AN ABSTRACT OF THE THESIS OF

Kevin Bradish DelGrande White for the degree of Master of Science in Civil Engineering and Wood Science presented on March 25, 2005.

Title: The Performance of Wood Frame Shear Walls Under Earthquake Loads.

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The overall goal of this study is to evaluate the earthquake performance of wood frame shear walls, and more specifically: (1) to compare the performance differences of fully and partially anchored walls under monotonic, cyclic, and earthquake loads, (2) to compare wall performance under earthquake loads with that of standardized monotonic and cyclic loads, (3) to evaluate earthquake performance of walls with respect to code measures, (4) to attain insight into the earthquake performance of walls carrying vertical load, and to compare this performance with that of walls without vertical load, and (5) to get a preliminary understanding of the performance of walls subjected to a sequence of earthquakes, and to compare this performance with that of walls subjected to a single earthquake.

Earthquake tests were conducted on 2440x2440 mm walls with 38x89 mm Douglas-fir studs 610 mm on center. Two 1220x2440x11.1 mm oriented strand board (OSB) panels were installed and fastened vertically to the frame with 8d nails (2.87x60.33 mm) 152 mm and 305 mm on center along panel edges and intermediate studs, respectively. Two 12.7 mm gypsum wallboard (GWB) panels were installed vertically on the face opposite the OSB. Partially anchored walls had two 12.7 mm A307 anchor bolts installed 305 mm inward on the sill plate from each end of the wall. In addition to these anchor bolts, fully anchored walls included hold-downs installed at the end studs of the wall and were attached to the foundation with 15.9 mm Grade 5 anchor bolts. Four historical ground motion time histories were used for earthquake tests, three of these were subduction zone ground motions, and the fourth had a strike-slip fault mechanism. Ground motions were scaled to the 10% in 50 year probability of exceedance design level for the Seattle, WA area, with a 4545 kg seismic mass. Thirty-four earthquake tests were conducted and split evenly between fully and partially anchored walls. Monotonic and cyclic tests were conducted in Phase I of this project by Seaders (2004).

For fully anchored walls, and with respect to monotonic and cyclic tests, subduction zone earthquake tests had capacities (P_{max}), energy dissipation (E) levels, and failure modes most similar to cyclic tests. Walls tested using the monotonic and cyclic protocols provided an upper limit to those tested with earthquake loads with respect to initial stiffness (k_e) and ductility (μ).

The wall displacement at maximum load (Δ_{max}) from earthquake tests was underestimated by cyclic tests and overestimated by monotonic tests. The cumulative (or total) drifts ($\Delta_{cumulative}$) of fully and partially anchored walls during a design level earthquake are likely to be similar, and the peak drift (Δ_{peak}) performance of these walls is likely to be similar during design level earthquakes that result in high energy demands or total wall drift.

For partially anchored walls, and with respect to monotonic and cyclic tests, subduction zone and strike-slip earthquake tests had P_{max}, Δ_{max}, k_e, and μ most similar to cyclic tests. Energy dissipation levels were most similar to monotonic tests and wall failure modes were consistent with monotonic and cyclic tests. For most parameters, statistically significant differences were not found when comparing wall performance from SE19 earthquake tests with that from monotonic and cyclic tests. Subduction zone earthquake tests did not satisfy the FEMA 356 collapse prevention drift limit requirements. Partially anchored walls had lower P_{max}, Δ_{max}, E, and k_e compared with fully anchored walls; however vertical load caused the performance of partially anchored walls to begin to converge with fully anchored walls.

The results of preliminary tests for fully and partially anchored walls subjected to a sequence of earthquake loads show that wall performance was about the same or better than the performance under a single earthquake loading, depending on the performance measure. This indicates that the first test of the earthquake sequence caused negligible damage to walls.

Overall, the results from this study suggest that cyclic tests, rather than monotonic tests, may provide the most conservative measure for some characteristics of wall performance under design earthquake loads. It is recommended that additional earthquake tests be conducted to determine if design values should be based on cyclic tests.

The Performance of Wood Frame Shear Walls Under Earthquake Loads

by

Kevin Bradish DelGrande White

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THE PERFORMANCE OF WOOD FRAME SHEAR WALLS UNDER EARTHQUAKE LOADS

CHAPTER 1. GENERAL INTRODUCTION

Wood-frame buildings have historically performed quite well during earthquakes. However, damage from natural disasters such as the 1994 Northridge earthquake was significant. In southern California the Northridge earthquake caused: (1) twenty-four fatalities in wood-frame buildings, (2) approximately $20 billion in property damage to wood-frame buildings, and (3) nearly 48,000 wood-frame housing units to be uninhabitable (Seible et al. 1999). The extensive damage from the Northridge earthquake raised questions concerning how to improve upon existing seismic provisions in building codes and how to retrofit existing structures to mitigate earthquake damage in the future (APA 1994).

Most commonly, building code earthquake provisions define three types of structural systems: (1) bearing wall systems, (2) building frame systems, and (3) moment-resisting frame systems. Bearing walls are generally located at the exterior and interior wall lines of buildings to support the gravity (or vertical) load of the structure above them. These walls are often also used to resist lateral forces, such as the forces from earthquakes or wind – in which case they are called shear walls and are part of the building's lateral force resisting system. In wood-frame buildings, shear walls are most commonly constructed with a 2x4 or 2x6 lumber frame that is sheathed with oriented strand board, plywood, and/or gypsum wallboard. The sheathing panels are attached to the wood-frame with dowel type fasteners (e.g., nails, screws, staples, etc.), and the spacing of these fasteners controls the strength and stiffness of the wall.

Shear walls in buildings are designed and built to have a larger strength (or capacity) than their design force. The design force for each shear wall in a building is dependent upon the total design earthquake force applied to the building, known as the base shear. According to the International Building Code (2003), the base shear is calculated as:

$$V = C_s \cdot W \qquad \textbf{Eq. [1]}$$

As shown in Equation 1, the base shear (V) is the product of the seismic response coefficient (C_s) and the weight of the structure (W) (the sum of the weight of all structural and non-structural components). The seismic response coefficient (C_s) is dependent upon the fundamental period of vibration of the building, the seismicity and soil conditions of the building site, the intended use/importance of the building, and the ductility and over-strength of the lateral force resisting

system. The static base shear (V) is distributed at the diaphragm level(s) within a building, and is resisted by the shear walls that are parallel to the force (Figure 1).

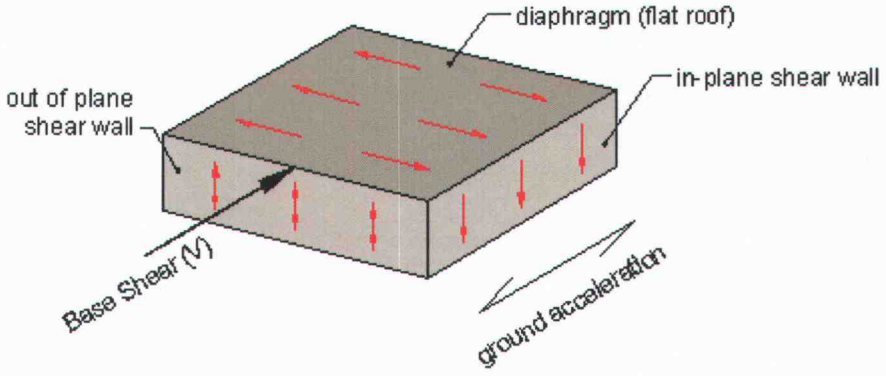

Figure 1. Schematic of Seismic Design Force (Base Shear) Application and Load Path

Tabulated shear wall strength used in design is currently based upon monotonic tests (ASTM 1999) of 2.4 x 2.4 m walls. Monotonic (or static) tests displace the top of the wall at a constant rate, in one direction, by applying force until the wall fails. This type of test is not very representative of the random, short duration, load reversal that walls can experience during earthquakes or wind. Furthermore, the walls used in these standard tests are not completely representative of those in buildings. Zacher (1999) suggested that losses due to disasters such as the Northridge earthquake may have been due to gaps in knowledge, and therefore, testing should be more representative of actual construction and loading conditions. This project addresses some of these issues with earthquake tests using actual ground motions conducted on code prescribed walls – thereby providing insight to the in-service earthquake performance.

This is a two phase project. Phase I (Seaders 2004) tested fully and partially anchored shear walls under monotonic, cyclic, and earthquake loads. The earthquake tests conducted in Phase I served as a lead-in to Phase II (this thesis), in which 34 earthquake tests were conducted. In addition, the two phases of this project allow for comparing shear wall performance under standard monotonic, cyclic, and earthquake loadings. Overall, the goals of this research are as follows:

1. To understand the behavior (load-deflection response, strength, failure mode, ductility, energy dissipation characteristics, etc.) of shear walls under various actual dynamic loading records: (a) subduction zone, long duration earthquakes from Washington/Chile, and (b) earthquakes (including sequences) from sites in California.

2. To compare the behavior of shear walls under standard static test (ASTM E564) (1995b) and cyclic test (CUREE) protocols to the behavior of the shear walls subjected to various actual dynamic loading records.

THE PERFORMANCE OF WOOD FRAME SHEAR WALLS UNDER EARTHQUAKE LOADS – PART A

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CHAPTER 2. THE PERFORMANCE OF WOOD FRAME SHEAR WALLS UNDER EARTHQUAKE LOADS – PART A

INTRODUCTION

Earthquakes and wind create lateral forces on buildings that are random and cyclic, thereby reflecting the behavior of these environmental events. In California, the second most seismically active state (USGS 2004b), 99% of the residences are of wood-framed construction, while throughout the United States the ratio of wood structures to total structures is between 80% and 90% (Malik 1995). Shear walls are the most common vertical lateral-force resisting element in light-frame construction. In fact, as of 1997, over ninety percent of U.S. residences used wood framed shear walls as the primary lateral-load resisting system (Home Builder 1997). Therefore, the ability of these walls to adequately resist random and cyclic lateral forces is critical to the safety of the inhabitants, and to the soundness of our residential infrastructure.

Design values for wood shear walls are based upon static tests. Static (or monotonic) tests apply neither cyclic nor random load reversals that occur during an earthquake or wind event. Static tests simply push the wall to failure by loading the top of the wall in one direction at a constant rate of displacement. This loading discrepancy was not believed to be significant until the 1994 Northridge earthquake in southern California. Not only was this the most costly earthquake in United States history (estimates up to $40 billion), but it killed 60 people and injured more than 7,000, and damaged over 40,000 homes in Los Angeles, Ventura, Orange, and San Bernardino counties (USGS 2004a). Since the occurrence of this natural disaster, substantial research has been directed toward the development of cyclic testing protocols that are more representative of the loading seen during earthquakes. Almost all of this research has been focused on mitigating the damage associated with the strike-slip earthquakes – like that of Northridge that are common to California's San Andreas Fault (Figure 2) – through the development of cyclic testing protocols representative of this earthquake type. However, the major fault mechanism in the Pacific Northwest is a subduction zone (Cascadia Subduction Zone) (Figure 2), not strike-slip. Historically speaking, subduction zone earthquakes are more infrequent than strike-slip earthquakes, yet have the potential to be of larger magnitude and longer duration due to a build-up of energy over a long period of time, and involving a very large potential rupture area.

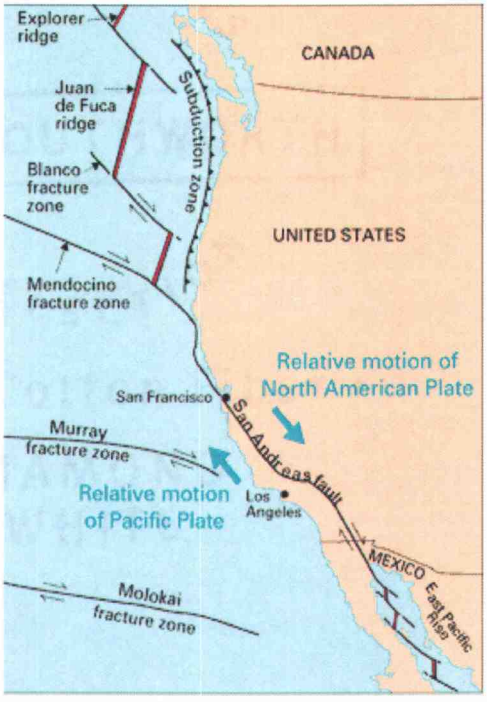


Figure 2. West Coast Seismic Regions (USGS 2003)

Most shear wall testing to this point has been conducted on walls anchored with hold-downs and anchor bolts (fully anchored walls), despite the International Residential Code (IRC) (ICC 2000) and its predecessors allowing for lateral resistance from walls with only anchor bolts (partially anchored walls). Very little research has been directed towards assessing the performance of partially anchored walls under monotonic, cyclic, or earthquake loads – this issue is addressed in this project.

With the aforementioned in mind, this study has the following objectives:

1. Evaluate and compare the performance of fully and partially anchored walls under monotonic, cyclic, and earthquake loads.
2. Compare wall performance under earthquake loads with that from standardized monotonic and cyclic tests.
3. Evaluate dynamic wall performance with respect to code performance measures.

This project has two phases. Phase I was conducted by Seaders (2004) and consisted of monotonic, cyclic, and preliminary earthquake tests. This study, Phase II, consists of two parts: (1) Part A – this document – focuses primarily on earthquake testing of fully and partially

anchored walls, and (2), Part B (White 2005) which encompasses the performance of walls under loading conditions that are more realistic than what is common to standard shear wall tests.

LITERATURE REVIEW

There have been several cyclic and shake table studies conducted to determine the performance of wood stud shear walls. Filiatrault and Foschi (1991) compared the performance of conventionally constructed walls with those constructed with nails and adhesive. Test protocols included static and earthquake time histories from San Fernando (1971), El Centro (1940), and Romania (1977). They found that walls with adhesive remained elastic under moderate (design) and large earthquake conditions, whereas conventionally constructed walls behaved inelastically for the design level earthquake, and were near total collapse for large earthquakes. Karacabeyli and Ceccotti (1998) tested walls using static, cyclic, and pseudo-dynamic procedures. Failure modes of nail fatigue, nail pull-through, nail withdrawal, and nail tear-out were observed, and were dependent upon test protocol. Nail fatigue was common to protocols with high energy demands. The basis for design unit shears was suggested to be the first envelope from cyclic tests or the monotonic curve. Dinehart and Shenton (1998) conducted static and Sequential Phased Displacement (SPD) shear wall tests. Due to the increased cycling of the SPD tests, static tests had a slightly larger wall capacity and a much greater displacement at maximum load which corresponded to a 40% higher ductility. Nail fatigue and withdrawal were common to the SPD test – this was very different from that of static testing. He et al. (1998) conducted tests using the FCC, CEN-short, and CEN-long protocols. The FCC protocol, containing a large number of cycles, was dominated by nail fatigue – uncommon to realistic earthquake loading. The CEN-long protocol caused failure modes consistent with earthquake loading, however energy dissipation from this protocol was the lowest observed, and much greater than common to shake table tests.

Yamaguchi et al. (2000) ran monotonic and cyclic tests with various loading rates, pseudo-dynamic tests, and El Centro shake table tests. Tests with more load cycling and high amplitudes corresponded to greater post-peak strength degradation. The fast-reversed cyclic test had results closest to that of shake table tests. Pseudo-dynamic tests had similar amplitudes and load cycles to shake table testing, yet had results that were the most different in comparison. McMullin and Merrick (2000) tested walls sheathed on both sides with oriented strand board (OSB), 3-ply plywood, 4-ply plywood, or gypsum wallboard (GWB) using force-controlled cyclic tests. The stiffness of gypsum wallboard was found to be greater than that of plywood and OSB,

thereby attracting significant load during the initial stages of an earthquake leading to subsequent damage. Durham et al. (2001) ran static, cyclic, and earthquake tests using the Landers, CA time history on walls with oversized OSB panels (2.44x2.44 m) and standard sized panels (1.22x2.44 m). A substantial increase in stiffness and shear capacity was achieved by using large OSB panels, and thus there was less wall drift and damage. Cyclic and shake table tests had consistent failure modes, however total energy dissipation from cyclic tests was about half seen during shake table tests.

Salenikovich and Dolan (2003a and 2003b) tested walls with various aspect ratios and overturning restraints both statically and cyclically. Wall capacity and corresponding displacement were 13% and 30% greater, respectively, for walls tested monotonically and having aspect ratios less than or equal to 2:1, while wall ductility and wall stiffness were about the same as a result of the two protocols. Gatto and Uang (2003) ran tests on 2.4 m square walls sheathed with plywood or OSB using static, CUREE standard (Krawinkler et al. 2001), ISO (1998), SPD, and CUREE near fault protocols (Krawinkler et al. 2001). Tests with large numbers of cycles and equal amplitude cycle groups appeared to be the most rigorous. The CUREE standard protocol had failure modes consistent with seismic behavior, and therefore was suggested to be a standard procedure for future wood-framed testing. Uang and Gatto (2003) conducted cyclic tests using the CUREE standard protocol at static and dynamic loading rates on 2.4 m square walls sheathed with nonstructural finish materials. The addition of stucco or GWB added to the strength and stiffness significantly, but reduced the deformation capacity by 31% and caused wall failure in elements such as studs and sill plates, rather than fasteners. The dynamic loading rate gave modest increases in wall strength and stiffness for some specimens. In Phase I of this project, Seaders (2004) ran subduction zone earthquake tests using SE13 and SE19 time histories from the SAC Steel Project (Somerville et al. 1997) – these tests were conducted on walls with and without hold-downs (per IRC brace panel construction). Walls tested under earthquake loading had lower capacity than monotonic tests, but about the same as CUREE cyclic tests. CUREE cyclic tests provided a more conservative estimate than monotonic tests of wall performance under earthquake loads.

The majority of the literature has been focused on testing engineered walls with hold-downs (Pardoen et al. 2000; Uang 2001) despite the IRC allowing shear resistance from walls not having them. However, Ni and Karacabeyli (2002) studied the performance of shear walls anchored with hold-downs, without hold-downs, and with dead-load and no hold-downs. Static and the reverse cycling ISO (1998) loading protocols were used. Maximum load and corresponding displacement of walls without hold-downs and no vertical load was 50% that of walls with hold-downs and no vertical load. Full capacity of walls without hold-downs was

attained when vertical loads resisted the overturning moment. Dujic and Zarnic (2001), and Yanaga et al. (2002) examined vertical loads effects on shear wall performance. Walls without hold-downs exhibited much lower strength and displacement capacity when no vertical load was applied. When vertical loads were applied, the capacity of walls with and without hold-downs converged.

The previous studies mentioned (Ni and Karacabeyli (2002); Dujic and Zarnic (2001); Yanaga et al. (2002)) for walls without hold-downs used inconsistent wall configurations per the brace panel construction specified in the IRC. However, Seaders (2004) ran static and CUREE cyclic tests on 2.4 m square shear walls with two types of anchorage: (1) with hold-downs, and (2) without hold-downs, and per the IRC. Walls tested per the CUREE cyclic protocol had statistically significant lower capacity, corresponding displacement and energy dissipation. Hold-downs increased wall capacity and energy dissipation by 2.5 and 9 times, respectively, and caused a different load path compared to walls without hold-downs.

Aside from Seaders (2004) (Phase I of this project), the limitations of the research discussed relative to this project include:

1. Shake table studies used strike-slip earthquake time histories. The duration, frequency content, and magnitude of subduction zone earthquakes may cause a different structural response.
2. Limited research has focused on the performance of walls without hold-downs, and furthermore, did not use wall configurations that are consistent with those specified in the IRC. This study quantifies performance of walls without hold-downs that have proper configuration per the IRC – as is common in residential construction – and does so under earthquake loading.

As a result of the 1994 Northridge earthquake, the City of Los Angeles/ UC Irvine implemented a shear wall test program (CoLA/UCI 2001). From this program, recommendations were made to reduce design shear values based on monotonic tests, similar to Dinehart and Shenton (1998), in which a 25% reduction was recommended as a result of a reduction in load between the first and fourth cycles from cyclic testing using the SPD protocol. However, to the contrary, a recent report stated that there is currently no evidence to support a reduction in design loads (Cobeen et al. 2004). Since performance comparisons of shake table tests with monotonic and cyclic tests have been conducted here, this project contributes to this discussion.

MATERIALS AND METHODS

WALL SPECIMENS

Shear wall test specimens were designed and constructed in accordance with the 2000 International Residential Code (IRC) (ICC 2000) prescribed braced panel construction. All tests were conducted on identical 2440x2440 mm walls constructed using Standard & Better 38x89 mm kiln dried Douglas-fir framing as shown in Figure 3. Framing studs were spaced at 610 mm on center, and were connected to the sill plate and first top plate using two 16d (3.33x82.6 mm) nails per connection, driven through the plates and into the end grain of the stud. A second top plate was connected to the first top plate using 16d nails at 610 mm on center. The walls were sheathed using two 1220x2440x11.1 mm oriented strand board (OSB) panels that were attached vertically to the wall frame while spaced 3.2 mm apart. The 24/16 APA rated OSB panels were connected to the wall frame using 8d nails spaced 152 mm on center along the panel edges and 305 mm along the intermediate studs. The walls were additionally sheathed with two 1220x2440x12.7 mm gypsum wallboard (GWB) panels installed vertically on the face opposite to the OSB structural panels. The gypsum panels were attached to the framing with bugle head coarse wallboard screws (2.31x41.3 mm) spaced 305 mm on center along the panel edges and intermediate studs. Sheathing to framing connections were not staggered. Double end studs were required for walls with hold-downs, and were connected together using 16d nails at 305 mm on center. Framing and sheathing nails were full round head, strip cartridge, and smooth shank SENCO® nails that were driven using a SENCO® SN 65 pneumatically driven nail gun.

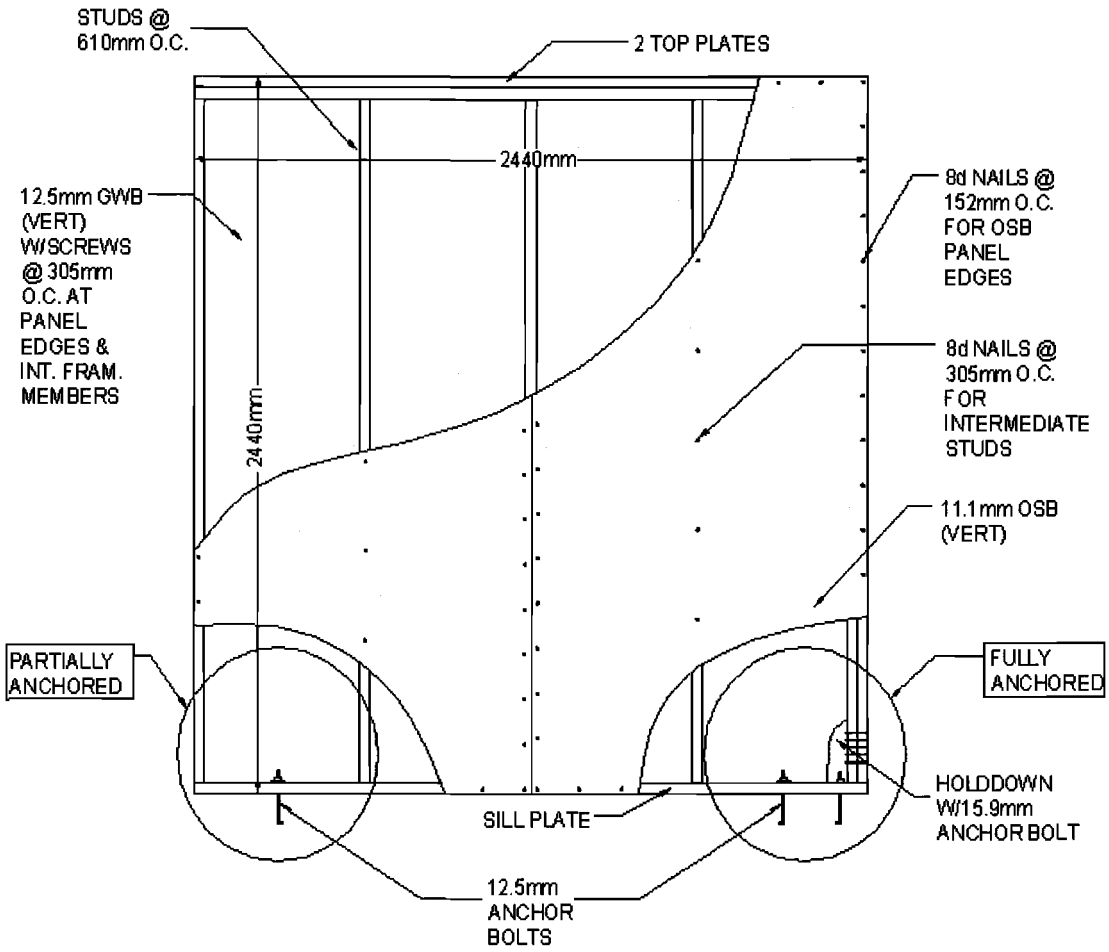


Figure 3. Schematic of Shear Wall Test Specimen

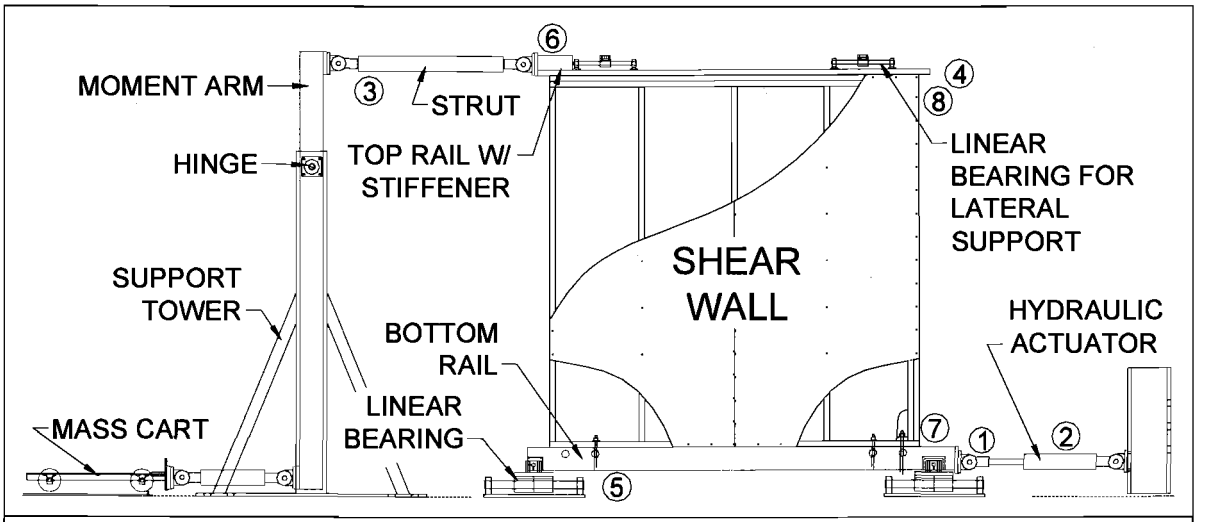
Wall Anchorage

All wall specimens were connected to the testing frame using one of two anchorage methods. The most basic anchorage method is per the IRC for brace panel construction using structural panel sheathing. This method does not require hold-downs; it assumes proper connection to the foundation will be provided by 12.5 mm anchor bolts installed at a minimum of 1829 mm on center. A wall anchored per this method will be referred to as a partially anchored (PA) wall. Partially anchored walls were attached to the test frame using 12.7 mm A307 anchor bolts that were placed 305 mm inward from each end of the wall. Fully anchored (FA) walls were the same as partially anchored walls with the addition of two SIMPSON Strong-Tie® PHD-2 hold-downs installed to double end studs. Each hold-down was attached to the testing frame with a 15.9 mm Grade 5 bolt. These two methods of anchoring the wall to the foundation are highlighted in Figure 3.

TESTING FRAME AND EQUIPMENT

Shear wall testing was completed at the Oregon State University Department of Wood Science and Engineering's Gene D. Knudson Wood Engineering Laboratory in Richardson Hall. A schematic of the test frame used for the earthquake and monotonic tests is shown in Figure 4. The testing frame consists of a 102x152x10 mm steel beam that rests on a set of linear bearings, one at each end of the beam. Two 51 mm solid steel rods rigidly attached to the strong floor of the laboratory were used as guides for the bearings. A 4.45 kN servo controlled hydraulic actuator capable of 153 mm of stroke was used to drive the steel load beam horizontally in one dimension to simulate ground motions. Walls were anchored to the moveable steel load beam, essentially serving as a foundation for the walls, using one of the two methods previously mentioned.

Shear walls in buildings laterally support the mass of all components tributary to them from the structure above. Here a 4543 kg tributary mass was used for a typical shear wall in a 140 m^2 residential home. For safety, seismic mass was placed on a steel cart that rolled on the floor and was connected to the top of the wall. The four-wheeled steel cart carried two 914x914x25.4 mm steel plates (each having a mass of . The cart rested on steel tracks that were rigidly attached to the strong-floor of the laboratory, and it was also connected to the bottom end of the moment arm by means of a steel rod pinned at both ends with 25.4 mm spherical rod ends. A laterally braced steel support tower held the 102x152x10 mm steel beam serving as a moment arm between the mass-bearing cart and a steel channel that was bolted to the top of the wall samples. Again, a steel rod and two 25.4 mm spherical rod ends were used to attach the top end of the moment arm to the steel channel, and thus the top of the walls. An equivalent mass ratio of 1:1 or 1:9 could be achieved at the top of the wall since the moment arm had two pivot points by which it connected to the steel support tower. The two pivot points were located at the one-third and one-half points along the length of the steel moment arm. A 51 mm steel shaft and bearings connected the moment arm to the support tower. The steel channel bolted to the top of the walls was laterally braced to a strong-wall in the laboratory through a series of steel struts. This limited the movement of the top of the wall to the one dimension in which the wall was being driven by the hydraulic actuator.



1. Load Cell: Force at bottom rail
2. Internal Linearly Variable Differential Transformer (LVDT): Bottom rail displacement
3. Load Cell: Force at top rail
4. String Potentiometer: Top rail displacement
5. Accelerometer: Bottom rail acceleration
6. Accelerometer: Top rail acceleration
7. LVDT: Stud to bottom rail uplift
8. LVDT: Stud to top rail separation

Figure 4. Schematic of Dynamic Test Frame (Seaders 2004)

Data Collection

Two load cells were used to measure wall forces during testing (Figure 4). The first was a 90 kN load cell connected in-line with the hydraulic actuator and the steel beam serving as the foundation for the walls. This load cell measured the force at the bottom of the wall required to achieve the desired ground motion and subsequently move the seismic mass. The second load cell was 55.6 kN rated and in-line between the top of the steel moment arm and the steel channel bolted to the top of the wall, thereby measuring the force at the top of the wall. Load beam displacement was monitored by a sensor built into the hydraulic actuator measuring cylinder position. Displacement at the top of the wall was monitored using a string potentiometer mounted between the strong-wall of the laboratory and the top chord of the wall.

Uplift displacements of the top chord with respect to the end stud of the wall, and the end stud with respect to the foundation were also monitored. For the top chord, this was achieved by mounting a linearly variable differential transducer (LVDT) on the end stud and monitoring its displacement with respect to the steel channel bolted to the top of the wall (Figure 4). Likewise,

an LVDT was mounted on the end stud and its displacement with respect to the foundation was monitored for bottom uplift (Figure 4). Uplift was recorded from one side of the wall only to ensure that a high frequency data-sampling rate could be maintained, necessary to embody the dynamic response of the wall. If needed, the uplift response of the opposite end of the wall could be determined as function of drift and the measured uplift response.

The data collection rate for all gauges was 50 Hz for dynamic testing. Data were routed to National Instruments LabVIEW 6.1 operated by a Dell Optiplex GX270 personal computer with a 2.4 GHz Intel Pentium 4 processor. For dynamic testing, the hydraulic actuator was controlled by a Wavetek Datron Model 302 2-channel arbitrary waveform generator.

EARTHQUAKE TIME HISTORIES

Selection

The selection of earthquake ground motions was based on many factors. A primary goal of this study was to determine the response of shear walls when subjected to ground motions that may be expected in the Pacific Northwest, affected by the Cascadia Subduction Zone. Thus, ground motions were to be high amplitude and long duration, typical to subduction zones. The SAC Steel Project (Somerville et al. 1997) contained a suite of ground motions meeting these criteria, and therefore was used as a basis from which to select ground motions. The SAC Steel Project was a joint partnership of the Structural Engineers Association of California (SEAOC), Applied Technology Council (ATC), and California Universities for Research in Earthquake Engineering (CUREE), with the objective to solve performance problems associated with welded, steel moment-frame connections as a result of the 1994 Northridge earthquake. Phase 2 of the SAC Steel Project yielded a suite of ground motion estimates for Seattle (UBC seismic zone 3), among other places (Boston and Los Angeles), to be used in analysis and testing. The ground motions for Seattle were at: (1) 2% probability of exceedance in 50 years, and (2) 10% probability of exeedance in 50 years.

According to the City of Seattle (2000), the Seattle urban area contained approximately 3.3 million people in the year 2000 – making it the largest city in the Pacific Northwest while lying within the most seismically active state in that region (overall #5 in the U.S.) (USGS 2004b). Thus, because of Seattle's size, and the active seismicity due to the Cascadia Subduction Zone, Seattle was selected as the focus of our design level ground motions. In addition to several subduction zone ground motions a strike-slip fault mechanism was also chosen (Table 1). Strike-slip earthquakes are common to the San Andreas Fault in California, and provided the basis for the standard cyclic testing protocols – developed to mitigate damage from this type of earthquake. They also occur throughout the Pacific Northwest. Because structural response is

dependent upon the frequency content and acceleration of the earthquake time-history, additional ground motion selection criteria were:

1. Collectively, the ground motions cover a broad range of frequencies (or periods) (1-10 Hz or 0.1-1 sec).
2. The time histories fall within the ±79 mm displacement limitation of the available testing equipment.

Table 1. Description of Selected Earthquakes

Characteristic	SE03	SE07	SE13	SE19
EQ Name	1984 Morgan Hill	1949 Olympia	1965 Seattle	1985 Valparaiso
Recording Location	Gilroy, CA	Seattle Army Base	Federal Office Building, Seattle	Vina del Mar, Chile
Time	April 24 1984	April 13 1949	April 29 1965	March 3 1985
Mechanism	Strike-slip	Subduction Intraplate	Subduction Intraplate	Subduction Interface
Dist. from epicenter, km	15	80	61	42
Magnitude (M_w)	6.2	6.5	7.1	8.0
Site (soil condition)	S_d (soil)	S_d (soil)	S_d (soil)	S_d (soil)
Scale Factor (Seattle/Original)	1.654	5.125	3.998	0.962
Peak Accel., g's	0.234	0.278	0.312	0.309
Peak Vel., mm/sec	198	346	365	370
Peak Disp., mm	50	72	63	55
Duration, sec	60.00	66.72	74.16	100.05
Time Step, sec	0.020	0.020	0.020	0.025

Scaling

The acceleration-time histories obtained from the SAC Steel Project had been scaled from the original (or actual) ground motions to match a design spectrum at periods of interest for steel structures. Since steel structures generally have a longer period of vibration than wood frame structures, the time histories needed to be rescaled to the appropriate level for a typical wood building in Seattle. In order to accomplish this, response spectra were generated based on the acceleration-time histories obtained from the SAC Steel Project, and thus, they needed to be scaled appropriately for this project.

To scale the time-histories appropriately for this study, a design response spectrum was generated according to FEMA 356 (2000) at the 10% probability of exceedance in 50 years level for downtown Seattle using a type 'D' soil (S_d) classification (stiff soil with 183 m/sec < shear

wave velocity of soil (v_s) ≤ 366 m/sec; used as the default site class per FEMA 356 1.6.1.4.2). Since most wood structures are 3 m to 9 m tall, they have natural periods of vibration between 0.1 and 0.3 seconds according to the empirical equation (Eq. [2]) provided by FEMA 356:

$$T = C_t \cdot h_n^{\beta} \qquad \textbf{Eq. [2]}$$

where T is the fundamental period of vibration in seconds, C_t is given as 0.060 for wood buildings, h_n is the roof height in feet, and β is given as 0.75. Using this information, the average spectral acceleration within the 0.1-0.3 sec target period range (shown in Figure 5) was determined for each of the time-histories selected for this study. The earthquake response spectra and corresponding time histories were then scaled (to the Seattle Design Level; 10% probability of exceedance in 50 yr.) by the ratio (or scale factor) of the average spectral acceleration from the FEMA 356 Seattle Design Level response spectrum to the average spectral acceleration from the earthquake response spectrum in the 0.1 to 0.3 sec period range. This scaling procedure was similar to that used in the SAC Steel Project.

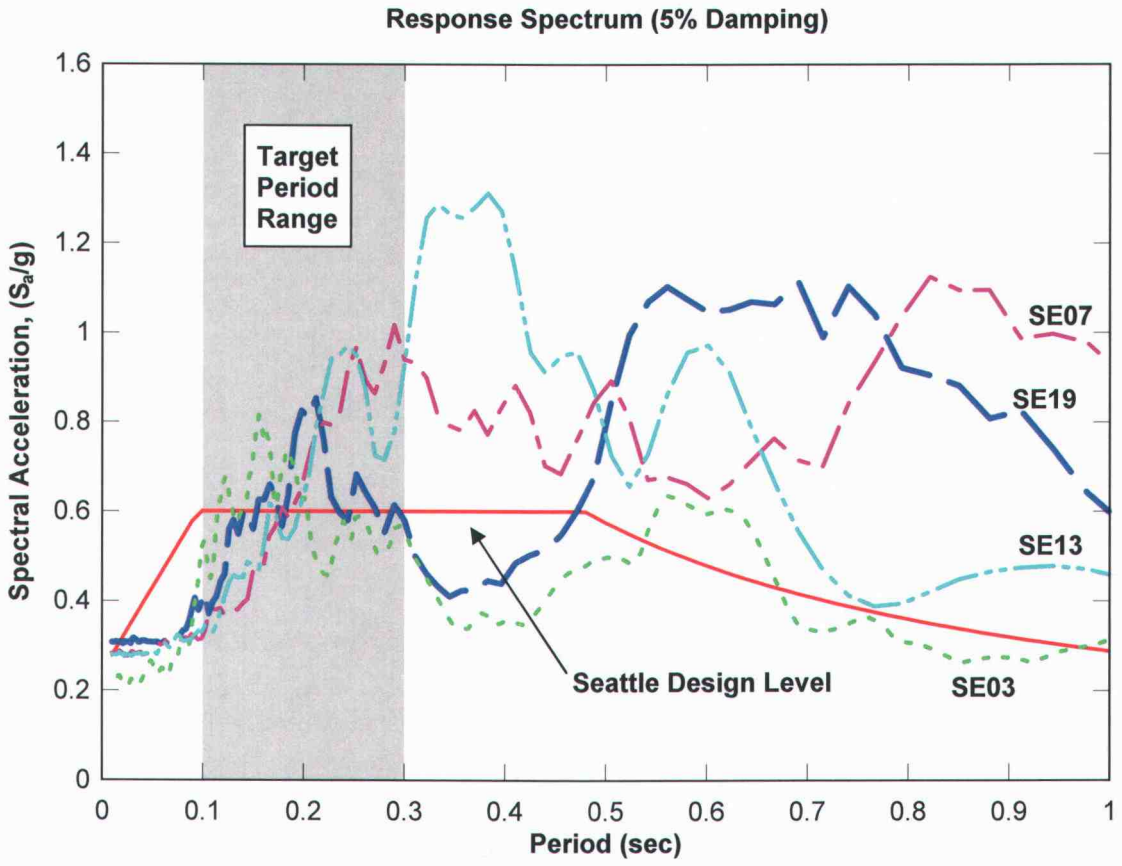


Figure 5. Scaled (to Seattle Design Level) Response Spectra for Selected Earthquakes

TEST MATRIX

This project consisted of two phases. Although some preliminary earthquake testing was conducted in Phase I of this project (Seaders 2004), it primarily focused on monotonic and cyclic testing. Earthquake testing was the primary interest of this study (Phase II). Both phases consisted of two wall treatments (fully anchored and partially anchored) to determine the performance differences of these types of walls with respect to testing protocol. Phase I tested eight walls under earthquake loads, while 34 earthquake tests were conducted in Phase II. In total 42 earthquake tests were conducted, 28 of the 42 tests will be discussed herein (Part A) (Table 2), the remainder are discussed in Part B (White 2005).

Table 2. Test Matrix

Anchorage	Phase I (Seaders 2004)		Phase II		
	Subduction Zone		Strike-slip	Subduction Zone	
	SE13	SE19	SE03	SE07	SE19
PA	2	2	2	2	6
FA	2	2	2	2	6

DATA ANALYSIS

Backbone Analysis

Analyzing the backbone (or envelope) curve provides a means to compare results from monotonic, cyclic, and earthquake testing. Each earthquake test yields a backbone curve with two segments, one segment corresponding to positive wall drift, the other segment corresponding to negative wall drift. Backbone curves were constructed, up to maximum load (P_{max}) for both positive and negative wall drift, by drawing a line between points of successively increasing peak loads on hysteretic cycles. Beyond P_{max}, backbone curves for positive and negative drift were constructed by drawing a line from P_{max} to the successively smaller peak loads on hysteretic cycles. Positive and negative backbone curves were terminated at the peak load on the hysteretic cycle that contained the largest drift. Wall failure, as defined in this study, occurred in the backbone curve segment at $0.8P_{max}$ post-peak.

Since an earthquake test yields a backbone curve with two segments, an average value reported for an earthquake test protocol was obtained by: (1) averaging the absolute values reported for a given parameter from the positive and negative backbone curve segments for an individual test, and then (2), combining this value with corresponding values from the remaining tests having the same earthquake protocol and wall anchorage and determining the mean; unless otherwise noted. In general, values reported for fully and partially anchored SE03, SE07 and SE13 tests are based on two walls, whereas values reported for fully and partially anchored SE19 tests are based on eight walls since the SE19 tests conducted in Phase I were included.

In general, the backbone analysis described previously is similar to that recommended in ASTM E 2126 (2001). Figure 6 depicts a backbone curve extracted from the hysteresis loops of an earthquake test. Reported values for performance parameters depicted in Figure 6 were averaged using the method previously described, except for Δ_{peak}. A complete description of all performance parameters and other notation used in this thesis is provided by White (2005).

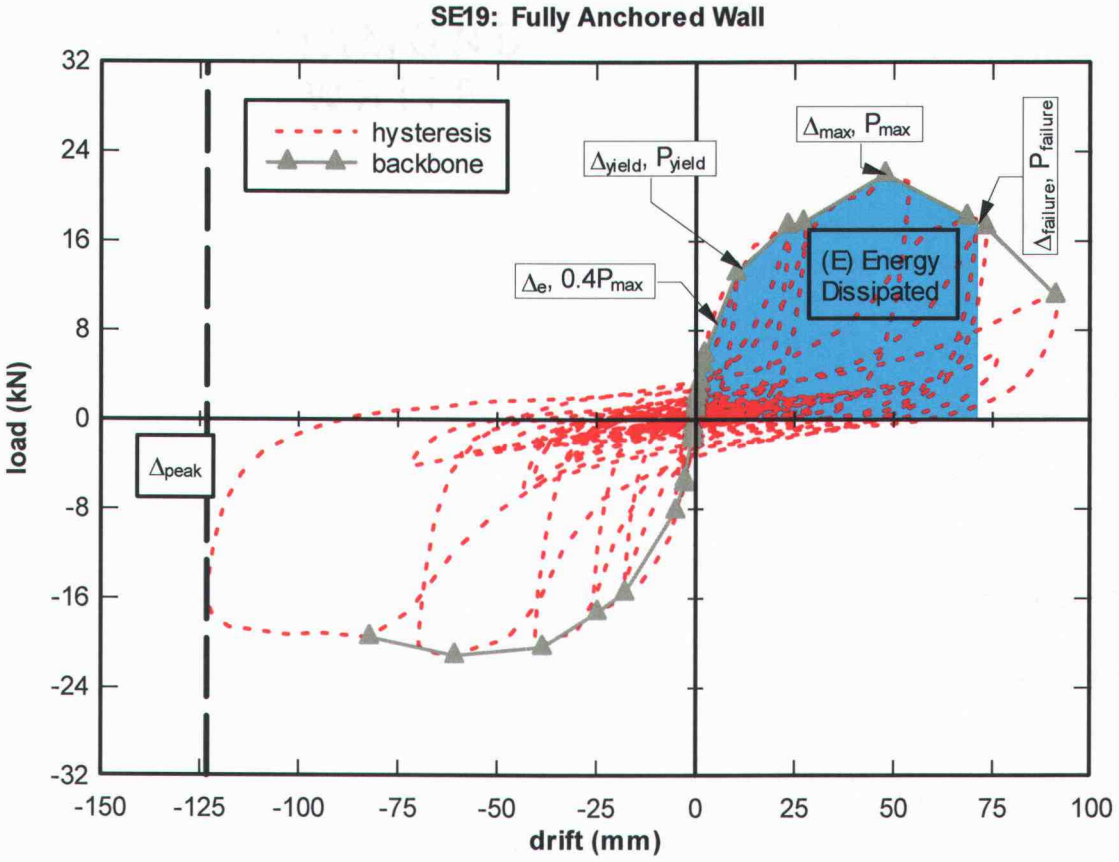


Figure 6. Hysteretic Data, Backbone Curve and Performance Parameters

Period Estimates And Calculations

The wall period becomes longer during an earthquake test due to stiffness degradation that is a result of damage accumulation. The fundamental period (T_o) and period at maximum load ($T_{failure}$) were calculated for each test. Calculations were conducted using the following equation:

$$T = 2 \cdot \pi \cdot \left(\sqrt{\text{mass/stiffness}} \right) \qquad \textbf{Eq. [3]}$$

The mass used in determining wall period was 9 times the mass on the cart and lower drag strut (4262 kg) (due to the test frame configuration), the rotational inertia of the pendulum arm (236 kg), and the testing frame mass attaching the top of the wall to the upper end of the pendulum arm (45 kg), summed to a total mass of 4543 kg. The fundamental period (T_o) was calculated using the initial stiffness (k_e) that is defined as the slope of the backbone curve up to $0.4P_{max}$ (k_e =

$0.4P_{max}/\Delta_e$). The failure period ($T_{failure}$) was calculated using the secant stiffness (k_{secant}), defined as the slope of the backbone curve up to P_{max} (P_{max}/Δ_{max}). Comparisons of the fundamental period calculated with Eq.[3] and the FEMA 356 empirical formula (Eq.[2]) were completed.

Cumulative Drift

Cumulative drift ($\Delta_{cumulative}$) is a parameter developed by Seaders (2004). It is the summation of the absolute value of the change in drift for each step (Eq.[4]) – essentially a measure of how much the building "moves". Therefore, a wall that accumulates a significant amount of damage and has a subsequent loss of stiffness will exhibit a high level of $\Delta_{cumulative}$. For this reason $\Delta_{cumulative}$ will be used to indicate the severity of loading conditions as a result of particular earthquake tests. In addition, $\Delta_{cumulative}$ is an important measure since the relative motion of stories within a building (interstory drift) is a primary source (and indication) of damage and stiffness degradation.

$$\Delta_{cumulative} = \sum_{i} \left(\left| Drift_i - Drift_{i-1} \right| \right) \qquad \textbf{Eq. [4]}$$

Since the change in relative displacement is recorded at each time step, cumulative drift can be summed over any interval. Cumulative drift up to and including the drift cycle containing maximum load ($\Delta_{cumulative\text{-}Pmax}$) is also of interest – it provides insight into the demands imposed upon the wall up to ultimate loading conditions.

