	0.05	0.05	0.06	0.06	0.07	0.06	0.13	0.06	0.12	0.07

Table 5.3 – Maximum simultaneous values on all wall uplifts for seismic test TEST015_03

TEST015_03	V10_E5Y	V02_E5X	V03_E2X	V04_E2X	V01_E5X	V07_E5Y	V16_O4Y	V11_E2X	V12_E2X	V13_O2x	V14_O2X
V10_E5Y	0.15	0.00	0.06	0.10	0.01	0.03	0.01	0.08	0.04	0.04	0.01
V02_E5X	0.03	0.05	0.07	0.15	0.02	0.10	0.02	0.03	0.05	0.03	0.01
V03_E2X	0.01	0.04	0.08	0.03	0.04	0.03	0.05	0.10	0.06	0.12	0.04
V04_E2X	0.02	0.01	0.04	0.21	0.02	0.00	0.02	0.04	0.03	0.06	0.04
V01_E5X	0.01	0.04	0.08	0.03	0.04	0.03	0.05	0.10	0.06	0.12	0.04
V07_E5Y	0.04	0.04	0.05	0.11	0.02	0.28	0.01	0.06	0.01	0.04	0.00
V16_O4Y	0.01	0.04	0.08	0.03	0.04	0.03	0.05	0.10	0.06	0.12	0.04
V11_E2X	0.01	0.04	0.01	0.05	0.04	0.05	0.04	0.11	0.05	0.09	0.06
V12_E2X	0.01	0.04	0.08	0.03	0.04	0.03	0.05	0.10	0.06	0.12	0.04
V13_O2x	0.01	0.04	0.08	0.03	0.04	0.03	0.05	0.10	0.06	0.12	0.04
V14_O2X	0.03	0.02	0.03	0.17	0.02	0.06	0.02	0.07	0.00	0.07	0.06

Table 5.4 – Maximum simultaneous values on all wall uplifts for seismic test TEST028_03

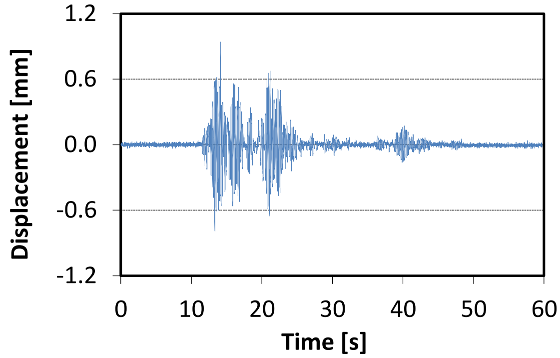
TEST028_03	V10_E5Y	V02_E5X	V03_E2X	V04_E2X	V01_E5X	V07_E5Y	V16_O4Y	V11_E2X	V12_E2X	V13_O2x	V14_O2X
V10_E5Y	0.60	0.01	0.48	0.37	0.02	0.03	0.03	0.16	0.11	0.05	0.02
V02_E5X	0.08	0.19	0.09	0.46	0.13	0.81	0.01	0.11	0.01	0.09	0.03
V03_E2X	0.59	0.02	0.48	0.39	0.02	0.03	0.03	0.16	0.12	0.05	0.02
V04_E2X	0.05	0.16	0.08	0.49	0.05	0.55	0.01	0.04	0.05	0.04	0.06
V01_E5X	0.12	0.12	0.06	0.30	0.19	0.71	0.02	0.15	0.05	0.12	0.02
V07_E5Y	0.10	0.19	0.08	0.46	0.14	0.86	0.01	0.12	0.01	0.08	0.03
V16_O4Y	0.48	0.01	0.37	0.29	0.03	0.05	0.04	0.14	0.07	0.04	0.02
V11_E2X	0.59	0.02	0.48	0.39	0.02	0.03	0.03	0.16	0.12	0.05	0.02
V12_E2X	0.23	0.06	0.20	0.33	0.02	0.03	0.00	0.02	0.12	0.05	0.04
V13_O2x	0.05	0.04	0.07	0.15	0.08	0.21	0.03	0.11	0.01	0.14	0.03
V14_O2X	0.21	0.11	0.15	0.47	0.01	0.24	0.02	0.04	0.08	0.00	0.07

Table 5.5 – Maximum simultaneous values on all wall uplifts for seismic test TEST050_03

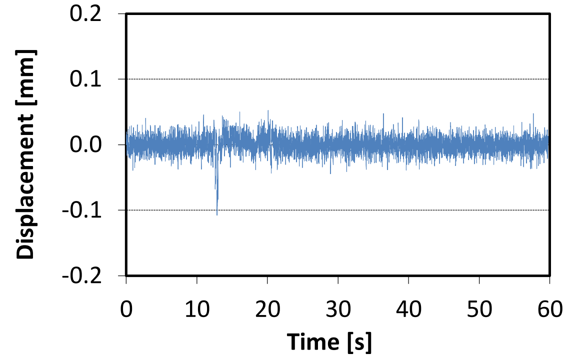
TEST050_03	V10_E5Y	V02_E5X	V03_E2X	V04_E2X	V01_E5X	V07_E5Y	V16_O4Y	V11_E2X	V12_E2X	V13_O2x	V14_O2X
V10_E5Y	1.19	0.49	1.00	0.76	0.07	0.93	0.00	0.04	0.23	0.08	0.13
V02_E5X	0.10	0.72	0.32	0.71	0.28	1.95	0.12	0.22	0.02	0.03	0.08
V03_E2X	1.17	0.04	1.08	0.47	0.07	0.04	0.05	0.24	0.21	0.15	0.07
V04_E2X	0.25	0.27	0.28	0.88	0.15	0.03	0.02	0.15	0.01	0.12	0.04
V01_E5X	0.18	0.21	0.15	0.45	0.54	1.34	0.09	0.30	0.07	0.20	0.03
V07_E5Y	0.06	0.72	0.30	0.71	0.30	1.97	0.13	0.23	0.02	0.04	0.07
V16_O4Y	0.22	0.63	0.12	0.70	0.37	1.75	0.21	0.28	0.06	0.08	0.04
V11_E2X	0.18	0.21	0.15	0.45	0.54	1.34	0.09	0.30	0.07	0.20	0.03
V12_E2X	1.11	0.19	0.88	0.72	0.08	0.00	0.01	0.13	0.31	0.01	0.13
V13_O2x	0.13	0.20	0.06	0.67	0.40	0.06	0.07	0.06	0.13	0.25	0.08
V14_O2X	1.19	0.52	1.00	0.76	0.07	1.05	0.00	0.05	0.22	0.13	0.14

5.2.4 Wall sliding

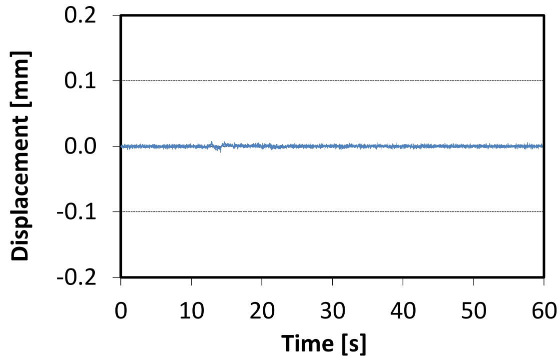
Figure 5.13 to Figure 5.16 show a small sample (four channels) of the ground and first levels wall sliding displacements recorded in seismic tests TEST007_05, TEST015_03, TEST028_03 and TEST050_03.



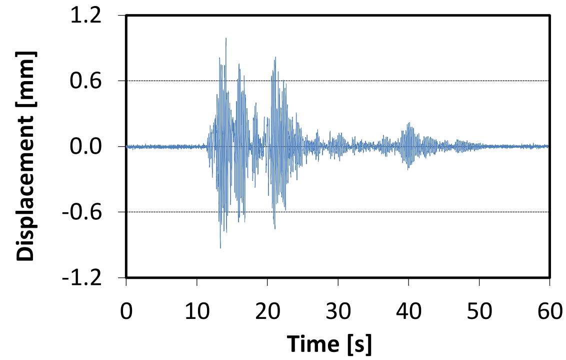
a) Ground level East wall sliding (channel LVDT_H03)



b) First level East wall sliding (channel LVDT_H04)

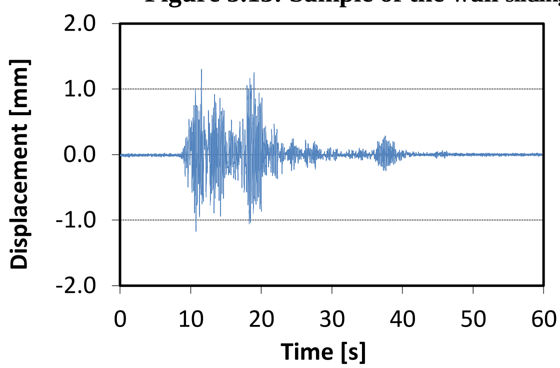


c) Ground level North wall sliding (channel LVDT_H05)

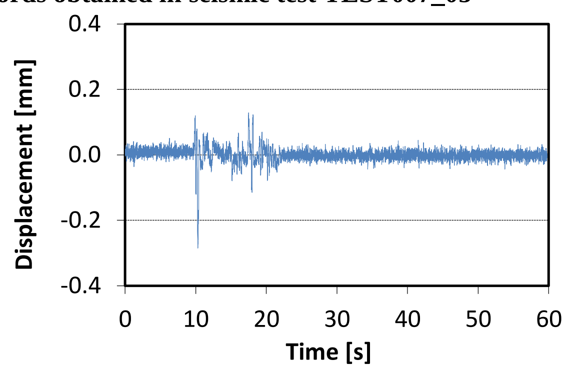


d) First level North wall sliding (channel LVDT_H07)

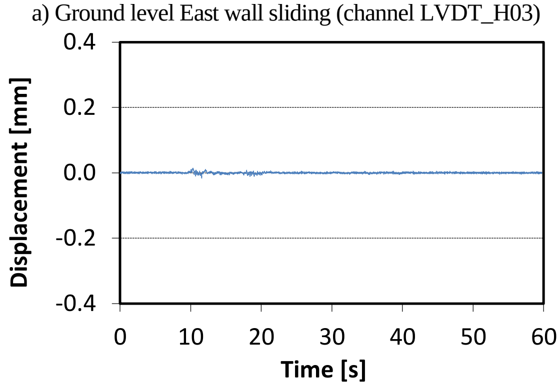
Figure 5.13: Sample of the wall sliding records obtained in seismic test TEST007_05



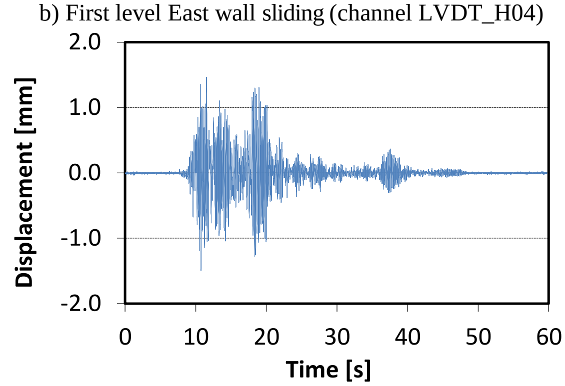
a) Ground level East wall sliding (channel LVDT_H03)



b) First level East wall sliding (channel LVDT_H04)

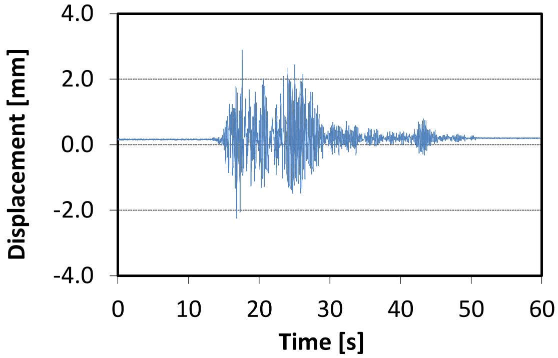


c) Ground level North wall sliding (channel LVDT_H05)

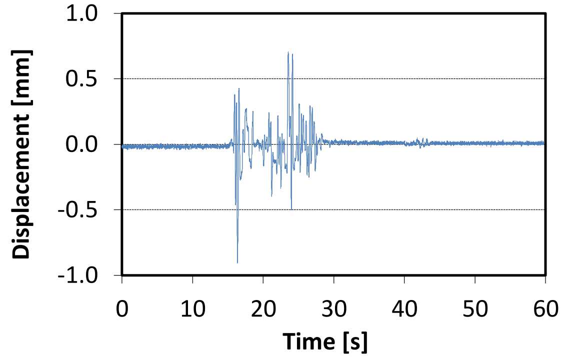


d) First level North wall sliding displacement (channel LVDT_H07)

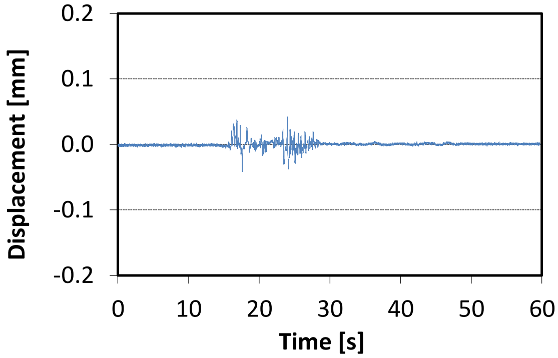
Figure 5.14: Sample of the wall sliding records obtained in seismic test TEST015_03



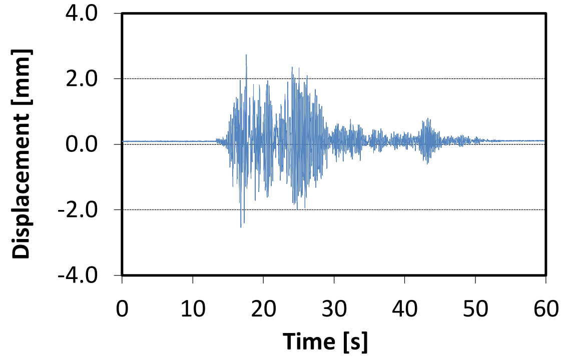
a) Ground level East wall sliding (channel LVDT_H03)



b) First level East wall sliding (channel LVDT_H04)

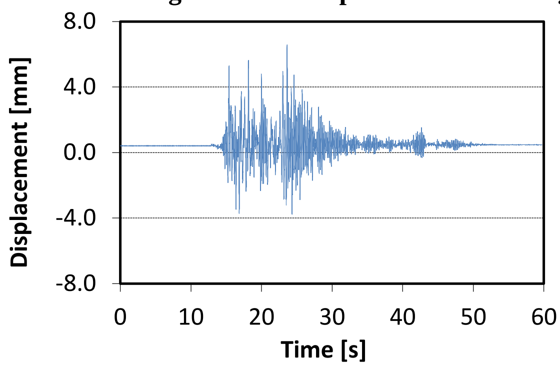


c) Ground level North wall sliding (channel LVDT_H05)

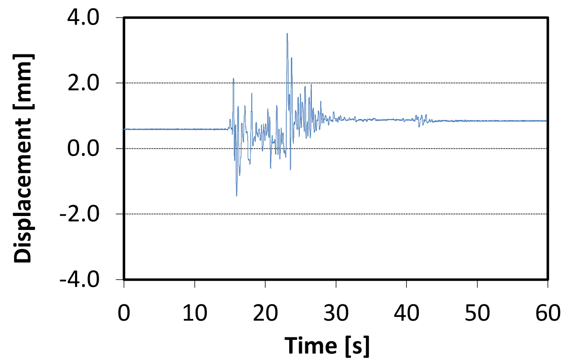


d) First level North wall sliding (channel LVDT_H07)

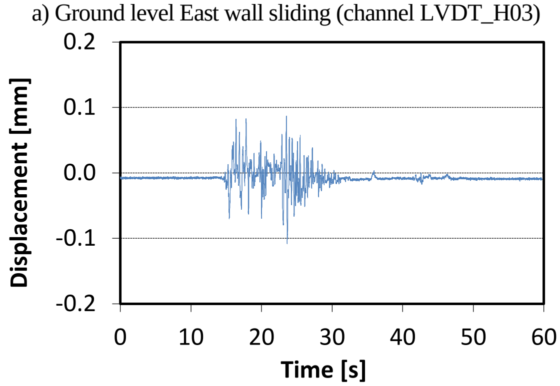
Figure 5.15: Sample of the wall sliding records obtained in seismic test TEST028_03



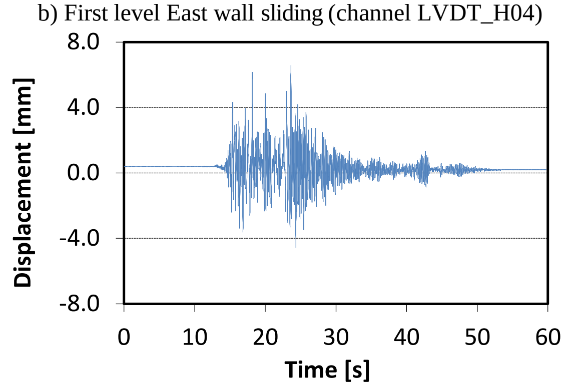
a) Ground level East wall sliding (channel LVDT_H03)



b) First level East wall sliding (channel LVDT_H04)



c) Ground level North wall sliding (channel LVDT_H05)



d) First level North wall sliding (channel LVDT_H07)

Figure 5.16: Sample of the wall sliding records obtained in seismic test TEST050_03

The values of the maximum simultaneous on all walls sliding were calculated and presented in Table 5.6 to Table 5.9**.** The highest value of wall uplifts measured in the test of 0.50g was 3.52mm and it was recorded at the wall 07 on the first floor.

Table 5.6 – Maximum simultaneous values on all wall sliding for seismic test TEST007_05

TEST007_05	LVDT_H05	LVDT_H03	LVDT_H04	LVDT_H07
LVDT_H05	0.03	0.01	0.05	0.03
LVDT_H03	0.01	0.01	0.04	0.01
LVDT_H04	0.03	0.01	0.05	0.05
LVDT_H07	0.01	0.00	0.03	0.11

Table 5.7 – Maximum simultaneous values on all wall sliding for seismic test TEST015_03

TEST015_03	LVDT_H05	LVDT_H03	LVDT_H04	LVDT_H07
LVDT_H05	0.03	0.00	0.04	0.03
LVDT_H03	0.01	0.02	0.06	0.00
LVDT_H04	0.01	0.02	0.06	0.00
LVDT_H07	0.01	0.01	0.00	0.30

Table 5.8 – Maximum simultaneous values on all wall sliding for seismic test TEST028_03

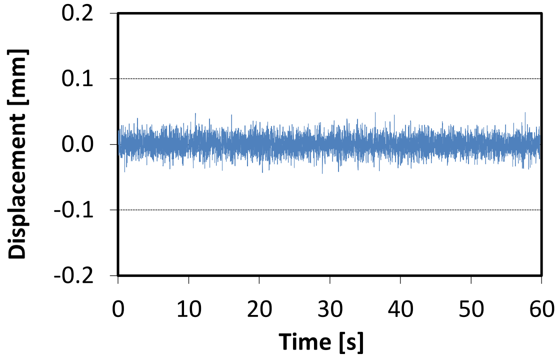
TEST028_03	LVDT_H05	LVDT_H03	LVDT_H04	LVDT_H07
LVDT_H05	0.15	0.03	0.02	0.71
LVDT_H03	0.07	0.04	0.00	0.27
LVDT_H04	0.03	0.03	0.14	0.87
LVDT_H07	0.02	0.03	0.11	0.90

Table 5.9 – Maximum simultaneous values on all wall sliding for seismic test TEST050_03

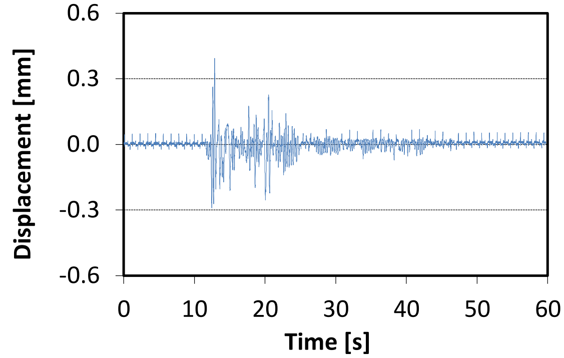
TEST050_03	LVDT_H05	LVDT_H03	LVDT_H04	LVDT_H07
LVDT_H05	0.26	0.01	0.53	0.57
LVDT_H03	0.15	0.11	0.25	0.86
LVDT_H04	0.26	0.07	0.59	0.62
LVDT_H07	0.18	0.08	0.03	3.52

5.2.5 Inter-storey drift

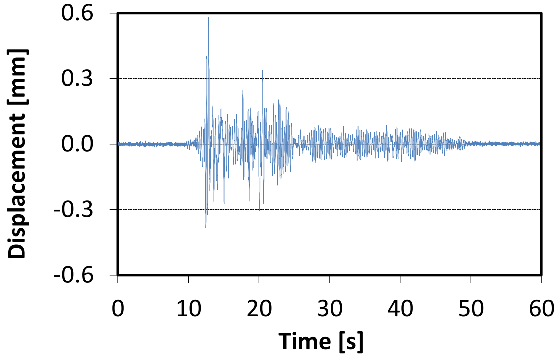
Figure 5.17 to Figure 5.20 show a small sample (four channels) of the ground and first levels inter-storey drift displacements recorded in seismic tests TEST007_05, TEST015_03, TEST028_03 and TEST050_03.



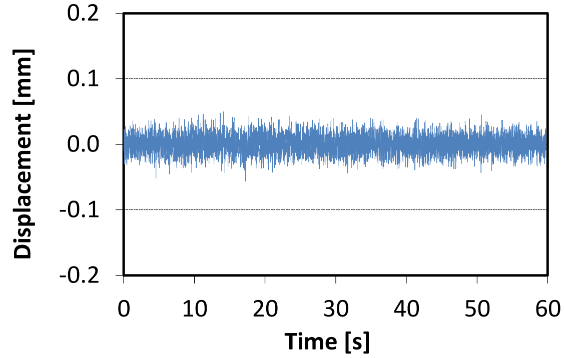
a) Internal inter-storey inside wall (channel LVDT_IID02)



b) Internal inter-storey inside wall (channel LVDT_IID04)

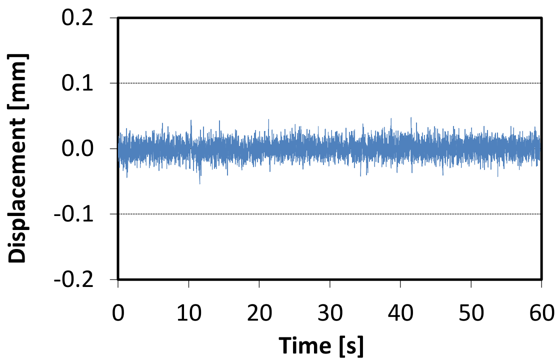


c) Internal inter-storey North wall (channel LVDT_IID01)

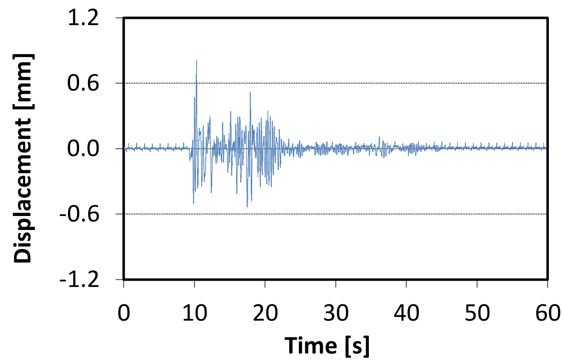


d) Internal inter-storey North wall (channel LVDT_IID03)

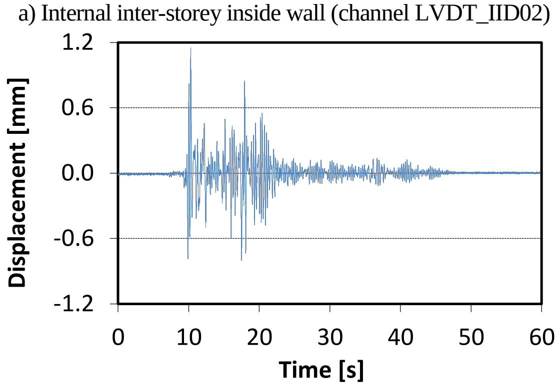
Figure 5.17: Sample of the inter-storey drift records obtained in seismic test TEST007_05



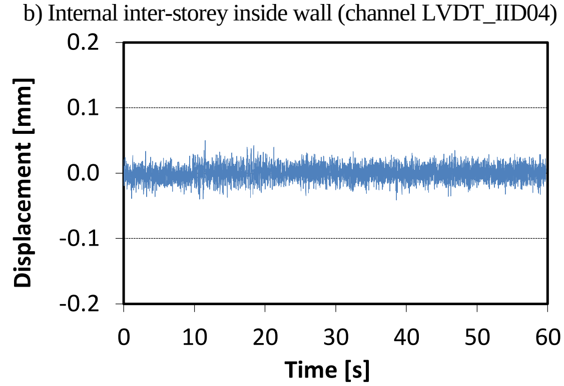
a) Internal inter-storey inside wall (channel LVDT_IID02)



b) Internal inter-storey inside wall (channel LVDT_IID04)

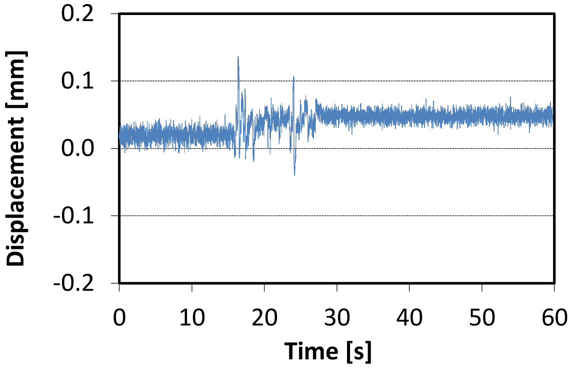


c) Internal inter-storey North wall (channel LVDT_IID01)

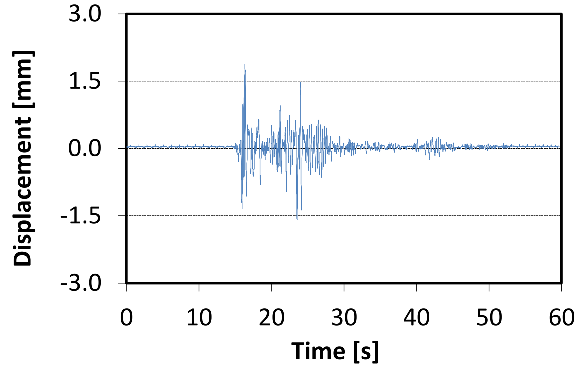


d) Internal inter-storey North wall (channel LVDT_IID03)

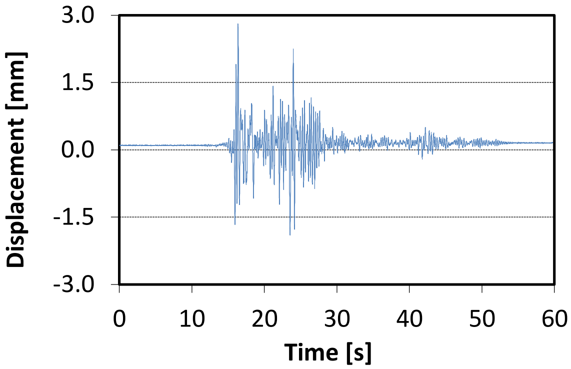
Figure 5.18: Sample of the inter-storey drift records obtained in seismic test TEST015_03



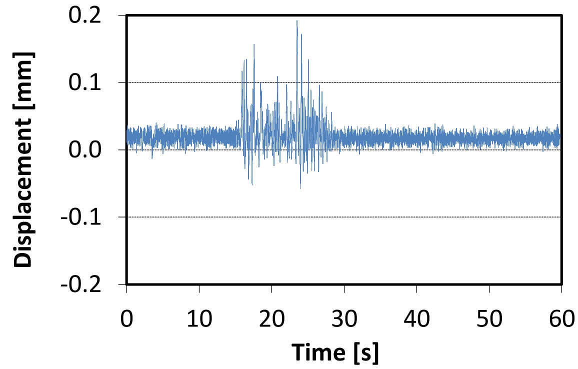
a) Internal inter-storey inside wall (channel LVDT_IID02)



b) Internal inter-storey inside wall (channel LVDT_IID04)

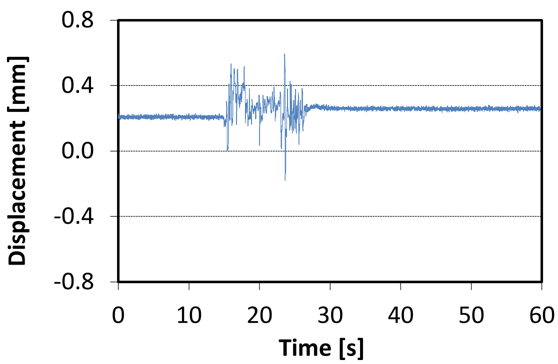


c) Internal inter-storey North wall (channel LVDT_IID01)

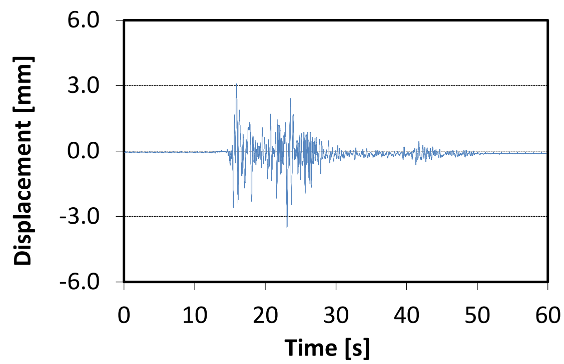


d) Internal inter-storey North wall (channel LVDT_IID03)

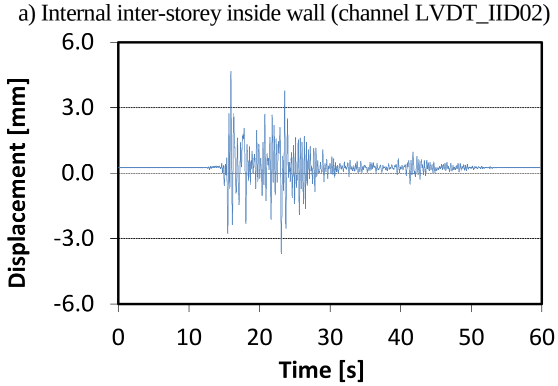
Figure 5.19: Sample of the inter-storey drift records obtained in seismic test TEST028_03



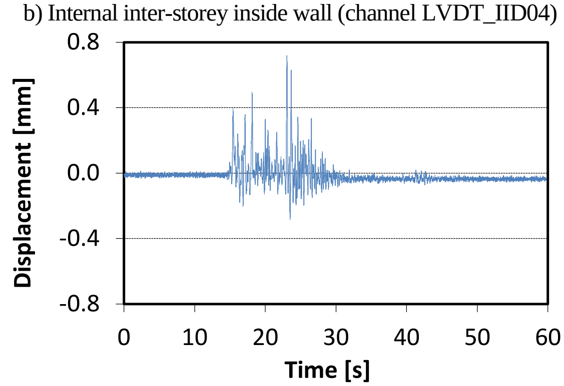
a) Internal inter-storey inside wall (channel LVDT_IID02)



b) Internal inter-storey inside wall (channel LVDT_IID04)



c) Internal inter-storey North wall (channel LVDT_IID01)



d) Internal inter-storey North wall (channel LVDT_IID03)

Figure 5.20: Sample of the inter-storey drift records obtained in seismic test TEST050_03

The values of the maximum simultaneous on all inter-storey drifts were calculated and presented in Table 5.10 to Table 5.13**.** The highest value of inter-storey drifts measured in the test of 0.50g was 6.59mm and it was recorded at the ground floor.

Table 5.10 – Maximum simultaneous values on all inter-storey drifts for seismic test TEST007_05

TEST007_05	LVDT_IID 02	LVDT_IID 04	LVDT_IID 01	LVDT_IID 03
LVDT_IID02	0.92	0.86	0.14	0.14
LVDT_IID04	0.66	0.97	0.17	0.14
LVDT_IID01	0.07	0.12	0.39	0.56
LVDT_IID03	0.20	0.46	0.27	0.58

Table 5.11 – Maximum simultaneous values on all inter-storey drifts for seismic test TEST015_03

TEST015_03	LVDT_IID 02	LVDT_IID 04	LVDT_IID 01	LVDT_IID 03
LVDT_IID02	1.29	1.28	0.23	0.24
LVDT_IID04	1.16	1.51	0.15	0.16
LVDT_IID01	0.47	0.84	0.82	1.17
LVDT_IID03	0.47	0.84	0.82	1.17

Table 5.12 – Maximum simultaneous values on all inter-storey drifts for seismic test TEST028_03

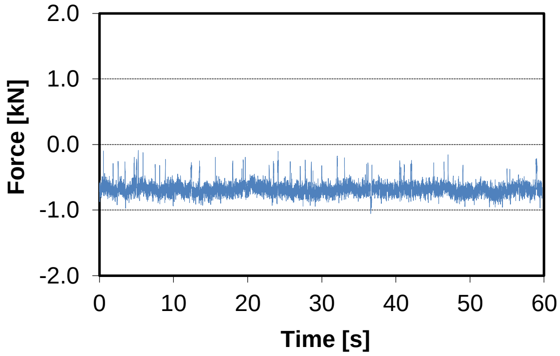
TEST028_03	LVDT_IID 02	LVDT_IID 04	LVDT_IID 01	LVDT_IID 03
LVDT_IID02	2.90	2.45	0.46	0.51
LVDT_IID04	2.74	2.74	0.48	0.48
LVDT_IID01	0.85	1.24	1.87	2.81
LVDT_IID03	0.85	1.24	1.87	2.81

Table 5.13 – Maximum simultaneous values on all inter-storey drifts for seismic test TEST050_03

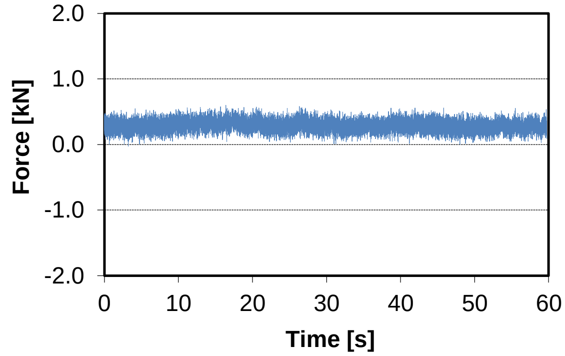
TEST050_03	LVDT_IID 02	LVDT_IID 04	LVDT_IID 01	LVDT_IID 03
LVDT_IID02	6.59	6.25	0.24	1.25
LVDT_IID04	6.02	6.58	0.87	0.07
LVDT_IID01	3.90	3.72	3.50	3.39
LVDT_IID03	1.70	2.07	3.03	4.66

5.2.6 Hold-down forces

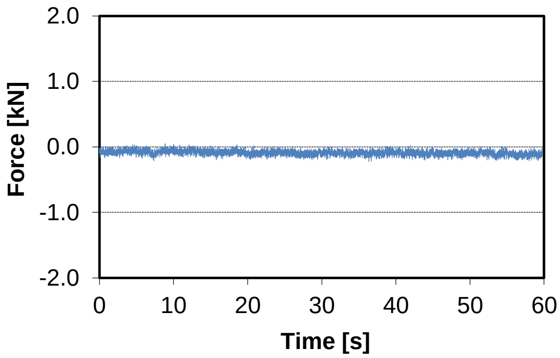
Figure 5.17 to Figure 5.20 show a small sample (four channels) of hold-down forces recorded in seismic tests TEST007_05, TEST015_03, TEST028_03 and TEST050_03.



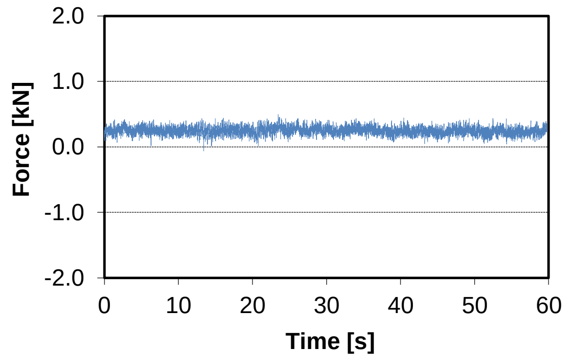
a) Hold-down load cell (channel LC_08_E4y_INTERIOR)



b) Hold-down load cell (channel LC_02_E2x_E)

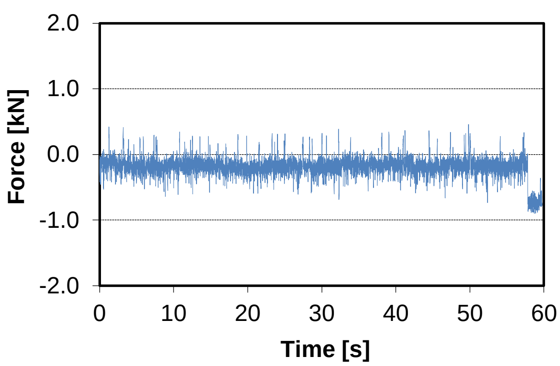


c) Hold-down load cell (channel LC_14_E3x_N)

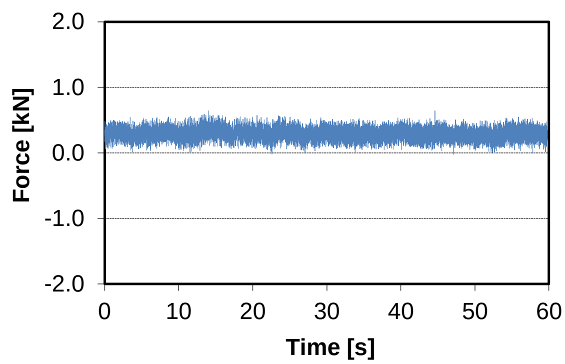


d) Hold-down load cell (channel LC_13_E3x_S)

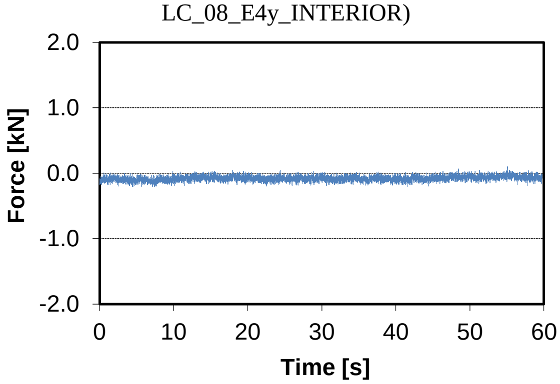
Figure 5.21: Sample of the hold-down forces records obtained in seismic test TEST007_05



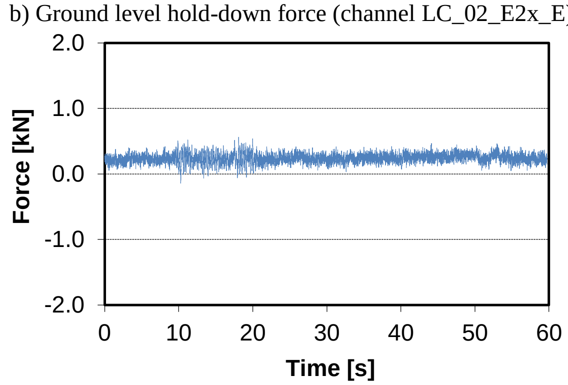
a) Ground level hold-down force (channel LC_08_E4y_INTERIOR)



b) Ground level hold-down force (channel LC_02_E2x_E)

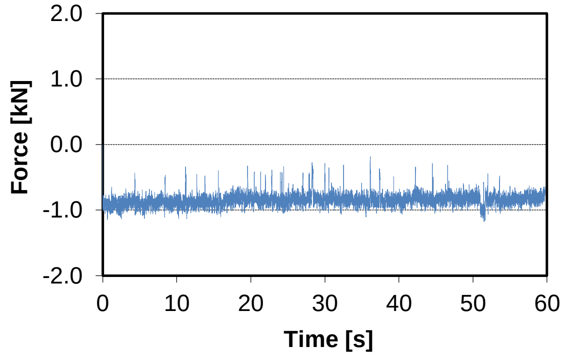


c) Ground level hold-down force (channel LC_14_E3x_N)

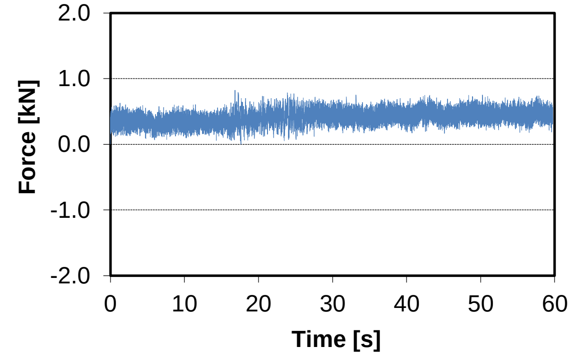


d) Ground level hold-down force (channel LC_13_E3x_S)

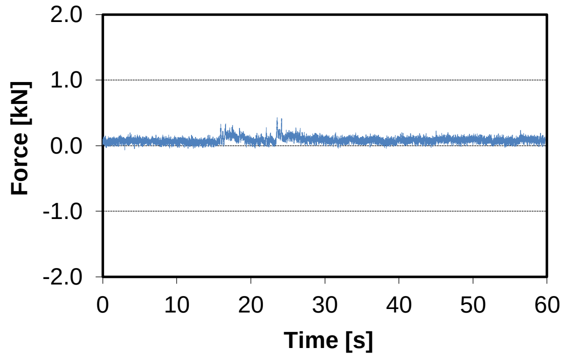
Figure 5.22: Sample of the hold-down forces records obtained in seismic test TEST015_03



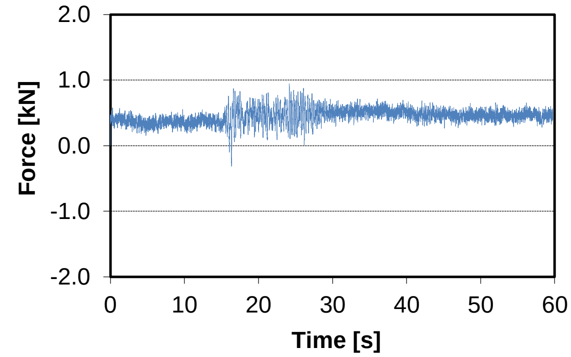
a) Ground level hold-down force (channel LC_08_E4y_INTERIOR)



b) Ground level hold-down force (channel LC_02_E2x_E)

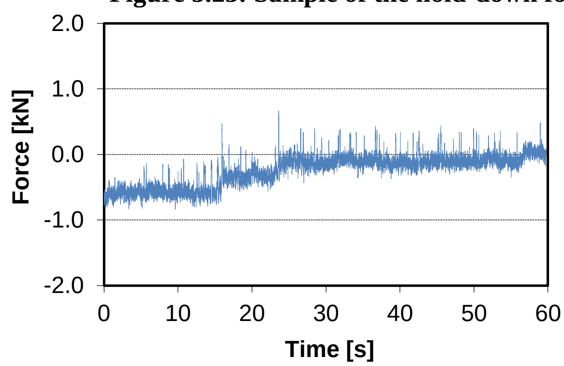


c) Ground level hold-down force (channel LC_14_E3x_N)

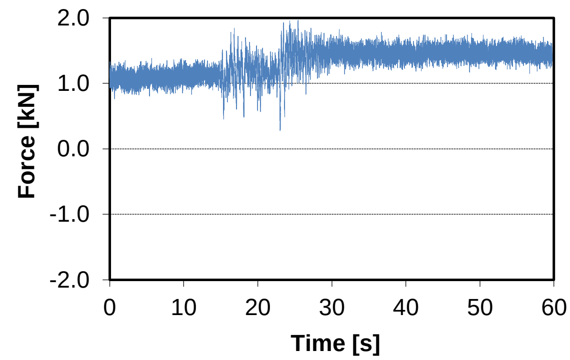


d) Ground level hold-down force (channel LC_13_E3x_S)

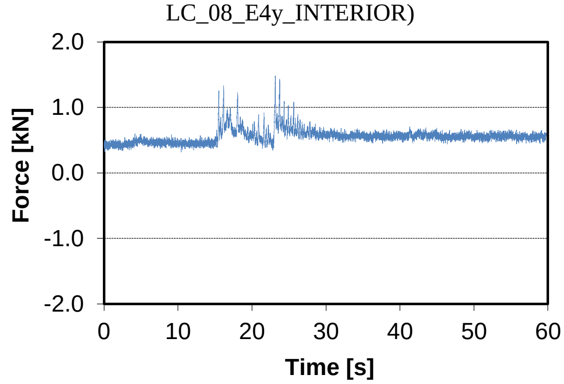
Figure 5.23: Sample of the hold-down forces records obtained in seismic test TEST028_03



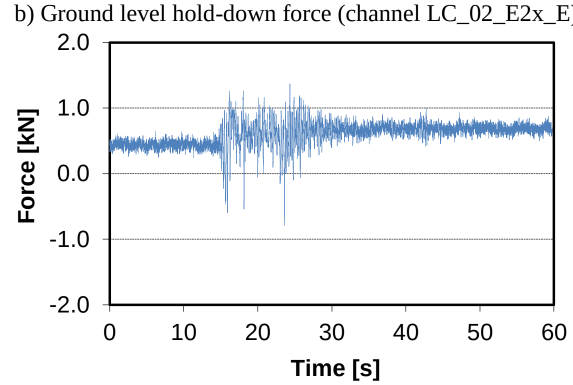
a) Ground level hold-down force (channel LC_08_E4y_INTERIOR)



b) Ground level hold-down force (channel LC_02_E2x_E)



c) Ground level hold-down force (channel LC_14_E3x_N)



d) Ground level hold-down force (channel LC_13_E3x_S)

Figure 5.24: Sample of the hold-down forces records obtained in seismic test TEST050_03

Table 5.14 to Table 5.17 illustrated maximum simultaneous values on all load cells for the seismic tests 0.07g, 0.15g, 0.28g and 0.50g.

Table 5.14 – Maximum simultaneous values on all load cells for seismic test TEST007_05

TEST007_05	01_E5x_SW	02_E2x_E	03_E5x_NW	16_E2x_NE	05_E3y_ INTERIOR	06_E3y_ INTERIOR	07_E4y_ INTERIOR	08_E4y_ INTERIOR	09_E5y_N	10_E5y_NE	11_E1y_SE	04_E1y_S	13_E3x_S	14_E3x_N	15_O2x_NE	12_O2x_E
01_E5x_SW	0.43	0.13	0.28	0.32	0.03	0.10	0.06	0.07	0.01	0.67	0.02	0.20	0.06	0.01	0.27	0.11
02_E2x_E	0.17	0.40	0.19	0.28	0.04	0.12	0.04	0.07	0.02	0.64	0.03	0.21	0.02	0.01	0.21	0.07
03_E5x_NW	0.13	0.21	0.60	0.21	0.07	0.04	0.01	0.02	0.10	0.77	0.03	0.32	0.01	0.01	0.37	0.11
16_E2x_NE	0.26	0.15	0.26	0.64	0.01	0.10	0.10	0.09	0.10	0.77	0.09	0.00	0.10	0.01	0.13	0.08
05_E3y_INTERIOR	0.10	0.17	0.29	0.45	0.11	0.02	0.05	0.06	0.10	0.80	0.03	0.06	0.05	0.05	0.32	0.05
06_E3y_INTERIOR	0.23	0.21	0.28	0.10	0.05	0.18	0.08	0.10	0.13	0.71	0.04	0.19	0.05	0.01	0.13	0.04
07_E4y_INTERIOR	0.24	0.22	0.15	0.37	0.00	0.08	0.13	0.12	0.05	0.69	0.05	0.03	0.11	0.03	0.20	0.06
08_E4y_INTERIOR	0.23	0.09	0.13	0.17	0.05	0.16	0.05	0.19	0.09	0.71	0.05	0.12	0.00	0.00	0.13	0.06
09_E5y_N	0.24	0.26	0.16	0.42	0.01	0.07	0.02	0.12	0.28	0.61	0.08	0.09	0.04	0.05	0.24	0.11
10_E5y_NE	0.12	0.13	0.36	0.13	0.01	0.03	0.07	0.05	0.03	1.05	0.08	0.30	0.02	0.06	0.29	0.12
11_E1y_SE	0.08	0.22	0.26	0.12	0.01	0.04	0.02	0.07	0.01	0.70	0.31	0.43	0.06	0.03	0.23	0.07
04_E1y_S	0.17	0.11	0.39	0.07	0.02	0.04	0.00	0.04	0.09	0.66	0.02	0.53	0.00	0.06	0.33	0.08
13_E3x_S	0.13	0.14	0.40	0.20	0.06	0.03	0.01	0.05	0.04	0.74	0.11	0.38	0.16	0.10	0.18	0.03
14_E3x_N	0.10	0.11	0.36	0.50	0.02	0.03	0.00	0.04	0.01	0.73	0.00	0.24	0.07	0.15	0.30	0.07
15_O2x_NE	0.19	0.13	0.40	0.13	0.05	0.01	0.05	0.01	0.00	0.38	0.07	0.26	0.05	0.03	0.50	0.09
12_O2x_E	0.14	0.15	0.33	0.30	0.03	0.03	0.02	0.04	0.02	0.71	0.05	0.36	0.01	0.01	0.29	0.23

Table 5.15 – Maximum simultaneous values on all load cells for seismic test TEST015_03

TEST015_03	01_E5x_SW	02_E2x_E	03_E5x_NW	16_E2x_NE	05_E3y_ INTERIOR	06_E3y_ INTERIOR	07_E4y_ INTERIOR	08_E4y_ INTERIOR	09_E5y_N	10_E5y_NE	11_E1y_SE	04_E1y_S	13_E3x_S	14_E3x_N	15_O2x_NE	12_O2x_E
01_E5x_SW	0.46	0.22	0.12	0.38	0.00	0.13	0.08	0.23	0.05	0.19	0.08	0.20	0.00	0.05	0.26	0.07
02_E2x_E	0.20	0.43	0.23	0.42	0.02	0.11	0.11	0.20	0.08	0.14	0.03	0.13	0.02	0.04	0.21	0.06
03_E5x_NW	0.13	0.17	0.64	0.06	0.00	0.07	0.03	0.15	0.12	0.01	0.01	0.38	0.06	0.02	0.23	0.11
16_E2x_NE	0.16	0.03	0.25	0.66	0.01	0.08	0.08	0.16	0.01	0.11	0.01	0.30	0.05	0.01	0.20	0.02
05_E3y_INTERIOR	0.04	0.10	0.32	0.02	0.20	0.24	0.03	0.24	0.15	0.27	0.17	0.40	0.07	0.05	0.08	0.13
06_E3y_INTERIOR	0.15	0.19	0.05	0.11	0.14	0.28	0.06	0.30	0.14	0.22	0.06	0.15	0.01	0.04	0.06	0.09
07_E4y_INTERIOR	0.27	0.06	0.20	0.37	0.00	0.13	0.15	0.19	0.14	0.20	0.05	0.25	0.00	0.05	0.27	0.05
08_E4y_INTERIOR	0.10	0.21	0.08	0.14	0.18	0.27	0.09	0.31	0.04	0.09	0.06	0.25	0.01	0.01	0.14	0.08
09_E5y_N	0.09	0.13	0.23	0.15	0.01	0.11	0.02	0.15	0.37	0.30	0.04	0.19	0.08	0.02	0.26	0.14
10_E5y_NE	0.16	0.07	0.41	0.13	0.02	0.11	0.04	0.11	0.07	0.90	0.13	0.40	0.01	0.03	0.29	0.06
11_E1y_SE	0.21	0.14	0.32	0.07	0.02	0.09	0.01	0.13	0.01	0.17	0.28	0.33	0.01	0.02	0.28	0.03
04_E1y_S	0.16	0.06	0.37	0.23	0.02	0.05	0.03	0.09	0.03	0.31	0.07	0.61	0.07	0.01	0.14	0.08
13_E3x_S	0.16	0.15	0.30	0.27	0.00	0.08	0.07	0.19	0.07	0.25	0.00	0.27	0.17	0.01	0.24	0.10
14_E3x_N	0.29	0.15	0.09	0.22	0.02	0.07	0.05	0.09	0.07	0.26	0.05	0.23	0.11	0.16	0.10	0.09
15_O2x_NE	0.10	0.00	0.48	0.28	0.00	0.08	0.03	0.11	0.08	0.23	0.09	0.20	0.03	0.09	0.56	0.04
12_O2x_E	0.20	0.07	0.36	0.11	0.03	0.09	0.01	0.11	0.14	0.19	0.07	0.31	0.01	0.01	0.22	0.21

Table 5.16 – Maximum simultaneous values on all load cells for seismic test TEST028_03

TEST028_03	01_E5x_SW	02_E2x_E	03_E5x_NW	16_E2x_NE	05_E3y_ INTERIOR	06_E3y_ INTERIOR	07_E4y_ INTERIOR	08_E4y_ INTERIOR	09_E5y_N	10_E5y_NE	11_E1y_SE	04_E1y_S	13_E3x_S	14_E3x_N	15_O2x_NE	12_O2x_E
01_E5x_SW	0.57	0.20	0.29	0.39	0.26	0.27	0.11	0.30	0.30	0.85	0.07	0.15	0.17	0.32	0.63	0.31
02_E2x_E	0.38	0.49	0.28	0.48	0.18	0.40	0.13	0.51	0.28	0.74	0.01	0.31	0.25	0.18	0.47	0.12
03_E5x_NW	0.19	0.29	0.82	0.03	0.13	0.34	0.03	0.42	0.26	0.94	0.08	0.26	0.07	0.30	0.83	0.17
16_E2x_NE	0.24	0.01	0.51	0.81	0.21	0.25	0.06	0.30	0.27	0.91	0.05	0.31	0.30	0.23	0.53	0.19
05_E3y_INTERIOR	0.22	0.07	0.26	0.08	0.33	0.54	0.02	0.61	0.16	0.86	0.06	0.46	0.06	0.10	0.32	0.07
06_E3y_INTERIOR	0.26	0.19	0.06	0.15	0.22	0.56	0.08	0.62	0.15	0.80	0.05	0.29	0.02	0.20	0.26	0.09
07_E4y_INTERIOR	0.45	0.20	0.40	0.16	0.06	0.51	0.19	0.64	0.23	0.58	0.11	0.27	0.22	0.15	0.31	0.14
08_E4y_INTERIOR	0.18	0.01	0.17	0.08	0.23	0.53	0.07	0.65	0.16	0.80	0.02	0.32	0.00	0.16	0.27	0.10
09_E5y_N	0.35	0.14	0.36	0.51	0.12	0.41	0.09	0.53	0.59	0.79	0.03	0.27	0.19	0.24	0.45	0.13
10_E5y_NE	0.29	0.05	0.52	0.48	0.10	0.36	0.08	0.49	0.31	1.18	0.02	0.25	0.19	0.20	0.47	0.07
11_E1y_SE	0.16	0.06	0.54	0.47	0.10	0.28	0.03	0.36	0.20	1.01	0.29	0.37	0.13	0.20	0.41	0.10
04_E1y_S	0.25	0.21	0.44	0.21	0.08	0.23	0.00	0.33	0.08	0.95	0.12	0.64	0.12	0.22	0.33	0.00
13_E3x_S	0.37	0.24	0.05	0.62	0.16	0.32	0.10	0.40	0.39	0.76	0.03	0.33	0.39	0.08	0.35	0.28
14_E3x_N	0.21	0.05	0.31	0.27	0.10	0.40	0.10	0.50	0.28	0.78	0.07	0.29	0.09	0.38	0.34	0.19
15_O2x_NE	0.32	0.13	0.49	0.47	0.28	0.13	0.08	0.22	0.38	0.70	0.02	0.17	0.31	0.25	0.95	0.36
12_O2x_E	0.48	0.34	0.27	0.66	0.20	0.16	0.11	0.25	0.42	0.97	0.08	0.15	0.16	0.19	0.73	0.43

Table 5.17 – Maximum simultaneous values on all load cells for seismic test TEST050_03

TEST050_03	01_E5x_SW	02_E2x_E	03_E5x_NW	16_E2x_NE	05_E3y_ INTERIOR	06_E3y_ INTERIOR	07_E4y_ INTERIOR	08_E4y_ INTERIOR	09_E5y_N	10_E5y_NE	11_E1y_SE	04_E1y_S	13_E3x_S	14_E3x_N	15_O2x_NE	12_O2x_E
01_E5x_SW	1.27	0.22	1.14	0.50	0.61	0.43	0.13	0.39	1.80	0.42	0.29	0.34	1.35	0.56	1.18	1.11
02_E2x_E	0.83	0.56	1.30	0.69	0.59	0.95	0.30	0.93	2.52	0.10	0.25	0.08	1.72	0.64	0.73	0.63
03_E5x_NW	0.86	0.11	1.97	0.44	0.45	1.02	0.15	0.92	2.31	0.20	0.08	0.19	1.82	0.73	0.91	0.66
16_E2x_NE	0.96	0.43	0.57	1.55	0.64	0.12	0.14	0.12	2.20	0.24	0.07	0.18	1.48	0.63	0.12	1.04
05_E3y_INTERIOR	0.92	0.27	1.25	0.99	0.70	0.83	0.25	0.82	2.56	0.04	0.24	0.21	1.78	0.80	0.87	0.81
06_E3y_INTERIOR	0.86	0.24	1.41	0.21	0.20	1.19	0.24	1.06	2.36	0.11	0.32	0.32	1.96	0.58	0.26	0.71
07_E4y_INTERIOR	0.91	0.31	1.53	0.32	0.54	1.06	0.34	1.01	2.49	0.15	0.29	0.03	1.71	0.68	0.78	0.62
08_E4y_INTERIOR	0.89	0.35	1.62	0.31	0.36	1.10	0.16	1.06	2.31	0.22	0.15	0.09	1.61	0.61	0.69	0.72
09_E5y_N	1.24	0.44	1.44	0.41	0.63	0.78	0.23	0.69	2.71	0.11	0.26	0.05	1.76	0.69	0.94	1.43
10_E5y_NE	0.61	0.15	1.35	0.51	0.38	0.73	0.18	0.75	1.55	0.84	0.01	0.41	1.30	0.50	0.48	0.41
11_E1y_SE	1.11	0.36	1.46	0.66	0.56	0.97	0.26	0.94	2.42	0.07	0.45	0.06	2.18	0.58	0.96	0.82
04_E1y_S	0.55	0.01	1.10	0.08	0.06	0.88	0.14	0.85	1.71	0.51	0.01	0.75	1.27	0.37	0.29	0.63
13_E3x_S	1.13	0.31	1.63	0.29	0.59	0.95	0.21	0.94	2.53	0.01	0.34	0.07	2.42	0.68	1.31	1.09
14_E3x_N	1.07	0.39	1.23	1.52	0.69	0.62	0.27	0.58	2.45	0.34	0.18	0.10	1.53	0.88	0.61	1.20
15_O2x_NE	1.05	0.07	1.66	0.21	0.60	0.92	0.20	0.92	2.50	0.18	0.23	0.11	2.33	0.66	1.37	1.08
12_O2x_E	0.88	0.10	1.71	0.61	0.57	0.77	0.18	0.70	2.52	0.10	0.14	0.15	1.58	0.60	0.90	1.48

5.2.7 Spectral content

To identify the dynamic characteristics of the TUGraz building, the frequency response functions (FRF's) were computed with LNEC SPA [20] taking into account single input, multi output relations (SIMO) obtained from the characterization signals CAT02 and CAT05. Figure 5.25 and Figure 5.26 show an example of the frequency response function, phase and coherence in the transverse and longitudinal directions calculated for the channel ACC_L2_C3_Y_NW and for the dynamic identification CAT02. In Figure 5.27 and Figure 5.28 are shown the same but for the dynamic identification CAT05.

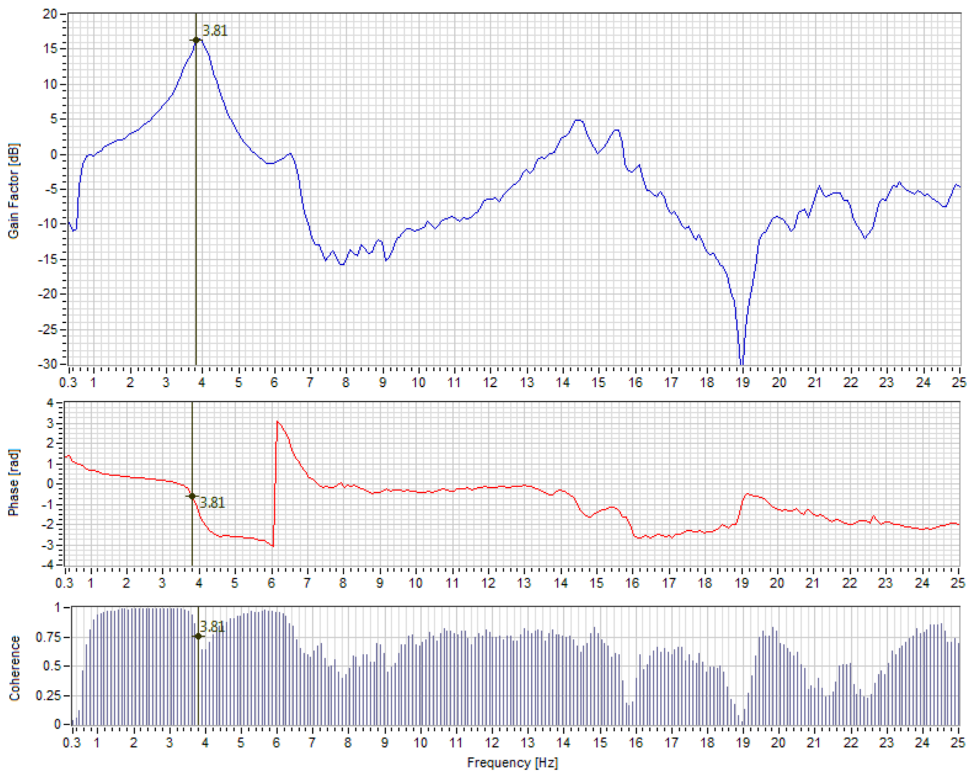


Figure 5.25: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_L2_C3_Y_NW

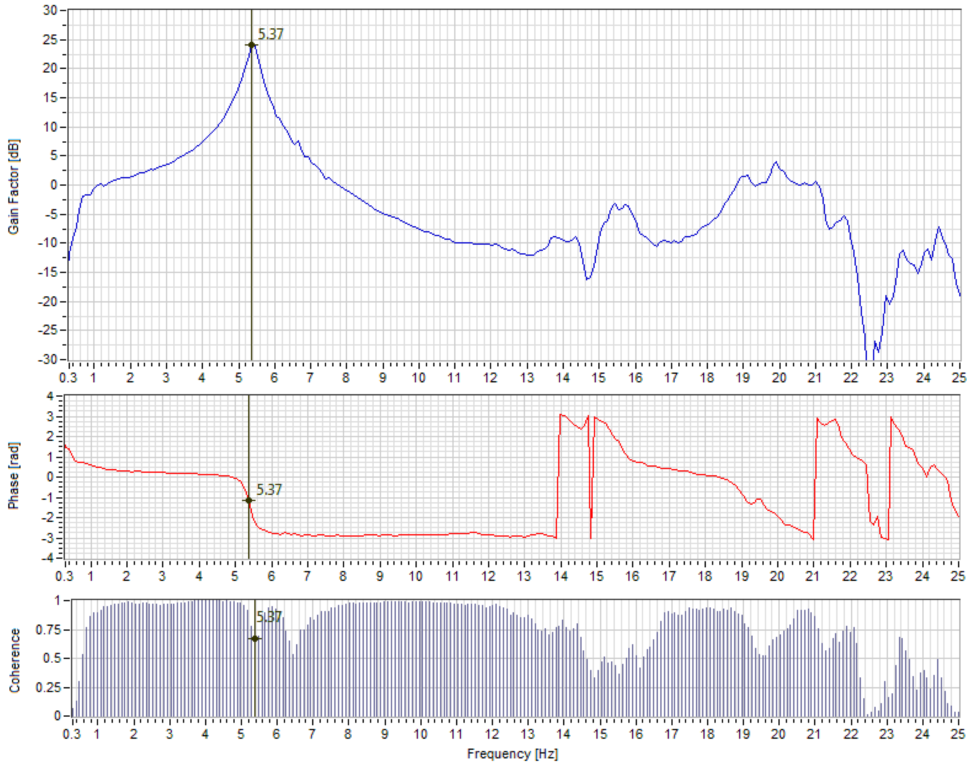


Figure 5.26: Frequency response function, phase and coherence (Cat02): ACC MESA LONG; ACC_L2_C3_Y_NW

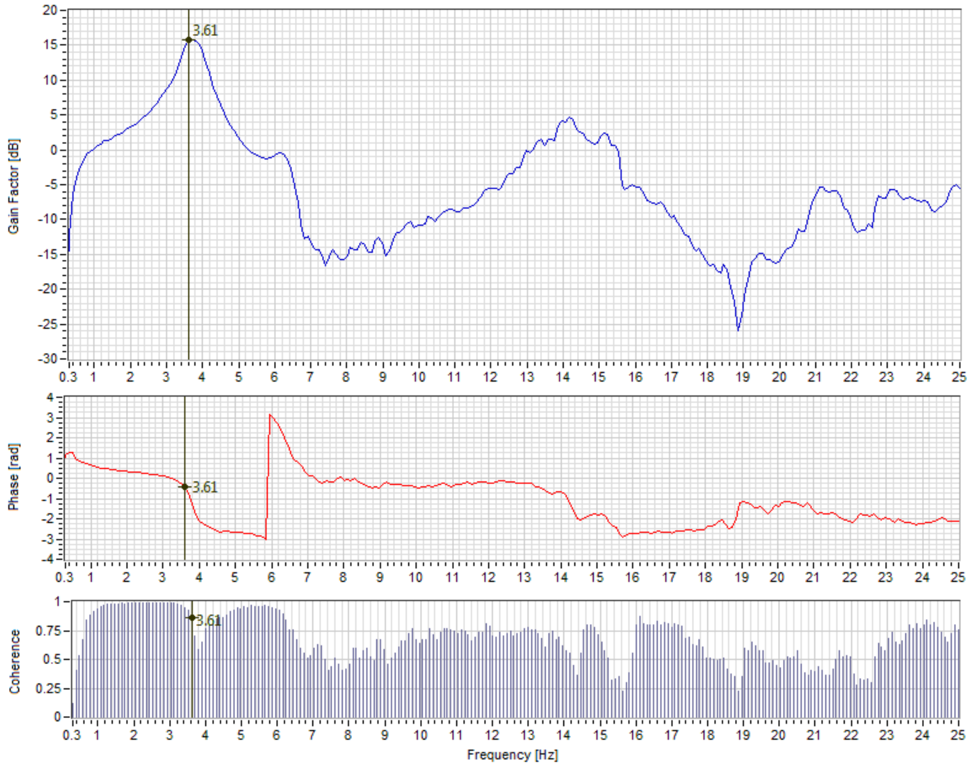


Figure 5.27: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_L2_C3_Y_NW

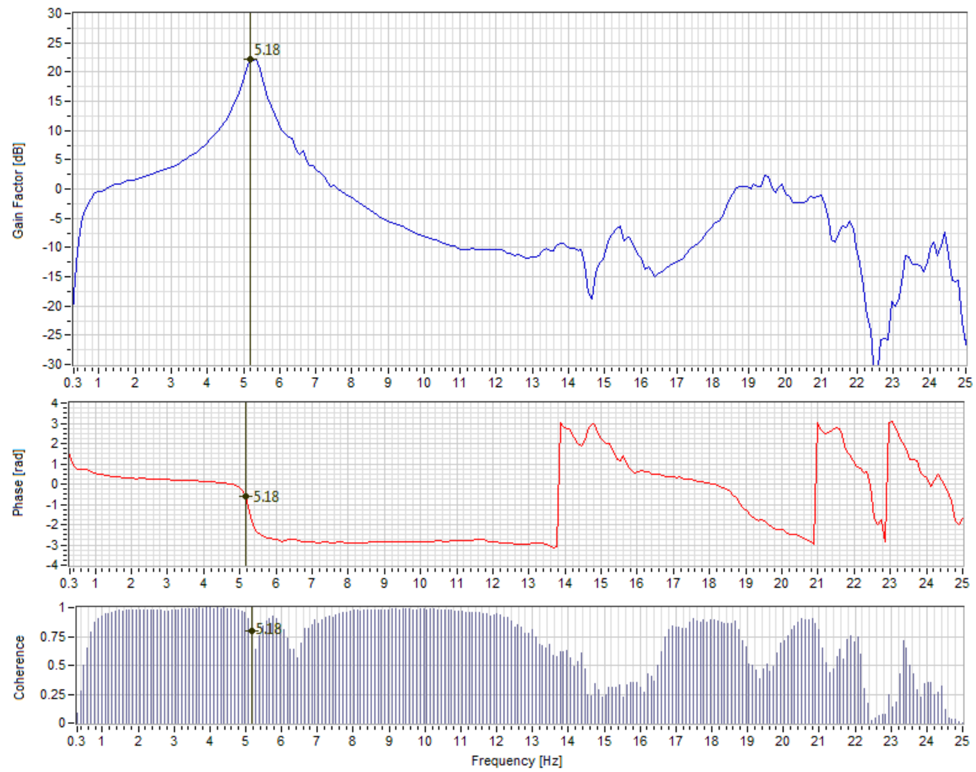


Figure 5.28: Frequency response function, phase and coherence (Cat05): ACC MESA LONG; ACC_L2_C3_Y_NW

5.3 MODE SHAPES AND NATURAL FREQUENCIES CHARACTERIZATION

Since the dynamic properties of the system play an important role in determining the seismic response of the structure, it is essential to estimate the natural frequencies, damping and mode shapes.

For the TUGraz model, the first three modes of the structure were identified. There were six dynamic characterization tests conducted in total, but the mode shapes from only two of the tests are shown: CAT02 corresponding to the characterization test at the start of the experiment; CAT05 to the characterization test after the final seismic test with 0.50g PGA.

The data recorded by the accelerometers during the dynamic characterization tests correspond to the data obtained from input-output modal identification techniques. In order to obtain the mode shapes of the structure the *LNEC-SPA Module Modal Analysis Output Only software* was used.

Figure 5.29 shows the TUGraz building modelled in LNEC-SPA with the accelerometer positions and directions mapped out on the specimen.

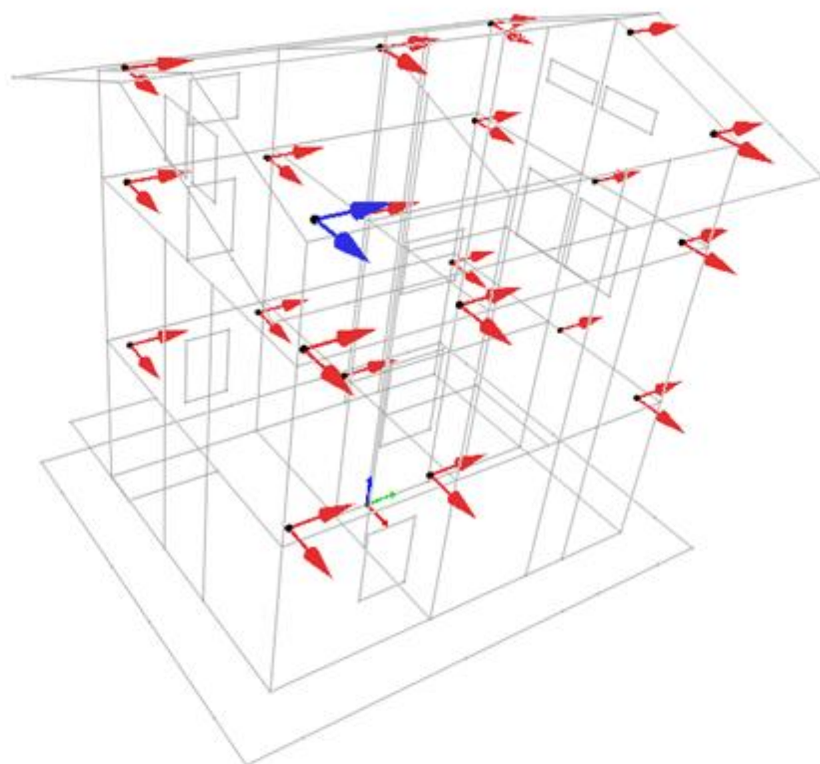


Figure 5.29 – 3D view configuration of TUGraz building.

The frequency domain decomposition for dynamic identification for CAT02 and CAT05 are showed in Figure 5.30 and Figure 5.31.

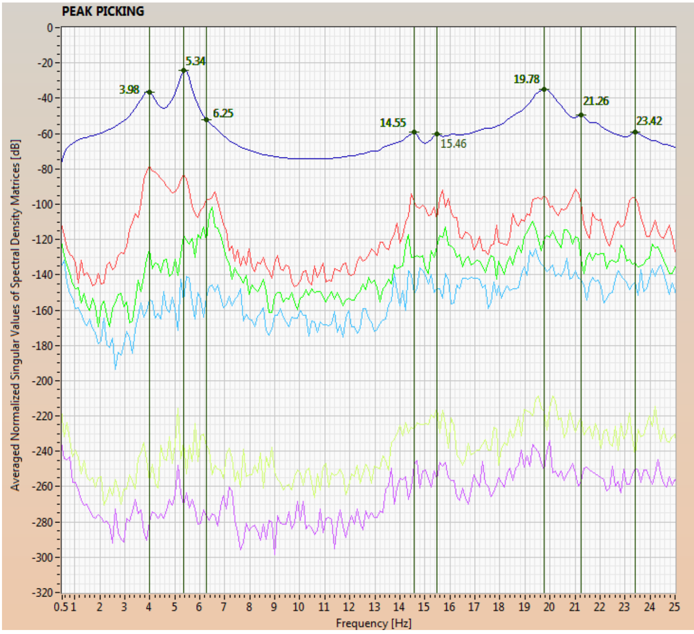


Figure 5.30: Frequency domain decomposition for dynamic identification CAT02

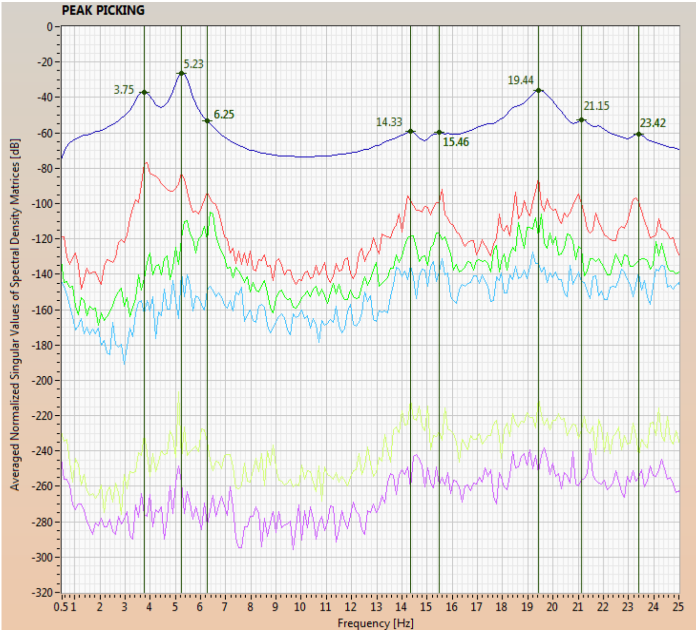


Figure 5.31: Frequency domain decomposition for dynamic identification CAT05.

Figure 5.32 and Figure 5.33 present the views of TUGraz building mode shapes for the first three frequencies.

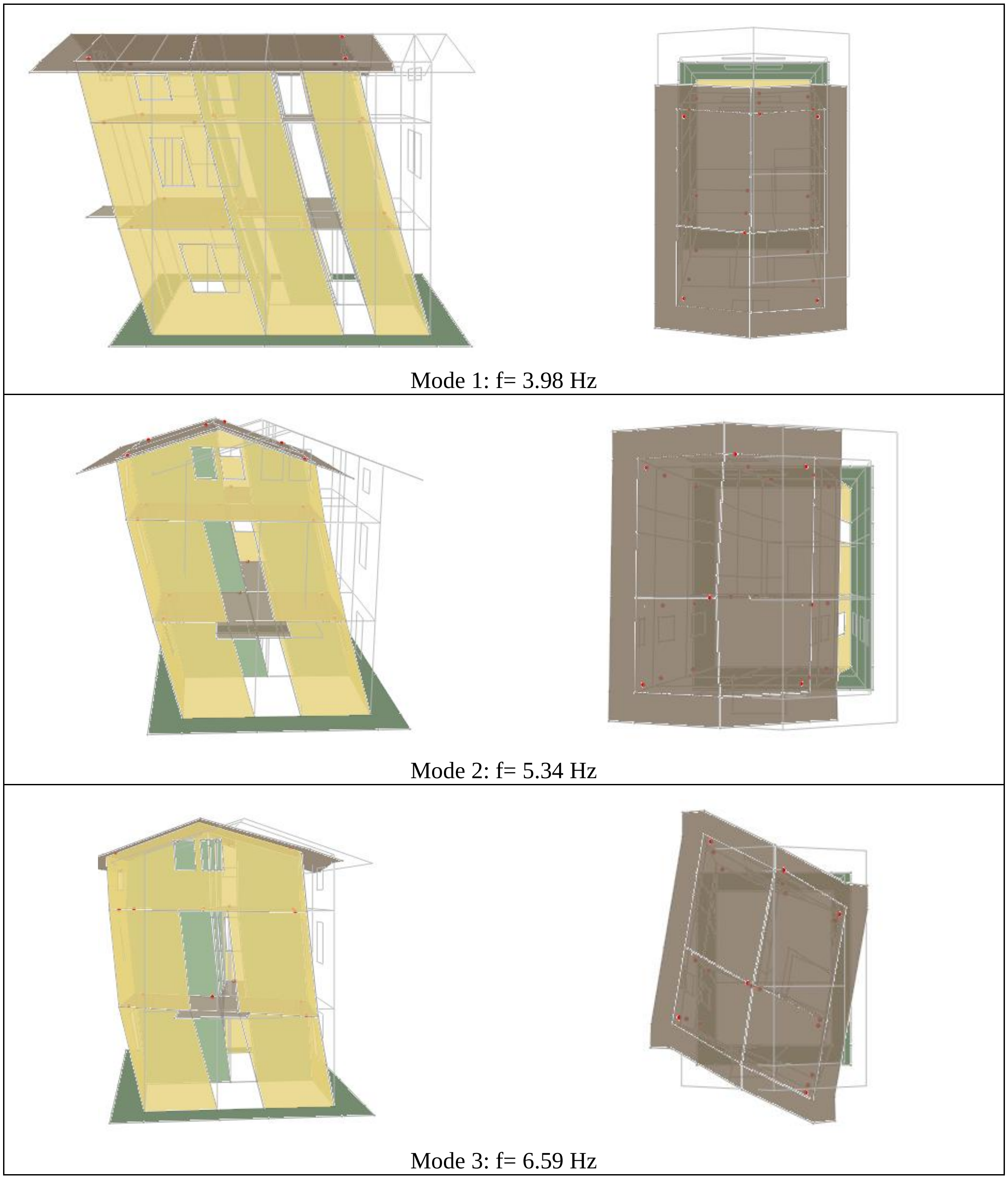
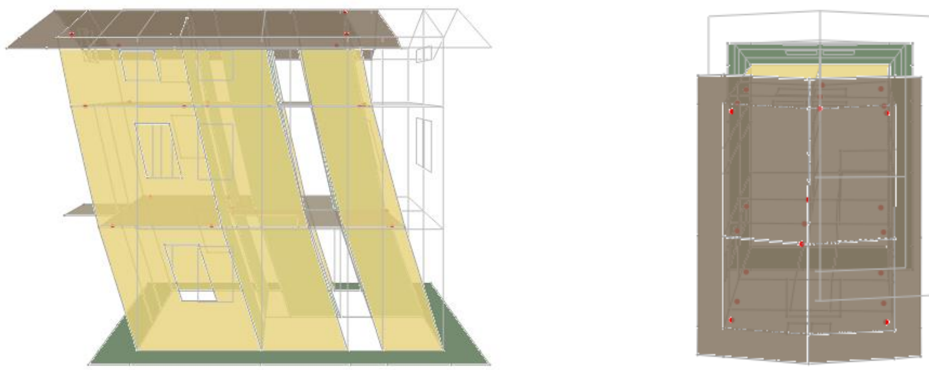
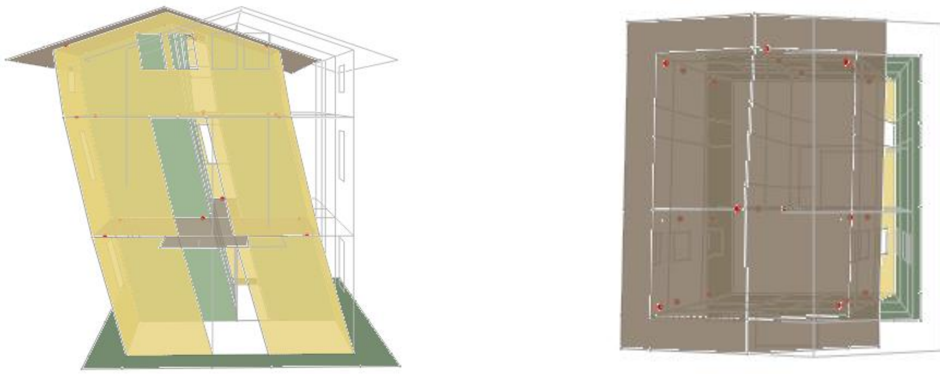


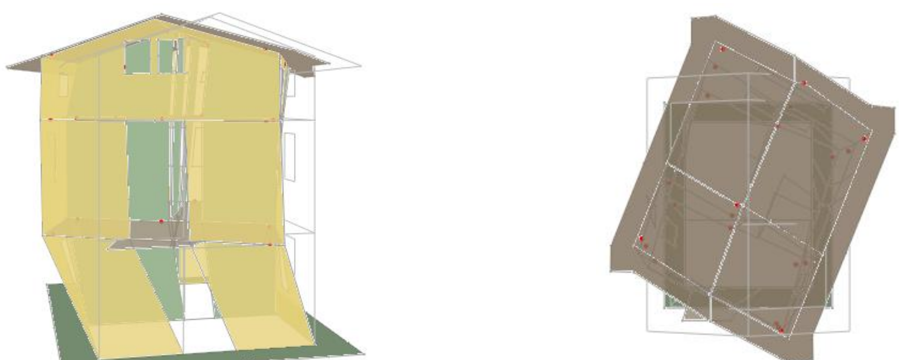
Figure 5.32: Mode shapes for CAT02



Mode 1: f= 3.75 Hz



Mode 2: f= 5.53 Hz



Mode 3: f= 6.25 Hz

Figure 5.33: Mode shapes for CAT05

The results of the dynamic identification CAT02 correspond to the initial structure while the results from CAT05 correspond to the structure after the final test. The numerical correlation of the mode shape vectors of the initial and after the final structure can be obtained by computing the Modal Assurance Criteria (MAC) value as shown in the equation below.

$$MAC_{u,d} = \frac{\left|\sum_{i=1}^{n} \varphi_i^u \varphi_i^d\right|^2}{\sum_{i=1}^{n} (\varphi_i^u)^2 \sum_{i=1}^{n} \left(\varphi_i^d\right)^2}$$

where φ^u is the mode shape vector corresponding to the undamaged condition of the structure, φ^d is the mode shape vector corresponding to the damaged condition of the structure and, n is the number of estimated degrees of freedom.

The result of the expression is a scalar value in the range of 0 and 1 and indicates the extent of correlation between the two cases.

Table 5.18 and Table 5.19 summarize the MAC coefficients for the mode shapes of the characterizations CAT01 and CAT04.

Table 5.18 – MAC coefficients for the mode shapes of the characterization CAT02

MODE_i_j		MODE_01_02	MODE_02_02	MODE_03_02	MODE_04_02	MODE_05_02	MODE_06_02	MODE_07_02	MODE_08_02
	Frequency	**3.98**	**5.34**	**6.59**	**14.55**	**15.46**	**19.78**	**21.26**	**23.42**
MODE_01_02	**3.98**	1.00	0.00	0.00	0.03	0.04	0.03	0.02	0.00
MODE_02_02	**5.34**	0.00	1.00	0.13	0.05	0.00	0.00	0.14	0.00
MODE_03_02	**6.59**	0.00	0.13	1.00	0.03	0.14	0.05	0.00	0.01
MODE_04_02	**14.55**	0.03	0.05	0.03	1.00	0.03	0.01	0.04	0.09
MODE_05_02	**15.46**	0.04	0.00	0.14	0.03	1.00	0.00	0.24	0.07
MODE_06_02	**19.78**	0.03	0.00	0.05	0.01	0.00	1.00	0.28	0.04
MODE_07_02	**21.26**	0.02	0.14	0.00	0.04	0.24	0.28	1.00	0.10
MODE_08_02	**23.42**	0.00	0.00	0.01	0.09	0.07	0.04	0.10	1.00

i Mode
j dynamic identification

Table 5.19 – MAC coefficients for the mode shapes of the characterization CAT05

MODE_i_j		MODE_01_05	MODE_02_05	MODE_03_05	MODE_04_05	MODE_05_05	MODE_06_05	MODE_07_05	MODE_08_05
	Frequency	**3.75**	**5.23**	**6.25**	**14.33**	**15.46**	**19.44**	**21.15**	**23.42**
MODE_01_02	**3.98**	0.9817	0.0005	0.0245	0.0228	0.1213	0.0357	0.0036	0.0047
MODE_02_02	**5.34**	0.0280	0.9994	0.0001	0.0372	0.0098	0.0218	0.1743	0.0015
MODE_03_02	**6.59**	0.0111	0.1346	0.7423	0.1824	0.2475	0.0008	0.0104	0.0000
MODE_04_02	**14.55**	0.0273	0.0516	0.1052	0.5590	0.1417	0.0387	0.0124	0.1441
MODE_05_02	**15.46**	0.0474	0.0015	0.2381	0.0002	0.2904	0.1078	0.2737	0.1060
MODE_06_02	**19.78**	0.0300	0.0014	0.1305	0.0497	0.0715	0.5134	0.1937	0.0039
MODE_07_02	**21.26**	0.0087	0.1421	0.0308	0.0884	0.2359	0.8104	0.9481	0.0545
MODE_08_02	**23.42**	0.0029	0.0018	0.0190	0.0064	0.0193	0.0529	0.1127	0.9572

i Mode
j dynamic identification

6 Main conclusions

The work presented in this report describes the study of the seismic behaviour of a cross laminated system (CTL) as part of the SERIES Project on multi-storey timber buildings. This project is coordinated by the University of Trento and involves the University of Minho and the Graz University of Technology, at LNEC, in Lisbon.

The test performed demonstrated the high seismic performance of the mock-up. After the completion of the seismic tests, only minor damages were detected on a visual inspection (walls, hold–downs, angle brackets).

Dynamic characterization tests revealed that the fundamental frequency of the structure was initially 3.98Hz and then decreased to 3.75Hz by the end of the seismic resting protocol. The slight decrease in the frequency further confirms the fact that there was no significant damage. The magnitude of the hold down forces that were measured during the seismic tests was low and the displacements of the walls were also within limits.

References

[1] SCHICKHOFER G.HOLZBAU, TEIL A | Der Roh- und Werkstoff Holz Version 1.2, WS 2006/2007

[2] SCHICKHOFER G.; et.al. - **BSPhandbuch | Holz-Massivbauweise in Brettsperrholz 2**. Auflage, Verlag der Technischen Universität Graz, 2010, ISBN: 978-3-85125-109-8.

[3] ÖNORM EN 1995-1-1:2009 - **Bemessung und Konstruktion von Holzbauten – Allgemeines – Allgemeine Regeln und Regeln für den Hochbau.** 2009.

[4] FLATSCHER G. - Außergewöhnliche Einwirkung „Erdbeben" – Überlegungen zur versuchstechnischen Erfassung der Verbindungstechnik im Holz-Massivbau Masterarbeit, TU Graz, 2010.

[5] FLATSCHER G. - **Versuchstechnische Betrachtung zyklisch beanspruchter Wandelemente in der Holz-Massivbauweise 18**. Internationales Holzbau-Forum 2012, Prolog IV, Garmisch-Partenkirchen Dezember, 2012.

[6] ÖNORM EN 1998-1:2011 - **Design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings (consolidated version)**. 2011.

[7] CECCOTTI A. - **Which seismic behaviour factor for multi-storey buildings made of cross-laminated wooden panels?**. CIB-W18/39-15-4.

[8] SANDHAAS, C. - **Projekt SOFIE – Erdbebenverhalten von Häusern aus XLAM Grazer Holzbau-Fachtagung**, Grazm, 2006.

[9] CECCOTTI A. - **New Technologies for Construction of Medium-Rise Buildings in Seismic Regions: The XLAM Case Structural Engineering International**, Vol. 18, Nr. 2, pp. 156-165, 2008.

[10] http://www.sofieveritas.com/upload/images/rsz__rom1887.jpg | 16.08.2010

[11] DUJIC B., KLOBCAR S., ZARNIC R. - **Influence of openings on shear capacity of wooden walls CIB-W18/40-15-6**. Slovenia, 2007.

[12] GAVRIC I, FRAGIACOMO M., CECCOTTI A. - **Strength and deformation characteristics of typical X-Lam connections**. World Conference on Timber Engineering, Auckland, 2012.

[13] HUMMEL J., SEIM W. - **Wall-slab interaction of multi-storey timber buildings under earthquake impact**. World Conference on Timber Engineering, Auckland, 2012.

[14] POPOVSKI M., KARACABEYLI E. - **Seismic behaviour of cross-laminated timber structures**. World Conference on Timber Engineering, Auckland, 2012.

[15] FRAGIACOMO M., DUJIC B., SUSTERSIC I - **Elastic and ductile design of multi-storey crosslam massive wooden buildings under seismic actions**. Engineering Structures, 2011.

[16] RINGHOFER A. - **Erdbebennormung in Europa und deren Anwendung auf Wohnbauten in Holz-Massivbauweise Masterarbeit TU Graz**. 2010.

[17] FLATSCHER G., SCHICKHOFER G. - **Verbindungstechnik in BSP bei monotoner und zyklischer Beanspruchung –Statusbericht TU Graz 9**. Grazer Holzbau-Fachtagung, pp. G-1 ÷ G-22, Graz, 2011.

[18] ISO 21581:2010 - **Timber structures – static and cyclic lateral load test methods for shear walls EN 338:2009 Structural timber – Strength classes**. 2010.

[19] CAMPOS COSTA, A., CANDEIAS, P., PIAZZA, M., TOMASI, R., LOURENÇO, P.B., BRANCO, J., SCHICKHOFER, G., FLATSCHER, G. - **The LNEC Earthquake Engineering Testing Facility. Background information: LNEC testing facility, testing setup and protocol and data processing**, SERIES Report, July 2013.

[20] MENDES, L.; CAMPOS COSTA, A. - **LNEC-SPA – Signal Processing and Analysis Tool for Civil Engineers**. Relatório LNEC.

[21] MATHCAD SOFTWARE (version 14), PTC.

[22] "Vision 2000 - A Framework for Performance Based Earthquake Engineering", Report, Structural Engineers Association of California (SEAOC), January 1995

[23] "EUROCODE8 – **Design of structures for earthquake resistance – Part 3: Assessment and retrofitting of buildings**. CEN, June 2005.

[24] “EUROCODE8 – **Design of structures for earthquake resistance – Part 1: General rules, seismic actions and rules for buildings**. CEN, 2004.

[25] DIPASQUALE, E.; ÇAKMAK, A. S. - **Seismic damage assessment using linear models**. Soil Dynamics and Earthquake Engineering, 9(4), pp. 194-215, 1990.

[26] COSENZA, E.; MANFREDI, G. - **Damage indices and damage measures**. Progress in Structural Engineering and Materials, 2:50-59, 2000.

[27] ARJOMANDI, K.; ESTEKANCHI1, H.; VAFAI1, A. - **Correlation Between Structural Performance Levels and Damage Indexes in Steel Frames Subjected to Earthquakes**. ScientiaIranica, Transaction A: Civil Engineering, Vol. 16, No. 2, pp. 147, Sharif University of Technology, April 2009

[28] FEMA - **Installing seismic restraints for electrical equipment**. Report FEMA413, Federal Emergency Management Agency, 2004 (available for free download at the internet address http://www.fema.gov/plan/prevent/earthquake/professionals.shtm)