Average Spectral Acceleration

T_o and $T_{failure}$ of a wall are the two extreme values characterizing its critical region, as defined here. The critical region contains the shift (increase) in wall period that occurs up to maximum loading during an earthquake, as a result of wall stiffness degradation. This increase in wall period means that the natural frequency of vibration for the wall decreases. Thus, a response spectrum with large accelerations at frequencies that are within the critical region is more likely to cause damage than one with lower levels of acceleration in this region. The average spectral acceleration within the critical region provides a method to evaluate the levels of acceleration in the critical region, and is calculated by summing the values of spectral acceleration (S_a) in the critical region and dividing by the number of observations.

$$\text{Average Spectral Acceleration} = \sum_{T_o}^{T_f} S_{a_i} / n \qquad \textbf{Eq.[5]}$$

where S_a is spectral acceleration and n is the number of observations in the interval. Because wall stiffness is different for fully and partially anchored walls, they have different critical regions.

FEMA 356 m-Factor Analysis

Wood shear walls are deformation-controlled elements because they exhibit significant inelastic behavior before strength loss, and thus, their ductility can be evaluated using m-factors per FEMA 356 (2000). The m-factor is for structural components, and is applicable to individual elements, not the entire lateral force resisting system. It is used to reduce the force level from one that is unrealistically high – as a result of evaluating the component in a linear analysis at the expected displacement during the demand earthquake – to a force level that is more realistic for the inelastic component. The acceptance criteria for deformation-controlled (i.e. ductile) elements as defined in FEMA 356 is:

$$m \cdot \kappa \cdot Q_{CE} \geq Q_{UD} \qquad \textbf{Eq. [6]}$$

where m is the modification factor for elements that indicates the available ductility, κ is a knowledge factor to account for uncertainty in the analysis of existing structures, Q_{CE} is the expected element strength at the deformation level being considered, and Q_{UD} is the ductile design action due to earthquake and gravity forces.

An m-factor analysis involves creating idealized load-displacement curves. These curves were drawn in conjunction with corresponding backbone curves (Figure 7). An idealized curve is constructed by drawing a linear segment from the origin through the point at $0.6P_{max}$ in the elastic region on the backbone curve. Next, an additional linear segment is drawn such that the areas under the idealized curve and backbone curves up to failure are equal.

Individual m-factors for each test were determined by drift ratios – the ratio of drift at the desired structural performance level to the drift at the yield point on the idealized curve. FEMA 356 defines the collapse prevention (CP) drift as that corresponding to the failure point of the idealized curve. The life safety (LS) and immediate occupancy (IO) levels are 0.75 and 0.5025 of the collapse prevention drift, respectively (Figure 7).

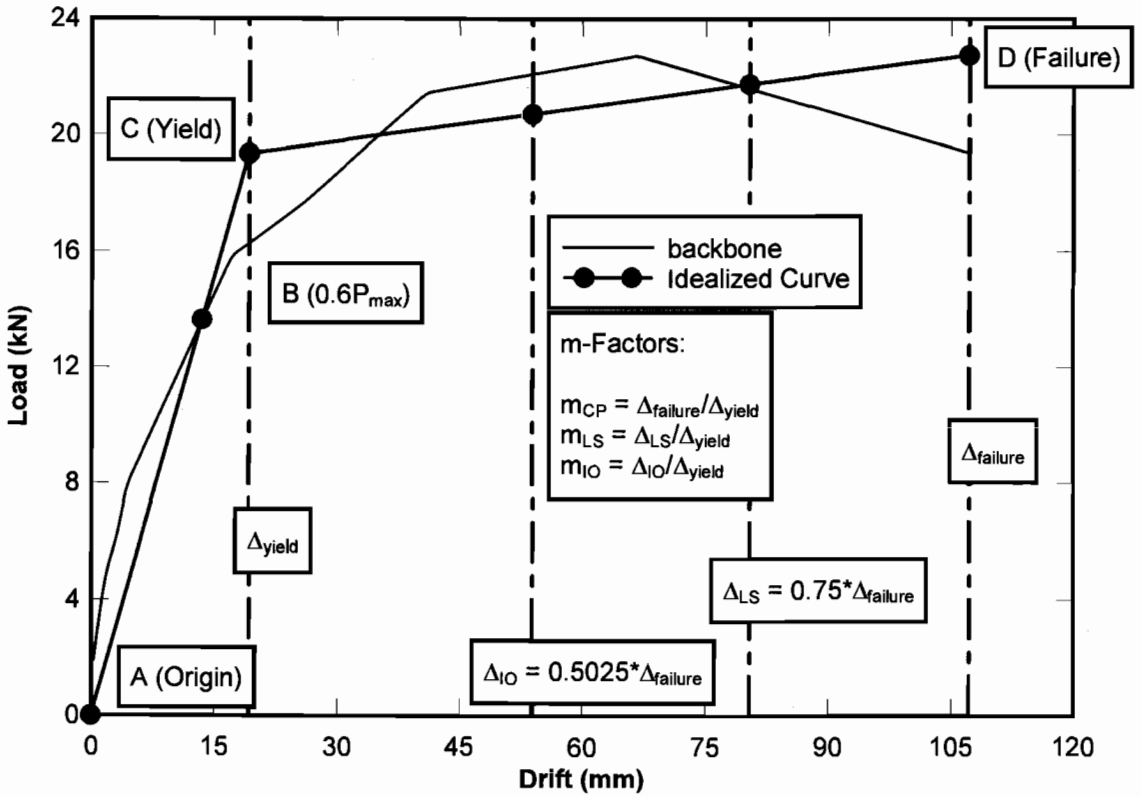


Figure 7. FEMA 356 Idealized Curve with m-Factors

Wall Failure Modes

A post-test wall evaluation was conducted to determine the overall condition of test specimens by recording failure location and type for the primary elements of the wall (studs, top and bottom plates, sheathing, and fasteners). The earthquake tests exhibited several failure modes, each of which involved failure of fasteners connecting the sheathing and the framing together. These fastener failure modes were classified into five general categories as depicted in Figure 8: (a) edge breakout from the nails and or GWB screws, (b) nail pull-through, (c) nail withdrawal, (d) localized crushing of the gypsum wallboard, and (e), fracture of screws attaching the gypsum wallboard. White (2005) contains a complete set of individual damage photographs taken during Phase II of this project.

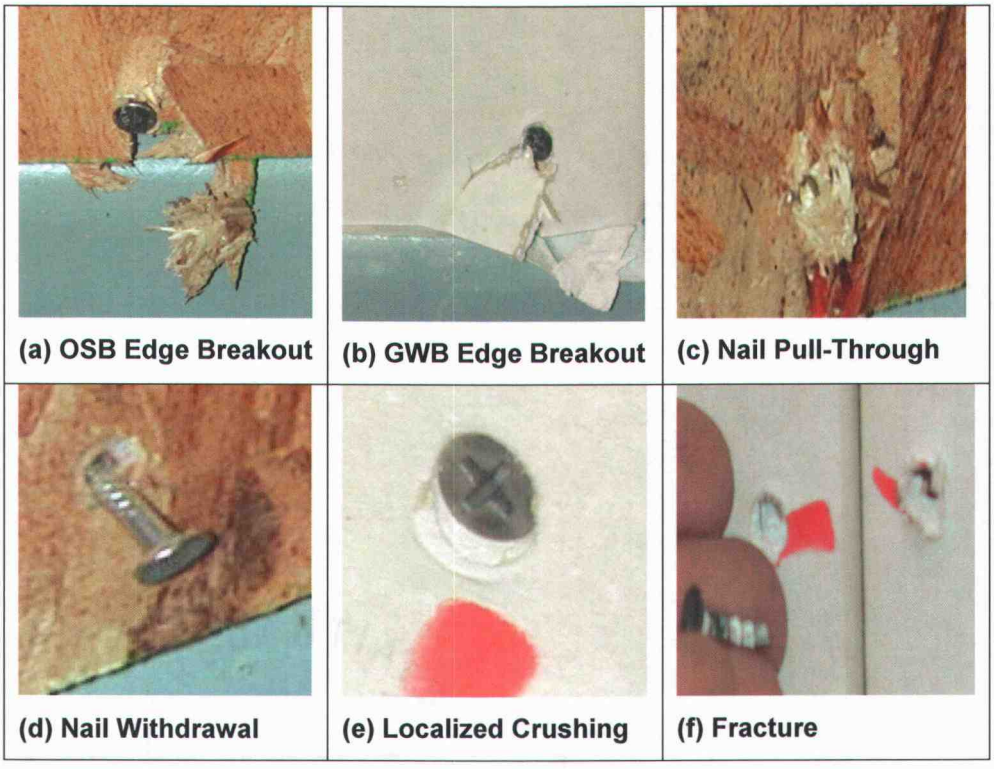


Figure 8. Observed Failure Modes

RESULTS AND DISCUSSION

PERFORMANCE DIFFERENCES OF FULLY AND PARTIALLY ANCHORED SHEAR WALLS

Based on the backbone curves, all fully and partially anchored subduction zone earthquake tests in this project resulted in ultimate loading conditions (see Figure 9) and caused significant damage (discussed later). In addition, these tests caused large levels of cumulative drift ($\Delta_{cumulative}$) and total energy dissipation (E_{total}) – parameters that indicate loading severity (Table 3). For fully and partially anchored walls tested with the SE03 strike-slip ground motion, this was not entirely true because the $\Delta_{cumulative}$ and E_{total} levels indicate that the loading conditions were less severe than subduction zone tests (Table 3). It seems most logical to base wall performance on earthquake tests of fully and partially anchored walls that cause significant damage and ultimate loading – so that the analysis accounts for the full potential performance of the wall. Thus, some discussions in this section exclude wall performance from SE03 tests. Nonetheless, the SE03 strike-slip tests will also be discussed herein.

Table 3. Parameters Indicating the Severity of Loading

Parameter	Fully Anchored				Partially Anchored		
	Strike-slip	Subduction Zone			Subduction Zone		
	SE03	SE07	SE13[a]	SE19	SE07	SE13[a]	SE19
P_{max} (kN)	16.31[b]	19.69	23.38	21.43	8.99	8.75	8.35
$\Delta_{cumulative}$ (mm)	1002	4907	2649	5428	4688	2435	4850
$\Delta_{cumulative\text{-}Pmax}$ (mm)	432	1846	559	471	1420	389	463
E_{total}[c] (J)	2177	12163	3882	9143	3698	1798	3538

[a]Conducted by Seaders (2004) in Phase I.

[b]Maximum observed value. Walls were not loaded to their full capacity.

[c]Total energy dissipated during the entire duration of earthquake testing.

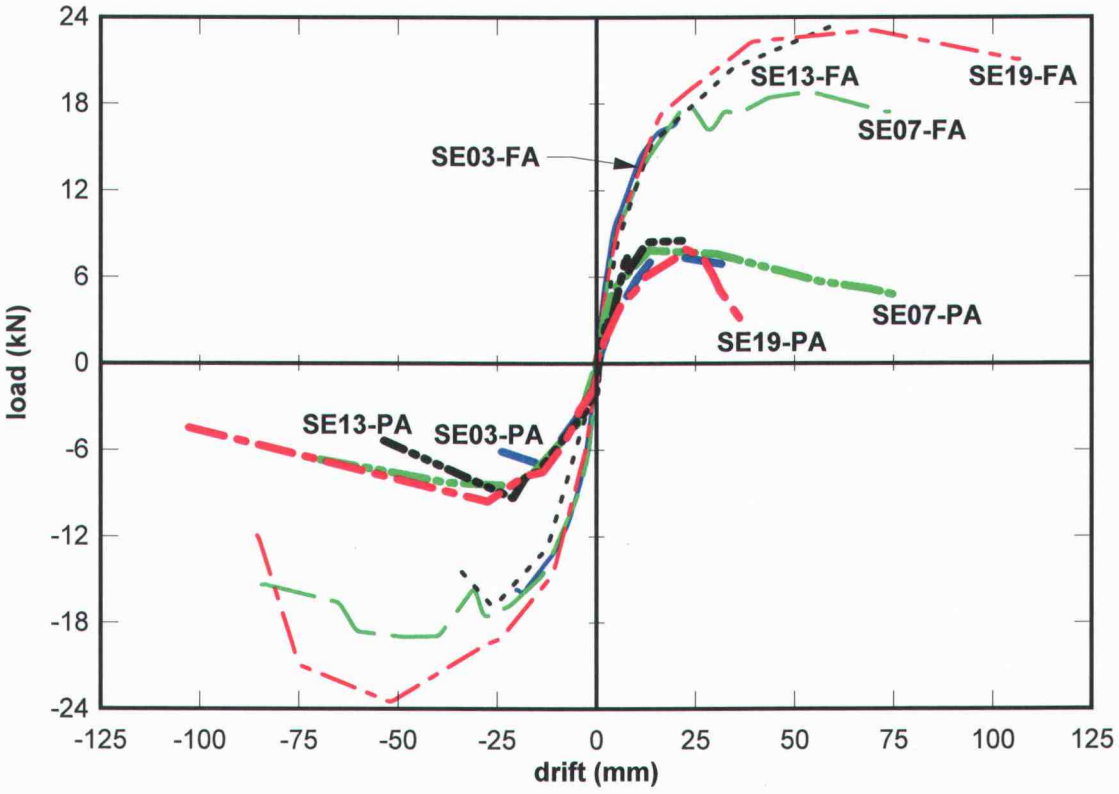


Figure 9. Typical Backbone Curves for Fully and Partially Anchored Earthquake Tests

SE03 Strike-Slip Earthquake Test Performance

The SE03-FA backbone curve in Figure 9 does not exhibit any post-peak behavior. Thus, this test did not reach ultimate loading conditions and did not cause significant inelastic behavior like other fully anchored subduction zone earthquake tests (Figure 9). As a result, this test caused much lower levels of $\Delta_{cumulative}$ and E_{total} (Table 3) – parameters that indicate the severity of loading – and exhibited much less damage than corresponding subduction zone earthquake tests. In general, damage consisted of minor nail withdrawal from the frame and localized GWB crushing around the screws attaching it to the frame.

Like corresponding subduction zone earthquake tests, the partially anchored SE03 strike-slip earthquake test attained ultimate loading and exhibited non-linear performance (Figure 9). Overall, the damage from this test was similar to that of corresponding subduction zone earthquake tests. Damage included localized GWB crushing, minor nail withdrawal from the framing, and edge breakout of sheathing to sill plate screw and nail fasteners (although less often than the subduction zone earthquake tests). In general, damage from the SE03 strike-slip ground motion was similar to that of subduction zone ground motions for partially anchored walls and much less severe for fully anchored walls.

Figure 10 provides explanation of the performance differences of SE03 tests and the corresponding subduction zone tests, for both fully and partially anchored walls. In particular, for fully and partially anchored walls, the critical regions that are bounded by T_o and $T_{failure}$, respectively, both fell within the lower acceleration region of the SE03 response spectrum (Figure 10). In comparison, subduction zone ground motions exhibited larger accelerations in both of these critical regions (Figure 10). One way to show this is by averaging the spectral acceleration in the critical region for each response spectrum. For fully anchored walls, the average spectral acceleration within the critical region for SE03 was 36%, 49%, and 40% below that of SE07, SE13, and SE19, respectively (Table 4). Thus, it seems reasonable that fully anchored SE03 tests resulted in less damage and lower levels of loading compared with the corresponding subduction zone tests.

For partially anchored walls, the average spectral acceleration within the critical region for SE03 was 25%, 36%, and 42% below that of SE07, SE13, and SE19, respectively (Table 4). However, since the capacity of partially anchored walls is about 2.5 times smaller than fully anchored walls, the differences in average spectral acceleration did not result in large differences in loading and damage, as was the case for fully anchored walls.

Table 4. Average Spectral Acceleration within the Critical Region for Fully Anchored and Partially Anchored Walls

Anchorage	Units	Strike-slip	Subduction Zone		
		SE03	SE07	SE13[a]	SE19
FA	g's	0.477	0.751	0.932	0.799
PA	g's	0.545	0.725	0.847	0.939

[a]Conducted by Seaders (2004) in Phase I.

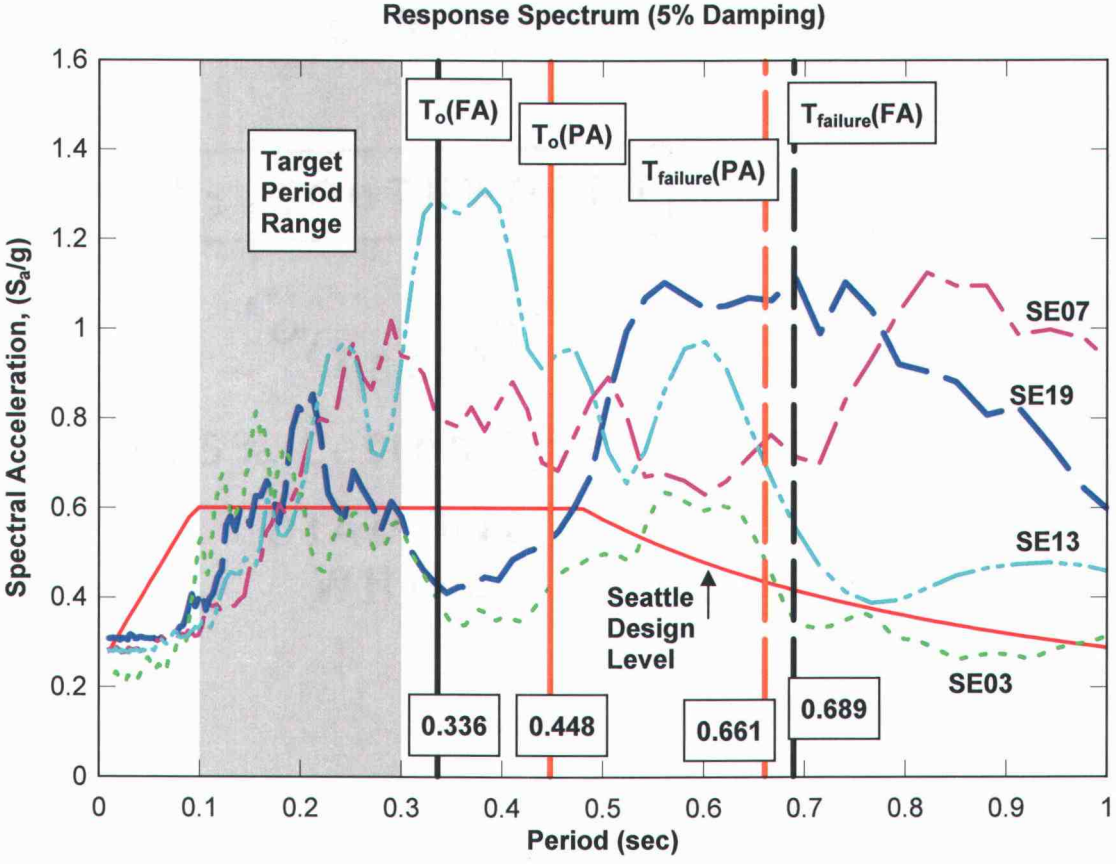


Figure 10. Comparison of Average Wall Periods and Scaled (to Seattle Design Level) Earthquake Response Spectra

Observed Failure Modes From Subduction Zone Earthquake Tests

In general, partially anchored subduction zone earthquake tests exhibited failure modes of screw and nail edge breakout (Figures 8a and 8b) along the sill plate. This failure mode was common to corresponding monotonic and cyclic tests from Phase I (Seaders 2004). Once these

connections failed, the walls exhibited little shear capacity, the top of the wall moved very little (compared to prior to the failure of these connections) as the bottom of the wall tracked the time history. This behavior resulted in partially anchored walls having large levels of $\Delta_{cumulative}$ after maximum loading conditions (note the difference in $\Delta_{cumulative}$ and $\Delta_{cumulative\text{-}Pmax}$, both are shown in Table 3). In a few instances the sheathing to sill plate damage was so extensive that the wall was almost completely detached from the sill plate. Other damage was minimal. Since the damage to partially anchored walls was almost entirely along the sill plate, the three subduction zone earthquakes collectively had low variability in damage (with respect to severity, abundance, and location). White (2005) contains additional photos depicting damage to partially and fully anchored walls.

Fully anchored subduction zone earthquake tests had more damage than partially anchored walls due to the stiff hold-down connections attaching the wall to the foundation. The presence of this connection resulted in the sheathing panels undergoing rigid body rotation as the wall was racked. Fully anchored walls used a greater number of connections between the sheathing and framing members, and thus, the damage was distributed throughout the wall more evenly than for partially anchored walls, and there was higher variability in damage (with respect to severity, abundance, and location). Failure modes from fully anchored subduction zone earthquake tests consisted of: (1) GWB and OSB edge breakout (Figures 8a and 8b), (2) nails pulling through the sheathing (Figure 8c), (3) nails withdrawing from the frame (Figure 8d), (4) screws causing localized crushing in the GWB (Figure 8e), and or (5), screw fracture (Figure 8f).

In general, for fully anchored walls, screw fracture and nail withdrawal were more prevalent in subduction zone earthquake tests with a large number of reverse loading cycles. Screw fracture was common along the sill plate and vertical studs along the GWB panel edges, and generally the damage was so extensive that the GWB panels lost their lateral load carrying capacity. Nail withdrawal from the framing was common to the vertical edges of the OSB sheathing and to the outer 610 mm of horizontal OSB panel edges. However, the most extensive damage to the OSB sheathing was at the panel edges (horizontal and vertical) located within the middle 1220 mm of the wall as a result of significant nail withdrawal, nail pull-through, or OSB or GWB edge breakout. Quite commonly this damage resulted in a space between the OSB sheathing and the frame along the center stud of the wall when the test was finished (see White 2005). In general, damage from fully anchored subduction zone earthquake tests corresponds best with the collapse prevention structural performance level for wood stud walls in Table C1-3 of FEMA 356 (2000).

In general, for fully anchored walls, the SE19 and SE07 tests caused the most damage. The SE13 test conducted in Phase I of this project (Seaders 2004) caused the least amount of

damage among fully anchored subduction zone earthquake tests, however it caused more than the corresponding SE03 test.

Fully anchored monotonic tests from Phase I (Seaders 2004) primarily consisted of nail pull-through and localized crushing of the GWB (Figures 8c and 8e). Nail withdrawal and screw fracture, common to the subduction zone earthquake tests, also occured during the cyclic tests from Phase I. Therefore, the failure modes of fully anchored subduction zone earthquake tests were most similar to cyclic tests, rather than monotonic tests, from Phase I of this project.

Load Paths

Fully and partially anchored walls exhibited different load paths; both are illustrated in Figure 11. For partially anchored walls, the only load path for overturning forces to be transmitted into the foundation was through the sheathing to sill plate nail and screw connections (see Figure 11), and the wall performance was limited by the edge breakout capacity of these connections. Once these fasteners broke through the sheathing edge (Figures 8a and 8b), partially anchored walls lost shear capacity, had poor drift performance, and had large uplift between the sill plate and end studs (U_{max}) (Table 5). When hold-downs are installed, the sheathing transfers overturning forces into the wall end studs, and subsequently into the foundation through the hold-downs (Figure 11). Compared with partially anchored walls, the fully anchored wall load path engages more fasteners since the transfer of load from sheathing to end studs is more evenly distributed throughout the wall. In this study, the result of this was that fully anchored walls had: (1) damage that was more evenly distributed throughout the wall (rather than at the sill plate), (2) favorable wall performance with respect to P_{max}, Δ_{max}, E, and k_e (see Table 6), and (3), less wall uplift by providing a stiff and durable attachment between the frame and the foundation (Table 5).

Table 5. Selected Parameters from Earthquake Tests

Parameter	Fully Anchored				Partially Anchored			
	Strike-slip	Subduction Zone			Strike-slip	Subduction Zone		
	SE03	SE07	SE13[a]	SE19	SE03	SE07	SE13[a]	SE19
P_{max} (kN)	16.31	19.69	23.38	21.43	7.56	8.99	8.75	8.35
E_{Pmax}[b] (J)	1463	6665	2405	2608	498	790	665	747
$\Delta_{cumulative\text{-}Pmax}$ (mm)	432	1846	559	471	313	1420	389	463
cycles to P_{max}[c]	18	37	19	34	11	21	15	29
U_{max} (mm)	2.4	8.5	8.1	6.3	14.6	61.2	50.4	101.0

[a]Conducted by Seaders (2004) in Phase I.

[b]Total energy dissipated up to and including hysteretic cycle containing P_{max}.

[c]Number of load reversing cycles up to and including cycle containing P_{max}.

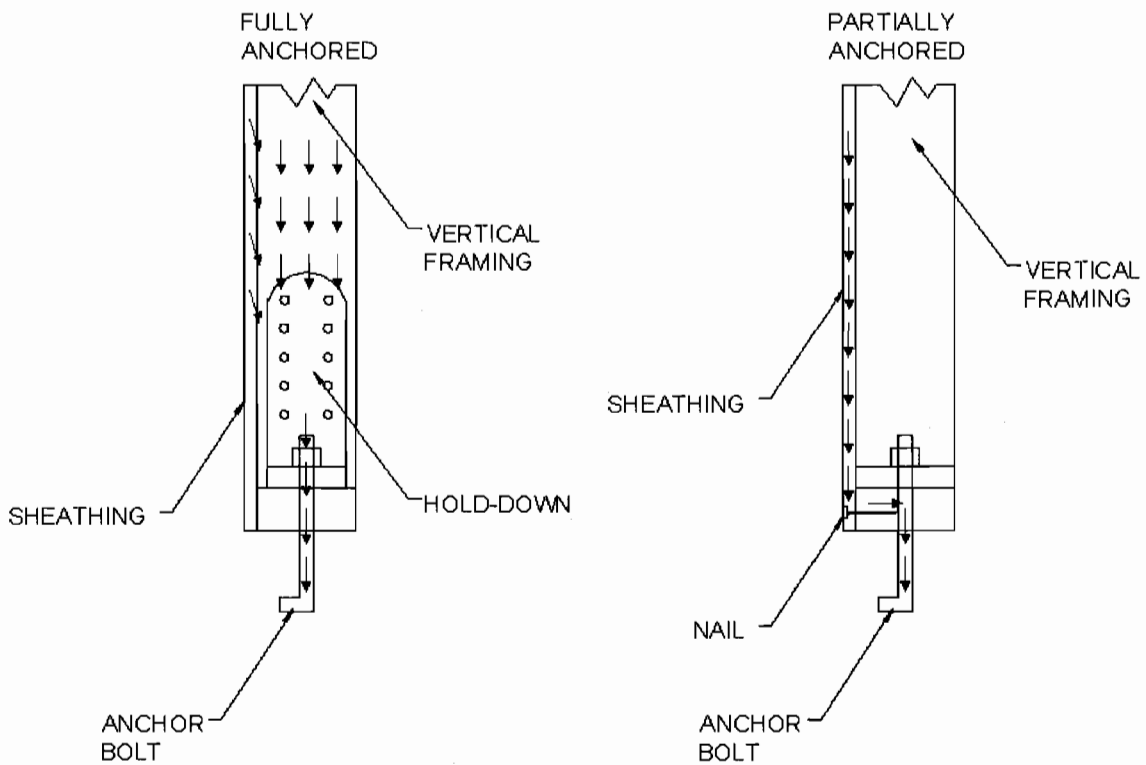


Figure 11. Load Paths of Fully and Partially Anchored Walls

As a result of the differing load paths of fully and partially anchored walls, the following correlations were only applicable to fully anchored walls. This is because the capacity of partially

anchored walls appeared to be limited by the edge breakout strength of the sheathing to sill plate nail and screw fasteners.

The first trend relates wall capacity (P_{max}) with energy dissipation up to and including the load cycle containing P_{max} (E_{Pmax}). The SE07 and SE19 tests both had about the same number of reverse load cycles up to P_{max} (cycles to P_{max}), however the SE07 test exhibited a 9% lower P_{max} (Table 5). This could be a result of the SE07 test causing cumulative drift up to maximum loading ($\Delta_{cumulative\text{-}Pmax}$) and subsequent energy dissipation (E_{Pmax}) levels that were 292% and 156% larger than the SE19 test, respectively (Table 5). Therefore, it appears that fully anchored tests with high levels of E_{Pmax} result in lower P_{max}. This trend agrees with the findings of Karacabeyli and Ceccotti (1998).

The second trend relates P_{max} with cycles to P_{max}. Although SE13 and SE19 tests had about the same E_{Pmax}, SE19 had a wall capacity of 21.43 kN, about 10% less than that of SE13 (23.38 kN) (Table 5). In addition, the SE19 test had approximately twice as many load cycles up to P_{max} and had the most severe and extensive fastener damage among all fully anchored earthquake tests in both phases of this project.

Karacabeyli and Ceccotti (1998), He et al. (1998), and Dinehart and Shenton (1998) found that test protocols with more load reversing cycles cause more fastener fractures. When fasteners are fractured in a wall, the load is transferred to other fasteners that are still intact, and because of this, the remaining fasteners are more likely to be overstressed as well. Thus, a fracture serves as a catalyst for additional fastener fracture or damage, and it also causes less favorable wall performance since wood shear wall performance is dependent upon the number of sheathing to frame fasteners. Thus, for fully anchored walls, it appears that the SE19 earthquake test likely had a smaller P_{max} than the SE13 test because of greater cycles to P_{max}.

Performance Differences Based On Backbone Curves

On average, for subduction zone earthquake tests, fully anchored walls exhibited P_{max}, Δ_{max}, E, and k_e approximately 2.5, 2.8, 4.4, and 1.6 times that of partially anchored walls, respectively (Table 6). For these parameters, this significant difference in performance is a result of the differing load paths previously discussed.

Table 6. Performance Ratio for Subduction Zone Earthquake Tests: Fully Anchored Walls to Partially Anchored Walls (FA/PA Ratio)

Parameter	SE07[a]	SE13[b]	SE19	EQ Avg.
P_{max}	2.2	2.7	2.6	2.5
Δ_{max}	2.9	2.6	2.8	2.8
E	-	3.0	5.9	4.4
k_e	1.5	1.9	1.4	1.6
μ	-	0.7	1.0	0.9

[a]E and μ not calculated (FA tests did not attain failure).

[b]Conducted by Seaders (2004) in Phase I.

Statistical tests comparing the mean performance of fully and partially SE19 tests were conducted at a level of significance of 0.1 ($\alpha = 0.1$), and were possible due to the larger sample sizes. With respect to mean performance, fully anchored walls had statistically greater levels of P_{max}, Δ_{max}, E, and k_e (Table 7). Statistically significant differences in ductility of fully and partially anchored walls were not found for SE19 tests (Table 7). In addition, fully anchored walls had about 10% less ductility than partially anchored walls for SE19 and SE13 subduction zone earthquake tests (Table 6).

Table 7. Statistical Comparison of Fully and Partially Anchored Walls Tested with the SE19 Ground Motion

Parameter	SE19-FA[a]		SE19-PA[a]		P values: FA vs. PA (SE19)	
	n=8		*n=8*		F-test[b]: Variance Test	T-test[b]: Mean Test
	Avg. (μ_1)	Std. Dev. (σ_1)	Avg. (μ_2)	Std. Dev. (σ_2)	(H_o:$\sigma_1^2=\sigma_2^2$)	(H_o:$\mu_1=\mu_2$)
P_{max} (kN)	21.43	1.41	8.35	0.75	**5.7E-02**	**1.1E-10[c]**
Δ_{max} (mm)	55.2	2.98	20.0	4.37	1.7E-01	**2.4E-11**
E (J)	1396	198	235	37.6	**1.4E-04**	**2.0E-07[c]**
k_e (kN/mm)	1.55	0.10	1.07	0.57	**9.8E-05**	**5.3E-02[c]**
μ	6.39	0.66	6.10	2.40	**1.4E-03**	7.5E-01[c]

[a]FA: (μ_1,σ_1), PA: (μ_2,σ_2).

[b]Bold values indicate statistically significant differences (α=0.10).

[c]T-test assuming unequal variances.

Drift Performance

The SE03 and SE13 partially anchored tests exhibited levels of peak drift (Δ_{peak}) that were 91% and 56% larger, respectively, than corresponding fully anchored tests, and likewise peak-to-peak drift (Δ_{p-p}) was 61% and 34% greater, respectively, for partially anchored tests (Table 8). This was not the case for SE07 and SE19, in which Δ_{peak} and Δ_{p-p} were at most approximately 10% different for fully and partially anchored walls (Table 8). Therefore, although clear-cut performance differences with respect to P_{max}, Δ_{max}, E, and k_e are apparent in Table 6 for fully and partially anchored walls, this was not the case for Δ_{peak} and Δ_{p-p} in this study.

Table 8. Selected Earthquake Test Parameters with respect to Wall Drift

Parameter	Fully Anchored				Partially Anchored			
	Strike-Slip	Subduction Zone			Strike-Slip	Subduction Zone		
	SE03	SE07	SE13[a]	SE19	SE03	SE07	SE13[a]	SE19
Δ_{peak} (mm)	26.8	80.5	65.9	127.4	51.2	85.4	102.5	124.4
Δ_{p-p} (mm)	40.2	154.7	98.9	211.7	64.7	151.8	132.2	192.9
total cycles[b]	57	64	78	121	51	65	81	124
T_0 (sec)	-	0.323	0.344	0.341	0.483	0.383	0.479	0.446
$T_{failure}$ (sec)	-	0.713	0.675	0.680	0.682	0.625	0.685	0.653

[a]Conducted by Seaders (2004) in Phase I.

[b]Number of load reversing cycles during test.

Among the fully and partially anchored earthquake tests, the SE19 ground motion caused the largest levels of Δ_{peak}, Δ_{p-p} (Table 8), total number of reverse loading cycles throughout the duration of earthquake testing (total cycles, Table 8), and caused the most severe damage to fully anchored walls. This can be explained by the large spectral accelerations in the critical region of the SE19 response spectra (Figure 10).

EARTHQUAKE AND STANDARDIZED TESTING COMPARISONS

This section compares the performance of fully and partially anchored walls under earthquake loads with the performance of walls during standard monotonic and cyclic tests conducted in Phase I (Seaders 2004). For reasons previously discussed, the SE03 fully anchored test was excluded from some comparisons. Table 9 contains average values from earthquake, monotonic, and cyclic tests of fully and partially anchored walls.

Table 9. Earthquake, Monotonic and Cyclic Testing Backbone Parameters

Type	Time History	Anchorage	*n*	P_{max} *kN*	Δ_{max} *mm*	E *J*	k_e *kN/mm*	μ
Strike-Slip	SE03	FA[a]	2	16.31	19.2	232	-	-
		PA	2	7.56	19.7	215[b]	0.77	3.87[b]
Subduction Zone	SE07	FA[c]	2	19.69	56.1	1171	1.78	-
		PA	2	8.99	19.6	338	1.22	7.44
	SE13[d]	FA	2	23.38	59.5	744	1.51	4.04
		PA	2	8.75	22.8	250	0.78	5.97
	SE19[e]	FA	8	21.43 (7)	55.2 (5)	1396 (14)	1.55 (7)	6.39 (10)
		PA	8	8.35 (9)	20.0 (22)	235 (16)	1.07 (53)	6.10 (39)
Standardized	MT[d]	FA	2	24.34	66.3	2063	2.86	12.80
		PA	7	9.66 (15)	23.4 (16)	**238** (25)	1.34 (33)	**5.03** (25)
	CT[d]	FA	2	**22.47**	44.5	**1171**	2.01	6.82
		PA	8	**8.58** (10)	**20.8** (17)	183 (14)	**1.18** (12)	**4.92** (14)

[a]Walls did not reach ultimate loading. Average maximum observed values are reported.

[b]Reported values are based on (+) backbone curve from one test only.

[c]Walls did not reach failure. E is average of maximum observed values, ductility cannot be calculated.

[d]Conducted by Seaders (2004) in Phase I.

[e]Seaders (2004) conducted two of the eight tests for both fully and partially anchored walls.

[f]Parenthetical values are coefficients of variation (COV).

[g]Bold values indicate the parameter was within the range exhibited by the respective earthquake tests, collectively. (Parameters for the SE03 time history were excluded from the range exhibited by FA earthquake tests because the walls did not attain ultimate loading.)

Maximum Load Comparison

Wall capacity (P_{max}) from earthquake tests was compared with that of standard monotonic and cyclic tests. These comparisons show that for fully anchored walls, P_{max} from cyclic testing fell within the range exhibited by subduction zone earthquake tests, whereas P_{max} from monotonic testing provides an upper bound for earthquake tests (Table 9). This result was also true for partially anchored walls; however in that case the range was from both the subduction zone and strike-slip earthquake tests.

Additional comparisons of P_{max} were also conducted. For fully anchored walls, the average capacity from cyclic tests was about 10% closer to that of SE07 and SE19 earthquake tests than was P_{max} from monotonic tests (Table 10). In addition, fully anchored SE13 earthquake tests had capacity that was equally similar to corresponding monotonic and cyclic tests (Table

10). For partially anchored walls, the average P_{max} from cyclic tests, rather than monotonic tests, was closer to that of all corresponding earthquake tests (Table 10). In addition, P_{max} from partially anchored SE19 earthquake tests was statistically lower than P_{max} from monotonic tests and was not found to be statistically different from P_{max} of cyclic testing, as discussed later (Table 12).

For partially anchored walls, an additional observation with respect to P_{max} shows that the coefficient of variation (COV) from cyclic tests (10%) is less than that of monotonic tests (15%) (Table 9). Thus, among partially anchored standardized tests, cyclic tests exhibited wall capacity that was most similar to earthquake tests, and also exhibited less variability with respect to P_{max}. Similar observations for fully anchored monotonic and cyclic tests cannot be made due to the smaller sample size associated with these tests in Phase I of this project. However, in general, results based on monotonic, cyclic, and earthquake tests in this study suggest that partially anchored wall capacity would be most accurately predicted based on cyclic tests, and fully anchored wall capacity from cyclic tests is also most similar to the earthquake tests conducted.

Table 10. Ratio of P_{max} from Monotonic and Cyclic Tests to P_{max} from Earthquake Tests

Anchorage	Standard Protocol	SE03 (*n*=2)	SE07 (*n*=2)	SE13 (*n*=2)	SE19 (*n*=8)
FA	MT (*n*=2)	-	1.24	1.04	1.14
	CT (*n*=2)	-	1.14	0.96	1.05
PA	MT (*n*=7)	1.28	1.07	1.10	1.16
	CT (*n*=8)	1.14	0.95	0.98	1.03

Energy Dissipation Comparison

For fully anchored walls, a comparison of energy dissipation (E) shows that the cyclic test values were within the range exhibited by subduction zone earthquake tests, while the monotonic test values were above this range and therefore provide an upper limit (Table 9). For partially anchored walls, monotonic tests yielded E within the range exhibited by subduction zone and strike-slip earthquake tests whereas cyclic tests had E below this range (Table 9).

Table 11 compares the average energy dissipation from fully and partially anchored monotonic and cyclic tests to that of corresponding earthquake tests. It is quite obvious that monotonic tests overestimated energy dissipation for all fully anchored earthquake tests (Table 11). Cyclic tests of fully anchored walls had energy dissipation levels that were most similar to those of earthquake tests (Table 11). In fact, for the SE07 test they matched those of earthquake tests, and for SE19, they were about 15% different (Table 11). For partially anchored walls,

excluding the SE03 ground motion, cyclic tests underestimated energy dissipation from earthquake tests by more than 20% and up to about 50% (Table 11). In fact, E from the partially anchored SE19 earthquake test was statistically greater than that of cyclic testing (Table 12). On the contrary, E from monotonic testing was not found to be statistically different from that of partially anchored earthquake tests. In addition, excluding the SE07 test, monotonic tests of partially anchored walls had energy dissipation within about 10% of corresponding earthquake tests (Table 11).

Overall, cyclic tests of fully anchored walls had E most similar to earthquake tests, whereas for partially anchored walls, monotonic tests had E most similar to earthquake tests.

Table 11. Ratio of E from Monotonic and Cyclic Tests to E from Earthquake Tests

Anchorage	Standard Protocol	SE03 (*n*=2)	SE07 (*n*=2)	SE13 (*n*=2)	SE19 (*n*=8)
FA	MT (*n*=2)	-	1.76	2.77	1.48
	CT (*n*=2)	-	1.00	1.57	0.84
PA	MT (*n*=7)	1.11	0.70	0.95	1.01
	CT (*n*=8)	0.85	0.54	0.73	0.78

Comparison Of Deflection At Maximum Load, Initial Stiffness, And Wall Ductility

With respect to deflection at maximum load (Δ_{max}), initial stiffness (k_e), and wall ductility (μ), monotonic tests of fully anchored walls exhibited values for these parameters that fell above the range exhibited by the corresponding subduction zone earthquake tests, as shown in Table 9. Like monotonic tests, cyclic tests yielded values for k_e and μ that were above the range exhibited by corresponding fully anchored subduction zone earthquake tests; however Δ_{max} from cyclic testing was below the corresponding range exhibited by fully anchored subduction zone earthquake tests (Table 9). Overall, it is clear that fully anchored monotonic and cyclic tests are not very representative of subduction zone earthquake tests with respect to Δ_{max}, k_e, and μ.

For partially anchored walls, and with respect to Δ_{max}, k_e, and μ, monotonic testing gave values that were above those exhibited by corresponding subduction zone and strike-slip earthquake tests with the exception of ductility (Table 9). Cyclic tests, however, exhibited values that were within the earthquake testing range for each of these parameters (Table 9). In general, partially anchored cyclic tests provided a good representation of corresponding earthquake tests with respect to Δ_{max}, k_e, and μ, and monotonic tests did not.

Statistical Comparison

The large sample size for the partially anchored SE19 earthquake test allowed for statistical comparisons with standardized testing performance. Table 12 contains p-values for F and T-tests with a level of significance of 0.1 ($\alpha = 0.1$) to determine if statistically significant differences in variances and means were exhibited. The p-value indicates the validity of the null hypothesis, H_o, which is being tested (the assumption of H_o is that variance or mean values are equal) by giving the probability that random sampling would lead to a difference in variances or means as large as (or larger than) observed – thereby enabling a determination of statistically significant differences. A lower p-value indicates a higher probability of statistical difference. The T-test type (assuming equal or unequal variances) was dependent upon the outcome of the corresponding F-test.

Table 12. Statistical Tests for Partially Anchored Walls

Parameter	P values: MT[a] vs. SE19[a]			P values: CT[a] vs. SE19[a]		
	F-test Variance Test ($H_o:\sigma_1^2=\sigma_3^2$)	T-test Mean Test ($H_o:\mu_1=\mu_3$)	Ratio SE19/ Mono (μ_3/μ_1)	F-test Variance Test ($H_o:\sigma_2^2=\sigma_3^2$)	T-test Mean Test ($H_o:\mu_2=\mu_3$)	Ratio SE19/ Cyclic (μ_3/μ_2)
P_{max}	0.11	**0.04**	0.864	0.80	0.56	0.973
Δ_{max}	0.68	0.13	0.855	0.62	0.68	0.962
E	0.25	0.91	0.987	0.31	**0.0058**	1.28
k_e	0.55	0.33	0.799	**0.0014**	0.59[c]	0.907
μ	0.13	0.31	1.21	**0.0043**	0.22[c]	1.24

[a]MT: (μ_1,σ_1), CT: (μ_2,σ_2), SE19: (μ_3,σ_3).

[b]Bold values indicate statistically significant differences.

[c]T-test assuming unequal variances.

For partially anchored walls, a statistical comparison of P_{max}, Δ_{max}, E, k_e, and μ from monotonic and cyclic tests with that of SE19 earthquake tests shows that monotonic tests yielded a statistically significant higher level for P_{max} and cyclic tests yielded a statistically significant smaller level for E (Table 12). The difference in P_{max} from monotonic and SE19 earthquake tests may be due to the fact that monotonic tests do not incorporate load reversal, and thus the fasteners do not lose embedment strength because they are not "loosened" as much from their embedment location in the wall frame. The lower E levels from cyclic tests may be a result of the cyclic protocol occurring at a much slower rate than the SE19 test, thereby allowing for greater

stress relief and redistribution during loading, resulting in a stiffer wall, and therefore, loads occurring at smaller deflections.

CODE COMPARISONS

Wall Period

Figure 10 shows the 0.1 to 0.3 sec fundamental period (T_o) estimate by the FEMA 356 empirical equation (Eq. [2]) underpredicted the actual values calculated (using Eq. [3]) for fully and partially anchored walls. The average T_o for fully anchored walls was 0.336 sec, and slightly longer at 0.448 sec for partially anchored walls because of their lower stiffness (Table 8). These periods were elongated due to stiffness degradation by 105% and 48%, respectively, to 0.689 sec and 0.661 sec for fully and partially anchored walls at maximum loading ($T_{failure}$) (Table 8). The fundamental periods for fully and partially anchored walls in this study are most likely greater than those from FEMA 356 (Eq. [2]) for buildings since there are components such as partitions, cross walls, and siding that contribute to building stiffness which were not incorporated into this study.

Drift Limit Analysis

Drift requirements are given by design codes or other guidelines. Some significant drift limits are the 3% for collapse prevention, 2% for life safety, and 1% for immediate occupancy transient drift limit requirements per FEMA 356.

Among the fully anchored earthquake tests conducted in Phase II of this project, the SE03 test was the only one to fulfill any drift requirements – it satisfied the life safety structural performance level of FEMA 356. From Phase I of this project (Seaders 2004), the SE13 fully anchored earthquake test met the collapse prevention limit per FEMA 356 (Δ_{peak}/h, Table 13), and thus, was the only fully anchored subduction zone earthquake test to meet FEMA 356 drift limit requirements. For partially anchored walls, the SE03 test fulfilled the FEMA 356 collapse prevention collapse prevention drift requirement (Table 13). The remaining partially anchored earthquake tests did not satisfy any drift limit requirements.

Overall, for fully and partially anchored walls, the peak drifts from earthquake tests in this project are clearly unacceptable with respect to FEMA 356 structural performance levels. Additional research is needed to develop cost effective methods of constructing, stiffening, and/or damping walls such that they minimize peak interstory drift and cumulative interstory drift.

Table 13. Earthquake Testing Results for Drift Analysis

Parameter	Fully Anchored				Partially Anchored			
	Strike-Slip	Subduction Zone			Strike-Slip	Subduction Zone		
	SE03	SE07	SE13[a]	SE19	SE03	SE07	SE13[a]	SE19
Δ_{peak}/h[b] (%)	1.1	3.3	2.7	5.2	2.1	3.5	4.2	5.1
$\Delta_{cumulative}$ (mm)	1002	4907	2649	5428	1323	4688	2435	4850
E_{total}[c] (J)	2177	12160	3882	9143	1496	3698	1798	3538

[a]Conducted by Seaders (2004) in Phase I.

[b]'h' is the story height of the building (2438 mm).

[c]Total energy dissipated during the entire duration of earthquake testing.

Fully anchored walls had lower levels of Δ_{peak}/h (Table 13) compared with partially anchored walls for the SE03 and SE13 tests. In addition, the SE03 and SE13 fully and partially anchored tests had lower $\Delta_{cumulative}$ and E_{total} compared to corresponding SE07 and SE19 tests (Table 13). Contrary to results from SE03 and SE13 fully and partially anchored tests, SE07 and SE19 fully and partially anchored tests had similar Δ_{peak}/h (Table 13). Therefore, it appears that ground motions causing low levels of $\Delta_{cumulative}$ and E_{total} resulted in favorable peak drift (shown by Δ_{peak}/h, Table 13) performance for fully anchored walls, and ground motions causing high levels of $\Delta_{cumulative}$ and E_{total} had similar Δ_{peak}/h performance for fully and partially anchored walls. However, with respect to total (or cumulative) wall drift, fully and partially anchored walls had $\Delta_{cumulative}$ values that were approximately equal, regardless of ground motion (Table 13).