ANNEX I
Shaking table tests: time histories

Seismic test TEST007_05

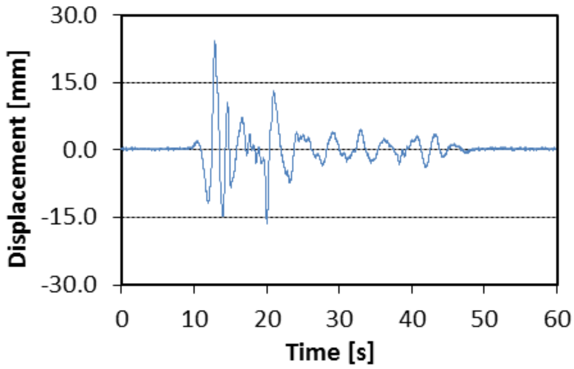


Figure AI. 1 – Channel DISP MESA TRANS

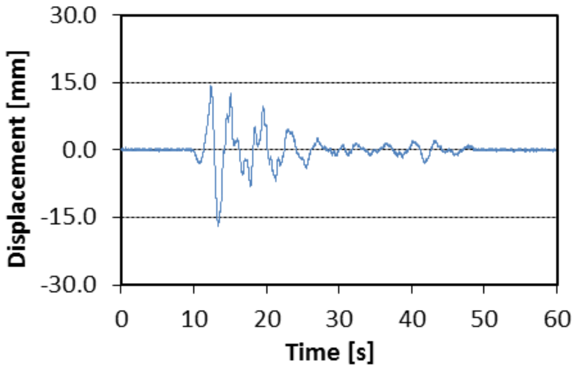


Figure AI. 2 - Channel DISP MESA LONG

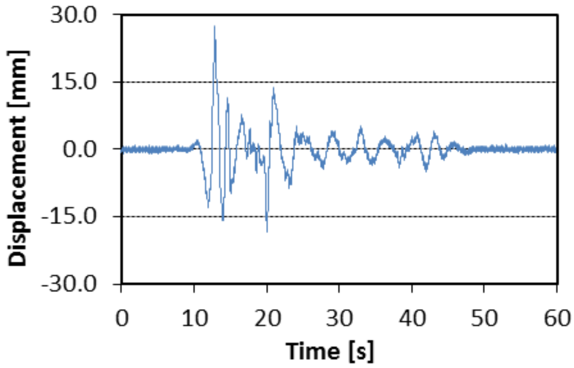


Figure AI. 3 - Channel DISP_L2_SE_X_T

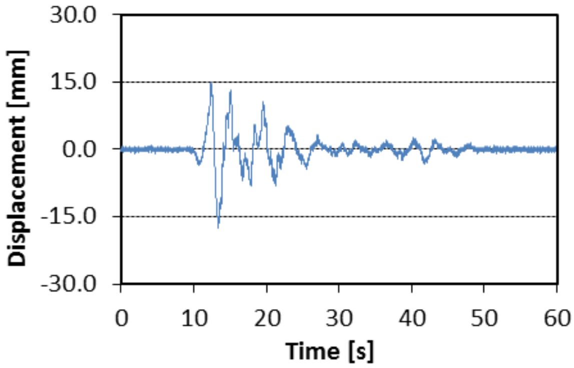


Figure AI. 4 - DISP_L2_SE_Y_L

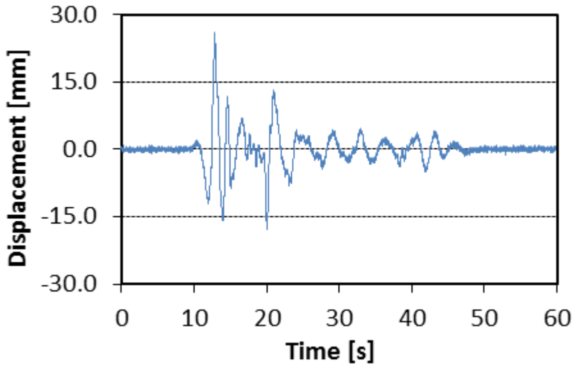


Figure AI. 5 - Channel DISP_L1_SE_X_T

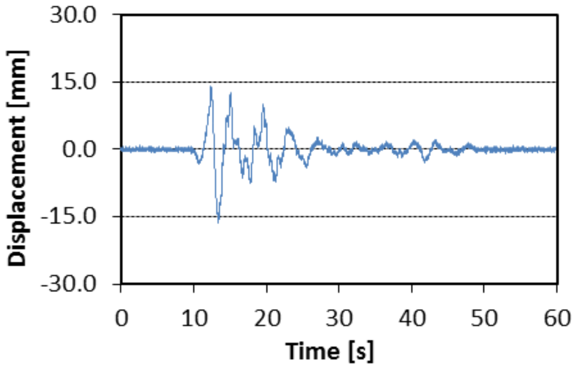


Figure AI. 6 - Channel DISP_L1_SE_Y_L

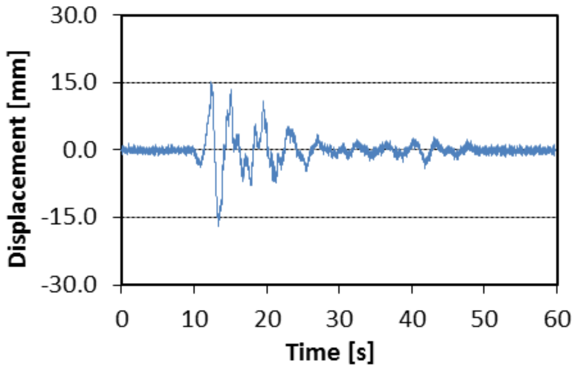


Figure AI. 7 - Channel DISP_L2_NW_X_L

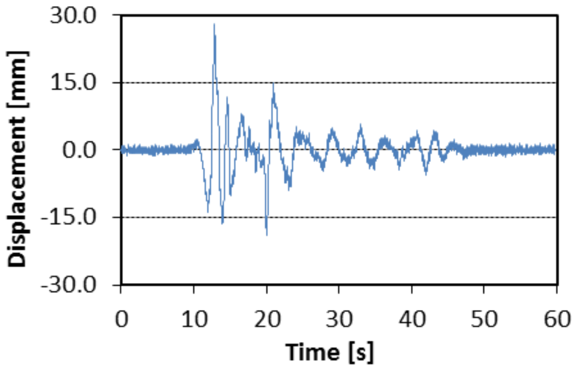


Figure AI. 8 - Channel DISP_L2_NW_Y_T

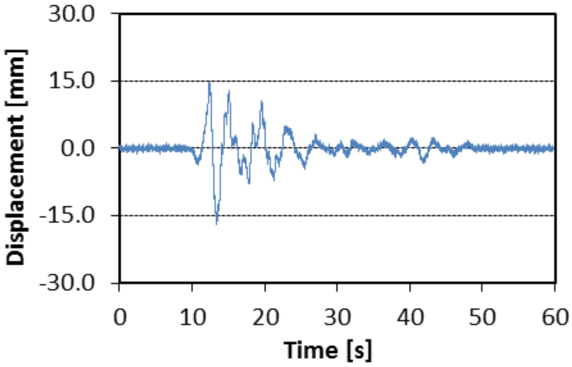


Figure AI. 9 - Channel DISP_L1_NW_X_L

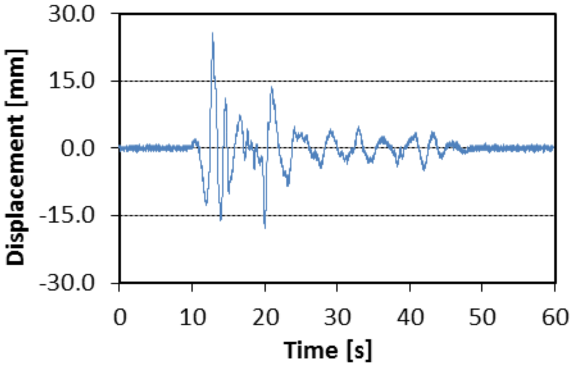


Figure AI. 10 – Channel DISP_L1_NW_Y_T

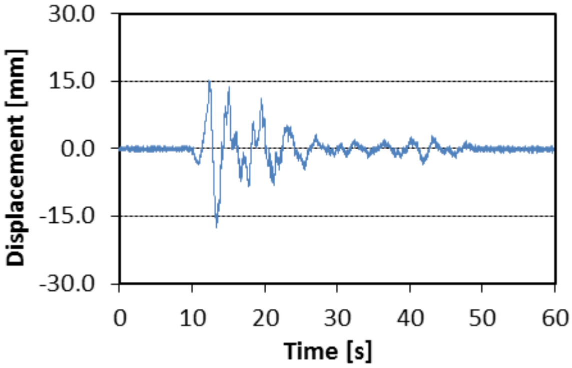


Figure AI. 11 - Channel DISP_RL_NW_X_L

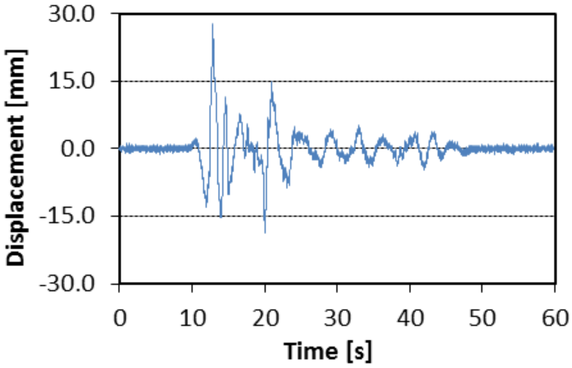


Figure AI. 12 - Channel DISP_RL_NW_Y_T

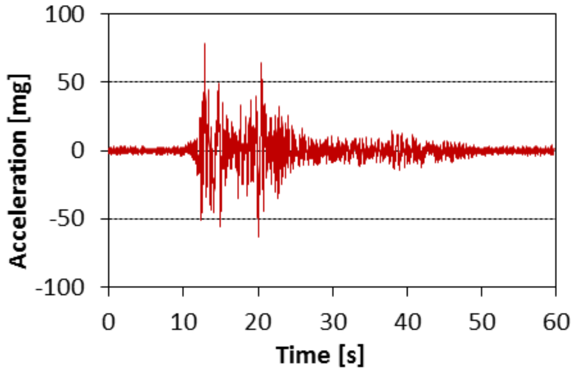


Figure AI. 13 - Channel ACC MESA TRANS

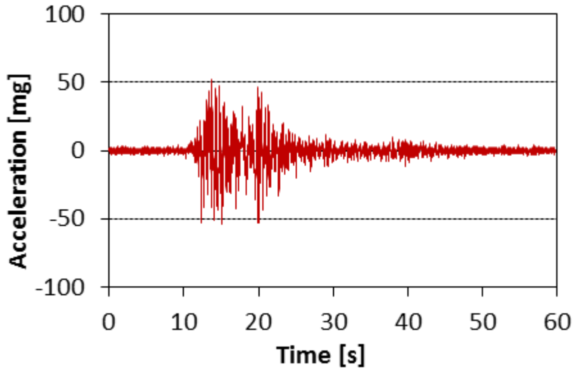


Figure AI. 14 - Channel ACC MESA LONG

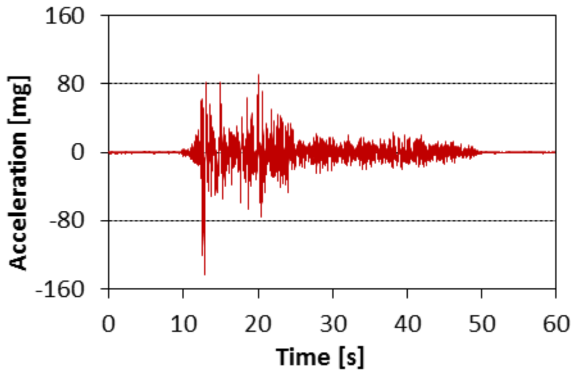


Figure AI. 15 - Channel ACC_L1_A1_Y_SE_T

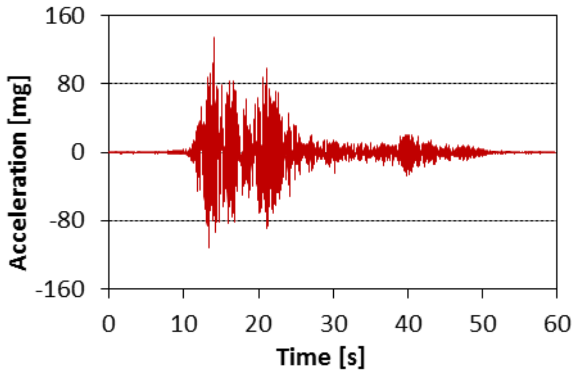


Figure AI. 16 - Channel ACC_L1_A1_X_SE_L

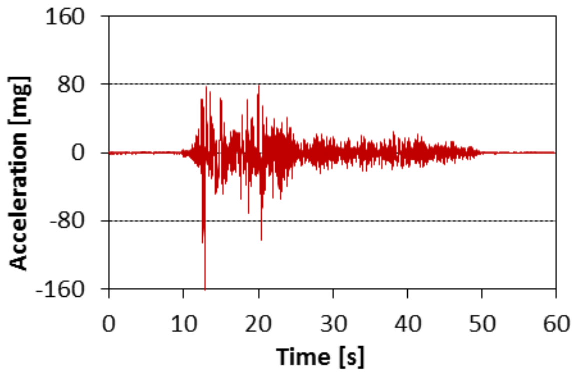


Figure AI. 17 - Channel ACC_L1_C1_Y_NE_T

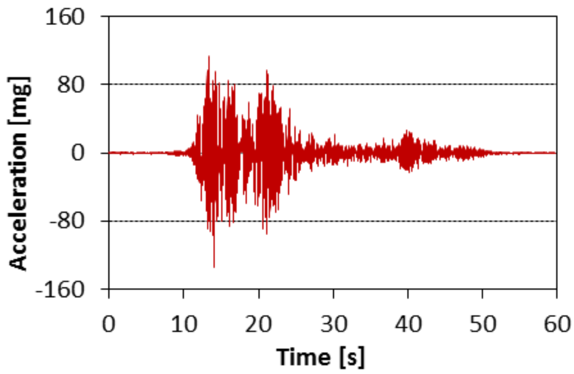


Figure AI. 18 - Channel ACC_L1_C1_X_NE_L

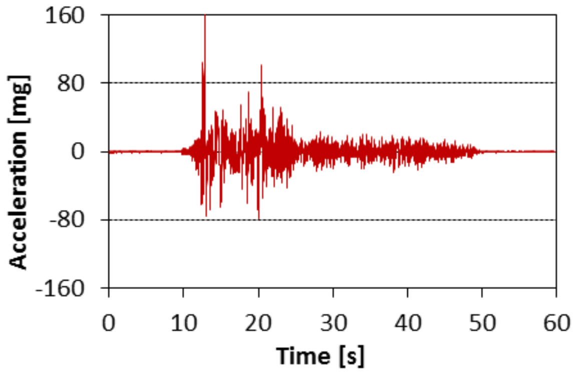


Figure AI. 19 - Channel ACC_L1_C2_Y_N_T

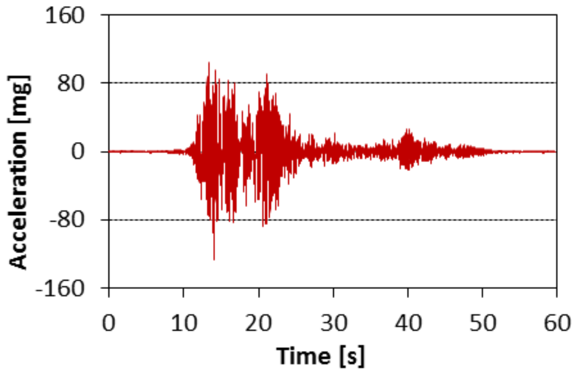


Figure AI. 20 - Channel ACC_L1_C2_X_N_L

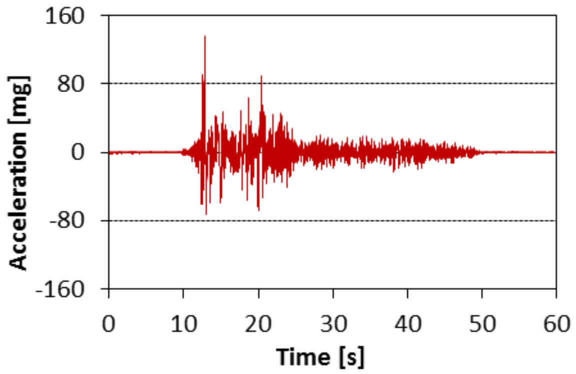


Figure AI. 21 - Channel ACC_L1_C3_Y_NW_T

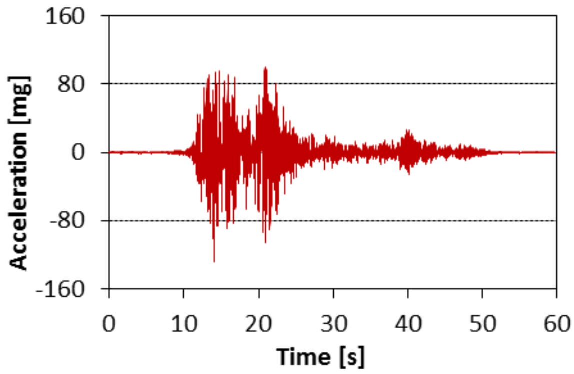


Figure AI. 22 - Channel ACC_L1_C3_X_NW_L

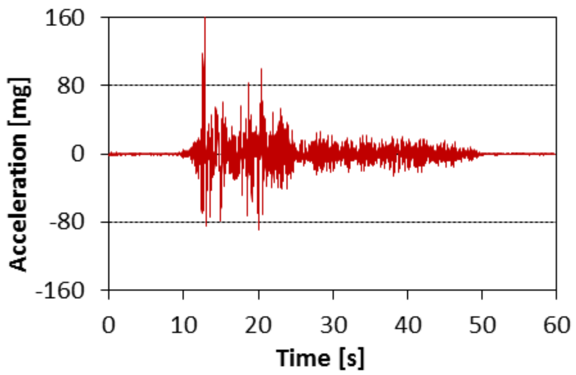


Figure AI. 23 - Channel ACC_L1_B3_Y_W_T

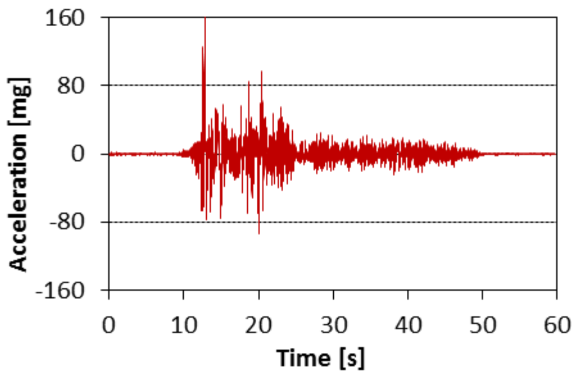


Figure AI. 24 - Channel ACC_L1_B2_Y_I_T

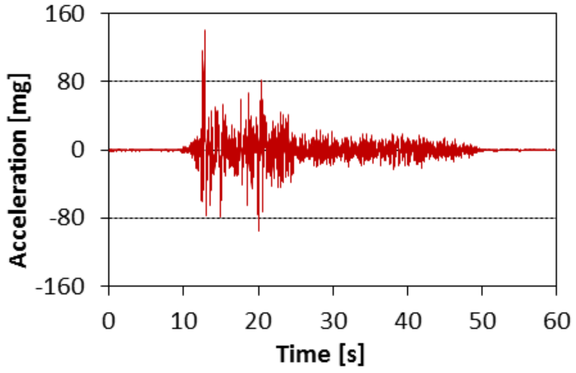


Figure AI. 25 - Channel ACC_L1_A3_Y_SW_T

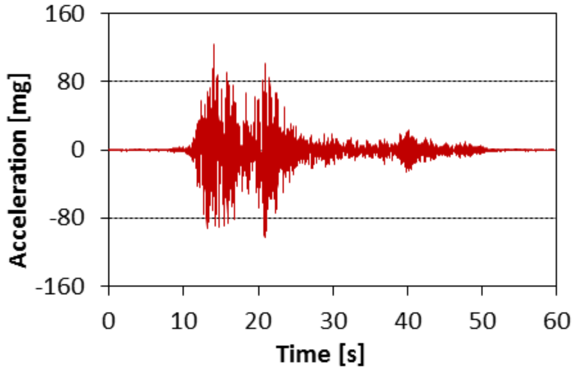


Figure AI. 26 - Channel ACC_L1_A3_X_SW_L

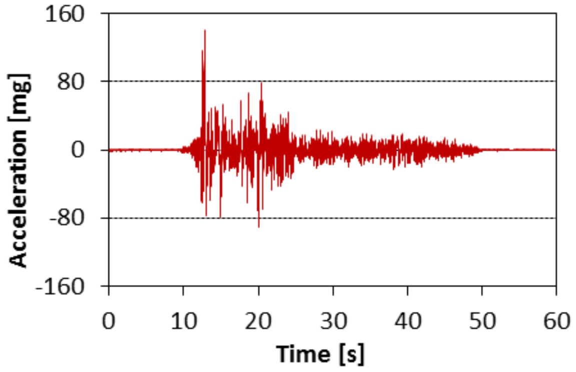


Figure AI. 27 - Channel ACC_L1_A2_Y_S_T

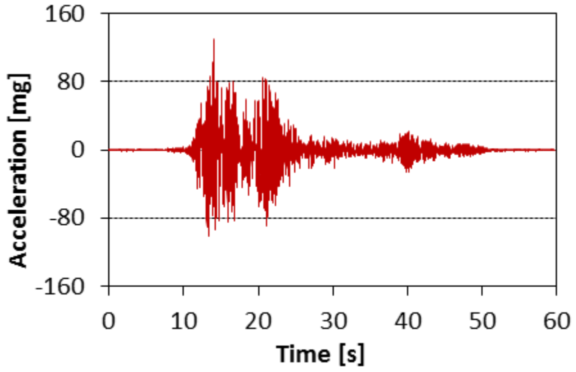


Figure AI. 28 - Channel ACC_L1_A2_X_S_L

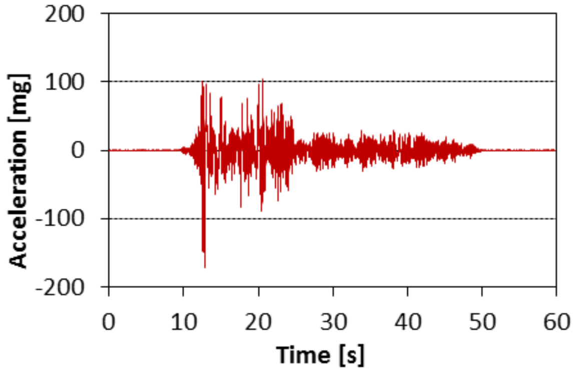


Figure AI. 29 - Channel ACC_L2_A1_Y_SE_T

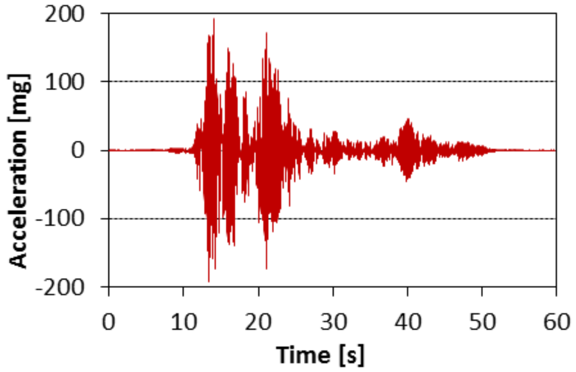


Figure AI. 30 - Channel ACC_L2_A1_X_SE_L

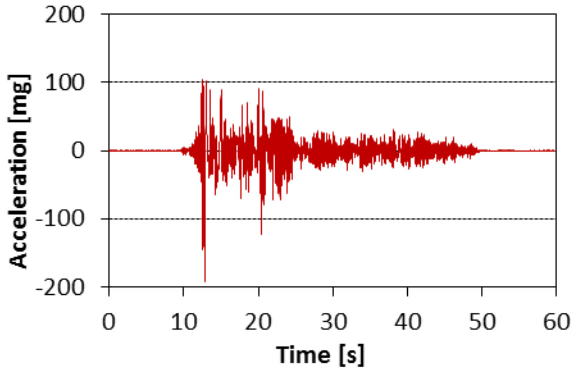


Figure AI. 31 - Channel ACC_L2_C1_Y_NE_T

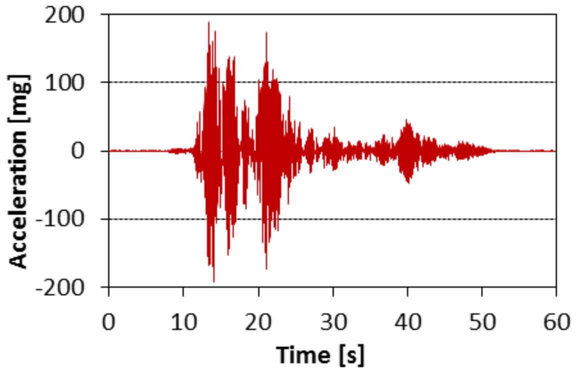


Figure AI. 32 - Channel ACC_L2_C1_X_NE_L

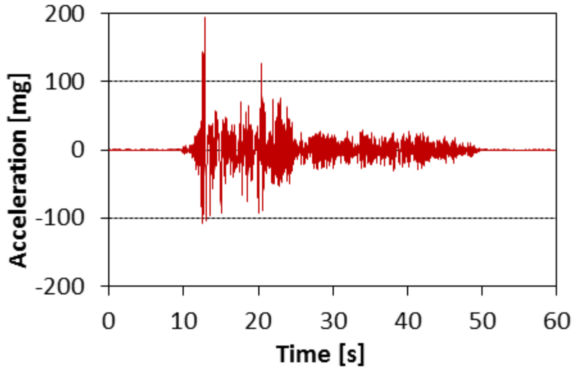


Figure AI. 33 - Channel ACC_L2_C2_Y_N_T

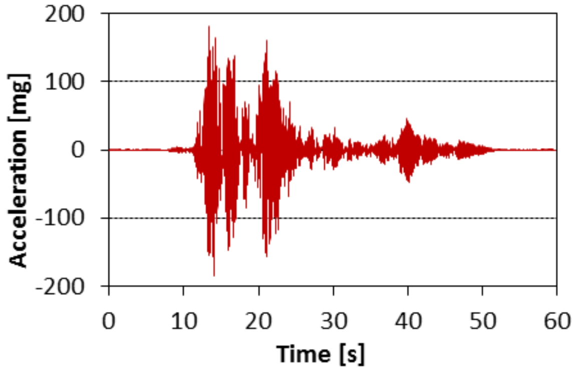


Figure AI. 34 - Channel ACC_L2_C2_X_N_L

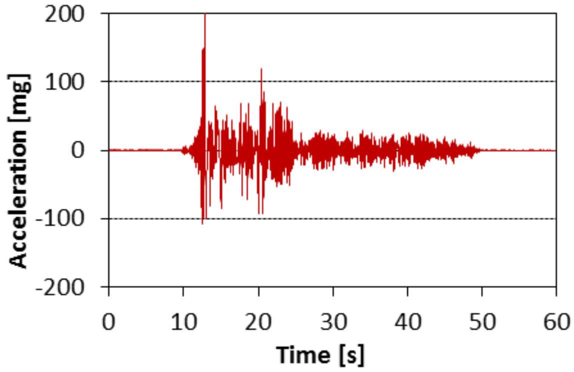


Figure AI. 35 - Channel ACC_L2_C3_Y_NW_T

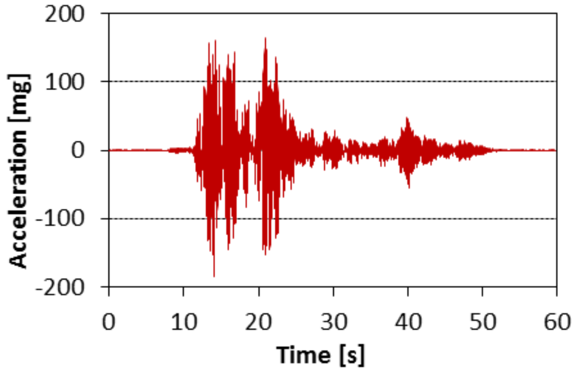


Figure AI. 36 - Channel ACC_L2_C3_X_NW_L

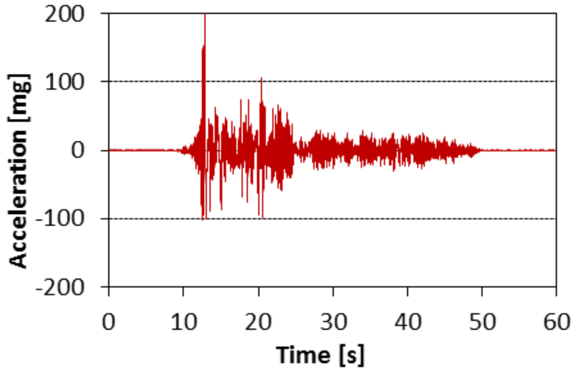


Figure AI. 37 - Channel ACC_L2_B3_Y_W_T

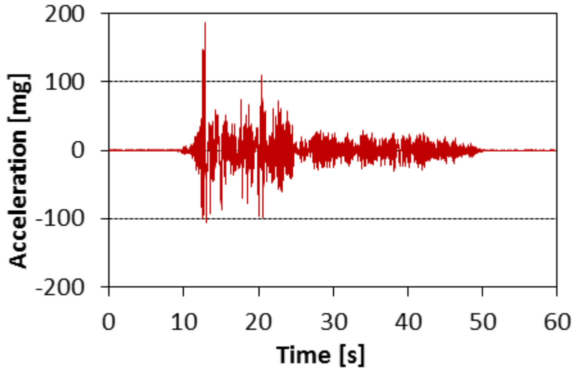


Figure AI. 38 - Channel ACC_L2_B2_Y_I_T

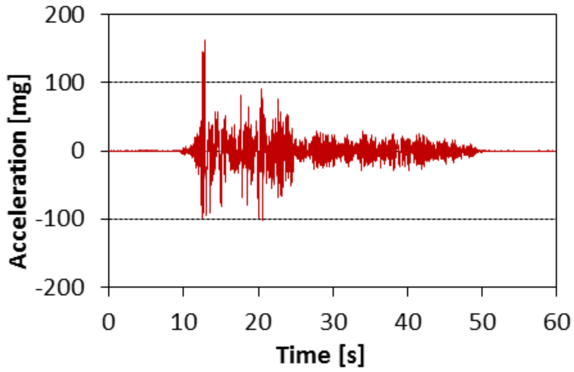


Figure AI. 39 - Channel ACC_L2_A3_Y_SW_T

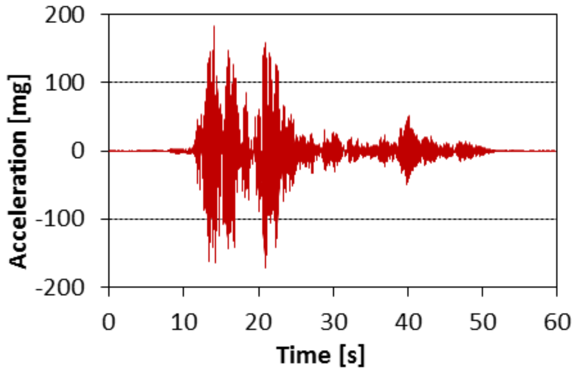


Figure AI. 40 - Channel ACC_L2_A3_X_SW_L

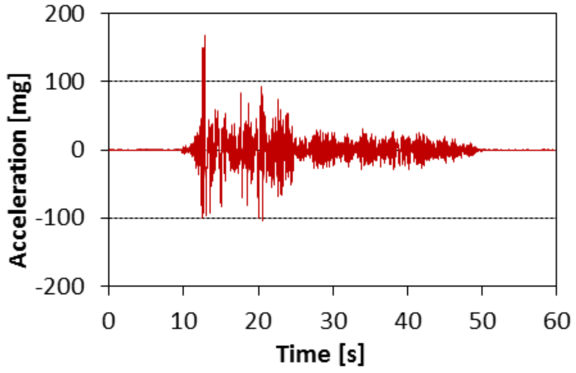


Figure AI. 41 - Channel ACC_L2_A2_Y_S_T

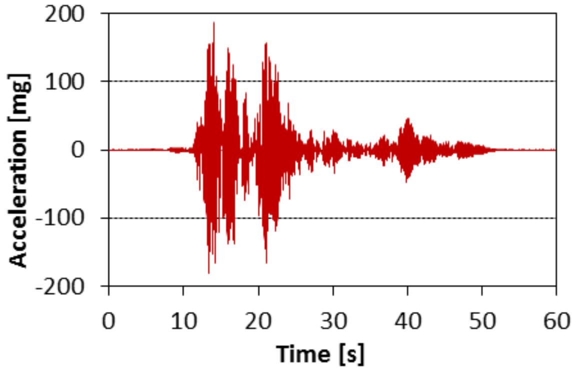


Figure AI. 42 - Channel ACC_L2_A2_X_S_L

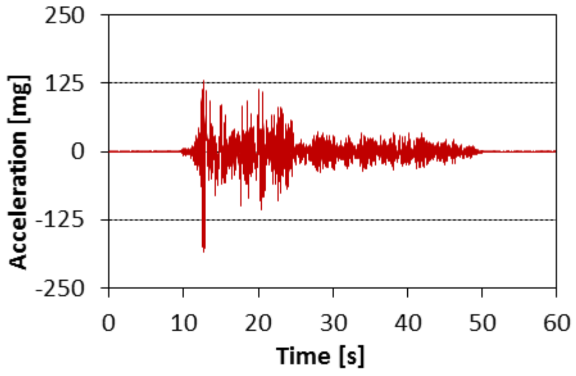


Figure AI. 43 - Channel ACC_RL_A1_Y_SE_T

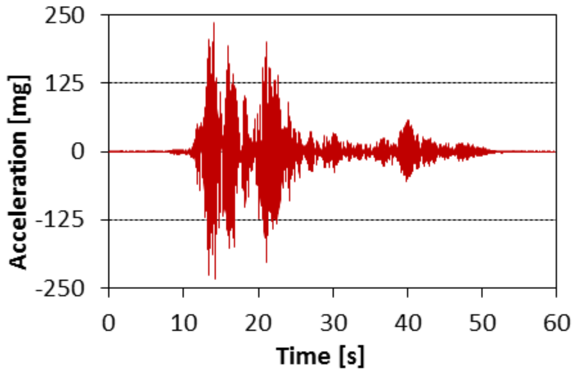


Figure AI. 44 - Channel ACC_RL_A1_X_SE_L

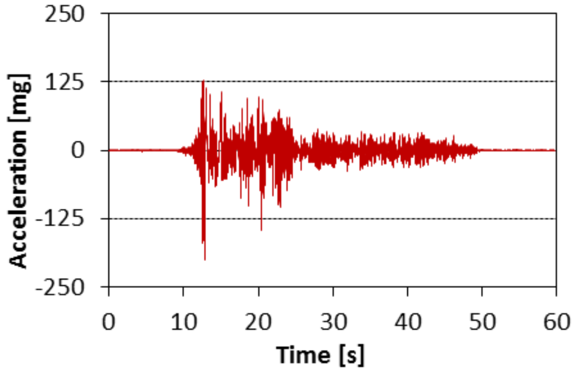


Figure AI. 45 - Channel ACC_RL_C1_Y_NE_T

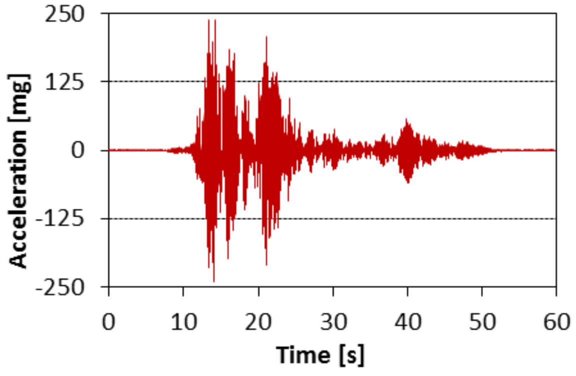


Figure AI. 46 - Channel ACC_RL_C1_X_NE_L

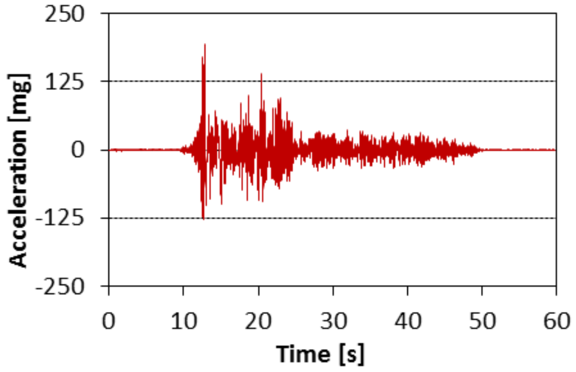


Figure AI. 47 - Channel ACC_RL_C3_Y_NW_T

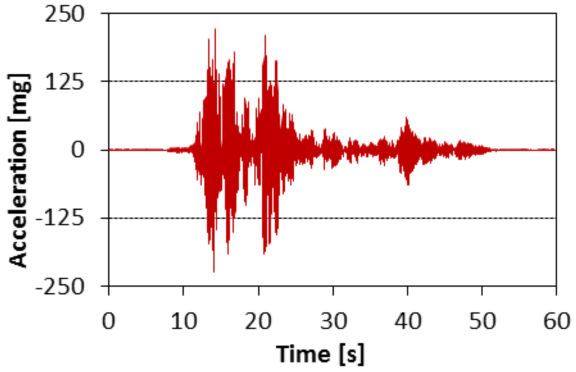


Figure AI. 48 - Channel ACC_RL_C3_X_NW_L

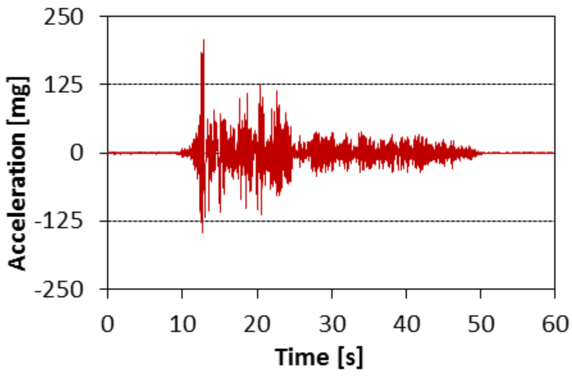


Figure AI. 49 - Channel ACC_RL_B3_Y_W_T

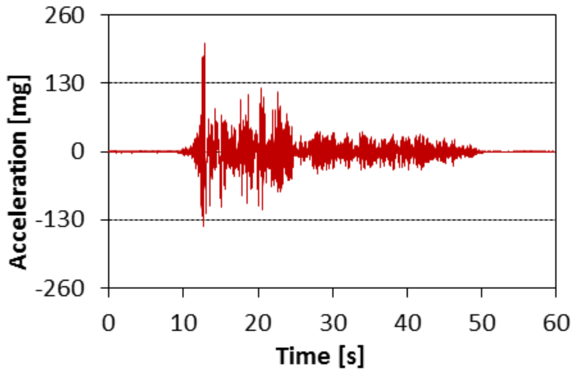


Figure AI. 50 - Channel ACC_RL_B2_Y_I_T

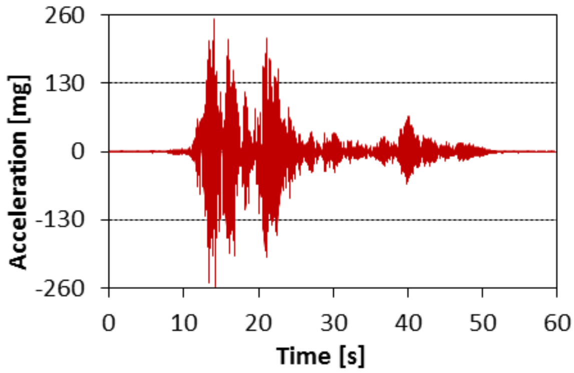


Figure AI. 51 - Channel ACC_RL_B2_X_I_L

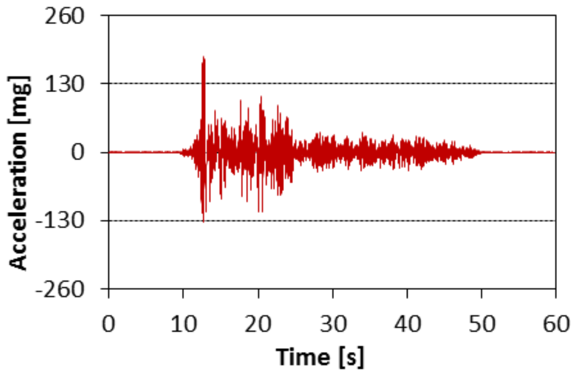


Figure AI. 52 - Channel ACC_RL_A3_Y_SW_T

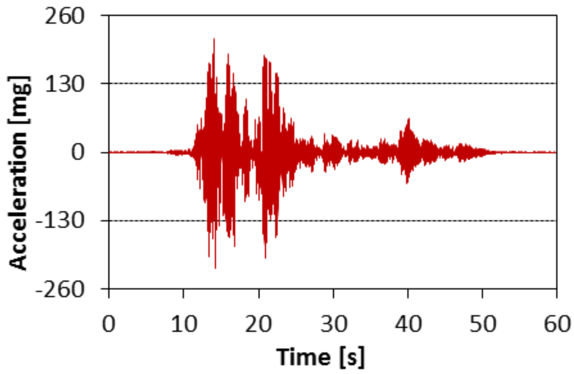


Figure AI. 53 - Channel ACC_RL_A3_X_SW_L

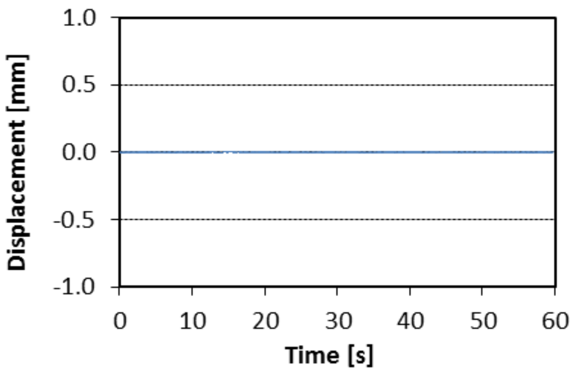


Figure AI. 54 - Channel LVDT_H05

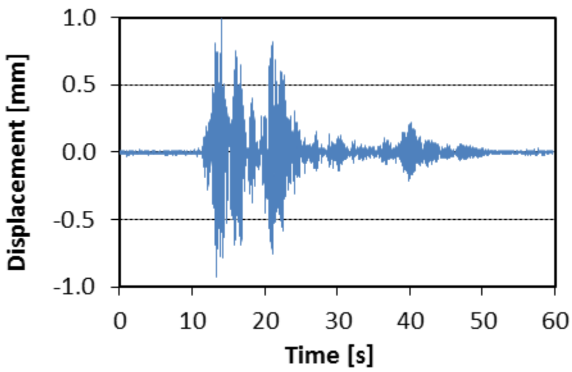


Figure AI. 55 - Channel LVDT_H07

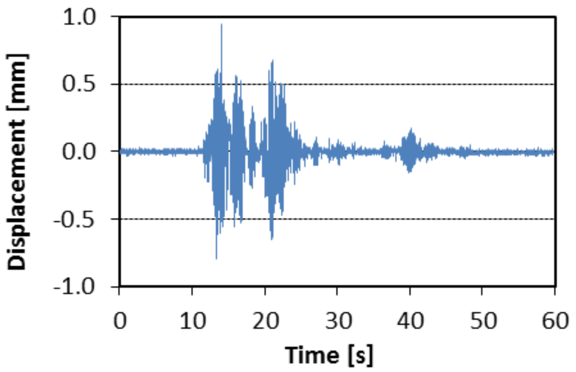


Figure AI. 56 - Channel LVDT_H03

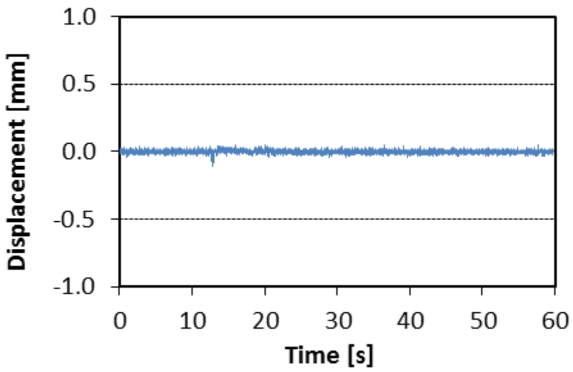


Figure AI. 57 - Channel LVDT_H04

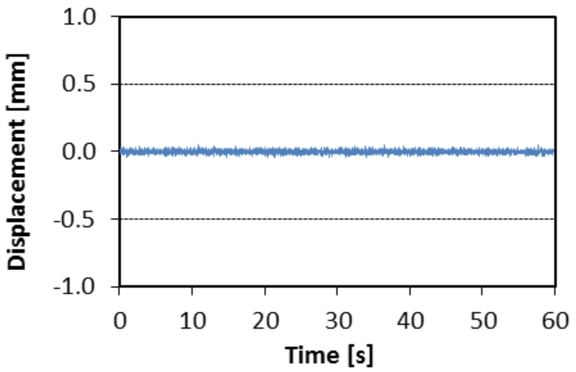


Figure AI. 58 - Channel LVDT_IID02

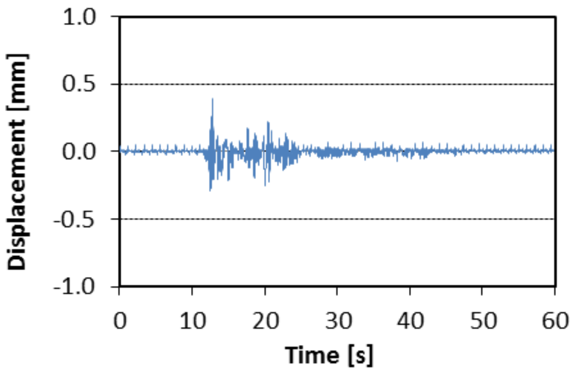


Figure AI. 59 - Channel LVDT_IID04

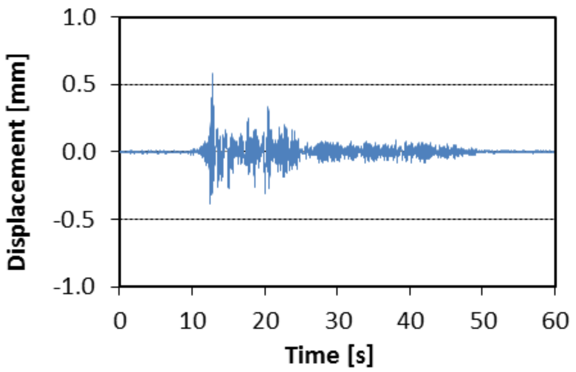


Figure AI. 60 - Channel LVDT_IID01

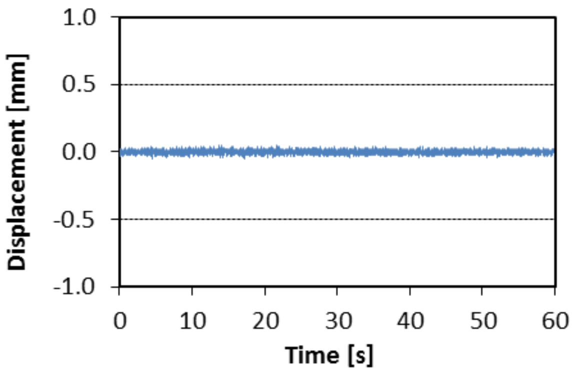


Figure AI. 61 - Channel LVDT_IID03

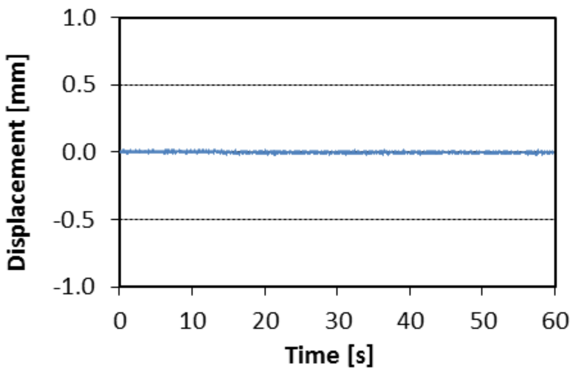


Figure AI. 62 - Channel LVDT_V10_E5Y

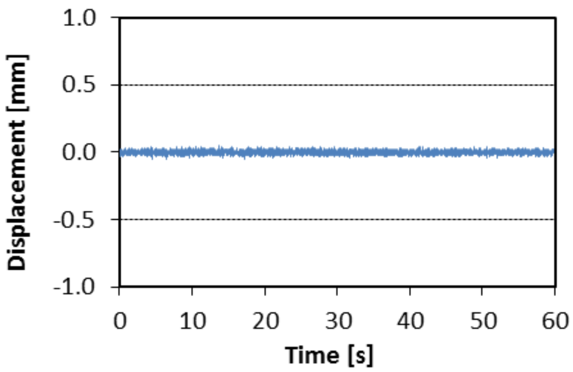


Figure AI. 63 - Channel LVDT_V02_E5X

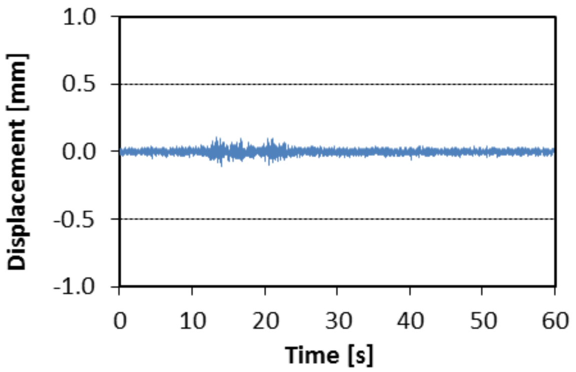


Figure AI. 64 - Channel LVDT_V03_E2X

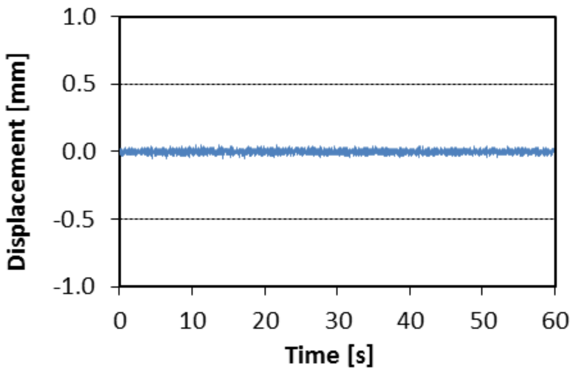


Figure AI. 65 - Channel LVDT_V04_E2X

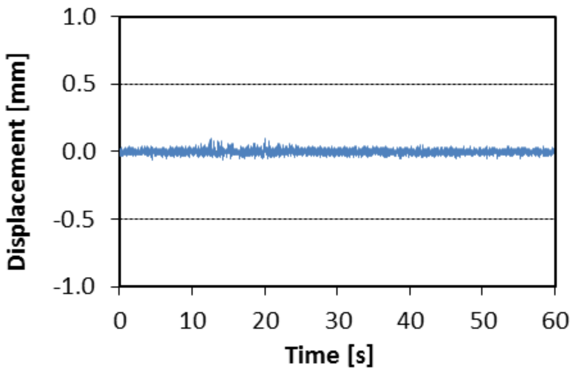


Figure AI. 66 - Channel LVDT_V01_E5X

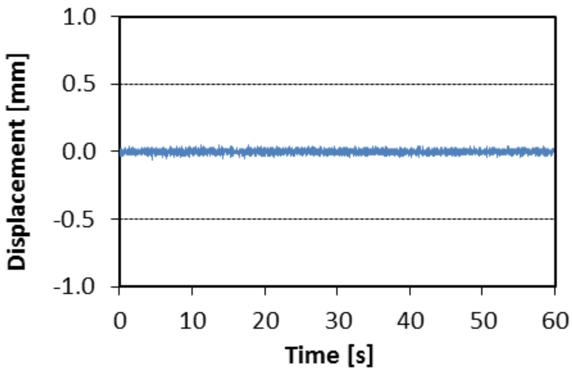


Figure AI. 67 - Channel LVDT_V07_E5Y

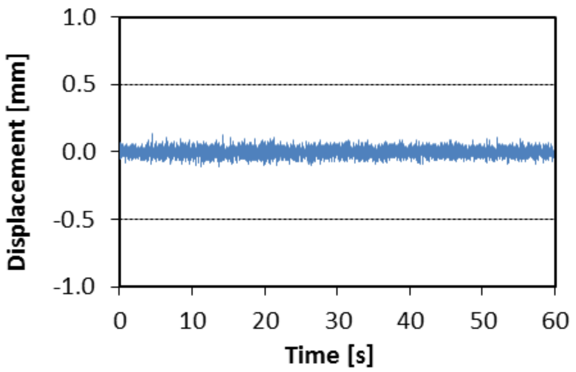


Figure AI. 68 - Channel LVDT_V16_O4Y

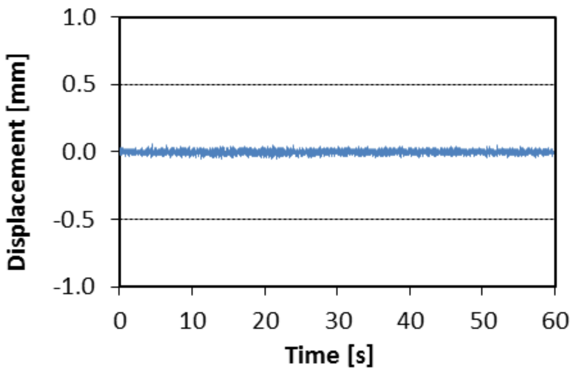


Figure AI. 69 - Channel LVDT_V11_E2X

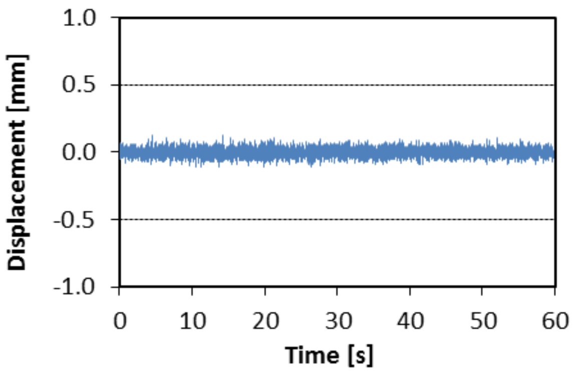


Figure AI. 70 - Channel LVDT_V12_E2X

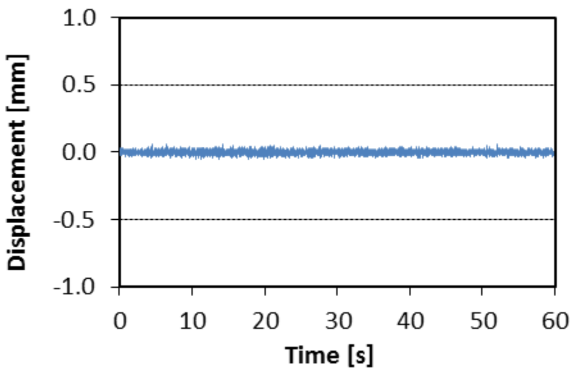


Figure AI. 71 - Channel LVDT_V13_O2x

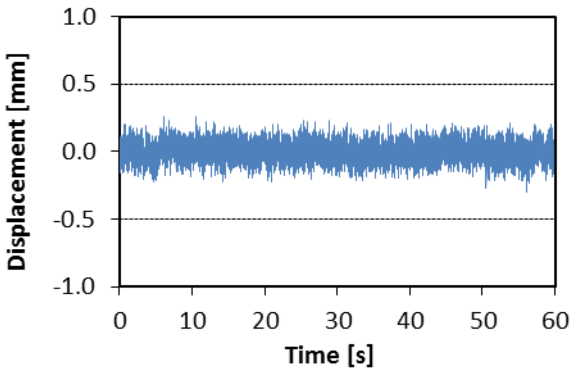


Figure AI. 72 - Channel LVDT_V14_O2X

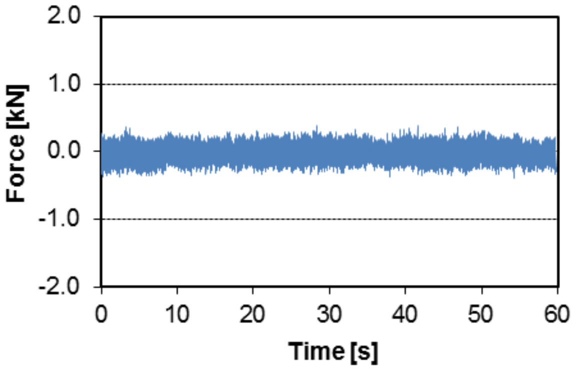


Figure AI. 73 - Channel LC_01_E5x_SW

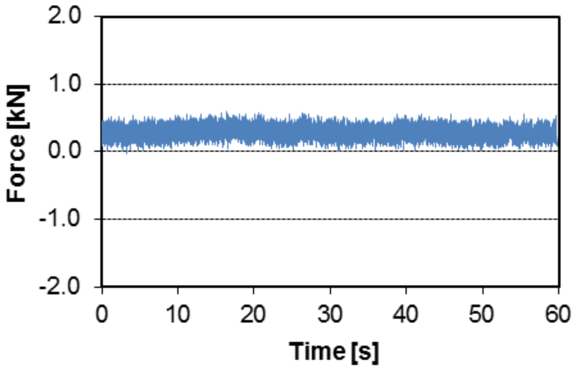


Figure AI. 74 - Channel LC_02_E2x_E

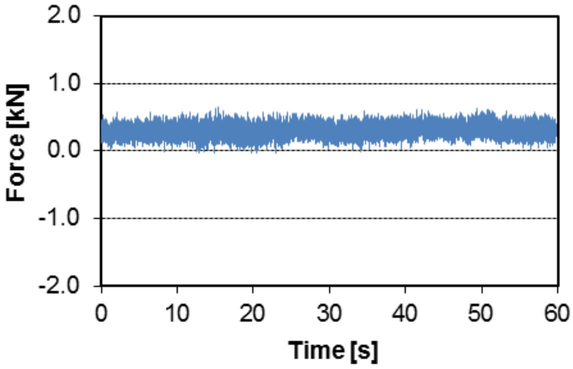


Figure AI. 75 - Channel LC_03_E5x_NW

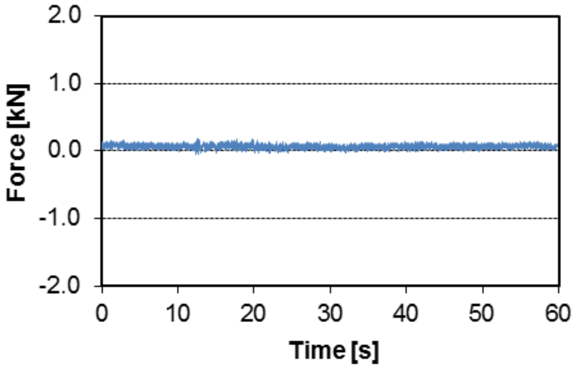


Figure AI. 76 - Channel LC_16_E2x_NE

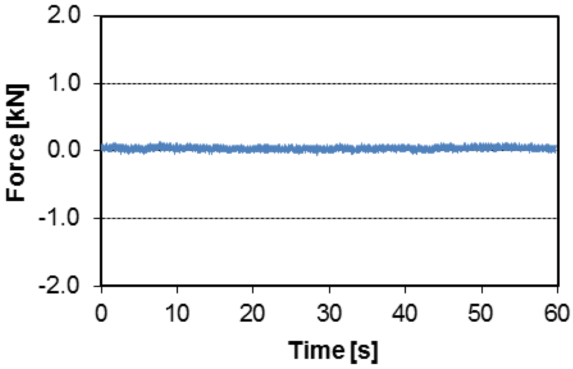


Figure AI. 77 - Channel LC_05_E3y_INTERIOR

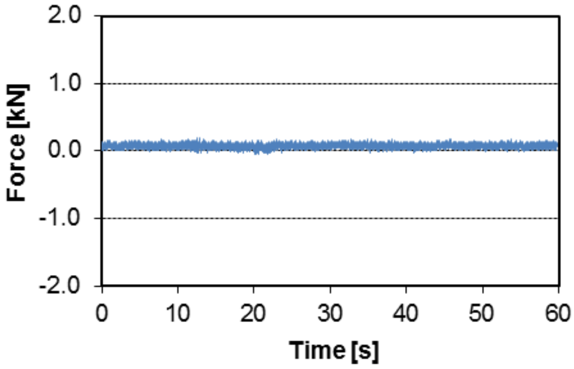


Figure AI. 78 - Channel LC_06_E3y_INTERIOR

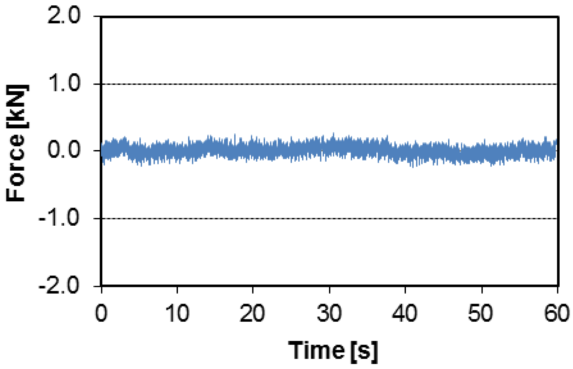


Figure AI. 79 - Channel LC_07_E4y_INTERIOR

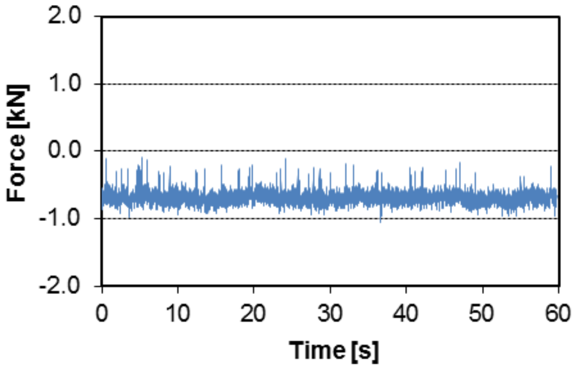


Figure AI. 80 - Channel LC_08_E4y_INTERIOR

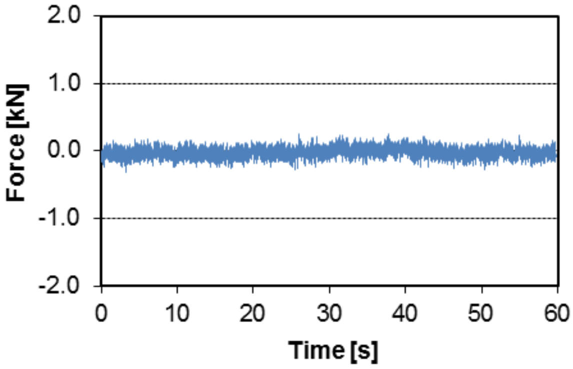


Figure AI. 81 - Channel LC_09_E5y_N

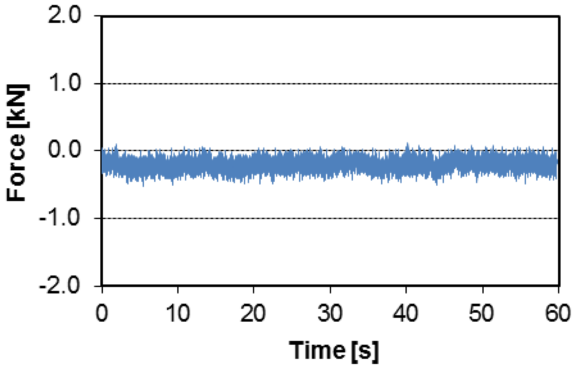


Figure AI. 82 - Channel LC_10_E5y_NE

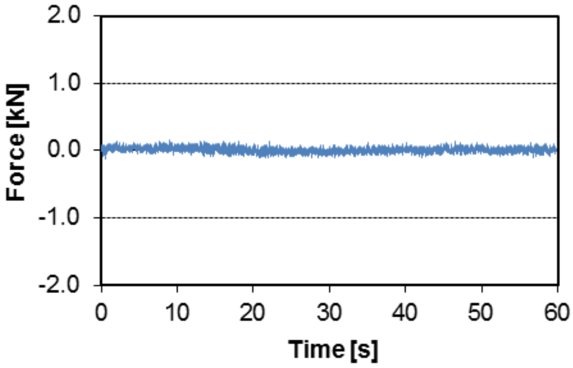


Figure AI. 83 - Channel LC_11_E1y_SE

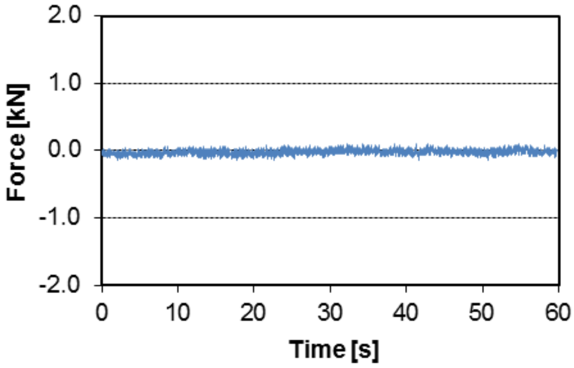


Figure AI. 84 - Channel LC_04_E1y_S

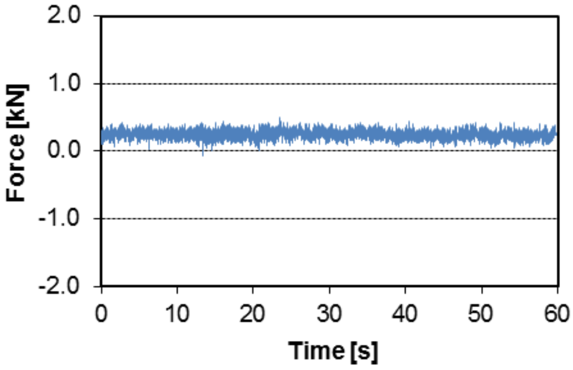


Figure AI. 85 - Channel LC_13_E3x_S

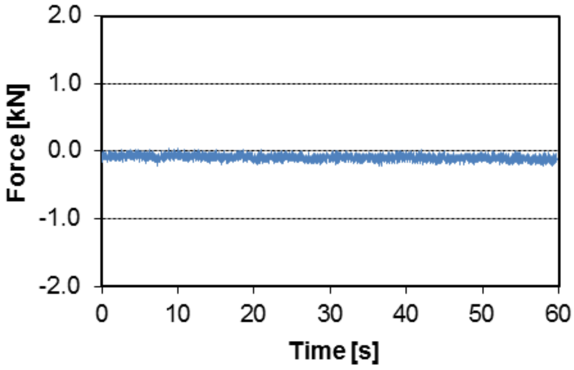


Figure AI. 86 - Channel LC_14_E3x_N

Seismic test TEST050_03

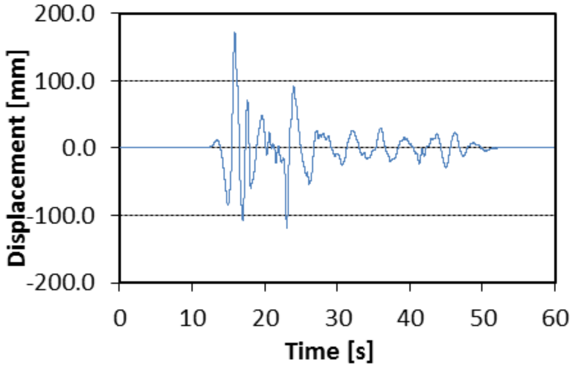


Figure AI. 87 – Channel DISP MESA TRANS

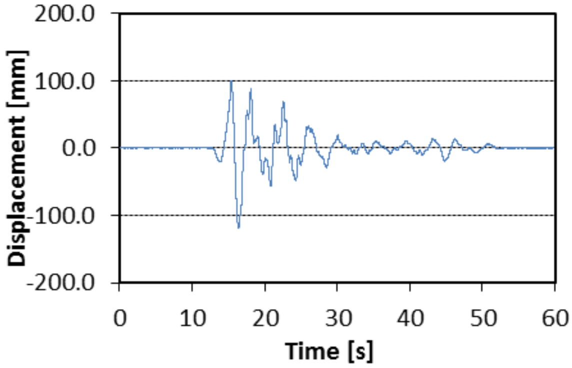


Figure AI. 88 - Channel DISP MESA LONG

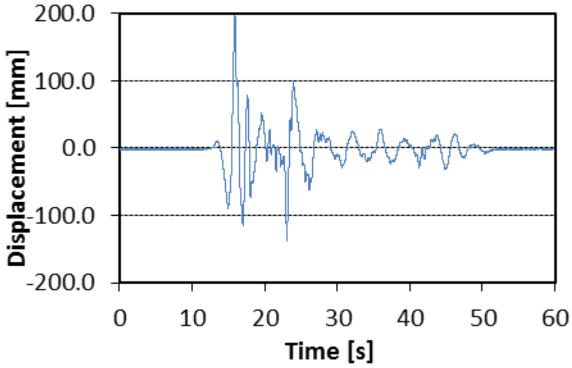


Figure AI. 89 - Channel DISP_L2_SE_X_T

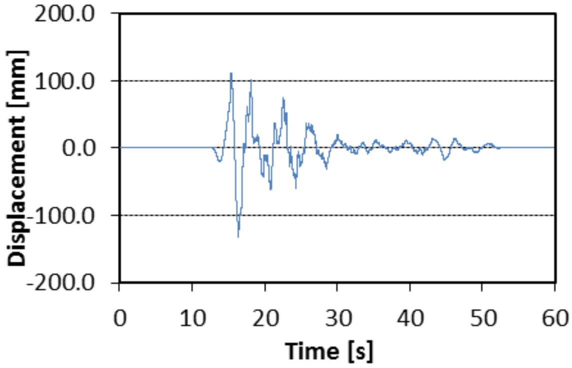


Figure AI. 90 - DISP_L2_SE_Y_L

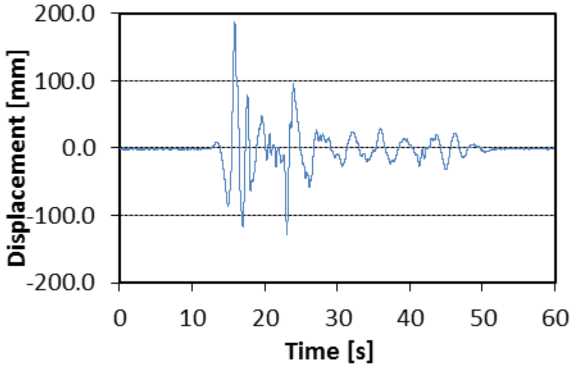


Figure AI. 91 - Channel DISP_L1_SE_X_T

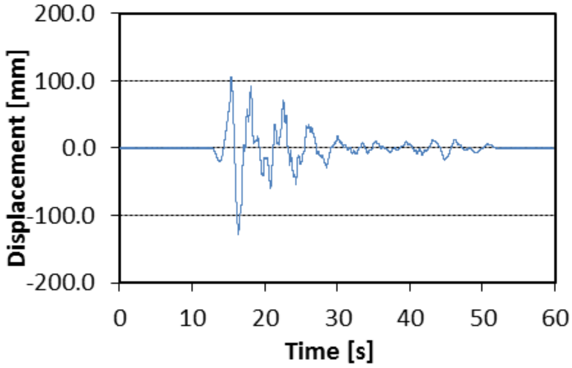


Figure AI. 92 - Channel DISP_L1_SE_Y_L

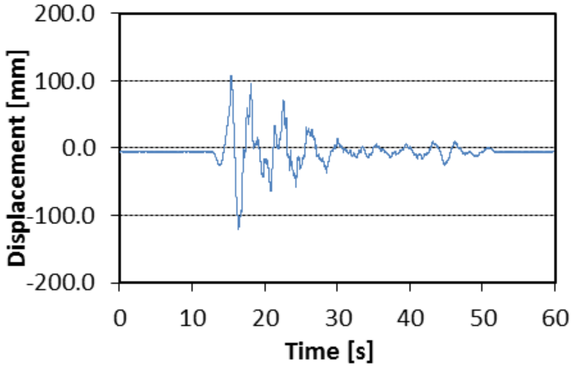


Figure AI. 93 - Channel DISP_L2_NW_X_L

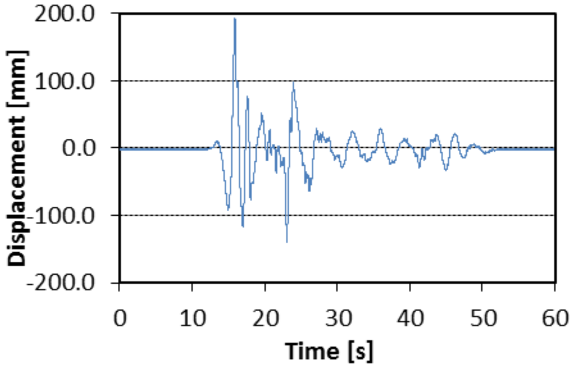


Figure AI. 94 - Channel DISP_L2_NW_Y_T

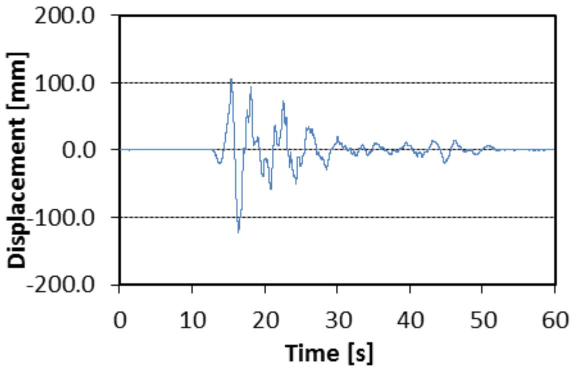


Figure AI. 95 - Channel DISP_L1_NW_X_L

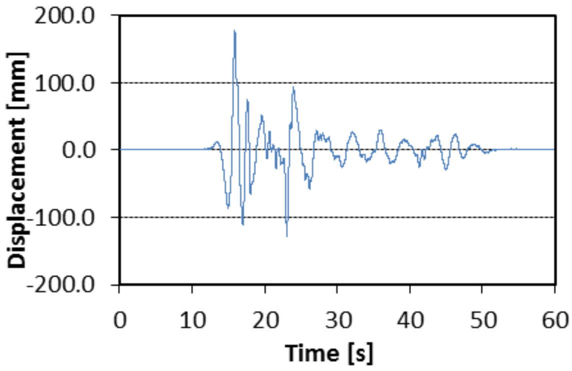


Figure AI. 96 – Channel DISP_L1_NW_Y_T

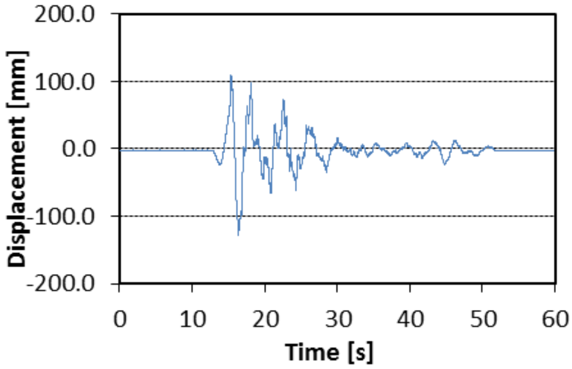


Figure AI. 97 - Channel DISP_RL_NW_X_L

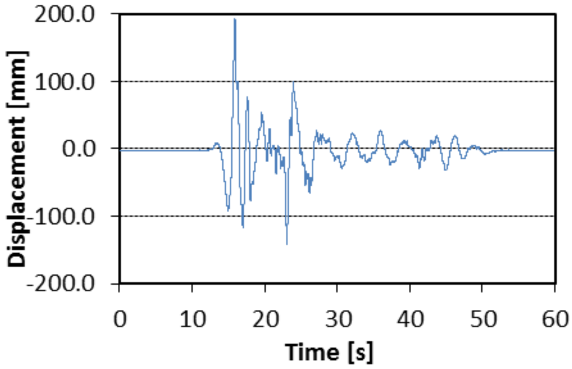


Figure AI. 98 - Channel DISP_RL_NW_Y_T

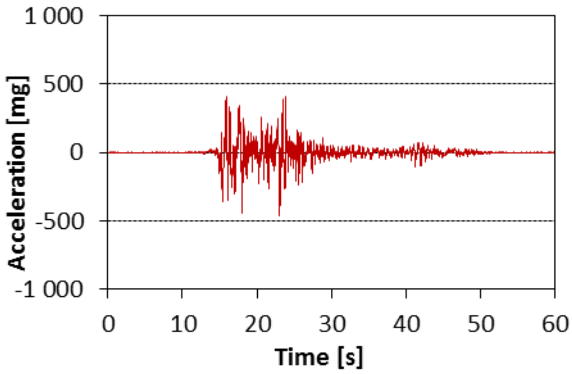


Figure AI. 99 - Channel ACC MESA TRANS

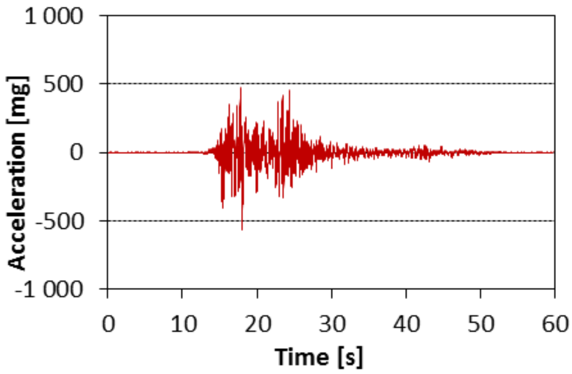


Figure AI. 100 - Channel ACC MESA LONG

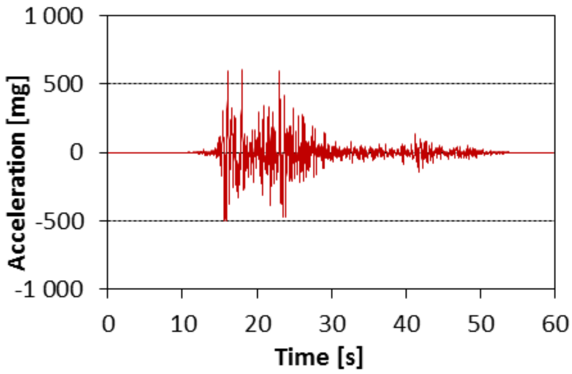


Figure AI. 101 - Channel ACC_L1_A1_Y_SE_T

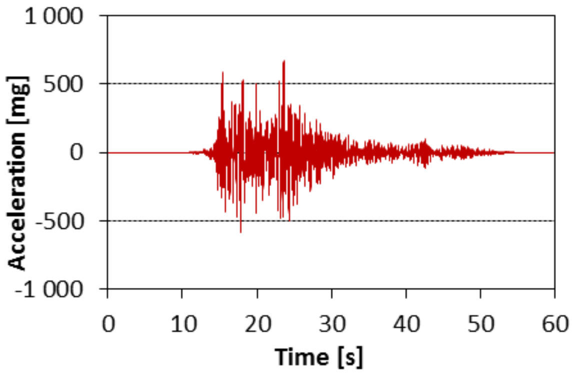


Figure AI. 102 - Channel ACC_L1_A1_X_SE_L

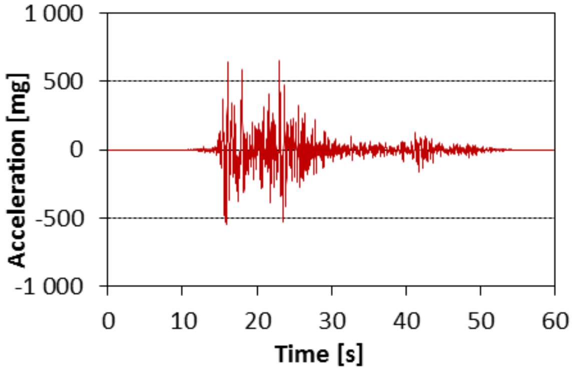


Figure AI. 103 - Channel ACC_L1_C1_Y_NE_T

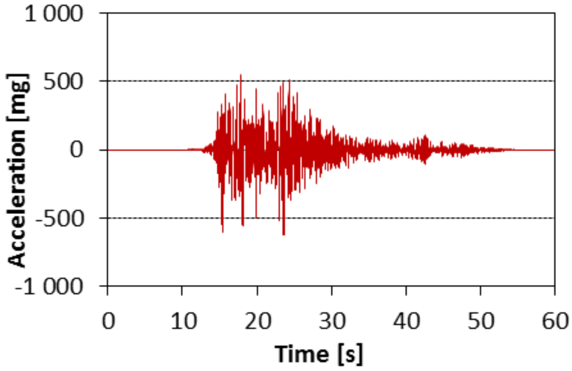


Figure AI. 104 - Channel ACC_L1_C1_X_NE_L

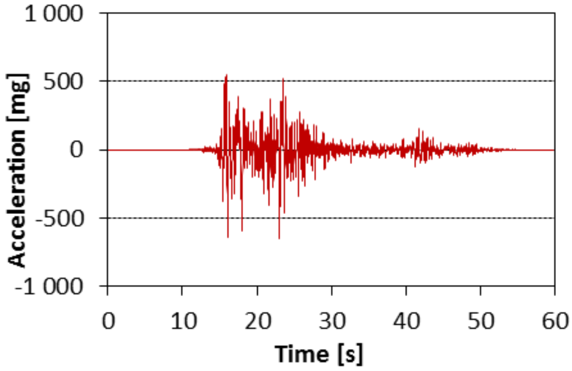


Figure AI. 105 - Channel ACC_L1_C2_Y_N_T

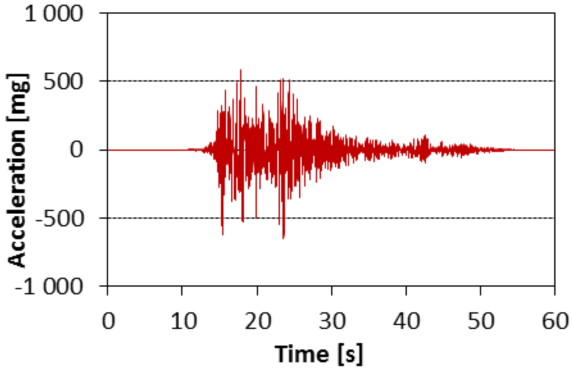


Figure AI. 106 - Channel ACC_L1_C2_X_N_L

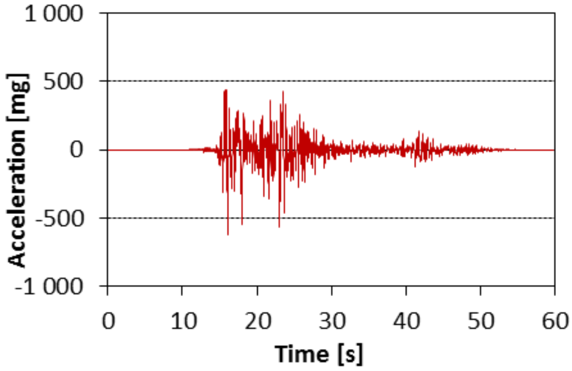


Figure AI. 107 - Channel ACC_L1_C3_Y_NW_T

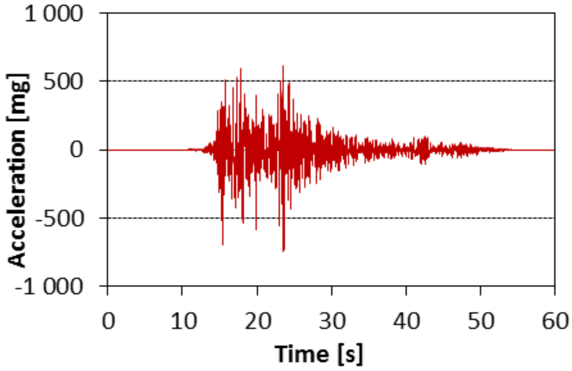


Figure AI. 108 - Channel ACC_L1_C3_X_NW_L

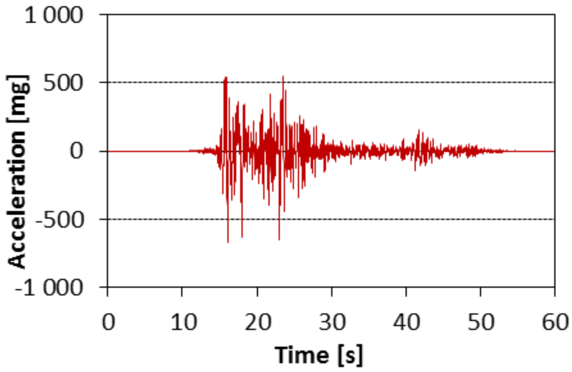


Figure AI. 109 - Channel ACC_L1_B3_Y_W_T

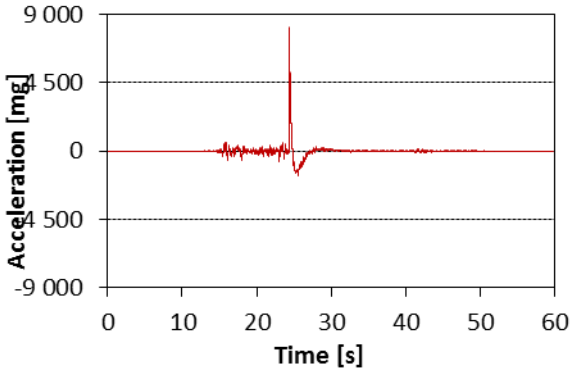


Figure AI. 110 - Channel ACC_L1_B2_Y_I_T

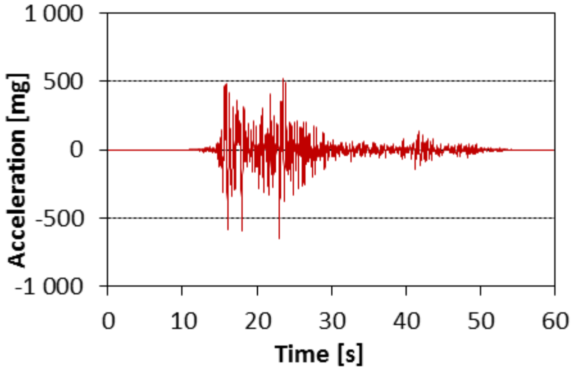


Figure AI. 111 - Channel ACC_L1_A3_Y_SW_T

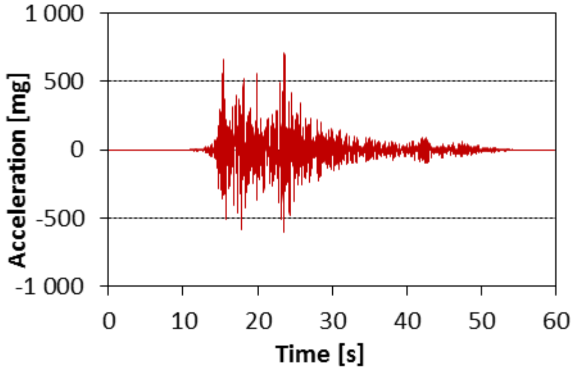


Figure AI. 112 - Channel ACC_L1_A3_X_SW_L

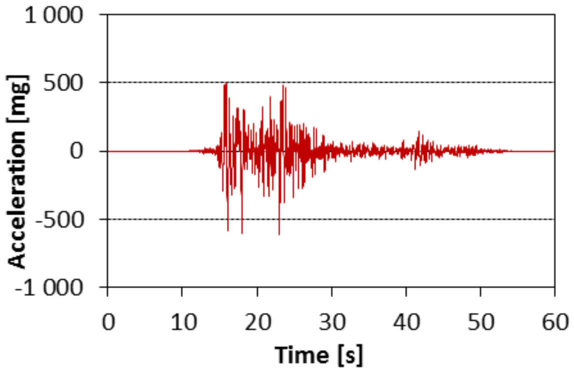


Figure AI. 113 - Channel ACC_L1_A2_Y_S_T

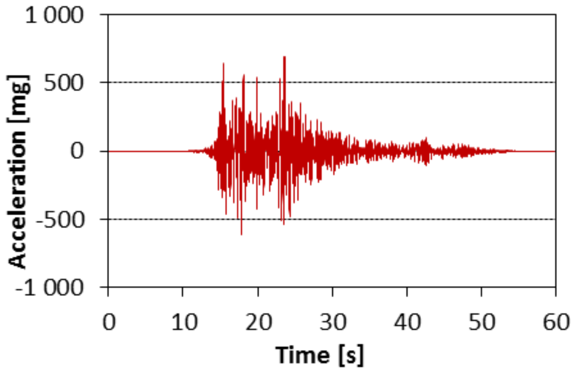


Figure AI. 114 - Channel ACC_L1_A2_X_S_L

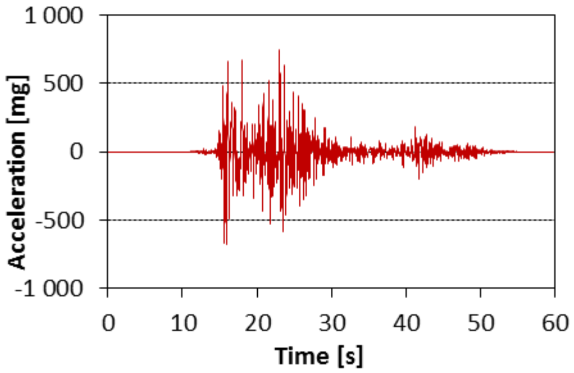


Figure AI. 115 - Channel ACC_L2_A1_Y_SE_T

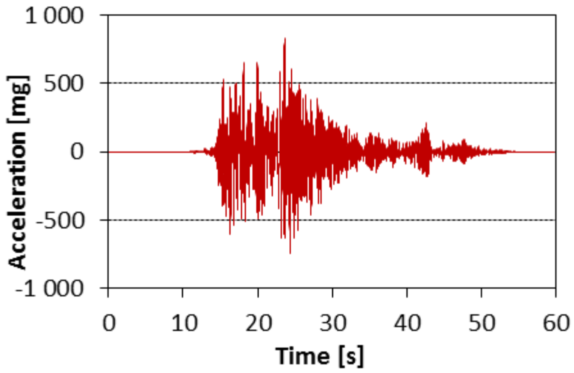


Figure AI. 116 - Channel ACC_L2_A1_X_SE_L

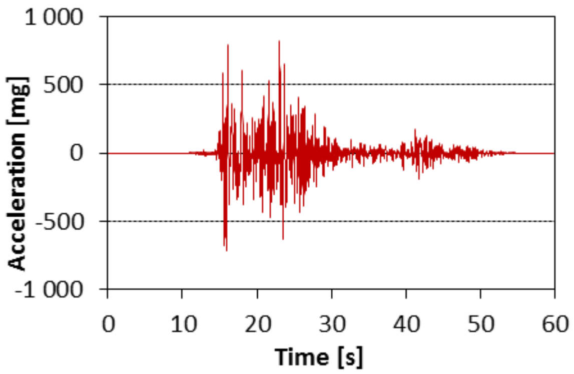


Figure AI. 117 - Channel ACC_L2_C1_Y_NE_T

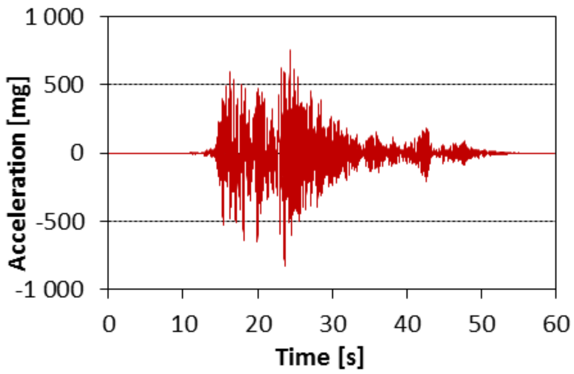


Figure AI. 118 - Channel ACC_L2_C1_X_NE_L

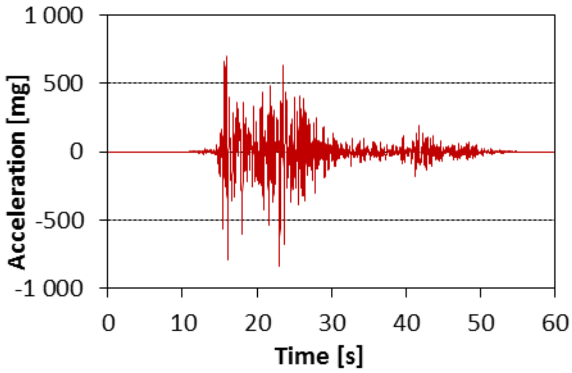


Figure AI. 119 - Channel ACC_L2_C2_Y_N_T

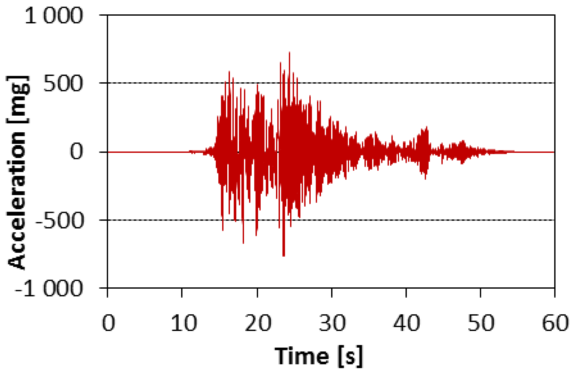


Figure AI. 120 - Channel ACC_L2_C2_X_N_L

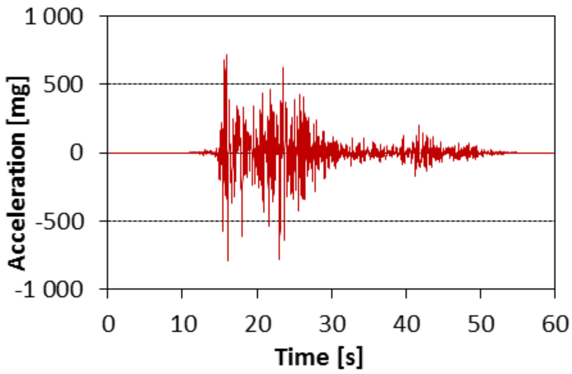


Figure AI. 121 - Channel ACC_L2_C3_Y_NW_T

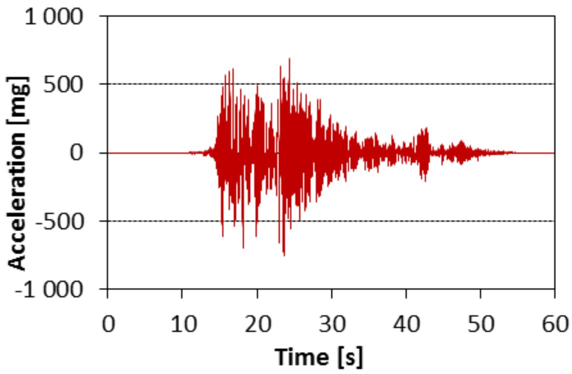


Figure AI. 122 - Channel ACC_L2_C3_X_NW_L

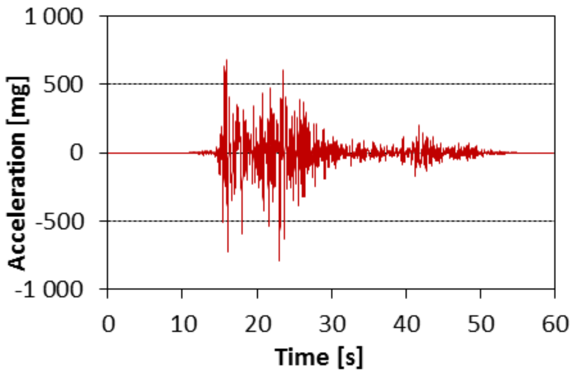


Figure AI. 123 - Channel ACC_L2_B3_Y_W_T

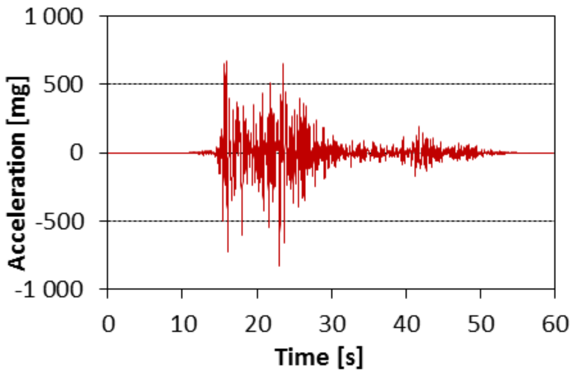


Figure AI. 124 - Channel ACC_L2_B2_Y_I_T

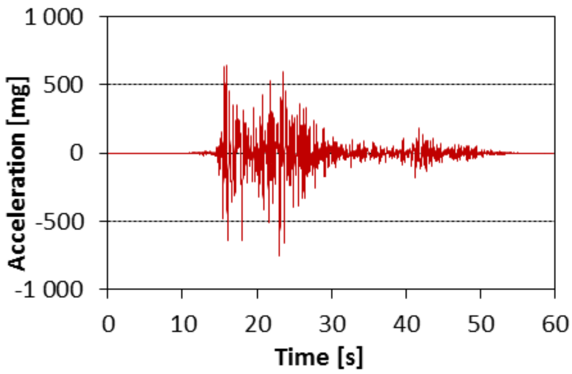


Figure AI. 125 - Channel ACC_L2_A3_Y_SW_T

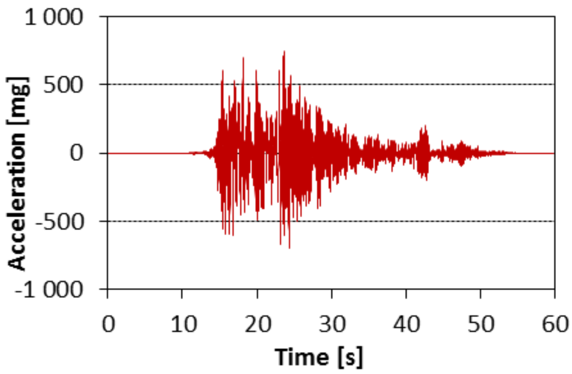


Figure AI. 126 - Channel ACC_L2_A3_X_SW_L

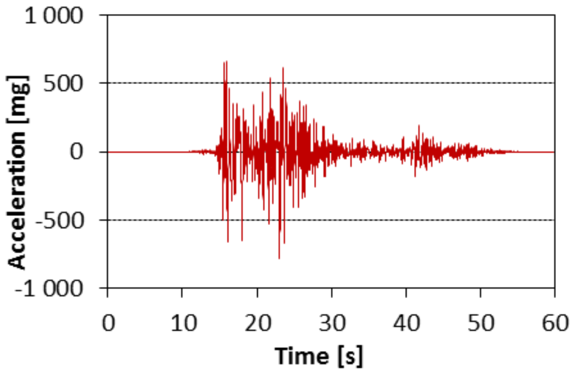


Figure AI. 127 - Channel ACC_L2_A2_Y_S_T

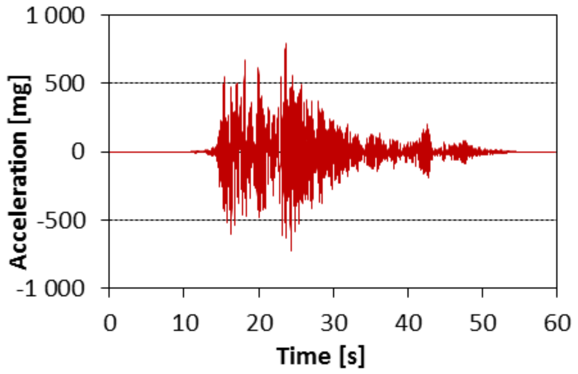


Figure AI. 128 - Channel ACC_L2_A2_X_S_L

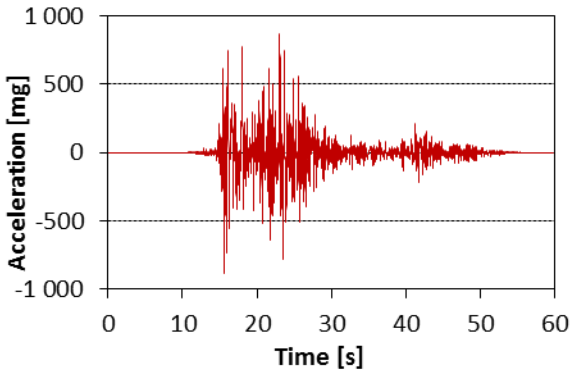


Figure AI. 129 - Channel ACC_RL_A1_Y_SE_T

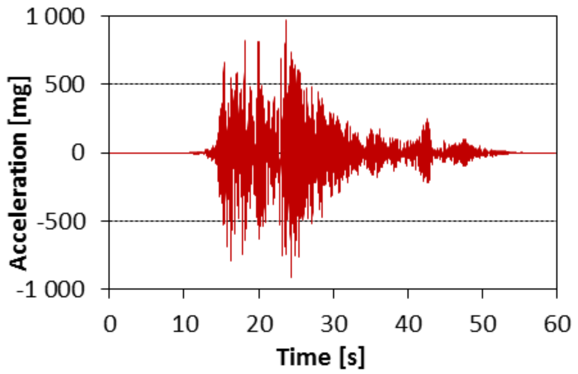


Figure AI. 130 - Channel ACC_RL_A1_X_SE_L

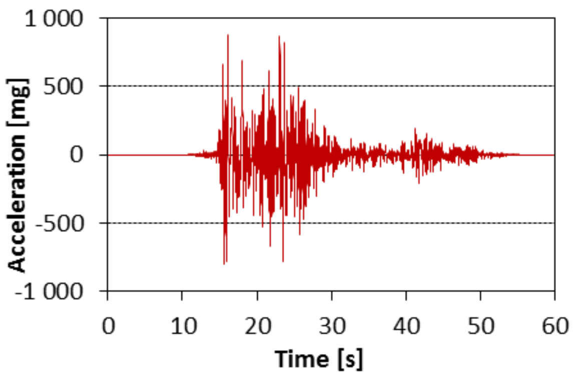


Figure AI. 131 - Channel ACC_RL_C1_Y_NE_T

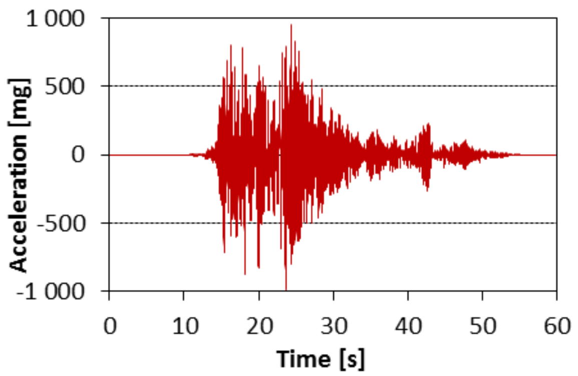


Figure AI. 132 - Channel ACC_RL_C1_X_NE_L

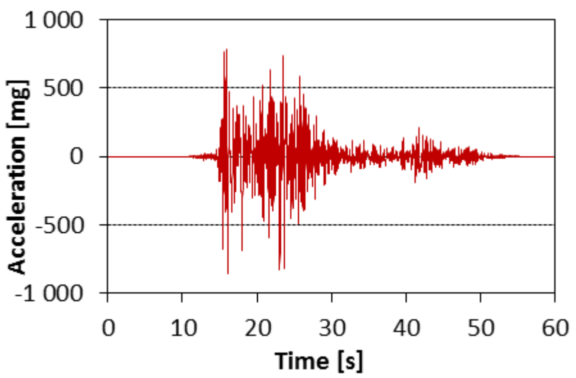


Figure AI. 133 - Channel ACC_RL_C3_Y_NW_T

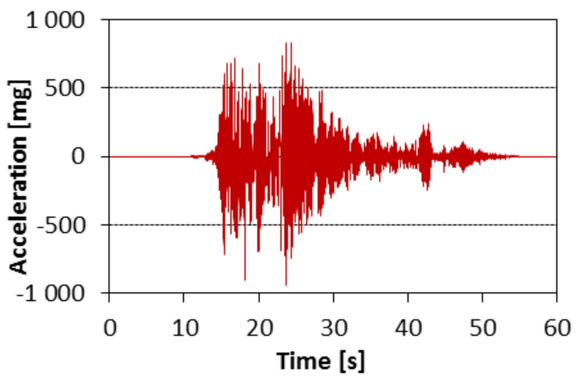


Figure AI. 134 - Channel ACC_RL_C3_X_NW_L

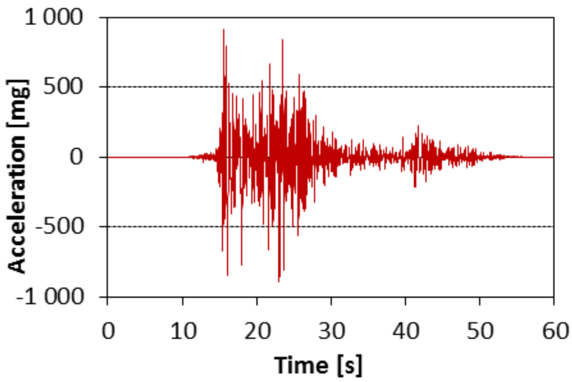


Figure AI. 135 - Channel ACC_RL_B3_Y_W_T

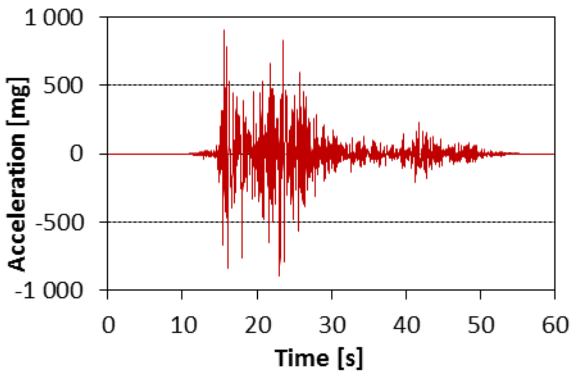


Figure AI. 136 - Channel ACC_RL_B2_Y_I_T

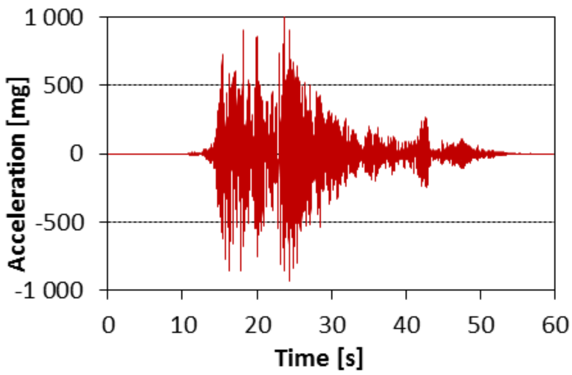


Figure AI. 137 - Channel ACC_RL_B2_X_I_L

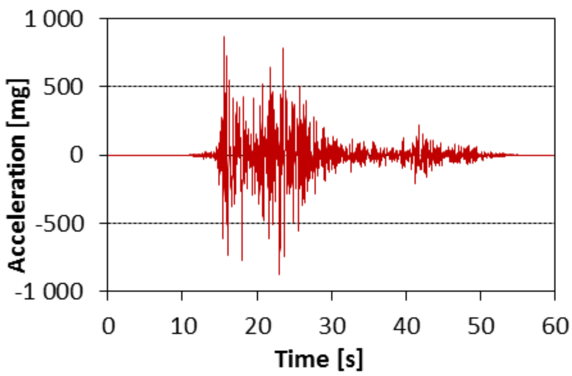


Figure AI. 138 - Channel ACC_RL_A3_Y_SW_T

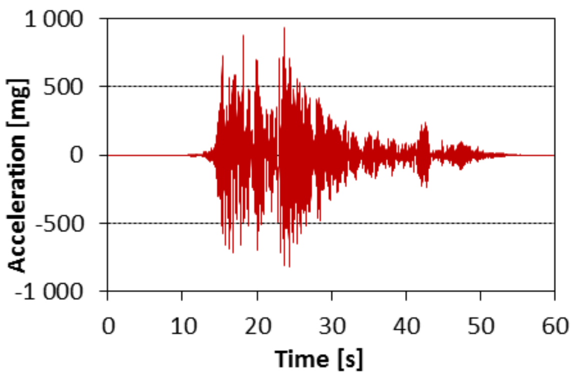


Figure AI. 139 - Channel ACC_RL_A3_X_SW_L

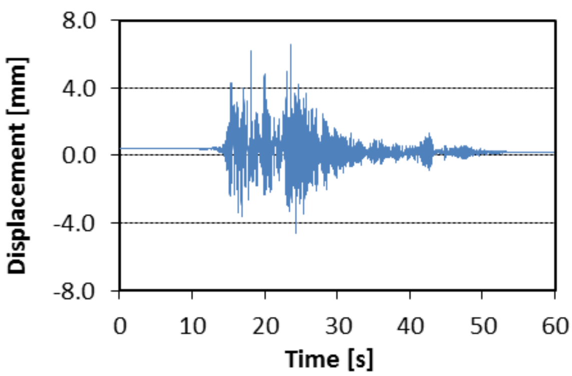


Figure AI. 140 - Channel LVDT_H07

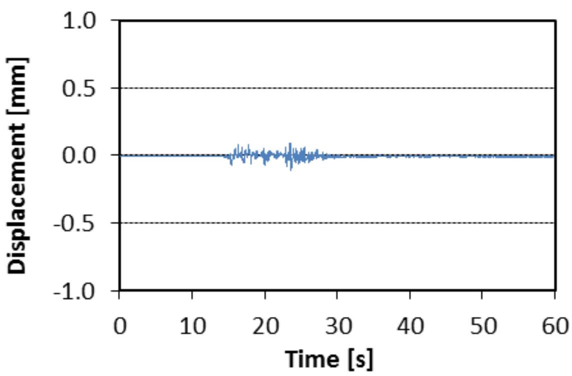


Figure AI. 141 - Channel LVDT_H05

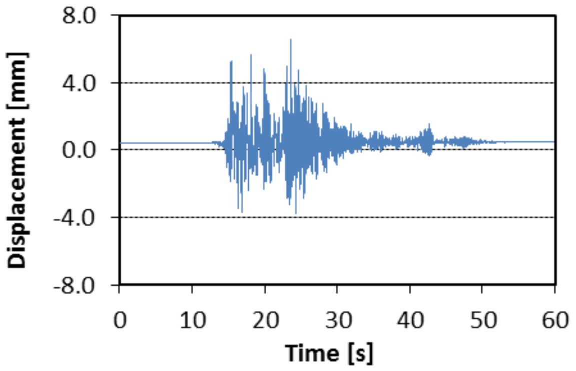


Figure AI. 142 - Channel LVDT_H03

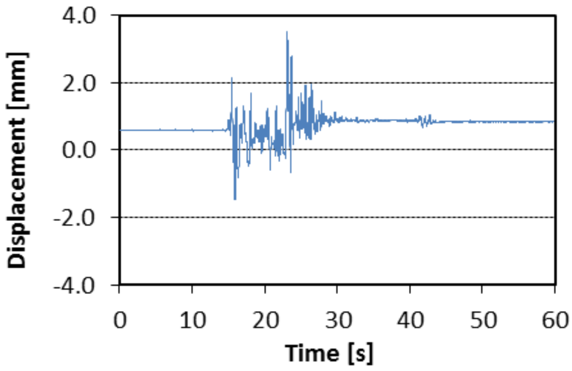


Figure AI. 143 - Channel LVDT_H04

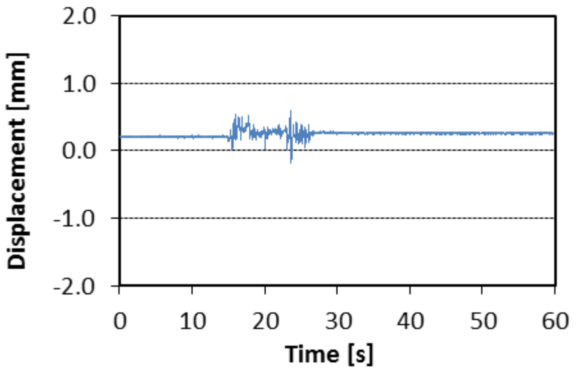


Figure AI. 144 - Channel LVDT_IID02

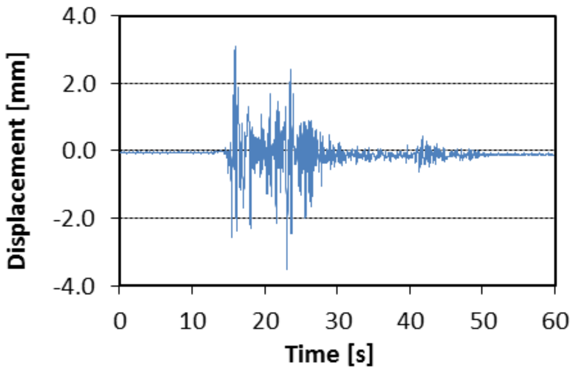


Figure AI. 145 - Channel LVDT_IID04

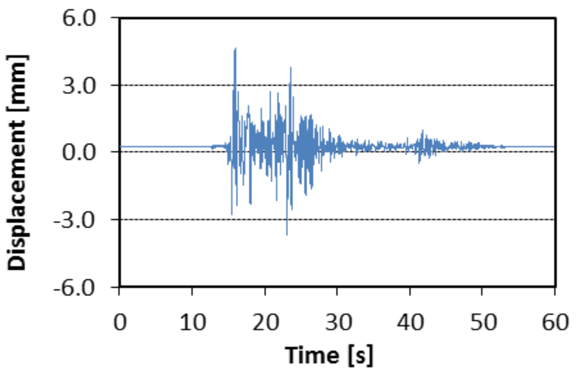


Figure AI. 146 - Channel LVDT_IID01

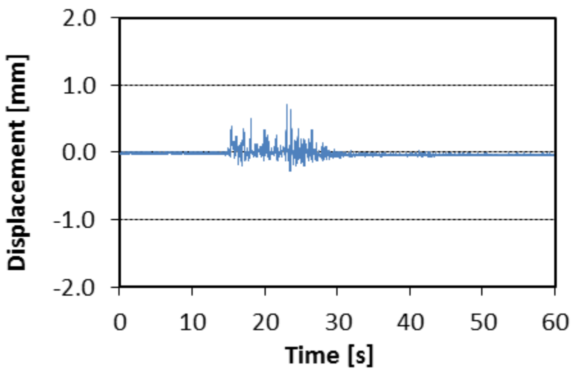


Figure AI. 147 - Channel LVDT_IID03

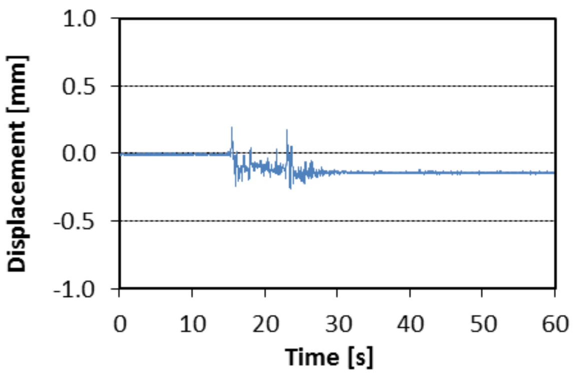


Figure AI. 148 - Channel LVDT_V10_E5Y

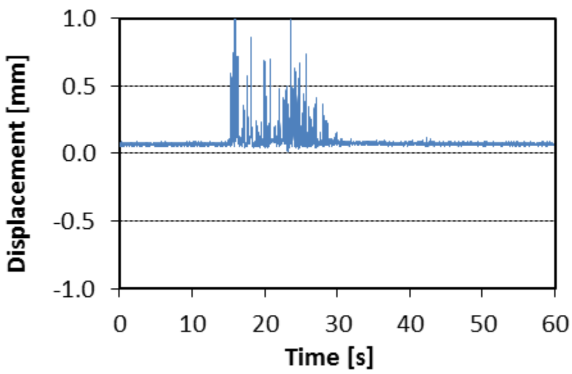


Figure AI. 149 - Channel LVDT_V02_E5X

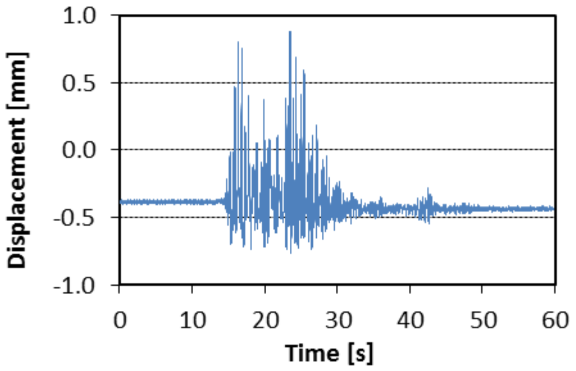


Figure AI. 150 - Channel LVDT_V03_E2X

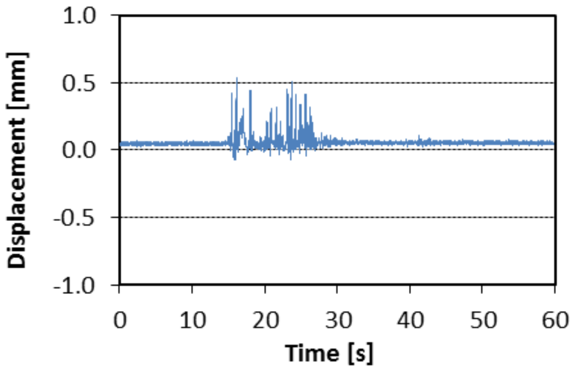


Figure AI. 151 - Channel LVDT_V04_E2X

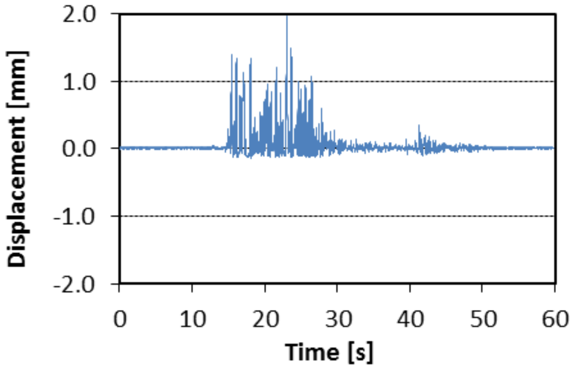


Figure AI. 152 - Channel LVDT_V01_E5X

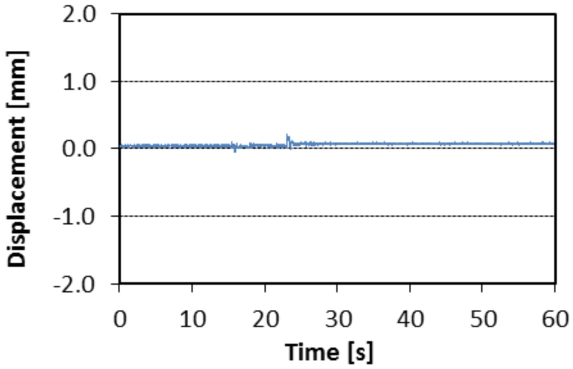


Figure AI. 153 - Channel LVDT_V07_E5Y

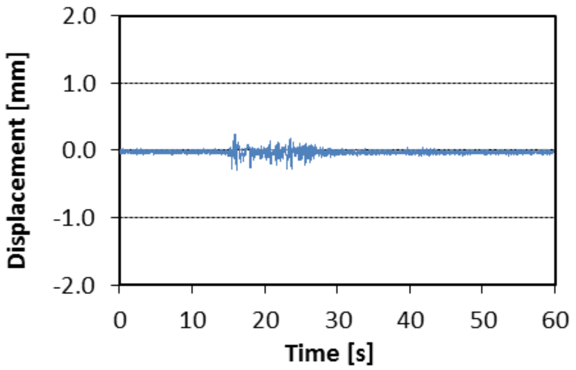


Figure AI. 154 - Channel LVDT_V16_O4Y

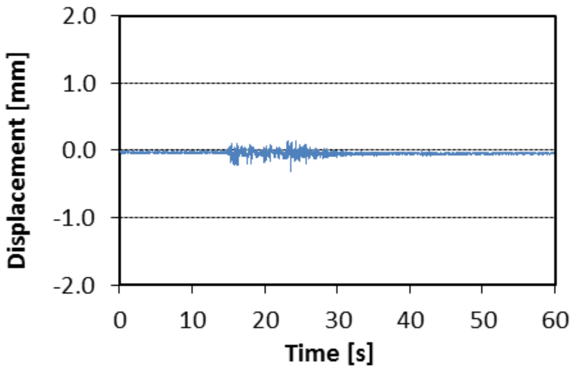


Figure AI. 155 - Channel LVDT_V11_E2X

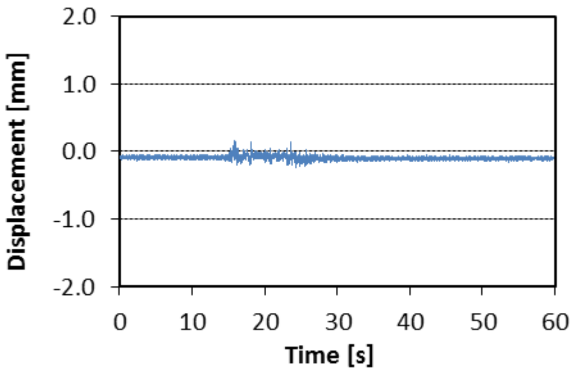


Figure AI. 156 - Channel LVDT_V12_E2X

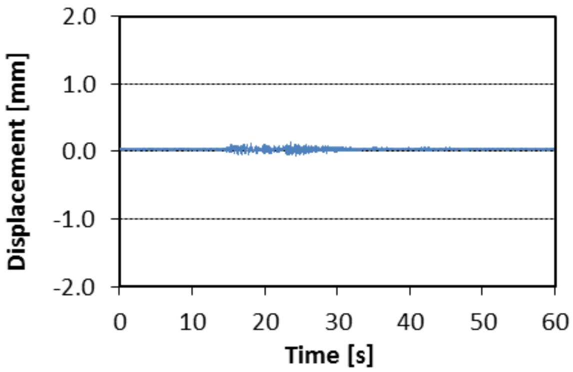


Figure AI. 157 - Channel LVDT_V13_O2x

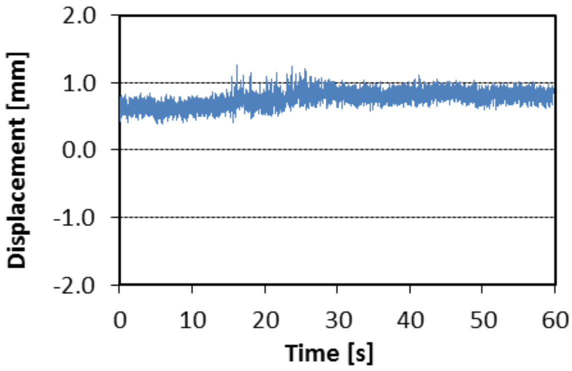


Figure AI. 158 - Channel LVDT_V14_O2X

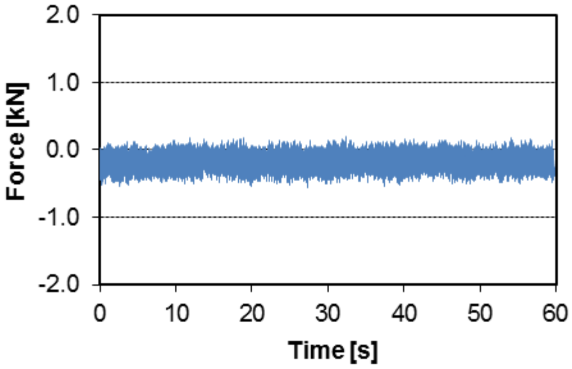


Figure AI. 159 - Channel LC_01_E5x_SW

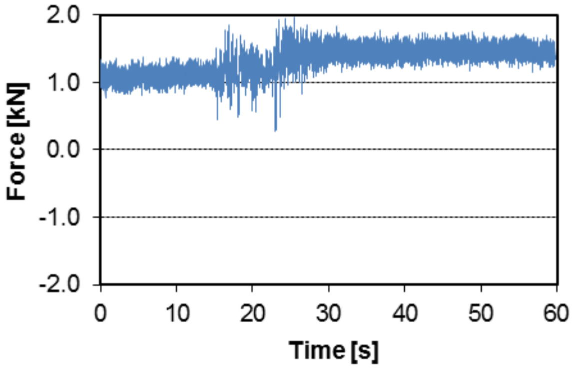


Figure AI. 160 - Channel LC_02_E2x_E

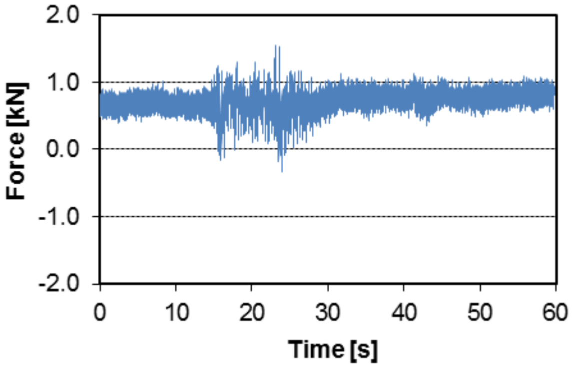


Figure AI. 161 - Channel LC_03_E5x_NW

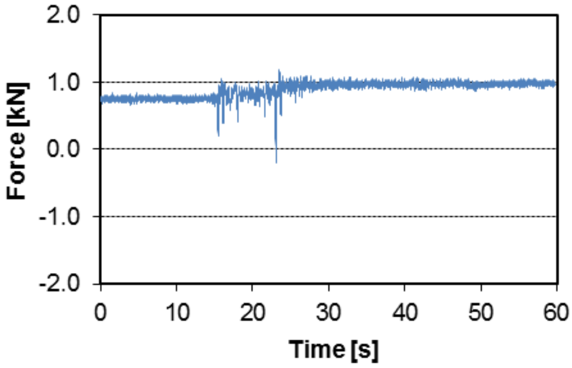


Figure AI. 162 - Channel LC_16_E2x_NE

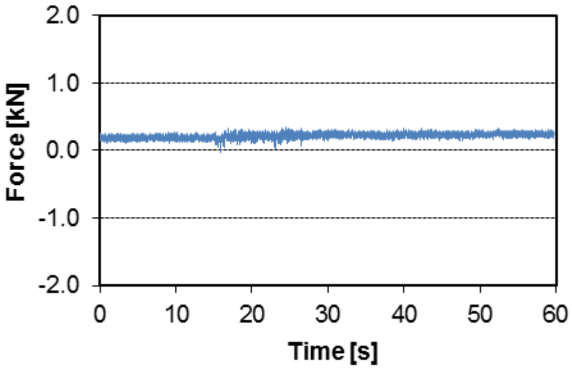


Figure AI. 163 - Channel LC_05_E3y_INTERIOR

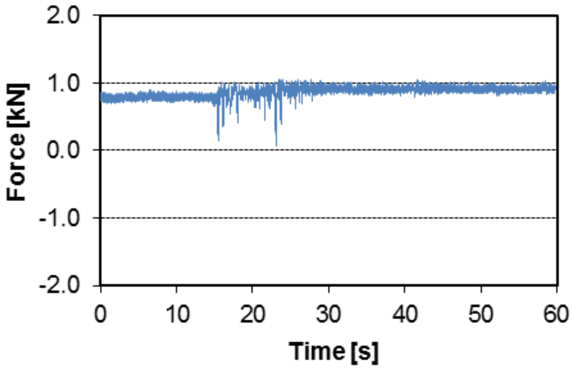


Figure AI. 164 - Channel LC_06_E3y_INTERIOR

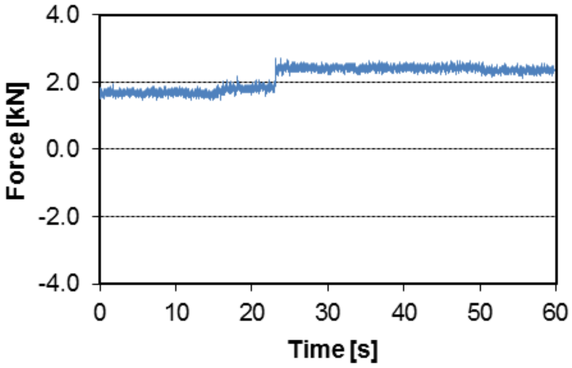


Figure AI. 165 - Channel LC_07_E4y_INTERIOR

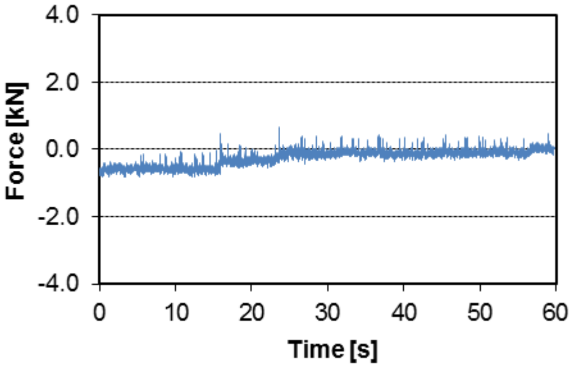


Figure AI. 166 - Channel LC_08_E4y_INTERIOR

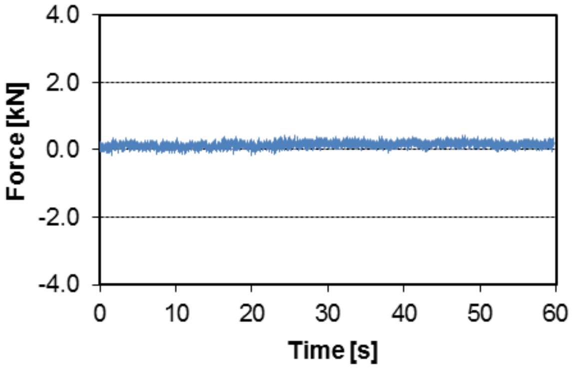


Figure AI. 167 - Channel LC_09_E5y_N

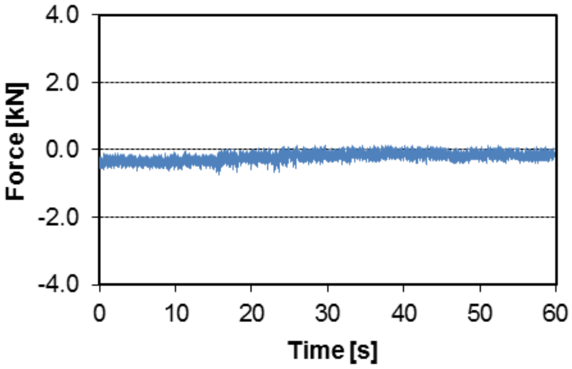


Figure AI. 168 - Channel LC_10_E5y_NE

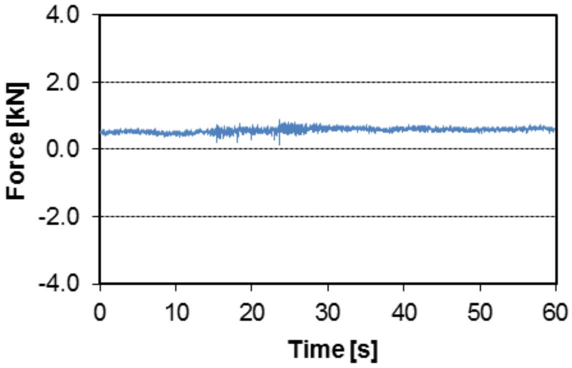


Figure AI. 169 - Channel LC_11_E1y_SE

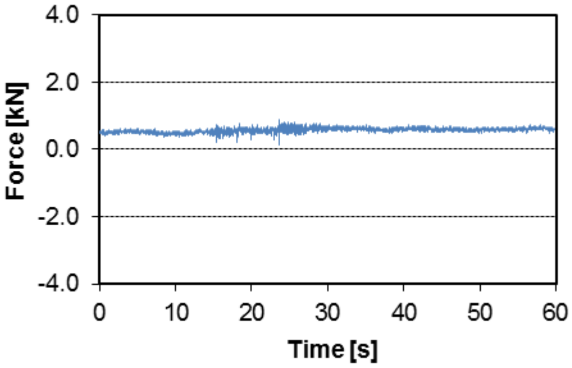


Figure AI. 170 - Channel LC_04_E1y_S

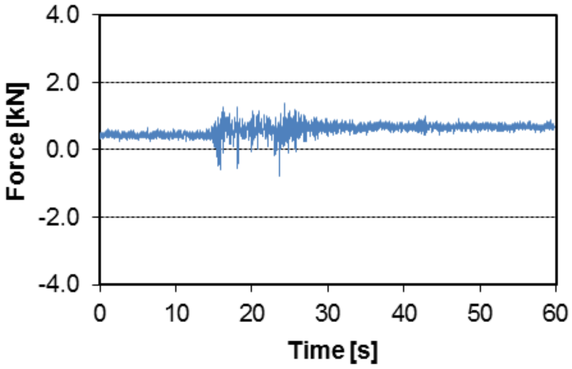


Figure AI. 171 - Channel LC_13_E3x_S

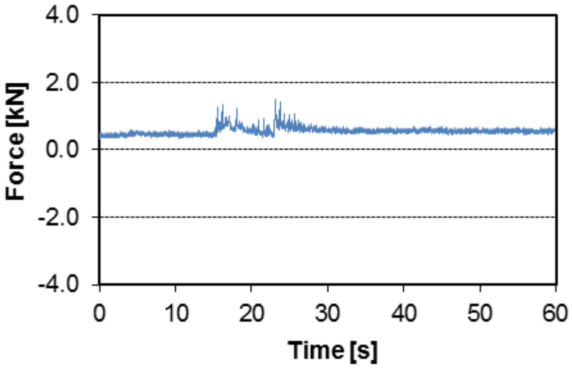


Figure AI. 172 - Channel LC_14_E3x_N

ANNEX II
Digital signal processing results

Maximum simultaneous values

Table AII.1 – Maximum simultaneous values on all vertical deformation for seismic test TEST007_01

TEST007_01	V10_E5Y	V02_E5X	V03_E2X	V04_E2X	V01_E5X	V07_E5Y	V16_O4Y	V11_E2X	V12_E2X	V13_O2x	V14_O2X
V10_E5Y	0.04	0.01	0.01	0.00	0.01	0.01	0.01	0.03	0.01	0.02	0.01
V02_E5X	0.00	0.04	0.03	0.02	0.03	0.06	0.03	0.05	0.04	0.05	0.02
V03_E2X	0.01	0.04	0.04	0.04	0.04	0.05	0.04	0.09	0.03	0.09	0.04
V04_E2X	0.00	0.03	0.03	0.09	0.04	0.03	0.04	0.07	0.02	0.08	0.04
V01_E5X	0.01	0.04	0.04	0.04	0.04	0.05	0.04	0.09	0.03	0.09	0.04
V07_E5Y	0.01	0.03	0.02	0.01	0.03	0.07	0.02	0.06	0.02	0.06	0.02
V16_O4Y	0.01	0.04	0.04	0.04	0.04	0.05	0.04	0.09	0.03	0.09	0.04
V11_E2X	0.01	0.04	0.04	0.04	0.04	0.05	0.04	0.09	0.04	0.10	0.04
V12_E2X	0.00	0.03	0.03	0.04	0.04	0.01	0.04	0.08	0.05	0.09	0.04
V13_O2x	0.01	0.04	0.04	0.04	0.04	0.05	0.04	0.09	0.04	0.10	0.04
V14_O2X	0.01	0.03	0.04	0.03	0.04	0.04	0.04	0.09	0.04	0.09	0.05

Table AII.2 – Maximum simultaneous values on all vertical deformation for seismic test TEST007_02

TEST007_02	V10_E5Y	V02_E5X	V03_E2X	V04_E2X	V01_E5X	V07_E5Y	V16_O4Y	V11_E2X	V12_E2X	V13_O2x	V14_O2X
V10_E5Y	0.05	0.00	0.01	0.02	0.01	0.03	0.01	0.05	0.00	0.04	0.01
V02_E5X	0.01	0.04	0.04	0.04	0.04	0.04	0.04	0.09	0.04	0.09	0.04
V03_E2X	0.00	0.04	0.04	0.04	0.04	0.04	0.04	0.08	0.04	0.08	0.04
V04_E2X	0.01	0.02	0.03	0.12	0.04	0.00	0.04	0.09	0.01	0.10	0.05
V01_E5X	0.00	0.04	0.04	0.04	0.04	0.04	0.04	0.08	0.04	0.08	0.04
V07_E5Y	0.00	0.02	0.02	0.01	0.02	0.09	0.02	0.03	0.00	0.02	0.01
V16_O4Y	0.00	0.03	0.04	0.08	0.04	0.03	0.04	0.07	0.03	0.08	0.05
V11_E2X	0.01	0.03	0.03	0.04	0.04	0.04	0.04	0.09	0.04	0.10	0.04
V12_E2X	0.00	0.03	0.03	0.02	0.03	0.04	0.04	0.09	0.04	0.09	0.04
V13_O2x	0.01	0.02	0.03	0.12	0.04	0.00	0.04	0.09	0.01	0.10	0.05
V14_O2X	0.01	0.02	0.03	0.12	0.04	0.00	0.04	0.09	0.01	0.10	0.05

Table AII.3 – Maximum simultaneous values on all vertical deformation for seismic test TEST007_03

TEST007_03	V10_E5Y	V02_E5X	V03_E2X	V04_E2X	V01_E5X	V07_E5Y	V16_O4Y	V11_E2X	V12_E2X	V13_O2x	V14_O2X
V10_E5Y	0.06	0.00	0.00	0.08	0.00	0.02	0.00	0.03	0.02	0.01	0.00
V02_E5X	0.01	0.05	0.05	0.05	0.05	0.06	0.05	0.10	0.04	0.10	0.06
V03_E2X	0.01	0.05	0.05	0.05	0.05	0.06	0.05	0.10	0.04	0.10	0.06
V04_E2X	0.00	0.00	0.02	0.13	0.02	0.09	0.02	0.06	0.02	0.07	0.04
V01_E5X	0.01	0.05	0.05	0.05	0.05	0.06	0.05	0.10	0.04	0.10	0.06
V07_E5Y	0.02	0.03	0.02	0.10	0.02	0.15	0.02	0.04	0.03	0.03	0.00
V16_O4Y	0.01	0.05	0.05	0.05	0.05	0.06	0.05	0.10	0.04	0.10	0.06
V11_E2X	0.00	0.04	0.04	0.05	0.05	0.05	0.05	0.11	0.05	0.11	0.05
V12_E2X	0.02	0.04	0.03	0.03	0.02	0.03	0.03	0.04	0.05	0.05	0.01
V13_O2x	0.00	0.04	0.04	0.04	0.04	0.05	0.05	0.10	0.05	0.11	0.05
V14_O2X	0.01	0.05	0.05	0.05	0.05	0.06	0.05	0.10	0.04	0.10	0.06

Table AII.4 – Maximum simultaneous values on all vertical deformation for seismic test TEST007_04

TEST007_04	V10_E5Y	V02_E5X	V03_E2X	V04_E2X	V01_E5X	V07_E5Y	V16_O4Y	V11_E2X	V12_E2X	V13_O2x	V14_O2X
V10_E5Y	0.05	0.01	0.01	0.02	0.01	0.04	0.01	0.03	0.00	0.01	0.02
V02_E5X	0.00	0.06	0.06	0.06	0.06	0.07	0.06	0.15	0.06	0.14	0.07
V03_E2X	0.00	0.06	0.06	0.06	0.06	0.07	0.06	0.15	0.06	0.14	0.07
V04_E2X	0.00	0.01	0.02	0.12	0.02	0.06	0.02	0.04	0.01	0.05	0.04
V01_E5X	0.00	0.06	0.06	0.06	0.06	0.07	0.06	0.15	0.06	0.14	0.07
V07_E5Y	0.00	0.04	0.04	0.02	0.04	0.11	0.04	0.08	0.03	0.08	0.02
V16_O4Y	0.00	0.06	0.06	0.06	0.06	0.07	0.06	0.15	0.06	0.14	0.07
V11_E2X	0.00	0.06	0.06	0.06	0.06	0.07	0.06	0.15	0.06	0.14	0.07
V12_E2X	0.01	0.04	0.04	0.05	0.05	0.05	0.04	0.13	0.06	0.12	0.07
V13_O2x	0.00	0.06	0.06	0.06	0.06	0.07	0.06	0.15	0.06	0.14	0.07
V14_O2X	0.00	0.06	0.06	0.06	0.06	0.07	0.06	0.15	0.06	0.14	0.07

Table AII.5 – Maximum simultaneous values on all vertical deformation for seismic test TEST007_05

TEST007_05	V10_E5Y	V02_E5X	V03_E2X	V04_E2X	V01_E5X	V07_E5Y	V16_O4Y	V11_E2X	V12_E2X	V13_O2x	V14_O2X
V10_E5Y	0.04	0.01	0.01	0.05	0.01	0.01	0.01	0.00	0.03	0.02	0.01
V02_E5X	0.01	0.06	0.05	0.05	0.05	0.06	0.05	0.09	0.05	0.09	0.05
V03_E2X	0.00	0.05	0.05	0.06	0.06	0.07	0.06	0.13	0.06	0.12	0.07
V04_E2X	0.02	0.01	0.01	0.11	0.01	0.03	0.01	0.04	0.01	0.04	0.04
V01_E5X	0.00	0.05	0.05	0.06	0.06	0.07	0.06	0.13	0.06	0.12	0.07
V07_E5Y	0.00	0.03	0.02	0.03	0.03	0.10	0.03	0.06	0.02	0.06	0.01
V16_O4Y	0.00	0.05	0.05	0.06	0.06	0.07	0.06	0.13	0.06	0.12	0.07
V11_E2X	0.00	0.05	0.05	0.06	0.06	0.07	0.06	0.13	0.06	0.12	0.07
V12_E2X	0.00	0.05	0.05	0.06	0.06	0.07	0.06	0.13	0.06	0.12	0.07
V13_O2x	0.00	0.05	0.05	0.06	0.06	0.07	0.06	0.13	0.06	0.12	0.07
V14_O2X	0.00	0.05	0.05	0.06	0.06	0.07	0.06	0.13	0.06	0.12	0.07

Table AII.6 – Maximum simultaneous values on all vertical deformation for seismic test TEST015_01

TEST015_01	V10_E5Y	V02_E5X	V03_E2X	V04_E2X	V01_E5X	V07_E5Y	V16_O4Y	V11_E2X	V12_E2X	V13_O2x	V14_O2X
V10_E5Y	0.07	0.02	0.02	0.03	0.02	0.04	0.02	0.07	0.01	0.05	0.02
V02_E5X	0.02	0.04	0.04	0.03	0.03	0.07	0.04	0.06	0.04	0.06	0.02
V03_E2X	0.01	0.03	0.04	0.04	0.04	0.05	0.04	0.08	0.03	0.07	0.04
V04_E2X	0.03	0.01	0.01	0.17	0.02	0.00	0.01	0.03	0.02	0.05	0.03
V01_E5X	0.01	0.03	0.04	0.04	0.04	0.05	0.04	0.08	0.03	0.07	0.04
V07_E5Y	0.00	0.03	0.03	0.03	0.03	0.14	0.03	0.07	0.02	0.07	0.02
V16_O4Y	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.06	0.03	0.08	0.03
V11_E2X	0.06	0.03	0.03	0.03	0.03	0.05	0.03	0.10	0.00	0.08	0.03
V12_E2X	0.00	0.03	0.03	0.01	0.03	0.05	0.03	0.09	0.05	0.08	0.04
V13_O2x	0.02	0.03	0.02	0.02	0.03	0.02	0.03	0.07	0.04	0.09	0.03
V14_O2X	0.03	0.00	0.02	0.16	0.03	0.05	0.03	0.07	0.00	0.07	0.06

Table AII.7 – Maximum simultaneous values on all vertical deformation for seismic test TEST015_02

TEST015_02	V10_E5Y	V02_E5X	V03_E2X	V04_E2X	V01_E5X	V07_E5Y	V16_O4Y	V11_E2X	V12_E2X	V13_O2x	V14_O2X
V10_E5Y	0.11	0.01	0.02	0.07	0.02	0.03	0.01	0.07	0.03	0.03	0.01
V02_E5X	0.03	0.06	0.05	0.14	0.02	0.12	0.02	0.05	0.06	0.04	0.00
V03_E2X	0.01	0.03	0.05	0.03	0.04	0.04	0.04	0.08	0.04	0.10	0.04
V04_E2X	0.01	0.01	0.02	0.20	0.02	0.01	0.01	0.03	0.02	0.06	0.04
V01_E5X	0.05	0.04	0.05	0.01	0.05	0.16	0.04	0.12	0.01	0.11	0.04
V07_E5Y	0.02	0.04	0.04	0.09	0.03	0.24	0.02	0.08	0.02	0.07	0.01
V16_O4Y	0.01	0.04	0.04	0.05	0.04	0.05	0.04	0.08	0.04	0.08	0.05
V11_E2X	0.05	0.04	0.05	0.01	0.05	0.16	0.04	0.12	0.01	0.11	0.04
V12_E2X	0.03	0.06	0.05	0.14	0.02	0.12	0.02	0.05	0.06	0.04	0.00
V13_O2x	0.05	0.04	0.05	0.01	0.05	0.16	0.04	0.12	0.01	0.11	0.04
V14_O2X	0.02	0.01	0.01	0.12	0.03	0.06	0.03	0.05	0.01	0.05	0.05

Table AII.8 – Maximum simultaneous values on all vertical deformation for seismic test TEST015_03

TEST015_03	V10_E5Y	V02_E5X	V03_E2X	V04_E2X	V01_E5X	V07_E5Y	V16_O4Y	V11_E2X	V12_E2X	V13_O2x	V14_O2X
V10_E5Y	0.15	0.00	0.06	0.10	0.01	0.03	0.01	0.08	0.04	0.04	0.01
V02_E5X	0.03	0.05	0.07	0.15	0.02	0.10	0.02	0.03	0.05	0.03	0.01
V03_E2X	0.01	0.04	0.08	0.03	0.04	0.03	0.05	0.10	0.06	0.12	0.04
V04_E2X	0.02	0.01	0.04	0.21	0.02	0.00	0.02	0.04	0.03	0.06	0.04
V01_E5X	0.01	0.04	0.08	0.03	0.04	0.03	0.05	0.10	0.06	0.12	0.04
V07_E5Y	0.04	0.04	0.05	0.11	0.02	0.28	0.01	0.06	0.01	0.04	0.00
V16_O4Y	0.01	0.04	0.08	0.03	0.04	0.03	0.05	0.10	0.06	0.12	0.04
V11_E2X	0.01	0.04	0.01	0.05	0.04	0.05	0.04	0.11	0.05	0.09	0.06
V12_E2X	0.01	0.04	0.08	0.03	0.04	0.03	0.05	0.10	0.06	0.12	0.04
V13_O2x	0.01	0.04	0.08	0.03	0.04	0.03	0.05	0.10	0.06	0.12	0.04
V14_O2X	0.03	0.02	0.03	0.17	0.02	0.06	0.02	0.07	0.00	0.07	0.06

Table AII.9 – Maximum simultaneous values on all vertical deformation for seismic test TEST028_01

TEST028_01	V10_E5Y	V02_E5X	V03_E2X	V04_E2X	V01_E5X	V07_E5Y	V16_O4Y	V11_E2X	V12_E2X	V13_O2x	V14_O2X
V10_E5Y	0.25	0.02	0.18	0.16	0.01	0.01	0.00	0.09	0.07	0.03	0.01
V02_E5X	0.05	0.08	0.06	0.19	0.05	0.44	0.02	0.09	0.00	0.09	0.00
V03_E2X	0.25	0.02	0.18	0.16	0.01	0.01	0.00	0.09	0.07	0.03	0.01
V04_E2X	0.03	0.02	0.04	0.32	0.02	0.01	0.00	0.00	0.06	0.08	0.04
V01_E5X	0.06	0.06	0.06	0.13	0.05	0.34	0.02	0.10	0.01	0.11	0.02
V07_E5Y	0.05	0.07	0.05	0.21	0.04	0.45	0.01	0.07	0.00	0.07	0.01
V16_O4Y	0.19	0.01	0.12	0.14	0.03	0.04	0.03	0.13	0.03	0.08	0.02
V11_E2X	0.19	0.01	0.12	0.14	0.03	0.04	0.03	0.13	0.03	0.08	0.02
V12_E2X	0.13	0.05	0.08	0.13	0.01	0.01	0.01	0.01	0.07	0.04	0.02
V13_O2x	0.06	0.06	0.06	0.13	0.05	0.34	0.02	0.10	0.01	0.11	0.02
V14_O2X	0.08	0.07	0.07	0.28	0.00	0.15	0.01	0.02	0.05	0.00	0.05

Table AII.10 – Maximum simultaneous values on all vertical deformation for seismic test TEST028_02

TEST028_02	V10_E5Y	V02_E5X	V03_E2X	V04_E2X	V01_E5X	V07_E5Y	V16_O4Y	V11_E2X	V12_E2X	V13_O2x	V14_O2X
V10_E5Y	0.42	0.00	0.31	0.23	0.04	0.04	0.04	0.17	0.08	0.08	0.04
V02_E5X	0.17	0.15	0.12	0.44	0.03	0.34	0.00	0.02	0.10	0.04	0.05
V03_E2X	0.42	0.01	0.31	0.24	0.03	0.03	0.03	0.16	0.08	0.07	0.03
V04_E2X	0.03	0.04	0.05	0.45	0.04	0.02	0.00	0.00	0.06	0.10	0.03
V01_E5X	0.10	0.09	0.05	0.28	0.12	0.58	0.01	0.10	0.04	0.09	0.00
V07_E5Y	0.07	0.15	0.07	0.39	0.10	0.71	0.01	0.11	0.01	0.09	0.02
V16_O4Y	0.42	0.00	0.31	0.23	0.04	0.04	0.04	0.17	0.08	0.08	0.04
V11_E2X	0.42	0.00	0.31	0.23	0.04	0.04	0.04	0.17	0.08	0.08	0.04
V12_E2X	0.15	0.15	0.11	0.43	0.03	0.34	0.01	0.03	0.10	0.05	0.04
V13_O2x	0.05	0.03	0.06	0.02	0.04	0.04	0.02	0.06	0.01	0.12	0.03
V14_O2X	0.18	0.07	0.11	0.37	0.00	0.04	0.02	0.05	0.08	0.00	0.06

Table AII.11 – Maximum simultaneous values on all vertical deformation for seismic test TEST028_03

TEST028_03	V10_E5Y	V02_E5X	V03_E2X	V04_E2X	V01_E5X	V07_E5Y	V16_O4Y	V11_E2X	V12_E2X	V13_O2x	V14_O2X
V10_E5Y	0.60	0.01	0.48	0.37	0.02	0.03	0.03	0.16	0.11	0.05	0.02
V02_E5X	0.08	0.19	0.09	0.46	0.13	0.81	0.01	0.11	0.01	0.09	0.03
V03_E2X	0.59	0.02	0.48	0.39	0.02	0.03	0.03	0.16	0.12	0.05	0.02
V04_E2X	0.05	0.16	0.08	0.49	0.05	0.55	0.01	0.04	0.05	0.04	0.06
V01_E5X	0.12	0.12	0.06	0.30	0.19	0.71	0.02	0.15	0.05	0.12	0.02
V07_E5Y	0.10	0.19	0.08	0.46	0.14	0.86	0.01	0.12	0.01	0.08	0.03
V16_O4Y	0.48	0.01	0.37	0.29	0.03	0.05	0.04	0.14	0.07	0.04	0.02
V11_E2X	0.59	0.02	0.48	0.39	0.02	0.03	0.03	0.16	0.12	0.05	0.02
V12_E2X	0.23	0.06	0.20	0.33	0.02	0.03	0.00	0.02	0.12	0.05	0.04
V13_O2x	0.05	0.04	0.07	0.15	0.08	0.21	0.03	0.11	0.01	0.14	0.03
V14_O2X	0.21	0.11	0.15	0.47	0.01	0.24	0.02	0.04	0.08	0.00	0.07

Table AII.12 – Maximum simultaneous values on all vertical deformation for seismic test TEST050_01

TEST050_01	V10_E5Y	V02_E5X	V03_E2X	V04_E2X	V01_E5X	V07_E5Y	V16_O4Y	V11_E2X	V12_E2X	V13_O2x	V14_O2X
V10_E5Y	0.62	0.02	0.51	0.35	0.04	0.06	0.06	0.21	0.10	0.10	0.05
V02_E5X	0.10	0.28	0.10	0.56	0.18	1.05	0.01	0.15	0.03	0.09	0.04
V03_E2X	0.60	0.04	0.54	0.37	0.01	0.01	0.00	0.09	0.14	0.02	0.01
V04_E2X	0.05	0.05	0.09	0.61	0.10	0.02	0.02	0.04	0.03	0.16	0.07
V01_E5X	0.15	0.22	0.08	0.43	0.24	1.00	0.03	0.18	0.04	0.12	0.00
V07_E5Y	0.12	0.27	0.08	0.57	0.18	1.08	0.01	0.13	0.00	0.07	0.05
V16_O4Y	0.62	0.02	0.50	0.35	0.05	0.07	0.07	0.24	0.08	0.13	0.06
V11_E2X	0.62	0.02	0.50	0.35	0.05	0.07	0.07	0.24	0.08	0.13	0.06
V12_E2X	0.60	0.04	0.54	0.37	0.01	0.01	0.00	0.09	0.14	0.02	0.01
V13_O2x	0.06	0.03	0.08	0.46	0.09	0.01	0.03	0.06	0.02	0.18	0.07
V14_O2X	0.20	0.19	0.17	0.58	0.02	0.58	0.02	0.02	0.06	0.01	0.09

Table AII.13 – Maximum simultaneous values on all vertical deformation for seismic test TEST050_02

TEST050_02	V10_E5Y	V02_E5X	V03_E2X	V04_E2X	V01_E5X	V07_E5Y	V16_O4Y	V11_E2X	V12_E2X	V13_O2x	V14_O2X
V10_E5Y	0.96	0.06	0.86	0.44	0.05	0.03	0.06	0.21	0.21	0.11	0.05
V02_E5X	0.09	0.59	0.15	0.69	0.27	1.72	0.08	0.20	0.01	0.02	0.07
V03_E2X	0.96	0.06	0.86	0.44	0.05	0.03	0.06	0.21	0.21	0.11	0.05
V04_E2X	0.00	0.13	0.06	0.91	0.13	0.04	0.01	0.05	0.09	0.16	0.05
V01_E5X	0.22	0.24	0.08	0.26	0.42	1.05	0.09	0.22	0.09	0.15	0.04
V07_E5Y	0.09	0.59	0.15	0.69	0.27	1.72	0.08	0.20	0.01	0.02	0.07
V16_O4Y	0.19	0.53	0.13	0.65	0.32	1.60	0.12	0.27	0.04	0.09	0.03
V11_E2X	0.19	0.53	0.13	0.65	0.32	1.60	0.12	0.27	0.04	0.09	0.03
V12_E2X	0.82	0.13	0.64	0.61	0.05	0.08	0.02	0.13	0.22	0.00	0.11
V13_O2x	0.14	0.19	0.11	0.47	0.31	1.06	0.04	0.22	0.01	0.19	0.01
V14_O2X	0.88	0.32	0.69	0.74	0.05	0.36	0.01	0.08	0.19	0.02	0.12

Table AII.14 – Maximum simultaneous values on all vertical deformation for seismic test TEST050_03

TEST050_03	V10_E5Y	V02_E5X	V03_E2X	V04_E2X	V01_E5X	V07_E5Y	V16_O4Y	V11_E2X	V12_E2X	V13_O2x	V14_O2X
V10_E5Y	1.19	0.49	1.00	0.76	0.07	0.93	0.00	0.04	0.23	0.08	0.13
V02_E5X	0.10	0.72	0.32	0.71	0.28	1.95	0.12	0.22	0.02	0.03	0.08
V03_E2X	1.17	0.04	1.08	0.47	0.07	0.04	0.05	0.24	0.21	0.15	0.07
V04_E2X	0.25	0.27	0.28	0.88	0.15	0.03	0.02	0.15	0.01	0.12	0.04
V01_E5X	0.18	0.21	0.15	0.45	0.54	1.34	0.09	0.30	0.07	0.20	0.03
V07_E5Y	0.06	0.72	0.30	0.71	0.30	1.97	0.13	0.23	0.02	0.04	0.07
V16_O4Y	0.22	0.63	0.12	0.70	0.37	1.75	0.21	0.28	0.06	0.08	0.04
V11_E2X	0.18	0.21	0.15	0.45	0.54	1.34	0.09	0.30	0.07	0.20	0.03
V12_E2X	1.11	0.19	0.88	0.72	0.08	0.00	0.01	0.13	0.31	0.01	0.13
V13_O2x	0.13	0.20	0.06	0.67	0.40	0.06	0.07	0.06	0.13	0.25	0.08
V14_O2X	1.19	0.52	1.00	0.76	0.07	1.05	0.00	0.05	0.22	0.13	0.14