Overall, this suggests that design level earthquakes may result in similar total drift performance ($\Delta_{cumulative}$) of fully and partially anchored walls, and the peak drift (Δ_{peak}) performance of these walls may be similar for earthquakes that result in high energy demands or total wall drift.

FEMA 356 m-Factor Analysis

An m-factor analysis was conducted for each earthquake test as discussed previously in the materials and methods section of this report. Average m-factor values for each earthquake test are reported in Table 14, and were compared with the acceptance criteria in FEMA 356 (2000) Table 8-4 for wood and light frame shear walls with wood structural panel sheathing or siding (aspect ratio ≤ 1).

The results show that fully and partially anchored walls tested with SE07 and SE19 ground motions were the only tests exhibiting m-factors (reflecting wall ductility) greater than

(meeting) the acceptance criteria (Table 14). The SE07 and SE19 ground motions also had the largest levels of cumulative drift ($\Delta_{cumulative}$), energy dissipation (E), and total energy dissipation (E_{total}) for fully and partially anchored wall tests (Table 14). On the contrary, for fully and partially anchored walls, the SE03 and SE13 tests resulted in low levels of E, E_{total}, and $\Delta_{cumulative}$ (Table 14) thereby causing the least amount of observed damage among the time histories. Thus, it appears that E and E_{total}, and $\Delta_{cumulative}$ can be related with the FEMA 356 m-factor. More specifically, earthquake tests with large E, E_{total} and $\Delta_{cumulative}$ are favorable since they demonstrated walls met the FEMA 356 m-factor acceptance criteria.

For the SE07 fully and partially anchored tests, m-factors were essentially the same, and for the SE19 fully and partially anchored tests, m-factors for partially anchored walls were 14% larger than those of fully anchored walls (Table 14). For fully and partially anchored SE13 tests conducted in Phase I of this project (Seaders 2004), partially anchored walls had m-factors 25% lower than fully anchored walls. However, the difference in m-factors of fully and partially anchored walls from SE19 and SE13 tests lies within the inherent variability associated with wood materials and construction practices. In addition, the small sample size for fully and partially anchored SE13 tests (2 walls each) may have also contributed to m-factor differences. Two of the three destructive ground motions used in this study suggest that m-factors of fully and partially anchored walls are similar; however additional testing is needed to realize a confident conclusion.

From Phase I of this project, monotonic and cyclic tests had partially anchored wall m-factors of 3.20 and 3.16, respectively, at the collapse prevention level (CP). These values are about 43% and 47% smaller than those from corresponding SE07 and SE19 tests, respectively. In addition, they are about 10% and 17% larger than those from SE03 and SE13 tests, respectively. Since SE13 partially anchored walls achieved failure (only one partially anchored wall tested with SE03 did), it is inconclusive whether m-factors from monotonic and cyclic tests are representative of those from partially anchored earthquake tests – although they do fall within the range exhibited by partially anchored earthquake tests.

For fully anchored walls, m-factors from monotonic and cyclic tests from Phase I of this project were 6.05 and 4.20, respectively, at the collapse prevention (CP) level. Thus, m-factors from monotonic tests provided an upper bound to m-factors from earthquake tests. In addition, the m-factor from cyclic tests is within the range exhibited by earthquake tests, however does not satisfy the acceptance criteria. Because an m-factor reduces the forces in an inelastic element, it would be conservative to underpredict the m-factor. Therefore, based on this study, it would be conservative to use m-factors from cyclic tests for fully anchored walls.

Table 14. Earthquake Test m-Factors

Acceptance Criteria (FEMA 356 Table 8-4)	Fully Anchored				Partially Anchored			
	Strike-Slip	Subduction Zone			Strike-Slip	Subduction Zone		
	SE03[a]	SE07[b]	SE13[c]	SE19	SE03	SE07	SE13[c]	SE19
CP 4.50	-	5.61	3.63	5.28	2.89	5.62	2.71	6.03
LS 3.60	-	4.21	2.72	3.96	2.16	4.22	2.03	4.52
IO 1.90	-	2.82	1.82	2.65	1.45	2.82	1.36	3.03
Parameter								
E (J)	232	1171	744	1396	215	338	250	235
E_{total}[d] (J)	2177	12163	3882	9143	1496	3698	1798	3538
$\Delta_{cumulative}$ (mm)	1002	4907	2649	5428	1323	4688	2435	4850

[a]m-factors were incalculable since tests did not reach failure ($0.8P_{max}$ post-peak).

[b]m-factors are based on ~$0.85P_{max}$ post-peak since walls did not completely fail.

[c]Conducted by Seaders (2004) in Phase I.

[d]Total energy dissipated during the entire duration of earthquake testing.

CONCLUSIONS

Conclusions based on the results of this study include:

1. Partially anchored subduction zone earthquake tests caused wall failure modes that were consistent with monotonic and cyclic tests from Phase I of this project. Fully anchored subduction zone earthquake tests caused wall failure modes that were consistent with cyclic tests from Phase I of this project. Fully anchored monotonic tests from Phase I of this project did not cause screw fracture or nail withdrawal, and therefore did not have failure modes consistent with subduction zone earthquake tests.

2. Fully and partially anchored walls exhibited different load paths. The partially anchored wall load path involved the sheathing to frame fasteners along the sill plate to transmit overturning forces into the foundation, whereas fully anchored walls utilized hold-downs for this load transfer. For this reason, partially anchored walls exhibited less favorable performance with respect to wall capacity (P_{max}), deflection at maximum load (Δ_{max}), energy dissipation (E), and initial stiffness (k_e), and exhibited less variability in observed damage with respect to damage severity, location, and abundance.

3. For SE19 earthquake tests, fully anchored walls had statistically significant larger capacity (P_{max}), deflection at maximum load (Δ_{max}), energy dissipation (E), and initial stiffness (k_e) when compared with partially anchored walls. In addition, statistically significant differences were not found for wall ductility (μ) of fully and partially anchored walls.

4. For fully anchored walls, subduction zone ground motions causing more reverse loading cycles up to maximum loading conditions (# cycles P_{max}) and/or dissipating more energy up to these conditions (E_{Pmax}) resulted in smaller wall capacities (P_{max}). These observations did not apply to partially anchored walls since their capacity seemed to be limited by the edge breakout strength of the sheathing to sill plate fasteners.

5. For fully anchored walls, with respect to monotonic and cyclic tests from Phase I of this project, subduction zone earthquake tests had capacities (P_{max}) and energy dissipation (E) levels that were most similar to the cyclic tests, rather than the monotonic tests. The monotonic and cyclic tests from Phase I of this project did not provide a good representation of subduction zone earthquake tests with respect to deflection at maximum load (Δ_{max}), initial wall stiffness (k_e), and wall ductility (μ).

6. For partially anchored walls, with respect to monotonic and cyclic tests from Phase I of this project, subduction zone and strike-slip earthquake tests had capacities (P_{max}), deflection at maximum load (Δ_{max}), initial stiffness (k_e), and wall ductility (μ) that were most similar to the cyclic tests; however, energy dissipation (E) levels were most similar to the monotonic tests.

7. For partially anchored walls, and with respect to wall capacity (P_{max}), deflection at maximum load (Δ_{max}), energy dissipation (E), initial stiffness (k_e), and wall ductility (μ), monotonic tests resulted in statistically significant greater P_{max}, and cyclic tests resulted in statistically significant smaller E when compared with the SE19 earthquake test. No other statistically significant differences were found when comparing the SE19 earthquake test with monotonic and cyclic tests.

8. Design level earthquakes may cause similar cumulative drift ($\Delta_{cumulative}$) response for fully and partially anchored walls, and the peak drift (Δ_{peak}) performance of these walls may be

similar during design level earthquakes that result in high energy demands or cumulative wall drift.

9. Among all fully and partially anchored walls tested with subduction zone ground motions in Phase I and Phase II of this project, the only walls to satisfy the FEMA 356 collapse prevention interstory drift requirements were fully anchored, and were tested with the SE13 ground motion. For fully anchored walls, the SE03 strike-slip earthquake test met the life safety interstory drift requirements, and for partially anchored walls, it met the collapse prevention interstory drift requirements.

10. Earthquake tests causing high levels of cumulative drift ($\Delta_{cumulative}$), energy dissipation (E), and total energy dissipation (E_{total}) corresponded to fully and partially anchored walls meeting the FEMA 356 m-factor acceptance criteria. For partially anchored walls, it is inconclusive whether m-factors from monotonic and cyclic tests are good representations for subduction zone and strike-slip earthquake tests. For fully anchored walls, m-factors from cyclic tests provided a conservative representation of those from subduction zone earthquake tests.

Recommendations based on the results of this study include:

1. Further earthquake testing research is needed to determine whether cyclic tests should be used as the standard from which design values are obtained for fully and partially anchored walls, as results from this study suggest.

2. Additional earthquake tests should be conducted on partially anchored walls constructed with innovative designs to minimize their capacity dependence upon the edge breakout strength of the fasteners attaching the sheathing to the sill plate. This may lead to more robust non-engineered walls that use natural resources more efficiently.

3. Additional earthquake tests should be conducted to determine if the FEMA 356 m-factor acceptance criteria needs to be revised to reflect differences in ductility of fully and partially anchored walls.

4. Research should be directed towards developing cost effective methods of modifying fully anchored walls such that they have fewer (or smaller with respect to drift) reversed

loading cycles resulting in lower levels of cumulative drift ($\Delta_{cumulative}$) and improved wall performance with respect to peak drift (Δ_{peak}).

5. If current standardized test procedures are used to develop FEMA 356 m-factors, they should be based upon cyclic tests (rather than monotonic tests) for fully anchored walls since cyclic test m-factors appear to be lower and therefore more conservative.

6. Further research is needed to investigate the performance of fully and partially anchored walls when subjected to time-histories with response spectra different from those used in this study.

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THE PERFORMANCE OF WOOD FRAME SHEAR WALLS UNDER EARTHQUAKE LOADS – PART B

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CHAPTER 3. THE PERFORMANCE OF WOOD FRAME SHEAR WALLS UNDER EARTHQUAKE LOADS – PART B

INTRODUCTION

Earthquakes are relatively common in the Pacific Northwest – according to the Pacific Northwest Seismograph Network (2005), each year several thousand Pacific Northwest earthquakes are recorded, although only a few dozen are large enough to be felt. The lateral forces that are imposed upon buildings as a result of these earthquakes – and also as a result of wind – are random and cyclic, and are resisted by the building's lateral force resisting system. Home Builder (1997) reported that over 90% of residences in the U.S. have shear walls for their primary lateral-load resisting system. Most commonly, shear walls in buildings resist lateral loads in addition to providing support to the weight (or gravity load) of the structure above. Thus, they serve as a load carrying mechanism for both lateral and vertical loads. Despite these facts, shear wall performance and design capacities are based upon static (or monotonic) tests that have not incorporated the vertical load. Therefore, the knowledge of shear wall performance may have shortfalls for the following reasons: (1) it is primarily based upon static tests rather than tests using earthquake time histories that contain random, cyclic load reversal, (2), it is based upon a single test rather than a sequence of tests that impose successive lateral forces that are common as a result of successive wind or earthquake events, or both, and (3) it is based upon tests that do not include vertical load. In addition to these potential shortfalls, nearly all of the shear wall research to date has been focused on walls anchored with hold-downs and anchor bolts (fully anchored walls), even though the International Residential Code (IRC) (ICC 2000) and its predecessors have allowed for lateral resistance from walls that were anchored only with anchor bolts (partially anchored walls). With this in mind, and for fully and partially anchored walls, this project has the following objectives that cumulatively serves to better understand wall behavior under realistic loading conditions:

1. To evaluate earthquake performance of walls carrying realistic vertical load (gravity load) for residential structures, and to compare this performance to that of walls having no vertical load.
2. To evaluate wall performance when subjected to a sequence of earthquake ground motions, and to compare this performance to that of walls subjected to a single earthquake ground motion.

Phase I of this research project was conducted by Seaders (2004) and covered the results of monotonic, cyclic, and preliminary earthquake testing. Phase II consists of two parts: (1) Part A focused on testing of shear walls under different earthquakes (White 2005), and (2), Part B focused on the earthquake performance of shear walls that have an applied gravity load, or shear walls that are subjected to a sequence of earthquake loads.

LITERATURE REVIEW

To date there has been limited experimental study to evaluate the effect of vertical load on wood shear wall performance. Dujic and Zarnic (2001) conducted monotonic and quasi-static cyclic tests with 2.4x2.4 m OSB sheathed walls anchored with and without tie-downs. Vertical loads of 4.17 kN/m, 21.25 kN/m, and 35 kN/m were used to represent the vertical load on walls in the fifth, third, and first story, respectively. For walls carrying the smallest vertical load, the tie-downs increased the racking resistance of the wall. For the walls carrying more than 20 kN/m, the tie-downs had very little effect on the lateral resistance of the wall. Dujic and Zarnic (2001) concluded that walls carrying small vertical loads should be anchored with tie-downs, and that vertical load improves the racking strength of walls anchored with and without tie-downs. Yanaga et al. (2002) conducted a numerical study on walls carrying dead load and anchored with or without hold-downs. They found walls without hold-downs that are carrying sufficient dead load have strength similar to walls with hold-downs that are not carrying dead load. They also found that walls without hold-downs have much lower strength and displacement capacity when dead loads is not applied. Ni and Karacabeyli (2002) investigated the performance of shear walls anchored with and without hold-downs subjected to either static loading or the reverse cycling ISO (1998) protocol. Some walls were vertically loaded – various magnitudes of vertical load were used (4.6 kN/m, 9.1 kN/m, 13.7 kN/m, and 18.2 kN/m). They found that aspect ratio and the vertical load magnitude influenced the capacity of walls without hold-downs. In addition, walls without hold-downs achieved full capacity when sufficient vertical load was applied, however if vertical load was not present these walls without hold-downs had a capacity 50% of walls with hold-downs and no vertical load. In general, the rate of increase in capacity decreased as applied vertical loads increased.

Seaders (2004) conducted two monotonic tests using partially anchored walls that had different applied gravity loads: (1) 4.39 kN/m, and (2) 7.30 kN/m. It was shown that the increase in load carrying capacity was related to the magnitude of the dead load resisting moment. In addition, Seaders (2004) suggested that fully anchored walls may represent an upper bound to

increases resulting from dead load application, although it is unlikely that this upper limit will be reached just by adding vertical load to partially anchored walls due to P-Δ effects. He et al. (1998) conducted cyclic tests using the FCC, CEN-short, and CEN-long protocols with 7.2 x 2.4 m walls carrying vertical load (9.12 kN/m) to compare performances from the different tests. There were no tests without the vertical load, and therefore the effect of vertical load could not be completely assessed. Karacabeyli and Ceccotti (1996, 1998) and Ni et al. (1999) summarized a shear wall testing program conducted by the Forintek Canada Corporation. Although numerous wall treatments and test protocols were compared, and vertical load was applied in some of the tests, the effect of vertical load was not discussed. Likewise, Durham et al. (1998) conducted monotonic, cyclic, and earthquake tests using the Landers, CA ground motion. Shear walls anchored with conventional hold-downs and sheathed with standard or oversized OSB panels were used. All walls tested carried a vertical load (9 kN/m) representing the weight of one story, and therefore the effect of the vertical load could not be completely determined. Nonetheless, Durham et al. (1998) concluded that the vertical load was crucial to uplift resistance at wall corners due to the larger overturning moment of the 2.4x2.4 m walls compared with longer walls.

The studies previously mentioned exhibit the limits of research focused on the effects of vertical load on shear wall performance. Further research is needed to determine the response of shear walls carrying dead load under different loading conditions. This study will contribute by testing walls having dead load with earthquake loads.

Limited research is reported on shear wall behavior during a sequence of earthquake loads, or a sequence of other test protocols. Durham et al. (2001) ran monotonic, cyclic, and earthquake tests (using the Landers, CA earthquake ground motion) on 2.4x2.4 m walls anchored with conventional hold-downs and sheathed with large (2.4x2.4 m) OSB panels. The objectives were to determine the effects of large OSB panels when loaded with different protocols. One earthquake test – scaled to a peak ground acceleration (PGA) of 0.35g – did not damage the wall. Thus, a second test – scaled to a PGA of 0.52g – was conducted using the same wall. The second test severely damaged the sheathing to frame connections by causing nails to pull through the sheathing, although nail fracture and complete withdrawal from the studs were also exhibited. In addition to these two successive tests, the researchers decided to repair the now severely damaged wall and perform a third test with a PGA of 0.3g. Compared with performance during the second test, the wall was more flexible and had a lower capacity during the third test, however, it performed similar to walls sheathed with one horizontally oriented 1.2x2.4 m panel along the bottom of the wall and two 1.2x1.2 panels at the top of the wall. Thus, it was concluded that a severely damaged wall can be retrofitted to achieve reasonable performance. McMullin and Merrick (2000) conducted a sequence of force-controlled cyclic tests on walls sheathed with

plywood, OSB, or gypsum wallboard (GWB) on both sides and anchored with hold-downs. The objectives were to determine the wall performance as a result of the three sheathing materials. One test – with GWB sheathing only – exhibited no visible damage after 20 load cycles. Thus, a second test – in which the load was doubled – was conducted, whereupon the wall failed after a few cycles. The total energy dissipated from this two test sequence was 2.3 times greater than the non-sequence test of walls sheathed with plywood.

Overall, these studies involve a sequence of tests conducted as a result of incomplete wall failure during the initial (or first) test. Therefore these test sequences were not intentional. Furthermore, the walls were non-conventionally sheathed, and only one wall was tested sequentially per study. Thus, it is clear that additional research beyond those mentioned is needed to determine wall performance during a sequence of earthquakes, or other load types.

MATERIALS AND METHODS

The following is a list of materials and methods used in this study that are identical to those described by White (2005). Refer to White (2005) for further detail:

1. Wall specimens and wall anchorage
2. Materials and methods of data collection
3. Backbone analysis
4. Wall failure modes

TEST FRAME AND EQUIPMENT

The test frame described by White (2005) was modified to apply a controlled vertical load to the test walls, as depicted in Figure 12. A 4.8 mm diameter steel cable was run through a series of pulleys. The cable attached to the steel load beam at two points that were 0.61 m in from each end of the wall. From there, the cable ran straight upward through the corresponding pulley at the top of the wall (each located at 0.61 m in from each end of the wall) and down the opposite side of the wall to two more pulleys located on the opposite face of the steel load beam and also 0.61 m in from each end of the wall. The cable was then attached to a 25.4 mm hydraulic cylinder with a 355 mm stroke. This setup yielded a 2:1 mechanical advantage and applied half of the total vertical load (5.35 kN) at two locations, both 0.61 m in from each end of the wall (Figure 12). A 4.45 kN load cell was installed in-line with the cable to provide feedback to a Continental Hydraulics® analog control board with proportional gain so that the vertical load

could be monitored and controlled. Aside from the modifications mentioned here, a more detailed description of the earthquake test setup is provided in Part A (White 2005).

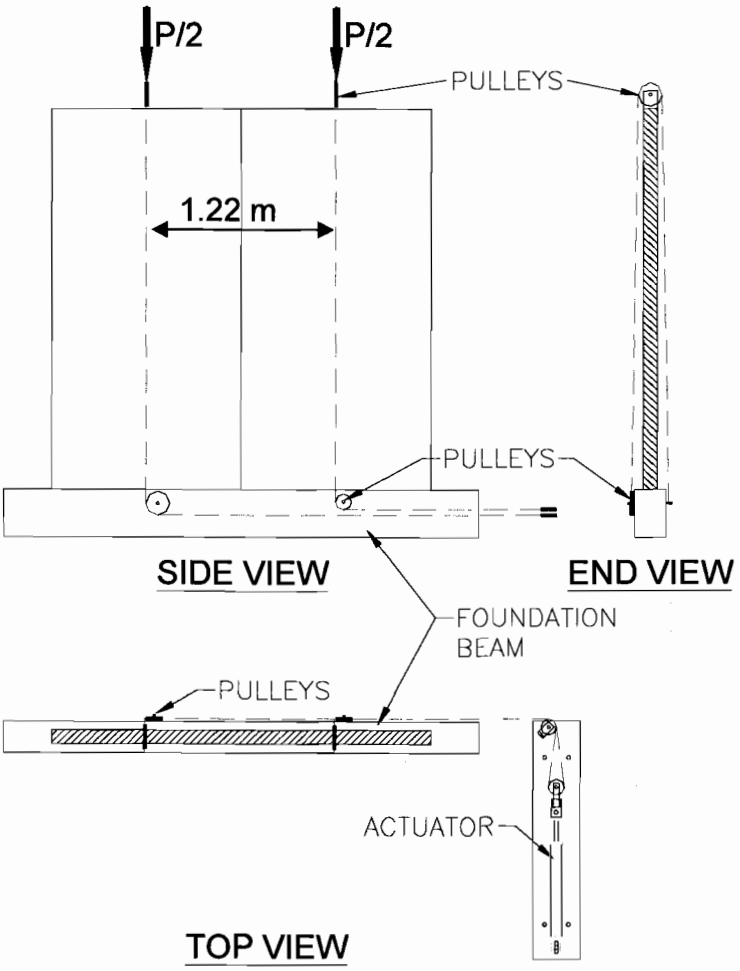

Figure 12. Schematic of Dead Load Assembly (Seaders 2004)

EARTHQUAKE TIME HISTORIES

Selection

Four earthquake ground motions from the SAC Steel Project (Somerville et al. 1997) (SE03, SE07, SE13, and SE19) were selected to conduct earthquake tests in Part A (White 2005). Since the earthquake tests in Part A did not incorporate vertical load, or a sequence of earthquake loads, they provided a benchmark to compare the results from this study. As a result, the ground motions from Part A encompassed a suite to choose from for earthquake tests that were to be conducted in Part B.

The SE19 ground motion was the most severe and caused the most observed damage to both fully and partially anchored walls in the earthquake tests described in White (2005). Thus, it was believed that the SE19 ground motion would be most likely among the four earthquake ground motions used to cause ultimate loading conditions to walls carrying vertical load. Therefore, the SE19 ground motion was selected for the fully and partially anchored dead load tests.

As for the earthquake test sequence, it was desired to subject walls to: (1) an original earthquake ground motion for the first test of the earthquake sequence (i.e. a displacement time history that actually occurred), (2) a sequence of ground motions that would not cause failure to fully or partially anchored walls in the first test of the earthquake sequence, and (3), a earthquake test used in Part A of this study for the second and final test of the earthquake sequence. This criterion would allow for inferences to be drawn based on performance comparisons of non-sequence tests in Part A (White 2005) with the second test of the sequence in this study. The SE13 ground motion seemed the most logical among those used in Part A that would fulfill all of these requirements; therefore it was selected for the earthquake test sequence.

Scaling

Three earthquake ground motions were used in this study: (1) the SE19 ground motion scaled to the Seattle design level (10% probability of exceedance in 50 yr.) was used in tests where vertical load was applied to walls, (2) the unscaled SE13 ground motion was used for the first test of the earthquake sequence, and (3), the SE13 ground motion scaled to the Seattle design level (10% probability of exceedance in 50 yr.) was used in the second and final test of the earthquake sequence.

Acceleration time-histories were obtained from the SAC Steel Project. However, they had been scaled from the original (or actual) ground motion to match a design spectrum at periods of interest for steel structures. Since steel structures generally have a longer period of vibration than wood frame structures, the time histories needed to be rescaled for this study. The procedure used to scale the time-histories to the Seattle Design Level (10% probability of exceedance in 50 yr.) was the same as described in Part A (White 2005), and was similar to that used in the SAC Steel Project. In addition, since the first test of the SE13 earthquake test sequence was an unscaled earthquake test (i.e. actual ground motion); a slightly different scaling method was used. In this case, the scaled (for steel structures) SE13 acceleration-time history obtained from the SAC Steel Project was rescaled to the original (or actual) time history using the inverse of the ratio (or scale factor) SAC used to scale it.

TEST MATRIX

Between Phase I and Phase II of this project 42 earthquake tests were conducted. Both phases consisted of two wall treatments (fully anchored and partially anchored) in order to determine the performance differences of these types of walls with respect to testing protocol. Although eight preliminary earthquake tests were conducted in Phase I of this project (Seaders 2004), it primarily focused on monotonic and cyclic testing. Earthquake testing was the primary interest of Phase II, in which 34 earthquake tests (corresponding to 30 walls) were conducted. Part A (White 2005) discussed the results of 20 earthquake tests. In this study – Part B – 14 earthquake tests (corresponding to 10 walls) were conducted, as shown in Table 15. Since Part B included an earthquake test sequence, the first test in the sequence will be referred to as SE13-1 (unscaled SE13 test) and the second test will be denoted SE13-2 (SE13 test scaled to Seattle design level). Both tests were conducted on the same wall. In addition, the results from the SE13 tests discussed in Part A (and conducted in Phase I of this project; Seaders 2004) will be referred to as SE13, and were used to gauge the effect of the earthquake test sequence.

Table 15. Test Matrix

Anchorage	SE19 with Vertical Load (1090 kg)	SE13 Earthquake Sequence[a]
PA	3	2
FA	3	2

[a]Comprised of SE13-1 and SE13-2 tests.

RESULTS AND DISCUSSION

EARTHQUAKE TESTING WITH DEAD LOAD

Failure Modes

Fully anchored walls with dead load subjected to the SE19 ground motion exhibited a significant amount of damage. Overall, the damage to the sheathing that attaches the OSB to the frame primarily consisted of nails withdrawing from the frame along all of the panel edges, and most intensively along the top plate, end studs, and sill plate. Along the center stud of the wall, the nails either tore through the edge of the panel or withdrew from the stud. About 25% of the screws along the end studs and center stud attaching the gypsum wallboard (GWB) to the frame fractured while the remainder caused severe localized crushing to the GWB. Screws along the top and bottom (sill) plates either caused severe localized crushing or tore out through the edge

of the panel, or both. Fasteners attaching the OSB or GWB sheathing to the frame along intermediate studs did not show signs of damage.

For partially anchored walls tested with dead load, the primary damage occurred along the sill plate. In this case, the nails attaching the OSB to the frame along the sill plate tore through the edge of the OSB at the outer edges of the wall and at the inner corners of the panels. The additional nails along the sill plate either withdrew from the sill plate or were pulled through the OSB sheathing. Additional damage included minor nail withdrawal from the frame along the top plate, end studs, and center stud. As for damage to the GWB, the screws attaching it to the frame along the top plate and end studs exhibited some severe localized crushing of the GWB. Screws along the center stud mostly caused severe localized crushing of the GWB, though some tore through the edge of the panel. At the sill plate, the screws tore out through the edge of the GWB panel along its entire length. No damage was observed around fasteners attaching the OSB or GWB to the frame along intermediate studs.

Overall, the damage patterns of fully anchored walls with dead load were consistent with, but more severe than, those of tests without dead load (discussed in White 2005). For partially anchored walls with vertical load, the primary damage of edge breakout at fasteners along the sill plate was consistent with tests not containing vertical load that were discussed by White (2005). However, partially anchored walls had additional damage that was not observed in the absence of dead load. This included a greater occurrence of nail withdrawal and localized crushing of the GWB along exterior framing members other than the sill plate. These additional fastener failures exhibited during partially anchored tests with dead load were common to fully anchored tests. This provides evidence that vertical load resisted overturning forces imposed upon the wall, and therefore suggests that with respect to failure mode, partially and fully anchored wall performance converge when vertical loads are applied. Pictures depicting the different types of damage from earthquake tests discussed in this document are provided by White (2005).

Effect Of Dead Load On Performance

Table 16 contains average performance parameters derived from backbone curves (Figure 13) for SE19 earthquake tests with and without a dead load of 1090 kg. Fully and partially anchored tests with dead load will be denoted SE19-FA-DL and SE19-PA-DL, respectively. SE19 tests of fully and partially anchored walls without dead load (discussed in White 2005) will be referred to as SE19-FA and SE19-PA, respectively. The SE19-FA and SE19-PA tests provide a baseline for determining the effect dead load has on wall performance under earthquake conditions.

Table 16. Selected Parameters from SE19 Earthquake Tests with and without Dead Load

Parameter	FA	FA-DL	% Diff.[a]	PA	PA-DL	% Diff.[a]
n	8	3	-	8	3	-
P_{max} (kN)	21.43	23.72	11	8.34	17.52	110
Δ_{max} (mm)	55.2	51.7	-6	20.0	60.8	204
E (J)	1396	1663	19	235	1263	437
k_e (kN/mm)	1.55	1.67	8	1.07	1.18	10
μ	6.39	6.62	4	6.10	7.40	21

[a]Percent difference of tests with dead load (DL) to tests without DL.

With respect to maximum load (P_{max}), the SE19-FA-DL tests exhibited an 11% increase compared to the SE19-FA test while the SE19-PA-DL test had a 110% increase in capacity compared to the SE19-PA test. Thus, as shown in Table 16, and as depicted in Figure 13, the results from this study show that the capacity of fully and partially anchored walls begins to converge when dead load is applied. This result agrees with the converging damage patterns previously discussed for fully and partially anchored walls. In addition, these results also agree with the monotonic tests from Ni and Karacabeyli (2002) and Seaders (2004), and the cyclic tests (ISO 98) from Ni and Karacabeyli (2002).

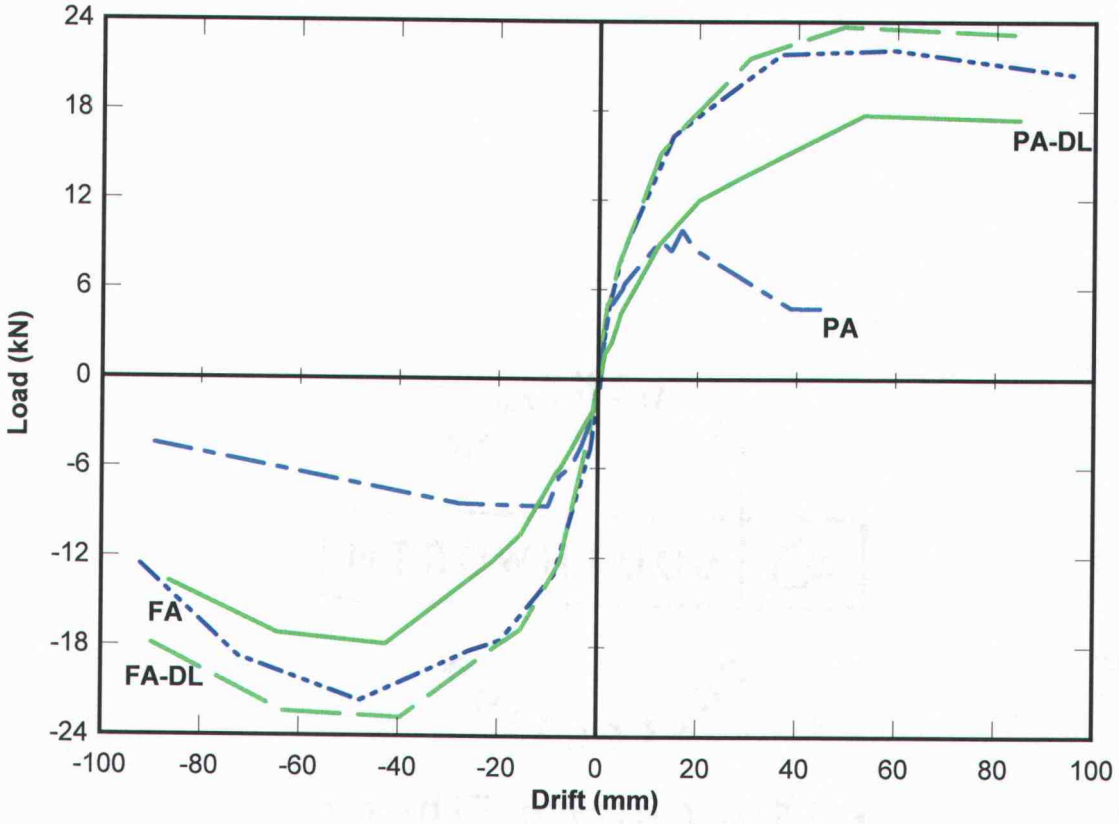

Figure 13. Typical Backbone Curves for SE19 Earthquake Tests of Fully and Partially Anchored Walls with and without Dead Load

For deflection at maximum load (Δ_{max}), the SE19-FA-DL test on average exhibited a slightly smaller value than the SE19-FA test (Table 16). The difference between Δ_{max} values from the two tests (3.5 mm) places Δ_{max} from the SE19-FA-DL test further than one standard deviation (±2.76 mm) below that of the SE19-FA test. Therefore, statistically, it seems likely that this difference stems from the application of dead load, and is also reflected in the 8% increase in wall stiffness (k_e, Table 16). For partially anchored walls, the application of dead load resulted in a 204% increase in Δ_{max} (Table 16). This increase in Δ_{max} is likely due to the 110% factor increase in wall capacity as a result of applied vertical load. If wall stiffness (k_e) had increased 110%, as was the case for wall capacity (because of dead load application), Δ_{max} levels for the SE19-PA and SE19-PA-DL tests would likely be more similar. In addition, the Δ_{max} levels for the SE19-PA-DL test were greater than that of the SE19-FA and SE-19-FA-DL tests. This could be due to the SE19-PA-DL test exhibiting wall stiffness that was 24% and 29% less than the SE19-FA and SE19-FA-DL tests, respectively.

With respect to energy dissipation (E), fully anchored walls exhibited a 19% increase while partially anchored walls had a 437% increase as a result of dead load application. Among the performance parameters shown in Table 16 for fully and partially anchored walls, energy dissipation had the largest relative change (gain or loss) due to dead load application. However, it is quite obvious that partially anchored walls have the greatest benefit from dead load application with respect to E; in this case nearly a 5.5 fold increase was seen. This is because partially anchored walls were able to carry much larger loads and corresponding deflections, as shown by the 110% and 204% increases for P_{max} and Δ_{max} in Table 16. The much smaller increase in E (19%) for the SE19-FA-DL test was also due to additional wall strength and a larger yield plateau, but to a smaller extent than the SE19-PA-DL test, as can be seen in Figure 13.

Fully anchored walls exhibited a slight increase in wall stiffness (k_e) and ductility (μ) with vertical load application (Table 16). For partially anchored walls with vertical load, the increases in k_e and μ were modest in comparison to those of P_{max}, Δ_{max}, and E. The modest (small) increases in k_e and μ for fully and partially anchored walls during the tests with vertical load may be merely due to the inherent variability of wood materials.

In general, partially anchored walls reaped the most benefit from vertical loading. For fully anchored walls, the changes in P_{max}, Δ_{max}, E, and μ were modest in comparison to the increases in these parameters for partially anchored walls due to vertical loading. This is because partially anchored wall performance is limited by the edge breakout capacity of the fasteners that attach the sheathing to the sill plate when dead load is absent. When dead load is present this limitation still exists, however the dead load adds additional resistance to the overturning forces that cause the edge breakout to occur, thereby increasing the wall performance.

Drift Performance

As shown in Table 17, the application of dead load decreased the peak drift (Δ_{peak}) and peak-to-peak drift (Δ_{p-p}) of fully anchored walls by 32% and 23%, respectively. The decrease in Δ_{peak} was not enough to satisfy the life safety transient drift limit requirement set forth by FEMA 356 (2000) of 2%, nor the collapse prevention requirement of 3% (Δ_{peak}/h Table 17). For partially anchored walls, Δ_{peak} decreased by 9% and Δ_{p-p} increased by 10%. These slight changes in Δ_{peak} and Δ_{p-p} for partially anchored walls are minimal in comparison to those exhibited for fully anchored walls, and in addition, because of their small size, they certainly may be due to the inherent variability of wood materials. Moreover, the slight decrease in Δ_{peak} for partially anchored walls was not enough to satisfy the collapse prevention drift limit requirement per FEMA 356. Overall, fully and partially anchored walls exhibited unsatisfactory drift performance with respect

to the FEMA 356 collapse prevention drift requirement, and fully anchored walls received the most benefit with respect to Δ_{peak} and Δ_{p-p} as a result of dead load application.

Table 17. Drift Performance of SE19 Tests for Fully and Partially Anchored Walls with and without Dead Load

Parameter	FA	FA-DL	% Diff.[a]	PA	PA-DL	% Diff.[a]
Δ_{peak} (mm)	144.0	98.0	-32	124.4	113.7	-9
Δ_{peak}/h (%)	5.2	4.0	-23	5.1	4.7	-8
Δ_{p-p} (mm)	211.7	189.3	-11	192.9	212.1	10

[a]Percent difference of tests with dead load (DL) to tests without DL.

SHEAR WALL RESPONSE DUE TO A SEQUENCE OF EARTHQUAKE TESTS

Failure Modes

For fully anchored walls, the SE13-1 test caused no visible damage. Most of the damage caused by the earthquake sequence came from the SE13-2 test. The SE13-2 test caused a few fasteners attaching the OSB to the sill plate at the outer edges of the wall to slightly withdraw from the framing. Additional damage included some minor nail withdrawal along the center stud, and pull-through along the GWB edges that was most severe at the bottom of the wall. Overall, for fully anchored walls, the damage from the SE13 earthquake sequence (SE13-1 and SE13-2) seemed to be slightly less than that resulting from the single SE13 test. This non-intuitive result is most likely due to: (1) the SE13-1 test not significantly loading the wall, and thus, having very little effect on the overall performance of the wall during the SE13-2 test, and (2) the larger stiffness of walls used in the earthquake test sequence (these two critical points will be discussed later).

For partially anchored walls, the SE13-1 test caused some minor nail withdrawal around the edges of the wall and some localized crushing of the GWB. Most damage to these walls resulted from the SE13-2 test. This damage primarily occurred along the sill plate and involved the nail fasteners that attach the OSB to the frame withdrawing from the frame and tearing through the edge of the panel. Likewise, the screws attaching the GWB to the frame tore through the panel edge along the sill plate. The fastener damage along the sill plate was less severe in the middle of the wall and most severe along the outer edges of the wall. In both tests some minor nail withdrawal from the frame occurred at the top plate, and in one test the end studs completely pulled free from the sill plate and were resting on top of the nails driven through their end-grain to attach them to the sill plate (shown in White 2005). As described here, most of the damage from the earthquake sequence resulted from the SE13-2 test, for partially anchored

walls. In addition, the total damage to partially anchored walls resulting from the SE13 earthquake sequence was about the same as that from the single SE13 test. This is likely a result of: (1) the SE13-1 test not significantly loading the wall, and thus, having very little effect on the overall performance of the wall during the SE13-2 test (discussed further in the next section), and (2) the finite amount of damage that partially anchored walls can accumulate since their capacity is limited by the edge breakout strength of the sheathing to sill plate fasteners (discussed in White 2005).

Performance Resulting From Unscaled SE13 Earthquake Test

Table 18 summarizes the average results of P_{max}, Δ_{max}, and E for fully and partially anchored walls from the SE13-1 and SE13-2 tests. In addition, Figure 14 depicts typical backbone curves for the SE13 test, and for the SE13-1 and SE13-2 tests.

Table 18. The Performance of Fully and Partially Anchored Walls during the SE13 Earthquake Test Sequence

Parameter	Fully Anchored			Partially Anchored		
	SE13-1	SE13-2	Ratio[a]	SE13-1	SE13-2	Ratio[a]
n	2	2	-	2	2	-
P_{max}[b] (kN)	10.57	21.69	2.1	6.59	9.47	1.4
Δ_{max}[b](mm)	4.4	30.6	7.0	7.9	21.1	2.7
E[b] (J)	24.3	469	19.3	31.6	244	7.7
k_4[c](kN/mm)	2.41	1.93	0.8	1.09	0.75	0.7
T_o[d] (sec)	0.273	0.305	1.1	0.406	0.489	1.2

[a]Ratio of SE13-2 values to SE13-1 values (SE13-2/SE13-1).

[b]Maximum observed values for SE13-1-FA, SE13-2-FA, and SE13-1-PA tests. Backbone curves did not reach ultimate load.

[c]Stiffness of backbone curve up to 4 mm.

[d]k_4 was used in T_o calculation.

For fully anchored walls, on average, the SE13-2 test caused loading that was about twice that seen during the SE13-1 test (Table 18), and no damage was observed from the SE13-1 test. In addition, for the SE13-1 test, Δ_{max} and E were minimal in comparison to those values from the SE13-2 test (Table 18). Moreover, an examination of Figure 14 for the SE13-1 test shows that the fully anchored wall backbone curve is linear. Overall, these results suggest that

the SE13-1 test caused linear elastic wall performance, and therefore did not result in damage to fully anchored walls.

For partially anchored walls, the SE13-2 test caused loading that was 44% greater than the SE13-1 test (Table 18). Damage from the SE13-1 test included some minor nail withdrawal and localized crushing of the GWB. Displacement at maximum load and energy dissipation levels from the SE13-1 test were much smaller than those from the SE13-2 test (Table 18). An examination of Figure 14 shows the backbone curve from the SE13-1 test for partially anchored walls is not as linear as the corresponding fully anchored backbone curve. This information suggests that partially anchored walls were affected more than fully anchored walls by the SE13-1 test. Overall, however, these results suggest that both fully and partially anchored walls were not significantly affected by the first test of the SE13 earthquake sequence (SE13-1).

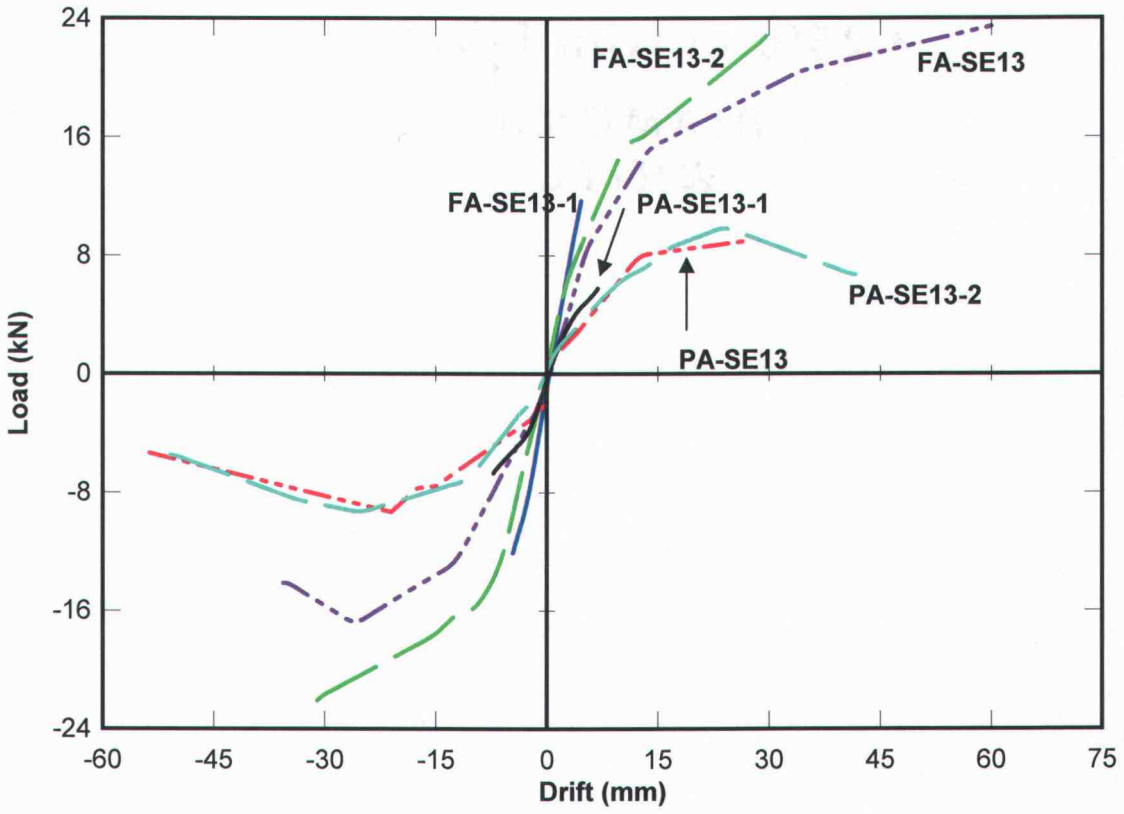

Figure 14. Typical Backbone Curves of Fully and Partially Anchored Walls from SE13 Sequence and Non-Sequence Earthquake Tests

For both fully and partially anchored walls, wall stiffnesses during the SE13-1 and SE13-2 tests were different. In this case the slope of the backbone curve up to 4 mm drift was used to

determine stiffness since the largest drift exhibited by fully anchored walls during the SE13-1 test was approximately 4 mm. During the SE13-2 test, fully and partially anchored walls exhibited approximately 20% and 30% lower stiffness (k_4) than during the corresponding SE13-1 test, respectively (Table 18). It is possible that load cycling during the SE13-1 test "loosened" nails within their embedment locations, and therefore caused this reduction in stiffness.

The lower wall stiffness during the second test (SE13-2) of the earthquake test sequence resulted in a longer fundamental period of vibration (To) when compared with the first test of the earthquake sequence (SE13-1). More specifically, the fundamental periods of fully anchored and partially anchored walls were about 10% and 20% larger during the second test of the earthquake sequence, respectively (Table 18). This increase in wall period means that there is a shift in the response spectrum, and therefore, this can affect the wall's response to ground motion.

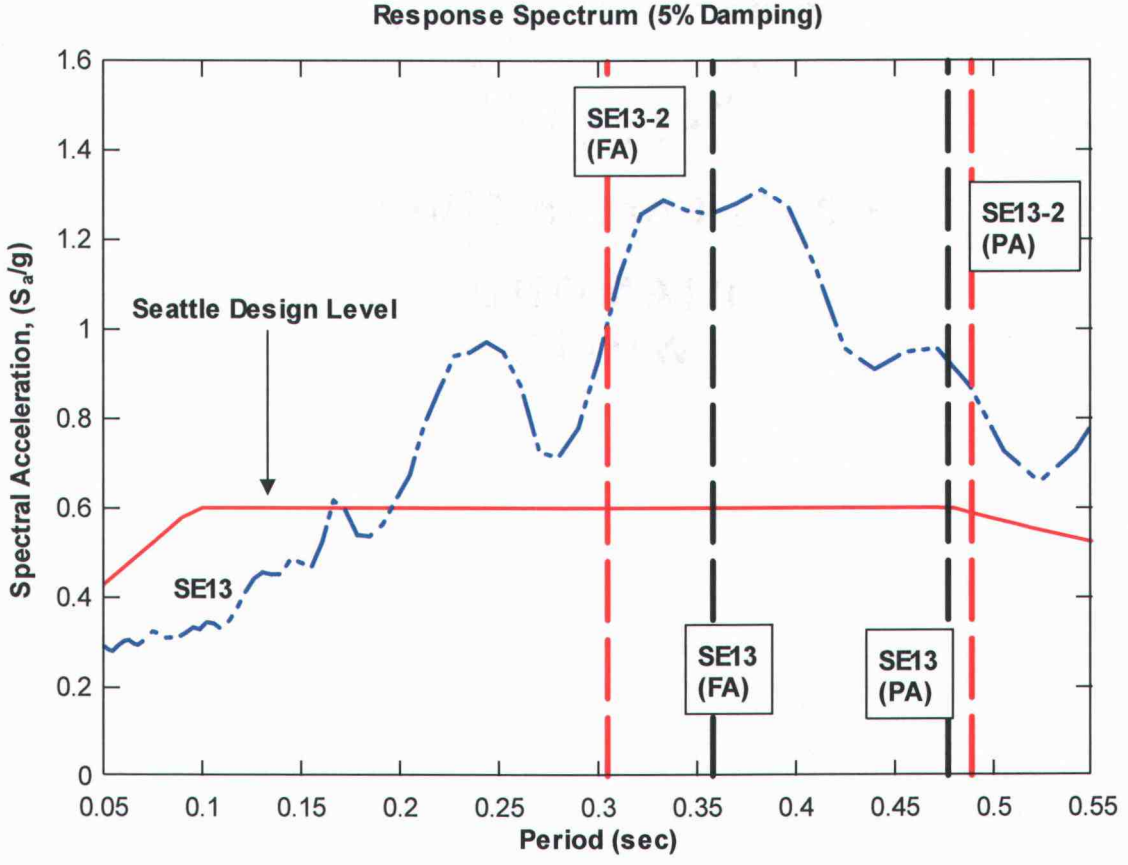

Figure 15. SE13 Response Spectrum showing spectral accelerations for SE13 Sequence and Non-Sequence Tests scaled to Seattle Design Level

Performance Resulting From Scaled SE13 Earthquake Test

For fully anchored walls the SE13-2 test did not cause ultimate loading conditions, therefore, maximum observed values are reported for this test in Table 19. Although ultimate load did not occur as a result of the SE13-2 test, Figure 14 shows that the fully anchored SE13-2 test yielded a backbone curve that provides an upper bound to that of the fully anchored SE13 test; however, it is not clear whether the backbone curve would have continued to provide an upper bound at drifts beyond those seen during the SE13-2 test. Nonetheless, this means that larger levels of wall strength, energy dissipation, and stiffness were achieved up to drifts of ±30 mm when walls were subjected to a sequence of SE13 earthquakes – this result is not intuitive.