Table AII.15 – Maximum simultaneous values on all horizontal deformation for seismic test TEST007_01

TEST007_01	LVDT_H05	LVDT_H03	LVDT_H04	LVDT_H07
LVDT_H05	0.03	0.01	0.05	0.04
LVDT_H03	0.02	0.01	0.05	0.05
LVDT_H04	0.03	0.01	0.06	0.06
LVDT_H07	0.03	0.01	0.06	0.06

Table AII.16 – Maximum simultaneous values on all horizontal deformation for seismic test TEST007_02

TEST007_02	LVDT_H05	LVDT_H03	LVDT_H04	LVDT_H07
LVDT_H05	0.03	0.00	0.04	0.04
LVDT_H03	0.01	0.01	0.01	0.00
LVDT_H04	0.02	0.01	0.04	0.04
LVDT_H07	0.01	0.00	0.02	0.07

Table AII.17 – Maximum simultaneous values on all horizontal deformation for seismic test TEST007_03

TEST007_03	LVDT_H05	LVDT_H03	LVDT_H04	LVDT_H07
LVDT_H05	0.02	0.01	0.04	0.05
LVDT_H03	0.02	0.01	0.02	0.03
LVDT_H04	0.02	0.01	0.04	0.05
LVDT_H07	0.01	0.00	0.01	0.11

Table AII.18 – Maximum simultaneous values on all horizontal deformation for seismic test TEST007_04

TEST007_04	LVDT_H05	LVDT_H03	LVDT_H04	LVDT_H07
LVDT_H05	0.03	0.01	0.05	0.04
LVDT_H03	0.01	0.01	0.02	0.01
LVDT_H04	0.03	0.01	0.05	0.03
LVDT_H07	0.01	0.00	0.02	0.11

Table AII.19 – Maximum simultaneous values on all horizontal deformation for seismic test TEST007_05

TEST007_05	LVDT_H05	LVDT_H03	LVDT_H04	LVDT_H07
LVDT_H05	0.03	0.01	0.05	0.03
LVDT_H03	0.01	0.01	0.04	0.01
LVDT_H04	0.03	0.01	0.05	0.05
LVDT_H07	0.01	0.00	0.03	0.11

Table AII.20 – Maximum simultaneous values on all horizontal deformation for seismic test TEST015_01

TEST015_01	LVDT_H05	LVDT_H03	LVDT_H04	LVDT_H07
LVDT_H05	0.03	0.01	0.05	0.04
LVDT_H03	0.01	0.02	0.03	0.05
LVDT_H04	0.03	0.01	0.05	0.04
LVDT_H07	0.01	0.00	0.02	0.13

Table AII.21 – Maximum simultaneous values on all horizontal deformation for seismic test TEST015_02

TEST015_02	LVDT_H05	LVDT_H03	LVDT_H04	LVDT_H07
LVDT_H05	0.03	0.01	0.04	0.04
LVDT_H03	0.01	0.02	0.04	0.04
LVDT_H04	0.02	0.02	0.05	0.03
LVDT_H07	0.02	0.00	0.03	0.25

Table AII.22 – Maximum simultaneous values on all horizontal deformation for seismic test TEST015_03

TEST015_03	LVDT_H05	LVDT_H03	LVDT_H04	LVDT_H07
LVDT_H05	0.03	0.00	0.04	0.03
LVDT_H03	0.01	0.02	0.06	0.00
LVDT_H04	0.01	0.02	0.06	0.00
LVDT_H07	0.01	0.01	0.00	0.30

Table AII.23 – Maximum simultaneous values on all horizontal deformation for seismic test TEST028_01

TEST028_01	LVDT_H05	LVDT_H03	LVDT_H04	LVDT_H07
LVDT_H05	0.06	0.01	0.00	0.22
LVDT_H03	0.03	0.03	0.05	0.12
LVDT_H04	0.03	0.02	0.05	0.09
LVDT_H07	0.01	0.01	0.02	0.45

Table AII.24 – Maximum simultaneous values on all horizontal deformation for seismic test TEST028_02

TEST028_02	LVDT_H05	LVDT_H03	LVDT_H04	LVDT_H07
LVDT_H05	0.11	0.02	0.01	0.50
LVDT_H03	0.06	0.04	0.02	0.27
LVDT_H04	0.04	0.01	0.10	0.00
LVDT_H07	0.00	0.01	0.04	0.71

Table AII.25 – Maximum simultaneous values on all horizontal deformation for seismic test TEST028_03

TEST028_03	LVDT_H05	LVDT_H03	LVDT_H04	LVDT_H07
LVDT_H05	0.15	0.03	0.02	0.71
LVDT_H03	0.07	0.04	0.00	0.27
LVDT_H04	0.03	0.03	0.14	0.87
LVDT_H07	0.02	0.03	0.11	0.90

Table AII.26 – Maximum simultaneous values on all horizontal deformation for seismic test TEST050_01

TEST050_01	LVDT_H05	LVDT_H03	LVDT_H04	LVDT_H07
LVDT_H05	0.22	0.05	0.02	1.27
LVDT_H03	0.07	0.05	0.02	0.44
LVDT_H04	0.01	0.03	0.16	0.45
LVDT_H07	0.21	0.05	0.03	1.27

Table AII.27 – Maximum simultaneous values on all horizontal deformation for seismic test TEST050_02

TEST050_02	LVDT_H05	LVDT_H03	LVDT_H04	LVDT_H07
LVDT_H05	0.29	0.07	0.08	2.69
LVDT_H03	0.09	0.08	0.43	0.12
LVDT_H04	0.02	0.07	0.52	0.82
LVDT_H07	0.25	0.06	0.06	2.72

Table AII.28 – Maximum simultaneous values on all horizontal deformation for seismic test TEST050_03

TEST050_03	LVDT_H05	LVDT_H03	LVDT_H04	LVDT_H07
LVDT_H05	0.26	0.01	0.53	0.57
LVDT_H03	0.15	0.11	0.25	0.86
LVDT_H04	0.26	0.07	0.59	0.62
LVDT_H07	0.18	0.08	0.03	3.52

Table AII.29 – Maximum simultaneous values for all inter-storey drift for seismic test TEST007_01

TEST007_01	LVDT_IID02	LVDT_IID04	LVDT_IID01	LVDT_IID03
LVDT_IID02	0.52	0.61	0.12	0.11
LVDT_IID04	0.52	0.61	0.12	0.11
LVDT_IID01	0.17	0.21	0.21	0.28
LVDT_IID03	0.15	0.27	0.17	0.29

Table AII.30 – Maximum simultaneous values for all inter-storey drift for seismic test TEST007_02

TEST007_02	LVDT_IID02	LVDT_IID04	LVDT_IID01	LVDT_IID03
LVDT_IID02	0.78	0.74	0.10	0.14
LVDT_IID04	0.75	0.98	0.13	0.12
LVDT_IID01	0.24	0.22	0.34	0.43
LVDT_IID03	0.23	0.36	0.27	0.47

Table AII.31 – Maximum simultaneous values for all inter-storey drift for seismic test TEST007_03

TEST007_03	LVDT_IID02	LVDT_IID04	LVDT_IID01	LVDT_IID03
LVDT_IID02	0.93	0.93	0.03	0.01
LVDT_IID04	0.88	1.08	0.10	0.05
LVDT_IID01	0.22	0.26	0.47	0.67
LVDT_IID03	0.15	0.23	0.44	0.68

Table AII.32 – Maximum simultaneous values for all inter-storey drift for seismic test TEST007_04

TEST007_04	LVDT_IID02	LVDT_IID04	LVDT_IID01	LVDT_IID03
LVDT_IID02	0.94	0.98	0.05	0.04
LVDT_IID04	0.90	0.99	0.07	0.06
LVDT_IID01	0.10	0.15	0.37	0.57
LVDT_IID03	0.10	0.15	0.36	0.58

Table AII.33 – Maximum simultaneous values for all inter-storey drift for seismic test TEST007_05

TEST007_05	LVDT_IID02	LVDT_IID04	LVDT_IID01	LVDT_IID03
LVDT_IID02	0.92	0.86	0.14	0.14
LVDT_IID04	0.66	0.97	0.17	0.14
LVDT_IID01	0.07	0.12	0.39	0.56
LVDT_IID03	0.20	0.46	0.27	0.58

Table AII.34 – Maximum simultaneous values for all inter-storey drift for seismic test TEST015_01

TEST015_01	LVDT_IID02	LVDT_IID04	LVDT_IID01	LVDT_IID03
LVDT_IID02	1.04	1.21	0.25	0.25
LVDT_IID04	0.97	1.30	0.18	0.23
LVDT_IID01	0.21	0.47	0.45	0.72
LVDT_IID03	0.14	0.31	0.44	0.72

Table AII.35 – Maximum simultaneous values for all inter-storey drift for seismic test TEST015_02

TEST015_02	LVDT_IID02	LVDT_IID04	LVDT_IID01	LVDT_IID03
LVDT_IID02	1.24	1.43	0.28	0.30
LVDT_IID04	1.24	1.43	0.28	0.30
LVDT_IID01	0.35	0.66	0.65	1.00
LVDT_IID03	0.35	0.66	0.65	1.00

Table AII.36 – Maximum simultaneous values for all inter-storey drift for seismic test TEST015_03

TEST015_03	LVDT_IID02	LVDT_IID04	LVDT_IID01	LVDT_IID03
LVDT_IID02	1.29	1.28	0.23	0.24
LVDT_IID04	1.16	1.51	0.15	0.16
LVDT_IID01	0.47	0.84	0.82	1.17
LVDT_IID03	0.47	0.84	0.82	1.17

Table AII.37 – Maximum simultaneous values for all inter-storey drift for seismic test TEST028_01

TEST028_01	LVDT_IID02	LVDT_IID04	LVDT_IID01	LVDT_IID03
LVDT_IID02	1.92	1.80	0.32	0.33
LVDT_IID04	1.59	1.93	0.31	0.38
LVDT_IID01	0.65	1.06	1.06	1.57
LVDT_IID03	0.65	1.06	1.06	1.57

Table AII.38 – Maximum simultaneous values for all inter-storey drift for seismic test TEST028_02

TEST028_02	LVDT_IID02	LVDT_IID04	LVDT_IID01	LVDT_IID03
LVDT_IID02	3.04	2.47	0.47	0.58
LVDT_IID04	2.45	2.57	0.47	0.55
LVDT_IID01	0.84	1.31	1.53	2.21
LVDT_IID03	0.84	1.31	1.53	2.21

Table AII.39 – Maximum simultaneous values for all inter-storey drift for seismic test TEST028_03

TEST028_03	LVDT_IID02	LVDT_IID04	LVDT_IID01	LVDT_IID03
LVDT_IID02	2.90	2.45	0.46	0.51
LVDT_IID04	2.74	2.74	0.48	0.48
LVDT_IID01	0.85	1.24	1.87	2.81
LVDT_IID03	0.85	1.24	1.87	2.81

Table AII.40 – Maximum simultaneous values for all inter-storey drift for seismic test TEST050_01

TEST050_01	LVDT_IID02	LVDT_IID04	LVDT_IID01	LVDT_IID03
LVDT_IID02	3.50	3.04	0.66	0.69
LVDT_IID04	3.08	3.33	0.63	0.67
LVDT_IID01	1.49	1.00	2.11	2.17
LVDT_IID03	1.12	1.46	1.98	2.96

Table AII.41 – Maximum simultaneous values for all inter-storey drift for seismic test TEST050_02

TEST050_02	LVDT_IID02	LVDT_IID04	LVDT_IID01	LVDT_IID03
LVDT_IID02	5.45	5.62	0.03	1.19
LVDT_IID04	5.43	5.69	0.12	0.83
LVDT_IID01	2.57	2.55	3.06	3.25
LVDT_IID03	1.78	2.06	2.43	3.91

Table AII.42 – Maximum simultaneous values for all inter-storey drift for seismic test TEST050_03

TEST050_03	LVDT_IID02	LVDT_IID04	LVDT_IID01	LVDT_IID03
LVDT_IID02	6.59	6.25	0.24	1.25
LVDT_IID04	6.02	6.58	0.87	0.07
LVDT_IID01	3.90	3.72	3.50	3.39
LVDT_IID03	1.70	2.07	3.03	4.66

Table AII.43 – Maximum simultaneous values for all hold-down forces for seismic test TEST007_01

TEST007_01	01_E5x_SW	02_E2x_E	03_E5x_NW	16_E2x_NE	05_E3y_ INTERIOR	06_E3y_ INTERIOR	07_E4y_ INTERIOR	08_E4y_ INTERIOR	09_E5y_N	10_E5y_NE	11_E1y_SE	04_E1y_S	13_E3x_S	14_E3x_N	15_O2x_NE	12_O2x_E
01_E5x_SW	0.28	0.12	0.08	0.12	0.05	0.02	0.01	0.01	0.09	0.01	0.03	0.06	0.01	0.16	0.03	0.04
02_E2x_E	0.01	0.45	0.22	0.00	0.00	0.06	0.03	0.05	0.05	0.13	0.03	0.01	0.07	0.04	0.03	0.01
03_E5x_NW	0.05	0.21	0.41	0.08	0.01	0.06	0.00	0.01	0.06	0.05	0.09	0.06	0.03	0.11	0.05	0.02
16_E2x_NE	0.15	0.13	0.30	0.39	0.00	0.02	0.06	0.05	0.02	0.01	0.07	0.10	0.03	0.04	0.06	0.00
05_E3y_INTERIOR	0.00	0.12	0.08	0.04	0.10	0.10	0.01	0.05	0.00	0.09	0.06	0.01	0.06	0.04	0.14	0.08
06_E3y_INTERIOR	0.02	0.13	0.17	0.10	0.06	0.13	0.06	0.05	0.03	0.04	0.03	0.20	0.00	0.04	0.07	0.09
07_E4y_INTERIOR	0.06	0.13	0.12	0.18	0.03	0.00	0.10	0.04	0.06	0.01	0.10	0.10	0.06	0.03	0.00	0.02
08_E4y_INTERIOR	0.05	0.18	0.05	0.16	0.02	0.04	0.01	0.13	0.10	0.12	0.02	0.11	0.01	0.01	0.10	0.04
09_E5y_N	0.01	0.06	0.06	0.08	0.03	0.06	0.01	0.10	0.27	0.03	0.11	0.05	0.05	0.01	0.08	0.02
10_E5y_NE	0.10	0.19	0.13	0.08	0.01	0.00	0.06	0.01	0.06	0.58	0.04	0.02	0.01	0.02	0.11	0.04
11_E1y_SE	0.01	0.14	0.11	0.08	0.02	0.05	0.02	0.03	0.08	0.10	0.31	0.06	0.01	0.06	0.04	0.06
04_E1y_S	0.02	0.13	0.02	0.25	0.02	0.04	0.01	0.00	0.05	0.16	0.00	0.52	0.01	0.03	0.01	0.07
13_E3x_S	0.03	0.01	0.07	0.08	0.01	0.02	0.01	0.05	0.03	0.01	0.05	0.04	0.13	0.02	0.03	0.01
14_E3x_N	0.09	0.19	0.06	0.13	0.05	0.01	0.02	0.03	0.01	0.06	0.01	0.14	0.02	0.18	0.04	0.02
15_O2x_NE	0.02	0.21	0.12	0.12	0.04	0.07	0.00	0.07	0.01	0.05	0.02	0.14	0.04	0.03	0.29	0.02
12_O2x_E	0.00	0.10	0.05	0.05	0.02	0.04	0.02	0.05	0.02	0.06	0.03	0.13	0.03	0.06	0.08	0.15

Table AII.44 – Maximum simultaneous values for all hold-down forces for seismic test TEST007_02

TEST007_02	01_E5x_SW	02_E2x_E	03_E5x_NW	16_E2x_NE	05_E3y_ INTERIOR	06_E3y_ INTERIOR	07_E4y_ INTERIOR	08_E4y_ INTERIOR	09_E5y_N	10_E5y_NE	11_E1y_SE	04_E1y_S	13_E3x_S	14_E3x_N	15_O2x_NE	12_O2x_E
01_E5x_SW	0.30	0.17	0.10	0.02	0.00	0.02	0.02	0.05	0.04	0.13	0.11	0.02	0.06	0.08	0.06	0.03
02_E2x_E	0.04	0.38	0.14	0.01	0.01	0.02	0.02	0.05	0.10	0.03	0.01	0.06	0.04	0.07	0.09	0.02
03_E5x_NW	0.02	0.25	0.34	0.06	0.04	0.03	0.04	0.03	0.02	0.03	0.06	0.10	0.06	0.03	0.05	0.04
16_E2x_NE	0.12	0.16	0.04	0.36	0.07	0.00	0.04	0.02	0.08	0.05	0.07	0.10	0.05	0.00	0.09	0.05
05_E3y_INTERIOR	0.02	0.08	0.03	0.17	0.12	0.05	0.02	0.01	0.03	0.32	0.02	0.12	0.11	0.05	0.10	0.06
06_E3y_INTERIOR	0.03	0.24	0.06	0.03	0.09	0.15	0.01	0.09	0.01	0.17	0.04	0.07	0.03	0.06	0.19	0.02
07_E4y_INTERIOR	0.02	0.10	0.13	0.12	0.02	0.06	0.10	0.01	0.07	0.12	0.01	0.15	0.01	0.06	0.08	0.02
08_E4y_INTERIOR	0.11	0.05	0.02	0.04	0.00	0.05	0.03	0.12	0.03	0.07	0.01	0.04	0.02	0.04	0.05	0.01
09_E5y_N	0.02	0.03	0.02	0.08	0.01	0.02	0.05	0.01	0.31	0.07	0.04	0.06	0.03	0.06	0.02	0.00
10_E5y_NE	0.02	0.20	0.11	0.04	0.05	0.02	0.04	0.06	0.05	0.86	0.04	0.04	0.01	0.08	0.05	0.07
11_E1y_SE	0.04	0.32	0.11	0.07	0.02	0.03	0.02	0.01	0.12	0.00	0.31	0.09	0.01	0.00	0.12	0.01
04_E1y_S	0.00	0.11	0.12	0.09	0.03	0.06	0.01	0.04	0.16	0.00	0.07	0.49	0.00	0.04	0.20	0.07
13_E3x_S	0.01	0.16	0.07	0.25	0.02	0.00	0.02	0.03	0.02	0.04	0.00	0.11	0.17	0.01	0.03	0.01
14_E3x_N	0.05	0.21	0.18	0.16	0.03	0.01	0.04	0.05	0.02	0.04	0.03	0.09	0.03	0.18	0.01	0.05
15_O2x_NE	0.03	0.07	0.26	0.13	0.07	0.05	0.04	0.06	0.08	0.47	0.15	0.03	0.03	0.01	0.30	0.02
12_O2x_E	0.17	0.24	0.09	0.15	0.02	0.01	0.06	0.01	0.02	0.12	0.10	0.08	0.00	0.03	0.02	0.14

Table AII.45 – Maximum simultaneous values for all hold-down forces for seismic test TEST007_03

TEST007_03	01_E5x_SW	02_E2x_E	03_E5x_NW	16_E2x_NE	05_E3y_ INTERIOR	06_E3y_ INTERIOR	07_E4y_ INTERIOR	08_E4y_ INTERIOR	09_E5y_N	10_E5y_NE	11_E1y_SE	04_E1y_S	13_E3x_S	14_E3x_N	15_O2x_NE	12_O2x_E
01_E5x_SW	0.34	0.27	0.12	0.26	0.00	0.07	0.02	0.11	0.03	0.65	0.09	0.06	0.00	0.09	0.09	0.00
02_E2x_E	0.10	0.43	0.14	0.23	0.01	0.10	0.02	0.11	0.00	0.14	0.00	0.05	0.04	0.04	0.11	0.05
03_E5x_NW	0.01	0.09	0.51	0.06	0.03	0.00	0.01	0.01	0.01	0.74	0.04	0.27	0.08	0.07	0.20	0.08
16_E2x_NE	0.00	0.23	0.01	0.53	0.06	0.04	0.03	0.02	0.00	0.59	0.01	0.09	0.12	0.05	0.10	0.03
05_E3y_INTERIOR	0.10	0.18	0.04	0.10	0.16	0.12	0.01	0.14	0.01	0.67	0.09	0.13	0.11	0.04	0.09	0.04
06_E3y_INTERIOR	0.13	0.20	0.00	0.14	0.07	0.17	0.00	0.15	0.01	0.60	0.02	0.04	0.12	0.04	0.22	0.01
07_E4y_INTERIOR	0.25	0.15	0.00	0.18	0.03	0.06	0.11	0.08	0.04	0.73	0.11	0.15	0.04	0.05	0.10	0.05
08_E4y_INTERIOR	0.11	0.14	0.08	0.14	0.07	0.13	0.03	0.19	0.06	0.69	0.04	0.01	0.06	0.03	0.02	0.02
09_E5y_N	0.00	0.20	0.19	0.09	0.02	0.02	0.00	0.01	0.32	0.75	0.10	0.39	0.01	0.01	0.11	0.05
10_E5y_NE	0.06	0.20	0.32	0.02	0.01	0.01	0.01	0.03	0.08	1.03	0.10	0.15	0.01	0.03	0.05	0.01
11_E1y_SE	0.04	0.17	0.28	0.02	0.07	0.00	0.01	0.03	0.02	0.75	0.33	0.23	0.01	0.01	0.09	0.07
04_E1y_S	0.02	0.02	0.19	0.09	0.01	0.03	0.03	0.03	0.12	0.63	0.14	0.49	0.09	0.09	0.17	0.06
13_E3x_S	0.13	0.13	0.17	0.04	0.10	0.08	0.01	0.06	0.08	0.79	0.21	0.21	0.15	0.02	0.01	0.06
14_E3x_N	0.08	0.27	0.05	0.24	0.04	0.05	0.02	0.06	0.01	0.71	0.08	0.15	0.02	0.22	0.08	0.09
15_O2x_NE	0.04	0.18	0.30	0.04	0.02	0.03	0.01	0.02	0.04	0.74	0.11	0.22	0.03	0.01	0.39	0.02
12_O2x_E	0.12	0.15	0.26	0.00	0.02	0.06	0.03	0.01	0.00	0.74	0.13	0.17	0.02	0.07	0.21	0.17

Table AII.46 – Maximum simultaneous values for all hold-down forces for seismic test TEST007_04

TEST007_04	01_E5x_SW	02_E2x_E	03_E5x_NW	16_E2x_NE	05_E3y_ INTERIOR	06_E3y_ INTERIOR	07_E4y_ INTERIOR	08_E4y_ INTERIOR	09_E5y_N	10_E5y_NE	11_E1y_SE	04_E1y_S	13_E3x_S	14_E3x_N	15_O2x_NE	12_O2x_E
01_E5x_SW	0.47	0.05	0.19	0.31	0.04	0.10	0.10	0.08	0.09	0.63	0.01	0.12	0.05	0.04	0.20	0.09
02_E2x_E	0.21	0.41	0.25	0.46	0.02	0.16	0.07	0.11	0.03	0.21	0.07	0.02	0.06	0.01	0.22	0.06
03_E5x_NW	0.10	0.22	0.61	0.13	0.04	0.02	0.01	0.06	0.01	0.79	0.02	0.22	0.04	0.05	0.32	0.10
16_E2x_NE	0.26	0.14	0.18	0.64	0.07	0.12	0.10	0.10	0.06	0.64	0.12	0.02	0.01	0.00	0.33	0.10
05_E3y_INTERIOR	0.21	0.16	0.17	0.29	0.11	0.10	0.08	0.10	0.01	0.68	0.01	0.08	0.04	0.02	0.32	0.08
06_E3y_INTERIOR	0.30	0.30	0.18	0.27	0.09	0.23	0.03	0.20	0.01	0.66	0.06	0.07	0.01	0.09	0.18	0.04
07_E4y_INTERIOR	0.29	0.24	0.10	0.40	0.02	0.12	0.14	0.13	0.04	0.49	0.02	0.11	0.03	0.03	0.19	0.01
08_E4y_INTERIOR	0.20	0.30	0.19	0.30	0.00	0.18	0.07	0.22	0.02	0.42	0.08	0.01	0.00	0.03	0.20	0.08
09_E5y_N	0.18	0.16	0.37	0.12	0.02	0.02	0.01	0.03	0.26	0.75	0.03	0.38	0.05	0.02	0.32	0.10
10_E5y_NE	0.04	0.18	0.46	0.20	0.01	0.08	0.00	0.04	0.05	0.97	0.02	0.29	0.01	0.01	0.34	0.12
11_E1y_SE	0.24	0.25	0.23	0.30	0.02	0.10	0.09	0.15	0.00	0.60	0.29	0.04	0.03	0.03	0.21	0.01
04_E1y_S	0.15	0.24	0.46	0.24	0.01	0.09	0.04	0.10	0.02	0.69	0.03	0.49	0.02	0.00	0.30	0.06
13_E3x_S	0.16	0.05	0.32	0.37	0.03	0.05	0.05	0.04	0.07	0.77	0.01	0.22	0.18	0.02	0.34	0.09
14_E3x_N	0.19	0.01	0.40	0.03	0.02	0.09	0.06	0.02	0.03	0.63	0.11	0.19	0.02	0.15	0.13	0.15
15_O2x_NE	0.05	0.04	0.45	0.07	0.04	0.10	0.04	0.05	0.08	0.35	0.14	0.19	0.01	0.03	0.52	0.12
12_O2x_E	0.15	0.05	0.29	0.15	0.00	0.10	0.05	0.05	0.05	0.64	0.07	0.14	0.08	0.08	0.23	0.21

Table AII.47 – Maximum simultaneous values for all hold-down forces for seismic test TEST007_05

TEST007_05	01_E5x_SW	02_E2x_E	03_E5x_NW	16_E2x_NE	05_E3y_ INTERIOR	06_E3y_ INTERIOR	07_E4y_ INTERIOR	08_E4y_ INTERIOR	09_E5y_N	10_E5y_NE	11_E1y_SE	04_E1y_S	13_E3x_S	14_E3x_N	15_O2x_NE	12_O2x_E
01_E5x_SW	0.43	0.13	0.28	0.32	0.03	0.10	0.06	0.07	0.01	0.67	0.02	0.20	0.06	0.01	0.27	0.11
02_E2x_E	0.17	0.40	0.19	0.28	0.04	0.12	0.04	0.07	0.02	0.64	0.03	0.21	0.02	0.01	0.21	0.07
03_E5x_NW	0.13	0.21	0.60	0.21	0.07	0.04	0.01	0.02	0.10	0.77	0.03	0.32	0.01	0.01	0.37	0.11
16_E2x_NE	0.26	0.15	0.26	0.64	0.01	0.10	0.10	0.09	0.10	0.77	0.09	0.00	0.10	0.01	0.13	0.08
05_E3y_INTERIOR	0.10	0.17	0.29	0.45	0.11	0.02	0.05	0.06	0.10	0.80	0.03	0.06	0.05	0.05	0.32	0.05
06_E3y_INTERIOR	0.23	0.21	0.28	0.10	0.05	0.18	0.08	0.10	0.13	0.71	0.04	0.19	0.05	0.01	0.13	0.04
07_E4y_INTERIOR	0.24	0.22	0.15	0.37	0.00	0.08	0.13	0.12	0.05	0.69	0.05	0.03	0.11	0.03	0.20	0.06
08_E4y_INTERIOR	0.23	0.09	0.13	0.17	0.05	0.16	0.05	0.19	0.09	0.71	0.05	0.12	0.00	0.00	0.13	0.06
09_E5y_N	0.24	0.26	0.16	0.42	0.01	0.07	0.02	0.12	0.28	0.61	0.08	0.09	0.04	0.05	0.24	0.11
10_E5y_NE	0.12	0.13	0.36	0.13	0.01	0.03	0.07	0.05	0.03	1.05	0.08	0.30	0.02	0.06	0.29	0.12
11_E1y_SE	0.08	0.22	0.26	0.12	0.01	0.04	0.02	0.07	0.01	0.70	0.31	0.43	0.06	0.03	0.23	0.07
04_E1y_S	0.17	0.11	0.39	0.07	0.02	0.04	0.00	0.04	0.09	0.66	0.02	0.53	0.00	0.06	0.33	0.08
13_E3x_S	0.13	0.14	0.40	0.20	0.06	0.03	0.01	0.05	0.04	0.74	0.11	0.38	0.16	0.10	0.18	0.03
14_E3x_N	0.10	0.11	0.36	0.50	0.02	0.03	0.00	0.04	0.01	0.73	0.00	0.24	0.07	0.15	0.30	0.07
15_O2x_NE	0.19	0.13	0.40	0.13	0.05	0.01	0.05	0.01	0.00	0.38	0.07	0.26	0.05	0.03	0.50	0.09
12_O2x_E	0.14	0.15	0.33	0.30	0.03	0.03	0.02	0.04	0.02	0.71	0.05	0.36	0.01	0.01	0.29	0.23

Table AII.48 – Maximum simultaneous values for all hold-down forces for seismic test TEST015_01

TEST015_01	01_E5x_SW	02_E2x_E	03_E5x_NW	16_E2x_NE	05_E3y_ INTERIOR	06_E3y_ INTERIOR	07_E4y_ INTERIOR	08_E4y_ INTERIOR	09_E5y_N	10_E5y_NE	11_E1y_SE	04_E1y_S	13_E3x_S	14_E3x_N	15_O2x_NE	12_O2x_E
01_E5x_SW	0.38	0.11	0.19	0.28	0.00	0.10	0.06	0.11	0.01	0.16	0.04	0.19	0.05	0.01	0.22	0.11
02_E2x_E	0.10	0.43	0.34	0.23	0.04	0.02	0.01	0.09	0.16	0.26	0.12	0.22	0.01	0.05	0.19	0.17
03_E5x_NW	0.07	0.03	0.60	0.10	0.00	0.06	0.03	0.05	0.09	0.44	0.14	0.28	0.03	0.03	0.15	0.08
16_E2x_NE	0.27	0.08	0.20	0.64	0.03	0.10	0.05	0.14	0.10	0.10	0.11	0.27	0.04	0.09	0.20	0.13
05_E3y_INTERIOR	0.20	0.02	0.31	0.02	0.14	0.15	0.02	0.15	0.08	0.19	0.08	0.21	0.09	0.02	0.06	0.14
06_E3y_INTERIOR	0.12	0.16	0.17	0.23	0.10	0.19	0.04	0.22	0.08	0.20	0.13	0.26	0.04	0.03	0.01	0.05
07_E4y_INTERIOR	0.15	0.18	0.20	0.28	0.00	0.10	0.14	0.09	0.00	0.28	0.10	0.18	0.04	0.09	0.02	0.06
08_E4y_INTERIOR	0.12	0.16	0.17	0.23	0.10	0.19	0.04	0.22	0.08	0.20	0.13	0.26	0.04	0.03	0.01	0.05
09_E5y_N	0.08	0.15	0.43	0.15	0.03	0.05	0.02	0.07	0.28	0.31	0.07	0.32	0.05	0.05	0.17	0.17
10_E5y_NE	0.16	0.09	0.30	0.34	0.00	0.10	0.06	0.10	0.00	0.66	0.04	0.35	0.04	0.02	0.12	0.13
11_E1y_SE	0.16	0.26	0.39	0.23	0.00	0.07	0.01	0.09	0.06	0.16	0.34	0.41	0.04	0.03	0.28	0.12
04_E1y_S	0.18	0.11	0.33	0.09	0.02	0.04	0.00	0.08	0.03	0.34	0.07	0.59	0.05	0.04	0.09	0.18
13_E3x_S	0.21	0.07	0.31	0.12	0.00	0.10	0.02	0.12	0.00	0.22	0.02	0.28	0.14	0.06	0.35	0.15
14_E3x_N	0.10	0.12	0.17	0.43	0.04	0.11	0.09	0.10	0.07	0.05	0.04	0.18	0.02	0.18	0.21	0.11
15_O2x_NE	0.19	0.07	0.23	0.23	0.03	0.00	0.03	0.05	0.06	0.18	0.10	0.35	0.00	0.01	0.46	0.13
12_O2x_E	0.15	0.15	0.44	0.16	0.02	0.04	0.05	0.06	0.11	0.35	0.01	0.39	0.00	0.07	0.14	0.24

Table AII.49 – Maximum simultaneous values for all hold-down forces for seismic test TEST015_02

TEST015_02	01_E5x_SW	02_E2x_E	03_E5x_NW	16_E2x_NE	05_E3y_ INTERIOR	06_E3y_ INTERIOR	07_E4y_ INTERIOR	08_E4y_ INTERIOR	09_E5y_N	10_E5y_NE	11_E1y_SE	04_E1y_S	13_E3x_S	14_E3x_N	15_O2x_NE	12_O2x_E
01_E5x_SW	0.47	0.04	0.30	0.18	0.03	0.15	0.07	0.10	0.04	0.03	0.17	0.23	0.02	0.03	0.17	0.11
02_E2x_E	0.22	0.39	0.23	0.25	0.01	0.13	0.12	0.19	0.01	0.10	0.12	0.20	0.04	0.02	0.16	0.06
03_E5x_NW	0.10	0.17	0.60	0.17	0.03	0.11	0.02	0.12	0.08	0.23	0.14	0.42	0.02	0.03	0.36	0.07
16_E2x_NE	0.15	0.08	0.09	0.67	0.01	0.10	0.07	0.15	0.01	0.02	0.01	0.12	0.01	0.00	0.11	0.07
05_E3y_INTERIOR	0.17	0.12	0.45	0.04	0.17	0.23	0.02	0.19	0.17	0.15	0.22	0.44	0.02	0.07	0.07	0.11
06_E3y_INTERIOR	0.13	0.13	0.15	0.22	0.12	0.27	0.07	0.25	0.14	0.17	0.10	0.21	0.03	0.05	0.07	0.04
07_E4y_INTERIOR	0.22	0.17	0.26	0.35	0.02	0.08	0.15	0.11	0.04	0.05	0.28	0.23	0.02	0.06	0.20	0.02
08_E4y_INTERIOR	0.11	0.18	0.26	0.21	0.05	0.23	0.06	0.29	0.04	0.09	0.07	0.29	0.01	0.08	0.01	0.05
09_E5y_N	0.18	0.10	0.43	0.16	0.01	0.10	0.01	0.10	0.29	0.33	0.09	0.33	0.00	0.03	0.20	0.05
10_E5y_NE	0.20	0.17	0.30	0.12	0.00	0.09	0.00	0.11	0.16	0.70	0.10	0.40	0.02	0.02	0.27	0.13
11_E1y_SE	0.03	0.13	0.48	0.16	0.02	0.10	0.03	0.08	0.05	0.22	0.39	0.29	0.02	0.01	0.22	0.10
04_E1y_S	0.11	0.14	0.45	0.14	0.01	0.11	0.02	0.10	0.04	0.08	0.21	0.58	0.04	0.11	0.11	0.09
13_E3x_S	0.20	0.18	0.29	0.09	0.01	0.18	0.07	0.15	0.10	0.17	0.04	0.23	0.18	0.02	0.34	0.03
14_E3x_N	0.17	0.11	0.41	0.13	0.01	0.09	0.04	0.10	0.05	0.46	0.19	0.39	0.07	0.14	0.17	0.07
15_O2x_NE	0.21	0.16	0.40	0.00	0.03	0.09	0.06	0.08	0.18	0.18	0.15	0.31	0.10	0.01	0.55	0.10
12_O2x_E	0.18	0.15	0.41	0.15	0.03	0.10	0.04	0.04	0.11	0.01	0.17	0.23	0.05	0.01	0.15	0.22

Table AII.50 – Maximum simultaneous values for all hold-down forces for seismic test TEST015_03

TEST015_03	01_E5x_SW	02_E2x_E	03_E5x_NW	16_E2x_NE	05_E3y_ INTERIOR	06_E3y_ INTERIOR	07_E4y_ INTERIOR	08_E4y_ INTERIOR	09_E5y_N	10_E5y_NE	11_E1y_SE	04_E1y_S	13_E3x_S	14_E3x_N	15_O2x_NE	12_O2x_E
01_E5x_SW	0.46	0.22	0.12	0.38	0.00	0.13	0.08	0.23	0.05	0.19	0.08	0.20	0.00	0.05	0.26	0.07
02_E2x_E	0.20	0.43	0.23	0.42	0.02	0.11	0.11	0.20	0.08	0.14	0.03	0.13	0.02	0.04	0.21	0.06
03_E5x_NW	0.13	0.17	0.64	0.06	0.00	0.07	0.03	0.15	0.12	0.01	0.01	0.38	0.06	0.02	0.23	0.11
16_E2x_NE	0.16	0.03	0.25	0.66	0.01	0.08	0.08	0.16	0.01	0.11	0.01	0.30	0.05	0.01	0.20	0.02
05_E3y_INTERIOR	0.04	0.10	0.32	0.02	0.20	0.24	0.03	0.24	0.15	0.27	0.17	0.40	0.07	0.05	0.08	0.13
06_E3y_INTERIOR	0.15	0.19	0.05	0.11	0.14	0.28	0.06	0.30	0.14	0.22	0.06	0.15	0.01	0.04	0.06	0.09
07_E4y_INTERIOR	0.27	0.06	0.20	0.37	0.00	0.13	0.15	0.19	0.14	0.20	0.05	0.25	0.00	0.05	0.27	0.05
08_E4y_INTERIOR	0.10	0.21	0.08	0.14	0.18	0.27	0.09	0.31	0.04	0.09	0.06	0.25	0.01	0.01	0.14	0.08
09_E5y_N	0.09	0.13	0.23	0.15	0.01	0.11	0.02	0.15	0.37	0.30	0.04	0.19	0.08	0.02	0.26	0.14
10_E5y_NE	0.16	0.07	0.41	0.13	0.02	0.11	0.04	0.11	0.07	0.90	0.13	0.40	0.01	0.03	0.29	0.06
11_E1y_SE	0.21	0.14	0.32	0.07	0.02	0.09	0.01	0.13	0.01	0.17	0.28	0.33	0.01	0.02	0.28	0.03
04_E1y_S	0.16	0.06	0.37	0.23	0.02	0.05	0.03	0.09	0.03	0.31	0.07	0.61	0.07	0.01	0.14	0.08
13_E3x_S	0.16	0.15	0.30	0.27	0.00	0.08	0.07	0.19	0.07	0.25	0.00	0.27	0.17	0.01	0.24	0.10
14_E3x_N	0.29	0.15	0.09	0.22	0.02	0.07	0.05	0.09	0.07	0.26	0.05	0.23	0.11	0.16	0.10	0.09
15_O2x_NE	0.10	0.00	0.48	0.28	0.00	0.08	0.03	0.11	0.08	0.23	0.09	0.20	0.03	0.09	0.56	0.04
12_O2x_E	0.20	0.07	0.36	0.11	0.03	0.09	0.01	0.11	0.14	0.19	0.07	0.31	0.01	0.01	0.22	0.21

Table AII.51 – Maximum simultaneous values for all hold-down forces for seismic test TEST028_01

TEST028_01	01_E5x_SW	02_E2x_E	03_E5x_NW	16_E2x_NE	05_E3y_ INTERIOR	06_E3y_ INTERIOR	07_E4y_ INTERIOR	08_E4y_ INTERIOR	09_E5y_N	10_E5y_NE	11_E1y_SE	04_E1y_S	13_E3x_S	14_E3x_N	15_O2x_NE	12_O2x_E
01_E5x_SW	0.47	0.21	0.19	0.43	0.00	0.18	0.09	0.31	0.07	0.83	0.05	0.23	0.00	0.17	0.40	0.05
02_E2x_E	0.17	0.43	0.11	0.50	0.03	0.14	0.05	0.16	0.08	0.87	0.07	0.23	0.01	0.10	0.01	0.08
03_E5x_NW	0.20	0.11	0.59	0.13	0.00	0.12	0.00	0.22	0.12	0.93	0.06	0.43	0.12	0.16	0.46	0.08
16_E2x_NE	0.24	0.13	0.14	0.70	0.12	0.02	0.00	0.04	0.02	0.90	0.08	0.28	0.08	0.13	0.39	0.01
05_E3y_INTERIOR	0.12	0.03	0.30	0.24	0.24	0.22	0.01	0.37	0.06	0.89	0.08	0.52	0.13	0.01	0.14	0.15
06_E3y_INTERIOR	0.18	0.23	0.12	0.18	0.11	0.29	0.05	0.39	0.03	0.82	0.01	0.29	0.03	0.05	0.12	0.00
07_E4y_INTERIOR	0.20	0.30	0.11	0.47	0.01	0.17	0.13	0.32	0.04	0.97	0.01	0.24	0.04	0.15	0.43	0.00
08_E4y_INTERIOR	0.21	0.23	0.01	0.02	0.20	0.27	0.02	0.43	0.04	0.79	0.12	0.38	0.09	0.06	0.28	0.04
09_E5y_N	0.13	0.07	0.22	0.25	0.01	0.13	0.00	0.19	0.33	0.80	0.12	0.38	0.04	0.08	0.33	0.01
10_E5y_NE	0.10	0.23	0.34	0.23	0.01	0.13	0.03	0.21	0.05	1.12	0.13	0.30	0.09	0.07	0.21	0.11
11_E1y_SE	0.28	0.00	0.18	0.10	0.04	0.15	0.01	0.20	0.08	1.02	0.33	0.47	0.02	0.10	0.24	0.06
04_E1y_S	0.14	0.01	0.30	0.14	0.02	0.12	0.00	0.19	0.07	0.96	0.06	0.70	0.07	0.08	0.35	0.04
13_E3x_S	0.16	0.06	0.46	0.17	0.03	0.18	0.00	0.34	0.06	0.95	0.11	0.14	0.21	0.26	0.55	0.02
14_E3x_N	0.25	0.18	0.26	0.14	0.00	0.12	0.04	0.18	0.03	0.75	0.13	0.48	0.00	0.29	0.44	0.07
15_O2x_NE	0.15	0.08	0.28	0.41	0.06	0.01	0.03	0.13	0.04	0.98	0.10	0.33	0.01	0.21	0.65	0.09
12_O2x_E	0.19	0.16	0.44	0.15	0.05	0.11	0.00	0.16	0.08	0.97	0.13	0.39	0.07	0.11	0.04	0.24

Table AII.52 – Maximum simultaneous values for all hold-down forces for seismic test TEST028_02

TEST028_02	01_E5x_SW	02_E2x_E	03_E5x_NW	16_E2x_NE	05_E3y_ INTERIOR	06_E3y_ INTERIOR	07_E4y_ INTERIOR	08_E4y_ INTERIOR	09_E5y_N	10_E5y_NE	11_E1y_SE	04_E1y_S	13_E3x_S	14_E3x_N	15_O2x_NE	12_O2x_E
01_E5x_SW	0.46	0.26	0.25	0.27	0.05	0.25	0.07	0.33	0.09	0.76	0.03	0.28	0.14	0.11	0.44	0.08
02_E2x_E	0.30	0.39	0.20	0.46	0.01	0.23	0.04	0.30	0.02	0.81	0.09	0.27	0.03	0.07	0.26	0.04
03_E5x_NW	0.12	0.17	0.67	0.28	0.04	0.18	0.01	0.28	0.16	0.86	0.00	0.46	0.15	0.12	0.26	0.01
16_E2x_NE	0.26	0.17	0.15	0.74	0.15	0.01	0.05	0.06	0.08	0.86	0.11	0.20	0.06	0.17	0.53	0.14
05_E3y_INTERIOR	0.07	0.01	0.31	0.23	0.30	0.32	0.02	0.44	0.03	0.86	0.02	0.44	0.01	0.02	0.24	0.04
06_E3y_INTERIOR	0.16	0.20	0.32	0.13	0.15	0.41	0.10	0.53	0.09	0.90	0.09	0.39	0.02	0.08	0.18	0.15
07_E4y_INTERIOR	0.22	0.26	0.24	0.37	0.05	0.29	0.15	0.38	0.19	0.82	0.02	0.18	0.10	0.13	0.42	0.11
08_E4y_INTERIOR	0.16	0.20	0.32	0.13	0.15	0.41	0.10	0.53	0.09	0.90	0.09	0.39	0.02	0.08	0.18	0.15
09_E5y_N	0.08	0.06	0.20	0.35	0.07	0.26	0.05	0.38	0.37	0.87	0.04	0.25	0.11	0.18	0.43	0.11
10_E5y_NE	0.16	0.18	0.44	0.20	0.07	0.24	0.02	0.31	0.03	1.13	0.08	0.60	0.09	0.10	0.37	0.07
11_E1y_SE	0.17	0.07	0.57	0.14	0.02	0.27	0.03	0.32	0.10	0.89	0.25	0.48	0.11	0.12	0.49	0.02
04_E1y_S	0.09	0.06	0.34	0.25	0.02	0.19	0.01	0.31	0.02	0.83	0.03	0.65	0.07	0.10	0.30	0.00
13_E3x_S	0.34	0.04	0.20	0.69	0.13	0.02	0.02	0.09	0.19	0.92	0.00	0.24	0.29	0.09	0.46	0.19
14_E3x_N	0.19	0.06	0.52	0.12	0.05	0.25	0.00	0.34	0.01	1.00	0.01	0.29	0.03	0.32	0.57	0.06
15_O2x_NE	0.42	0.35	0.15	0.54	0.18	0.10	0.10	0.16	0.07	0.88	0.01	0.33	0.09	0.22	0.87	0.29
12_O2x_E	0.26	0.05	0.32	0.38	0.14	0.11	0.09	0.10	0.13	0.87	0.06	0.51	0.06	0.16	0.62	0.36

Table AII.53 – Maximum simultaneous values for all hold-down forces for seismic test TEST028_03

TEST028_03	01_E5x_SW	02_E2x_E	03_E5x_NW	16_E2x_NE	05_E3y_ INTERIOR	06_E3y_ INTERIOR	07_E4y_ INTERIOR	08_E4y_ INTERIOR	09_E5y_N	10_E5y_NE	11_E1y_SE	04_E1y_S	13_E3x_S	14_E3x_N	15_O2x_NE	12_O2x_E
01_E5x_SW	0.57	0.20	0.29	0.39	0.26	0.27	0.11	0.30	0.30	0.85	0.07	0.15	0.17	0.32	0.63	0.31
02_E2x_E	0.38	0.49	0.28	0.48	0.18	0.40	0.13	0.51	0.28	0.74	0.01	0.31	0.25	0.18	0.47	0.12
03_E5x_NW	0.19	0.29	0.82	0.03	0.13	0.34	0.03	0.42	0.26	0.94	0.08	0.26	0.07	0.30	0.83	0.17
16_E2x_NE	0.24	0.01	0.51	0.81	0.21	0.25	0.06	0.30	0.27	0.91	0.05	0.31	0.30	0.23	0.53	0.19
05_E3y_INTERIOR	0.22	0.07	0.26	0.08	0.33	0.54	0.02	0.61	0.16	0.86	0.06	0.46	0.06	0.10	0.32	0.07
06_E3y_INTERIOR	0.26	0.19	0.06	0.15	0.22	0.56	0.08	0.62	0.15	0.80	0.05	0.29	0.02	0.20	0.26	0.09
07_E4y_INTERIOR	0.45	0.20	0.40	0.16	0.06	0.51	0.19	0.64	0.23	0.58	0.11	0.27	0.22	0.15	0.31	0.14
08_E4y_INTERIOR	0.18	0.01	0.17	0.08	0.23	0.53	0.07	0.65	0.16	0.80	0.02	0.32	0.00	0.16	0.27	0.10
09_E5y_N	0.35	0.14	0.36	0.51	0.12	0.41	0.09	0.53	0.59	0.79	0.03	0.27	0.19	0.24	0.45	0.13
10_E5y_NE	0.29	0.05	0.52	0.48	0.10	0.36	0.08	0.49	0.31	1.18	0.02	0.25	0.19	0.20	0.47	0.07
11_E1y_SE	0.16	0.06	0.54	0.47	0.10	0.28	0.03	0.36	0.20	1.01	0.29	0.37	0.13	0.20	0.41	0.10
04_E1y_S	0.25	0.21	0.44	0.21	0.08	0.23	0.00	0.33	0.08	0.95	0.12	0.64	0.12	0.22	0.33	0.00
13_E3x_S	0.37	0.24	0.05	0.62	0.16	0.32	0.10	0.40	0.39	0.76	0.03	0.33	0.39	0.08	0.35	0.28
14_E3x_N	0.21	0.05	0.31	0.27	0.10	0.40	0.10	0.50	0.28	0.78	0.07	0.29	0.09	0.38	0.34	0.19
15_O2x_NE	0.32	0.13	0.49	0.47	0.28	0.13	0.08	0.22	0.38	0.70	0.02	0.17	0.31	0.25	0.95	0.36
12_O2x_E	0.48	0.34	0.27	0.66	0.20	0.16	0.11	0.25	0.42	0.97	0.08	0.15	0.16	0.19	0.73	0.43

Table AII.54 – Maximum simultaneous values for all hold-down forces for seismic test TEST050_01

TEST050_01	01_E5x_SW	02_E2x_E	03_E5x_NW	16_E2x_NE	05_E3y_ INTERIOR	06_E3y_ INTERIOR	07_E4y_ INTERIOR	08_E4y_ INTERIOR	09_E5y_N	10_E5y_NE	11_E1y_SE	04_E1y_S	13_E3x_S	14_E3x_N	15_O2x_NE	12_O2x_E
01_E5x_SW	0.73	0.07	0.67	0.09	0.32	0.35	0.04	0.34	0.63	0.42	0.09	0.52	0.35	0.34	0.84	0.52
02_E2x_E	0.38	0.55	0.45	0.36	0.20	0.55	0.14	0.57	0.53	0.77	0.07	0.31	0.34	0.32	0.22	0.18
03_E5x_NW	0.38	0.17	0.95	0.11	0.10	0.51	0.00	0.54	0.26	0.43	0.08	0.33	0.23	0.37	0.72	0.13
16_E2x_NE	0.51	0.18	0.29	0.89	0.35	0.03	0.01	0.08	0.66	0.55	0.07	0.36	0.39	0.42	0.60	0.49
05_E3y_INTERIOR	0.61	0.33	0.13	0.70	0.41	0.06	0.08	0.14	0.50	0.29	0.02	0.43	0.42	0.36	0.45	0.40
06_E3y_INTERIOR	0.31	0.41	0.15	0.03	0.12	0.66	0.09	0.72	0.35	0.31	0.10	0.50	0.07	0.21	0.22	0.08
07_E4y_INTERIOR	0.44	0.30	0.45	0.57	0.25	0.54	0.21	0.56	0.56	0.85	0.10	0.23	0.35	0.33	0.41	0.19
08_E4y_INTERIOR	0.40	0.23	0.72	0.05	0.04	0.60	0.06	0.72	0.51	0.43	0.03	0.38	0.23	0.37	0.41	0.25
09_E5y_N	0.32	0.21	0.43	0.57	0.22	0.49	0.10	0.62	0.86	0.94	0.07	0.27	0.36	0.31	0.42	0.17
10_E5y_NE	0.40	0.02	0.76	0.26	0.22	0.48	0.10	0.50	0.51	1.27	0.03	0.48	0.31	0.27	0.52	0.14
11_E1y_SE	0.25	0.11	0.68	0.39	0.16	0.35	0.08	0.42	0.26	0.42	0.36	0.52	0.14	0.25	0.37	0.05
04_E1y_S	0.39	0.05	0.67	0.42	0.26	0.39	0.08	0.43	0.65	0.38	0.01	0.73	0.40	0.31	0.29	0.14
13_E3x_S	0.58	0.31	0.24	0.57	0.32	0.33	0.11	0.41	0.44	0.28	0.06	0.23	0.57	0.23	0.67	0.28
14_E3x_N	0.33	0.28	0.47	0.41	0.19	0.48	0.13	0.54	0.39	0.44	0.11	0.18	0.31	0.48	0.49	0.10
15_O2x_NE	0.51	0.08	0.35	0.43	0.29	0.15	0.03	0.13	0.32	0.62	0.01	0.40	0.18	0.30	0.93	0.32
12_O2x_E	0.65	0.31	0.34	0.66	0.36	0.32	0.11	0.29	0.74	0.39	0.14	0.33	0.33	0.33	0.73	0.68

Table AII.55 – Maximum simultaneous values for all hold-down forces for seismic test TEST050_02

TEST050_02	01_E5x_SW	02_E2x_E	03_E5x_NW	16_E2x_NE	05_E3y_ INTERIOR	06_E3y_ INTERIOR	07_E4y_ INTERIOR	08_E4y_ INTERIOR	09_E5y_N	10_E5y_NE	11_E1y_SE	04_E1y_S	13_E3x_S	14_E3x_N	15_O2x_NE	12_O2x_E
01_E5x_SW	0.99	0.51	1.02	0.41	0.45	0.59	0.11	0.55	1.80	0.55	0.17	0.22	1.43	0.41	0.88	1.16
02_E2x_E	0.71	0.59	0.93	0.73	0.39	0.75	0.15	0.80	1.59	0.03	0.11	0.26	1.37	0.34	0.49	0.47
03_E5x_NW	0.66	0.08	1.38	0.04	0.15	0.83	0.06	0.83	1.40	0.78	0.09	0.38	1.24	0.38	0.74	0.60
16_E2x_NE	0.70	0.43	0.06	1.37	0.46	0.16	0.01	0.04	1.24	0.61	0.10	0.47	1.33	0.32	0.13	0.76
05_E3y_INTERIOR	0.78	0.28	0.85	0.81	0.53	0.44	0.18	0.43	1.69	0.72	0.04	0.28	1.39	0.55	0.66	1.06
06_E3y_INTERIOR	0.63	0.25	0.95	0.04	0.05	0.95	0.18	0.91	1.56	0.57	0.18	0.42	1.51	0.26	0.09	0.70
07_E4y_INTERIOR	0.53	0.40	0.83	0.03	0.19	0.88	0.28	0.87	1.67	0.48	0.15	0.28	1.38	0.32	0.07	0.57
08_E4y_INTERIOR	0.56	0.21	1.08	0.01	0.05	0.94	0.17	0.94	1.61	0.53	0.11	0.40	1.52	0.25	0.15	0.74
09_E5y_N	0.60	0.38	0.90	0.68	0.40	0.77	0.20	0.80	1.90	0.52	0.05	0.15	1.38	0.43	0.39	0.48
10_E5y_NE	0.36	0.04	0.77	0.25	0.20	0.45	0.07	0.50	0.55	1.10	0.01	0.57	0.35	0.29	0.39	0.09
11_E1y_SE	0.68	0.20	0.90	0.75	0.41	0.72	0.19	0.78	1.67	0.59	0.36	0.15	1.34	0.40	0.42	0.48
04_E1y_S	0.28	0.12	0.43	0.11	0.34	0.73	0.04	0.76	0.69	0.73	0.17	0.76	0.32	0.13	0.51	0.21
13_E3x_S	0.62	0.09	0.81	0.18	0.30	0.61	0.16	0.70	0.71	0.67	0.25	0.24	1.82	0.30	1.05	0.50
14_E3x_N	0.78	0.43	0.70	1.28	0.46	0.48	0.13	0.45	1.53	0.50	0.01	0.25	1.35	0.56	0.33	0.98
15_O2x_NE	0.79	0.02	0.87	0.01	0.40	0.33	0.01	0.30	0.85	0.71	0.07	0.25	0.34	0.33	1.31	0.89
12_O2x_E	0.73	0.32	0.79	0.83	0.48	0.42	0.19	0.41	1.75	0.60	0.11	0.29	1.37	0.45	0.62	1.22

Table AII.56 – Maximum simultaneous values for all hold-down forces for seismic test TEST050_03

TEST050_03	01_E5x_SW	02_E2x_E	03_E5x_NW	16_E2x_NE	05_E3y_ INTERIOR	06_E3y_ INTERIOR	07_E4y_ INTERIOR	08_E4y_ INTERIOR	09_E5y_N	10_E5y_NE	11_E1y_SE	04_E1y_S	13_E3x_S	14_E3x_N	15_O2x_NE	12_O2x_E
01_E5x_SW	1.27	0.22	1.14	0.50	0.61	0.43	0.13	0.39	1.80	0.42	0.29	0.34	1.35	0.56	1.18	1.11
02_E2x_E	0.83	0.56	1.30	0.69	0.59	0.95	0.30	0.93	2.52	0.10	0.25	0.08	1.72	0.64	0.73	0.63
03_E5x_NW	0.86	0.11	1.97	0.44	0.45	1.02	0.15	0.92	2.31	0.20	0.08	0.19	1.82	0.73	0.91	0.66
16_E2x_NE	0.96	0.43	0.57	1.55	0.64	0.12	0.14	0.12	2.20	0.24	0.07	0.18	1.48	0.63	0.12	1.04
05_E3y_INTERIOR	0.92	0.27	1.25	0.99	0.70	0.83	0.25	0.82	2.56	0.04	0.24	0.21	1.78	0.80	0.87	0.81
06_E3y_INTERIOR	0.86	0.24	1.41	0.21	0.20	1.19	0.24	1.06	2.36	0.11	0.32	0.32	1.96	0.58	0.26	0.71
07_E4y_INTERIOR	0.91	0.31	1.53	0.32	0.54	1.06	0.34	1.01	2.49	0.15	0.29	0.03	1.71	0.68	0.78	0.62
08_E4y_INTERIOR	0.89	0.35	1.62	0.31	0.36	1.10	0.16	1.06	2.31	0.22	0.15	0.09	1.61	0.61	0.69	0.72
09_E5y_N	1.24	0.44	1.44	0.41	0.63	0.78	0.23	0.69	2.71	0.11	0.26	0.05	1.76	0.69	0.94	1.43
10_E5y_NE	0.61	0.15	1.35	0.51	0.38	0.73	0.18	0.75	1.55	0.84	0.01	0.41	1.30	0.50	0.48	0.41
11_E1y_SE	1.11	0.36	1.46	0.66	0.56	0.97	0.26	0.94	2.42	0.07	0.45	0.06	2.18	0.58	0.96	0.82
04_E1y_S	0.55	0.01	1.10	0.08	0.06	0.88	0.14	0.85	1.71	0.51	0.01	0.75	1.27	0.37	0.29	0.63
13_E3x_S	1.13	0.31	1.63	0.29	0.59	0.95	0.21	0.94	2.53	0.01	0.34	0.07	2.42	0.68	1.31	1.09
14_E3x_N	1.07	0.39	1.23	1.52	0.69	0.62	0.27	0.58	2.45	0.34	0.18	0.10	1.53	0.88	0.61	1.20
15_O2x_NE	1.05	0.07	1.66	0.21	0.60	0.92	0.20	0.92	2.50	0.18	0.23	0.11	2.33	0.66	1.37	1.08
12_O2x_E	0.88	0.10	1.71	0.61	0.57	0.77	0.18	0.70	2.52	0.10	0.14	0.15	1.58	0.60	0.90	1.48

FRF Estimates

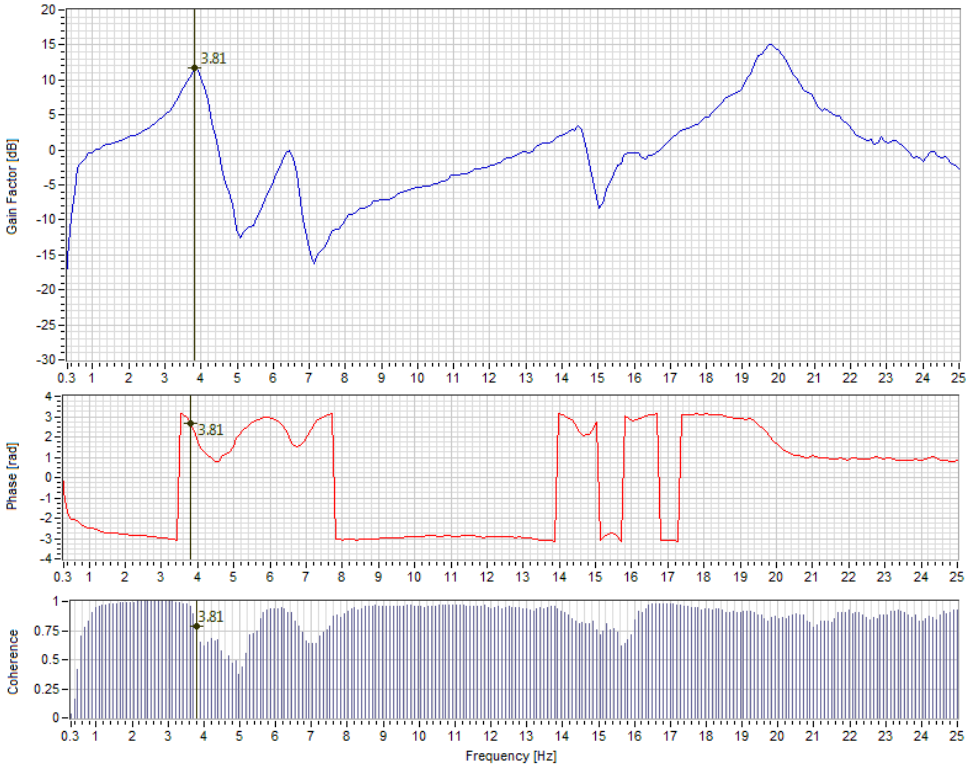


Figure AII.1: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_L1_A1_Y_SE_T

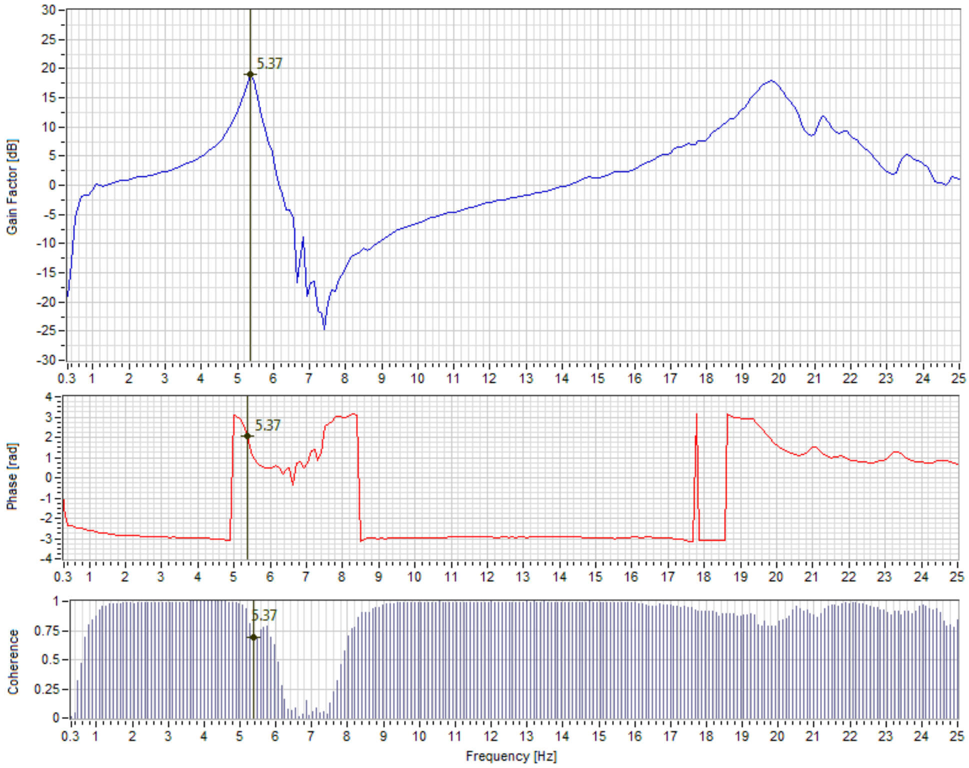


Figure AII.2: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_L1_A1_X_SE_L

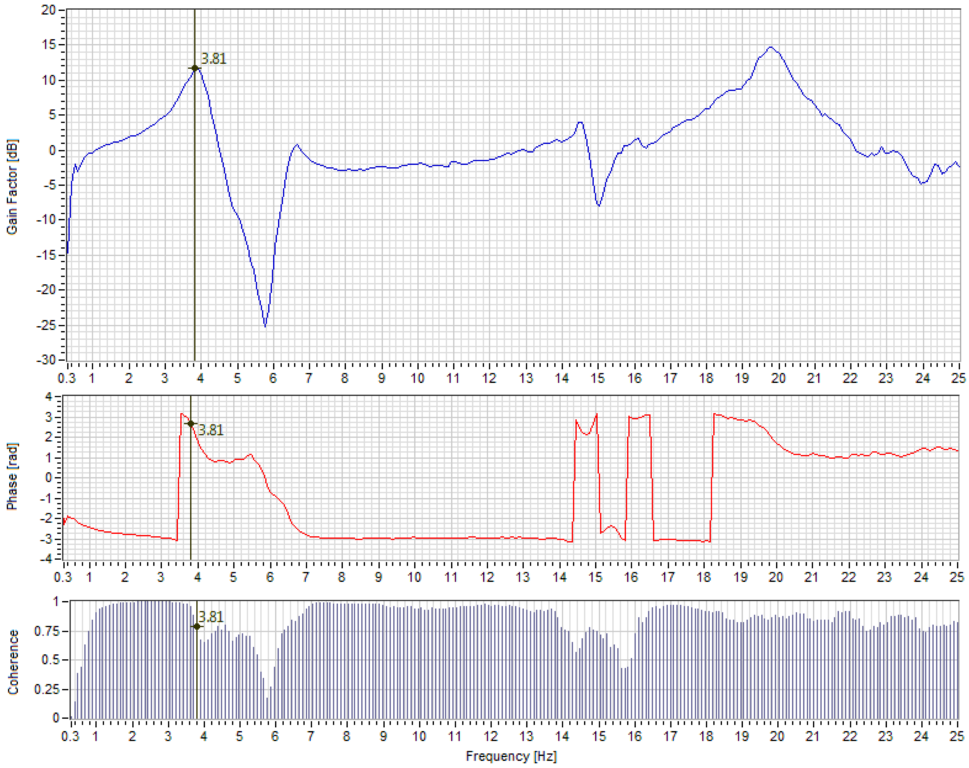


Figure AII. 3: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_L1_C1_Y_NE_T

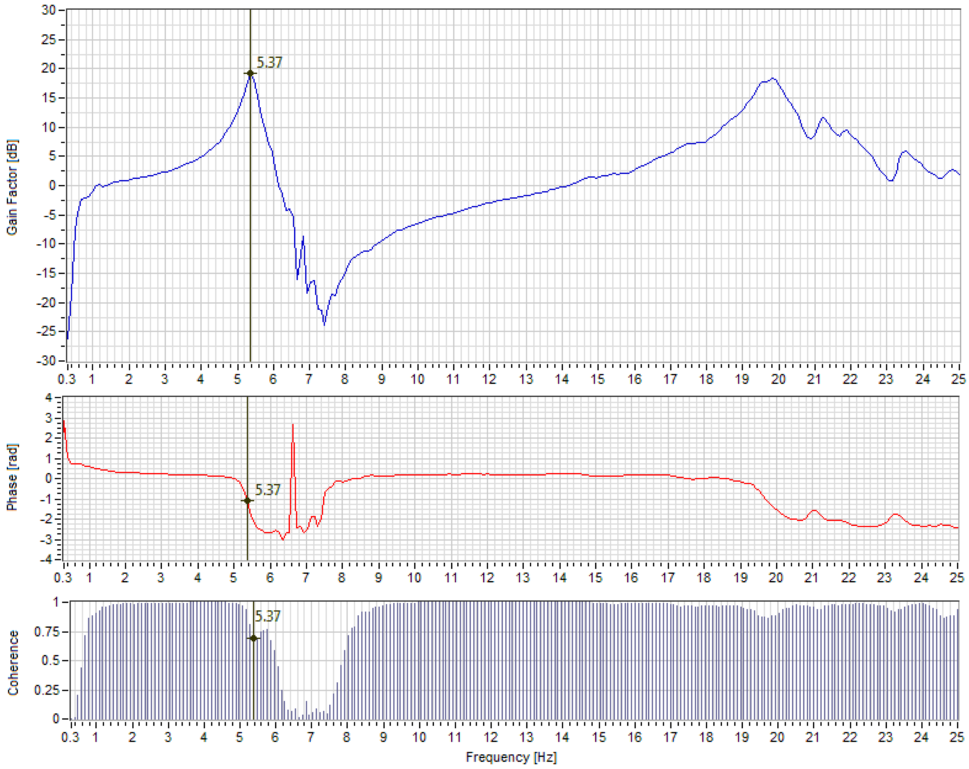


Figure AII. 4: Frequency response function, phase and coherence (Cat02): ACC MESA LONG; ACC_L1_C1_X_NE_L

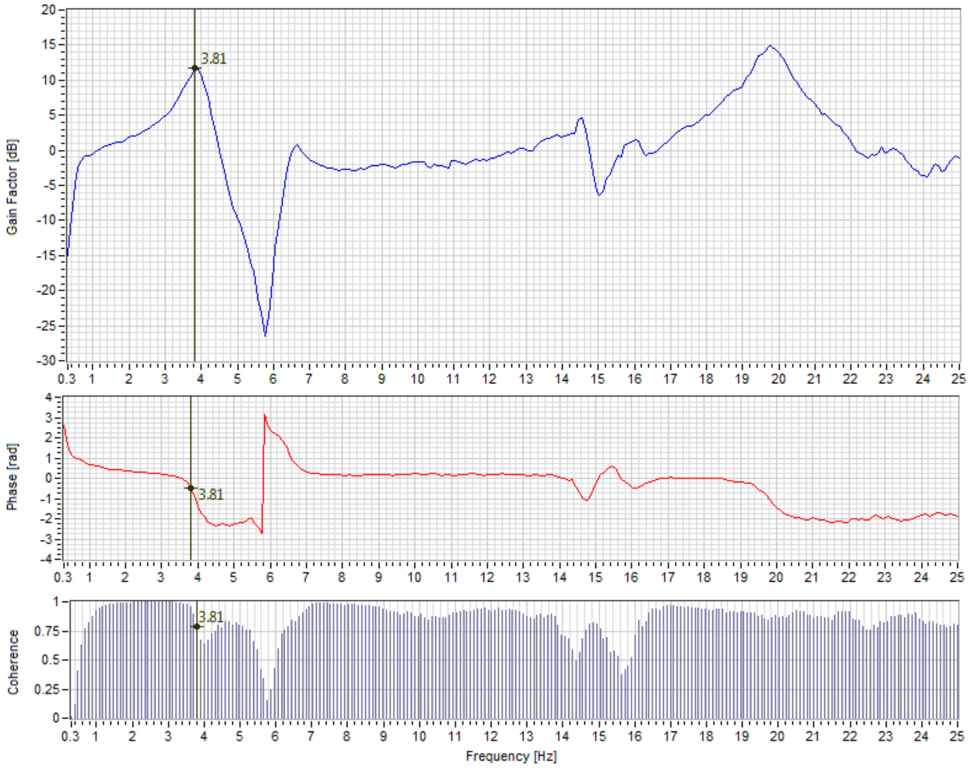


Figure AII. 5: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_L1_C2_Y_N_T

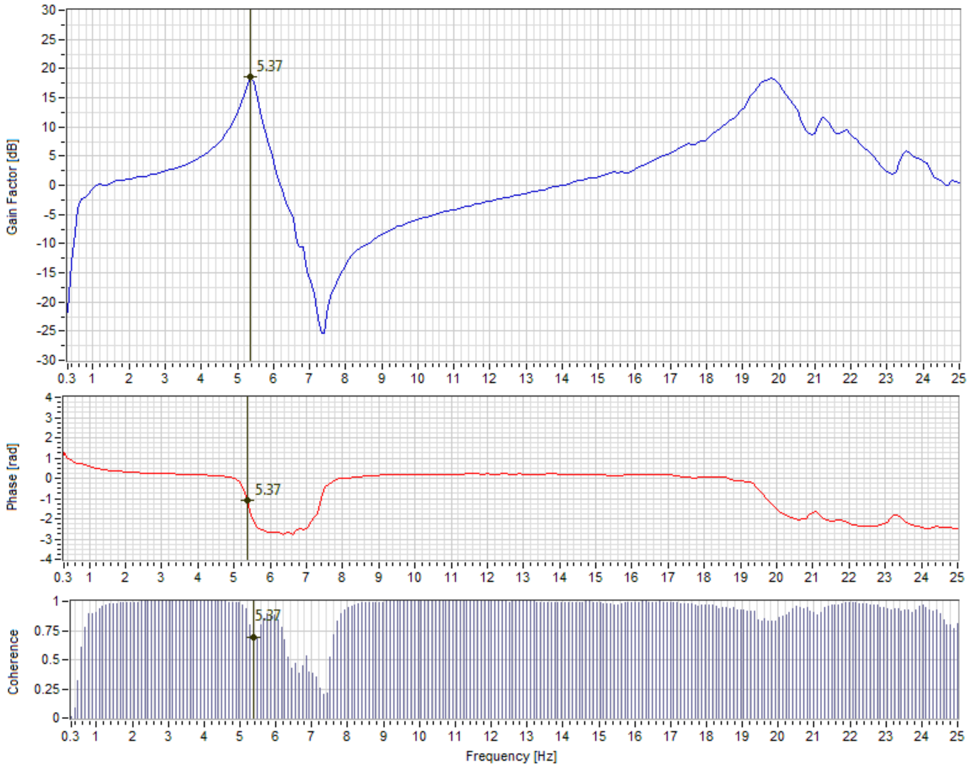


Figure AII. 6: Frequency response function, phase and coherence (Cat02): ACC MESA LONG; ACC_L1_C2_X_N_L

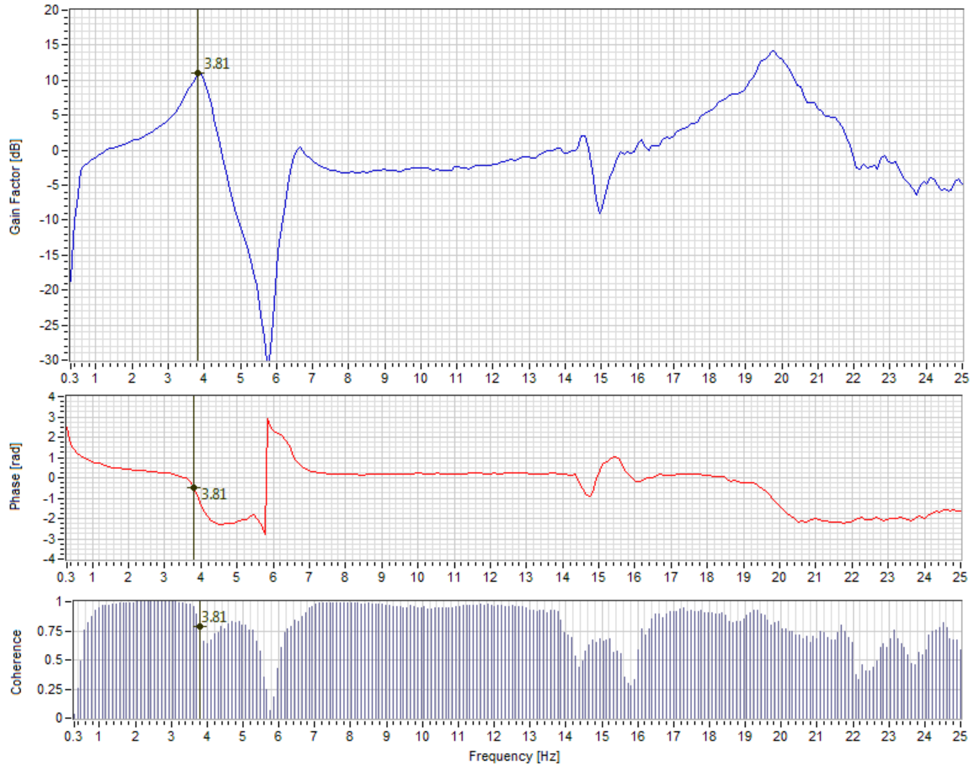


Figure AII. 7: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_L1_C3_Y_NW_T

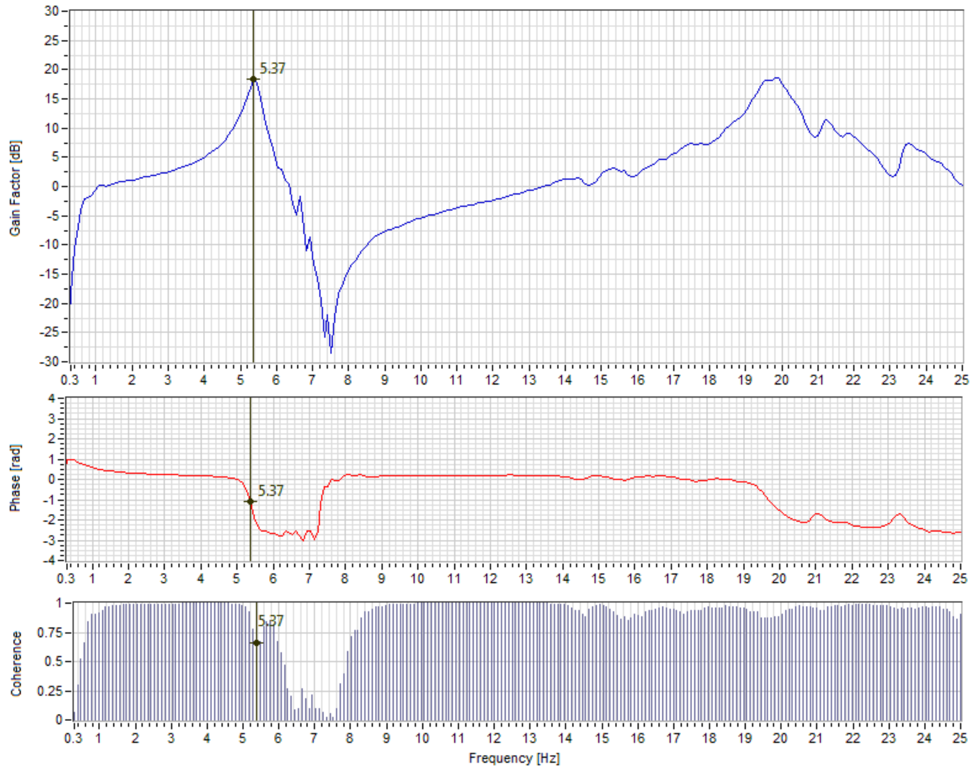


Figure AII. 8: Frequency response function, phase and coherence (Cat02): ACC MESA LONG; ACC_L1_C3_X_NW_L

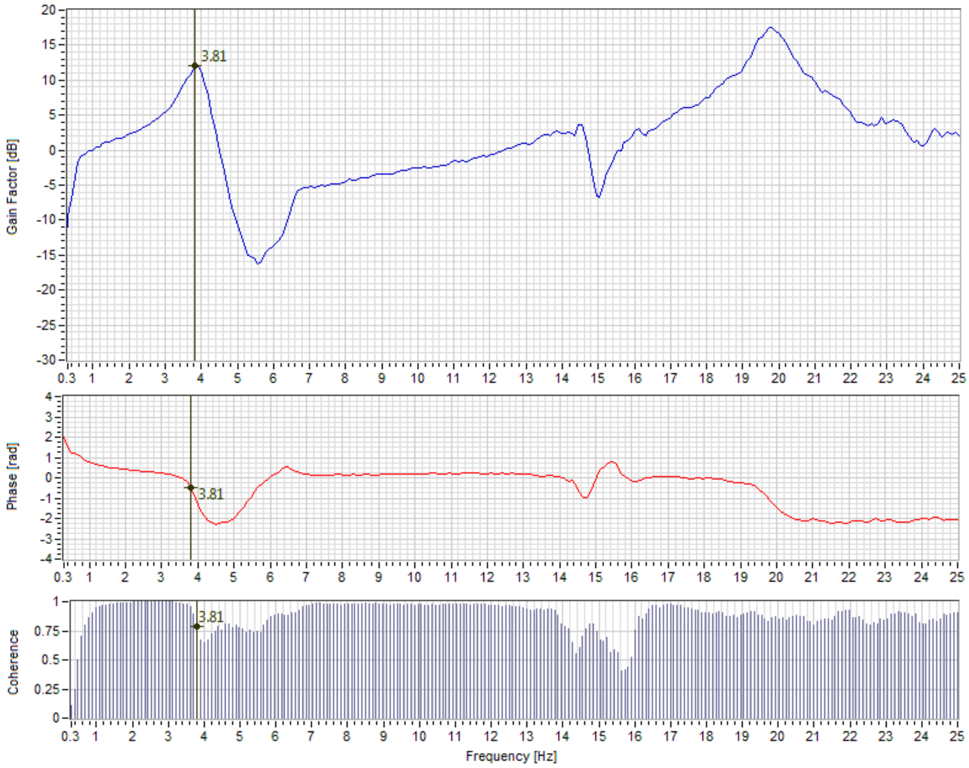


Figure AII. 9: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_L1_B3_Y_W_T

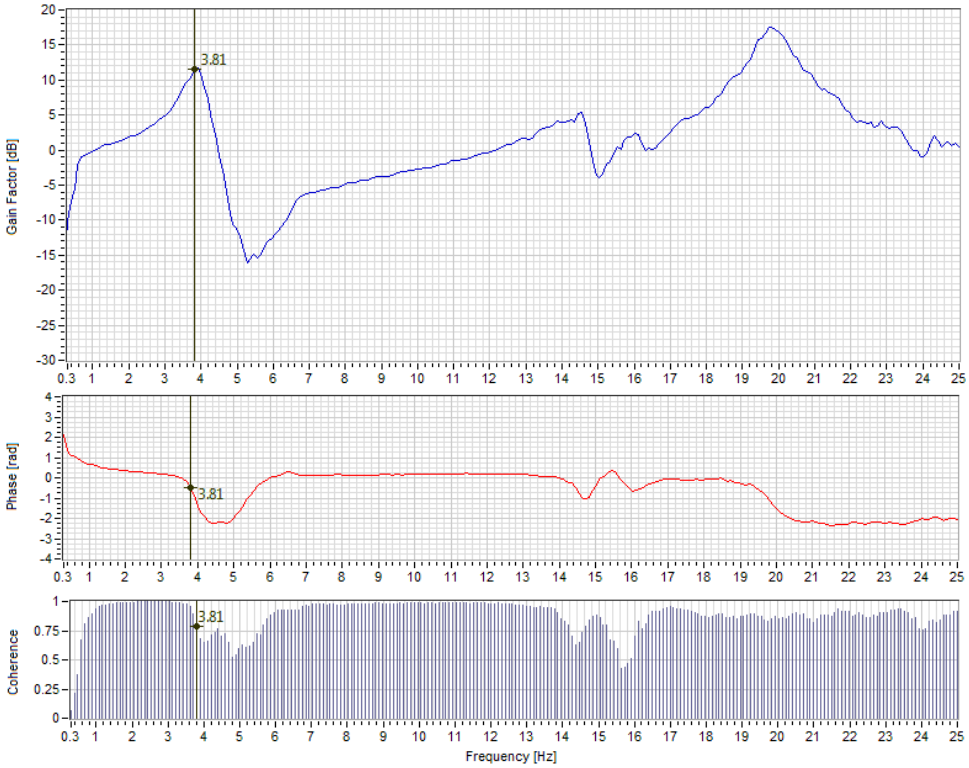


Figure AII. 10: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_L1_B2_Y_I_T

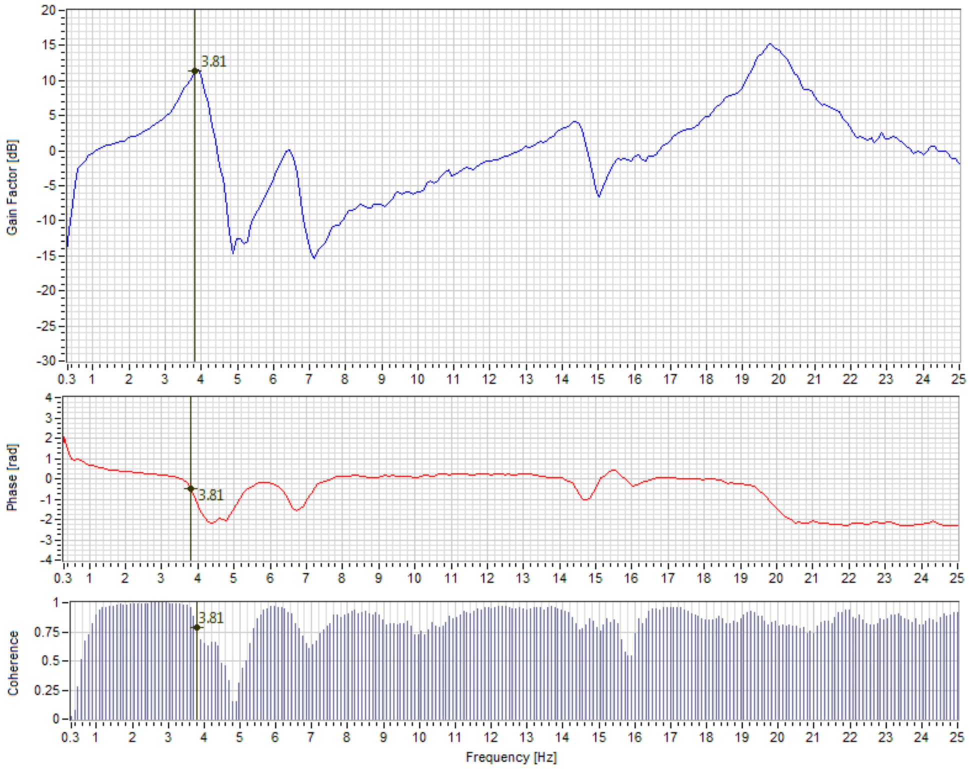


Figure AII. 11: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_L1_A3_Y_SW_T

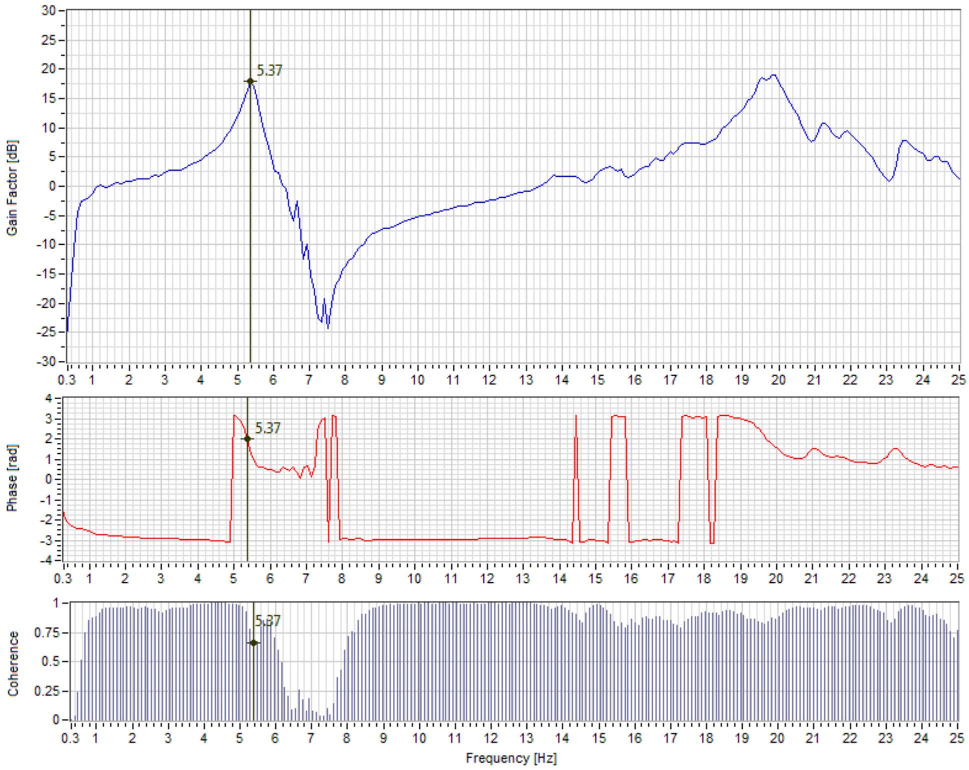


Figure AII. 12: Frequency response function, phase and coherence (Cat02): ACC MESA LONG; ACC_L1_A3_X_SW_L

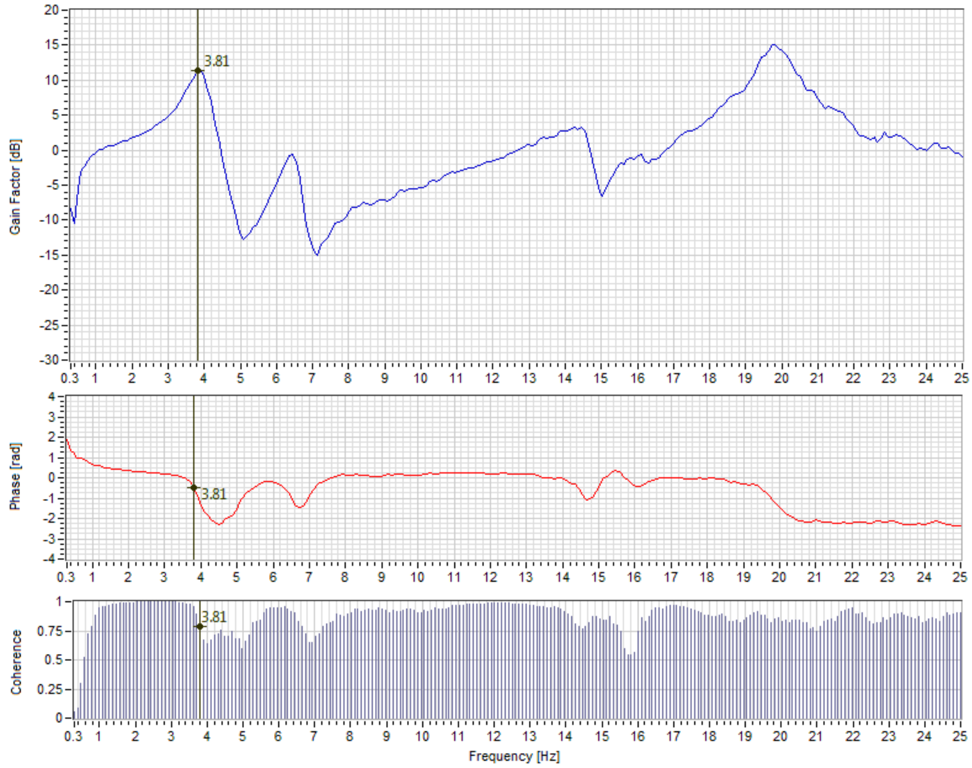


Figure AII. 13: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_L1_A2_Y_S_T

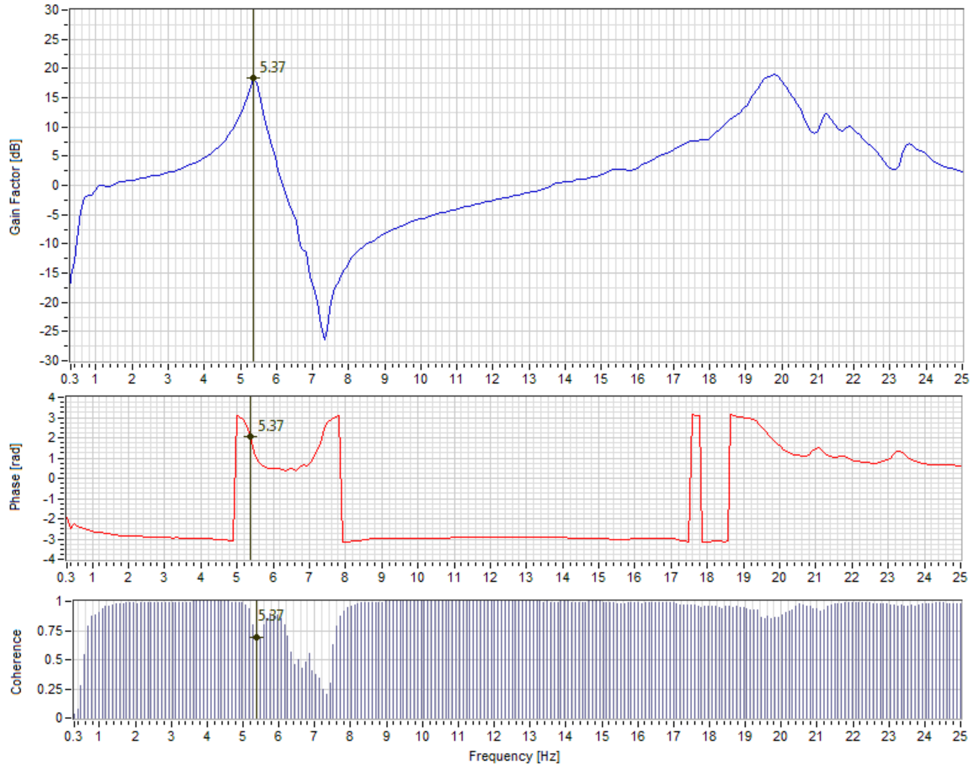


Figure AII. 14: Frequency response function, phase and coherence (Cat02): ACC MESA LONG; ACC_L1_A2_X_S_L

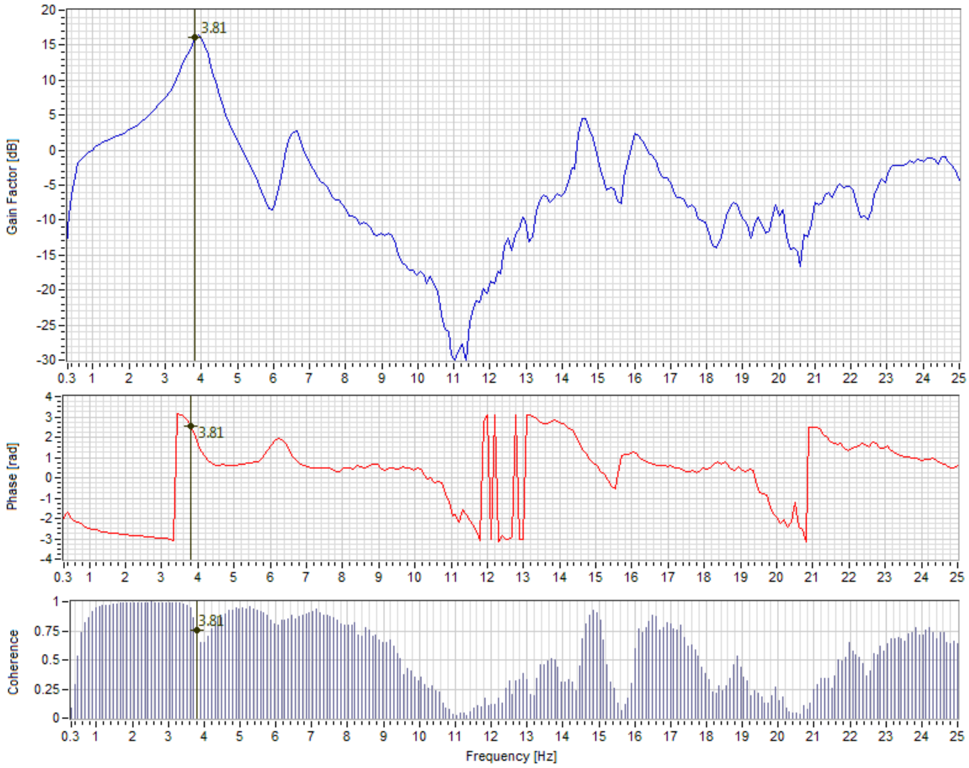


Figure AII. 15: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_L2_A1_Y_SE_T

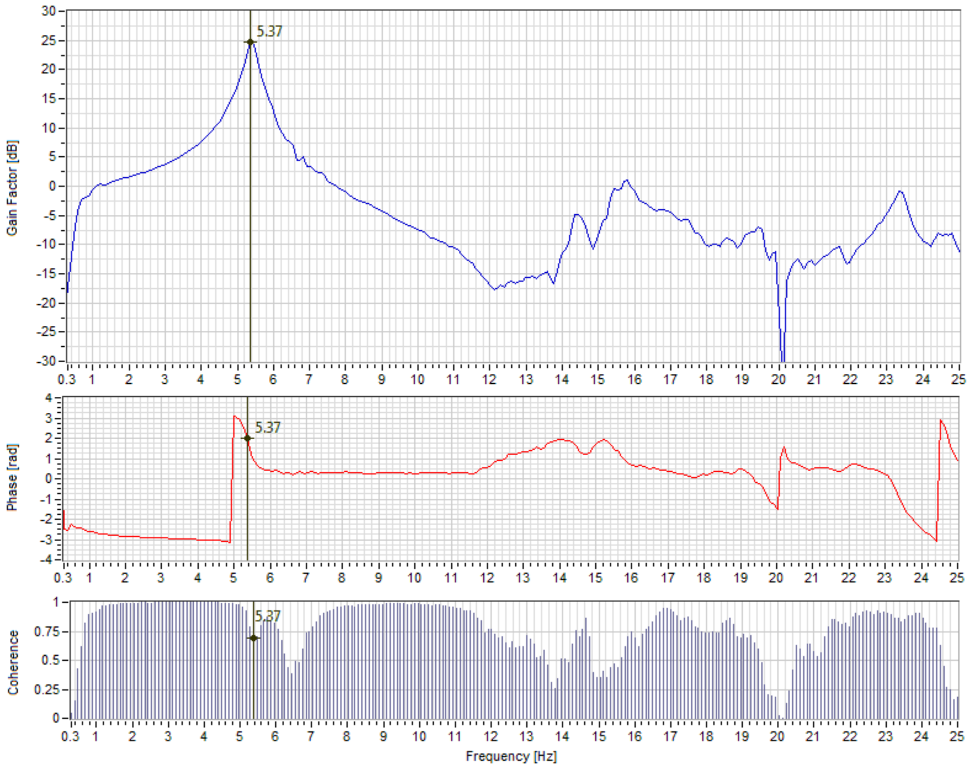


Figure AII. 16: Frequency response function, phase and coherence (Cat02): ACC MESA LONG; ACC_L2_A1_X_SE_L

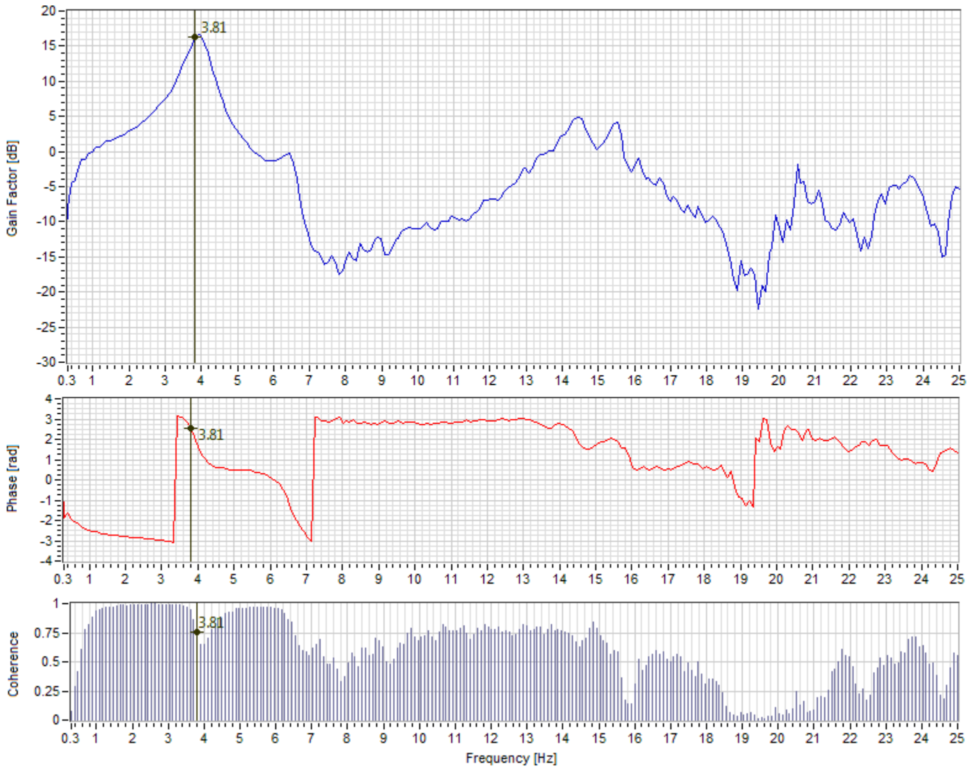


Figure AII. 17: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_L2_C1_Y_NE_T

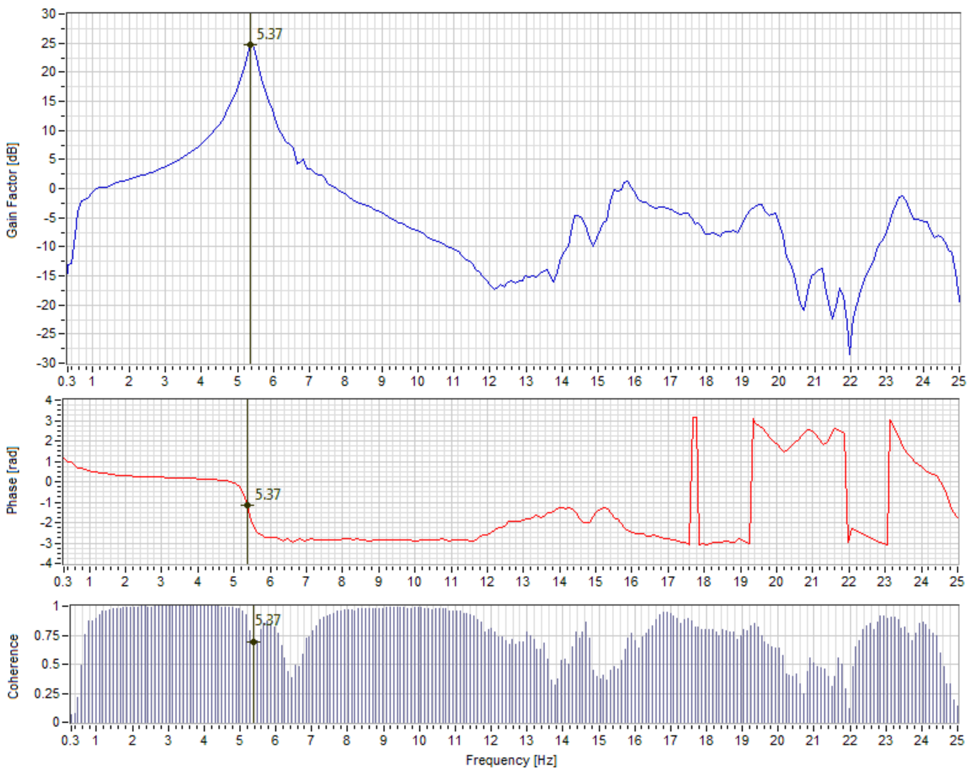


Figure AII. 18: Frequency response function, phase and coherence (Cat02): ACC MESA LONG; ACC_L2_C1_X_NE_L

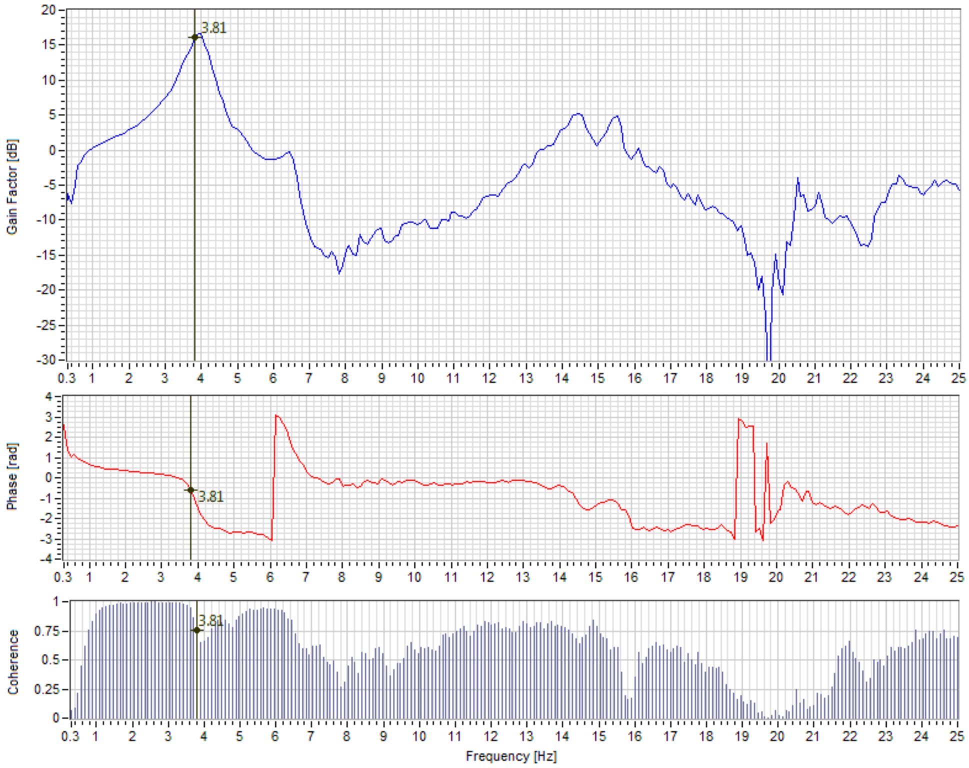


Figure AII. 19: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_L2_C2_Y_N_T

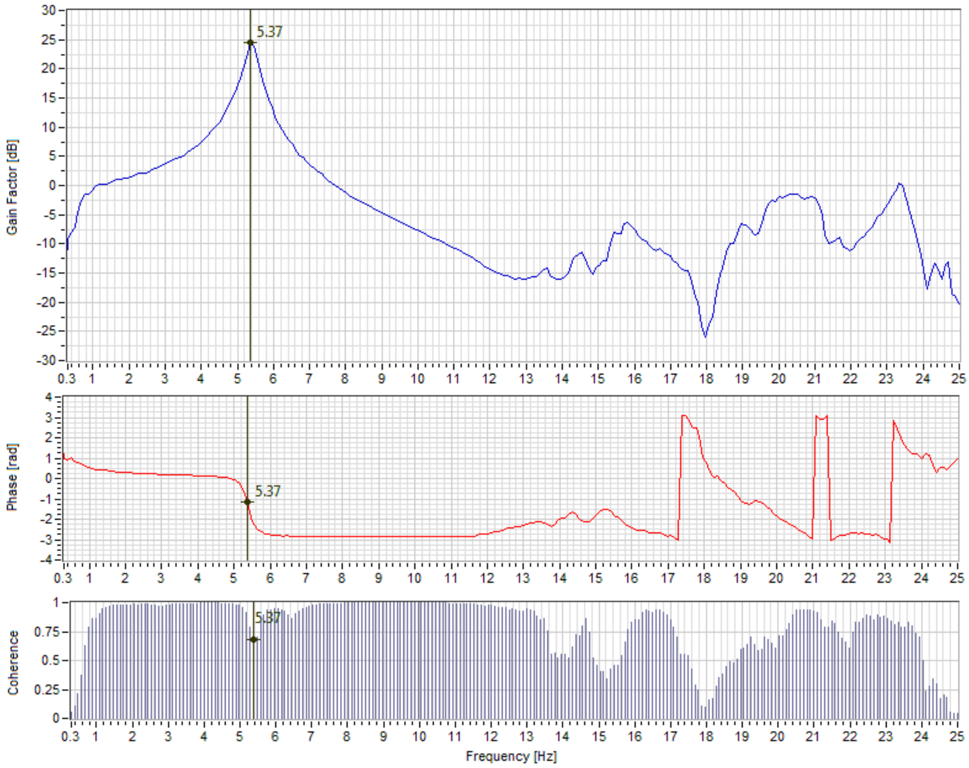


Figure AII. 20: Frequency response function, phase and coherence (Cat02): ACC MESA LONG; ACC_L2_C2_X_N_L

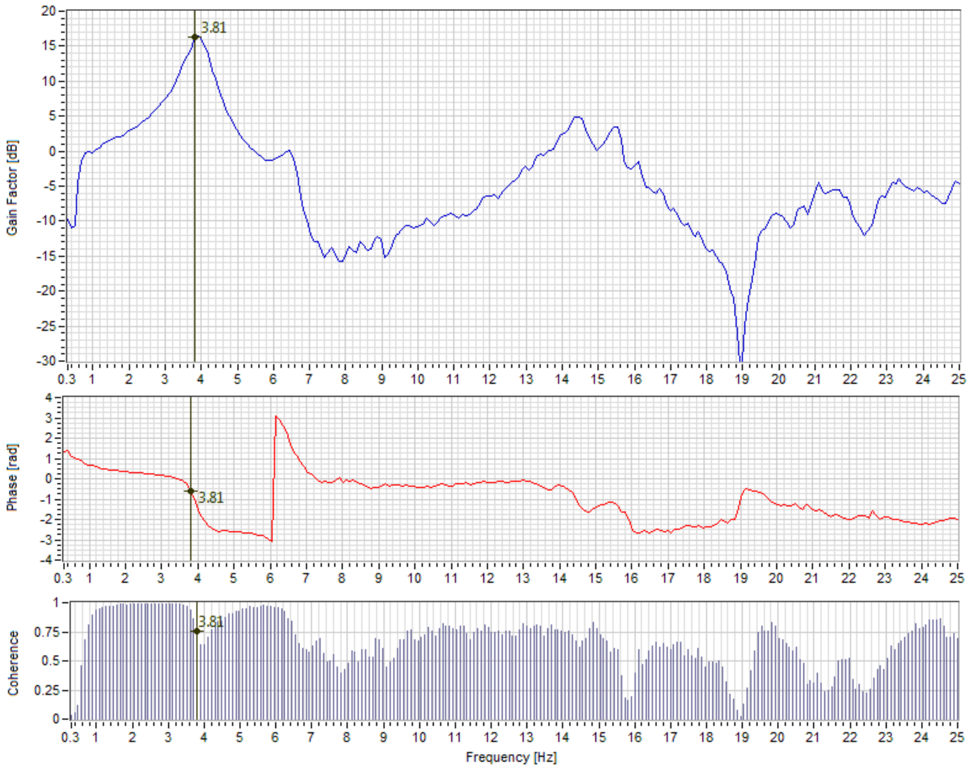


Figure AII. 21: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_L2_C3_Y_NW_T

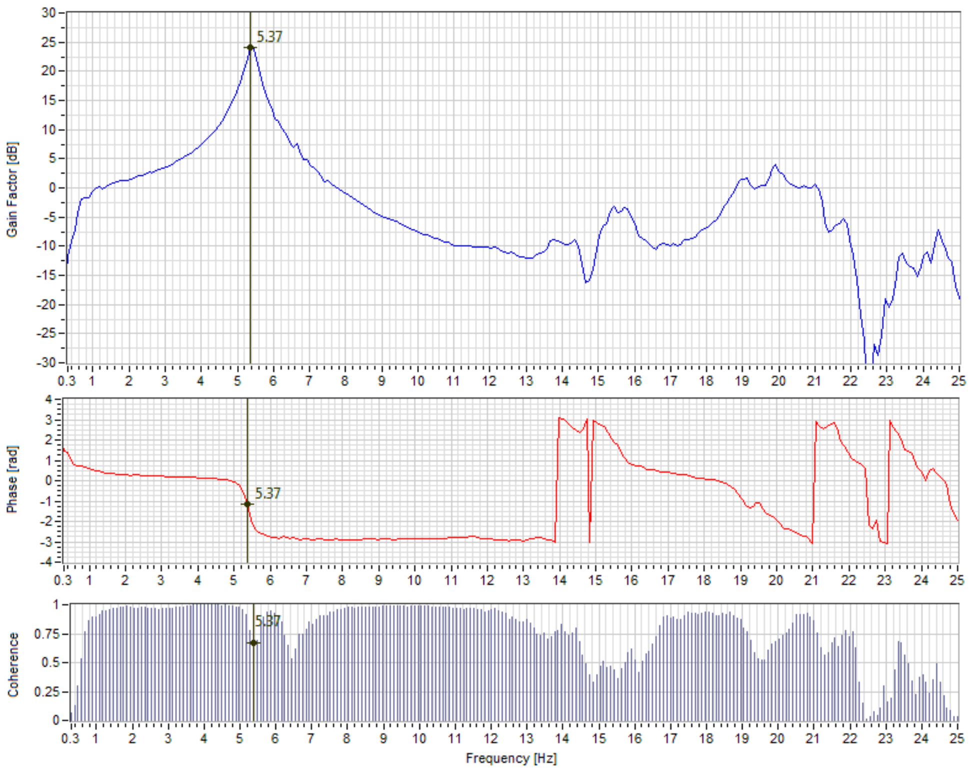


Figure AII. 22: Frequency response function, phase and coherence (Cat02): ACC MESA LONG; ACC_L2_C3_X_NW_L

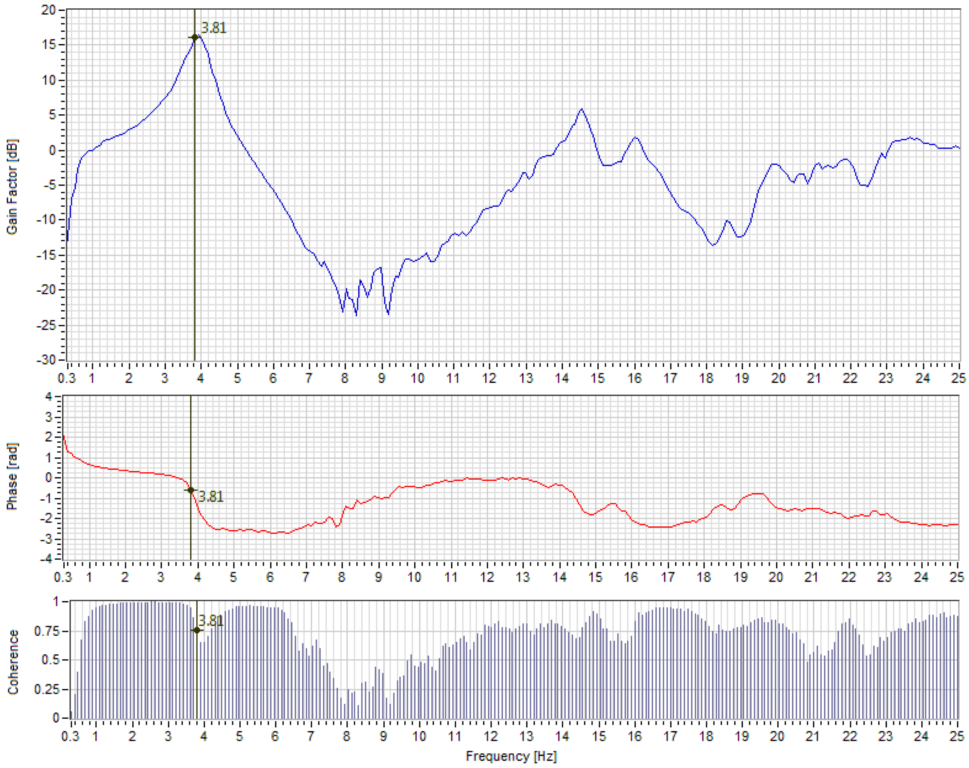


Figure AII. 23: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_L2_B3_Y_W_T

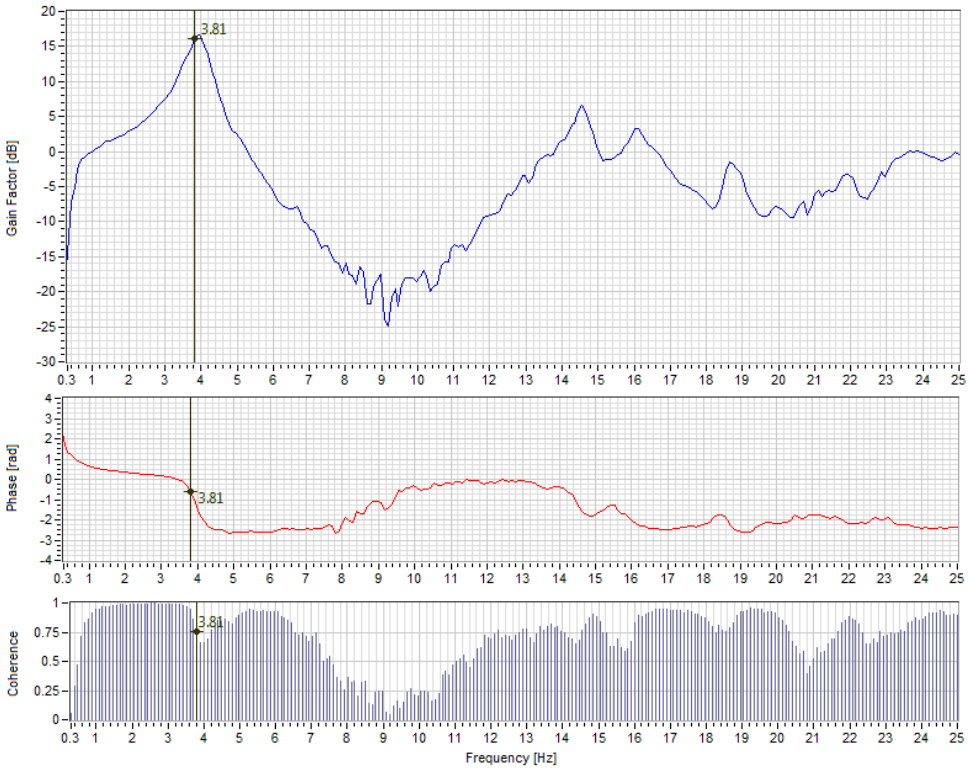


Figure AII. 24: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_L2_B2_Y_I_T

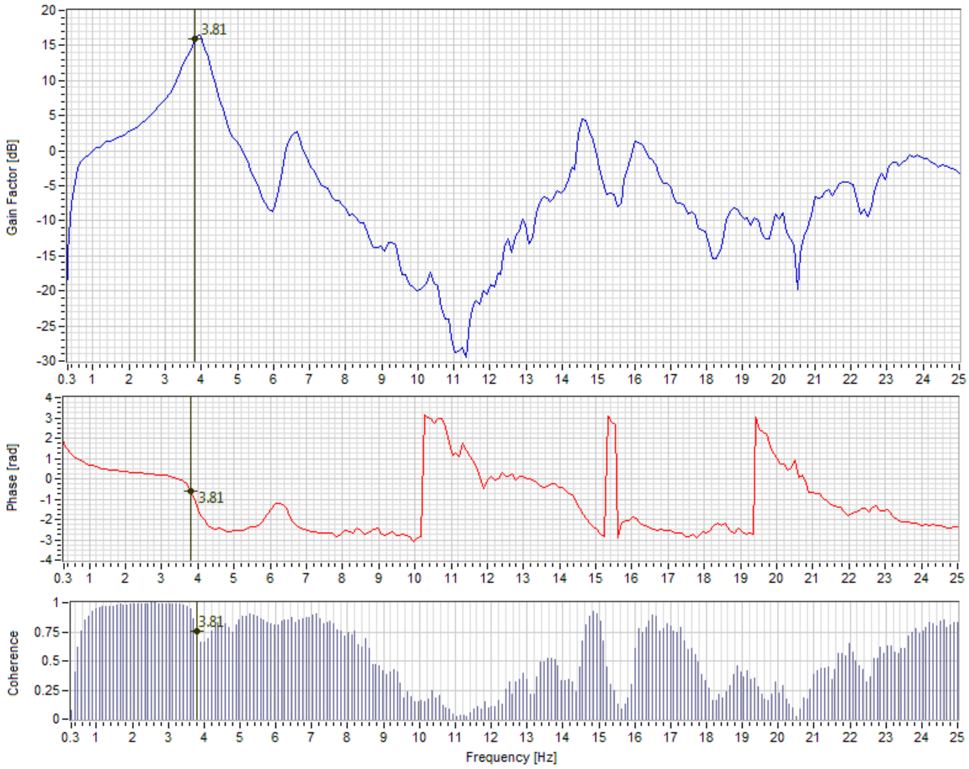


Figure AII. 25: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_L2_A3_Y_SW_T

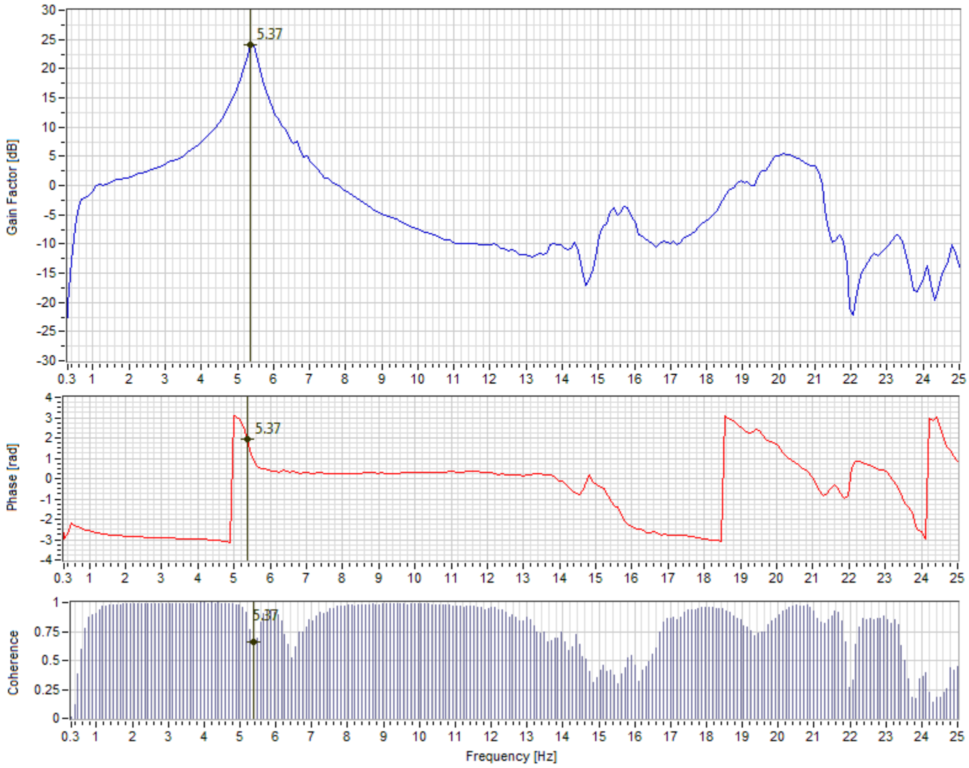


Figure AII. 26: Frequency response function, phase and coherence (Cat02): ACC MESA LONG; ACC_L2_A3_X_SW_L

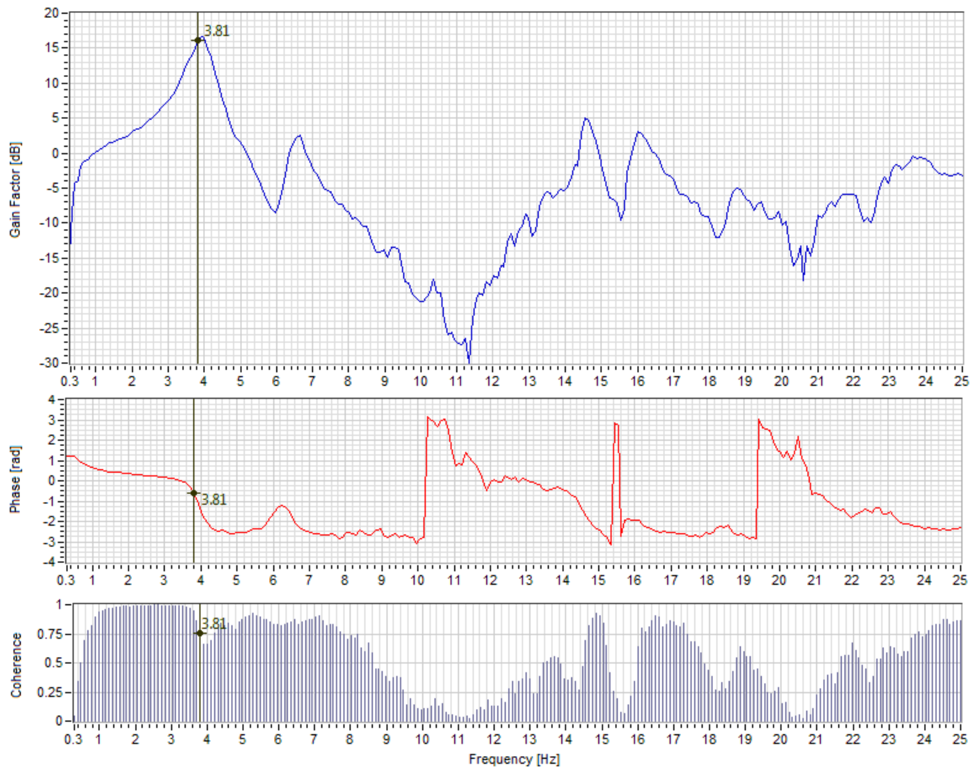


Figure AII. 27: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_L2_A2_Y_S_T

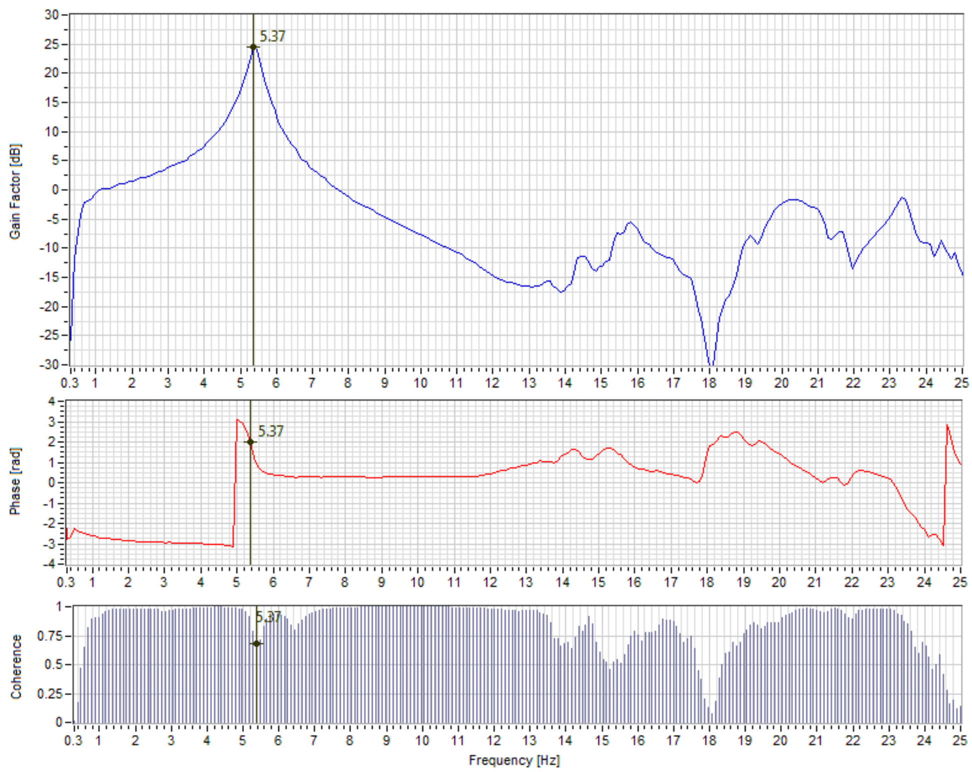


Figure AII. 28: Frequency response function, phase and coherence (Cat02): ACC MESA LONG; ACC_L2_A2_X_S_L