Figure 15 shows: (1) the SE13 response spectrum scaled to the Seattle Design Level (10% in 50 yr.), and (2) T_o for fully and partially anchored walls during the SE13 non-sequence test and also during the second test of the earthquake sequence (SE13-2). There is a non-intuitive result based on Figure 15 that is worth pointing out. More specifically, fully anchored walls exhibited a longer period during the SE13 test than during the SE13-2 test (Figure 15). This is because wall stiffness (k_4) during the second test of the SE13 earthquake sequence was approximately 38% greater than that of fully anchored walls during the non-sequence SE13 test (Table 19). It seems most likely that this is due to the variability associated with wood materials and construction practices because: (1) two different crews constructed the walls, and (2) the framing members used in Phase II came from a different lot than those in Phase I, and they had a statistically significant lower modulus of elasticity and specific gravity than those of Phase I (shown in White 2005).

The 38% difference in fully anchored wall stiffness during SE13 and SE13-2 tests is significant since T_o and the spectral acceleration are a function of stiffness. In particular, for fully anchored walls, the difference in stiffness of the SE13 and SE13-2 tests resulted in the SE13 test having a spectral acceleration (1.26 g) that was about 24% larger than for the SE13-2 tests (1.02 g) (Figure 15). It seems most likely that this is why: (1) the SE13 test resulted in ultimate loading and wall failure whereas the SE13-2 test did not, (2) the backbone curve from the SE13-2 test had superior levels of wall strength, energy dissipation, and stiffness up to drifts of ±30 mm when compared with the SE13 test, and (3) the earthquake sequence (SE13-1 and SE13-2) seemed to cause less observed damage to fully anchored walls than the SE13 test.

For partially anchored walls, an examination of the backbone curves from the SE13 and SE13-2 tests reveals that both tests resulted in ultimate and failure loading conditions, and that the shape of the backbone curves appears to be quite similar (Figure 14). This suggests partially anchored walls exhibited similar performance during these two tests. Overall this appears to be the case for reasons discussed below.

With respect to wall capacity (P_{max}), the SE13-2 test exhibited an 8% larger P_{max} than that of the SE13 (Table 19). SE19 tests of partially anchored walls (discussed in White 2005) had a larger sample size (8 walls) and exhibited a coefficient of variation (COV) for P_{max} of approximately 9%. Thus, the 8% difference in P_{max} from the SE13 and SE13-2 tests appears to be within the variability associated with this parameter for earthquake tests due to the inherent nature of wood materials and construction practices.

A comparison of Δ_{max}, E, and k_4 from partially anchored SE13 and SE13-2 tests shows small differences, and therefore, also suggests that partially anchored walls had similar performance as a result of these tests (Table 19). In addition, μ from the SE13-2 test was 24% smaller than that of the SE13 test (Table 19). However, this difference is well within the 39% COV for μ from partially anchored SE19 tests discussed in White (2005) (Table 9) and therefore it seems likely that the difference is again due to the inherent variability of wood materials and construction practices. In addition, the 5% lower wall stiffness (k_4, Table 19) during the SE13-2 test corresponded to an SE13 response spectrum acceleration of 0.86 g that was only 8% lower than that of the SE13 test (0.93 g) (Figure 15). This also suggests that partially anchored wall response should be similar during the SE13 and SE13-2 tests, and therefore parallels the results for P_{max}, Δ_{max}, E, k_4, μ, and the backbone curves from these tests.

Overall, for partially anchored walls it appears likely that the SE13 test and the SE13-2 test exhibited similar performance as a result of: (1) the inherent variability associated with wood materials and corresponding construction practices, and/or (2) the SE13-1 test resulting in low levels of loading and causing very little damage to the wall.

Table 19. For Fully and Partially Anchored Walls: Performance from the SE13 Earthquake Test Sequence Compared with Wall Performance from the SE13 Non-Sequence Test

Parameter	Fully Anchored			Partially Anchored		
	SE13[a]	SE13-2[b]	% Diff.[c]	SE13	SE13-2	% Diff.[c]
n	2	2	-	2	2	-
P_{max} (kN)	23.38	21.69	-7	8.75	9.47	8
Δ_{max} (mm)	59.5	30.6	-49	22.9	21.1	-8
E (J)	744	469	-37	250	244	-2
k_4 (kN/mm)	1.40	1.93	38	0.79	0.75	-5
μ	4.05	-	-	4.06	3.10	-24
T_o[d] (sec)	0.358	0.305	-15	0.477	0.489	3

[a]Conducted by Seaders (2004) in Phase I. Reported values are average of (+) backbone curves due to asymmetry of earthquake response.

[b]Maximum observed values for P_{max}, Δ_{max}, and E . Backbone curves did not reach ultimate load.

[c]Percent difference of SE13-2 relative to SE13.

[d]k_4 was used in T_o calculation.

Drift Performance

Table 20 summarizes the drift response of fully and partially anchored walls as a result of the SE13-1 and SE13-2 tests. The drift performance of fully and partially anchored walls as a result of the SE13 test is also summarized in Table 20. This test provides a benchmark to determine the change in drift performance as a result of the SE13 earthquake test sequence.

As shown in Table 20, the drift of fully and partially anchored walls as a result of the unscaled SE13-1 test is minimal in comparison to that of the scaled SE13-2 and SE13 tests. This is because, as discussed previously, fully anchored walls exhibited elastic performance, and partially anchored performance was mostly elastic with some slight inelastic behavior as a result of the SE13-1 test. The peak drift (Δ_{peak}) and peak-to-peak drift (Δ_{p-p}) levels of partially anchored walls are about twice those of fully anchored walls for the SE13-1 test. This is likely because fully anchored wall stiffness (k_4, Table 19) was about twice that for partially anchored walls. Nonetheless, both fully and partially anchored walls met the immediate occupancy drift limit requirement of 1% per FEMA 356 (Δ_{peak}/h, Table 20) as a result of the SE13-1 test.

For fully anchored walls, Δ_{peak} and Δ_{p-p} from the SE13-2 test were 47% and 34% smaller, respectively, than those of the SE13 test (Table 20). Thus, the SE13-2 test met FEMA 356 life safety drift requirements (2%), whereas the SE13 test only met the collapse prevention requirement (3%). Likewise, for partially anchored walls tested with the SE13 earthquake

sequence, more favorable drift performance with respect to Δ_{peak} and Δ_{p-p} was exhibited during the SE13-2 test. In this case Δ_{peak} and Δ_{p-p} were 39% and 24% smaller, respectively, than those of the SE13 test (Table 20). Thus, for partially anchored walls, only the SE13-2 test met the collapse prevention requirement.

Table 20. Drift Performance of Fully and Partially Anchored Walls as a Result of the SE13 Earthquake Test Sequence

Parameter	Fully Anchored				Partially Anchored			
	SE13-1	SE13	SE13-2	% Diff.[a]	SE13-1	SE13	SE13-2	% Diff.[a]
Δ_{peak} (mm)	4.9	65.9	34.7	-47	9.7	102.5	62.1	-39
Δ_{peak}/h (%)	0.2	2.7	1.4	-48	0.4	4.2	2.5	-40
Δ_{p-p} (mm)	9.3	98.9	65.2	-34	17.5	132.2	100.7	-24

[a]Percent difference of SE13-2 relative to SE13.

Although the results do not seem intuitive, they show that fully and partially anchored walls in this study had favorable Δ_{peak} and Δ_{p-p} drift performance during the SE13 earthquake test sequence when compared to the single SE13 test. For fully anchored walls, this result most likely stems from walls having a 38% larger wall stiffness and a subsequent 24% lower SE13 response spectrum acceleration during the SE13-2 test, when compared with the non-sequence SE13 test.

For partially anchored walls, the non-intuitive results contradict those discussed earlier showing similar wall performance for these walls during the SE13 and SE13-2 tests. Since the wall stiffness (k_4) from SE13 and SE13-2 tests were within 5%, this corresponded to a small difference (8%) in the SE13 spectral acceleration (Figure 15). Thus, it appears that the difference in response for these walls is not due to a different location in the SE13 response spectrum, as appears to be the case for corresponding fully anchored tests. In addition, the large differences in Δ_{peak} and Δ_{p-p} (40% and 24%, Table 20) from SE13 and SE13-2 partially anchored tests were considerably higher than the 10% and 6% COV's for Δ_{peak} and Δ_{p-p} from partially anchored SE19 tests.

For partially anchored walls, and based on the previous discussion, it is inconclusive as to why the SE13-2 test (and thus the SE13 earthquake test sequence) exhibited favorable drift response (Δ_{peak} and Δ_{p-p}) compared with the SE13 test. However, it is likely that earthquake test sequences comprised of ground motions different from SE13 may yield different results. For this reason, additional shear wall test sequences should be conducted.

CONCLUSIONS

Conclusions based on the results of this study include:

1. For partially anchored walls with vertical load, the failure modes were consistent with those tests not containing vertical load, however additional fastener damage common to fully anchored walls was manifested as a result of the vertical load providing additional resistance to overturning forces. In general, with respect to P_{max}, Δ_{max}, E, and μ, partially anchored walls realized a greater improvement in performance as a result of dead load application when compared with fully anchored walls. Therefore, these results provide additional evidence suggesting that partially anchored wall performance converges with that of fully anchored walls when vertical load is applied.

2. Fully and partially anchored walls were tested with the following sequence of ground motions: (1) an unscaled SE13 ground motion, and (2) a scaled to Seattle Design Level (10% in 50 yr.) SE13 ground motion. As a result of this sequence, fully anchored walls exhibited wall strength, energy dissipation, and stiffness up to drifts of ±30 mm better than or equal to walls subjected to a single SE13 ground motion scaled to the Seattle Design Level. Peak drift (Δ_{peak}) and peak-to-peak drift (Δ_{p-p}) performance were also favorable during the SE13 earthquake sequence. It appears that these non-intuitive results are due to: (1) the first test of the SE13 earthquake sequence (SE13-1) resulting in loading levels well below the capacity of the wall and thereby causing no visible damage, and (2) the variability associated with wood materials and construction resulting in wall stiffness that was at least 38% greater during the SE13 earthquake sequence when compared with the single non-sequence SE13 test.

3. Partially anchored walls tested with a sequence of SE13 ground motions exhibited performance with respect to wall capacity (P_{max}), deflection at maximum load (Δ_{max}), energy dissipation (E), and wall stiffness up to 4 mm (k_4) that was about the same as that from the non-sequence SE13 test. It appears likely that these results are due to: (1) the SE13-1 test resulting in low levels of loading and causing very little damage to the wall, and/or (2) the typical variation in these parameters due to the inherent variability associated with wood materials and corresponding construction practices.

4. Partially anchored walls tested with a sequence of SE13 ground motions exhibited performance with respect to peak drift (Δ_{peak}) and peak-to-peak drift (Δ_{p-p}) that was

favorable in comparison to that from the non-sequence SE13 test. It appears these non-intuitive results are not due to: (1) a different location on the SE13 response spectrum, and (2) the typical variation of Δ_{peak} and Δ_{p-p} due to the inherent variability associated with wood materials and construction practices. It is inconclusive as to why partially anchored walls tested with a sequence of SE13 ground motions exhibited favorable drift response (Δ_{peak} and Δ_{p-p}) when compared with the single SE13 test.

Recommendations based on the results of this study include:

1. Additional research is needed to comprehensively assess the effect of vertical loads on the performance of shear walls under realistic seismic and wind conditions since this could lead to a more efficient design and utilization of materials as a result of the performance increase (as observed in this study).

2. Further research is needed to comprehensively assess the effect of a sequence of common lateral loads (earthquake or wind) on the performance of shear walls.

3. Future shear wall testing research should maintain a record that contains modulus of elasticity, moisture content, specific gravity, and location (within wall) for all framing members.

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CHAPTER 4. GENERAL CONCLUSIONS

Forty-two earthquake tests of fully and partially anchored walls were conducted in this two-phase project. Thirty-six of these earthquake tests were conducted in this study, Phase II. The earthquake test data were analyzed to: (1) evaluate the performance differences of fully and partially anchored walls under earthquake loads, (2) compare wall performance under earthquake loading with standardized monotonic and cyclic loading (from Phase I of this project), and (3) evaluate the earthquake performance with respect to code measures. Based on the results from this study, the following conclusions are made:

1. Partially anchored subduction zone earthquake tests caused wall failure modes that were consistent with monotonic and cyclic tests from Phase I of this project. Fully anchored subduction zone earthquake tests caused wall failure modes that were consistent with cyclic tests from Phase I of this project. Fully anchored monotonic tests from Phase I of this project did not cause screw fracture or nail withdrawal, and therefore did not have failure modes consistent with subduction zone earthquake tests.

2. Fully and partially anchored walls exhibited different load paths. The partially anchored wall load path involved the sheathing to frame fasteners along the sill plate to transmit overturning forces into the foundation, whereas fully anchored walls utilized hold-downs for this load transfer. For this reason, partially anchored walls exhibited less favorable performance with respect to wall capacity (P_{max}), deflection at maximum load (Δ_{max}), energy dissipation (E), and initial stiffness (k_e), and exhibited less variability in observed damage with respect to damage severity, location, and abundance.

3. For SE19 earthquake tests, fully anchored walls had statistically significant larger capacity (P_{max}), deflection at maximum load (Δ_{max}), energy dissipation (E), and initial stiffness (k_e) when compared with partially anchored walls. In addition, statistically significant differences were not found for wall ductility (μ) of fully and partially anchored walls.

4. For fully anchored walls, subduction zone ground motions causing more reverse loading cycles up to maximum loading conditions (# cycles P_{max}) and/or dissipating more energy up to these conditions (E_{Pmax}) resulted in smaller wall capacities (P_{max}). These

observations did not apply to partially anchored walls since their capacity seemed to be limited by the edge breakout strength of the sheathing to sill plate fasteners.

5. For fully anchored walls, with respect to monotonic and cyclic tests from Phase I of this project, subduction zone earthquake tests had capacities (P_{max}) and energy dissipation (E) levels that were most similar to the cyclic tests, rather than the monotonic tests. The monotonic and cyclic tests from Phase I of this project did not provide a good representation of subduction zone earthquake tests with respect to deflection at maximum load (Δ_{max}), initial wall stiffness (k_e), and wall ductility (μ).

6. For partially anchored walls, with respect to monotonic and cyclic tests from Phase I of this project, subduction zone and strike-slip earthquake tests had capacities (P_{max}), deflection at maximum load (Δ_{max}), initial stiffness (k_e), and wall ductility (μ) that were most similar to the cyclic tests; however, energy dissipation (E) levels were most similar to the monotonic tests.

7. For partially anchored walls, and with respect to wall capacity (P_{max}), deflection at maximum load (Δ_{max}), energy dissipation (E), initial stiffness (k_e), and wall ductility (μ), monotonic tests resulted in statistically significant greater P_{max}, and cyclic tests resulted in statistically significant smaller E when compared with the SE19 earthquake test. No other statistically significant differences were found when comparing the SE19 earthquake test with monotonic and cyclic tests.

8. Design level earthquakes may cause similar cumulative drift ($\Delta_{cumulative}$) response for fully and partially anchored walls, and the peak drift (Δ_{peak}) performance of these walls may be similar during design level earthquakes that result in high energy demands or cumulative wall drift.

9. Among the fully and partially anchored subduction zone earthquake tests in Phase I and Phase II of this project, the fully anchored SE13 test was the only one to satisfy FEMA 356 collapse prevention interstory drift requirements. For fully anchored walls, the SE03 strike-slip earthquake test met the life safety interstory drift requirements, and for partially anchored walls, it met the collapse prevention interstory drift requirements.

10. For fully and partially anchored walls, earthquake tests resulting in high levels of cumulative drift ($\Delta_{cumulative}$), energy dissipation (E), and total energy dissipation (E_{total}) met the FEMA 356 m-factor acceptance criteria. For partially anchored walls, it is inconclusive whether m-factors from monotonic and cyclic tests are good representations for subduction zone and strike-slip earthquake tests. For fully anchored walls, m-factors from cyclic tests provided a conservative representation of those from subduction zone earthquake tests.

11. For partially anchored walls with vertical load, the failure modes were consistent with those tests not containing vertical load, however additional fastener damage common to fully anchored walls was manifested as a result of the vertical load providing additional resistance to overturning forces. In general, with respect to P_{max}, Δ_{max}, E, and μ, partially anchored walls realized a greater improvement in performance as a result of dead load application when compared with fully anchored walls. Therefore, these results provide additional evidence suggesting that partially anchored wall performance converges with that of fully anchored walls when vertical load is applied.

12. Fully and partially anchored walls were tested with the following sequence of ground motions: (1) an unscaled SE13 ground motion, and (2) a scaled to Seattle Design Level (10% in 50 yr.) SE13 ground motion. As a result of this sequence, fully anchored walls exhibited wall strength, energy dissipation, and stiffness up to drifts of ±30 mm better than or equal to walls subjected to a single SE13 ground motion scaled to the Seattle Design Level. Peak drift (Δ_{peak}) and peak-to-peak drift ($\Delta_{p\text{-}p}$) performance were also favorable during the SE13 earthquake sequence. It appears that these non-intuitive results are due to: (1) the first test of the SE13 earthquake sequence (SE13-1) resulting in loading levels well below the capacity of the wall and thereby causing no visible damage, and (2) the variability associated with wood materials and construction resulting in wall stiffness that was at least 38% greater during the SE13 earthquake sequence when compared with the single non-sequence SE13 test.

13. Partially anchored walls tested with a sequence of SE13 ground motions exhibited performance with respect to wall capacity (P_{max}), deflection at maximum load (Δ_{max}), energy dissipation (E), and wall stiffness up to 4 mm (k_4) that was about the same as that from the non-sequence SE13 test. It appears likely that these results are due to: (1) the SE13-1 test resulting in low levels of loading and causing very little damage to the wall,

and/or (2) the typical variation in these parameters due to the inherent variability associated with wood materials and corresponding construction practices.

14. Partially anchored walls tested with a sequence of SE13 ground motions exhibited performance with respect to peak drift (Δ_{peak}) and peak-to-peak drift ($\Delta_{p\text{-}p}$) that was favorable in comparison to that from the non-sequence SE13 test. It appears these non-intuitive results are not due to: (1) a different location on the SE13 response spectrum, and (2) the typical variation of Δ_{peak} and $\Delta_{p\text{-}p}$ due to the inherent variability associated with wood materials and construction practices. It is inconclusive as to why partially anchored walls tested with a sequence of SE13 ground motions exhibited favorable drift response (Δ_{peak} and $\Delta_{p\text{-}p}$) when compared with the single SE13 test.

In addition, based on the results from this study, the following recommendations are being presented:

1. Further earthquake testing research is needed to determine whether cyclic tests should be used as the standard from which design values are obtained for fully and partially anchored walls, as results from this study suggest.

2. Additional earthquake tests should be conducted on partially anchored walls constructed with innovative designs to minimize their capacity dependence upon the edge breakout strength of the fasteners attaching the sheathing to the sill plate. This may lead to more robust non-engineered walls that use natural resources more efficiently.

3. Additional earthquake tests should be conducted to determine if the FEMA 356 m-factor acceptance criteria needs to be revised to reflect differences in ductility of fully and partially anchored walls.

4. Research should be directed towards developing cost effective methods of modifying fully anchored walls such that they have fewer (or smaller with respect to drift) reversed loading cycles resulting in lower levels of cumulative drift ($\Delta_{cumulative}$) and improved wall performance with respect to peak drift (Δ_{peak}).

5. If current standardized test procedures are used to develop FEMA 356 m-factors, they should be based upon cyclic tests (rather than monotonic tests) for fully anchored walls since cyclic test m-factors appear to be lower and therefore more conservative.

6. Further research is needed to investigate the performance of fully and partially anchored walls when subjected to time-histories with response spectra different from those used in this study.

7. Additional research is needed to comprehensively assess the effect of vertical loads on the performance of shear walls under realistic seismic and wind conditions since this could lead to a more efficient design and utilization of materials as a result of the performance increase (as observed in this study).

8. Further research is needed to comprehensively assess the effect of a sequence of common lateral loads (earthquake or wind) on the performance of shear walls.

9. Future shear wall testing research should maintain a record that contains modulus of elasticity, moisture content, specific gravity, and location (within wall) for all framing members.

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CHAPTER 6. APPENDICES

APPENDIX A: NOTATION

The following is a list of the symbols used in this paper:

Symbol	*Units*	Parameter Description
C_s		Seismic response coefficient
C_t		Numerical value for adjustment of period (0.060 for wood buildings)
E	*J*	Calculated energy under the backbone curve up to $0.8P_{max}$ post-peak
E_{cyclic}	*J*	Total energy dissipated during the entire duration of cyclic testing
E_{Pmax}	*J*	Total energy dissipated up to and including hysteretic cycle containing P_{max}
E_{total}	*J*	Total energy dissipated during the entire duration of earthquake testing
h	*mm*	Story height of the building (2438 mm)
h_n	*ft*	Height to roof level
H_o		Null hypothesis
k_4	*kN/mm*	Slope of backbone curve up to 4 mm
k_e	*kN/mm*	Initial wall stiffness ($0.4P_{max}/\Delta_e$)
m		Modification factor for elements (FEMA 356)
M_w		Earthquake magnitude
n		Sample size (or number of observations)
$P_{failure}$	*kN*	Failure load: backbone curve load at $0.8P_{max}$ post-peak
P_{max}	*kN*	Maximum load achieved during test
P_{yield}	*kN*	Yield load $(\{\Delta_{failure} - [(\Delta_{failure})^2-(2*E/k_e)]^{0.5}\}*k_{e)}$
Q_{CE}	*lb*	Expected element strength at the deformation level being considered
Q_{UD}	*lb*	Ductile design action due to earthquake and gravity forces
S_a	*g*	Spectral acceleration
S_d		Site class D (stiff soil with 183 m/sec < v_s ≤ 366 m/sec)
total cycles		Number of load reversing cycles during test
T	*sec*	Building period ($C_t*h_n^{\beta}$) per FEMA 356
$T_{failure}$	*sec*	Failure period $[2\pi*(k_{secant}/mass)^{0.5}]$ (k_{secant} of hysteretic cycle containing P_{max})
T_o	*sec*	Fundamental period $[2\pi*(k_e/mass)^{0.5}]$
U_{max}	*mm*	Maximum uplift between foundation and stud at end of wall
v_s	*m/sec*	Shear wave velocity of soil
V	*kN*	Base shear
W	*lb*	Weight of building (weight of all structural and non-structural components)
β		Factor to adjust the building fundamental period (0.75 for wood buildings)
κ		Knowledge factor (FEMA 356)
$\Delta_{cumulative}$	*mm*	Cumulative drift: summation of total change in wall drift during entire test
$\Delta_{cumulative\text{-}Pmax}$	*mm*	Summation of total change in wall drift up to and including cycle containing P_{max}
Δ_e	*mm*	Displacement on backbone curve corresponding to $0.4P_{max}$

Symbol	*Units*	Parameter Description
$\Delta_{failure}$	*mm*	Failure displacment: backbone curve displacement at $0.8P_{max}$ post-peak
Δ_{IO}	*mm*	$0.5025*\Delta_{failure}$
Δ_{LS}	*mm*	$0.75*\Delta_{failure}$
Δ_{max}	*mm*	Displacment at maximum load, displacement corresponding to P_{max}
Δ_{peak}	*mm*	Maximum wall drift experienced during test
Δ_{yield}	*mm*	Yield displacement $(\Delta_{failure} - [(\Delta_{failure})^2-(2*E/k_e)]^{0.5})$
μ		Wall ductility $(\Delta_{failure}/\Delta_{yield})$
μ_i		Mean value
σ_i		Standard deviation
cycles to P_{max}		Number of load reversing cycles up through cycle containing P_{max}

APPENDIX B: DAMAGE PHOTOS

FULLY ANCHORED EARTHQUAKE TESTS

Figure 1. OSB sheathing nail withdrawal along the sill plate

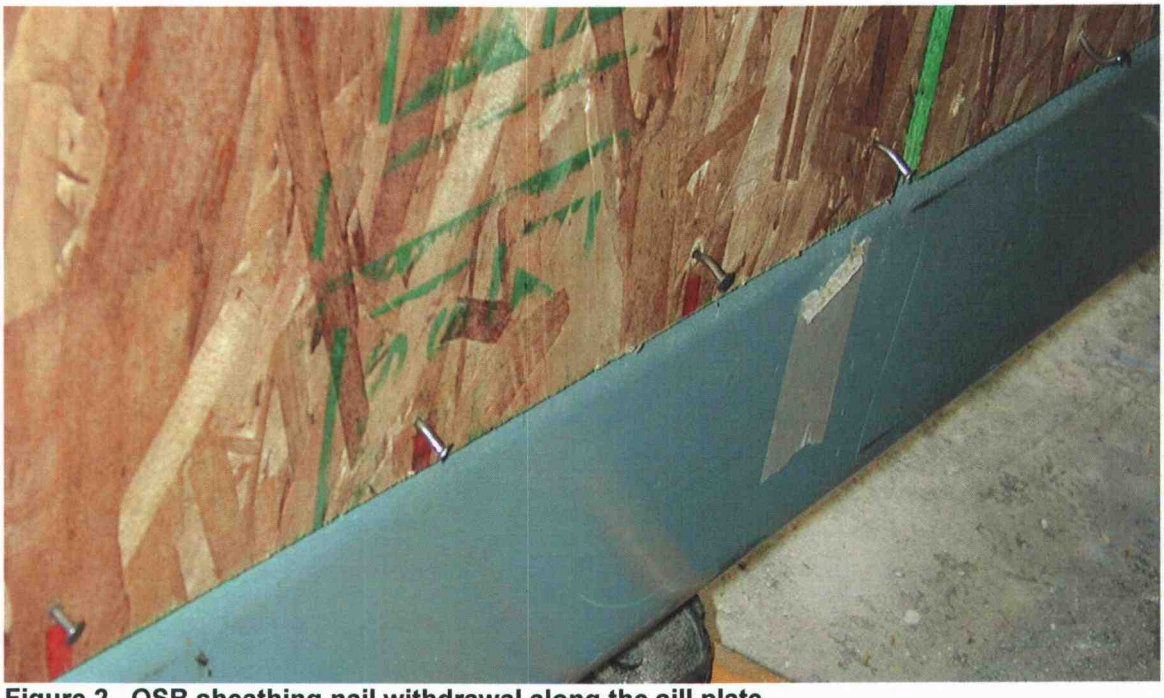


Figure 2. OSB sheathing nail withdrawal along the sill plate

Figure 3. Splitting of sill plate caused by tension perpendicular to the grain

Figure 4. OSB sheathing nail withdrawal along the top plate (at top of picture) and OSB separation from the framing at the center stud (at left of picture)

Figure 5. OSB separation from the framing along the center stud

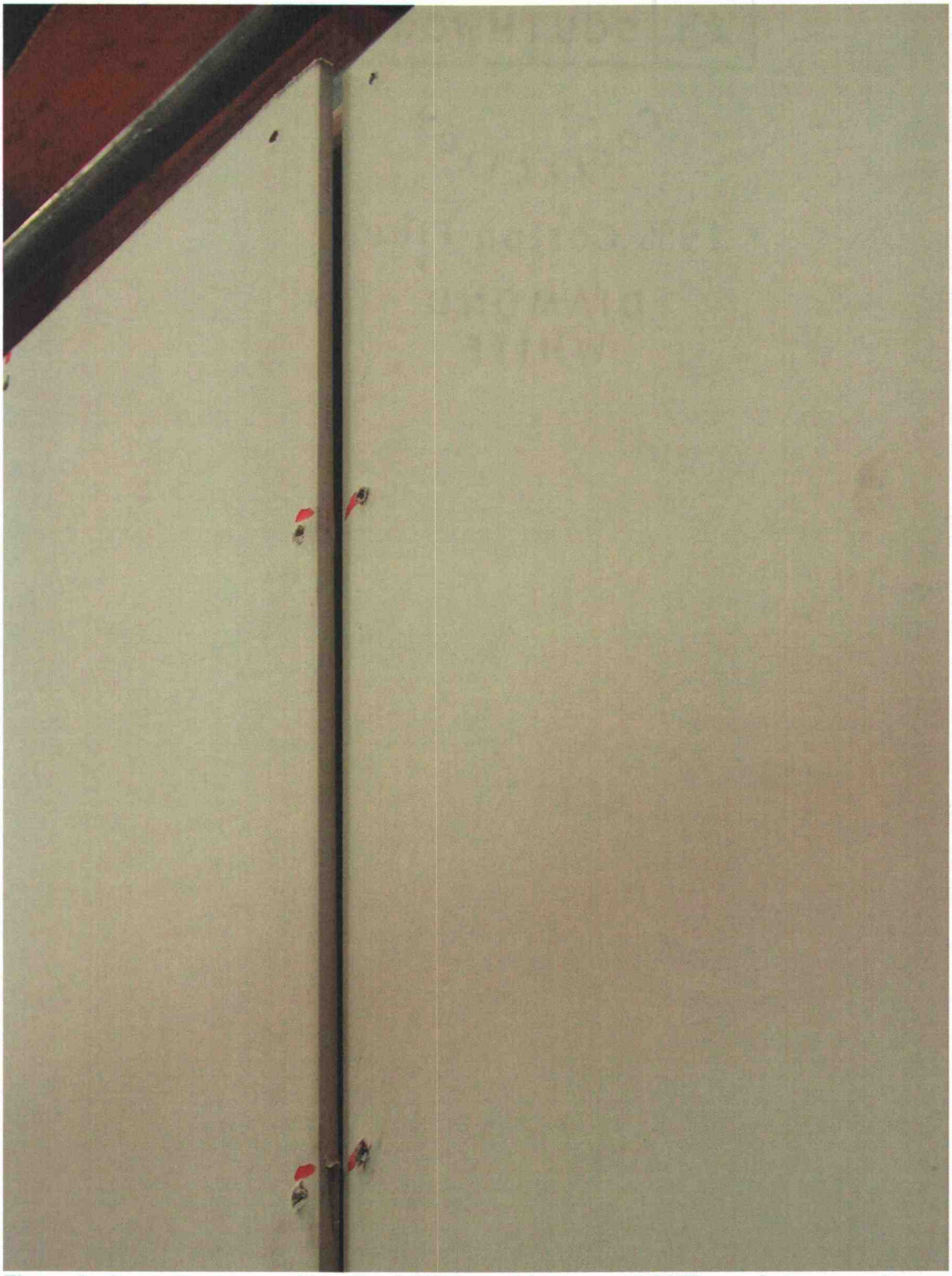


Figure 6. Screw fracture and localized GWB crushing caused GWB panels to separate from the framing along the center stud

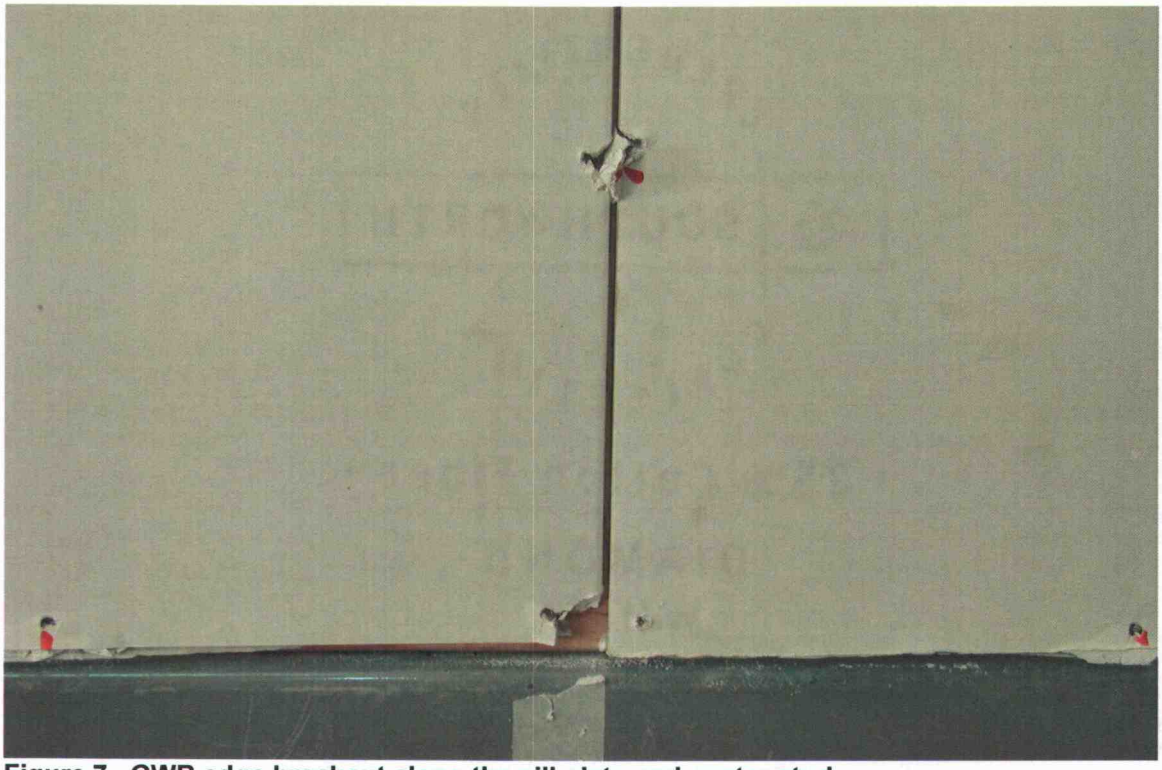


Figure 7. GWB edge breakout along the sill plate and center stud

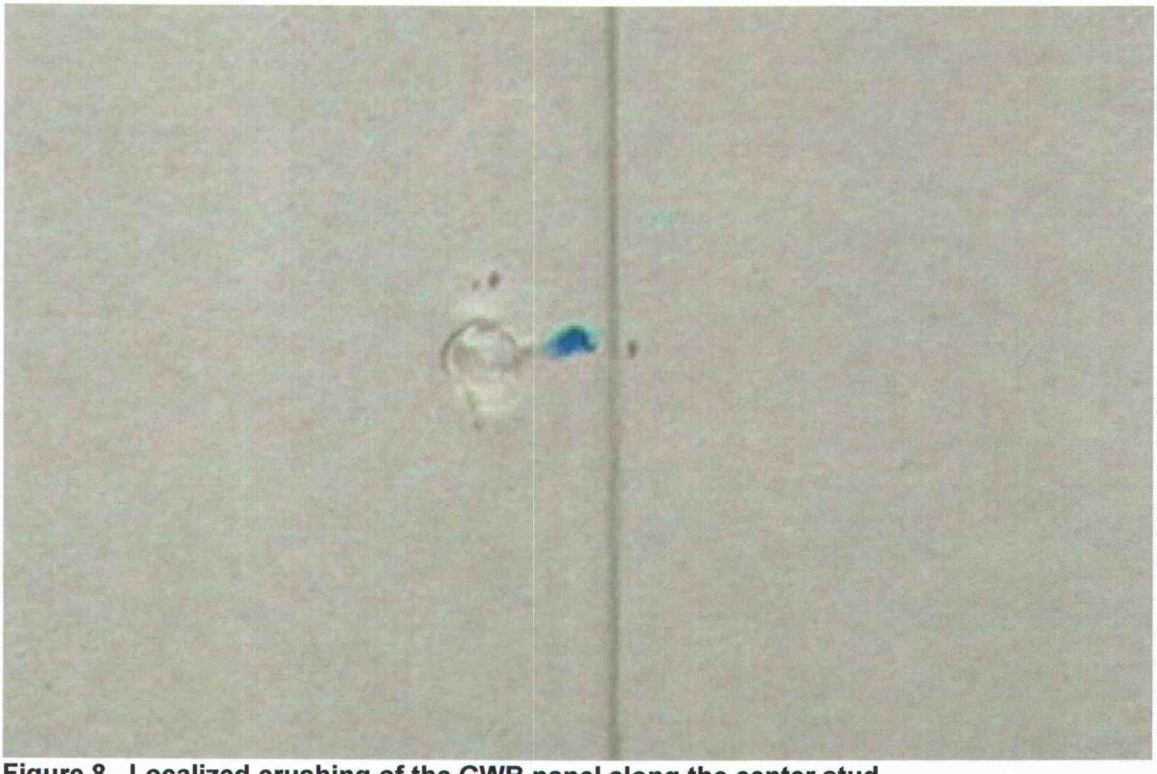


Figure 8. Localized crushing of the GWB panel along the center stud

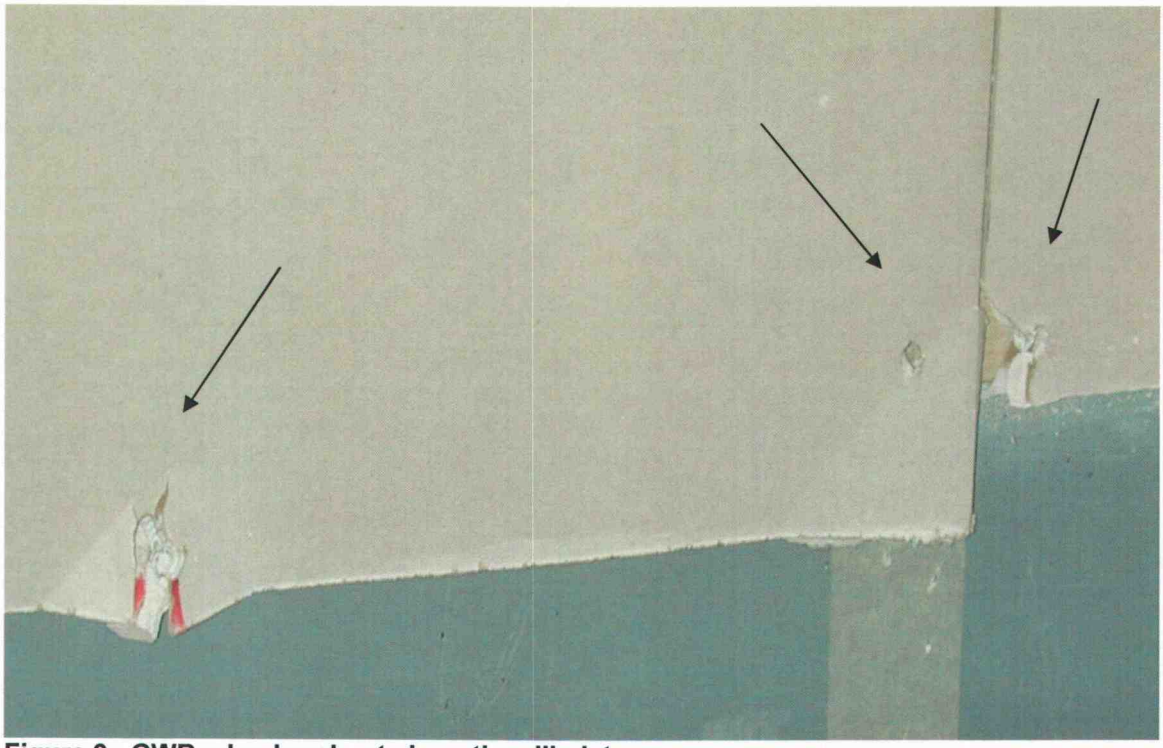


Figure 9. GWB edge breakout along the sill plate

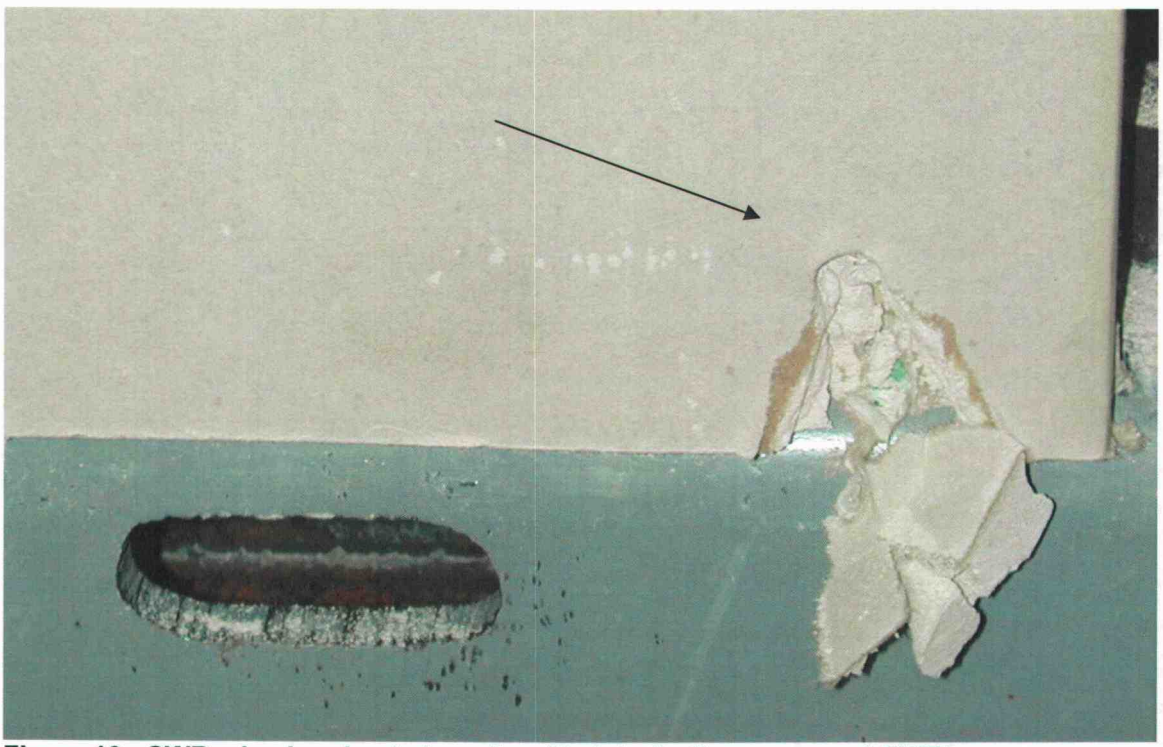


Figure 10. GWB edge breakout along the sill plate (bottom corner of GWB)