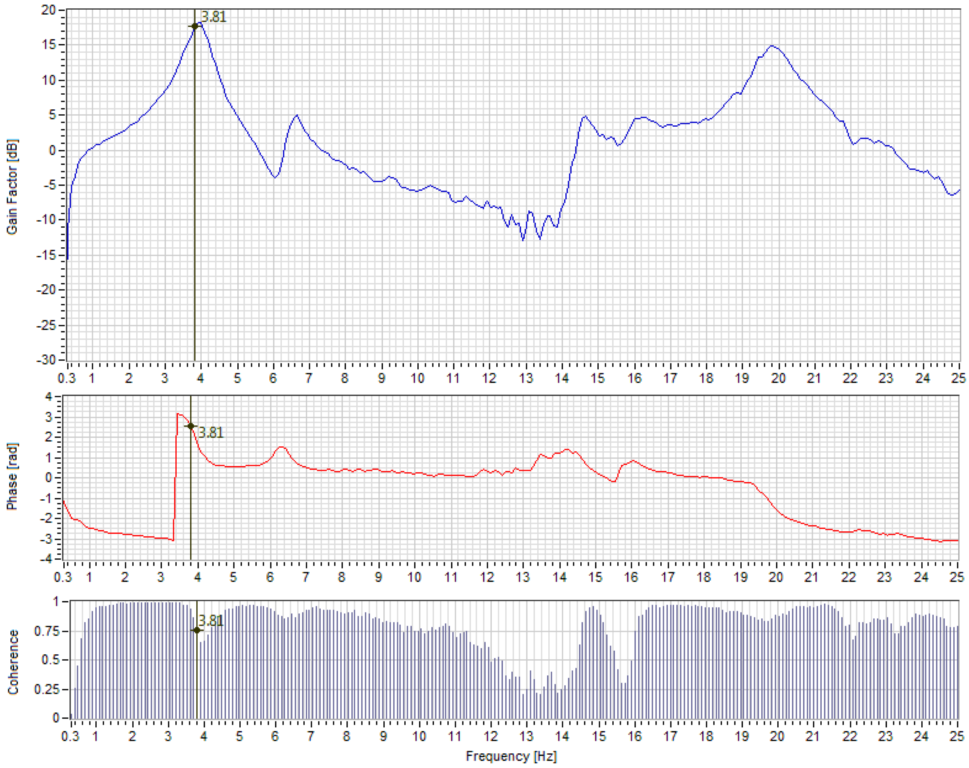


Figure AII. 29: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_RL_A1_Y_SE_T

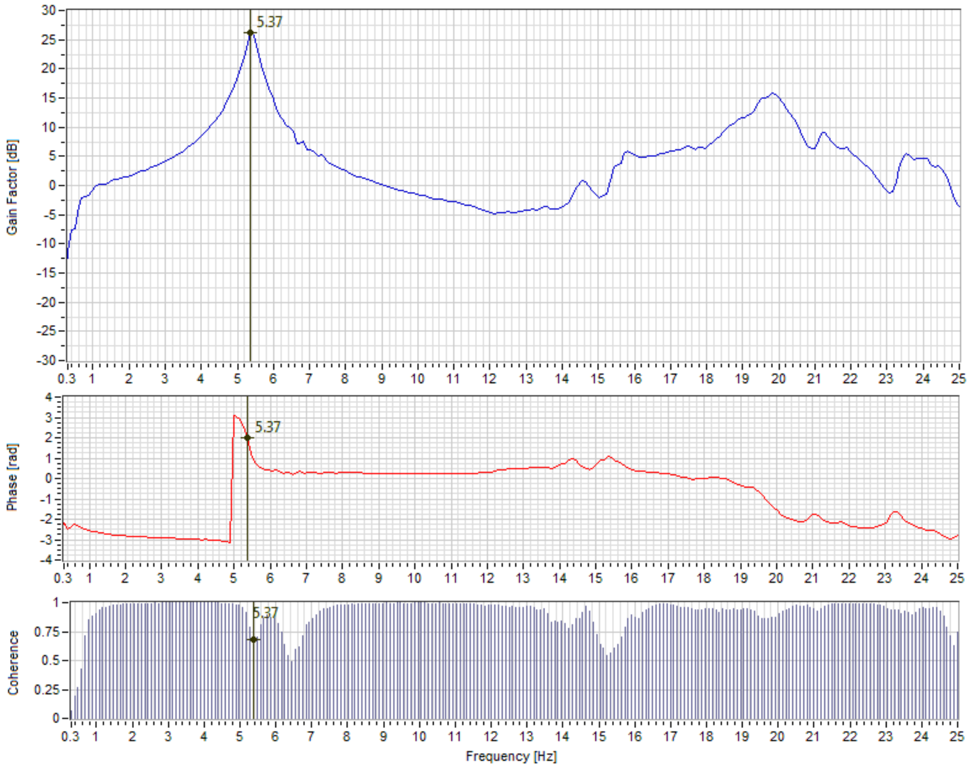


Figure AII. 30: Frequency response function, phase and coherence (Cat02): ACC MESA LONG; ACC_RL_A1_X_SE_L

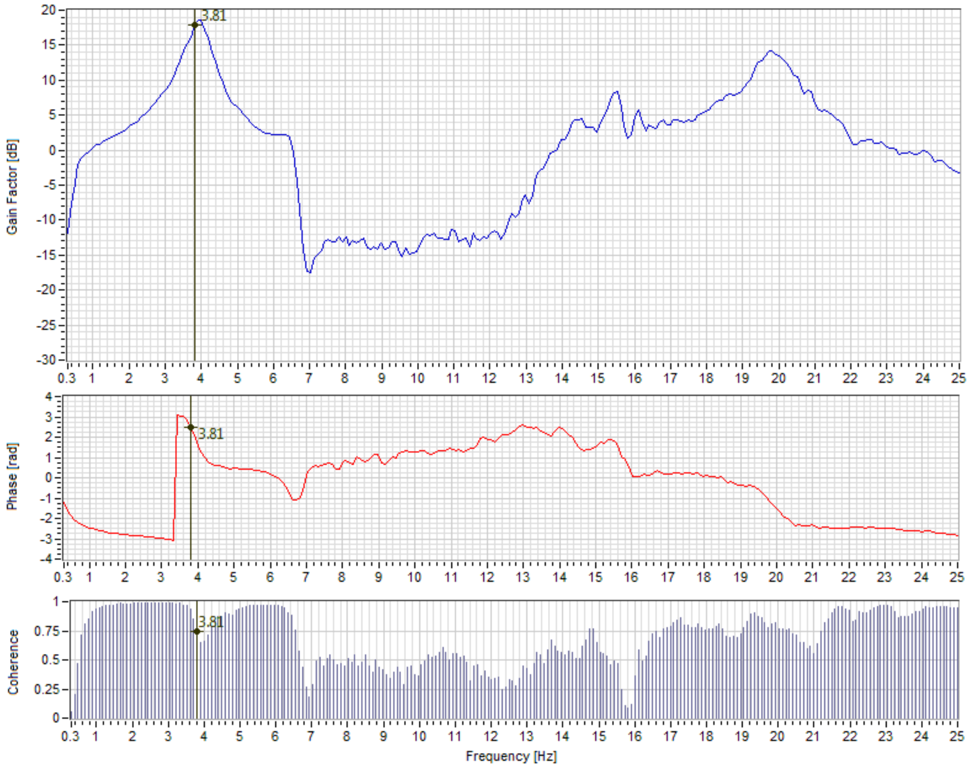


Figure AII. 31: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_RL_C1_Y_NE_T

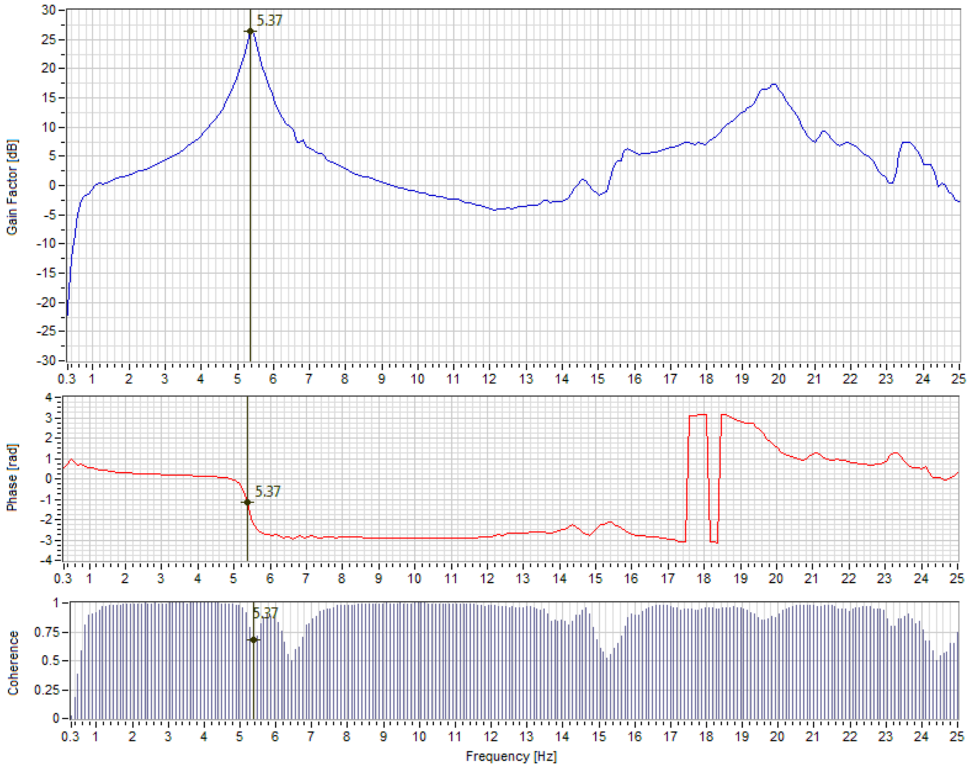


Figure AII. 32: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_RL_C1_X_NE_L

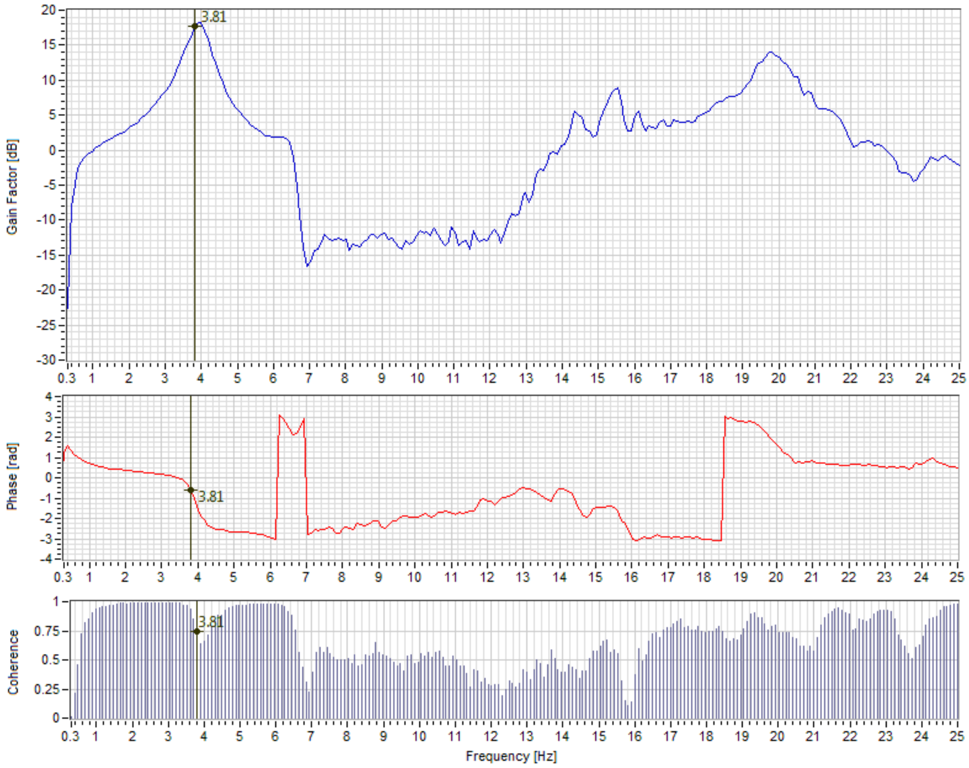


Figure AII. 33: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_RL_C3_Y_NW_T

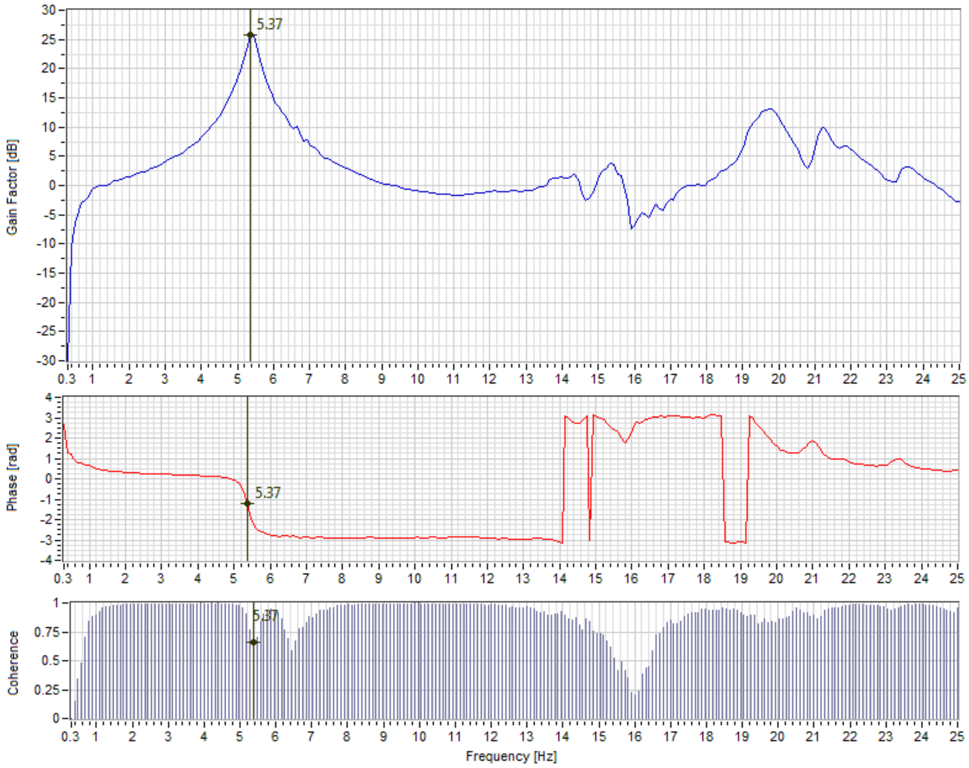


Figure AII. 34: Frequency response function, phase and coherence (Cat02): ACC MESA LONG; ACC_RL_C3_X_NW_L

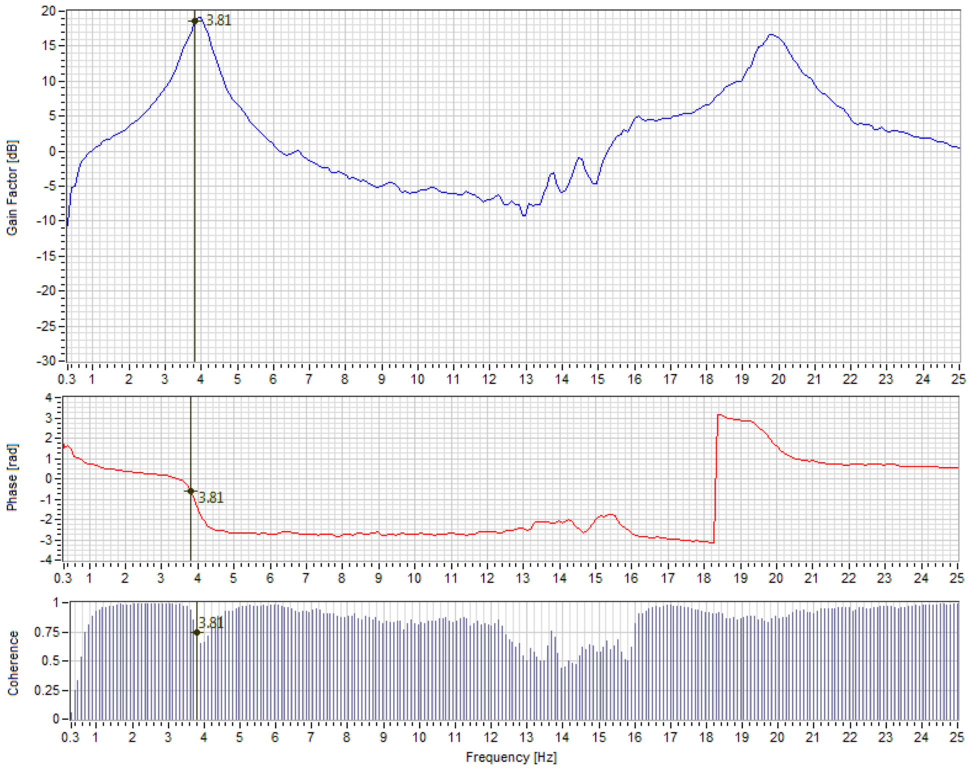


Figure AII. 35: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_RL_B3_Y_W_T

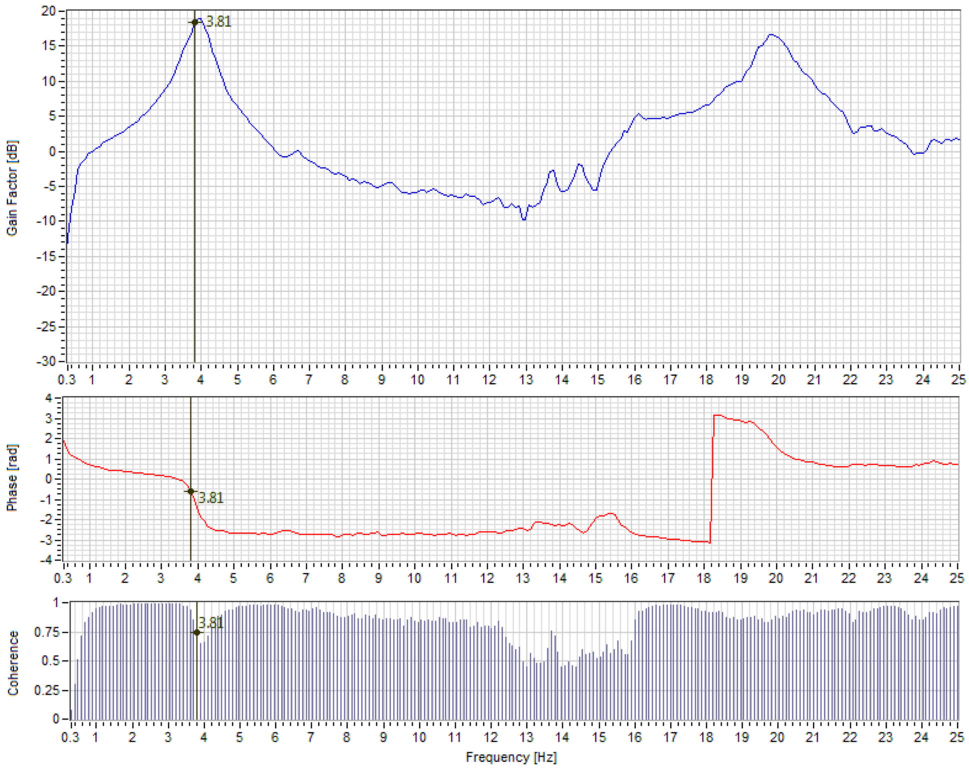


Figure AII. 36: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_RL_B2_Y_I_T

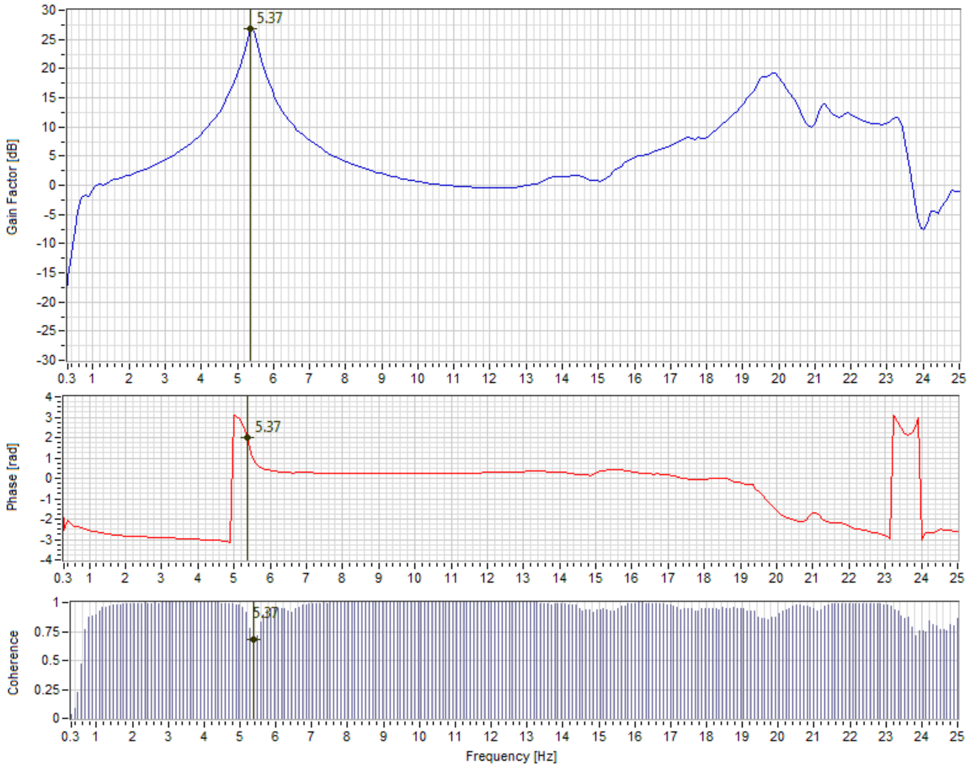


Figure AII. 37: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_RL_B2_X_I_L

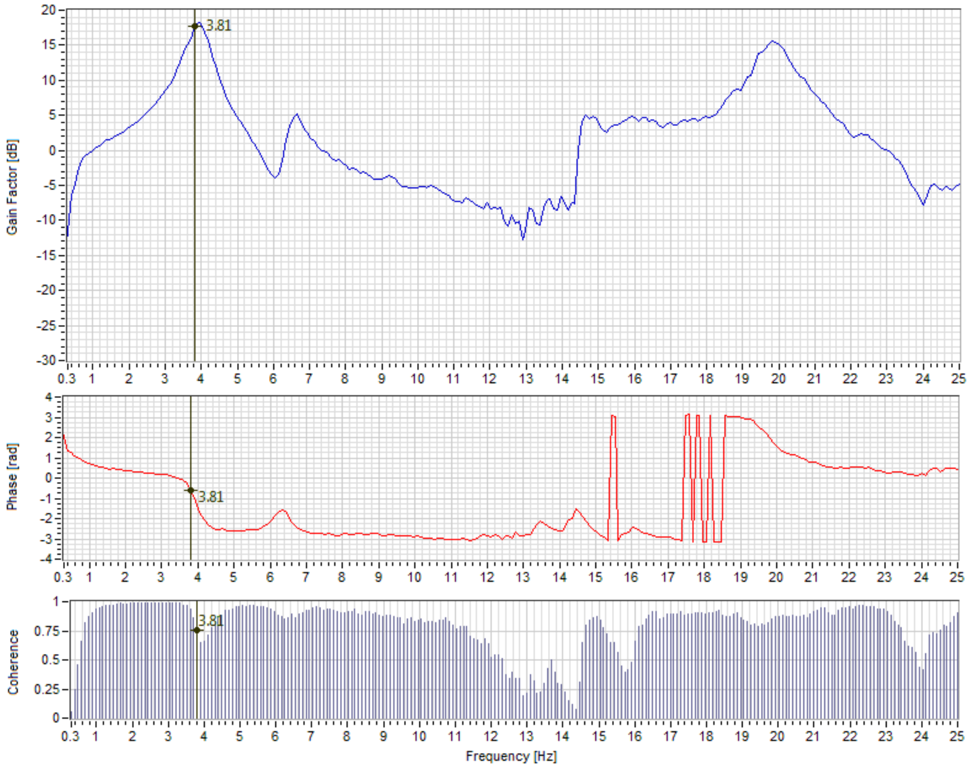


Figure AII. 38: Frequency response function, phase and coherence (Cat02): ACC MESA TRANS; ACC_RL_A3_Y_SW_T

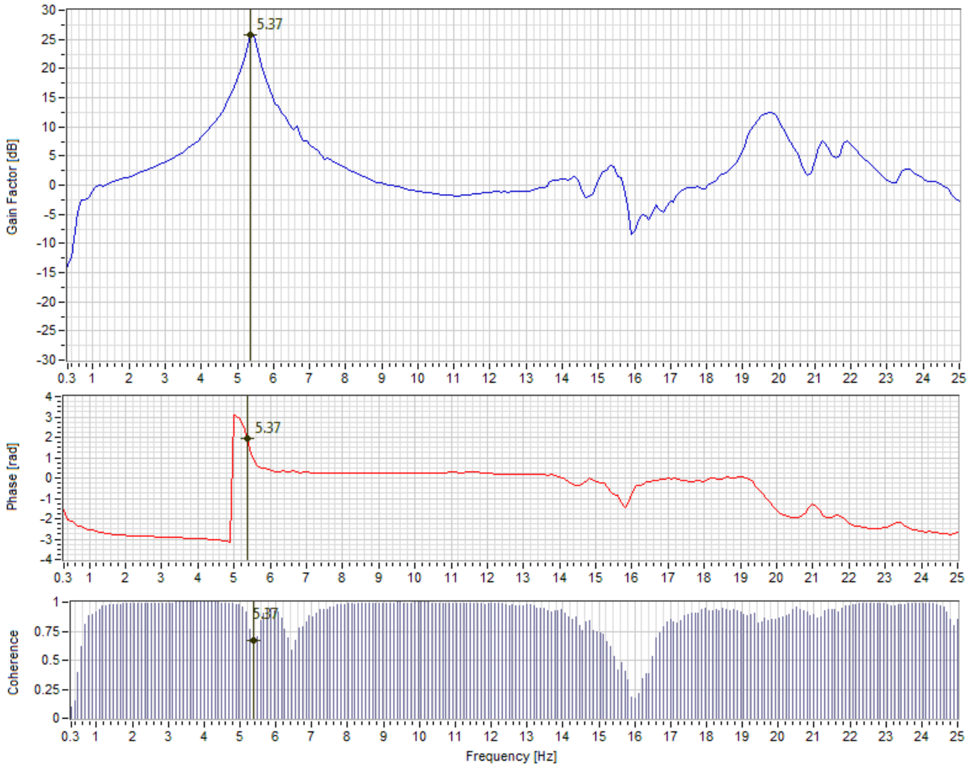


Figure AII.39: Frequency response function, phase and coherence (Cat02): ACC MESA LONG; ACC_RL_A3_X_SW_L

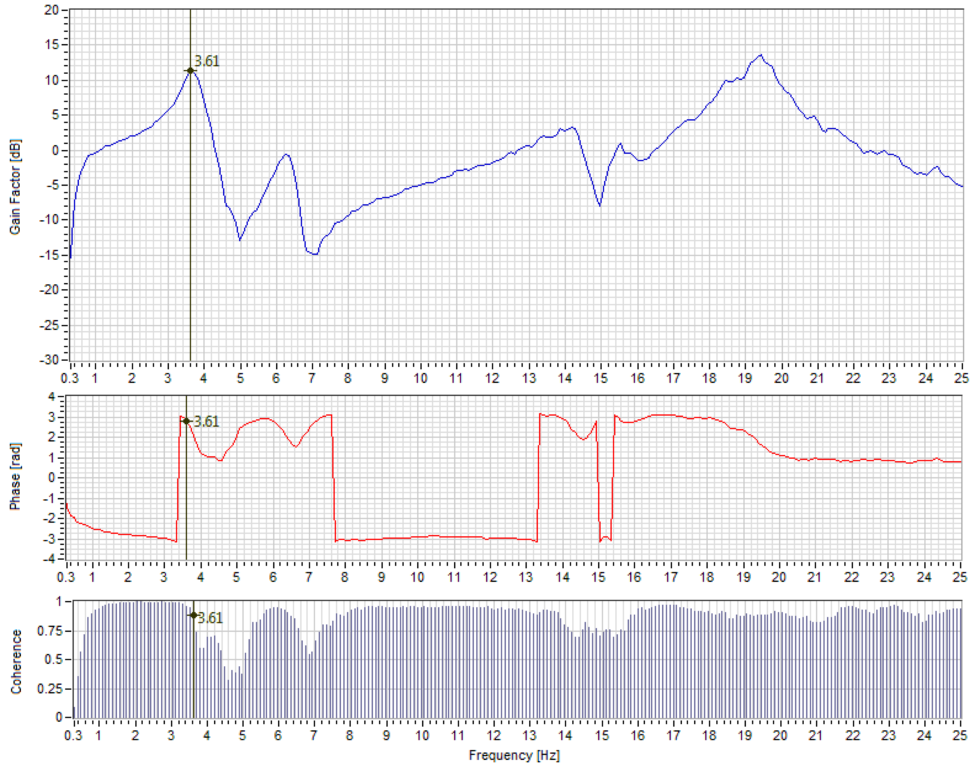


Figure AII. 40: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_L1_A1_Y_SE_T

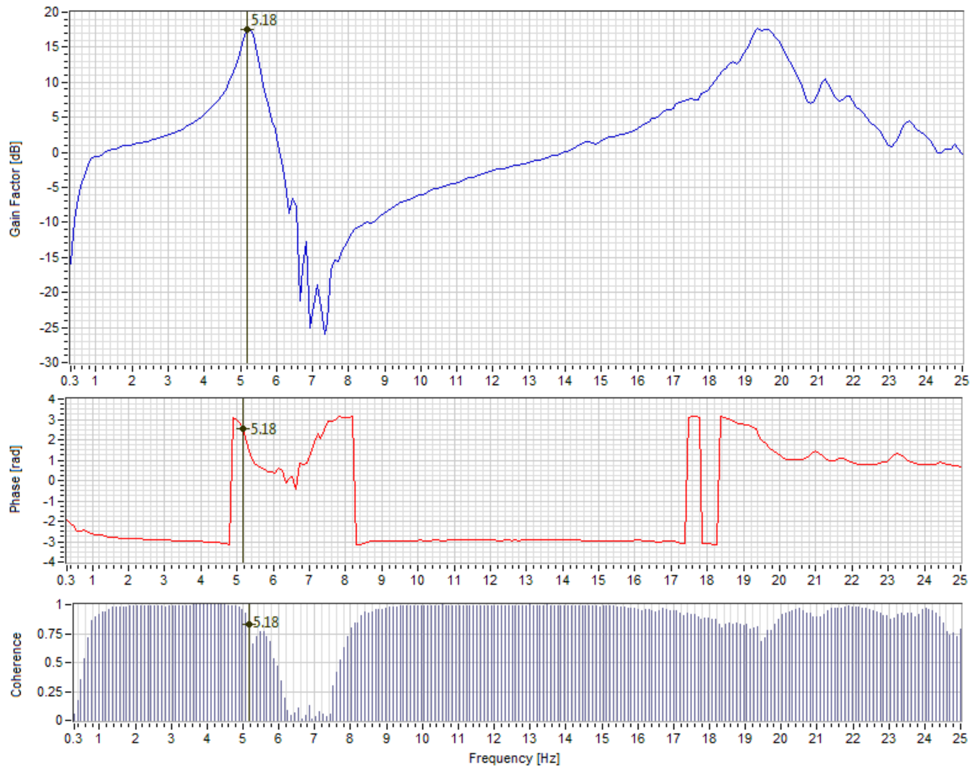


Figure AII. 41: Frequency response function, phase and coherence (Cat05): ACC MESA LONG; ACC_L1_A1_X_SE_L

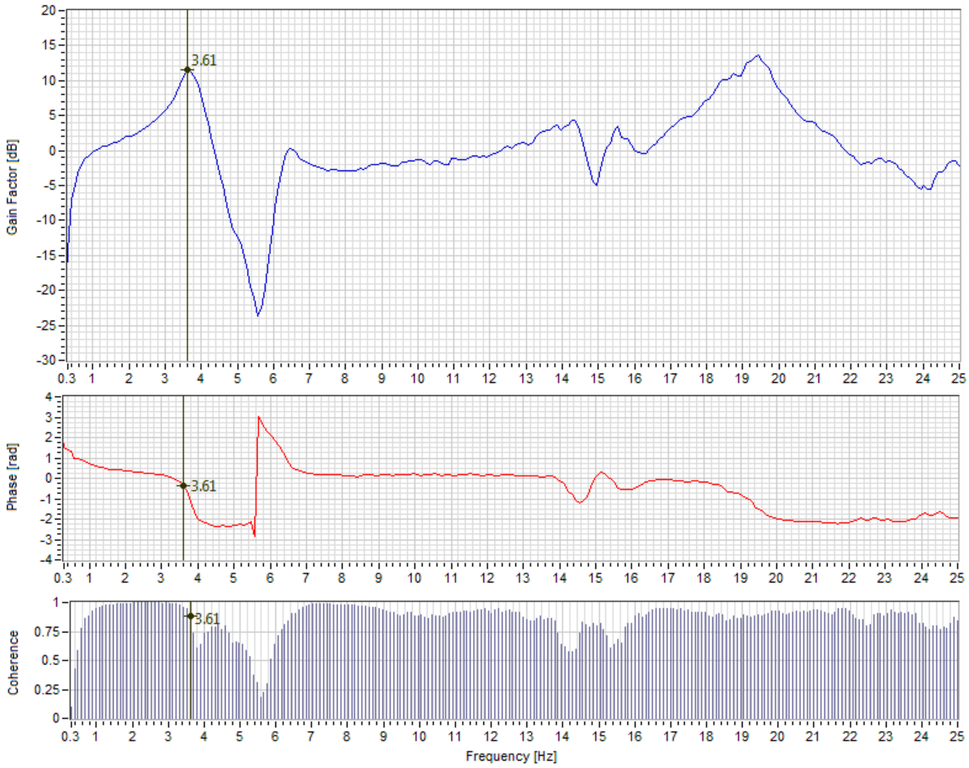


Figure AII. 42: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_L1_C1_Y_NE_T

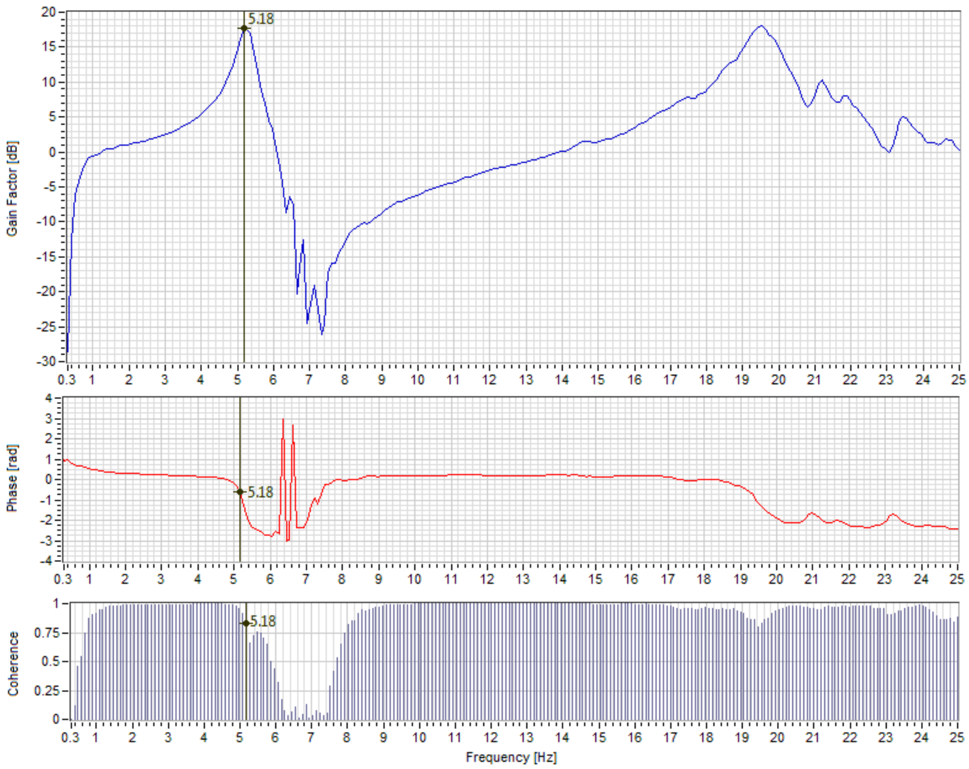


Figure AII. 43: Frequency response function, phase and coherence (Cat05): ACC MESA LONG; ACC_L1_C1_X_NE_L

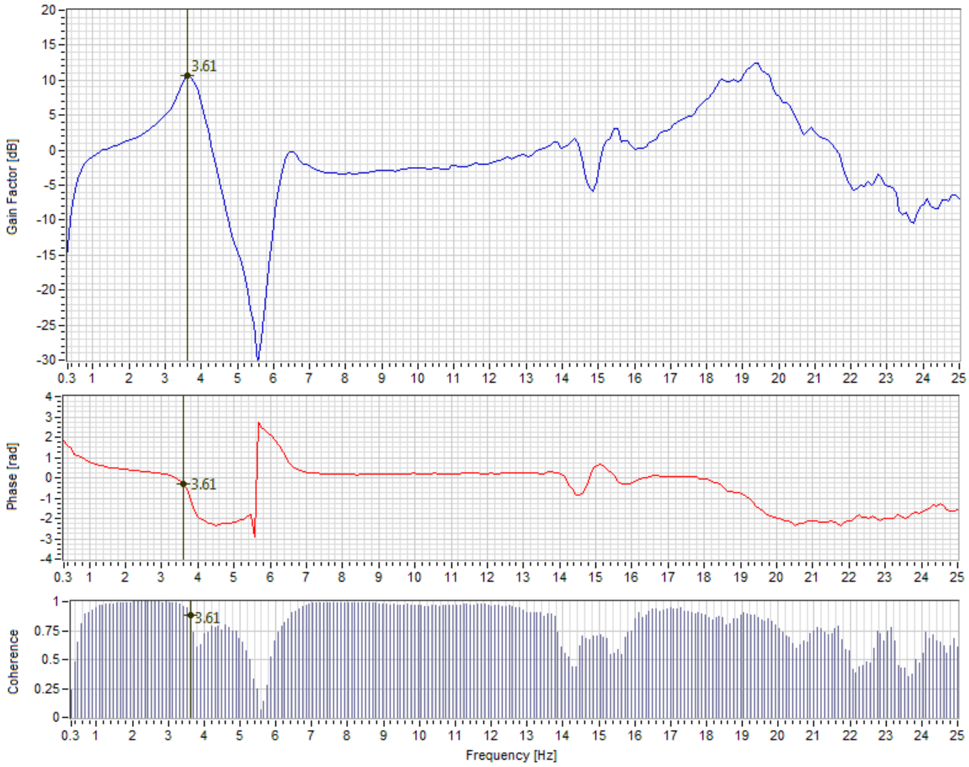


Figure AII. 44: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_L1_C2_Y_N_T

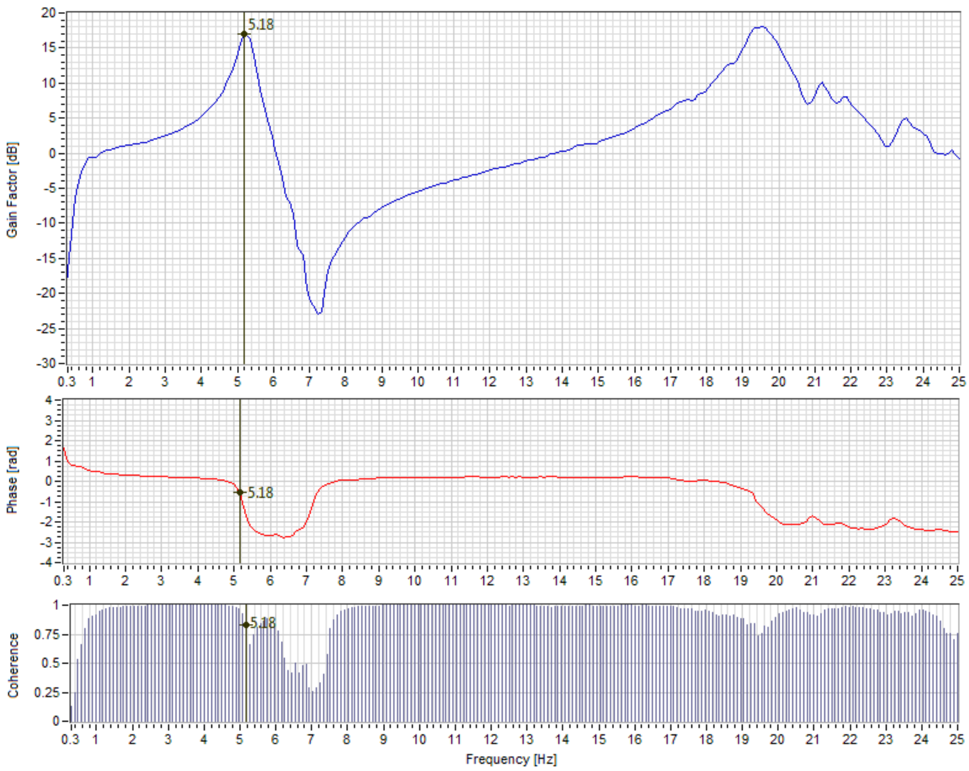


Figure AII. 45: Frequency response function, phase and coherence (Cat05): ACC MESA LONG; ACC_L1_C2_X_N_L

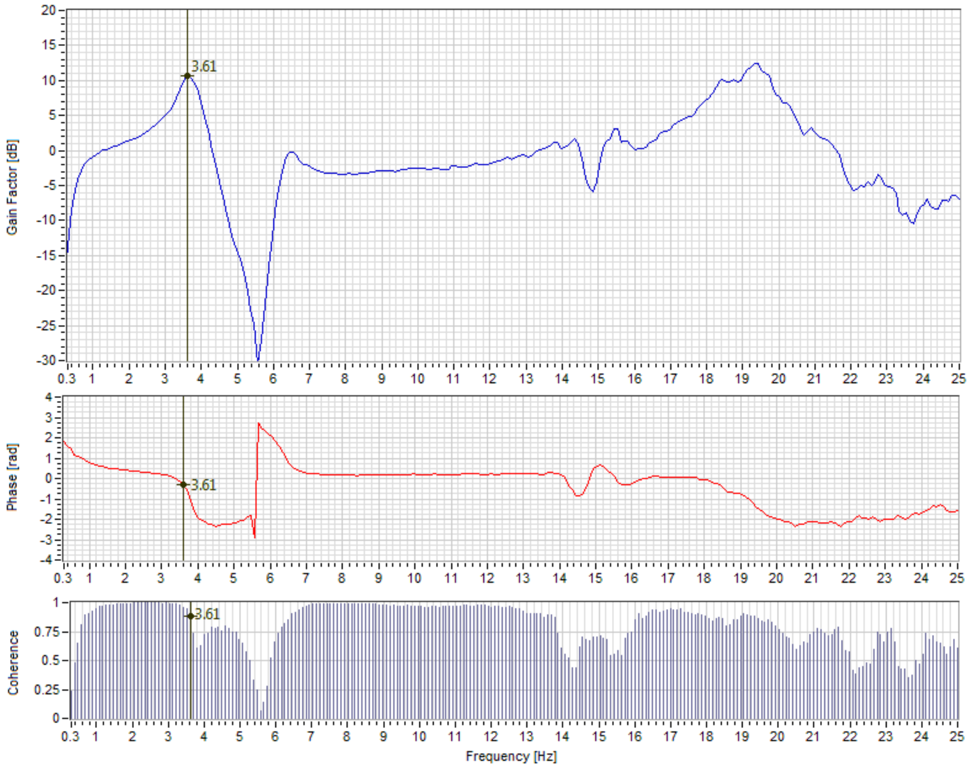


Figure AII. 46: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_L1_C3_Y_NW_T

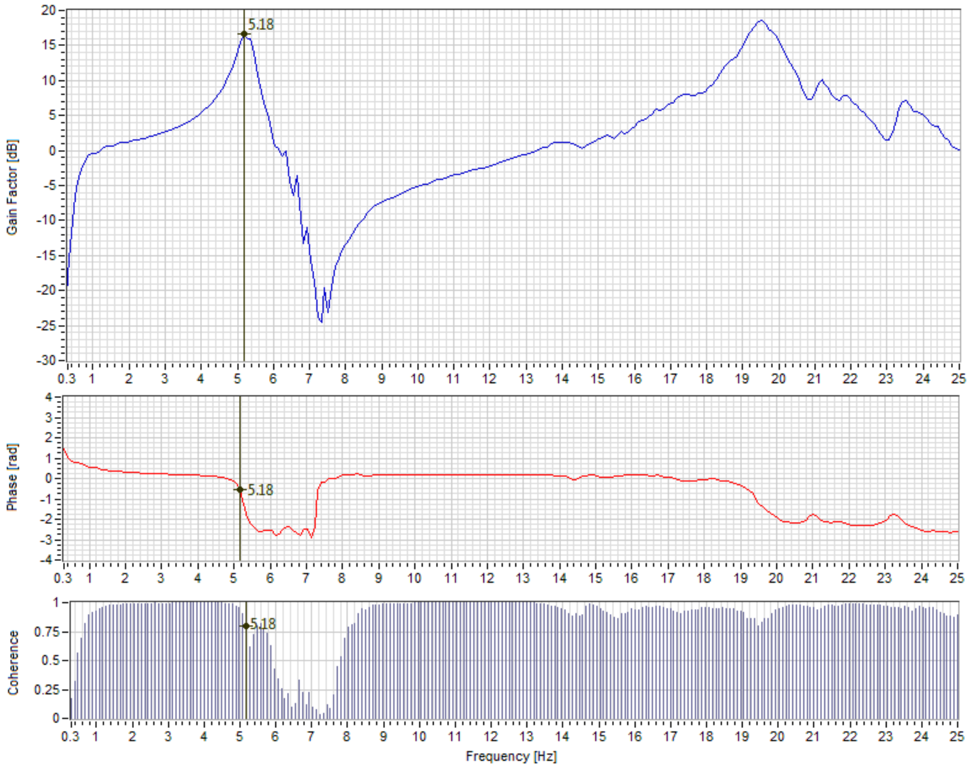


Figure AII. 47: Frequency response function, phase and coherence (Cat05): ACC MESA LONG; ACC_L1_C3_X_NW_L

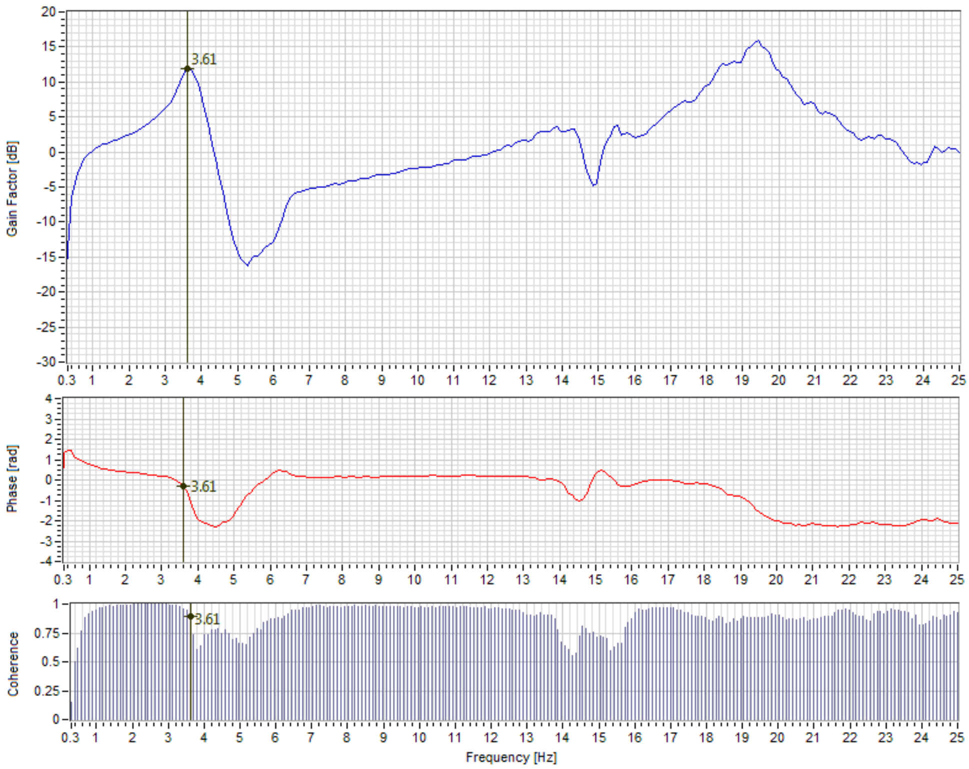


Figure AII. 48: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_L1_B3_Y_W_T

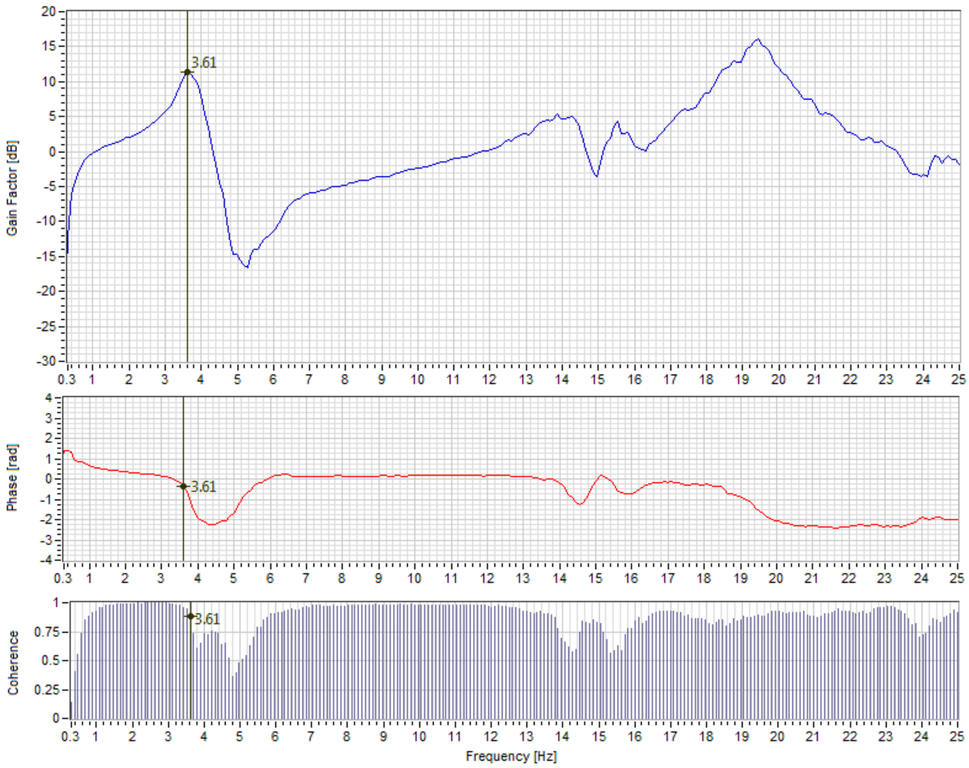


Figure AII. 49: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_L1_B2_Y_I_T

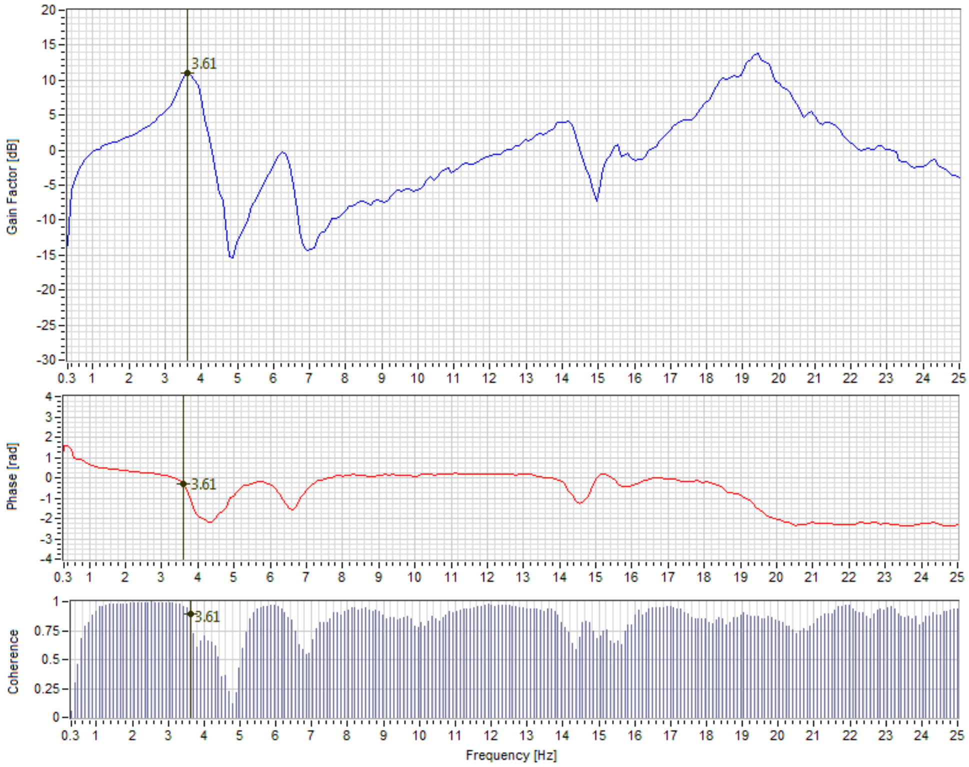


Figure AII. 50: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_L1_A3_Y_SW_T

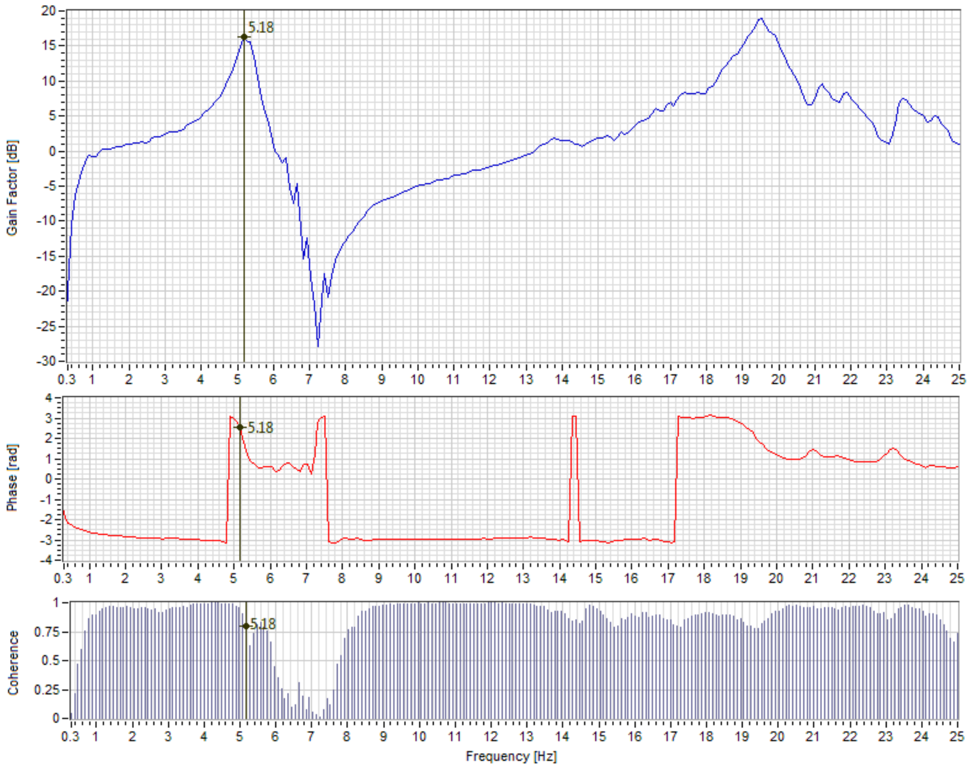


Figure AII. 51: Frequency response function, phase and coherence (Cat05): ACC MESA LONG; ACC_L1_A3_X_SW_L

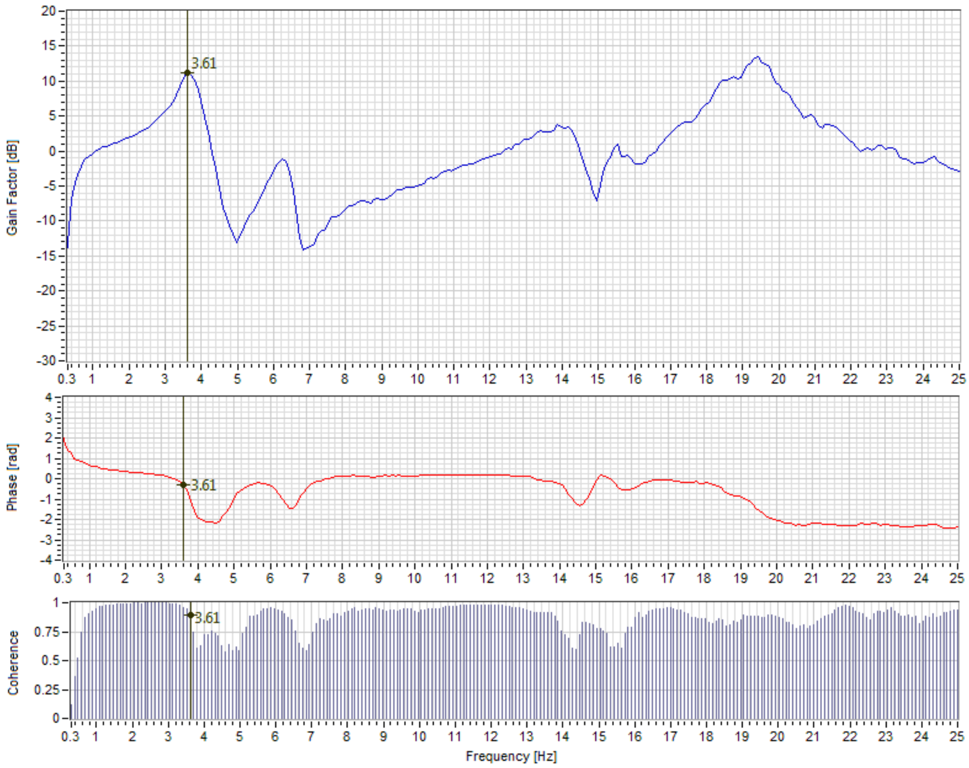


Figure AII. 52: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_L1_A2_Y_S_T

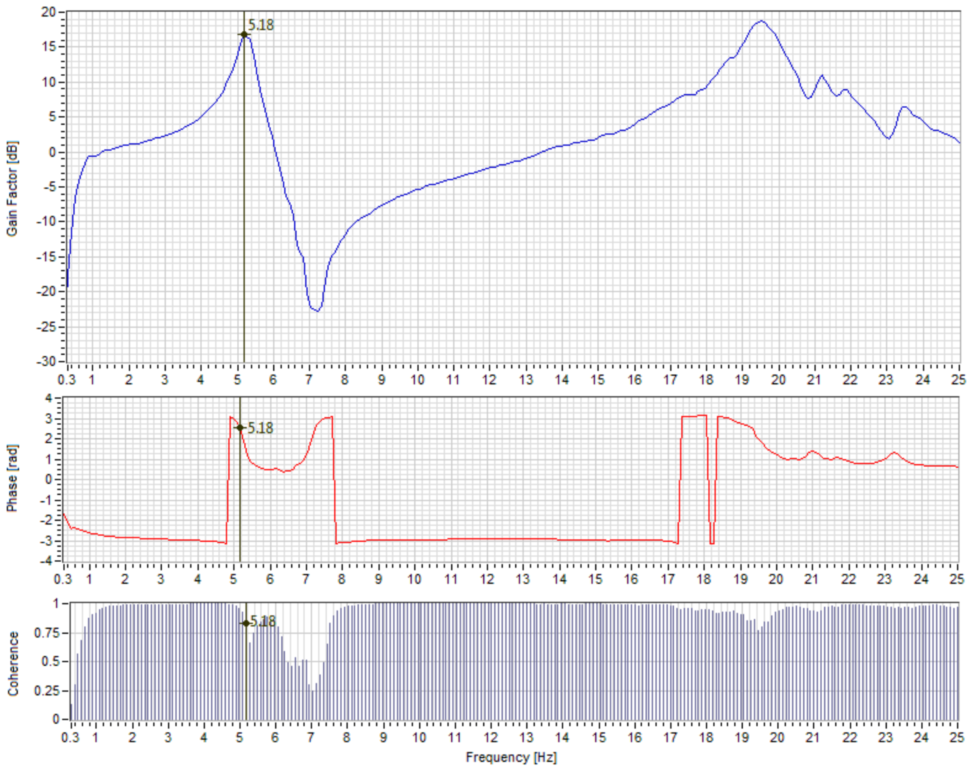


Figure AII. 53: Frequency response function, phase and coherence (Cat05): ACC MESA LONG; ACC_L1_A2_X_S_L