Figure 11. Uplift caused wall end stud to separate from the sill plate

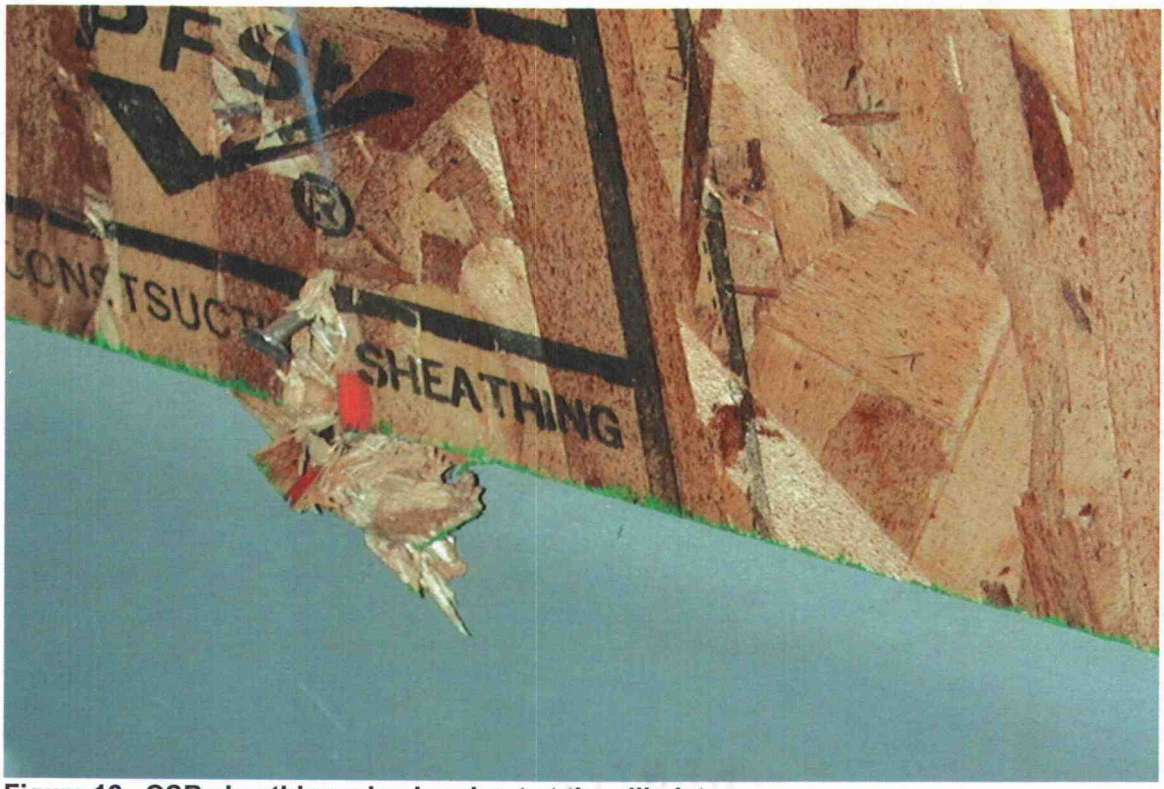


Figure 12. OSB sheathing edge breakout at the sill plate

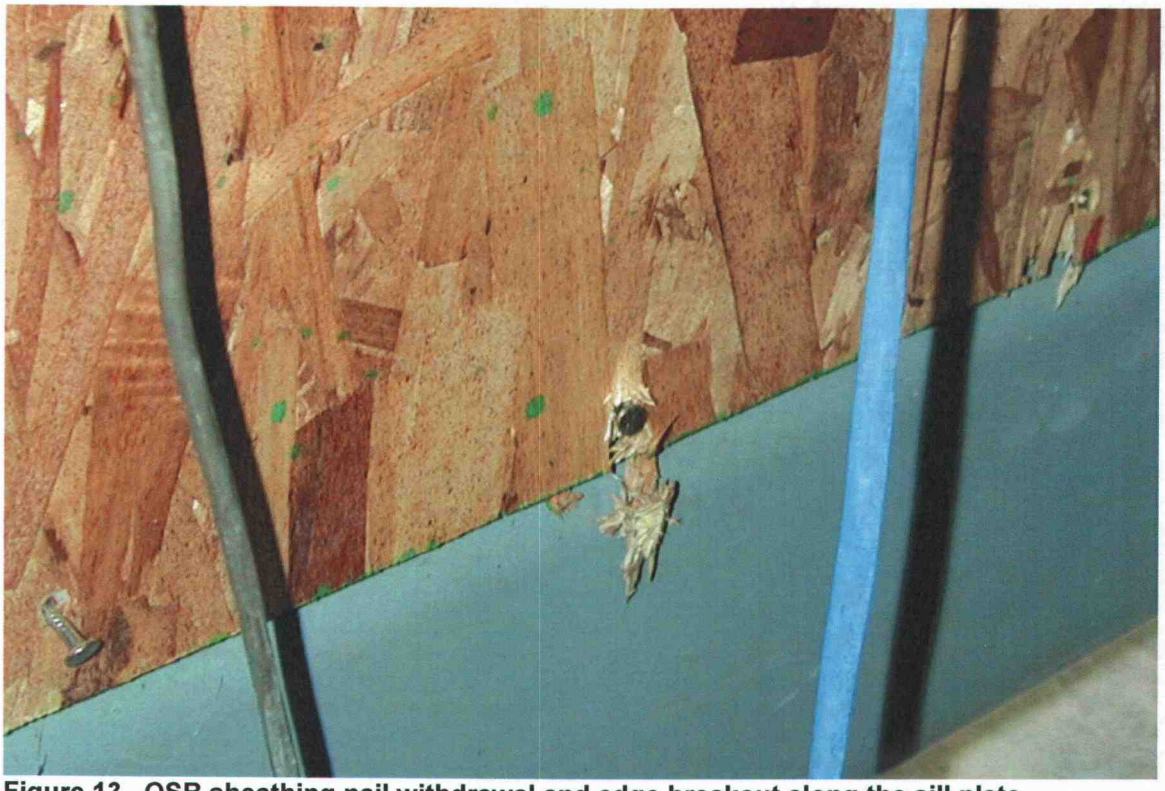


Figure 13. OSB sheathing nail withdrawal and edge breakout along the sill plate

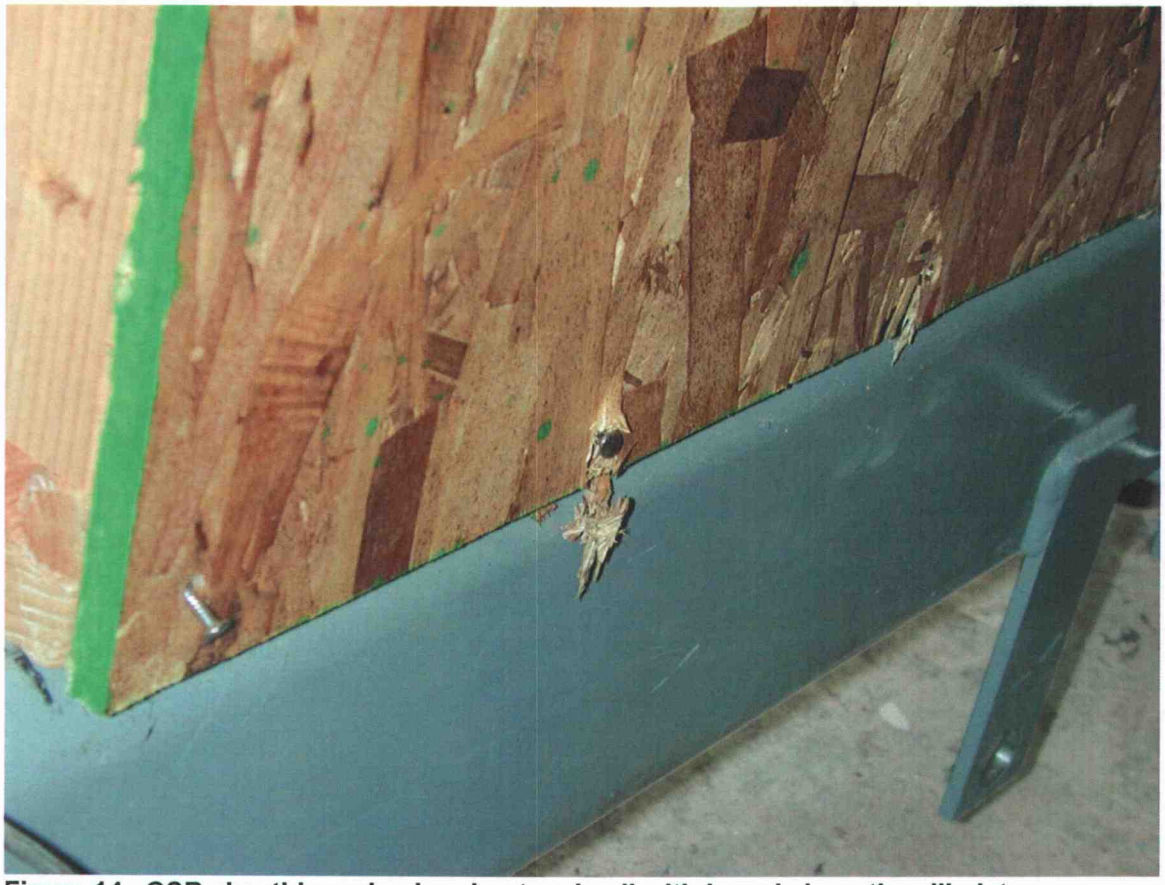


Figure 14. OSB sheathing edge breakout and nail withdrawal along the sill plate

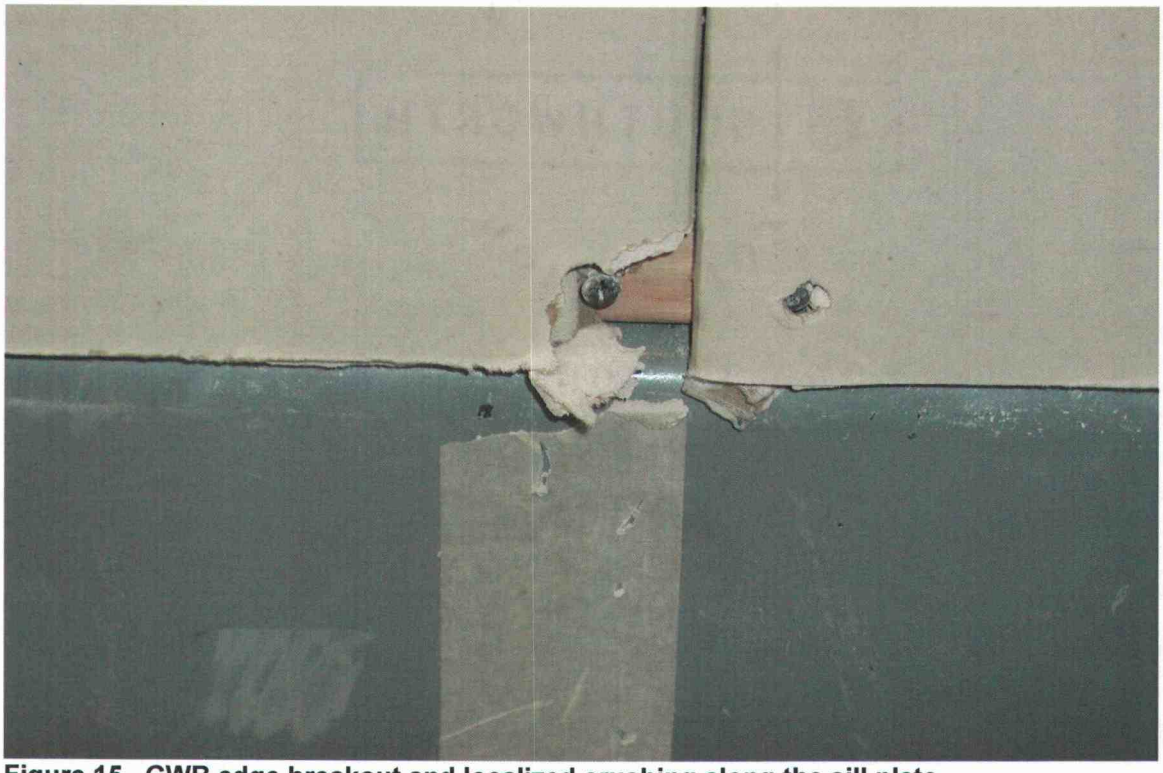


Figure 15. GWB edge breakout and localized crushing along the sill plate

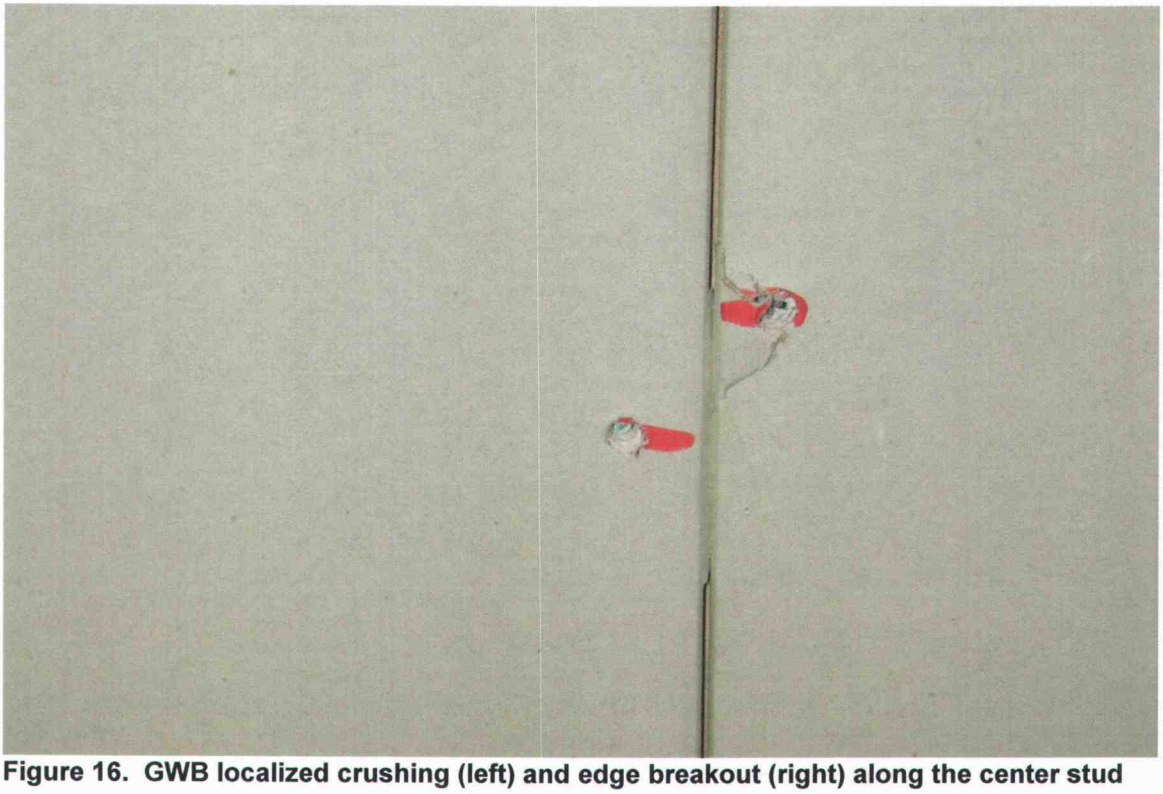


Figure 16. GWB localized crushing (left) and edge breakout (right) along the center stud

Figure 17. OSB sheathing edge breakout (left) and nail pull-through along the sill plate (right)

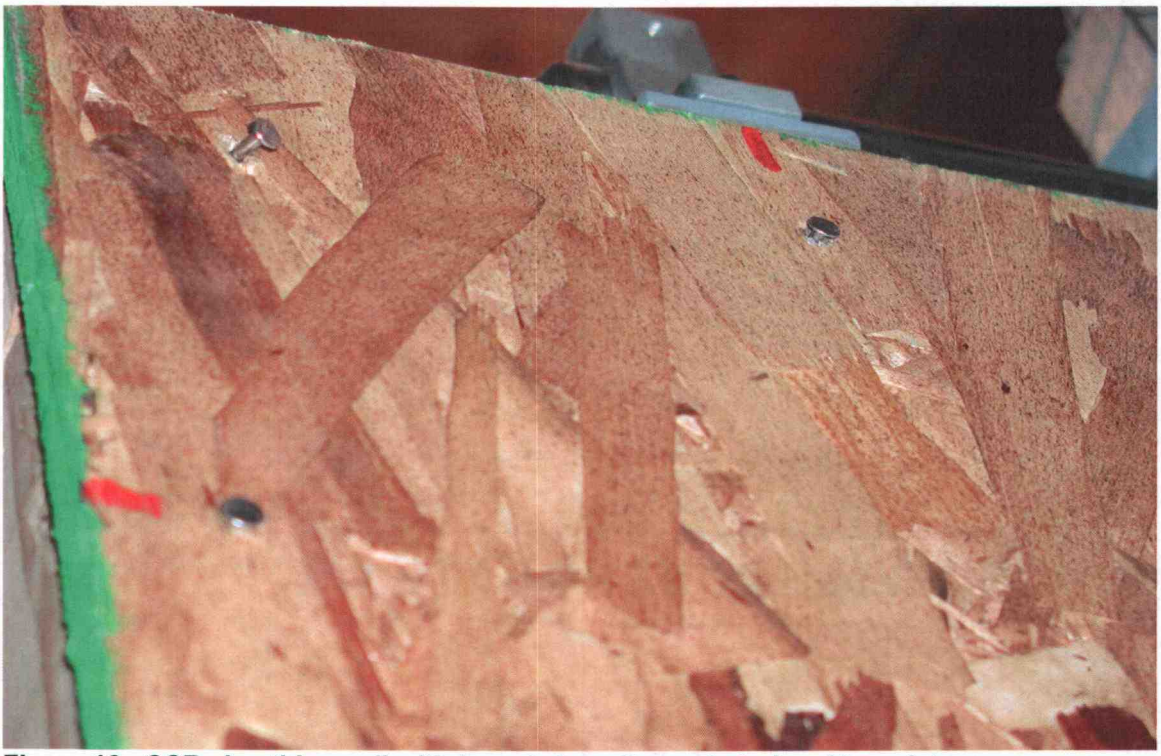


Figure 18. OSB sheathing nail withdrawal along the end stud and top plate

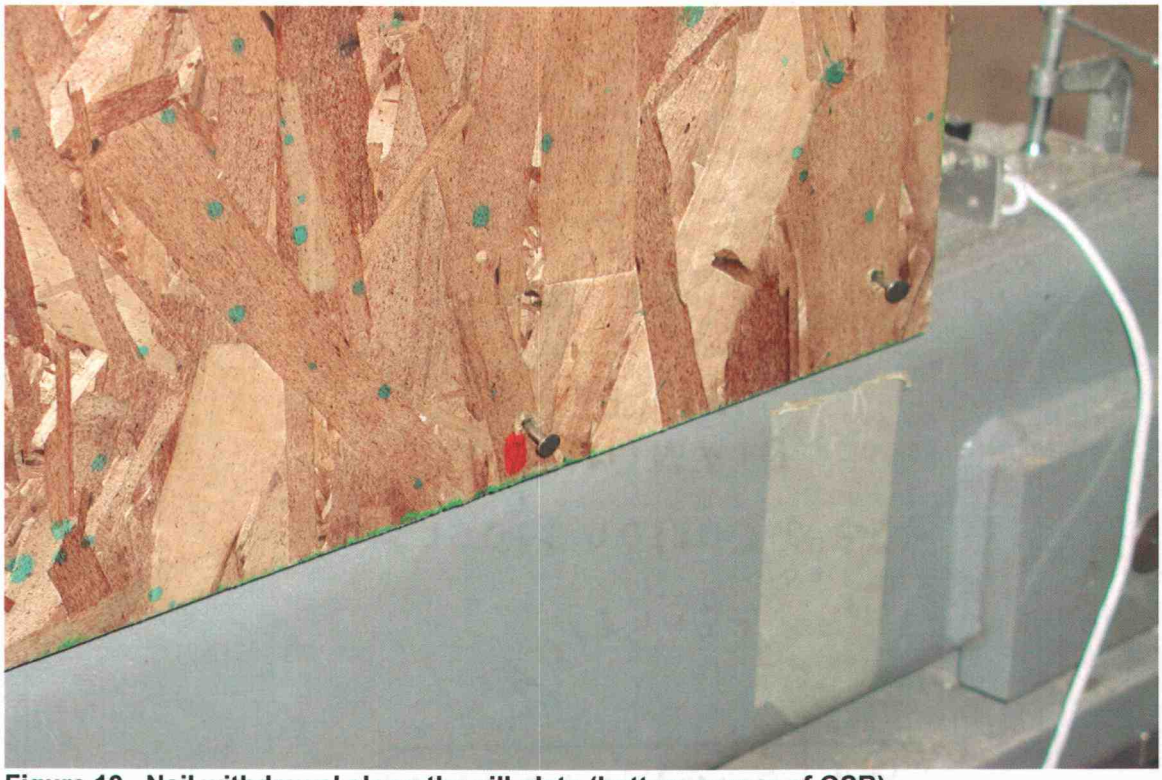


Figure 19. Nail withdrawal along the sill plate (bottom corner of OSB)

Figure 20. OSB sheathing nail withdrawal and nail pull-through along the sill plate

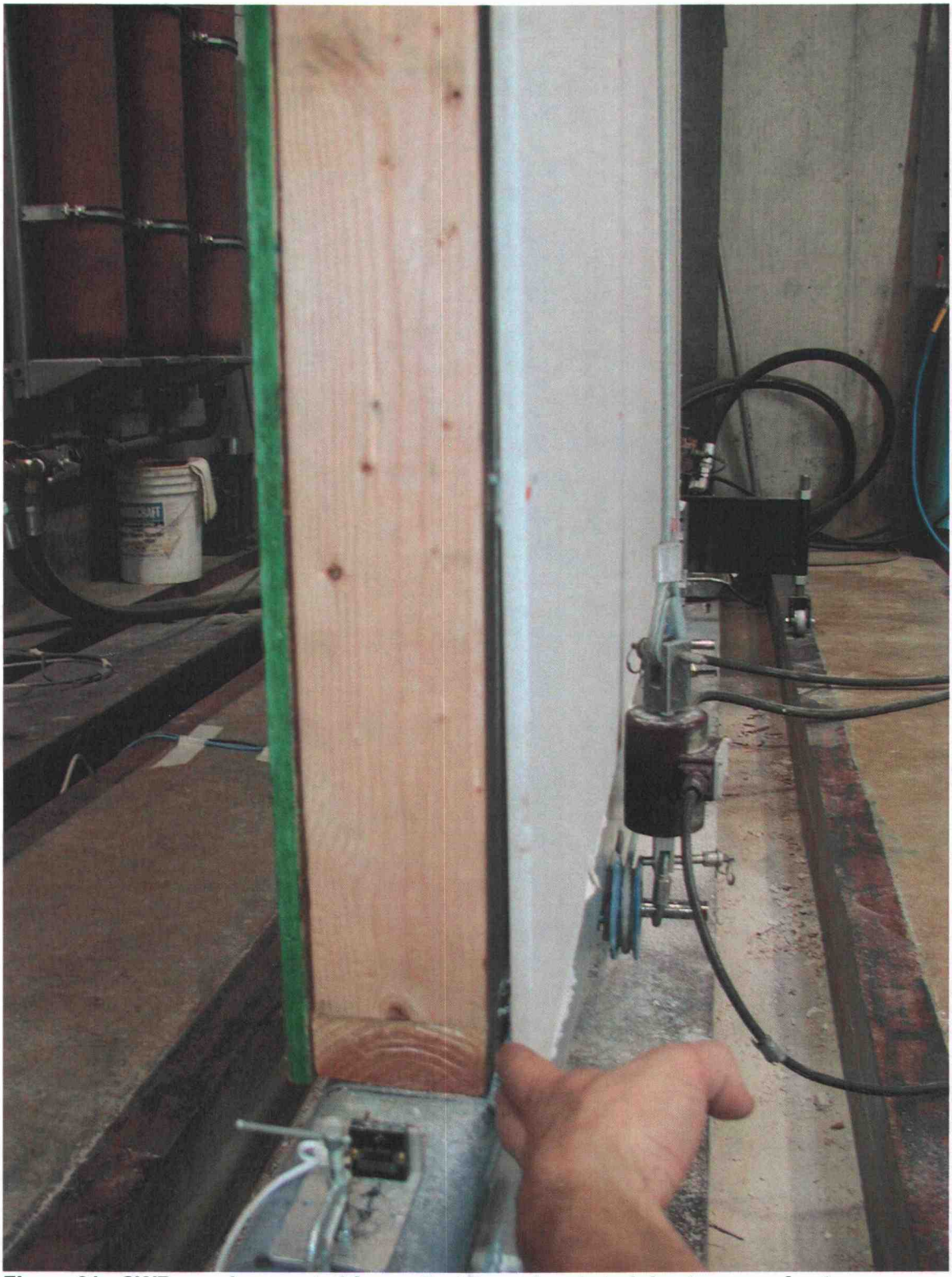


Figure 21. GWB panel separated from sill plate and end stud due to screw fracture, localized GWB crushing, and edge breakout of GWB

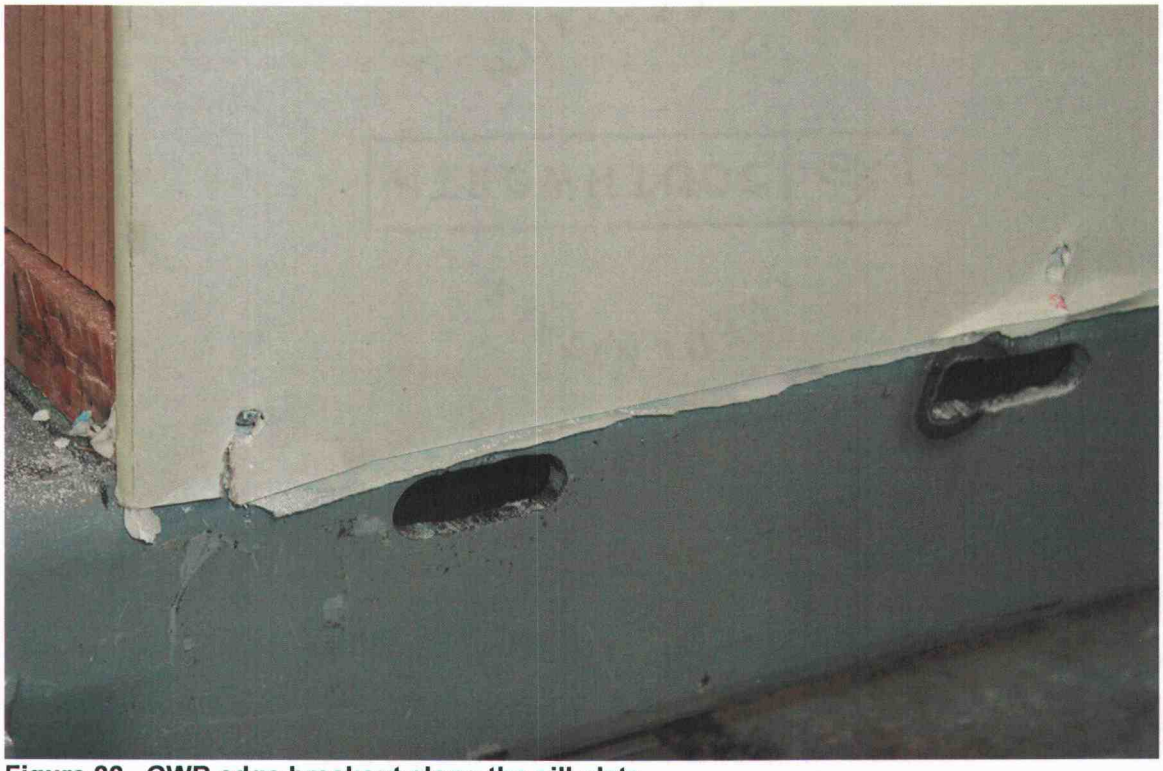


Figure 22. GWB edge breakout along the sill plate

Figure 23. OSB sheathing edge breakout along the sill plate

Figure 24. OSB sheathing nail withdrawal and nail pull-through along the sill plate

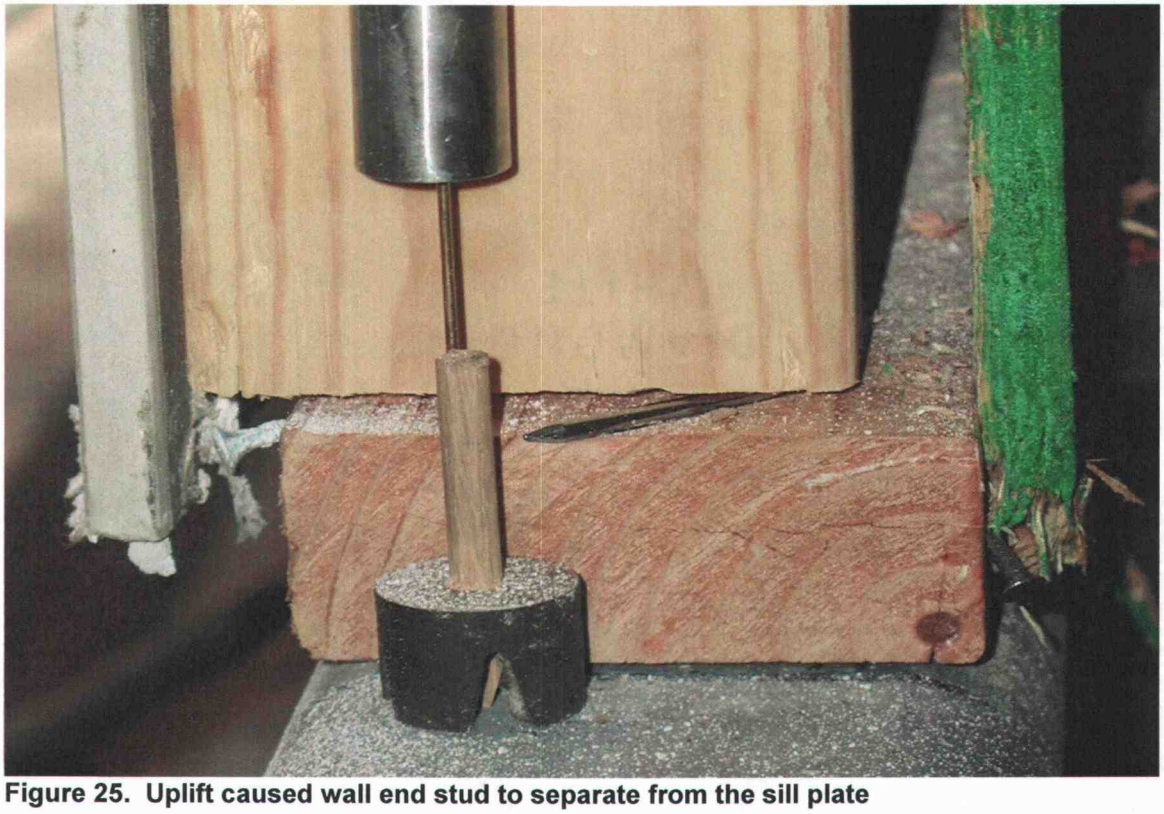


Figure 25. Uplift caused wall end stud to separate from the sill plate

APPENDIX C: DETAILED RESULT TABLES

FULLY ANCHORED EARTHQUAKE TESTS

Test	bb +/-	P_{max}[2] kN	Δ_{max}[2] mm	$P_{failure}$ kN	$\Delta_{failure}$ mm	E^2 J	P_e kN	Δ_e mm	k_e kN/mm	Δ_{yield} mm	P_{yield} kN	ductility mm/mm
SE03-1	(+)[1]	16.60	20.3	-	-	247	-	-	-	-	-	-
	(-)[1]	16.08	18.9	-	-	233	-	-	-	-	-	-
	avg.	16.34	19.6	-	-	240	-	-	-	-	-	-
SE03-2	(+)[1]	16.46	20.8	-	-	248	-	-	-	-	-	-
	(-)[1]	16.09	16.8	-	-	199	-	-	-	-	-	-
	avg.	16.28	18.8	-	-	224	-	-	-	-	-	-
AVG.		**16.31**	**19.2**	-	-	**232**	-	-	-	-	-	-

[1]Backbone curve did not reach ultimate load.
[2]Maximum observed value(s).

Test	bb +/-	P_{max} kN	Δ_{max} mm	$P_{failure}$ kN	$\Delta_{failure}$ mm	E^3 J	P_e kN	Δ_e mm	k_e kN/mm	Δ_{yield} mm	P_{yield} kN	ductility mm/mm
SE07-1	(+)[2]	18.83	53.8	-	-	1190	7.53	3.8	1.99	-	-	-
	(-)[2]	18.98	48.7	-	-	1352	7.59	3.2	2.35	-	-	-
	avg.	18.91	51.3	-	-	1271	7.56	3.5	2.17	-	-	-
SE07-2	(+)[2]	19.15	49.3	-	-	882	7.66	5.5	1.39	-	-	-
	(-)[1]	21.80[3]	72.5[3]	-	-	1261				-	-	-
	avg.	20.48	60.9	-	-	1072	7.66[4]	5.52[4]	1.39[4]	-	-	-
	AVG.	**19.69**	**56.1**	**-**	**-**	**1171**	**7.61**	**4.5**	**1.78**	**-**	**-**	**-**

[1]Backbone curve did not reach ultimate load.
[2]Backbone curve did not reach failure load.
[3]Maximum observed value(s).
[4]Value is from one side of the envelope curve due to asymmetry of earthquake response.

Test	bb +/-	P_{max} kN	Δ_{max} mm	$P_{failure}$ kN	$\Delta_{failure}$ mm	E J	P_e kN	Δ_e mm	k_e kN/mm	Δ_{yield} mm	P_{yield} kN	ductility mm/mm
SE19-1	(+)[1]	22.75	66.6	-	-	2038[2]	9.10	6.2	1.46	-	-	-
	(-)	23.56	44.7	18.85	66.1	1207	9.42	6.0	1.58	12.8	20.23	5.16
	avg.	23.16	55.7	18.85[3]	66.1[3]	1623	9.26	6.1	1.52	12.8[3]	20.23[3]	5.16[3]
SE19-2	(+)	19.08	65.0	15.26	95.9	1486	7.63	5.2	1.48	11.1	16.45	8.61
	(-)	19.21	40.5	15.37	52.5	783	7.68	5.4	1.43	11.7	16.80	4.47
	avg.	19.15	52.8	15.32	74.2	1134	7.66	5.3	1.45	11.4	16.63	6.54
SE19-3	(+)[1]	21.11	60.7	-	-	1442[2]	8.44	5.5	1.54	-	-	-
	(-)	21.98	47.8	17.58	71.6	1230	8.79	5.5	1.61	11.6	18.69	6.17
	avg.	21.55	54.3	17.58[3]	71.6[3]	1336	8.62	5.5	1.57	11.6[3]	18.69[3]	6.17[3]
SE19-4	(+)[1]	22.08	59.4	-	-	1828[2]	8.83	5.3	1.68	-	-	-
	(-)	21.66	47.8	17.33	76.8	1353	8.66	4.9	1.77	10.7	18.94	7.17
	avg.	21.87	53.6	17.33[3]	76.8[3]	1591	8.75	5.1	1.72	10.7[3]	18.94[3]	7.17[3]
SE19-5	(+)[1]	20.87	58.7	-	-	1408[2]	8.35	5.6	1.50	-	-	-
	(-)	21.46	46.3	17.17	71.5	1207	8.58	5.6	1.54	12.0	18.41	5.98
	avg.	21.17	52.5	17.17[3]	71.5[3]	1308	8.47	5.6	1.52	12.0[3]	18.41[3]	5.98[3]
SE19-6	(+)[1]	19.65	62.2	-	-	1311[2]	7.86	6.5	1.20	-	-	-
	(-)	20.42	44.4	16.34	62.9	1011	8.17	4.7	1.73	10.1	17.47	6.24
	avg.	20.04	53.3	16.34[3]	62.9[3]	1161	8.01	5.6	1.47	10.1[3]	17.47[3]	6.24[3]
AVG.		**21.15**	**53.7**	**17.10**	**70.5**	**1359**	**8.46**	**5.5**	**1.54**	**11.5**	**18.40**	**6.21**
COV (%)		**6.7**	**2.1**	**7.0**	**7.3**	**15.3**	**6.7**	**6.3**	**6.3**	**8.3**	**6.7**	**11.9**

[1]Backbone curve did not reach failure load.
[2]Maximum observed value.
[3]Value is from one side of the envelope curve due to asymmetry of earthquake response.

PARTIALLY ANCHORED EARTHQUAKE TESTS

Test	bb +/-	P_{max} kN	Δ_{max} mm	$P_{failure}$ kN	$\Delta_{failure}$ mm	E J	P_e kN	Δ_e mm	k_e kN/mm	Δ_{yield} mm	P_{yield} kN	ductility mm/mm
SE03-1	(+)[2]	7.41	20.3	-	-	233[3]	2.96	4.2	0.71	-	-	-
	(-)[2]	6.94	14.6	-	-	125[3]	2.78	3.0	0.93	-	-	-
	avg.	7.18	17.5	-	-	179[3]	2.87	3.6	0.82	-	-	-
SE03-2	(+)	7.47	22.0	5.98	36.4	215	2.99	4.1	0.72	9.4	6.79	3.87
	(-)[1]	8.43[3]	17.6[3]	-	-	93[3]	-	-	-	-	-	-
	avg.	7.95	22.0[4]	5.98[4]	36.4[4]	215[4]	2.99[4]	4.1[4]	0.72[4]	9.4[4]	6.79[4]	3.87[4]
AVG.		**7.56**	**19.7**	-	-	**197**	**2.93**	**3.9**	**0.77**	-	-	-

[1]Backbone curve did not reach ultimate load.
[2]Backbone curve did not reach failure load.
[3]Maximum observed value.
[4]Value is from one side of the envelope curve due to asymmetry of earthquake response.

Test	bb +/-	P_{max} kN	Δ_{max} mm	$P_{failure}$ kN	$\Delta_{failure}$ mm	E J	P_e kN	Δ_e mm	k_e kN/mm	Δ_{yield} mm	P_{yield} kN	ductility mm/mm
SE07-1	(+)	7.85	13.2	6.28	48.1	320	3.14	2.1	1.50	4.7	6.99	10.33
	(-)	8.48	21.1	6.78	67.5	480	3.39	3.7	0.93	8.2	7.57	8.26
	avg.	8.17	17.2	6.53	57.8	400	3.27	2.9	1.21	6.4	7.28	9.30
SE07-2	(+)	10.06	26.9	8.05	39.1	291	4.02	3.0	1.36	5.9	8.06	6.59
	(-)	9.56	17.2	7.65	34.8	259	3.82	3.5	1.10	7.6	8.36	4.56
	avg.	9.81	22.1	7.85	36.9	275	3.92	3.2	1.23	6.8	8.21	5.58
	AVG.	**8.99**	**19.6**	**7.19**	**47.4**	**338**	**3.60**	**3.1**	**1.22**	**6.6**	**7.74**	**7.44**

Test	bb +/-	P_{max} kN	Δ_{max} mm	$P_{failure}$ kN	$\Delta_{failure}$ mm	E J	P_e kN	Δ_e mm	k_e kN/mm	Δ_{yield} mm	P_{yield} kN	ductility mm/mm
	(+)	7.33	25.1	5.86	37.7	194	2.93	6.4	0.46	13.6	6.28	2.77
SE19-1	(-)	8.96	19.5	7.17	46.6	281	3.58	3.6	0.99	6.6	6.49	7.10
	avg.	8.15	22.3	6.52	42.1	238	3.26	5.0	0.73	10.1	6.39	4.93
	(+)	7.32	22.8	5.86	25.4	136	2.93	4.7	0.63	10.9	6.82	2.33
SE19-2	(-)	7.07	13.0	5.66	57.0	310	2.83	2.4	1.19	4.8	5.68	11.91
	avg.	7.20	17.9	5.76	41.2	223	2.88	3.5	0.91	7.8	6.25	7.12
	(+)	7.40	30.2	5.92	39.5	203	2.96	7.8	0.38	17.4	6.60	2.27
SE19-3	(-)	7.95	19.9	6.36	67.1	387	3.18	6.3	0.51	12.5	6.36	5.35
	avg.	7.68	25.1	6.14	53.3	295	3.07	7.0	0.44	15.0	6.48	3.81
	(+)	9.43	15.1	7.54	22.1	154	3.77	2.3	1.63	4.8	7.81	4.61
SE19-4	(-)	9.05	24.1	7.24	42.7	319	3.62	1.5	2.40	3.2	7.78	13.15
	avg.	9.24	19.6	7.39	32.4	237	3.70	1.9	2.01	4.0	7.79	8.88
	(+)	7.44	25.8	5.95	38.9	218	2.98	4.8	0.63	10.3	6.46	3.77
SE19-5	(-)	9.75	17.7	7.80	42.5	283	3.90	3.5	1.11	6.5	7.21	6.53
	avg.	8.60	21.8	6.88	40.7	251	3.44	4.1	0.87	8.4	6.84	5.15
	(+)	9.98	16.7	7.98	22.6	163	3.99	1.8	2.21	3.5	7.81	6.39
SE19-6	(-)	8.57	10.0	6.86	51.9	358	3.43	2.2	1.57	4.6	7.22	11.31
	avg.	9.28	13.4	7.42	37.3	261	3.71	2.0	1.89	4.1	7.51	8.85
AVG.		**8.35**	**20.0**	**6.68**	**41.2**	**251**	**3.34**	**3.9**	**1.14**	**8.2**	**6.88**	**6.46**
COV (%)		**10.1**	**20.3**	**10.1**	**16.8**	**10.1**	**10.1**	**49.2**	**56.9**	**49.8**	**9.3**	**33.3**

FULLY ANCHORED EARTHQUAKE TESTS WITH VERTICAL LOAD

Test	bb +/-	P_{max} kN	Δ_{max} mm	$P_{failure}$ kN	$\Delta_{failure}$ mm	E J	P_e kN	Δ_e mm	k_e kN/mm	Δ_{yield} mm	P_{yield} kN	ductility mm/mm
SE19-DL-1	(+)[1]	25.12	76.5	-	-	1552[3]	10.05	5.1	1.96	-	-	-
	(-)	25.24	50.4	20.19	87.7	1826	10.10	5.4	1.87	12.0	22.36	7.32
	avg.	25.18	63.5	20.19[4]	87.7[4]	1826[4]	10.07	5.3	1.91	12.0[4]	22.36[4]	7.32[4]
SE19-DL-2	(+)[2]	23.65	49.2	-	-	1716[3]	9.46	6.0	1.57	-	-	-
	(-)	22.77	39.6	18.22	87.8	1670	9.11	5.5	1.66	12.3	20.45	7.13
	avg.	23.21	44.4	18.22[4]	87.8[4]	1670	9.28	5.7	1.62	12.3[4]	20.45[4]	7.13[4]
SE19-DL-3	(+)[2]	23.05	51.5	-	-	1624[3]	9.22	5.9	1.56	-	-	-
	(-)	22.49	43.0	17.99	74.4	1315	9.00	6.4	1.41	13.8	19.49	5.40
	avg.	22.77	47.3	17.99[4]	74.4[4]	1315	9.11	6.1	1.49	13.8[4]	19.49[4]	5.40[4]
AVG.		**23.72**	**51.7**	**18.80**	**83.3**	**7083**	**9.49**	**5.7**	**1.67**	**12.7**	**20.77**	**6.62**

[1]Backbone curve did not reach ultimate load.

[2]Backbone curve did not reach failure load.

[3]Maximum observed value(s).

[4]Value is from one side of the envelope curve due to asymmetry of earthquake response.

PARTIALLY ANCHORED EARTHQUAKE TESTS WITH VERTICAL LOAD

Test	bb +/-	P_{max} kN	Δ_{max} mm	$P_{failure}$ kN	$\Delta_{failure}$ mm	E J	P_e kN	Δ_e mm	k_e kN/mm	Δ_{yield} mm	P_{yield} kN	ductility mm/mm
SE19-DL-1	(+)[1]	16.99	82.2	-	-	1118[3]	6.80	4.8	1.42	-	-	-
	(-)	15.58	48.0	12.46	76.4	975	6.23	4.4	1.42	9.6	13.62	7.95
	avg.	16.29	65.1	12.46[4]	76.4[4]	975	6.51	4.6	1.42	9.62[4]	13.62[4]	7.95[4]
SE19-DL-2	(+)[2]	17.7	53.3	-	-	1190[3]	7.08	9.0	0.79	-	-	-
	(-)	17.86	42.6	14.29	82.7	1145	7.14	9.8	0.73	21.9	15.97	3.77
	avg.	17.78	48.0	14.29[4]	82.7[4]	1145	7.11	9.4	0.76	21.9[4]	15.97[4]	3.77[4]
SE19-DL-3	(+)[1]	18.78	96.1	-	-	1400[3]	7.51	6.5	1.16	-	-	-
	(-)	18.21	42.8	14.57	104.6	1574	7.28	4.6	1.58	10.0	15.80	10.48
	avg.	18.50	69.5	14.57[4]	104.6[4]	1574[4]	7.40	5.6	1.37	10.0[4]	15.80[4]	10.48[4]
	AVG.	**17.52**	**60.8**	**13.78**	**87.9**	**5955**	**7.01**	**6.5**	**1.18**	**13.9**	**15.13**	**7.40**

[1]Backbone curve did not reach ultimate load.

[2]Backbone curve did not reach failure load.

[3]Maximum observed value(s).

[4]Value is from one side of the envelope curve due to asymmetry of earthquake response.

SE13 FULLY ANCHORED EARTHQUAKE TEST SEQUENCE

Test	bb +/-	P_{max}[2] kN	Δ_{max}[2] mm	$P_{failure}$ kN	$\Delta_{failure}$ mm	E^2 J	P_e kN	Δ_e mm	k_e kN/mm	Δ_{yield} mm	P_{yield} kN	ductility mm/mm
SE13-1-A	(+)[1]	9.75	4.0	-	-	19.2	-	-	-	-	-	-
	(-)[1]	8.81	4.3	-	-	18.4	-	-	-	-	-	-
	avg.	9.28	4.2	-	-	18.8	-	-	-	-	-	-
SE13-1-B	(+)[1]	12.07	4.7	-	-	26.5	-	-	-	-	-	-
	(-)[1]	11.66	4.6	-	-	33.2	-	-	-	-	-	-
	avg.	11.87	4.7	-	-	29.9	-	-	-	-	-	-
	AVG.	**10.57**	**4.4**	-	-	**24.3**	-	-	-	-	-	-

[1]Backbone curve did not reach ultimate load.
[2]Maximum observed value(s).

Test	bb +/-	P_{max}[2] kN	Δ_{max}[2] mm	$P_{failure}$ kN	$\Delta_{failure}$ mm	E^2 J	P_e kN	Δ_e mm	k_e kN/mm	Δ_{yield} mm	P_{yield} kN	ductility mm/mm
SE13-2-A	(+)[1]	21.26	32.9	-	-	490	-	-	-	-	-	-
	(-)[1]	20.83	28.8	-	-	433	-	-	-	-	-	-
	avg.	21.05	30.9	-	-	462	-	-	-	-	-	-
SE13-2-B	(+)[1]	22.74	29.7	-	-	459	-	-	-	-	-	-
	(-)[1]	21.93	31.0	-	-	493	-	-	-	-	-	-
	avg.	22.34	30.4	-	-	476	-	-	-	-	-	-
	AVG.	**21.69**	**30.6**	-	-	**469**	-	-	-	-	-	-

[1]Backbone curve did not reach ultimate load.
[2]Maximum observed value(s).

SE13 PARTIALLY ANCHORED EARTHQUAKE TEST SEQUENCE

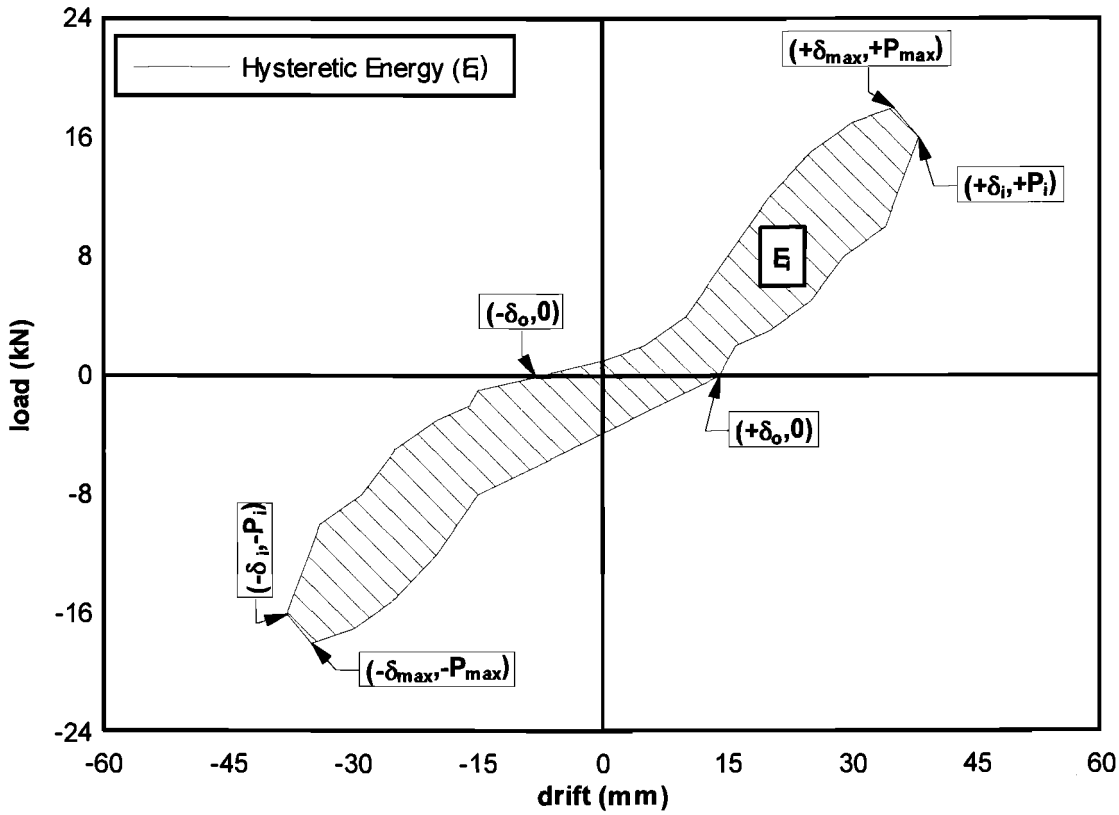
Test	bb +/-	P_{max}[2] kN	Δ_{max}[2] mm	$P_{failure}$ kN	$\Delta_{failure}$ mm	E[2] J	P_e kN	Δ_e mm	k_e kN/mm	Δ_{yield} mm	P_{yield} kN	ductility mm/mm
SE13-1-A	(+)[1]	6.70	7.9	-	-	30.1	-	-	-	-	-	-
	(-)[1]	7.34	9.4	-	-	40.8	-	-	-	-	-	-
	avg.	7.02	8.7	-	-	35.5	-	-	-	-	-	-
SE13-1-B	(+)[1]	5.71	7.0	-	-	23.7	-	-	-	-	-	-
	(-)[1]	6.59	7.2	-	-	31.6	-	-	-	-	-	-
	avg.	6.15	7.1	-	-	27.7	-	-	-	-	-	-
	AVG.	**6.59**	**7.9**	-	-	**31.6**	-	-	-	-	-	-

[1]Backbone curve did not reach ultimate load.
[2]Maximum observed value(s).

Test	bb +/-	P_{max} kN	Δ_{max} mm	$P_{failure}$ kN	$\Delta_{failure}$ mm	E J	P_e kN	Δ_e mm	k_e kN/mm	Δ_{yield} mm	P_{yield} kN	ductility mm/mm
SE13-2-A	(+)	10.06	24.5	8.05	30.2	212	4.02	5.4	0.74	11.8	8.74	2.56
	(-)	9.58	17.0	7.66	31.5	212	3.83	5.2	0.74	11.1	8.16	2.85
	avg.	9.82	20.8	7.86	30.8	212	3.93	5.3	0.74	11.4	8.45	2.71
SE13-2-B	(+)	9.93	23.9	7.94	34.5	240	3.97	5.4	0.73	11.4	8.35	3.02
	(-)	9.36	25.2	7.49	39.3	276	3.74	5.3	0.71	11.7	8.25	3.36
	avg.	9.65	24.6	7.72	36.9	258	3.86	5.4	0.72	11.6	8.30	3.19
	AVG.	**9.47**	**21.1**	**7.58**	**35.4**	**244**	**3.79**	**5.3**	**0.72**	**11.4**	**8.21**	**3.10**

APPENDIX D: CYCLIC TEST DATA

Tables with cyclic test data contain parameters for each loading cycle in all earthquake tests. Figure 26 depicts some of the parameters highlighted in the tables:



Additional parameters beyond those depicted in Figure 26 include:

1. K_i = Secant stiffness = $(P_{i\_pos} - P_{i\_neg})/(\delta_{i\_pos} - \delta_{i\_neg})$
2. E Input = Energy input from the hydraulic actuator
3. V_{max} = Maximum velocity at the top of the wall
4. Time = Time at beginning of loading cycle

EARTHQUAKE CYCLIC TEST DATA

Table 1. SE03-FA-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	23.5	12.9	32.9	15.93	-7.9	-14.78	32.8	16.57	-6.3	-16.05	0.85	2221.1	2541.2	226.2	
1		***12.7***	***12.8***	***-0.07***	***0.0***	***0.00***			***12.6***	***-0.37***	***0.01***	***-4.5***	***-4.4***	***2.91***	***5.24***
2	**13.0**	**12.9**	**13.1**	**0.92**	**0.0**	**0.00**	**13.1**	**0.92**	**12.7**	**-0.52**	**0.07**	**0.2**	**0.9**	**5.97**	**6.02**
3	12.9	12.6	13.0	0.28	0.0	0.00	13.0	0.28	12.4	-1.12	0.02	0.1	0.7	4.06	6.42
4	**13.0**	**12.6**	**13.1**	**1.05**	**0.0**	**0.00**	**13.1**	**1.12**	**12.4**	**-1.46**	**0.08**	**0.7**	**2.0**	**12.95**	**6.80**
5	**13.1**	**12.3**	**13.4**	**1.77**	**0.0**	**0.00**	**13.4**	**1.92**	**11.6**	**-2.63**	**0.13**	**2.5**	**14.7**	**21.27**	**7.20**
6	**13.3**	**12.4**	**14.0**	**4.67**	**0.0**	**0.00**	**14.0**	**4.67**	**11.6**	**-3.35**	**0.33**	**6.7**	**-0.6**	**30.15**	**7.66**
7	**12.7**	**12.3**	**13.4**	**2.05**	**0.0**	**0.00**	**13.4**	**2.05**	**11.1**	**-3.73**	**0.15**	**3.6**	**17.5**	**26.61**	**8.04**
8	**13.6**	**11.4**	**14.6**	**5.13**	**0.0**	**0.00**	**14.6**	**5.13**	**9.2**	**-7.61**	**0.35**	**19.6**	**44.7**	**38.89**	**8.46**
9	**15.1**	**9.0**	**17.6**	**9.33**	**0.0**	**0.00**	**17.5**	**9.70**	**5.4**	**-11.17**	**0.53**	**77.8**	**138.1**	**99.19**	**8.98**
10	***14.8***	***9.2***	***17.3***	***9.92***	***0.0***	***0.00***	***17.3***	***10.09***	***7.6***	***-6.99***	***0.57***	***54.9***	***-14.9***	***105.54***	***9.50***
11	***17.9***	***7.7***	***24.0***	***13.93***	***0.0***	***0.00***	***23.6***	***14.37***	***1.7***	***-13.23***	***0.58***	***196.7***	***201.9***	***120.94***	***10.06***
12	15.0	8.3	17.1	5.87	0.0	0.00	16.9	6.33	4.1	-8.65	0.34	69.6	54.7	103.44	10.88
13	12.3	7.8	14.0	3.31	0.0	0.00	13.8	3.38	4.0	-8.21	0.24	32.9	99.2	102.84	11.34
14	13.9	7.5	17.6	6.13	0.0	0.00	17.5	6.51	0.5	-13.57	0.35	101.6	78.7	156.27	12.30
15	17.3	7.8	23.1	12.44	0.0	0.00	23.1	12.44	0.7	-12.00	0.54	145.1	176.3	148.21	12.88
16	13.8	5.4	17.8	6.22	0.0	0.00	17.8	6.37	0.6	-11.30	0.35	75.2	235.3	135.89	13.42
17	***21.9***	***2.2***	***29.5***	***15.69***	***-7.1***	***-15.50***	***28.1***	***16.05***	***-6.3***	***-16.05***	***0.85***	***360.0***	***228.0***	***197.40***	***14.08***
18	***23.5***	***0.3***	***32.9***	***15.93***	***-7.9***	***-14.78***	***32.8***	***16.57***	***-7.6***	***-15.37***	***0.75***	***357.2***	***349.1***	***226.19***	***14.70***
19	17.1	9.0	24.3	7.76	0.0	0.00	24.1	7.84	4.5	-3.93	0.32	90.6	-25.7	171.91	15.38
20	13.0	10.4	15.0	2.02	0.0	0.00	15.0	2.02	8.5	-1.89	0.13	9.3	24.3	66.31	16.16
21	13.2	9.8	16.0	2.29	0.0	0.00	15.6	2.40	6.4	-2.98	0.14	15.6	20.6	52.26	17.26
22	14.0	11.2	17.0	2.87	0.0	0.00	16.7	2.98	10.2	-1.28	0.17	11.8	21.5	57.15	18.78
23	14.8	6.1	17.5	3.19	-0.8	-7.19	17.5	3.19	-0.7	-7.29	0.57	51.1	161.6	116.46	19.44
24	21.7	3.0	30.9	13.62	-6.8	-13.47	30.8	13.71	-6.7	-13.92	0.72	246.2	210.2	152.15	20.14
25	15.8	11.9	20.6	5.24	0.0	0.00	20.6	5.24	11.3	-1.22	0.25	41.1	-31.9	152.08	20.66
26	14.6	6.3	17.3	2.79	-1.2	-6.75	17.3	2.79	-1.2	-6.75	0.51	44.3	120.9	117.09	21.30
27	16.3	9.4	23.1	6.60	0.0	0.00	23.1	6.77	5.9	-3.24	0.29	62.2	0.2	127.19	21.92

Table 1. SE03-FA-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
28	13.8	10.9	16.4	2.23	0.0	0.00	16.4	2.36	9.8	-1.61	0.14	10.0	10.1	56.45	22.52
29	14.2	8.9	16.5	2.23	0.0	0.00	16.5	2.37	4.8	-3.48	0.14	16.0	73.4	33.15	23.40
30	14.1	9.2	16.7	2.19	0.0	0.00	16.4	2.77	5.5	-3.30	0.13	19.1	7.8	40.70	24.56
31	11.3	10.3	11.8	0.81	0.0	0.00	11.7	0.83	10.0	-0.75	0.07	1.4	-1.8	23.13	25.04
32	12.2	9.6	13.1	0.92	0.0	0.00	13.1	1.09	7.4	-2.19	0.07	5.7	27.5	37.15	25.98
33	15.1	9.6	18.7	3.65	0.0	0.00	18.6	3.68	5.9	-3.12	0.20	24.5	29.6	52.01	26.86
34	14.2	10.2	16.7	2.62	0.0	0.00	16.7	2.62	8.1	-2.17	0.16	12.7	26.1	33.27	28.28
35	12.5	10.2	12.8	0.95	0.0	0.00	12.6	0.99	8.0	-1.96	0.07	4.7	20.9	24.51	29.26
36	13.6	10.3	18.0	3.21	0.0	0.00	18.0	3.27	6.8	-2.76	0.18	26.9	105.3	31.97	32.56
37	13.0	11.7	14.1	1.43	0.0	0.00	14.1	1.43	11.2	-0.86	0.10	2.9	-5.0	19.33	33.76
38	12.5	11.0	12.8	0.54	0.0	0.00	12.8	0.54	10.0	-1.18	0.04	1.5	8.0	10.16	34.48
39	11.0	10.7	11.1	0.12	0.0	0.00	11.1	0.17	10.0	-0.95	0.01	0.4	5.1	14.70	34.94
40	12.7	10.2	13.4	0.94	0.0	0.00	13.3	1.02	8.6	-1.79	0.07	4.5	39.8	16.32	36.64
41	12.6	10.7	13.7	1.17	0.0	0.00	13.6	1.18	9.4	-1.51	0.09	4.0	7.7	14.41	38.34
42	12.4	10.9	12.7	0.48	0.0	0.00	12.4	0.88	10.3	-0.99	0.04	1.8	4.6	15.94	39.78
43	12.6	12.0	*13.4*	1.09	0.0	0.00	13.4	1.14	11.8	-0.55	0.08	1.4	5.8	11.73	40.74
44	12.5	10.9	12.8	0.75	0.0	0.00	12.7	0.82	9.9	-1.28	0.06	3.2	20.9	12.57	43.32
45	**12.7**	**11.1**	**13.3**	**1.01**	**0.0**	**0.00**	**13.3**	**1.03**	**11.0**	**-0.71**	**0.08**	**2.5**	**9.9**	**12.26**	**45.70**
46	**12.2**	**12.1**	**12.4**	**0.39**	**0.0**	**0.00**	**12.3**	**0.51**	**12.2**	**-0.08**	**0.03**	**0.4**	**2.0**	**6.60**	**46.60**
47	**12.1**	**11.4**	**12.3**	**0.17**	**0.0**	**0.00**	**12.3**	**0.23**	**11.1**	**-0.67**	**0.01**	**0.3**	**1.4**	**4.37**	**47.48**
48	**12.5**	**12.2**	**12.9**	**0.82**	**0.0**	**0.00**	**12.9**	**0.82**	**11.2**	**-0.59**	**0.06**	**1.1**	**3.3**	**8.45**	**50.10**
49	**12.2**	**11.6**	**12.3**	**0.08**	**0.0**	**0.00**	**12.3**	**0.08**	**11.2**	**-0.58**	**0.01**	**0.3**	**1.6**	**3.37**	**51.90**
50	**12.3**	**11.6**	**12.8**	**0.65**	**0.0**	**0.00**	**12.8**	**0.66**	**11.2**	**-0.60**	**0.05**	**0.7**	**2.9**	**8.42**	**54.08**
51	12.4	11.4	12.7	0.59	0.0	0.00	12.6	0.61	11.0	-0.77	0.05	1.3	4.7	6.92	56.66
52	11.5	11.7	11.7	-0.05	0.0	0.00	11.5	0.07	11.4	-0.35	0.00	0.0	0.0	4.13	57.12
53	***12.1***	***11.4***	***12.4***	***0.43***	***0.0***	***0.00***	***12.4***	***0.44***	***11.2***	***-0.62***	***0.03***	***0.5***	***1.9***	***4.75***	***59.22***

Table 2. SE03-FA-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	10.7	-9.1	21.5	16.38	-18.0	-15.38	20.8	16.44	-16.8	-16.07	3.31	2132.8	2439.9	220.7	
1	0.5	0.3	0.5	0.91	-0.1	-0.03	0.5	0.93	0.0	-0.51	1.55	0.2	0.9	7.22	0.72
2	0.3	0.0	0.5	0.33	-0.2	-1.01	0.5	0.33	-0.1	-1.06	2.17	0.1	0.7	2.67	1.10
3	0.4	-0.1	0.5	0.92	-0.2	-1.36	0.5	1.06	-0.2	-1.42	3.19	0.8	2.0	8.28	1.50
4	0.5	0.0	0.8	1.77	-0.8	-2.42	0.8	1.92	-0.8	-2.51	2.51	1.7	14.6	22.36	1.90
5	1.1	0.0	1.7	4.74	-0.7	-3.28	1.7	4.74	-0.7	-3.28	3.31	7.6	-0.4	30.67	2.34
6	0.2	0.0	0.9	2.00	-1.2	-3.42	0.9	2.00	-1.1	-3.53	2.56	2.9	16.9	21.48	2.74
7	1.2	-0.8	2.1	4.90	-3.0	-7.22	2.1	5.02	-2.8	-7.49	2.38	18.8	43.5	34.61	3.16
8	2.4	-2.7	4.8	9.00	-6.1	-10.87	4.7	9.37	-6.0	-11.17	1.82	68.8	132.5	101.73	3.68
9	2.6	-2.0	5.1	10.03	-3.5	-6.17	5.1	10.03	-3.5	-6.30	1.87	51.2	-22.0	103.31	4.20
10	5.4	-2.9	11.4	13.26	-9.2	-12.19	11.3	13.77	-9.1	-13.09	1.23	175.9	186.6	117.06	4.76
11	2.1	0.8	5.3	6.01	-0.9	1.48	5.3	6.60	0.5	-1.25	0.74	25.3	-32.5	95.14	5.14
12	3.8	-2.5	5.9	6.60	-7.2	-9.00	5.9	6.60	-7.1	-9.46	1.19	51.7	100.4	66.04	5.58
13	0.4	-3.0	2.6	3.56	-7.2	-8.66	2.6	3.80	-7.2	-8.66	1.24	33.7	106.3	108.25	6.04
14	2.3	-6.2	6.2	6.66	-10.9	-13.43	6.2	6.66	-10.6	-13.61	1.18	103.4	69.3	133.92	6.98
15	5.1	-4.4	11.0	12.31	-10.4	-11.64	11.0	12.33	-10.2	-12.15	1.12	138.8	162.4	153.23	7.56
16	2.4	-4.7	5.5	6.02	-9.9	-10.83	5.4	6.12	-9.9	-10.83	1.09	64.6	229.2	132.46	8.12
17	9.4	-6.7	17.1	14.92	-17.2	-15.43	16.3	15.53	-16.8	-16.07	0.89	326.1	196.5	208.66	8.78
18	10.7	-8.6	21.5	16.38	-18.0	-15.38	20.8	16.44	-17.3	-15.61	0.81	344.2	336.9	220.75	9.40
19	6.4	-2.8	13.2	7.52	-6.7	-4.03	13.2	8.02	-6.7	-4.27	0.58	89.0	-26.0	169.35	10.06
20	2.2	-0.9	4.6	2.47	-2.1	-1.74	4.6	2.47	-2.1	-1.74	0.63	10.8	21.6	69.80	10.84
21	2.6	1.5	4.5	2.11	-0.4	0.14	4.5	2.14	1.5	-0.42	0.41	5.4	2.4	25.97	11.42
22	2.0	-1.2	2.6	1.00	-4.9	-3.17	2.6	1.00	-4.9	-3.17	0.56	9.6	21.0	57.02	11.96
23	2.8	-0.1	6.3	2.94	-0.7	-1.31	6.0	3.12	-0.7	-1.31	0.61	12.3	11.3	64.48	12.98
24	0.0	-0.4	0.0	0.06	-0.9	-1.11	0.0	0.06	-0.9	-1.14	1.25	0.4	9.5	17.80	13.46
25	3.4	-4.0	6.2	3.11	-11.3	-7.28	6.2	3.11	-11.2	-7.50	0.59	47.3	160.9	121.69	14.14
26	10.1	-9.1	20.0	13.39	-17.1	-14.22	19.8	13.75	-17.1	-14.22	0.75	238.6	198.0	140.27	14.82
27	4.0	-0.1	9.9	5.61	-6.4	0.01	9.9	5.61	-0.7	-1.44	0.34	43.5	-31.3	150.81	15.36

Table 2. SE03-FA-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
28	3.4	-6.2	6.0	2.64	-11.7	-6.79	5.9	2.72	-11.6	-6.85	0.53	46.0	121.0	109.54	15.98
29	6.8	-1.8	12.4	6.65	-5.9	-3.64	12.3	7.10	-5.9	-3.64	0.57	64.9	1.4	134.54	16.62
30	2.5	-0.6	5.7	2.35	-1.7	-1.70	5.6	2.57	-1.7	-1.70	0.55	12.2	11.3	60.07	17.22
31	2.9	-2.2	5.0	2.34	-6.0	-3.24	5.0	2.34	-5.9	-3.48	0.50	17.4	70.6	34.42	18.10
32	2.6	-1.9	5.5	2.24	-5.3	-2.81	5.0	2.63	-5.0	-3.33	0.47	18.1	7.5	36.70	19.26
33	0.0	-0.9	0.4	0.75	-1.5	0.14	0.3	0.78	-1.2	-0.79	0.31	1.3	-1.1	20.08	19.72
34	1.0	-1.3	1.9	1.16	-3.6	-2.15	1.8	1.17	-3.6	-2.15	0.60	6.0	26.7	40.29	20.68
35	4.0	-1.7	7.6	3.67	-5.2	-2.96	7.5	3.69	-5.1	-3.15	0.52	24.1	28.0	52.77	21.56
36	2.4	-1.3	5.8	2.72	-2.9	-2.18	5.8	2.72	-2.8	-2.21	0.56	13.5	26.8	36.07	22.96
37	0.9	-1.1	1.1	0.94	-2.6	-1.90	1.1	0.94	-2.6	-1.90	0.77	3.9	18.6	21.65	23.94
38	2.8	-1.5	6.6	3.12	-4.4	-2.56	6.5	3.19	-4.3	-2.86	0.52	17.1	70.5	27.94	25.46
39	2.4	-1.2	4.6	2.04	-2.8	-1.87	4.6	2.15	-2.6	-1.90	0.53	9.3	33.0	19.88	27.24
40	2.0	0.3	2.8	1.40	-1.0	0.03	2.8	1.42	0.1	-0.81	0.36	3.2	-4.4	21.34	28.44
41	0.9	-0.4	1.1	0.56	-0.9	-1.10	1.1	0.56	-0.9	-1.10	0.82	1.4	12.3	9.33	29.58
42	1.1	-0.9	1.8	0.75	-2.5	-1.81	1.2	0.87	-2.5	-1.85	0.59	3.9	38.0	17.55	31.32
43	0.1	-0.7	2.3	1.10	-1.8	-1.53	2.3	1.23	-1.8	-1.53	0.64	4.2	7.8	15.20	33.02
44	1.3	-0.2	1.5	0.69	-0.7	-0.97	1.0	0.86	-0.6	-1.01	0.76	1.9	4.0	15.14	34.50
45	1.5	0.6	2.2	1.14	-0.2	0.08	2.1	1.14	0.6	-0.55	0.44	1.7	6.1	13.21	35.38
46	0.8	-0.4	0.8	0.19	-1.1	-1.19	0.8	0.19	-1.1	-1.19	0.71	1.2	9.0	5.59	36.28
47	1.1	-0.1	1.4	0.52	-0.5	-0.88	1.3	0.74	-0.5	-0.88	0.72	1.5	11.6	10.01	38.02
48	0.8	0.2	1.0	0.47	-0.1	0.04	0.9	0.47	0.0	-0.58	0.41	0.6	1.1	6.79	39.00
49	1.3	-0.1	2.0	0.89	-0.5	-0.84	1.9	1.00	-0.5	-0.84	0.71	1.6	8.2	8.57	40.40
50	0.9	0.4	1.2	0.41	-0.2	-0.62	1.1	0.56	-0.1	-0.65	0.75	1.1	4.9	5.57	44.04
51	1.2	0.8	1.6	0.74	0.0	0.00	1.6	0.83	0.8	-0.27	0.46	0.5	1.9	8.32	44.62
52	0.7	0.4	1.0	0.27	0.0	0.00	1.0	0.30	0.1	-0.56	0.27	0.1	1.5	4.00	46.64
53	1.0	0.1	1.4	0.73	0.0	-0.56	1.4	0.73	0.0	-0.60	0.88	0.7	2.4	9.08	47.90
54	0.3	0.3	0.3	0.12	-0.1	-0.56	0.3	0.12	0.0	-0.58	1.98	0.1	0.7	4.24	48.74
55	0.9	0.3	1.2	0.65	-0.1	-0.63	1.2	0.65	-0.1	-0.64	0.96	0.6	1.7	6.97	49.98
56	0.8	0.1	1.1	0.51	-0.3	-0.77	1.1	0.56	-0.3	-0.77	0.91	0.6	2.9	4.96	51.32
57	0.8	0.1	1.0	0.42	-0.2	-0.58	0.9	0.49	-0.1	-0.65	0.88	0.5	2.1	6.47	53.88

Table 2. SE03-FA-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
58	1.0	0.8	1.4	0.73	0.0	0.00	1.4	0.74	0.8	-0.20	0.53	0.5	1.4	9.14	54.46
59	0.9	0.2	0.9	0.08	-0.1	-0.54	0.9	0.09	0.0	-0.58	0.63	0.3	0.7	2.67	55.20
60	0.6	0.5	0.8	0.31	0.0	0.00	0.8	0.38	0.4	-0.17	0.39	0.1	0.1	3.68	55.82

Table 3. SE07-FA-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	64.1	-61.5	86.8	15.28	-87.7	-14.83	53.8	18.83	-48.7	-18.98	3.62	12308.4	13565.4	517.4	
1	***1.3***	***-0.1***	***2.3***	***4.28***	***-1.2***	***-4.75***	***2.3***	***4.28***	***-1.1***	***-4.87***	***2.63***	***7.6***	***27.6***	***24.26***	***10.98***
2	1.0	0.1	2.2	3.82	-0.7	-2.67	2.2	4.17	-0.7	-2.93	2.21	7.0	9.8	28.38	11.38
3	0.8	0.0	1.6	2.37	-0.8	-2.75	1.6	2.37	-0.7	-2.79	2.12	3.4	12.9	17.40	12.20
4	1.0	0.0	1.9	3.77	-1.0	-3.26	1.9	3.89	-1.0	-3.32	2.39	6.2	11.5	27.37	12.58
5	***0.9***	***0.3***	***1.4***	***1.91***	***0.0***	***0.00***	***1.0***	***2.18***	***0.3***	***-1.79***	***1.32***	***2.8***	***-1.5***	***15.88***	***13.08***
6	0.9	0.2	1.2	1.70	-0.3	-1.92	1.0	1.80	-0.2	-1.93	2.55	2.0	8.9	10.20	13.52
7	1.0	0.0	1.5	1.87	-0.7	-2.72	1.3	2.50	-0.6	-3.19	2.15	4.0	6.6	21.92	14.12
8	*1.3*	*-0.5*	*2.2*	*3.97*	*-1.6*	*-4.91*	*2.2*	*3.97*	*-1.6*	*-4.91*	*2.34*	*10.0*	*19.3*	*37.27*	*14.50*
9	**1.1**	**0.0**	**2.6**	**5.03**	**-0.8**	**-3.30**	**2.6**	**5.24**	**-0.7**	**-3.37**	**2.46**	**11.1**	**7.2**	**38.16**	**14.88**
10	***0.9***	***-0.3***	***2.0***	***3.48***	***-1.3***	***-4.09***	***2.0***	***3.48***	***-1.3***	***-4.09***	***2.28***	***7.6***	***14.9***	***30.09***	***15.28***
11	**0.9**	**0.5**	**1.8**	**3.63**	**-0.2**	**-1.77**	**1.7**	**3.63**	**-0.2**	**-1.95**	**2.74**	**3.8**	**-0.1**	**30.75**	**15.56**
12	*1.0*	*0.3*	*1.8*	*3.14*	*-0.5*	*-2.23*	*1.8*	*3.14*	*-0.3*	*-2.26*	*2.29*	*3.3*	*12.6*	*20.38*	*16.02*
13	**0.5**	**0.2**	**0.6**	**1.07**	**-0.1**	**-1.43**	**0.6**	**1.18**	**0.0**	**-1.59**	**3.62**	**0.5**	**3.0**	**4.95**	**16.40**
14	***1.1***	***0.1***	***1.7***	***2.36***	***-0.7***	***-2.90***	***1.7***	***2.36***	***-0.7***	***-2.92***	***2.18***	***4.1***	***8.9***	***17.23***	***16.88***
15	0.5	0.4	1.0	1.81	0.0	0.00	1.0	1.81	0.1	-1.03	1.89	0.6	-3.5	11.11	17.20
16	*0.9*	*0.4*	*1.2*	*1.76*	*0.0*	*0.00*	*1.2*	*1.76*	*0.3*	*-1.23*	*1.42*	*1.0*	*4.8*	*9.94*	*17.72*
17	0.6	0.3	0.7	1.04	-1.0	-3.47	0.7	1.06	-1.0	-3.56	2.71	2.2	26.0	26.99	18.06
18	***2.0***	***0.1***	***3.9***	***7.00***	***-1.9***	***-5.89***	***3.6***	***7.10***	***-1.8***	***-6.05***	***2.24***	***22.9***	***10.6***	***36.80***	***18.50***
19	*0.8*	*-0.9*	*2.2*	*4.04*	*-3.1*	*-7.33*	*2.2*	*4.04*	*-2.8*	*-7.39*	*2.16*	*17.3*	*76.6*	*52.64*	*18.86*
20	***2.6***	***-1.6***	***4.3***	***8.33***	***-3.2***	***-7.56***	***4.2***	***8.47***	***-3.2***	***-7.56***	***2.11***	***38.8***	***-10.3***	***59.84***	***19.26***
21	**2.3**	**1.1**	**5.2**	**8.88**	**-0.2**	**0.02**	**5.1**	**9.05**	**0.8**	**-1.53**	**1.63**	**23.8**	**56.1**	**73.80**	**19.66**
22	*1.2*	*-1.4*	*1.4*	*0.32*	*-4.8*	*-9.29*	*1.2*	*0.41*	*-4.8*	*-9.29*	*1.57*	*23.5*	*87.5*	*58.99*	*20.00*
23	***1.5***	***-6.2***	***3.3***	***4.56***	***-13.5***	***-14.33***	***2.9***	***5.22***	***-13.4***	***-14.66***	***1.12***	***129.9***	***551.7***	***142.94***	***20.98***
24	**5.1**	**-4.4**	**13.2**	**13.86**	**-11.3**	**-11.18**	**12.7**	**14.15**	**-11.3**	**-11.18**	**1.02**	**196.1**	**-100.1**	**137.89**	**22.08**
25	***15.6***	***-11.9***	***26.7***	***17.51***	***-23.0***	***-16.09***	***23.0***	***18.22***	***-21.7***	***-16.80***	***0.68***	***571.3***	***574.8***	***184.20***	***22.84***
26	***8.1***	***-11.3***	***14.8***	***6.94***	***-22.7***	***-15.08***	***14.7***	***7.07***	***-22.7***	***-15.08***	***0.59***	***214.5***	***306.3***	***224.67***	***23.72***
27	***14.2***	***-17.8***	***27.5***	***16.58***	***-29.1***	***-17.45***	***26.6***	***16.79***	***-28.1***	***-17.63***	***0.60***	***504.2***	***379.4***	***272.99***	***24.40***

Table 3. SE07-FA-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
28	7.8	-7.4	15.8	6.06	-16.3	-5.78	15.4	6.72	-16.1	-5.98	0.37	133.1	73.7	241.20	25.58
29	**4.1**	**-13.4**	**11.1**	**4.40**	**-24.8**	**-11.46**	**11.1**	**4.40**	**-24.5**	**-11.95**	**0.44**	**149.8**	**285.6**	**167.51**	**26.30**
30	**17.6**	**-17.2**	**28.1**	**15.15**	**-30.0**	**-16.70**	**28.0**	**16.12**	**-29.4**	**-16.80**	**0.55**	**423.9**	**539.3**	**201.05**	**27.12**
31	**17.2**	**-18.1**	**29.9**	**16.06**	**-29.8**	**-15.86**	**29.7**	**16.39**	**-29.8**	**-15.86**	**0.53**	**437.1**	**276.9**	**312.34**	**27.86**
32	**19.5**	**-15.6**	**33.9**	**17.42**	**-30.5**	**-15.46**	**32.1**	**17.51**	**-30.5**	**-15.46**	**0.51**	**489.5**	**618.1**	**417.39**	**28.56**
33	10.3	3.3	18.7	5.98	-12.9	0.49	18.7	5.98	1.1	-1.24	0.17	86.5	-65.3	160.97	29.06
34	11.0	-25.8	21.5	6.71	-40.1	-18.16	21.5	6.71	-39.7	-18.93	0.40	389.0	854.8	226.73	29.82
35	**24.7**	**-8.3**	**37.4**	**16.51**	**-21.1**	**0.17**	**35.8**	**17.30**	**-19.2**	**-5.39**	**0.28**	**408.9**	**46.8**	**274.08**	**31.04**
36	16.2	-19.5	25.5	6.49	-33.6	-11.92	25.5	6.49	-33.6	-11.92	0.31	266.5	382.7	237.17	31.88
37	**31.0**	**-33.8**	**43.9**	**17.69**	**-49.2**	**-18.23**	**43.5**	**18.43**	**-48.7**	**-18.98**	**0.39**	**839.6**	**1063.9**	**291.27**	**32.72**
38	**36.4**	**-41.9**	**56.1**	**18.02**	**-62.1**	**-17.22**	**53.8**	**18.83**	**-60.5**	**-18.60**	**0.30**	**1164.0**	**1209.4**	**342.71**	**33.70**
39	35.6	-25.5	49.8	11.63	-35.7	-5.11	49.2	11.71	-35.7	-5.11	0.20	489.4	170.1	418.31	34.56
40	30.2	-45.2	41.2	6.73	-65.9	-16.24	41.2	6.73	-64.8	-16.60	0.21	593.3	1171.4	347.15	35.38
41	**64.1**	**-61.5**	**86.8**	**15.28**	**-87.7**	**-14.83**	**73.8**	**17.36**	**-84.4**	**-15.32**	**0.17**	**1667.8**	**1368.8**	**517.40**	**36.46**
42	33.1	-56.0	47.8	4.74	-79.3	-9.81	47.5	4.77	-79.2	-10.04	0.11	523.7	624.3	343.57	37.96
43	53.7	-43.7	70.8	8.56	-64.8	-5.87	70.8	8.56	-64.0	-5.90	0.11	586.6	493.7	436.18	39.24
44	12.4	-14.7	22.8	2.20	-39.3	0.20	22.8	2.20	-25.7	-1.81	0.03	124.7	87.7	207.96	40.88
45	19.8	-36.0	33.6	2.56	-55.4	-4.17	33.5	2.65	-55.4	-4.17	0.08	185.2	265.9	223.90	41.94
46	19.7	12.4	32.4	2.53	-31.5	0.34	31.9	2.59	11.1	-0.44	0.03	91.1	53.6	247.08	42.86
47	12.6	-2.2	12.6	0.01	-8.4	-1.31	12.6	0.01	-8.2	-1.32	0.06	15.4	26.9	113.44	43.44
48	29.9	-20.0	40.8	3.01	-34.1	-2.34	40.6	3.07	-34.0	-2.37	0.07	130.7	174.2	181.66	44.60
49	21.0	-16.9	33.4	2.37	-29.6	-2.15	33.2	2.40	-29.5	-2.21	0.07	113.2	125.9	148.27	45.76
50	15.4	-16.7	26.2	1.92	-30.3	-2.18	26.1	1.96	-30.2	-2.24	0.07	84.9	141.0	174.63	47.52
51	29.1	-16.9	42.5	3.20	-30.0	-2.27	42.1	3.21	-29.2	-2.30	0.08	146.4	168.4	238.61	48.84
52	27.1	-0.4	40.1	2.81	-13.7	0.05	39.7	2.89	-8.0	-1.50	0.05	93.5	109.4	188.12	50.18
53	15.9	7.0	23.2	1.33	0.0	0.00	22.9	1.37	3.8	-0.73	0.06	16.1	11.8	103.06	51.06
54	15.7	-0.9	23.2	1.37	-10.9	-1.61	23.2	1.37	-10.9	-1.61	0.09	25.4	58.8	95.31	52.46
55	**17.6**	**11.4**	**25.8**	**1.60**	**0.0**	**0.00**	**25.6**	**1.64**	**10.6**	**-0.32**	**0.06**	**18.7**	**26.8**	**95.33**	**53.76**
56	**17.1**	**-6.3**	**24.5**	**1.45**	**-16.0**	**-1.72**	**24.0**	**1.46**	**-15.3**	**-1.79**	**0.08**	**32.3**	**60.9**	**115.70**	**54.88**
57	**11.2**	**3.0**	**18.3**	**1.19**	**-3.8**	**0.05**	**18.3**	**1.24**	**-0.5**	**-0.69**	**0.05**	**16.3**	**12.3**	**122.82**	**56.50**

Table 3. SE07-FA-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
58	**18.6**	**-16.6**	**29.2**	**1.96**	**-29.6**	**-2.30**	**28.7**	**2.00**	**-29.2**	**-2.33**	**0.07**	**74.4**	**123.1**	**132.38**	**57.72**
59	**24.8**	**-6.3**	**36.6**	**2.58**	**-16.7**	**-1.71**	**36.4**	**2.62**	**-16.3**	**-1.73**	**0.08**	**91.3**	**110.5**	**132.57**	**59.24**
60	**20.5**	**-2.9**	**31.1**	**2.08**	**-13.0**	**-1.59**	**30.8**	**2.13**	**-12.8**	**-1.61**	**0.08**	**55.5**	**79.5**	**133.07**	**60.64**
61	**8.8**	**-3.1**	**13.8**	**0.94**	**-10.5**	**-1.37**	**13.8**	**0.94**	**-10.3**	**-1.39**	**0.10**	**16.1**	**14.0**	**100.27**	**61.56**
62	**21.0**	**3.6**	**31.4**	**2.17**	**-4.4**	**-1.25**	**31.4**	**2.17**	**-4.0**	**-1.25**	**0.10**	**42.6**	**50.0**	**136.59**	**62.56**
63	**13.9**	**-2.4**	**20.1**	**1.08**	**-12.2**	**-1.60**	**20.0**	**1.13**	**-12.0**	**-1.62**	**0.08**	**25.0**	**60.0**	**70.69**	**64.02**
64	**10.0**	**0.3**	**14.4**	**0.94**	**-5.7**	**-1.03**	**14.1**	**0.95**	**-5.6**	**-1.03**	**0.10**	**11.7**	**10.8**	**72.33**	**65.44**
65	**15.1**	**3.6**	**22.3**	**1.44**	**-2.9**	**-1.03**	**22.1**	**1.45**	**-2.9**	**-1.03**	**0.10**	**19.8**	**23.6**	**89.00**	**66.66**

Table 4. SE07-FA-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	47.4	-53.9	60.4	12.90	-74.5	-19.79	49.3	19.15	-72.5	-21.79	2.28	12016.8	13242.0	472.6	
1	***0.5***	***-1.1***	***1.6***	***3.96***	***-2.6***	***-4.72***	***1.6***	***3.96***	***-2.6***	***-4.72***	***2.05***	***7.9***	***23.7***	***34.58***	***10.98***
2	0.6	-0.8	1.3	3.43	-1.6	-1.65	1.3	3.43	-1.4	-1.70	1.70	6.5	9.7	37.05	11.48
3	0.3	0.1	1.4	3.67	-0.6	-0.84	1.4	3.67	-0.5	-1.05	2.28	4.2	0.8	21.54	11.84
4	0.5	-0.8	0.7	1.51	-1.6	-1.76	0.7	1.51	-1.5	-1.82	1.44	2.3	5.7	26.35	12.22
5	0.1	-0.6	0.5	1.70	-1.5	-1.29	0.4	1.95	-1.4	-1.41	1.54	1.3	4.6	20.65	12.64
6	0.5	-0.8	1.1	2.78	-1.7	-1.65	0.9	2.79	-1.5	-1.98	1.60	4.8	4.3	21.35	13.10
7	0.0	-0.5	0.2	1.71	-2.1	-2.18	0.0	1.74	-2.0	-2.27	1.71	2.3	8.8	25.15	13.56
8	0.3	-1.2	0.8	1.57	-2.0	-2.58	0.7	2.70	-2.0	-2.85	1.49	5.1	4.5	28.25	14.10
9	*0.7*	*-1.1*	*1.4*	*3.49*	*-2.7*	*-3.57*	*1.4*	*3.49*	*-2.6*	*-4.05*	*1.72*	*10.7*	*14.2*	*42.86*	*14.50*
10	***0.8***	***-0.3***	***1.3***	***3.59***	***-1.0***	***-1.39***	***1.3***	***3.59***	***-1.0***	***-1.42***	***2.16***	***5.2***	***2.3***	***37.91***	***14.90***
11	***0.4***	***-0.5***	***1.1***	***1.98***	***-1.9***	***-2.24***	***1.1***	***2.06***	***-1.8***	***-2.29***	***1.38***	***4.2***	***6.8***	***26.73***	***15.30***
12	*-0.3*	*-0.5*	*0.0*	*0.00*	*-1.1*	*-0.77*	*0.0*	*1.16*	*-1.0*	*-0.94*	*0.71*	*0.6*	*0.4*	*26.99*	*15.52*
13	**0.6**	**-0.6**	**1.5**	**2.96**	**-1.7**	**-2.14**	**1.5**	**2.96**	**-1.7**	**-2.23**	**1.60**	**4.5**	**12.5**	**29.08**	**16.02**
14	***-0.5***	***-0.8***	***0.0***	***0.00***	***-2.0***	***-1.61***	***-0.2***	***1.44***	***-2.0***	***-1.68***	***0.81***	***1.1***	***3.3***	***22.67***	***16.46***
15	*0.5*	*-1.4*	*1.5*	*3.56*	*-2.7*	*-3.73*	*1.5*	*3.56*	*-2.6*	*-3.73*	*1.73*	*9.6*	*13.9*	*26.51*	*16.90*
16	***0.2***	***-0.4***	***0.4***	***1.06***	***-1.1***	***-1.12***	***0.3***	***1.95***	***-1.1***	***-1.12***	***1.40***	***1.7***	***-1.4***	***23.69***	***17.74***
17	-0.3	-0.9	0.0	0.00	-2.2	-2.63	-0.3	0.41	-2.2	-2.63	1.20	1.9	18.5	38.13	18.06
18	***0.1***	***-1.8***	***3.2***	***6.18***	***-3.2***	***-4.87***	***3.2***	***6.33***	***-3.0***	***-5.00***	***1.71***	***29.6***	***58.0***	***38.45***	***18.84***
19	**1.5**	**-1.2**	**3.3**	**6.69**	**-2.8**	**-5.05**	**3.3**	**6.69**	**-2.8**	**-5.05**	**1.91**	**22.5**	**-8.2**	**47.37**	**19.26**
20	***1.1***	***-3.0***	***3.5***	***5.95***	***-6.2***	***-9.32***	***3.5***	***5.95***	***-6.1***	***-9.48***	***1.58***	***38.3***	***131.6***	***66.55***	***19.96***
21	***1.0***	***-8.7***	***2.9***	***4.28***	***-14.6***	***-15.08***	***2.5***	***5.02***	***-14.3***	***-15.13***	***1.10***	***131.1***	***524.8***	***150.62***	***20.94***
22	***7.0***	***-5.3***	***13.5***	***13.17***	***-12.7***	***-11.23***	***12.6***	***13.67***	***-12.5***	***-11.83***	***0.93***	***206.4***	***-107.4***	***157.48***	***22.04***
23	***13.8***	***-9.0***	***24.6***	***16.33***	***-22.0***	***-16.09***	***23.7***	***17.26***	***-21.4***	***-16.99***	***0.70***	***501.5***	***526.3***	***171.39***	***22.82***
24	***7.5***	***-11.7***	***12.7***	***6.37***	***-20.9***	***-14.58***	***12.7***	***6.41***	***-20.8***	***-15.02***	***0.62***	***179.5***	***269.0***	***197.50***	***23.68***
25	***14.0***	***-15.8***	***25.9***	***16.06***	***-25.8***	***-16.46***	***24.9***	***16.34***	***-24.3***	***-17.94***	***0.63***	***454.1***	***332.2***	***248.67***	***24.36***
26	7.6	-5.0	15.5	6.56	-12.7	-4.75	15.3	7.06	-12.5	-4.87	0.40	116.1	39.5	242.09	25.58
27	*6.1*	*-10.0*	*11.4*	*4.70*	*-22.4*	*-12.36*	*11.4*	*4.70*	*-22.4*	*-12.36*	*0.50*	*140.0*	*283.1*	*161.56*	*26.28*

Table 4. SE07-FA-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
28	***16.5***	***-12.3***	***26.3***	***15.19***	***-26.7***	***-16.65***	***26.3***	***15.78***	***-26.3***	***-16.91***	***0.60***	***382.2***	***472.2***	***171.39***	***27.08***
29	***14.7***	***-15.1***	***26.8***	***15.29***	***-27.6***	***-17.03***	***26.8***	***15.29***	***-26.8***	***-17.16***	***0.59***	***397.4***	***251.2***	***311.02***	***27.82***
30	***26.0***	***-14.7***	***36.3***	***18.61***	***-29.3***	***-16.63***	***36.3***	***18.61***	***-28.7***	***-16.98***	***0.54***	***612.7***	***687.5***	***395.61***	***28.50***
31	10.9	2.5	19.9	6.20	-11.6	0.34	19.9	6.20	-0.4	-1.72	0.19	94.6	-62.1	157.91	29.04
32	0.0	*-20.8*	*21.9*	*6.52*	*-37.0*	*-18.26*	*21.8*	*6.52*	*-36.2*	*-19.53*	*0.42*	*362.7*	*812.7*	*238.86*	*29.80*
33	**15.1**	**-18.7**	**37.8**	**16.99**	**-29.7**	**-11.47**	**36.8**	**17.37**	**-29.5**	**-11.56**	**0.42**	**632.4**	**373.2**	**260.46**	**31.84**
34	***27.2***	***-29.1***	***42.2***	***18.26***	***-44.1***	***-19.27***	***41.5***	***18.43***	***-43.8***	***-19.92***	***0.44***	***744.6***	***963.0***	***264.13***	***32.68***
35	***35.7***	***-33.4***	***49.3***	***18.22***	***-54.7***	***-20.34***	***49.3***	***19.15***	***-53.9***	***-20.92***	***0.37***	***1010.7***	***1081.0***	***322.40***	***33.64***
36	30.8	-30.1	46.3	14.58	-44.7	-10.48	45.7	14.61	-44.7	-10.94	0.28	596.3	323.3	403.48	34.50
37	*34.4*	*-53.9*	*49.7*	*16.23*	*-74.5*	*-19.79*	*49.7*	*16.23*	*-72.5*	*-21.79*	0.29	*1157.6*	*1787.6*	*428.88*	*35.30*
38	**47.4**	**-53.6**	**60.4**	**12.90**	**-74.5**	**-16.12**	**57.9**	**17.31**	**-74.3**	**-16.63**	**0.22**	**1090.9**	**874.6**	**472.59**	**36.38**
39	32.1	-38.9	48.3	7.05	-53.3	-5.44	47.5	7.09	-53.3	-5.44	0.12	441.0	348.6	375.87	37.94
40	33.1	-41.8	46.9	6.57	-60.2	-7.30	46.9	6.57	-60.2	-7.30	0.13	397.4	433.9	325.56	39.14
41	4.0	-5.8	13.3	2.24	-38.3	0.16	13.1	2.27	-10.3	-0.90	0.04	72.8	-0.8	215.55	39.96
42	12.9	-18.3	23.7	2.84	-30.2	-2.31	23.2	2.88	-29.6	-2.33	0.10	87.8	103.6	136.18	40.86
43	17.2	-39.0	26.8	3.10	-57.4	-6.22	26.6	3.13	-57.2	-6.32	0.11	205.5	332.6	250.76	41.88
44	27.3	2.4	39.9	4.75	-34.1	0.36	39.8	4.90	-4.6	-1.54	0.06	173.1	129.2	287.59	43.36
45	31.5	-31.4	44.5	5.81	-47.3	-3.97	44.4	5.86	-46.7	-3.99	0.11	214.6	275.0	196.99	44.52
46	22.1	-24.0	32.5	3.30	-39.1	-2.93	32.3	3.35	-38.3	-2.93	0.09	168.7	167.3	179.19	45.74
47	10.3	-18.0	20.5	2.07	-28.8	-2.10	20.5	2.07	-28.4	-2.14	0.08	82.5	138.1	154.56	47.46
48	27.6	-18.1	40.0	4.56	-33.9	-2.59	40.0	4.64	-33.6	-2.62	0.10	168.5	197.3	229.74	48.80
49	25.3	-6.5	38.5	4.20	-16.9	-1.82	38.5	4.24	-16.8	-1.82	0.11	122.6	138.8	198.18	50.14
50	12.8	1.9	21.0	1.58	-4.2	0.07	20.9	1.63	-2.7	-1.00	0.06	25.1	14.3	120.84	51.06
51	10.1	-4.0	15.4	1.05	-13.2	-1.56	15.4	1.05	-13.1	-1.62	0.09	20.0	51.8	96.41	52.42
52	13.6	7.9	20.7	1.59	-2.2	0.01	20.7	1.62	5.9	-0.40	0.07	16.1	19.1	91.12	53.76
53	11.8	-8.7	*19.2*	1.42	-18.9	-1.89	19.2	1.42	-18.5	-1.93	0.09	30.4	63.9	119.95	54.84
54	11.0	2.0	17.6	1.32	-6.4	0.03	17.2	1.56	-1.7	-0.76	0.05	20.5	14.2	126.68	56.46
55	**15.2**	**-16.8**	**24.8**	**2.02**	**-32.8**	**-2.57**	**24.7**	**2.08**	**-32.8**	**-2.57**	**0.08**	**74.4**	**128.8**	**142.05**	**57.70**
56	**22.2**	**-10.5**	**32.8**	**3.15**	**-23.5**	**-2.07**	**32.8**	**3.15**	**-23.5**	**-2.07**	**0.09**	**102.2**	**118.5**	**142.56**	**59.20**
57	**17.3**	**-7.6**	**26.6**	**2.25**	**-18.7**	**-1.79**	**26.5**	**2.27**	**-18.0**	**-1.82**	**0.09**	**62.5**	**85.4**	**132.84**	**60.58**

Table 4. SE07-FA-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
58	**6.1**	**-5.2**	**10.5**	**1.02**	**-13.3**	**-1.35**	**10.5**	**1.05**	**-13.3**	**-1.41**	**0.10**	**17.0**	**13.5**	**99.64**	**61.54**
59	**15.7**	**-1.5**	**25.5**	**2.17**	**-10.0**	**-1.41**	**25.5**	**2.17**	**-9.9**	**-1.43**	**0.10**	**42.7**	**47.1**	**128.27**	**62.54**
60	**8.2**	**-5.7**	**13.1**	**0.94**	**-16.8**	**-1.70**	**13.1**	**0.95**	**-16.5**	**-1.74**	**0.09**	**22.9**	**57.9**	**76.07**	**63.98**
61	**6.6**	**-1.8**	**11.3**	**1.01**	**-7.2**	**-0.93**	**10.9**	**1.04**	**-7.1**	**-0.94**	**0.11**	**11.7**	**10.5**	**76.45**	**65.40**
62	**11.5**	**-1.2**	**18.0**	**1.46**	**-8.7**	**-1.19**	**17.4**	**1.48**	**-8.5**	**-1.24**	**0.10**	**21.2**	**24.8**	**80.00**	**66.60**