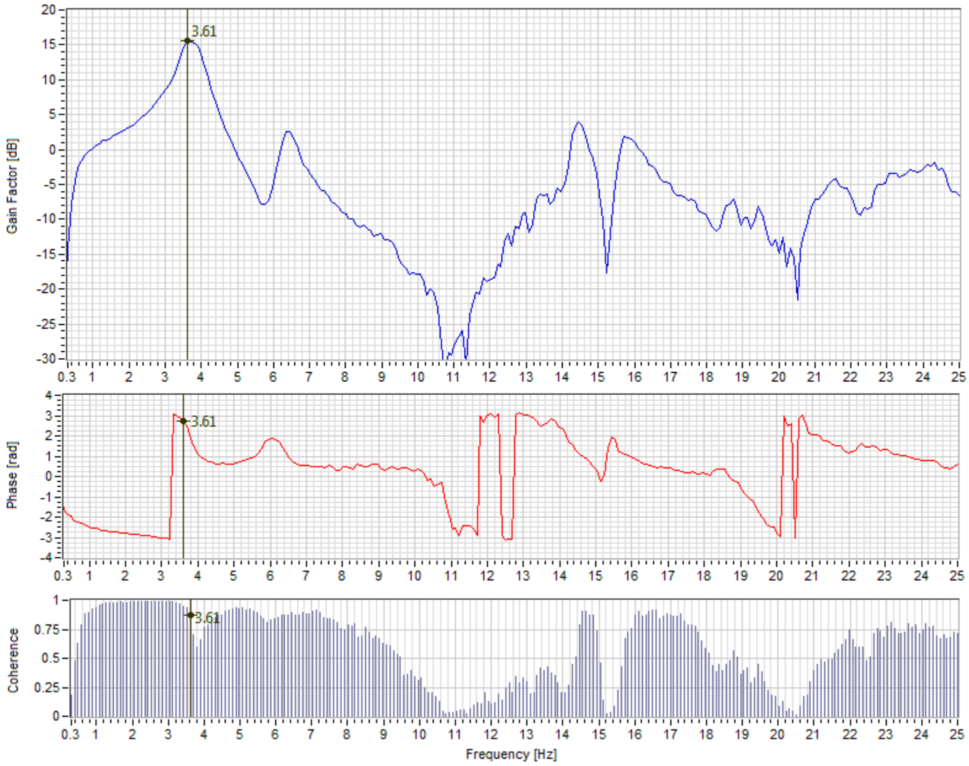


Figure AII. 54: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_L2_A1_Y_SE_T

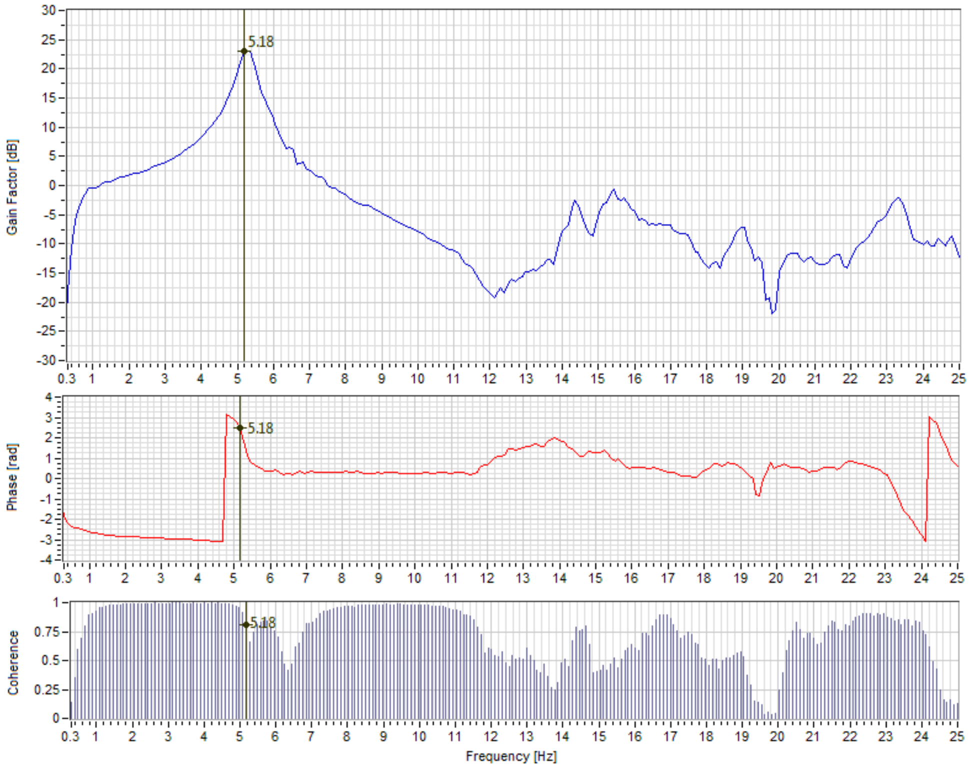


Figure AII. 55: Frequency response function, phase and coherence (Cat05): ACC MESA LONG; ACC_L2_A1_X_SE_L

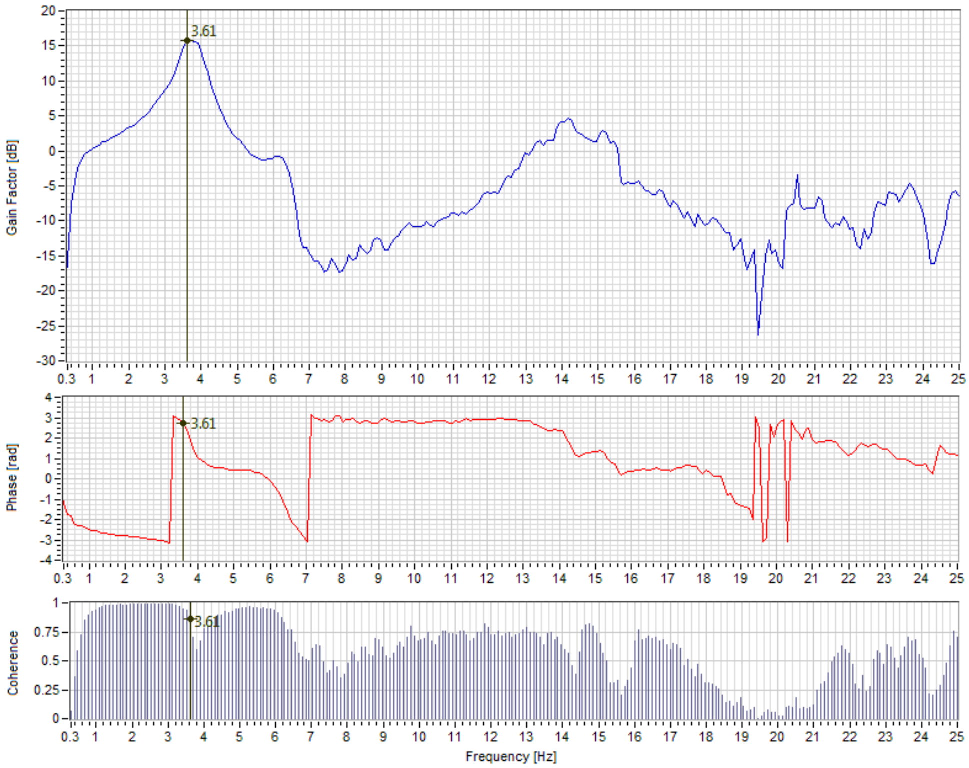


Figure AII. 56: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_L2_C1_Y_NE_T

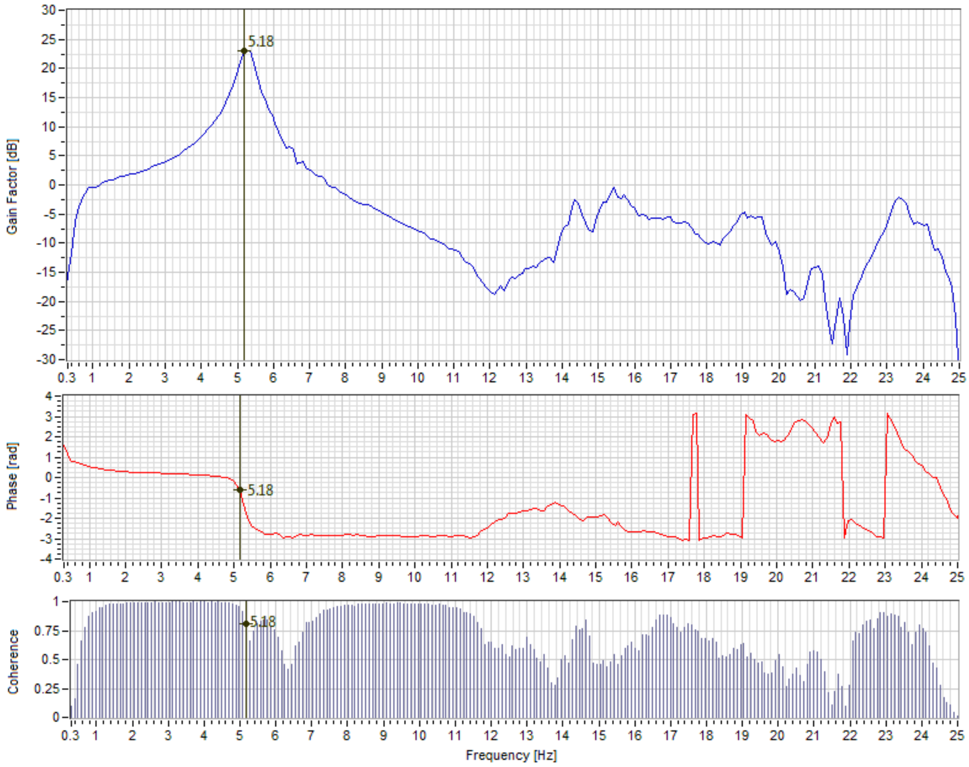


Figure AII. 57: Frequency response function, phase and coherence (Cat05): ACC MESA LONG; ACC_L2_C1_X_NE_L

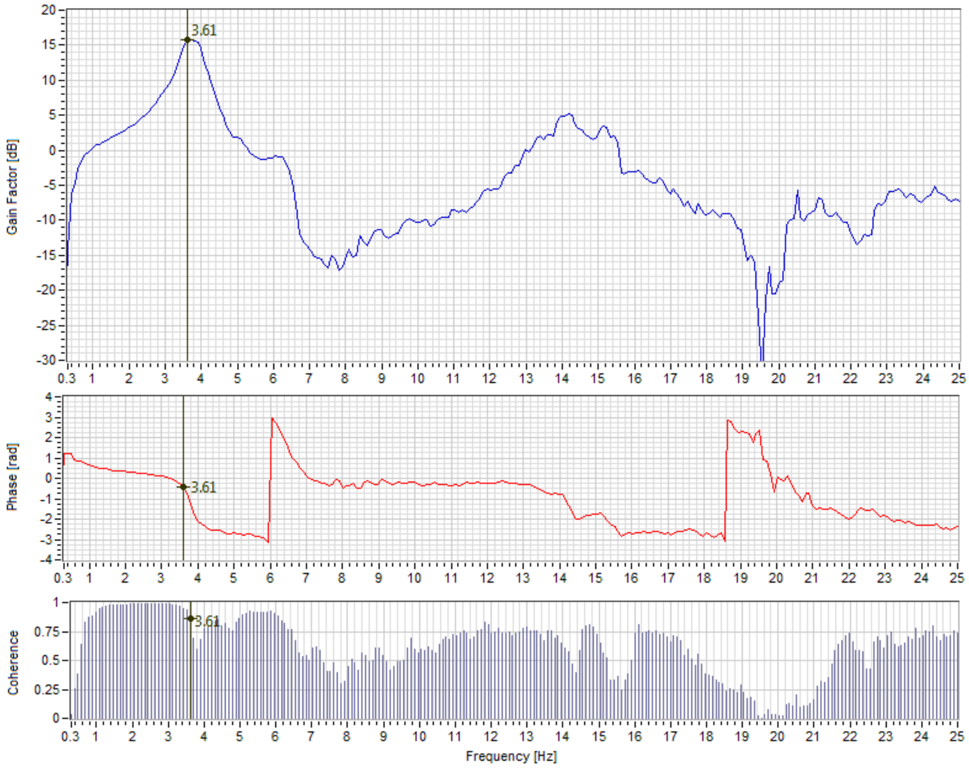


Figure AII. 58: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_L2_C2_Y_N_T

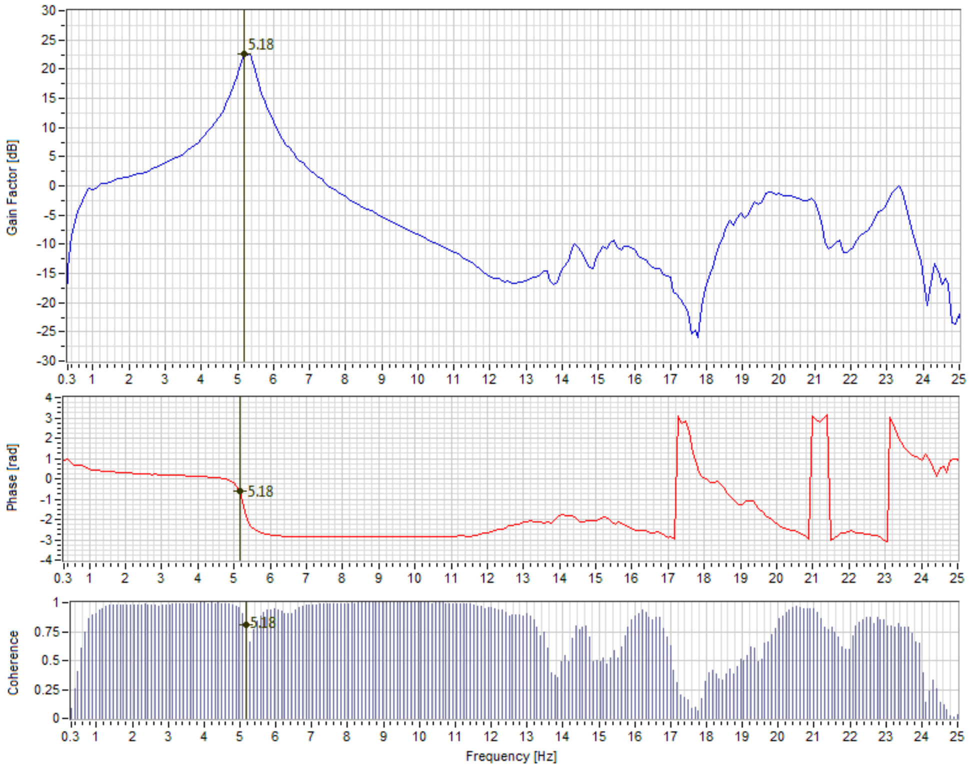


Figure AII. 59: Frequency response function, phase and coherence (Cat05): ACC MESA LONG; ACC_L2_C2_X_N_L

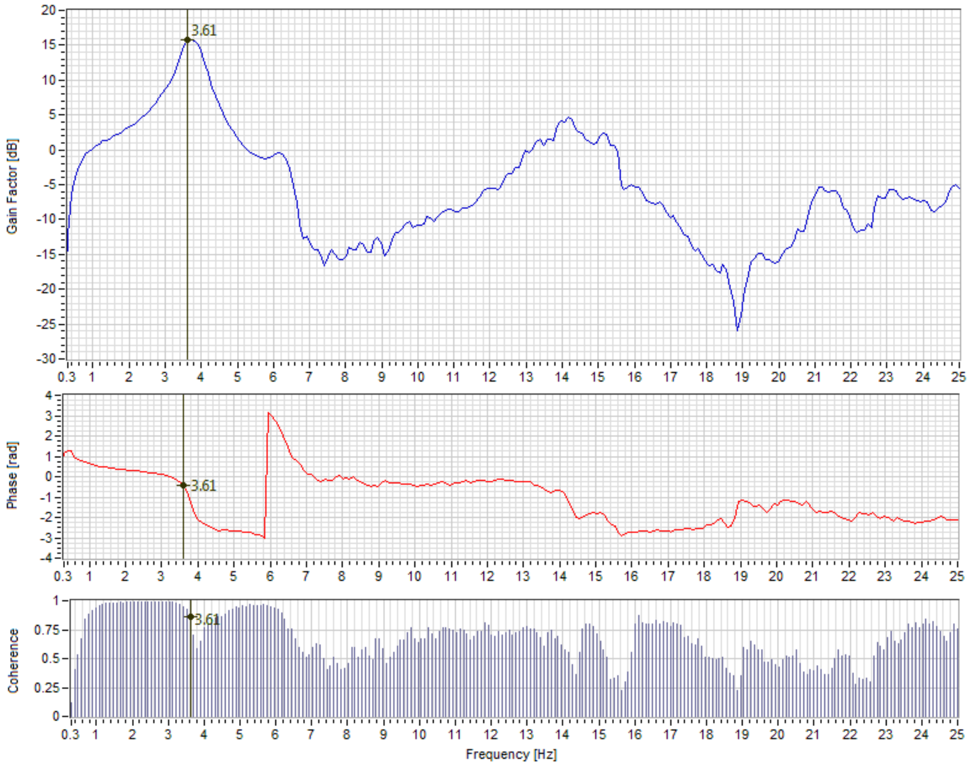


Figure AII. 60: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_L2_C3_Y_NW_T

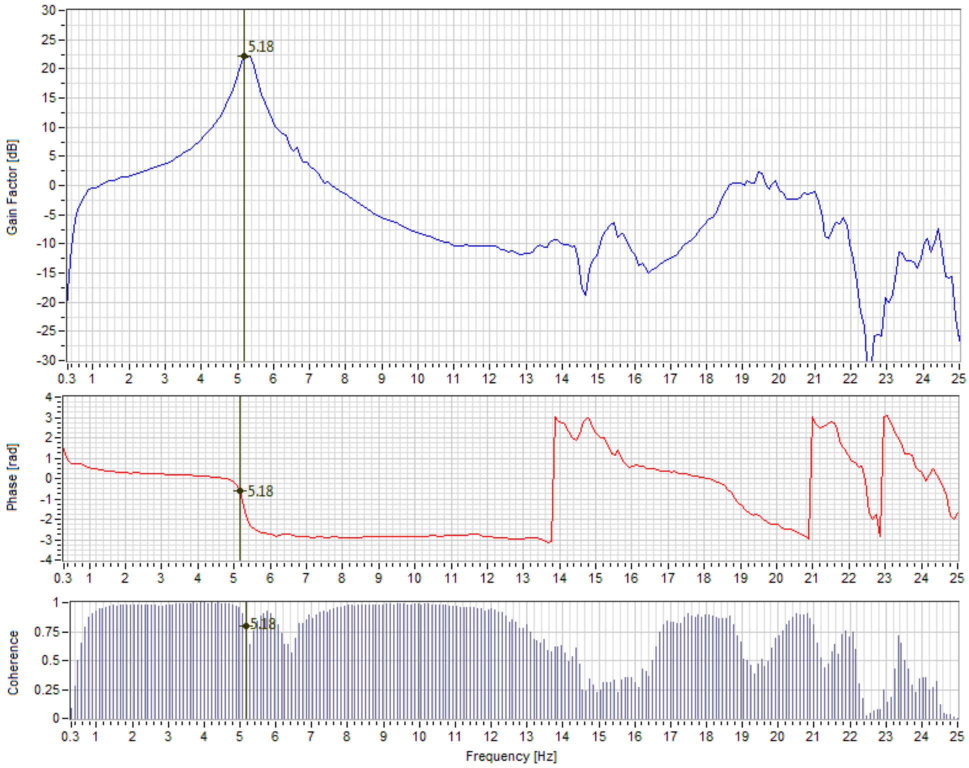


Figure AII. 61: Frequency response function, phase and coherence (Cat05): ACC MESA LONG; ACC_L2_C3_X_NW_L

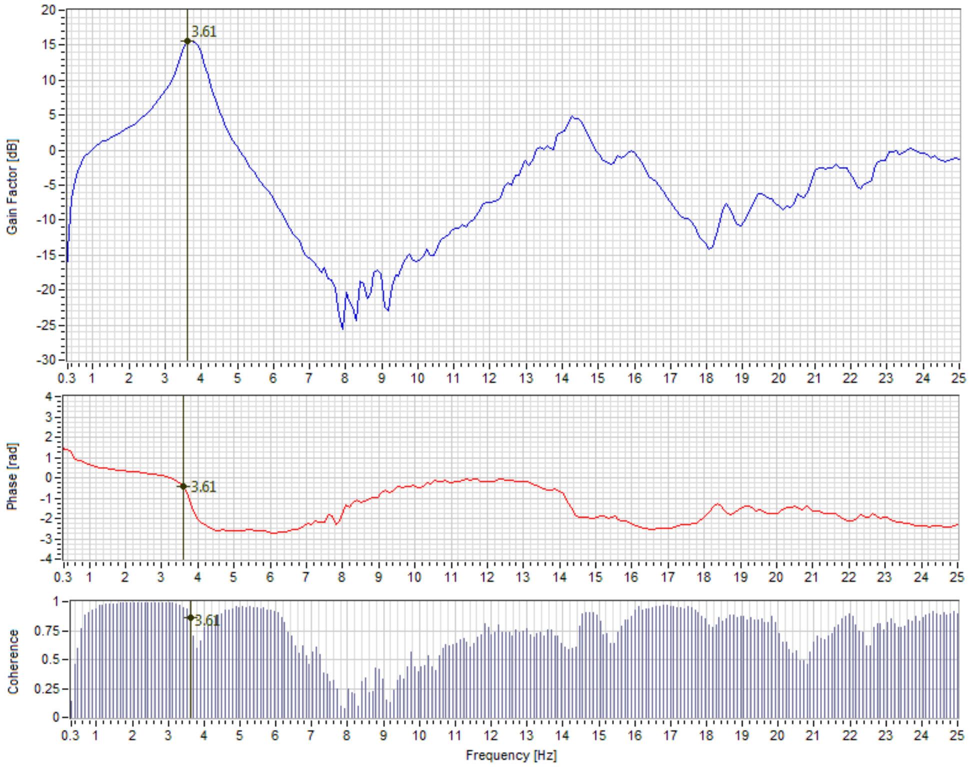


Figure AII. 62: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_L2_B3_Y_W_T

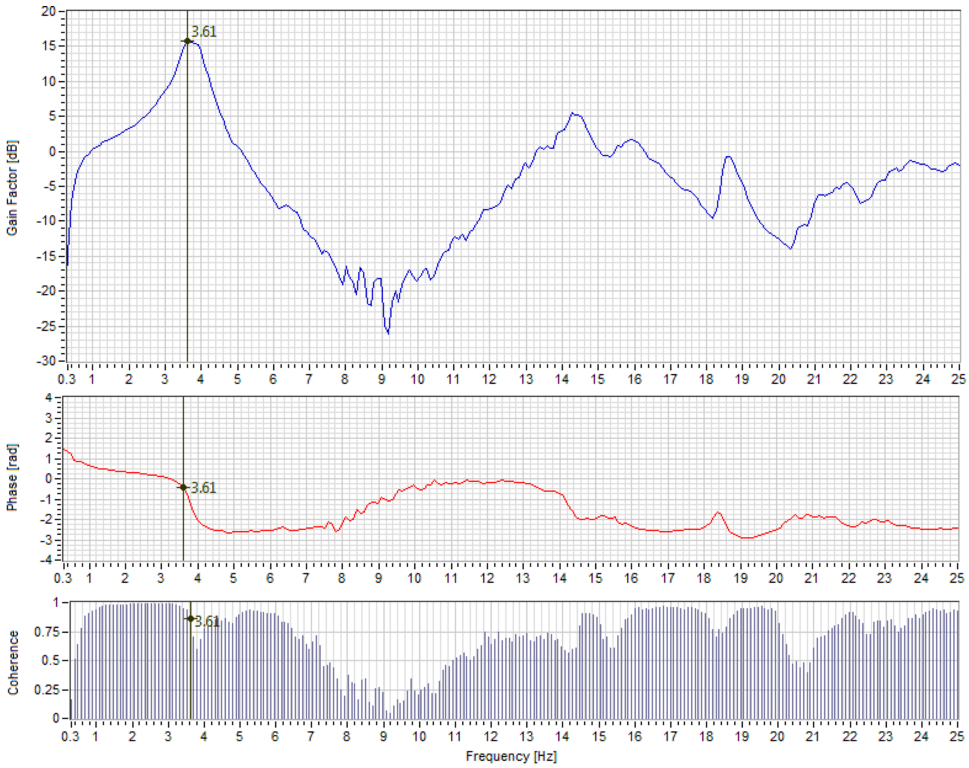


Figure AII. 63: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_L2_B2_Y_I_T

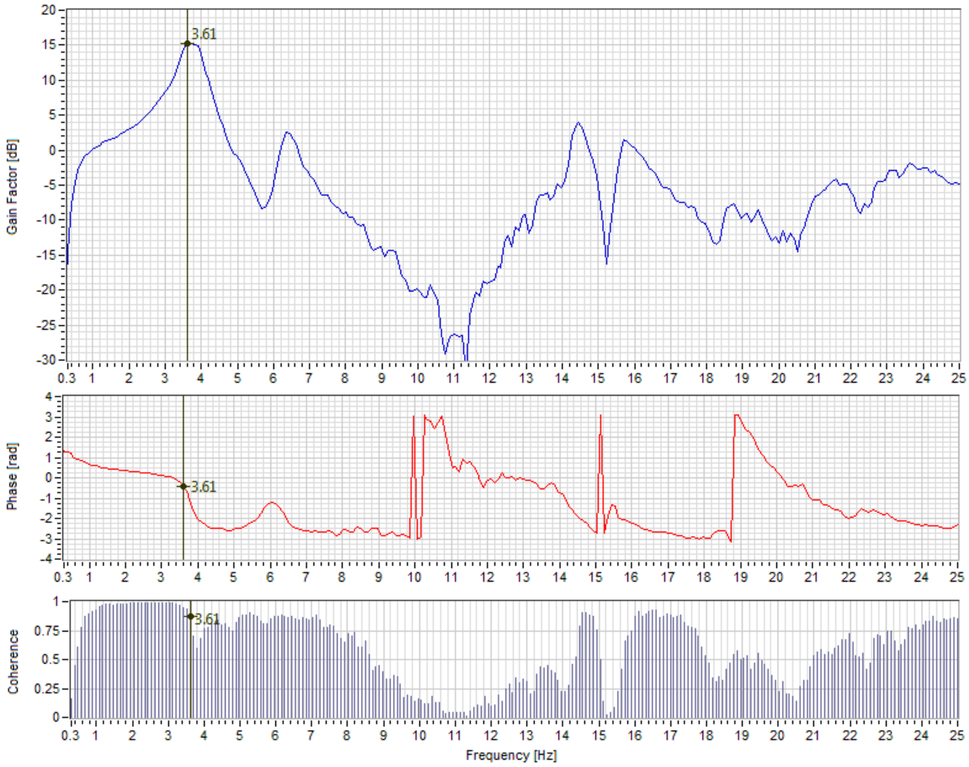


Figure AII. 64: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_L2_A3_Y_SW_T

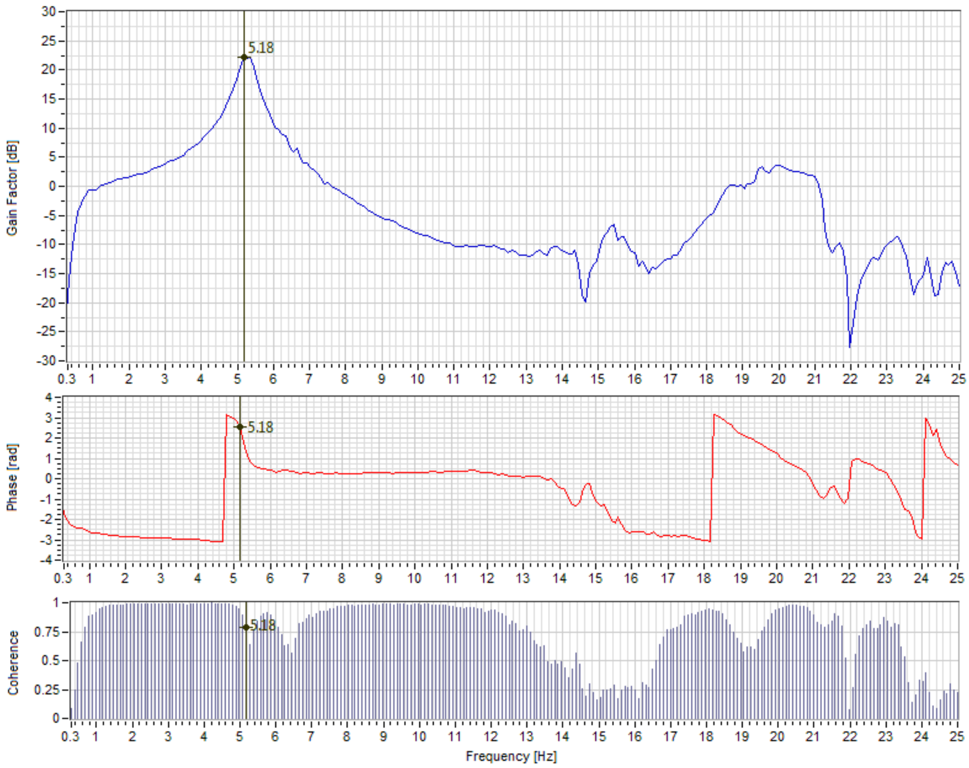


Figure AII. 65: Frequency response function, phase and coherence (Cat05): ACC MESA LONG; ACC_L2_A3_X_SW_L

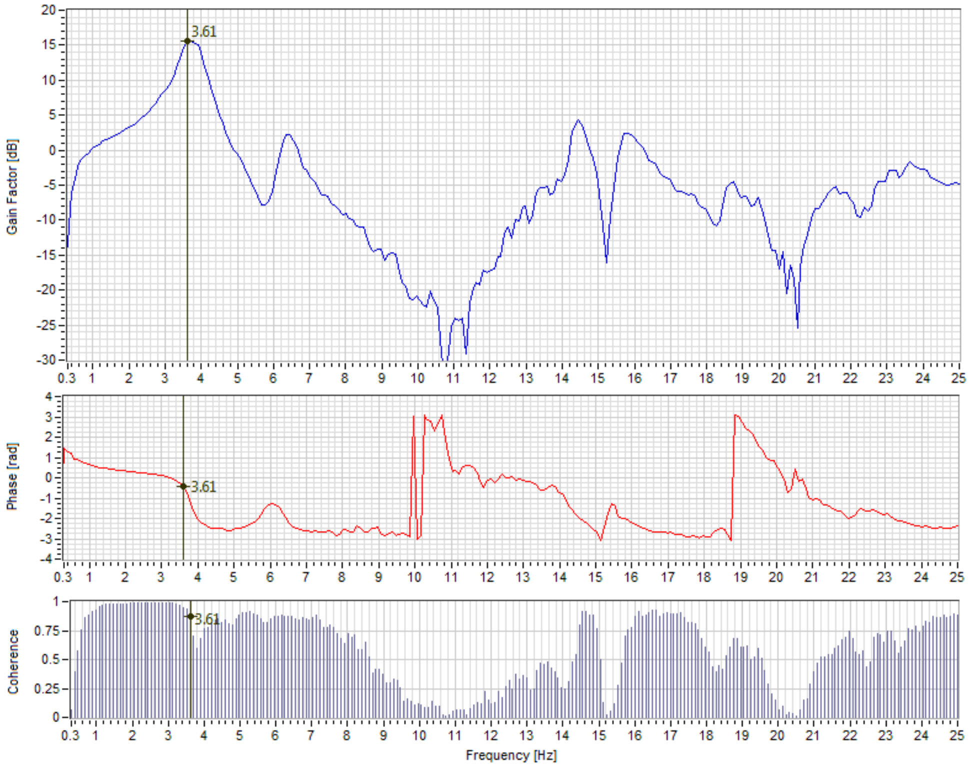


Figure AII. 66: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_L2_A2_Y_S_T

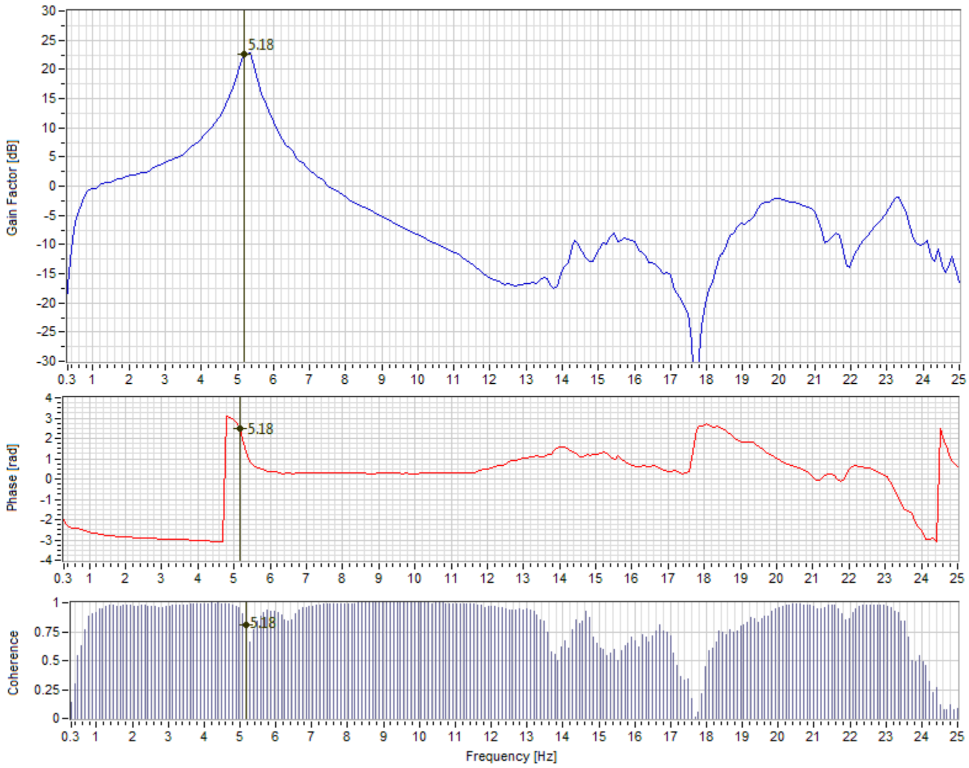


Figure AII. 67: Frequency response function, phase and coherence (Cat05): ACC MESA LONG; ACC_L2_A2_X_S_L

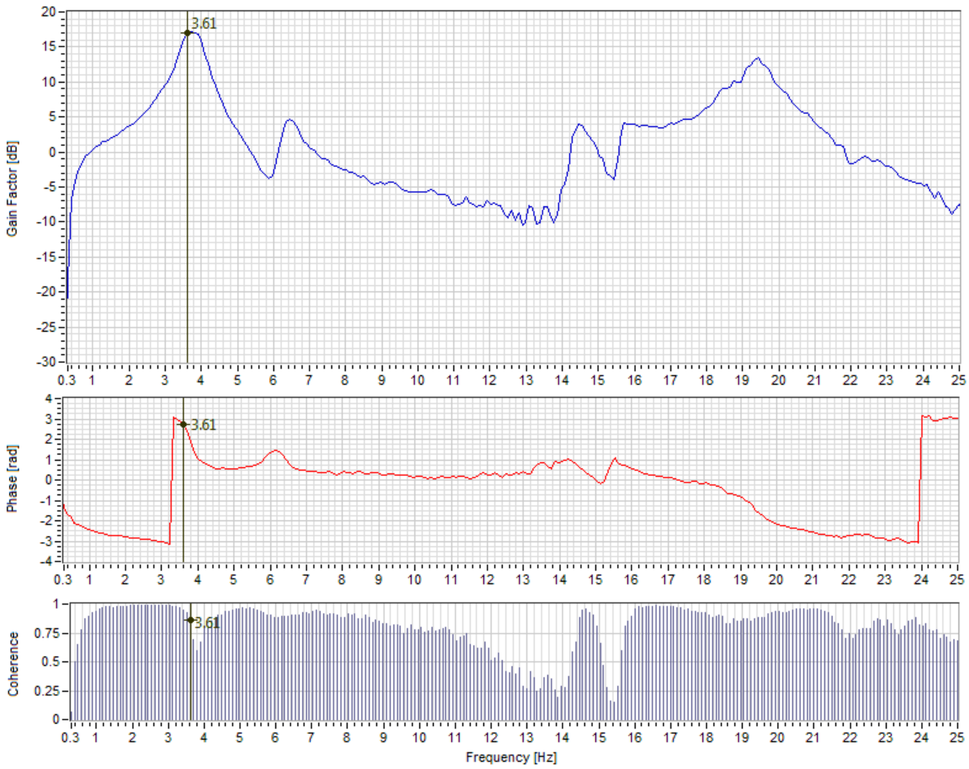


Figure AII. 68: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_RL_A1_Y_SE_T

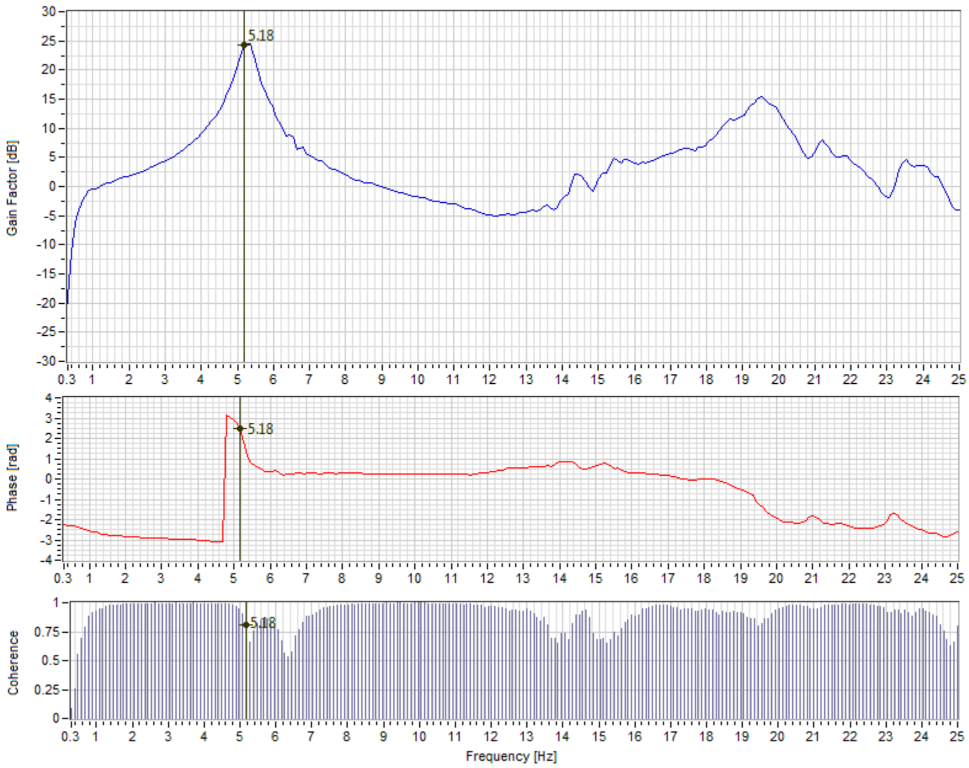


Figure AII. 69: Frequency response function, phase and coherence (Cat05): ACC MESA LONG; ACC_RL_A1_X_SE_L

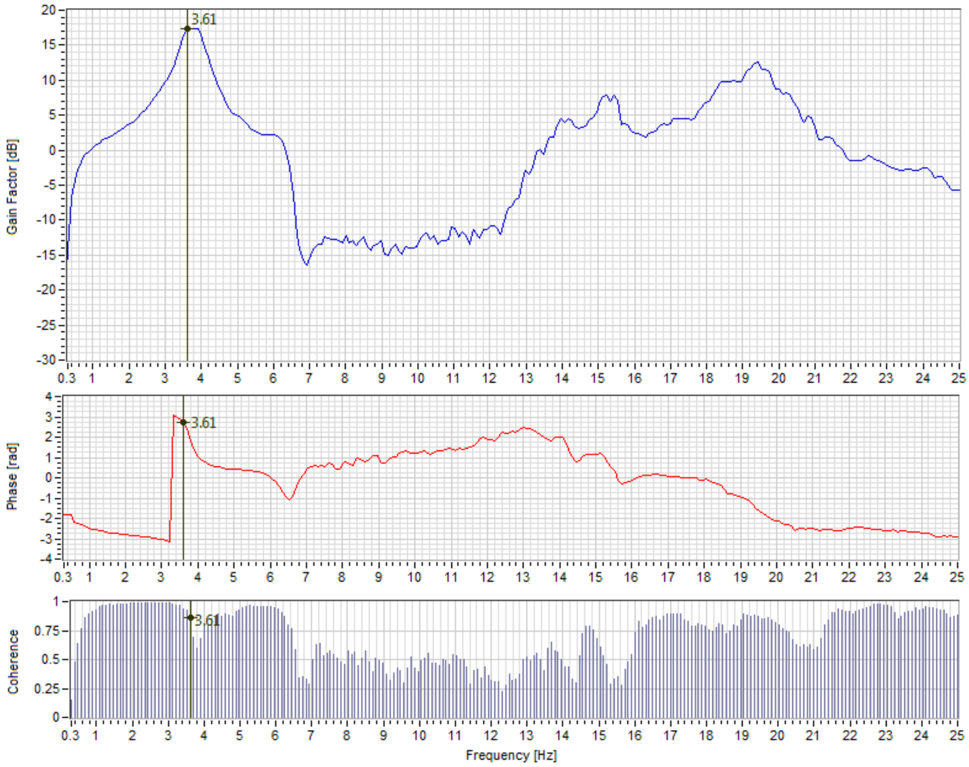


Figure AII. 70: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_RL_C1_Y_NE_T

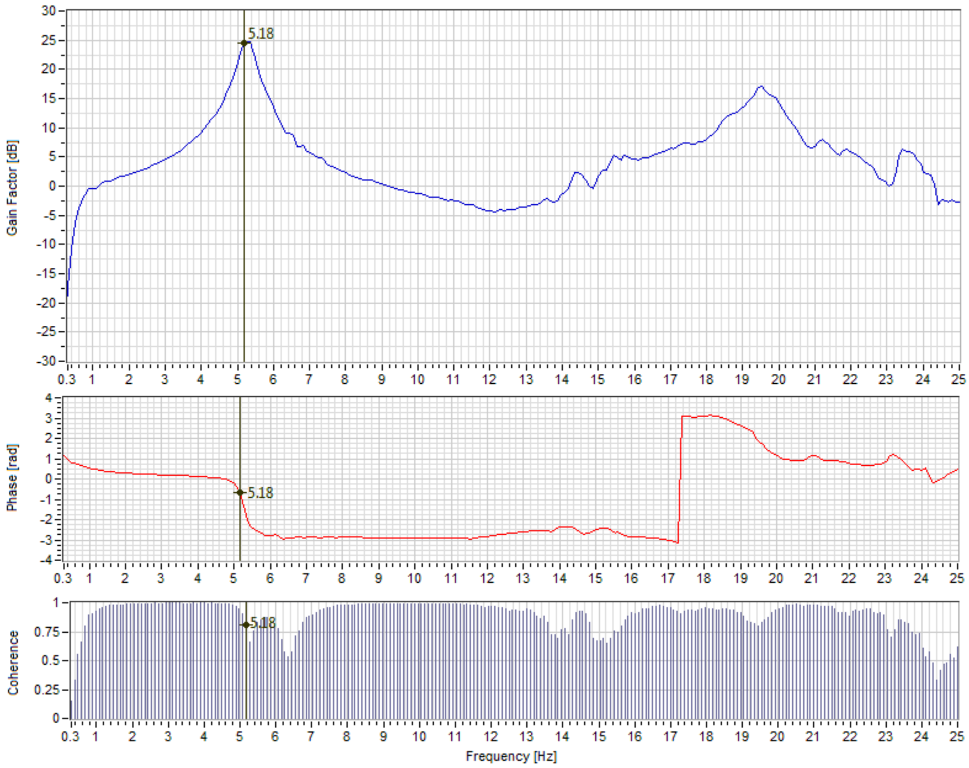


Figure AII. 71: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_RL_C1_X_NE_L

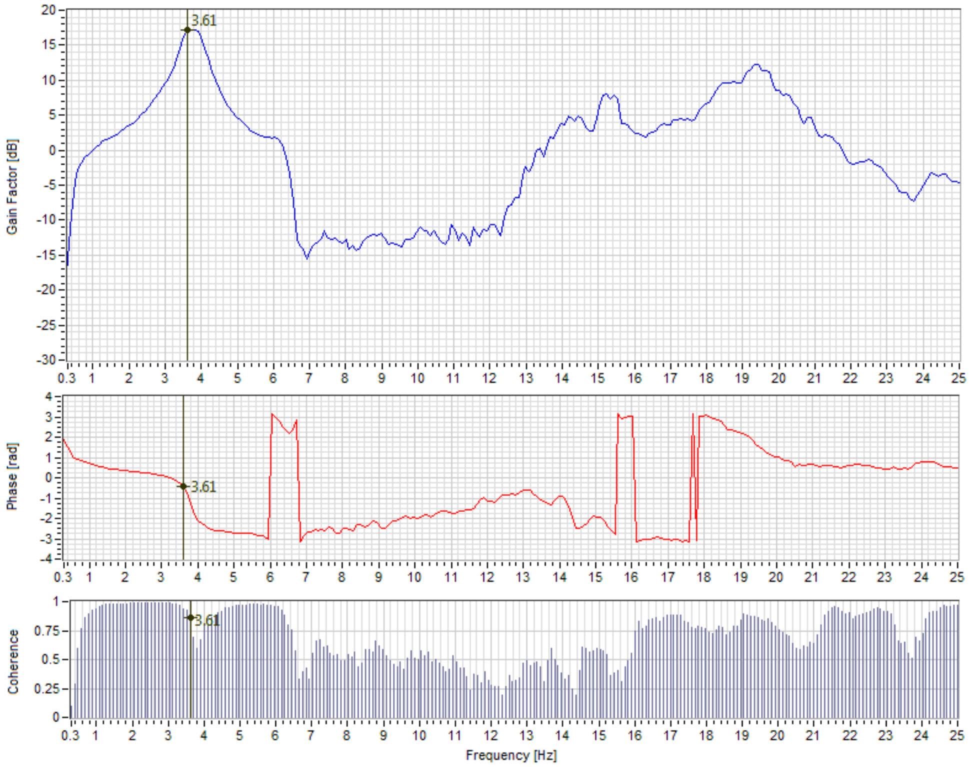


Figure AII. 72: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_RL_C3_Y_NW_T

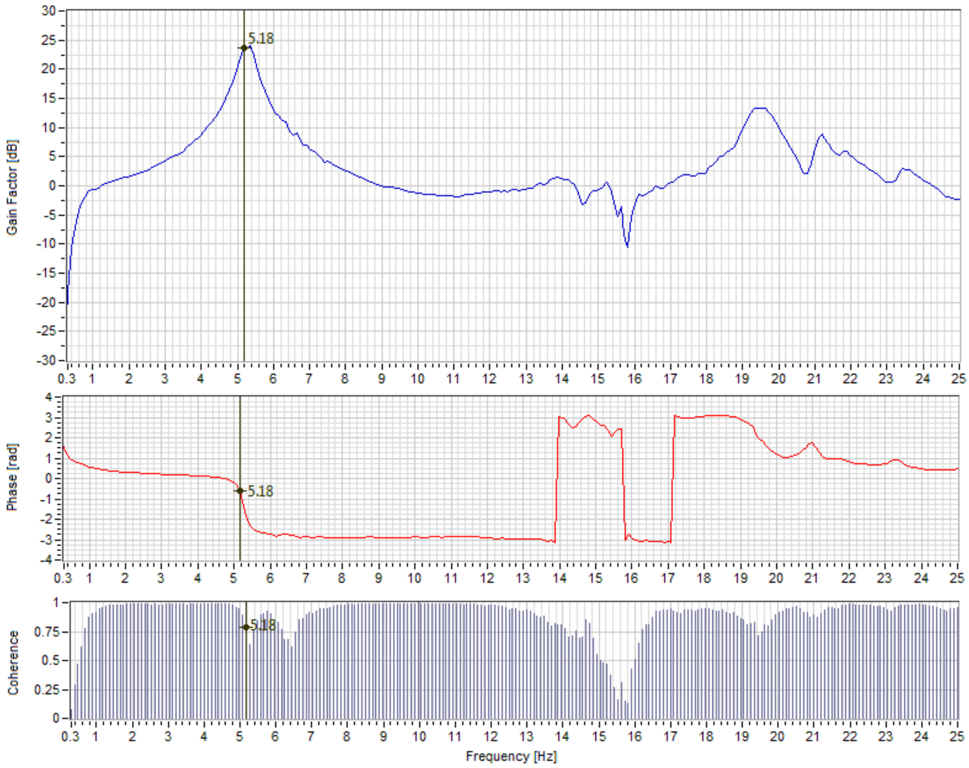


Figure AII. 73: Frequency response function, phase and coherence (Cat05): ACC MESA LONG; ACC_RL_C3_X_NW_L

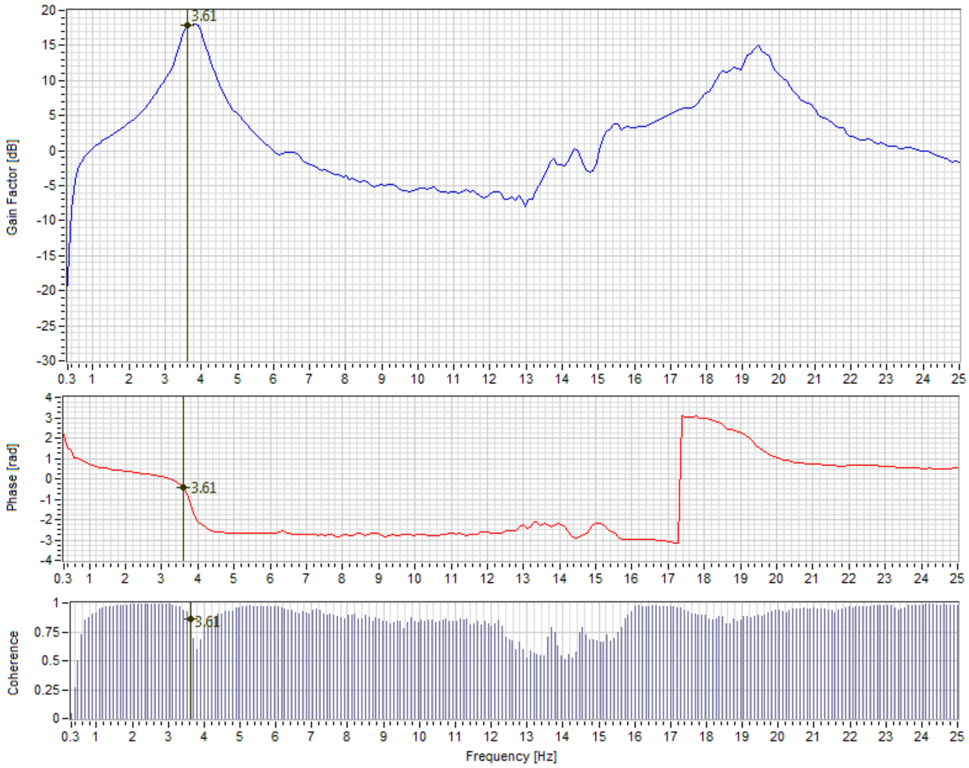


Figure AII. 74: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_RL_B3_Y_W_T

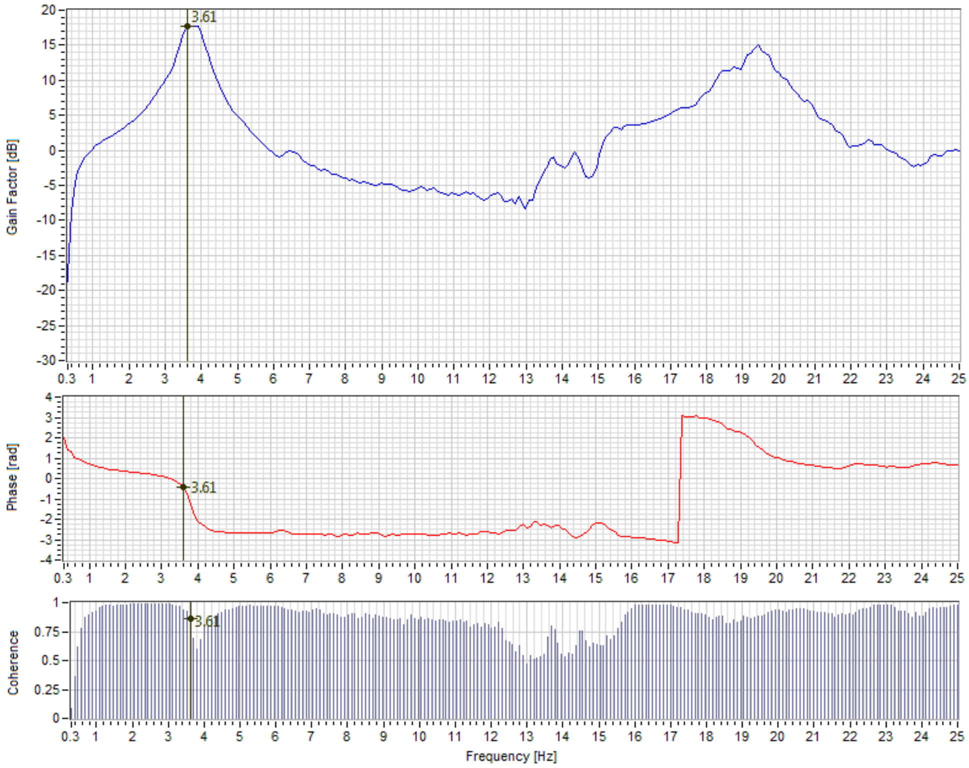


Figure AII. 75: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_RL_B2_Y_I_T

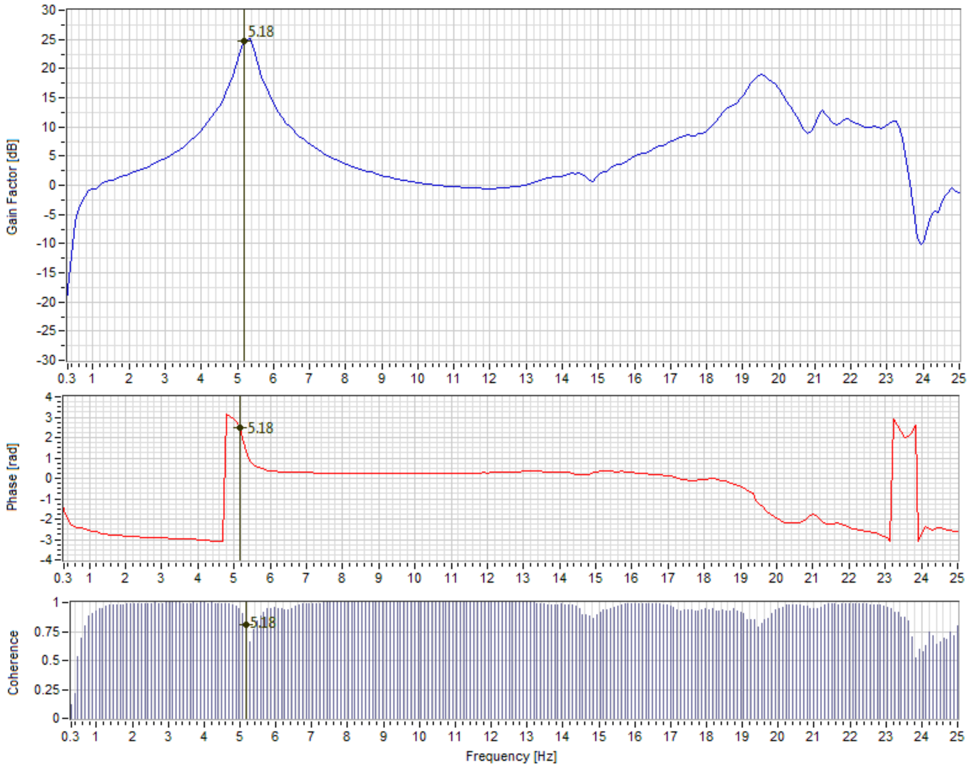


Figure AII. 76: Frequency response function, phase and coherence (Cat05): ACC MESA LONG; ACC_RL_B2_X_I_L

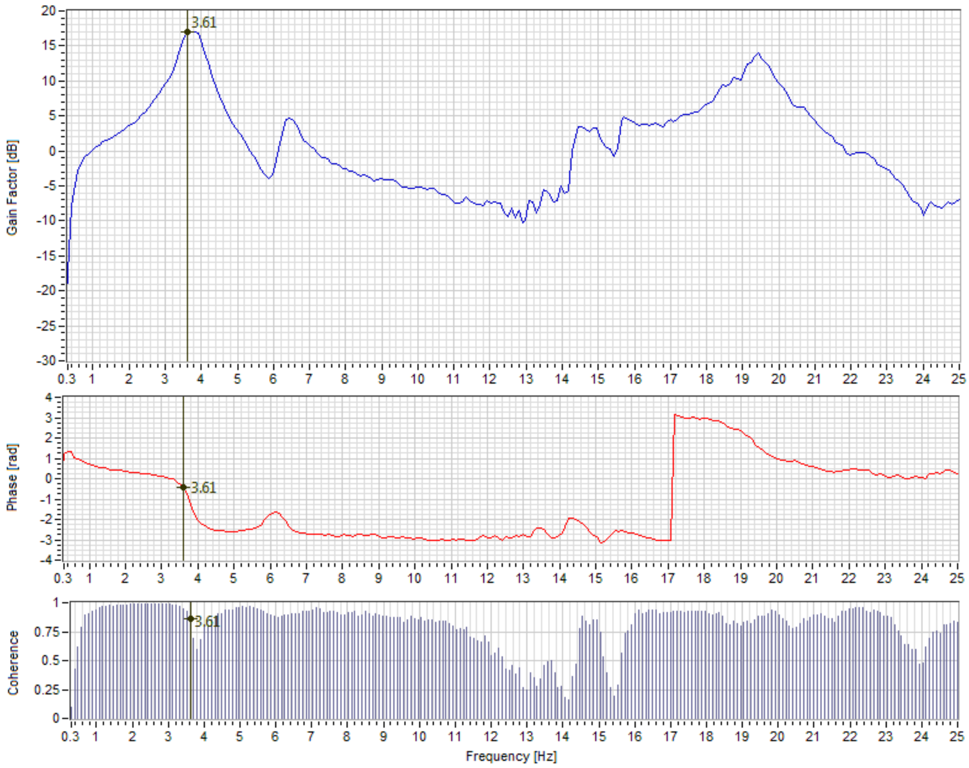


Figure AII. 77: Frequency response function, phase and coherence (Cat05): ACC MESA TRANS; ACC_RL_A3_Y_SW_T

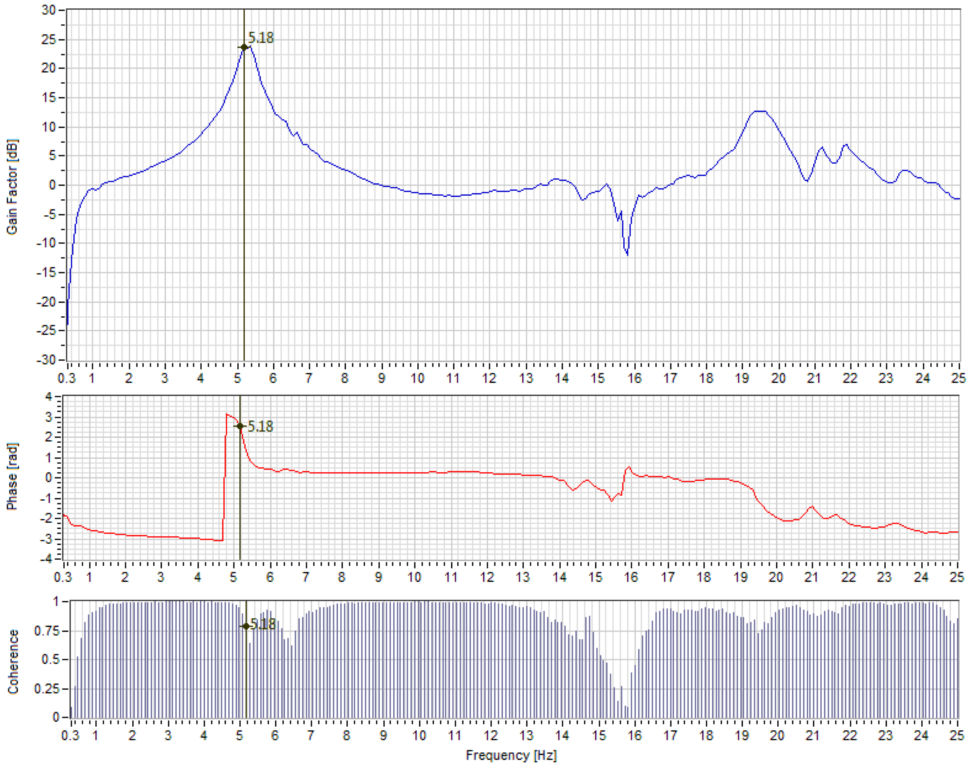


Figure AII. 78: Frequency response function, phase and coherence (Cat05): ACC MESA LONG; ACC_RL_A3_X_SW_L