Table 5. SE19-FA-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	89.4	-64.5	122.3	14.71	-88.5	-8.58	66.6	22.75	-44.7	-23.56	3.06	9497.3	9536.1	627.0	
1	***-0.2***	***-0.7***	***0.0***	***0.92***	***-0.8***	***-0.72***	***0.0***	***0.92***	***-0.7***	***-0.95***	***2.07***	***0.5***	***1.3***	***5.13***	***0.44***
2	-0.6	-0.6	0.0	0.00	-0.8	-0.44	-0.5	0.75	-0.7	-0.46	0.59	0.1	-0.1	3.80	0.86
3	-0.7	-0.7	0.0	0.00	-0.7	-0.27	-0.6	0.25	-0.7	-0.31	0.38	0.0	0.1	2.79	1.28
4	-0.6	-0.7	0.0	0.00	-0.7	-0.32	-0.6	0.07	-0.7	-0.32	0.43	0.0	0.1	2.59	1.56
5	-0.2	-0.2	0.0	0.00	-0.6	0.06	-0.2	0.69	-0.3	-0.20	0.10	0.2	0.4	4.95	1.96
6	*-0.2*	*-0.6*	*0.0*	*0.00*	*-0.6*	*0.00*	*-0.1*	*0.62*	*-0.5*	*-0.42*	*0.01*	*0.1*	*0.4*	*2.20*	*2.36*
7	-0.2	-0.7	0.0	0.00	-0.7	-0.30	-0.1	0.70	-0.4	-0.59	0.44	0.3	0.6	4.81	2.80
8	*-0.6*	*-0.7*	*0.0*	*0.00*	*-0.8*	*-0.60*	*-0.5*	*0.64*	*-0.8*	*-0.65*	*0.75*	*0.1*	*0.8*	*5.52*	*3.18*
9	-0.2	-0.7	0.0	0.00	-0.7	-0.60	-0.4	0.68	-0.6	-0.78	0.82	0.5	0.3	3.37	3.66
10	***-0.2***	***-0.3***	***0.0***	***0.00***	***-0.6***	***0.15***	***-0.3***	***0.77***	***-0.3***	***-0.41***	***0.26***	***0.3***	***0.1***	***4.31***	***4.00***
11	*-0.2*	*-0.7*	*0.0*	*0.00*	*-0.8*	*-0.91*	*-0.1*	*0.59*	*-0.8*	*-0.91*	*1.09*	*0.3*	*1.4*	*3.81*	*4.38*
12	-0.4	-0.7	0.0	0.00	-0.8	-0.81	-0.4	1.31	-0.7	-0.97	1.04	0.5	0.2	4.83	4.74
13	-0.2	-0.5	0.0	0.00	-0.7	-0.51	-0.1	0.79	-0.5	-0.73	0.76	0.4	1.3	3.29	5.84
14	-0.2	-0.6	0.0	0.00	-0.8	-0.91	-0.2	0.94	-0.8	-0.91	1.15	0.6	1.6	4.89	6.34
15	*-0.2*	*-0.4*	*0.0*	*1.25*	*-0.6*	*0.15*	*-0.3*	*1.44*	*-0.4*	*-0.91*	*1.87*	*0.7*	*0.3*	*5.07*	*6.82*
16	***-0.3***	***-0.6***	***0.0***	***0.00***	***-0.7***	***-0.49***	***-0.2***	***0.64***	***-0.7***	***-0.57***	***0.67***	***0.2***	***1.1***	***4.00***	***7.64***
17	***-0.2***	***-0.7***	***0.1***	***1.51***	***-1.2***	***-1.88***	***0.1***	***1.51***	***-0.9***	***-1.90***	***2.68***	***1.7***	***3.8***	***8.76***	***8.06***
18	***0.0***	***-0.8***	***0.4***	***1.71***	***-1.1***	***-1.83***	***0.2***	***1.98***	***-0.9***	***-1.99***	***2.29***	***2.1***	***2.0***	***8.38***	***8.52***
19	***-0.1***	***-0.6***	***0.2***	***1.66***	***-0.8***	***-0.51***	***0.1***	***1.94***	***-0.7***	***-1.68***	***2.26***	***1.5***	***-0.4***	***8.13***	***8.96***
20	***-0.2***	***-0.7***	***0.0***	***0.00***	***-0.8***	***-0.73***	***-0.3***	***1.48***	***-0.8***	***-0.76***	***0.92***	***0.7***	***0.9***	***6.16***	***9.62***
21	-0.3	-0.8	0.0	0.00	-0.9	-1.07	-0.1	1.43	-0.8	-1.41	1.21	1.2	1.2	6.60	10.02
22	-0.1	-0.5	0.2	1.66	-0.6	0.28	0.1	1.67	-0.5	-1.10	1.63	1.1	0.9	8.04	10.48
23	-0.2	-0.2	0.0	0.00	-0.5	0.31	-0.1	0.86	-0.4	-0.35	0.57	0.3	0.5	6.79	10.90
24	-0.2	-0.7	0.0	0.96	-1.0	-1.62	0.0	1.05	-1.0	-1.71	2.50	0.9	5.3	4.25	11.36
25	-0.1	-0.5	0.4	1.79	-0.9	-2.09	0.1	2.00	-0.8	-2.14	2.93	1.5	-0.2	7.92	11.92
26	-0.1	-0.3	0.2	1.51	-0.5	-0.73	0.0	1.58	-0.4	-1.05	3.06	0.9	0.8	7.09	12.26
27	*-0.1*	*-0.8*	*0.2*	*0.96*	*-1.6*	*-2.04*	*0.1*	*1.43*	*-1.2*	*-2.08*	*1.70*	*1.4*	*8.5*	*10.35*	*12.72*

Table 5. SE19-FA-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
28	*-0.2*	*-1.0*	*0.0*	*0.95*	*-2.0*	*-3.12*	*0.0*	*1.92*	*-2.0*	*-3.12*	*2.02*	*2.9*	*11.2*	*16.47*	*13.32*
29	***0.3***	***-1.4***	***2.1***	***5.07***	***-2.6***	***-4.76***	***1.9***	***5.21***	***-2.6***	***-4.76***	***2.10***	***13.7***	***16.1***	***31.24***	***13.80***
30	***1.0***	***-1.1***	***2.8***	***5.79***	***-2.8***	***-5.74***	***2.8***	***5.79***	***-2.8***	***-5.74***	***2.04***	***17.3***	***9.1***	***35.37***	***14.34***
31	***0.3***	***-1.2***	***1.5***	***3.25***	***-2.0***	***-2.99***	***1.3***	***3.67***	***-1.7***	***-3.04***	***1.80***	***7.7***	***13.5***	***29.46***	***14.94***
32	***1.8***	***-5.7***	***4.3***	***7.89***	***-9.7***	***-13.80***	***4.3***	***7.91***	***-9.7***	***-13.80***	***1.55***	***91.2***	***217.4***	***115.44***	***15.46***
33	***7.7***	***-8.0***	***17.1***	***15.83***	***-19.6***	***-18.63***	***17.1***	***15.83***	***-19.6***	***-18.63***	***0.94***	***432.7***	***471.9***	***235.52***	***16.04***
34	***17.4***	***-13.6***	***26.0***	***16.63***	***-23.9***	***-19.08***	***25.9***	***17.68***	***-23.1***	***-19.25***	***0.72***	***546.5***	***525.9***	***263.65***	***16.62***
35	***28.5***	***-32.7***	***43.7***	***20.24***	***-47.8***	***-22.37***	***40.9***	***21.45***	***-44.7***	***-23.56***	***0.47***	***1360.4***	***1627.9***	***373.53***	***17.28***
36	***55.0***	***-49.6***	***72.9***	***21.05***	***-65.7***	***-19.61***	***66.6***	***22.75***	***-62.4***	***-20.56***	***0.29***	***1922.8***	***1559.8***	***504.63***	***18.08***
37	42.6	20.2	57.3	8.97	-41.9	0.41	57.2	9.34	16.4	-1.76	0.09	402.2	63.6	465.58	18.96
38	30.9	13.4	35.5	2.23	0.0	0.00	35.5	2.23	7.9	-2.21	0.06	41.3	55.6	85.53	19.72
39	14.0	12.7	14.0	0.18	0.0	0.00	14.0	0.18	11.3	-1.04	0.01	1.2	9.4	48.70	19.98
40	37.1	-1.2	47.9	5.50	-9.6	-2.89	47.6	5.52	-8.7	-3.01	0.15	150.1	193.2	163.13	21.20
41	25.8	8.7	36.7	3.51	0.0	0.00	35.8	3.73	2.8	-1.90	0.10	81.2	46.8	173.10	21.94
42	30.3	-3.4	39.3	3.97	-13.9	-3.23	39.0	3.98	-13.9	-3.23	0.14	116.1	125.3	184.15	22.74
43	11.3	1.9	16.0	1.61	-1.4	0.16	16.0	1.61	-0.4	-1.03	0.08	20.8	25.2	88.65	24.26
44	10.5	-0.4	16.3	1.56	-6.0	-1.92	15.9	1.62	-5.8	-1.93	0.16	20.5	25.2	91.31	24.90
45	10.5	3.2	17.2	1.80	-0.2	-1.09	16.9	1.82	0.0	-1.12	0.17	18.8	16.7	110.24	25.92
46	9.5	-1.4	15.0	1.36	-9.3	-2.45	14.8	1.38	-9.2	-2.48	0.16	23.3	59.2	97.73	26.86
47	27.0	-51.3	38.8	4.10	-64.3	-16.75	38.2	4.27	-64.3	-16.75	0.20	501.2	1093.7	349.90	28.30
48	***89.4***	***-64.5***	***122.3***	***14.71***	***-88.5***	***-8.58***	***107.2***	***19.39***	***-87.6***	***-8.77***	***0.11***	***2010.8***	***1540.2***	***627.00***	***29.44***
49	33.6	-46.8	46.0	2.44	-65.2	-3.57	45.6	2.50	-65.1	-3.78	0.05	281.9	234.1	235.50	31.22
50	-19.0	-31.6	0.0	0.00	-42.0	0.07	-14.8	0.99	-39.1	-1.24	0.00	25.7	25.2	240.57	31.84
51	0.8	-15.0	10.2	1.41	-28.5	0.18	8.3	1.42	-17.0	-0.71	0.03	42.6	40.7	177.16	32.56
52	-8.2	-40.8	0.0	0.00	-58.9	-2.89	-4.7	0.51	-58.7	-2.99	0.05	67.0	118.3	223.33	33.26
53	40.7	5.9	57.2	2.96	-36.1	0.14	56.7	3.02	-2.0	-1.26	0.03	162.9	125.0	286.24	34.46
54	24.5	5.0	32.7	1.10	-4.3	-1.18	32.7	1.10	-4.1	-1.23	0.06	28.8	34.9	155.77	35.52
55	31.3	-9.2	45.4	1.96	-20.7	-1.55	45.4	1.96	-16.7	-1.56	0.05	73.7	87.1	218.00	36.44
56	-6.6	-7.7	0.0	0.00	-11.7	-0.62	-6.9	0.04	-11.7	-0.74	0.05	1.4	9.9	79.30	37.02
57	64.9	-16.1	77.5	4.26	-30.8	-2.03	76.5	4.29	-30.7	-2.09	0.06	248.1	251.5	307.46	38.02

Table 5. SE19-FA-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
58	6.0	-11.1	9.0	0.72	-19.9	-1.32	8.1	0.73	-19.9	-1.32	0.07	21.3	25.6	177.80	38.60
59	18.0	-11.6	27.4	1.22	-25.1	-1.67	26.4	1.31	-25.1	-1.67	0.05	56.4	64.3	221.81	39.32
60	11.1	1.7	20.8	1.05	-7.4	0.18	20.6	1.13	-0.3	-0.44	0.03	19.7	11.7	213.84	39.98
61	17.4	1.1	25.8	1.18	-6.0	-0.93	25.8	1.20	-6.0	-0.93	0.07	19.7	25.1	121.60	40.88
62	16.0	0.1	21.3	0.91	-6.0	-0.80	21.3	0.91	-5.5	-0.81	0.06	14.2	16.3	121.09	41.52
63	9.5	1.4	14.3	0.62	-1.0	-0.48	14.3	0.62	-1.0	-0.48	0.07	5.5	5.3	100.40	42.08
64	15.2	5.4	23.4	1.04	-12.6	-1.05	22.7	1.08	-12.6	-1.11	0.06	24.9	32.7	105.59	44.22
65	16.0	5.3	21.9	0.96	0.0	0.00	21.9	1.01	3.2	-0.43	0.04	7.9	10.8	109.96	44.80
66	9.6	-0.5	12.5	0.35	-8.6	-0.92	12.5	0.35	-8.6	-0.92	0.06	8.5	11.8	102.80	45.38
67	7.3	5.2	10.9	0.49	0.0	0.00	10.7	0.50	4.9	-0.14	0.04	2.7	1.2	103.63	45.80
68	9.6	-3.9	12.4	0.55	-8.4	-0.89	12.4	0.55	-8.4	-0.89	0.07	8.3	10.1	91.78	46.40
69	11.0	1.1	15.9	0.76	-1.9	-0.51	15.9	0.76	-1.8	-0.54	0.07	8.3	7.6	113.98	46.96
70	17.2	0.8	25.8	1.20	-6.0	-0.86	25.2	1.21	-5.8	-0.91	0.06	21.3	23.6	124.84	47.68
71	15.4	-0.5	25.8	1.20	-7.0	-0.91	25.8	1.20	-7.0	-0.91	0.06	20.4	23.4	141.22	48.44
72	6.7	-0.4	9.0	0.32	-4.5	-0.68	6.9	0.32	-4.1	-0.70	0.07	4.9	5.6	84.18	48.94
73	32.5	-29.5	47.5	1.82	-44.5	-2.44	47.4	1.97	-44.5	-2.44	0.05	134.4	155.5	221.68	49.90
74	11.1	0.1	21.9	1.30	-24.5	0.12	21.4	1.35	-2.6	-0.53	0.03	37.6	25.7	258.70	50.78
75	0.0	1.2	6.5	0.26	0.0	0.00	6.5	0.30	0.1	-0.29	0.04	1.5	1.5	56.06	51.28
76	9.4	0.8	14.0	0.69	-1.3	-0.38	14.0	0.69	-0.7	-0.40	0.07	5.6	7.0	65.24	52.00
77	13.5	-12.6	21.9	1.23	-24.9	-1.44	21.9	1.23	-24.9	-1.44	0.06	34.6	40.8	151.70	52.76
78	8.5	-5.7	16.2	1.10	-10.5	-0.70	16.2	1.10	-10.5	-0.70	0.07	20.4	18.6	165.99	53.48
79	7.1	-10.7	12.5	0.81	-16.4	-0.96	12.2	0.84	-16.4	-0.98	0.06	16.0	17.6	128.59	54.12
80	15.8	6.8	26.0	1.37	-7.9	0.01	26.0	1.37	6.5	-0.33	0.04	23.8	25.1	168.47	54.78
81	13.5	-7.5	21.0	0.93	-16.7	-1.07	20.9	0.93	-16.6	-1.12	0.05	18.6	41.8	83.36	56.12
82	14.2	9.1	23.3	1.23	-6.1	0.06	23.1	1.26	8.2	-0.21	0.04	16.2	7.2	94.70	57.02
83	10.5	2.5	11.7	0.24	-0.1	-0.41	11.7	0.24	-0.1	-0.41	0.06	2.5	3.4	56.90	57.78
84	22.3	8.0	34.4	1.57	0.0	0.00	33.0	1.58	4.9	-0.61	0.05	28.2	35.1	145.22	58.48
85	15.9	-2.3	18.7	0.49	-10.6	-1.02	18.7	0.49	-10.6	-1.02	0.05	15.0	36.7	105.21	59.44
86	28.0	9.1	40.3	1.77	0.0	0.00	39.3	1.84	1.7	-0.82	0.04	43.2	29.9	168.03	60.32
87	27.3	0.0	35.2	1.36	-9.0	-1.10	35.0	1.39	-7.3	-1.15	0.06	32.8	36.7	170.26	61.06

Table 5. SE19-FA-1

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
88	13.5	9.8	17.0	0.57	0.0	0.00	17.0	0.57	9.5	-0.17	0.03	4.3	4.8	58.29	61.92
89	13.7	3.0	18.1	0.57	-1.0	-0.59	17.6	0.59	-1.0	-0.61	0.06	5.9	8.3	69.93	62.78
90	14.8	4.0	19.9	0.66	0.0	0.00	18.7	0.71	0.9	-0.55	0.03	8.1	10.6	71.06	64.00
91	0.0	7.9	14.3	0.40	0.0	0.00	14.3	0.40	7.2	-0.18	0.03	2.2	1.5	59.09	64.62
92	10.9	7.5	*11.9*	0.23	0.0	0.00	11.9	0.23	6.9	-0.20	0.02	0.9	0.9	28.06	65.08
93	14.4	9.4	22.1	0.80	0.0	0.00	22.1	0.80	8.8	-0.20	0.04	5.9	8.1	77.41	66.16
94	***11.2***	***9.3***	***12.7***	***0.26***	***0.0***	***0.00***	***12.6***	***0.26***	***4.5***	***-0.39***	***0.02***	***2.5***	***2.7***	***34.04***	***67.30***
95	***11.0***	***8.1***	***12.7***	***0.23***	***0.0***	***0.00***	***12.7***	***0.25***	***5.9***	***-0.30***	***0.02***	***1.0***	***1.1***	***28.12***	***67.96***
96	***10.3***	***5.5***	***10.9***	***0.13***	***0.0***	***0.00***	***10.9***	***0.13***	***3.4***	***-0.44***	***0.01***	***1.7***	***2.2***	***27.69***	***68.54***
97	***0.0***	***4.8***	***17.8***	***0.48***	***0.0***	***0.00***	***17.8***	***0.51***	***1.6***	***-0.51***	***0.03***	***5.2***	***7.6***	***48.13***	***69.90***
98	***13.6***	***11.8***	***16.1***	***0.49***	***0.0***	***0.00***	***15.9***	***0.49***	***11.6***	***-0.11***	***0.03***	***2.6***	***2.2***	***57.66***	***70.44***
99	***15.9***	***6.3***	***19.2***	***0.59***	***0.0***	***0.00***	***19.2***	***0.59***	***4.4***	***-0.44***	***0.03***	***4.6***	***6.6***	***30.16***	***72.10***
100	***15.0***	***12.0***	***19.4***	***0.62***	***0.0***	***0.00***	***19.4***	***0.62***	***11.5***	***-0.14***	***0.03***	***3.7***	***4.2***	***64.14***	***72.74***
101	***17.1***	***7.5***	***20.7***	***0.67***	***0.0***	***0.00***	***20.6***	***0.68***	***5.1***	***-0.45***	***0.03***	***5.5***	***6.6***	***62.93***	***73.40***
102	16.4	9.5	19.8	0.61	0.0	0.00	19.6	0.62	8.2	-0.27	0.03	5.1	5.4	73.85	73.98
103	14.7	7.1	19.6	0.63	0.0	0.00	19.6	0.63	6.4	-0.34	0.03	4.1	4.7	60.60	74.60
104	***0.0***	***5.3***	***9.9***	***0.13***	***0.0***	***0.00***	***9.8***	***0.15***	***1.1***	***-0.63***	***0.01***	***2.4***	***5.3***	***36.29***	***75.34***
105	*15.3*	*6.6*	*19.2*	*0.58*	*0.0*	*0.00*	*19.1*	*0.62*	*4.5*	*-0.46*	*0.03*	*6.9*	*8.9*	*58.80*	*76.58*
106	***10.0***	***8.7***	***10.7***	***0.20***	***0.0***	***0.00***	***10.7***	***0.20***	***8.1***	***-0.13***	***0.02***	***0.5***	***0.5***	***39.05***	***77.04***
107	*14.5*	*8.3*	*17.2*	*0.45*	*0.0*	*0.00*	*17.0*	*0.46*	*7.6*	*-0.26*	*0.03*	2.5	*3.4*	*35.81*	*78.16*
108	***10.6***	***6.3***	***11.6***	***0.20***	***0.0***	***0.00***	***11.6***	***0.20***	***4.6***	***-0.33***	***0.02***	***1.3***	***1.5***	***26.70***	***78.82***
109	***8.6***	***7.6***	***8.8***	***0.06***	***0.0***	***0.00***	***8.7***	***0.07***	***7.0***	***-0.19***	***0.01***	***0.3***	***0.3***	***24.70***	***79.28***
110	***9.9***	***7.0***	***10.7***	***0.19***	***0.0***	***0.00***	***10.7***	***0.19***	***5.5***	***-0.29***	***0.02***	***0.8***	***0.9***	***23.37***	***80.24***
111	***13.7***	***9.7***	***16.1***	***0.41***	***0.0***	***0.00***	***16.1***	***0.42***	***10.4***	***-0.14***	***0.03***	***2.0***	***2.2***	***26.42***	***81.36***
112	***12.4***	***8.1***	***15.4***	***0.34***	***0.0***	***0.00***	***15.2***	***0.34***	***7.6***	***-0.24***	***0.02***	***2.4***	***2.5***	***29.91***	***83.32***
113	***14.5***	***9.7***	***16.3***	***0.39***	***0.0***	***0.00***	***16.0***	***0.41***	***9.7***	***-0.17***	***0.02***	***2.3***	***2.5***	***43.24***	***83.94***
114	11.9	11.5	14.2	0.29	0.0	0.00	13.3	0.32	4.4	-0.35	0.02	3.4	3.7	41.68	85.42
115	11.5	11.0	11.5	0.01	0.0	0.00	11.5	0.01	10.9	-0.07	0.00	0.0	0.0	4.06	85.72
116	13.0	10.0	15.9	0.39	0.0	0.00	15.9	0.39	8.6	-0.20	0.02	1.6	2.1	17.14	89.28
117	10.4	10.2	10.5	0.03	0.0	0.00	10.4	0.03	9.8	-0.11	0.00	0.0	0.0	6.30	89.92

Table 5. SE19-FA-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
118	11.5	11.5	12.6	0.16	0.0	0.00	12.5	0.16	11.4	-0.03	0.01	0.2	0.2	7.33	91.42
119	11.6	11.3	12.0	0.10	0.0	0.00	12.0	0.10	11.3	-0.04	0.01	0.0	0.0	4.69	91.92
120	11.6	10.3	11.8	0.08	0.0	0.00	11.8	0.08	9.8	-0.12	0.01	0.1	0.1	4.95	93.02
121	0.0	10.5	10.9	0.06	0.0	0.00	10.9	0.06	10.4	-0.08	0.01	0.0	0.0	5.33	93.86
122	10.9	10.6	11.1	0.07	0.0	0.00	11.1	0.07	9.8	-0.12	0.01	0.1	0.1	8.49	94.76
123	11.0	10.8	11.2	0.06	0.0	0.00	11.2	0.07	10.7	-0.04	0.01	0.0	0.0	4.51	95.34
124	10.8	10.8	10.9	0.04	0.0	0.00	10.9	0.04	10.7	-0.04	0.00	0.0	0.0	2.60	95.98

Table 6. SE19-FA-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	95.2	69.7	155.9	2.65	-60.9	-14.49	64.8	19.05	-40.7	-19.18	2.23	11226.8	8051.4	630.6	
1	***0.4***	***0.0***	***0.7***	***0.77***	***-0.2***	***0.20***	***0.5***	***0.85***	***-0.1***	***-0.65***	***0.66***	***2.2***	***1.9***	***3.60***	***3.50***
2	**0.6**	**0.0**	**0.7**	**0.71**	**-0.2**	**-1.11**	**0.5**	**1.38**	**-0.2**	**-1.11**	**2.00**	**3.7**	**2.5**	**3.18**	**6.20**
3	***0.6***	***-0.1***	***0.8***	***0.94***	***-0.2***	***-1.29***	***0.7***	***1.80***	***0.1***	***-1.69***	***2.23***	***5.9***	***-0.4***	***4.99***	***8.40***
4	0.7	0.1	0.7	0.62	0.0	-0.84	0.5	1.46	0.3	-1.39	1.98	3.5	-1.2	3.92	9.90
5	***0.8***	***-0.2***	***1.2***	***1.79***	***-0.5***	***-1.96***	***0.7***	***1.79***	***0.0***	***-2.11***	***2.16***	***9.4***	***4.1***	***5.49***	***12.60***
6	***2.6***	***-0.2***	***2.6***	***3.04***	***-1.8***	***-4.57***	***1.9***	***4.52***	***-1.8***	***-4.57***	***1.74***	***31.1***	***2.8***	***21.21***	***13.70***
7	***36.1***	***8.2***	***83.3***	***16.65***	***-53.0***	***-15.22***	***64.8***	***19.05***	***-40.7***	***-19.18***	***0.23***	***6266.6***	***3572.5***	***440.52***	***19.90***
8	48.9	-1.3	50.2	4.69	-8.8	-2.67	50.2	4.69	-8.8	-2.67	0.12	190.7	178.4	155.56	21.10
9	7.2	3.8	42.3	3.32	-10.2	-2.86	42.3	3.32	-10.2	-2.86	0.12	223.2	170.9	163.13	22.90
10	19.1	14.3	23.1	1.49	0.0	0.00	21.5	1.58	0.1	-1.51	0.06	76.1	69.1	79.96	25.20
11	***95.2***	***69.7***	***155.9***	***2.65***	***-60.9***	***-14.49***	***131.7***	***10.82***	***-60.9***	***-14.49***	***0.08***	***2147.6***	***1780.0***	***630.65***	***29.70***
12	27.6	19.9	114.2	1.49	-3.6	-2.65	77.2	1.81	-3.6	-2.65	0.04	1331.5	1331.9	264.39	48.80
13	31.7	10.0	68.0	1.10	-17.2	-2.42	47.7	1.38	-14.9	-3.27	0.04	494.3	502.9	245.28	55.90
14	32.4	9.9	54.7	1.24	0.0	0.00	49.8	1.40	1.0	-1.68	0.02	112.1	124.3	140.52	59.30
15	20.0	19.0	62.7	1.36	-3.8	-2.07	55.9	1.36	-3.8	-2.07	0.05	300.0	281.1	165.07	79.20
16	22.1	20.7	24.9	0.56	0.0	0.00	24.9	0.56	16.2	-0.44	0.02	7.7	8.9	27.38	81.70
17	22.1	20.9	26.1	0.69	0.0	0.00	26.1	0.69	14.3	-0.58	0.03	16.6	16.6	45.57	85.70
18	22.7	18.9	25.3	0.47	0.0	0.00	25.3	0.56	17.7	-0.33	0.02	2.5	3.5	11.55	88.50

Table 7. SE19-FA-3

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	94.0	-63.6	123.2	16.24	-91.6	-10.89	60.7	21.11	-47.8	-21.98	4.15	9452.3	9391.5	645.1	
1	***0.6***	***0.0***	***0.6***	***0.59***	***-0.1***	***-1.25***	***0.6***	***0.59***	***0.0***	***-1.34***	***2.60***	***0.6***	***1.4***	***5.27***	***0.42***
2	*0.1*	*0.0*	*0.3*	*0.89*	*-0.1*	*-0.96*	*0.3*	*0.89*	*-0.1*	*-1.00*	*4.15*	*0.1*	*0.3*	*3.87*	*0.82*
3	0.4	0.5	0.5	0.29	-0.1	-0.47	0.2	0.49	0.3	-0.57	1.30	0.2	0.5	5.00	1.96
4	0.5	0.2	0.5	0.34	0.0	0.00	0.4	0.52	0.3	-0.86	0.62	0.6	0.8	4.24	2.76
5	*0.2*	*0.1*	*0.3*	*0.40*	*-0.1*	*-0.84*	*0.2*	*0.51*	*-0.1*	*-0.92*	*3.54*	*0.1*	*1.2*	*2.79*	*3.16*
6	0.5	0.1	0.5	0.09	0.0	-0.68	0.3	0.47	0.1	-1.10	1.38	0.6	0.5	5.02	3.64
7	**0.5**	**0.4**	**0.5**	**0.17**	**0.0**	**0.00**	**0.3**	**0.80**	**0.3**	**-0.83**	**0.33**	**0.3**	**0.0**	**3.17**	**4.00**
8	***0.5***	***0.1***	***0.6***	***0.61***	***-0.2***	***-1.34***	***0.6***	***0.61***	***-0.1***	***-1.49***	***2.42***	***0.6***	***2.1***	***5.21***	***4.36***
9	*0.5*	*0.1*	*0.5*	*1.04*	*0.0*	*0.00*	*0.4*	*1.45*	*0.2*	*-1.59*	*1.95*	*0.9*	*0.4*	*4.95*	*4.72*
10	***0.4***	***0.5***	***0.5***	***-0.35***	***0.0***	***0.00***	***0.4***	***0.93***	***0.4***	***-0.72***	***0.64***	***0.1***	***-0.3***	***4.45***	***5.10***
11	**0.6**	**0.5**	**0.7**	**0.56**	**0.0**	**0.00**	**0.7**	**0.56**	**0.5**	**-0.44**	**0.81**	**0.0**	**0.1**	**3.23**	**5.42**
12	0.5	0.1	0.7	0.54	0.0	0.00	0.7	0.57	0.3	-1.17	0.80	0.4	0.9	2.41	5.84
13	0.6	0.0	0.7	0.69	-0.1	-1.19	0.4	1.00	0.1	-1.46	2.45	1.1	1.9	5.07	6.30
14	**0.6**	**0.2**	**0.8**	**0.69**	**0.0**	**0.00**	**0.4**	**1.35**	**0.3**	**-0.99**	**0.90**	**0.8**	**-0.8**	**6.03**	**7.00**
15	*0.6*	*0.1*	*0.6*	*0.09*	*0.0*	*-0.90*	*0.5*	*0.18*	*0.0*	*-0.90*	*1.71*	*0.3*	*1.2*	*3.81*	*7.60*
16	***0.6***	***0.1***	***0.8***	***1.25***	***-0.4***	***-1.98***	***0.7***	***1.29***	***-0.3***	***-2.10***	***2.75***	***1.7***	***3.7***	***7.24***	***8.04***
17	***0.8***	***0.0***	***1.0***	***1.64***	***-0.4***	***-2.06***	***0.8***	***1.77***	***-0.2***	***-2.20***	***2.54***	***2.4***	***2.1***	***8.51***	***8.52***
18	***0.7***	***0.0***	***1.0***	***1.52***	***-0.1***	***-1.39***	***0.9***	***1.85***	***-0.1***	***-2.07***	***2.63***	***2.2***	***0.0***	***8.28***	***8.94***
19	***0.7***	***0.1***	***0.8***	***0.73***	***-0.1***	***-0.84***	***0.6***	***1.54***	***0.3***	***-1.21***	***1.83***	***1.1***	***0.6***	***5.97***	***9.62***
20	***0.8***	***0.1***	***0.8***	***0.76***	***0.0***	***0.00***	***0.4***	***1.13***	***0.0***	***-1.67***	***0.98***	***1.3***	***1.2***	***6.40***	***10.00***
21	**0.7**	**0.2**	**1.1**	**1.55**	**0.0**	**0.00**	**0.9**	**1.55**	**0.2**	**-1.55**	**1.44**	**1.3**	**0.1**	**9.46**	**10.46**
22	0.6	0.4	0.7	0.70	0.0	0.00	0.6	0.83	0.4	-0.91	1.03	0.4	0.2	7.67	10.86
23	0.6	0.1	0.8	0.91	-0.3	-2.06	0.7	0.97	-0.3	-2.06	2.82	1.2	5.6	4.57	11.34
24	**0.7**	**0.2**	**1.2**	**1.54**	**-0.2**	**-2.23**	**0.7**	**1.72**	**-0.1**	**-2.26**	**2.70**	**1.7**	**-1.5**	**10.86**	**11.90**
25	0.8	0.4	1.0	1.49	0.0	0.00	1.0	1.53	0.2	-1.48	1.46	1.2	0.0	8.64	12.26
26	*0.5*	*0.0*	*0.8*	*1.24*	*-0.9*	*-2.46*	*0.7*	*1.28*	*-0.8*	*-2.55*	*2.19*	*2.0*	*9.4*	*12.10*	*12.72*
27	*0.7*	*-0.3*	*0.8*	*1.09*	*-1.3*	*-3.46*	*0.8*	*1.84*	*-1.2*	*-3.50*	*2.15*	*4.0*	*12.6*	*17.78*	*13.28*

Table 7. SE19-FA-3

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
28	***1.1***	***-0.5***	***2.8***	***4.76***	***-1.9***	***-4.66***	***2.7***	***5.31***	***-1.9***	***-4.90***	***1.98***	***15.7***	***15.1***	***26.04***	***13.78***
29	***1.9***	***-0.4***	***3.2***	***5.69***	***-2.2***	***-5.86***	***2.9***	***5.72***	***-2.2***	***-5.86***	***2.16***	***19.2***	***6.3***	***32.77***	***14.32***
30	1.3	-0.5	2.2	3.19	-1.4	-3.29	1.8	3.56	-1.3	-3.56	1.79	9.0	16.7	29.53	14.92
31	***2.8***	***-6.0***	***5.2***	***7.77***	***-10.4***	***-12.88***	***5.0***	***8.16***	***-10.3***	***-13.15***	***1.33***	***109.0***	***215.8***	***136.50***	***15.44***
32	***7.7***	***-14.0***	***17.8***	***14.55***	***-23.7***	***-16.73***	***17.8***	***15.48***	***-23.2***	***-17.40***	***0.75***	***477.2***	***492.8***	***224.80***	***16.02***
33	***14.8***	***-16.6***	***25.8***	***17.01***	***-27.9***	***-17.55***	***24.8***	***17.21***	***-27.1***	***-17.65***	***0.64***	***543.4***	***486.4***	***294.51***	***16.62***
34	***27.7***	***-34.8***	***40.3***	***19.97***	***-53.8***	***-20.16***	***38.6***	***20.35***	***-47.8***	***-21.98***	***0.43***	***1261.7***	***1507.1***	***396.11***	***17.28***
35	***47.8***	***-46.9***	***69.7***	***20.09***	***-70.8***	***-17.05***	***60.7***	***21.11***	***-68.4***	***-18.18***	***0.26***	***1737.8***	***1373.6***	***521.81***	***18.10***
36	29.6	18.7	43.3	6.25	-39.0	0.54	43.2	6.35	15.4	-1.16	0.07	249.4	14.0	430.66	18.96
37	24.2	4.3	27.7	1.66	-6.1	-2.26	27.7	1.66	-5.6	-2.27	0.12	44.4	67.3	91.06	20.00
38	28.8	-5.7	40.9	5.54	-19.9	-2.93	40.9	5.54	-19.4	-3.05	0.14	152.5	186.1	175.64	21.20
39	21.5	4.3	29.9	3.41	-3.4	-1.78	29.9	3.41	-2.7	-1.80	0.16	72.2	37.3	179.89	21.92
40	21.7	-7.7	32.6	3.66	-22.3	-3.19	32.5	3.73	-21.9	-3.19	0.12	109.7	111.9	183.58	22.80
41	-5.4	-7.2	0.0	0.00	-8.7	-0.60	-5.1	0.24	-8.7	-0.60	0.07	1.4	3.4	49.33	23.06
42	6.3	-3.3	10.4	1.44	-9.2	-1.46	10.3	1.48	-9.2	-1.46	0.15	20.3	24.1	95.39	24.26
43	5.5	-4.1	11.4	1.55	-11.2	-1.81	11.3	1.61	-11.1	-1.81	0.15	21.4	21.9	95.11	24.90
44	5.2	2.4	9.2	1.35	-2.0	0.04	9.2	1.35	1.7	-0.34	0.12	7.4	4.8	101.85	25.36
45	4.8	-2.2	5.5	0.58	-7.8	-1.37	5.5	0.58	-7.8	-1.37	0.15	7.5	10.6	78.68	25.92
46	4.8	-5.0	8.0	1.13	-17.6	-2.42	8.0	1.17	-17.3	-2.53	0.14	24.7	63.1	120.14	26.88
47	*23.4*	*-54.3*	*32.1*	*3.72*	*-73.4*	*-16.68*	*31.7*	*3.85*	*-73.3*	*-17.27*	*0.19*	*519.1*	*1141.8*	*407.16*	*28.28*
48	***94.0***	***-63.6***	***123.2***	***16.24***	***-91.6***	***-10.89***	***82.2***	***19.46***	***-90.8***	***-11.12***	***0.13***	***2151.9***	***1624.0***	***645.13***	***29.40***
49	35.1	-46.7	48.5	2.57	-76.5	-5.87	47.7	2.61	-76.2	-5.98	0.07	345.4	265.6	274.70	31.22
50	-19.8	-26.4	0.0	0.00	-41.5	0.28	-14.2	0.99	-29.0	-0.69	0.01	21.1	14.0	265.43	31.76
51	10.0	-9.9	20.1	1.66	-24.3	0.10	19.5	1.67	-17.3	-1.07	0.04	59.3	53.9	178.82	32.60
52	-5.8	-40.7	0.0	0.00	-57.8	-3.07	-5.6	0.16	-57.2	-3.10	0.05	71.7	133.9	223.01	33.22
53	18.5	-0.1	59.2	3.25	-36.1	0.01	58.6	3.27	-14.0	-1.54	0.03	200.7	157.0	291.08	35.50
54	30.1	-9.6	38.5	1.63	-28.6	-1.92	38.4	1.70	-28.3	-1.95	0.05	80.7	106.3	220.11	37.02
55	54.6	-22.1	72.0	4.09	-41.2	-2.52	71.7	4.19	-40.4	-2.52	0.06	246.1	239.4	308.29	38.02
56	-3.7	-14.4	0.0	0.00	-30.1	-1.55	-1.7	0.57	-30.0	-1.64	0.05	20.1	26.6	221.81	38.60
57	12.1	-16.9	19.9	1.26	-33.0	-1.96	19.3	1.29	-32.8	-1.99	0.06	58.4	67.9	231.46	39.30

Table 7. SE19-FA-3

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
58	7.2	-2.3	13.8	1.00	-12.8	0.01	13.4	1.03	-7.8	-0.63	0.04	17.4	11.0	215.23	40.04
59	9.4	-5.3	17.7	1.12	-17.6	-1.26	17.7	1.12	-17.6	-1.27	0.07	23.1	24.1	120.29	40.90
60	4.8	-8.0	9.1	0.65	-17.8	-1.19	9.0	0.68	-17.7	-1.22	0.07	15.5	18.3	117.50	41.52
61	2.0	-4.5	4.4	0.46	-10.4	-0.74	4.4	0.52	-10.4	-0.74	0.08	5.8	6.1	106.43	42.12
62	-1.9	-8.4	0.0	0.00	-20.8	-1.33	-1.9	0.12	-20.8	-1.35	0.06	9.4	20.1	109.39	43.04
63	8.7	-2.2	15.2	0.99	-9.8	-0.87	15.0	0.99	-9.8	-0.87	0.07	16.8	14.2	106.74	44.24
64	5.5	-2.1	8.6	0.62	-9.2	-0.82	8.6	0.62	-8.9	-0.84	0.08	7.4	7.9	103.06	44.84
65	0.6	-8.8	0.9	0.16	-19.2	-1.32	0.9	0.16	-19.2	-1.32	0.07	11.0	18.0	112.18	45.36
66	1.3	-1.0	3.4	0.44	-6.3	0.00	3.1	0.47	-1.5	-0.20	0.04	2.4	0.8	112.27	45.78
67	3.0	-7.5	5.7	0.54	-17.1	-1.18	5.7	0.54	-17.1	-1.18	0.08	10.9	12.7	109.79	46.42
68	2.6	-3.8	6.8	0.64	-11.6	-0.83	6.6	0.65	-11.6	-0.83	0.08	8.7	8.6	112.90	46.98
69	8.8	-5.8	16.5	1.11	-16.6	-1.25	16.4	1.13	-16.6	-1.25	0.07	22.6	22.8	140.02	47.68
70	8.0	-6.4	15.2	1.02	-18.1	-1.25	15.2	1.02	-18.0	-1.27	0.07	22.3	25.2	140.81	48.46
71	-1.1	-2.9	0.0	0.00	-12.9	-0.86	-1.0	0.21	-12.8	-0.86	0.07	4.3	6.9	133.67	48.96
72	25.8	-35.4	40.0	1.82	-54.9	-3.42	39.9	1.89	-54.9	-3.42	0.06	156.0	179.1	254.06	49.88
73	9.6	-2.4	18.1	1.32	-30.5	0.00	18.1	1.36	-8.6	-0.73	0.03	39.2	22.3	279.84	50.82
74	-0.2	-3.2	0.0	0.00	-6.2	-0.50	-0.1	0.12	-6.0	-0.50	0.08	1.4	1.7	62.55	51.28
75	4.6	-2.6	7.9	0.60	-9.1	-0.73	7.9	0.60	-9.0	-0.76	0.08	6.9	7.2	119.57	52.02
76	7.3	-14.6	14.6	1.05	-32.5	-1.85	14.6	1.05	-32.5	-1.85	0.06	39.5	45.7	174.32	52.76
77	3.2	-8.2	10.0	1.03	-17.9	-1.01	9.9	1.04	-17.9	-1.01	0.07	20.9	19.3	171.96	53.50
78	0.7	-13.5	5.0	0.73	-23.9	-1.29	5.0	0.73	-23.6	-1.31	0.07	17.9	20.8	158.10	54.12
79	10.2	1.2	19.8	1.42	-10.1	0.01	19.8	1.42	-2.4	-0.55	0.05	23.5	22.1	173.10	54.82
80	6.5	-9.0	9.7	0.57	-23.7	-1.38	9.7	0.58	-23.7	-1.38	0.06	19.6	46.5	83.31	56.12
81	9.7	-3.0	19.5	1.28	-9.9	-0.77	18.9	1.34	-9.8	-0.79	0.07	22.6	13.7	99.50	57.78
82	19.3	5.3	30.3	1.57	-1.2	-0.72	29.3	1.68	-0.8	-0.72	0.07	33.7	34.7	157.91	58.50
83	9.7	-5.1	10.2	0.25	-19.7	-1.34	10.2	0.25	-18.7	-1.36	0.05	19.4	50.3	149.10	59.44
84	25.4	3.3	36.9	1.74	-4.7	-0.98	36.2	1.87	-4.5	-0.99	0.07	49.5	30.0	180.97	60.30
85	19.5	-3.9	26.8	1.16	-19.3	-1.49	26.4	1.19	-19.0	-1.55	0.06	37.1	39.0	166.12	61.16
86	6.3	2.1	*8.8*	0.48	-3.1	0.02	8.6	0.49	-0.4	-0.38	0.04	4.0	3.6	55.63	61.96
87	0.0	-2.2	7.0	0.30	-11.4	-1.01	6.7	0.31	-11.4	-1.01	0.07	6.8	10.9	80.07	62.80

Table 7. SE19-FA-3

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
88	**9.3**	**-1.2**	**13.3**	**0.69**	**-8.3**	**-0.82**	**12.2**	**0.70**	**-8.3**	**-0.85**	**0.07**	**10.5**	**13.6**	**71.39**	**64.02**
89	**5.9**	**3.1**	**7.9**	**0.43**	**0.0**	**0.00**	**7.9**	**0.43**	**0.6**	**-0.35**	**0.05**	**2.4**	**1.5**	**63.66**	**64.66**
90	**4.9**	**2.9**	**5.1**	**0.13**	**-0.5**	**-0.42**	**5.0**	**0.15**	**-0.5**	**-0.42**	**0.10**	**1.2**	**1.2**	**49.28**	**65.12**
91	**9.4**	**1.5**	**13.9**	**0.75**	**-4.2**	**-0.62**	**13.9**	**0.78**	**-3.9**	**-0.63**	**0.08**	**8.3**	**10.9**	**74.55**	**66.78**
92	**5.2**	**3.3**	**5.5**	**0.18**	**0.0**	**0.00**	**5.5**	**0.21**	**1.6**	**-0.30**	**0.03**	**1.0**	**0.9**	**34.14**	**67.32**
93	**4.9**	**1.8**	**5.1**	**0.13**	**-1.7**	**-0.44**	**5.1**	**0.14**	**-1.6**	**-0.47**	**0.08**	**1.5**	**1.9**	**24.25**	**67.98**
94	**3.3**	**0.9**	**3.4**	**0.06**	**-4.4**	**-0.62**	**3.3**	**0.07**	**-4.2**	**-0.63**	**0.09**	**2.0**	**3.0**	**31.88**	**68.62**
95	**7.2**	**-0.8**	**9.6**	**0.43**	**-9.2**	**-0.92**	**9.5**	**0.44**	**-9.2**	**-0.94**	**0.07**	**7.6**	**11.8**	**69.15**	**69.92**
96	**7.7**	**5.4**	**9.9**	**0.58**	**0.0**	**0.00**	**9.9**	**0.58**	**4.8**	**-0.17**	**0.06**	**2.7**	**1.6**	**68.39**	**70.48**
97	**6.8**	**4.5**	**7.6**	**0.25**	**0.0**	**0.00**	**7.6**	**0.25**	**3.1**	**-0.27**	**0.03**	**0.7**	**0.7**	**22.68**	**71.02**
98	**7.2**	**0.5**	**9.0**	**0.39**	**-5.6**	**-0.69**	**9.0**	**0.39**	**-5.5**	**-0.71**	**0.07**	**4.4**	**7.4**	**43.62**	**72.14**
99	7.8	3.8	11.4	0.59	0.0	0.00	11.4	0.59	1.7	-0.38	0.05	4.0	3.6	64.64	72.78
100	0.0	0.2	8.8	0.38	-7.7	-0.88	8.8	0.38	-7.4	-0.88	0.08	6.5	7.5	82.74	73.42
101	***7.6***	***1.4***	***10.0***	***0.56***	***-1.4***	***-0.47***	***10.0***	***0.56***	***-1.1***	***-0.47***	***0.09***	***4.5***	***4.2***	***82.98***	***73.98***
102	*7.8*	*-0.7*	*9.9*	*0.51*	*-7.3*	*-0.77*	*9.9*	*0.51*	*-7.3*	*-0.82*	*0.07*	*7.3*	*13.5*	*60.52*	*75.34*
103	5.5	*1.3*	*11.8*	*0.57*	*-6.9*	*-0.83*	*11.6*	*0.65*	*-6.7*	*-0.85*	*0.08*	*11.1*	*11.9*	*61.44*	*78.24*
104	***2.0***	***1.0***	***3.0***	***0.09***	***-3.8***	***-0.55***	***3.0***	***0.09***	***-3.7***	***-0.58***	***0.09***	***2.6***	***4.1***	***26.16***	***80.24***
105	*5.7*	*1.0*	*6.7*	*0.29*	*-1.8*	*-0.48*	*6.6*	*0.30*	*-1.8*	*-0.48*	*0.09*	*2.4*	*2.6*	*30.78*	*81.44*
106	***3.5***	***2.4***	***3.7***	***0.08***	***0.0***	***0.00***	***3.6***	***0.09***	***0.9***	***-0.28***	***0.02***	***0.4***	***0.4***	***29.97***	***81.94***
107	***2.7***	***1.1***	***4.3***	***0.12***	***-2.9***	***-0.53***	***4.2***	***0.12***	***-2.9***	***-0.53***	***0.09***	***2.1***	***2.7***	***44.91***	***83.36***
108	***5.9***	***2.6***	***7.1***	***0.34***	***-0.7***	***-0.42***	***7.1***	***0.34***	***-0.7***	***-0.42***	***0.10***	***2.2***	***2.2***	***45.67***	***84.08***
109	***3.7***	***0.7***	***3.9***	***0.09***	***-5.7***	***-0.71***	***3.9***	***0.09***	***-5.7***	***-0.71***	***0.08***	***2.7***	***4.1***	***51.75***	***84.72***
110	***4.9***	***3.4***	***5.8***	***0.26***	***0.0***	***0.00***	***5.7***	***0.28***	***2.4***	***-0.22***	***0.05***	***0.9***	***0.8***	***48.39***	***85.82***
111	***4.5***	***4.0***	***5.0***	***0.16***	***0.0***	***0.00***	***5.0***	***0.16***	***3.9***	***-0.10***	***0.03***	***0.2***	***0.2***	***14.51***	***86.26***
112	4.5	3.3	5.1	0.17	0.0	0.00	5.1	0.17	2.3	-0.22	0.03	0.3	0.4	12.51	86.94
113	4.5	4.0	4.9	0.14	0.0	0.00	4.9	0.15	4.0	-0.08	0.03	0.1	0.2	13.56	87.36
114	4.5	2.4	5.1	0.18	-1.1	-0.39	5.1	0.18	-0.8	-0.39	0.09	1.1	1.8	8.95	90.00
115	0.0	3.3	3.6	0.08	0.0	0.00	3.6	0.08	3.1	-0.07	0.02	0.1	0.1	7.47	90.64
116	3.4	1.8	3.5	0.06	0.0	0.00	3.5	0.07	0.8	-0.27	0.02	0.6	0.6	23.75	99.84

Table 8. SE19-FA-4

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	81.8	-66.7	105.9	19.14	-92.5	-12.18	59.4	22.08	-47.8	-21.66	3.29	10197.0	10323.5	617.8	
1	***0.7***	***0.2***	***0.7***	***0.58***	***-0.1***	***-0.27***	***0.6***	***0.60***	***0.2***	***-1.10***	***1.03***	***0.6***	***1.3***	***7.43***	***0.46***
2	0.2	0.1	0.3	0.34	0.0	0.00	0.3	0.61	0.1	-0.71	1.15	0.1	0.3	3.10	0.84
3	0.1	0.0	0.1	0.14	-0.1	-0.30	0.1	0.15	-0.1	-0.44	1.88	0.0	0.6	2.16	1.60
4	0.4	0.4	0.5	0.33	0.0	0.00	0.5	0.37	0.5	-0.24	0.68	0.1	0.1	6.79	1.98
5	0.5	0.2	0.6	0.47	0.0	0.00	0.6	0.51	0.2	-0.70	0.85	0.2	0.4	3.04	2.36
6	*0.5*	0.2	*0.6*	*0.64*	0.0	0.00	*0.6*	*0.64*	*0.3*	*-0.86*	*1.10*	*0.4*	*0.5*	*5.46*	*2.78*
7	0.2	0.0	0.3	0.54	-0.1	-0.64	0.3	0.54	0.0	-0.82	3.23	0.1	1.0	2.91	3.18
8	0.5	0.1	0.5	0.02	0.0	-0.69	0.2	0.33	0.0	-0.87	1.37	0.4	0.4	5.19	3.66
9	0.5	0.4	0.5	0.07	0.0	0.00	0.3	0.56	0.3	-0.58	0.13	0.2	0.0	2.98	4.02
10	*0.5*	*0.1*	*0.5*	*0.28*	*-0.1*	*-1.18*	*0.5*	*0.47*	*-0.1*	*-1.29*	*2.11*	*0.3*	*1.8*	*3.94*	*4.38*
11	***0.5***	***0.1***	***0.5***	***0.57***	***0.0***	***0.00***	***0.4***	***1.26***	***0.1***	***-1.33***	***1.15***	***0.7***	***0.3***	***4.62***	***4.74***
12	0.3	0.4	0.4	-0.18	0.0	0.00	0.3	0.73	0.4	-0.37	0.41	0.0	-0.2	2.48	5.10
13	0.5	0.5	0.6	0.55	0.0	0.00	0.5	0.57	0.4	-0.38	0.90	0.0	0.2	3.36	5.42
14	**0.5**	**0.1**	**0.6**	**0.59**	**0.0**	**0.00**	**0.6**	**0.59**	**0.2**	**-0.96**	**0.92**	**0.3**	**0.8**	**4.24**	**5.86**
15	*0.5*	*0.1*	*0.6*	*0.69*	0.0	*-1.13*	*0.4*	0.77	0.0	*-1.13*	*2.88*	*0.6*	*1.7*	*5.32*	*6.34*
16	***0.6***	***0.2***	***0.6***	***1.08***	***0.0***	***0.00***	***0.5***	***1.25***	***0.3***	***-0.92***	***1.67***	***0.6***	***-0.2***	***4.64***	***7.00***
17	**0.6**	**0.1**	**0.6**	**0.01**	**0.0**	**0.00**	**0.5**	**0.35**	**0.1**	**-0.87**	**0.02**	**0.4**	**1.3**	**3.48**	**7.62**
18	***0.6***	***0.1***	***0.7***	***1.27***	***-0.2***	***-1.51***	***0.7***	***1.27***	***-0.2***	***-1.94***	***3.10***	***1.4***	***3.2***	***6.73***	***8.06***
19	***0.6***	***0.1***	***0.9***	***1.46***	***-0.1***	***-1.79***	***0.7***	***1.64***	***0.0***	***-1.82***	***3.22***	***1.5***	***1.3***	***5.78***	***8.52***
20	***0.5***	***0.1***	***0.6***	***0.63***	***0.0***	***0.00***	***0.5***	***1.56***	***0.2***	***-1.43***	***0.99***	***0.9***	***-0.4***	***5.76***	***8.96***
21	0.6	0.1	0.6	0.41	0.0	-0.93	0.4	0.93	0.0	-1.00	2.21	0.4	1.4	3.84	9.62
22	0.5	0.2	0.7	1.10	-0.1	-1.35	0.5	1.31	0.1	-1.63	3.29	1.0	0.9	5.26	10.02
23	**0.6**	**0.3**	**0.9**	**1.37**	**0.0**	**0.00**	**0.7**	**1.52**	**0.2**	**-1.27**	**1.55**	**0.7**	**0.1**	**7.28**	**10.50**
24	0.6	0.5	0.6	0.44	0.0	0.00	0.6	0.61	0.5	-0.41	0.68	0.1	0.2	6.03	10.92
25	**0.6**	**0.4**	**1.0**	**1.58**	**-0.1**	**-1.92**	**0.7**	**1.74**	**0.1**	**-2.21**	**2.97**	**2.1**	**4.5**	**10.48**	**11.92**
26	0.7	0.6	0.9	1.23	0.0	0.00	0.9	1.39	0.4	-1.30	1.32	0.5	0.2	5.82	12.26
27	*0.6*	*0.1*	*0.9*	*1.09*	*-0.5*	*-2.25*	*0.8*	*1.13*	*-0.5*	*-2.25*	*2.37*	*1.5*	*7.7*	*11.11*	*12.72*

Table 8. SE19-FA-4

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
28	*0.7*	*-0.3*	*0.8*	*1.58*	*-1.2*	*-3.46*	*0.6*	*1.64*	*-1.1*	*-3.63*	*2.53*	*3.4*	*14.0*	*17.21*	*13.32*
29	***1.3***	***-0.2***	***2.6***	***5.11***	***-1.5***	***-4.46***	***2.5***	***5.53***	***-1.5***	***-4.67***	***2.31***	***14.1***	***14.3***	***27.18***	***13.80***
30	**1.8**	**-0.1**	**2.8**	**5.38**	**-1.4**	**-3.77**	**2.6**	**5.46**	**-1.4**	**-5.21**	**2.16**	**14.6**	**3.0**	**29.53**	**14.34**
31	***1.2***	***0.0***	***1.9***	***2.26***	***-0.8***	***-2.57***	***1.5***	***2.86***	***-0.7***	***-2.88***	***1.82***	***6.0***	***18.9***	***21.60***	***14.96***
32	***3.0***	***-4.7***	***4.8***	***8.06***	***-8.8***	***-12.92***	***4.7***	***8.39***	***-8.7***	***-13.13***	***1.55***	***94.8***	***205.3***	***124.66***	***15.46***
33	***7.9***	***-12.0***	***15.3***	***15.76***	***-20.3***	***-17.10***	***14.9***	***16.31***	***-19.4***	***-17.58***	***0.92***	***411.7***	***446.3***	***195.33***	***16.02***
34	***11.3***	***-13.2***	***22.1***	***17.70***	***-26.0***	***-17.36***	***21.6***	***18.07***	***-25.7***	***-18.30***	***0.73***	***523.1***	***518.8***	***287.78***	***16.62***
35	***25.8***	***-37.9***	***38.1***	***20.98***	***-54.2***	***-20.22***	***36.6***	***21.79***	***-47.8***	***-21.66***	***0.45***	***1343.2***	***1589.6***	***355.09***	***17.28***
36	***46.3***	***-51.4***	***65.4***	***20.54***	***-73.2***	***-17.92***	***59.4***	***22.08***	***-72.3***	***-18.74***	***0.28***	***1819.8***	***1482.6***	***497.68***	***18.10***
37	32.3	14.6	44.4	7.95	-44.3	0.57	44.4	7.95	10.6	-1.67	0.08	319.5	40.3	448.88	18.98
38	22.9	4.1	27.0	2.19	-4.7	-2.49	26.7	2.28	-4.4	-2.50	0.15	47.6	70.5	76.20	20.00
39	25.7	-7.4	38.0	5.41	-17.9	-3.26	37.7	5.52	-17.4	-3.41	0.16	149.6	195.4	169.10	21.20
40	21.0	1.1	30.8	4.17	-6.5	-2.25	30.8	4.17	-5.8	-2.31	0.17	92.9	55.4	179.01	21.94
41	21.6	-10.0	31.7	4.09	-21.7	-3.55	31.5	4.15	-21.4	-3.68	0.14	121.9	129.1	190.25	22.74
42	3.3	-3.7	8.6	1.55	-8.0	0.12	8.6	1.55	-6.6	-1.24	0.09	20.2	21.0	93.68	24.26
43	4.8	-5.7	9.9	1.73	-14.2	-2.37	9.9	1.73	-14.0	-2.43	0.17	25.8	32.6	108.95	24.92
44	4.7	2.9	10.6	1.82	-3.4	0.17	10.5	1.88	2.6	-0.25	0.12	12.7	6.3	119.44	25.38
45	4.7	-3.4	5.3	0.56	-7.7	-1.51	5.3	0.56	-7.7	-1.51	0.16	7.9	11.9	68.71	25.92
46	4.1	-6.6	9.0	1.47	-16.3	-2.67	8.9	1.56	-16.3	-2.81	0.16	27.6	70.4	104.77	26.86
47	19.9	18.7	32.5	4.64	-4.5	0.12	32.5	4.64	18.7	-0.19	0.12	75.1	61.6	164.62	27.46
48	22.0	-51.1	28.4	3.00	-70.9	-14.50	28.3	3.05	-70.7	-15.15	0.18	427.9	964.9	396.96	28.32
49	***81.8***	***-66.7***	***105.9***	***19.14***	***-92.5***	***-12.18***	***95.4***	***20.45***	***-92.1***	***-12.57***	***0.16***	***2081.7***	***1734.0***	***617.79***	***29.36***
50	23.4	16.3	36.0	2.97	-61.2	0.22	35.2	3.12	16.1	-0.42	0.03	167.4	11.6	316.14	30.30
51	29.6	-49.5	39.8	3.15	-70.7	-5.53	39.8	3.15	-70.7	-5.53	0.08	240.4	281.0	272.54	31.20
52	-11.3	-21.1	0.0	0.00	-43.5	0.21	-5.6	1.61	-26.3	-0.92	0.00	46.4	25.7	284.67	31.82
53	4.1	-17.2	15.4	2.05	-25.6	-1.64	15.4	2.05	-25.6	-1.64	0.09	68.0	70.0	160.21	32.62
54	-11.1	-39.4	0.0	0.00	-55.8	-3.60	-10.8	0.34	-54.9	-3.61	0.06	76.2	165.2	222.25	33.22
55	45.8	-12.5	61.9	4.83	-35.0	0.07	61.9	4.83	-24.1	-2.38	0.05	292.7	231.5	303.72	34.46
56	12.9	-10.0	20.0	1.39	-21.6	-2.12	20.0	1.39	-21.6	-2.12	0.08	48.8	51.1	171.34	35.52
57	20.9	-14.9	31.6	2.00	-31.3	-2.56	31.6	2.00	-29.3	-2.59	0.07	100.6	122.7	229.55	36.40

Table 8. SE19-FA-4

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
58	-7.8	-11.1	0.0	0.00	-13.9	-0.54	-6.4	0.43	-13.7	-0.58	0.04	3.4	0.8	76.07	37.02
59	49.2	-36.4	61.1	4.51	-53.2	-3.82	61.1	4.68	-53.2	-3.96	0.07	309.7	320.7	279.53	38.00
60	-5.9	-22.2	0.0	0.00	-31.8	0.07	-1.7	1.30	-28.3	-1.46	0.00	35.0	33.3	214.16	38.58
61	8.1	-28.0	16.8	1.70	-41.0	-2.69	16.4	1.74	-40.7	-2.83	0.08	91.0	109.1	214.47	39.30
62	2.1	-7.2	10.7	1.47	-23.8	0.03	10.5	1.51	-11.0	-0.69	0.04	31.1	17.3	233.98	40.02
63	5.5	-15.8	12.6	1.52	-26.2	-1.77	12.6	1.52	-26.2	-1.77	0.08	33.6	37.7	126.62	40.90
64	-2.0	-16.1	2.1	0.90	-24.4	-1.55	2.0	0.90	-24.3	-1.58	0.09	20.4	25.2	122.75	41.52
65	-7.3	-15.8	0.3	0.89	-24.7	-1.55	0.3	0.89	-24.7	-1.57	0.10	19.3	30.4	117.73	43.02
66	1.4	-10.3	8.5	1.26	-18.5	-1.22	7.5	1.31	-18.5	-1.22	0.09	24.4	21.5	119.38	44.26
67	-0.3	-8.5	3.4	0.92	-12.7	-0.75	3.3	0.96	-12.7	-0.75	0.10	9.3	10.4	119.15	44.82
68	-4.3	-14.2	0.0	0.00	-22.3	-1.41	-2.5	0.46	-22.3	-1.48	0.06	12.0	19.9	111.44	45.36
69	-4.1	-5.8	0.6	0.80	-12.0	0.04	0.3	0.83	-6.4	-0.20	0.06	5.2	1.3	118.11	45.82
70	-3.0	-14.5	0.0	0.00	-22.4	-1.50	-0.4	0.62	-22.4	-1.50	0.07	12.2	16.7	109.07	46.42
71	-1.7	-9.7	4.0	1.10	-14.8	-0.84	3.6	1.12	-14.7	-0.88	0.10	13.1	11.2	122.24	46.98
72	3.5	-12.7	11.4	1.46	-23.8	-1.62	11.3	1.52	-23.2	-1.69	0.09	32.2	34.8	150.62	47.70
73	1.3	-13.8	10.3	1.40	-23.0	-1.57	10.1	1.43	-23.0	-1.57	0.09	30.4	35.3	150.63	48.44
74	-4.9	-11.3	0.0	0.00	-15.7	-0.84	-2.8	0.58	-15.7	-0.84	0.05	6.3	5.8	96.60	48.94
75	19.4	-42.5	31.9	2.30	-61.7	-4.79	31.5	2.32	-61.7	-4.79	0.08	207.6	267.2	278.83	49.88
76	15.9	1.8	27.7	2.18	-36.5	0.09	27.3	2.22	-4.4	-0.94	0.03	89.5	44.8	325.39	50.86
77	3.4	0.7	3.5	0.13	-2.3	-0.67	3.5	0.13	-2.3	-0.67	0.14	1.5	2.2	62.80	51.30
78	0.0	1.6	12.7	0.77	-4.8	-0.90	12.2	0.78	-4.7	-0.91	0.10	9.0	9.7	116.40	52.04
79	12.6	-17.0	19.4	1.43	-28.4	-2.08	19.4	1.48	-28.4	-2.08	0.07	50.6	59.0	151.00	52.74
80	7.5	-8.8	15.0	1.46	-16.1	-1.26	14.8	1.52	-16.1	-1.26	0.09	33.5	30.1	178.69	53.50
81	3.5	-10.3	7.5	0.91	-21.2	-1.59	7.4	0.96	-20.9	-1.59	0.09	22.1	26.5	163.32	54.14
82	12.8	2.0	23.3	1.92	-7.1	0.14	22.3	1.92	-2.9	-0.79	0.06	35.0	33.4	177.36	54.86
83	7.5	-7.4	10.3	0.58	-17.4	-1.46	10.2	0.64	-17.3	-1.48	0.07	18.3	47.0	76.65	56.04
84	11.0	-3.5	19.7	1.66	-9.7	-1.03	19.7	1.66	-9.7	-1.04	0.09	27.9	20.9	87.19	57.78
85	19.8	3.8	31.8	2.28	-3.4	-1.01	31.8	2.39	-3.4	-1.06	0.09	48.6	50.2	157.34	58.54
86	7.6	-6.4	8.3	0.30	-15.4	-1.55	8.3	0.30	-15.1	-1.57	0.08	18.1	48.1	90.11	59.40
87	24.5	-4.5	34.6	2.44	-16.1	-1.70	34.2	2.47	-15.8	-1.74	0.08	72.0	54.5	173.29	60.34

Table 8. SE19-FA-4

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
88	13.2	-9.8	18.7	1.26	-21.5	-1.96	18.6	1.28	-21.5	-1.96	0.08	41.5	49.4	180.53	61.04
89	6.1	-0.5	11.6	1.00	-7.7	0.06	11.6	1.00	-4.2	-0.65	0.05	11.4	9.5	91.19	62.06
90	2.1	-4.8	2.5	0.17	-11.6	-1.10	2.4	0.17	-11.3	-1.12	0.09	6.6	13.2	87.66	62.78
91	7.9	-3.7	13.8	1.12	-10.5	-1.07	13.7	1.18	-10.3	-1.09	0.09	16.6	22.4	88.77	64.00
92	4.2	1.0	9.7	0.87	-2.2	0.07	9.7	0.87	-1.3	-0.42	0.07	7.0	3.8	75.95	65.12
93	7.6	-0.6	12.6	1.02	-5.3	-0.73	12.5	1.06	-5.3	-0.73	0.10	8.5	11.8	73.47	66.22
94	1.5	-1.3	*1.7*	0.17	-4.8	-0.63	1.7	0.17	-4.8	-0.63	0.12	1.7	2.4	36.13	66.76
95	3.1	0.6	4.0	0.25	-0.6	0.01	3.9	0.30	-0.4	-0.28	0.05	1.2	1.2	34.61	67.32
96	**2.5**	**-0.6**	**3.1**	**0.21**	**-3.4**	**-0.50**	**3.1**	**0.21**	**-3.4**	**-0.52**	**0.11**	**1.5**	**2.1**	**24.64**	**67.96**
97	**1.9**	**-1.5**	**2.1**	**0.14**	**-5.4**	**-0.73**	**1.9**	**0.16**	**-5.2**	**-0.73**	**0.12**	**2.2**	**3.5**	**31.50**	**68.58**
98	**5.2**	**-3.6**	**8.4**	**0.67**	**-10.2**	**-1.07**	**8.2**	**0.67**	**-10.1**	**-1.10**	**0.09**	**9.0**	**16.3**	**72.83**	**69.90**
99	**5.9**	**3.7**	**10.6**	**0.92**	**-2.1**	**0.05**	**10.5**	**0.99**	**3.2**	**-0.20**	**0.07**	**5.8**	**3.5**	**75.88**	**70.56**
100	**4.8**	**2.7**	**4.9**	**0.15**	**0.0**	**0.00**	**4.9**	**0.15**	**1.9**	**-0.27**	**0.03**	**0.5**	**0.6**	**20.57**	**71.02**
101	**5.2**	**-1.7**	**7.7**	**0.53**	**-6.4**	**-0.78**	**7.7**	**0.53**	**-6.4**	**-0.78**	**0.09**	**5.0**	**8.2**	**29.91**	**72.10**
102	**5.7**	**0.6**	**9.9**	**0.84**	**-1.7**	**-0.45**	**9.9**	**0.84**	**-1.6**	**-0.48**	**0.11**	**5.6**	**6.1**	**62.29**	**72.80**
103	**6.2**	**0.8**	**10.1**	**0.88**	**-8.2**	**-0.94**	**9.8**	**0.89**	**-8.1**	**-0.95**	**0.10**	**12.8**	**14.3**	**87.19**	**74.02**
104	**-0.7**	**-2.7**	**7.9**	**0.61**	**-7.8**	**-0.82**	**7.8**	**0.62**	**-7.6**	**-0.89**	**0.09**	**8.2**	**14.8**	**58.61**	**75.32**
105	5.3	-1.4	10.6	0.86	-7.6	-0.90	10.2	0.88	-7.5	-0.93	0.10	9.4	10.4	58.55	76.62
106	1.2	-0.2	2.0	0.24	-0.5	-0.16	2.0	0.26	-0.5	-0.17	0.16	0.6	0.4	42.76	77.02
107	***4.1***	***-1.3***	***6.4***	***0.52***	***-4.8***	***-0.64***	***6.4***	***0.52***	***-4.8***	***-0.64***	***0.10***	***3.8***	***6.5***	***35.34***	***78.20***
108	*2.1*	*-0.9*	*2.8*	*0.27*	*-4.2*	*-0.58*	*2.8*	*0.27*	*-4.2*	*-0.58*	*0.12*	*1.7*	*2.0*	*35.12*	*78.90*
109	***-0.6***	***-0.8***	***0.0***	***0.00***	***-2.7***	***-0.36***	***-0.6***	***0.03***	***-2.7***	***-0.36***	***0.13***	***0.3***	***0.4***	***23.94***	***79.34***
110	*0.7*	*-1.5*	*0.8*	*0.11*	*-3.2*	*-0.42*	*0.8*	*0.11*	*-3.2*	*-0.45*	*0.13*	*0.8*	*1.6*	*20.00*	*80.20*
111	***3.6***	***-0.4***	***5.6***	***0.46***	***-3.1***	***-0.45***	***5.6***	***0.46***	***-2.9***	***-0.52***	***0.11***	***2.9***	***3.6***	***33.08***	***81.46***
112	***2.3***	***0.8***	***2.6***	***0.20***	***-0.1***	***-0.23***	***2.6***	***0.20***	***0.0***	***-0.24***	***0.16***	***0.6***	***0.6***	***31.10***	***81.94***
113	***2.6***	***0.2***	***3.2***	***0.20***	***-1.5***	***-0.32***	***3.1***	***0.23***	***-1.4***	***-0.34***	***0.11***	***1.0***	***1.1***	***23.48***	***82.62***
114	***1.6***	***-1.0***	***1.6***	***0.12***	***-4.0***	***-0.55***	***1.6***	***0.12***	***-4.0***	***-0.55***	***0.12***	***1.2***	***1.7***	***40.51***	***83.36***
115	***4.0***	***-0.3***	***5.9***	***0.49***	***-2.5***	***-0.46***	***5.7***	***0.49***	***-2.5***	***-0.46***	***0.11***	***2.7***	***2.9***	***46.24***	***84.04***
116	2.3	-2.3	2.4	0.18	-6.6	-0.82	2.3	0.18	-6.6	-0.82	0.11	3.0	4.8	50.80	84.70
117	3.2	1.2	5.0	0.46	-1.2	0.02	4.9	0.46	0.5	-0.22	0.07	1.8	1.5	51.37	85.82

Table 8. SE19-FA-4

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
118	2.8	2.5	3.2	0.20	0.0	0.00	3.2	0.20	2.4	-0.06	0.06	0.2	0.3	15.71	86.22
119	3.2	1.7	4.0	0.28	0.0	0.00	4.0	0.28	1.2	-0.19	0.07	0.4	0.5	13.59	86.92
120	0.8	0.5	3.7	0.25	-2.4	-0.41	3.7	0.26	-2.3	-0.41	0.11	1.3	2.1	14.16	89.94
121	0.0	1.4	2.4	0.15	0.0	0.00	2.4	0.16	1.2	-0.12	0.06	0.2	0.3	7.62	91.50
122	1.7	1.4	1.8	0.06	0.0	0.00	1.8	0.06	1.0	-0.13	0.03	0.0	0.0	5.65	92.00
123	0.7	0.6	1.6	0.03	-0.5	-0.24	1.5	0.03	-0.4	-0.25	0.13	0.4	0.4	8.06	94.36
124	0.9	0.8	0.9	0.03	0.0	0.00	0.8	0.03	0.3	-0.15	0.03	0.0	0.0	4.56	94.86
125	1.0	0.5	1.0	0.03	-0.3	-0.21	1.0	0.03	-0.1	-0.22	0.20	0.1	0.1	26.92	99.86

Table 9. SE19-FA-5

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	101.0	-52.2	124.5	11.54	-79.6	-8.34	58.7	20.87	-46.3	-21.46	4.32	9195.9	9152.3	633.5	
1	***0.5***	***0.1***	***0.6***	***0.49***	***-0.1***	***-1.14***	***0.5***	***0.50***	***0.0***	***-1.37***	***2.21***	***0.7***	***1.4***	***6.33***	***0.44***
2	*0.2*	*0.0*	*0.4*	*0.87*	*-0.1*	*-1.13*	*0.3*	*0.96*	*-0.1*	*-1.13*	*4.32*	*0.2*	*0.4*	*4.19*	*0.80*
3	**0.2**	**0.1**	**0.3**	**0.61**	**-0.1**	**-0.70**	**0.3**	**0.61**	**0.0**	**-0.75**	**3.97**	**0.1**	**0.1**	**3.29**	**1.22**
4	*0.1*	*-0.1*	*0.1*	*0.03*	*-0.2*	*-0.56*	*0.1*	*0.03*	*-0.1*	*-0.65*	*2.50*	*0.1*	*0.4*	*3.42*	*1.54*
5	0.5	0.5	0.6	0.48	0.0	0.00	0.4	0.71	0.3	-0.87	0.85	0.3	0.1	7.79	1.96
6	***0.5***	***0.1***	***0.7***	***0.66***	***0.0***	***0.00***	***0.7***	***0.66***	***0.2***	***-1.20***	***0.99***	***0.4***	***0.6***	***3.43***	***2.32***
7	0.6	0.1	0.6	0.79	0.0	0.00	0.4	0.98	0.3	-1.40	1.32	0.7	0.5	5.31	2.72
8	0.2	0.0	0.3	0.40	-0.1	-1.30	0.3	0.83	-0.1	-1.42	3.52	0.3	1.4	3.18	3.12
9	0.2	0.0	0.4	-0.22	-0.1	-0.55	0.1	0.75	0.0	-0.71	0.72	0.3	-0.4	4.00	3.64
10	***0.4***	***0.4***	***0.4***	***-0.17***	***0.0***	***0.00***	***0.1***	***0.43***	***0.4***	***-0.63***	***0.38***	***0.1***	***0.0***	***4.31***	***3.98***
11	***0.5***	***-0.1***	***0.6***	***0.52***	***-0.2***	***-1.40***	***0.6***	***0.56***	***-0.2***	***-1.45***	***2.28***	***0.7***	***2.0***	***4.25***	***4.34***
12	0.4	0.1	0.4	-0.09	-0.1	-1.19	0.4	1.43	0.1	-1.73	2.12	0.9	0.4	5.78	4.72
13	0.3	0.3	0.3	-0.30	0.0	0.00	0.2	1.09	0.2	-0.95	0.92	0.1	-0.4	3.36	5.08
14	0.5	0.4	0.6	0.78	0.0	0.00	0.6	0.78	0.3	-0.78	1.42	0.1	0.1	4.24	5.42
15	**0.6**	**0.1**	**0.7**	**0.70**	**0.0**	**0.00**	**0.6**	**0.72**	**0.2**	**-1.31**	**1.03**	**0.5**	**1.0**	**2.35**	**5.82**
16	*0.5*	*0.0*	*0.6*	*0.33*	*-0.1*	*-1.53*	*0.4*	*1.21*	*0.1*	*-1.64*	*2.43*	*1.2*	*1.8*	*5.46*	*6.28*
17	***0.5***	***0.6***	***0.6***	***0.40***	***0.0***	***0.00***	***0.3***	***1.36***	***0.3***	***-0.85***	***0.68***	***0.6***	***-1.2***	***4.88***	***7.28***
18	***0.0***	***0.2***	***0.6***	***0.00***	***0.0***	***0.00***	***0.6***	***0.02***	***0.0***	***-1.00***	***0.01***	***0.4***	***1.2***	***2.35***	***7.60***
19	***0.5***	***0.0***	***0.8***	***1.28***	***-0.5***	***-2.18***	***0.7***	***1.38***	***-0.5***	***-2.18***	***2.69***	***1.8***	***4.0***	***7.62***	***8.04***
20	***0.7***	***-0.2***	***1.1***	***1.92***	***-0.7***	***-2.42***	***0.8***	***2.24***	***-0.5***	***-2.42***	***2.46***	***2.9***	***2.5***	***11.94***	***8.50***
21	***0.6***	***-0.1***	***1.0***	***1.62***	***-0.4***	***-2.25***	***0.8***	***2.37***	***-0.4***	***-2.25***	***2.69***	***2.7***	***0.0***	***9.63***	***8.94***
22	0.6	0.1	0.9	1.37	0.0	0.00	0.8	1.91	0.1	-1.76	1.52	1.5	-0.6	10.10	9.36
23	0.1	-0.1	0.2	0.47	-0.2	-0.91	0.2	0.47	-0.2	-0.91	3.58	0.1	0.4	2.54	9.66
24	0.5	0.0	0.5	0.93	-0.1	-1.12	0.5	1.01	0.0	-1.63	2.99	1.1	1.2	6.86	10.02
25	0.6	0.2	1.0	1.51	0.0	0.00	0.7	1.59	0.1	-1.85	1.59	1.3	0.3	11.60	10.46
26	0.5	0.4	0.8	1.19	0.0	0.00	0.7	1.30	0.2	-1.50	1.44	0.8	0.2	7.81	10.86
27	0.6	0.0	0.9	1.26	-0.5	-2.15	0.9	1.33	-0.5	-2.16	2.41	1.4	5.8	8.13	11.32

Table 9. SE19-FA-5

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
28	0.6	0.2	0.7	1.20	-0.2	-2.03	0.3	1.52	0.0	-2.12	3.41	1.4	-2.9	6.46	11.90
29	0.6	0.4	1.0	1.49	0.0	0.00	0.9	1.53	0.2	-1.57	1.53	0.9	-0.2	8.04	12.26
30	*0.6*	*-0.2*	*0.8*	*1.31*	*-0.9*	*-2.63*	*0.8*	*1.31*	*-0.8*	*-2.80*	*2.32*	*2.2*	*9.7*	*11.05*	*12.70*
31	***0.6***	***-0.4***	***0.8***	***2.05***	***-1.1***	***-3.32***	***0.8***	***2.06***	***-1.0***	***-3.46***	***2.78***	***3.5***	***10.9***	***13.46***	***13.28***
32	***1.4***	***-0.2***	***2.5***	***4.43***	***-1.5***	***-4.62***	***2.3***	***5.34***	***-1.5***	***-4.62***	***2.25***	***14.4***	***12.5***	***26.82***	***13.78***
33	***1.5***	***-0.4***	***2.7***	***5.22***	***-1.7***	***-5.34***	***2.6***	***5.37***	***-1.7***	***-5.34***	***2.42***	***15.2***	***2.2***	***31.75***	***14.32***
34	1.0	-0.4	1.7	2.62	-1.2	-3.23	1.4	2.98	-1.0	-3.30	2.08	6.6	17.6	26.92	14.92
35	***2.7***	***-6.0***	***4.8***	***7.94***	***-10.4***	***-12.28***	***4.8***	***7.94***	***-10.2***	***-12.44***	***1.33***	***107.6***	***205.6***	***118.51***	***15.44***
36	***11.7***	***-14.2***	***17.1***	***13.96***	***-23.0***	***-16.19***	***17.0***	***14.67***	***-20.4***	***-16.59***	***0.75***	***461.9***	***478.2***	***212.03***	***16.02***
37	***15.0***	***-16.3***	***25.0***	***16.28***	***-26.6***	***-16.61***	***25.0***	***16.28***	***-25.3***	***-16.71***	***0.64***	***512.5***	***456.6***	***281.67***	***16.62***
38	***27.5***	***-33.4***	***38.9***	***19.30***	***-52.1***	***-19.85***	***37.1***	***19.51***	***-46.3***	***-21.46***	***0.43***	***1200.9***	***1452.8***	***384.04***	***17.28***
39	***53.2***	***-50.6***	***67.7***	***19.73***	***-68.8***	***-18.15***	***58.7***	***20.87***	***-67.0***	***-18.64***	***0.28***	***1699.6***	***1367.8***	***507.01***	***18.08***
40	32.3	20.5	44.5	6.34	-42.6	0.42	44.5	6.34	18.1	-1.28	0.07	258.1	20.3	432.05	18.94
41	26.2	4.5	30.0	1.81	-4.9	-2.42	29.8	1.81	-4.5	-2.46	0.12	51.3	73.0	75.50	19.98
42	29.4	-6.7	41.5	5.34	-16.9	-2.97	41.5	5.34	-16.5	-3.05	0.14	155.2	186.5	173.86	21.18
43	21.4	3.7	30.4	3.27	-3.4	0.04	30.4	3.27	-2.1	-1.97	0.10	75.6	45.0	173.48	21.90
44	26.8	-8.0	34.5	3.87	-21.0	-3.23	34.5	3.87	-19.7	-3.24	0.13	123.5	123.3	185.29	22.76
45	-4.5	-6.0	0.0	0.00	-8.3	-0.69	-4.0	0.33	-8.3	-0.69	0.08	2.1	4.0	63.94	23.08
46	6.0	-1.9	10.0	1.44	-7.4	-1.44	9.9	1.48	-7.4	-1.44	0.17	20.6	23.6	98.04	24.26
47	6.5	-3.5	11.6	1.50	-11.7	-2.06	11.2	1.66	-11.7	-2.14	0.15	26.2	28.7	107.25	24.90
48	6.4	3.5	10.5	1.53	-1.5	0.11	10.5	1.53	2.7	-0.41	0.12	10.0	5.8	110.21	25.38
49	5.5	-6.8	9.4	1.43	-16.0	-2.52	9.4	1.43	-16.0	-2.58	0.16	36.5	79.4	100.84	26.84
50	*24.8*	*-52.2*	*33.2*	*3.65*	*-71.5*	*-16.90*	*32.9*	*3.87*	*-71.3*	*-17.53*	*0.20*	*523.6*	*1135.5*	*401.96*	*28.28*
51	***101.0***	***-50.3***	***124.5***	***11.54***	***-79.6***	***-8.34***	***82.6***	***18.53***	***-77.6***	***-8.36***	***0.10***	***2006.4***	***1459.7***	***633.54***	***29.48***
52	31.9	-47.5	41.6	2.12	-67.3	-5.20	41.6	2.12	-67.3	-5.20	0.07	275.6	241.8	257.62	31.18
53	-10.4	-20.7	0.0	0.00	-42.2	0.05	-6.3	1.10	-24.8	-0.79	0.00	27.3	18.7	270.28	31.78
54	10.4	-8.8	21.1	1.61	-18.3	0.07	21.1	1.61	-16.5	-1.14	0.04	55.8	52.9	168.05	32.60
55	-4.6	-33.2	0.0	0.00	-56.2	-3.37	-4.8	0.16	-56.0	-3.39	0.06	76.4	144.1	249.68	33.24
56	47.0	8.1	63.7	2.91	-28.1	0.24	62.8	2.98	-1.2	-1.48	0.03	181.5	131.0	297.24	34.48
57	26.3	3.0	30.5	0.92	-8.2	-1.63	29.5	0.93	-8.2	-1.63	0.07	32.7	33.1	165.89	35.50

Table 9. SE19-FA-5

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
58	33.7	-8.6	41.8	1.61	-23.9	-1.96	41.7	1.62	-23.9	-1.96	0.05	83.8	109.4	224.17	37.00
59	60.4	-10.2	76.2	3.51	-30.1	-2.22	75.6	3.53	-29.5	-2.22	0.05	234.9	224.2	307.59	38.02
60	6.7	-10.2	9.0	0.63	-21.0	-1.55	9.0	0.63	-20.8	-1.61	0.07	22.8	27.8	197.17	38.58
61	18.7	-11.2	26.7	1.24	-27.4	-2.00	26.3	1.27	-27.2	-2.06	0.06	63.7	74.3	223.85	39.30
62	12.8	3.8	19.1	1.05	-7.0	0.08	18.7	1.06	-1.9	-0.65	0.04	19.3	12.7	216.22	40.04
63	17.5	-0.8	23.7	1.16	-12.7	-1.30	23.3	1.17	-12.7	-1.35	0.07	26.0	25.4	117.94	40.90
64	10.2	-3.2	13.0	0.57	-13.7	-1.35	13.0	0.57	-13.7	-1.35	0.07	15.8	19.0	115.38	41.52
65	7.5	1.8	9.7	0.49	-4.7	-0.69	9.7	0.49	-4.7	-0.69	0.08	5.9	5.8	110.28	42.14
66	3.7	-3.5	3.7	0.11	-15.9	-1.42	3.7	0.11	-15.8	-1.43	0.08	10.3	20.9	108.01	43.04
67	15.6	3.9	20.3	0.97	-5.2	-0.91	20.3	0.97	-5.2	-0.91	0.07	17.8	14.1	108.76	44.26
68	10.5	2.2	12.4	0.47	-5.3	-0.91	12.4	0.47	-5.1	-0.91	0.08	7.4	7.4	93.87	44.84
69	5.3	-3.4	5.6	0.13	-14.3	-1.38	5.6	0.13	-14.3	-1.38	0.08	11.1	18.7	114.01	45.36
70	6.6	4.3	8.4	0.42	-1.2	0.00	8.3	0.42	4.2	-0.20	0.04	2.3	0.9	112.50	45.76
71	9.2	0.3	11.9	0.50	-11.4	-1.17	11.8	0.58	-11.4	-1.17	0.07	12.1	13.0	112.08	46.44
72	9.5	-0.5	12.1	0.59	-6.4	-0.84	11.8	0.63	-6.4	-0.84	0.08	8.9	8.8	109.47	46.96
73	16.2	-0.6	21.5	1.05	-11.5	-1.28	20.6	1.10	-11.5	-1.28	0.07	23.3	23.0	143.53	47.68
74	15.3	0.1	20.4	0.99	-13.2	-1.35	20.4	0.99	-13.2	-1.35	0.07	23.5	25.8	141.38	48.48
75	3.9	0.4	4.2	0.19	-7.5	-0.81	4.2	0.19	-7.4	-0.82	0.09	4.3	6.9	112.08	48.94
76	35.3	-31.5	45.8	1.84	-49.8	-3.32	45.7	1.89	-49.8	-3.32	0.05	162.7	179.8	246.13	49.88
77	11.8	-0.2	19.3	1.28	-26.0	0.03	19.1	1.31	-7.0	-0.81	0.03	38.7	24.4	267.37	50.84
78	1.3	-0.1	1.3	0.05	-4.7	-0.55	1.2	0.07	-4.7	-0.55	0.10	1.4	1.8	68.64	51.30
79	7.0	-0.2	10.1	0.57	-6.9	-0.75	9.9	0.57	-6.8	-0.77	0.08	7.0	6.8	117.16	52.02
80	8.9	-15.8	16.4	1.02	-30.8	-1.91	16.4	1.02	-30.8	-1.91	0.06	40.8	47.3	165.32	52.74
81	7.8	-7.6	12.5	1.02	-15.3	-1.00	12.4	1.05	-14.9	-1.01	0.07	22.7	20.3	175.13	53.48
82	13.1	5.8	22.4	1.38	-21.4	-1.33	22.4	1.38	-21.3	-1.34	0.06	43.0	43.8	174.89	54.84
83	9.7	-7.1	12.7	0.48	-20.6	-1.42	12.1	0.49	-20.1	-1.43	0.06	20.2	46.4	79.49	56.10
84	14.8	-0.7	22.9	1.25	-6.3	-0.78	22.7	1.33	-6.3	-0.81	0.07	23.9	14.3	99.32	57.76
85	14.1	-3.2	34.5	1.60	-15.5	-1.38	33.7	1.67	-14.9	-1.40	0.06	55.9	87.1	158.62	59.42
86	30.2	11.7	*41.8*	1.78	-0.2	0.04	41.0	1.88	0.4	-1.05	0.04	52.1	31.1	182.37	60.32
87	26.2	0.1	31.1	1.11	-15.3	-1.59	30.7	1.12	-15.1	-1.60	0.06	39.2	40.6	160.57	61.16

Table 9. SE19-FA-5

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
88	**10.4**	**6.5**	**13.1**	**0.49**	**0.0**	**0.00**	**12.9**	**0.50**	**3.5**	**-0.40**	**0.04**	**4.2**	**3.6**	**57.45**	**61.98**
89	**9.5**	**0.6**	**10.1**	**0.21**	**-8.8**	**-1.07**	**10.0**	**0.22**	**-8.8**	**-1.08**	**0.07**	**7.9**	**11.9**	**83.76**	**62.80**
90	**13.4**	**3.7**	**17.3**	**0.72**	**-4.8**	**-0.83**	**17.3**	**0.72**	**-4.7**	**-0.86**	**0.07**	**11.5**	**13.4**	**75.88**	**64.04**
91	**10.0**	**6.8**	**11.7**	**0.42**	**0.0**	**0.00**	**11.7**	**0.42**	**5.0**	**-0.32**	**0.04**	**2.2**	**1.3**	**62.99**	**64.64**
92	**9.3**	**6.8**	**9.4**	**0.15**	**0.0**	**0.00**	**9.4**	**0.15**	**3.6**	**-0.41**	**0.02**	**1.3**	**1.2**	**47.73**	**65.12**
93	**13.2**	**4.9**	**17.8**	**0.69**	**-0.6**	**-0.65**	**17.4**	**0.72**	**-0.5**	**-0.67**	**0.07**	**8.8**	**11.1**	**74.87**	**66.76**
94	**9.5**	**7.8**	**10.2**	**0.21**	**0.0**	**0.00**	**10.2**	**0.24**	**6.3**	**-0.28**	**0.02**	**1.1**	**0.9**	**40.10**	**67.32**
95	**9.5**	**6.3**	**9.7**	**0.13**	**0.0**	**0.00**	**9.6**	**0.15**	**2.6**	**-0.46**	**0.01**	**1.6**	**1.9**	**25.34**	**67.98**
96	**7.9**	**5.3**	**7.9**	**0.04**	**0.0**	**0.00**	**7.8**	**0.09**	**0.2**	**-0.60**	**0.01**	**2.0**	**2.9**	**31.18**	**68.62**
97	**11.7**	**3.3**	**13.7**	**0.43**	**-6.7**	**-0.99**	**13.4**	**0.45**	**-6.6**	**-1.00**	**0.07**	**8.7**	**12.3**	**72.96**	**69.94**
98	10.8	9.7	13.4	0.52	0.0	0.00	13.3	0.52	9.3	-0.14	0.04	2.4	1.2	69.94	70.48
99	11.0	8.1	11.6	0.26	0.0	0.00	11.6	0.26	6.4	-0.31	0.02	1.0	0.8	22.42	71.04
100	***11.5***	***4.9***	***12.1***	***0.30***	***-1.9***	***-0.72***	***12.1***	***0.30***	***-1.9***	***-0.73***	***0.07***	***4.5***	***7.4***	***48.77***	***72.14***
101	*12.1*	*8.6*	*15.9*	*0.61*	*0.0*	*0.00*	*15.9*	*0.62*	*6.3*	*-0.37*	*0.04*	*4.4*	*3.9*	*65.79*	*72.80*
102	*11.0*	*2.8*	*12.3*	*0.28*	*-4.8*	*-0.90*	*12.3*	*0.28*	*-4.7*	*-0.92*	*0.07*	*6.7*	*7.1*	*84.65*	*73.42*
103	***10.5***	***6.1***	***12.8***	***0.45***	***0.0***	***0.00***	***12.8***	***0.45***	***2.1***	***-0.50***	***0.04***	***3.9***	***3.7***	***83.42***	***74.00***
104	***11.5***	***5.5***	***13.6***	***0.46***	***-4.0***	***-0.85***	***13.5***	***0.48***	***-4.0***	***-0.85***	***0.07***	***7.6***	***13.8***	***61.15***	***75.38***
105	*12.8*	*4.6*	*16.6*	*0.59*	*-3.7*	*-0.88*	*15.7*	*0.69*	*-3.7*	*-0.88*	*0.07*	*9.8*	*8.0*	*65.24*	*77.12*
106	***8.9***	***4.9***	***9.4***	***0.19***	***-0.1***	***-0.57***	***9.4***	***0.19***	***0.0***	***-0.58***	***0.08***	***2.6***	***3.9***	***34.23***	***78.24***
107	***6.8***	***4.8***	***6.9***	***0.10***	***0.0***	***0.00***	***6.9***	***0.11***	***0.1***	***-0.59***	***0.01***	***2.6***	***4.0***	***26.92***	***80.24***
108	***7.4***	***6.9***	***7.5***	***0.01***	***0.0***	***0.00***	***7.4***	***0.11***	***6.7***	***-0.14***	***0.00***	***0.2***	***0.1***	***24.38***	***80.70***
109	***9.1***	***5.7***	***9.7***	***0.21***	***0.0***	***0.00***	***9.5***	***0.21***	***1.1***	***-0.55***	***0.02***	***2.2***	***2.1***	***32.26***	***81.50***
110	***6.6***	***6.0***	***6.6***	***0.03***	***0.0***	***0.00***	***6.5***	***0.03***	***4.0***	***-0.31***	***0.01***	***0.4***	***0.5***	***23.30***	***81.96***
111	***6.1***	***5.0***	***7.6***	***0.04***	***0.0***	***0.00***	***7.2***	***0.06***	***0.6***	***-0.55***	***0.01***	***2.2***	***3.0***	***48.27***	***83.36***
112	10.1	6.5	11.3	0.29	0.0	0.00	11.0	0.33	3.2	-0.45	0.03	2.5	2.3	48.76	84.08
113	7.8	4.8	7.8	0.04	-1.8	-0.71	7.6	0.05	-1.8	-0.71	0.08	2.9	4.3	52.13	84.72
114	9.5	7.7	9.9	0.26	0.0	0.00	9.9	0.27	6.1	-0.26	0.03	1.1	0.8	47.82	85.86
115	8.3	7.2	8.6	0.10	0.0	0.00	8.6	0.11	6.0	-0.26	0.01	0.6	0.4	13.78	86.96
116	8.5	8.0	8.6	0.07	0.0	0.00	8.3	0.09	7.4	-0.18	0.01	0.1	0.1	14.25	87.48
117	8.5	6.9	8.6	0.08	0.0	0.00	8.6	0.08	3.0	-0.41	0.01	1.1	1.8	10.92	90.12
118	7.2	5.6	7.2	0.02	0.0	0.00	7.1	0.02	4.5	-0.30	0.00	0.7	0.8	25.40	99.84

Table 10. SE19-FA-6

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	106.8	-48.3	140.7	7.46	-66.1	-15.45	62.2	19.65	-44.4	-20.42	2.96	7884.6	8428.3	616.5	
1	***0.7***	***0.2***	***0.9***	***1.13***	***0.0***	***0.00***	***0.9***	***1.15***	***0.2***	***-0.93***	***1.28***	***0.7***	***2.1***	***6.02***	***0.50***
2	*0.4*	*0.2*	*0.4*	*0.09*	*0.0*	*-0.70*	*0.3*	*0.30*	*0.1*	*-0.95*	*2.00*	*0.1*	*1.8*	*3.68*	*1.62*
3	0.6	0.6	0.7	0.56	0.0	0.00	0.7	0.76	0.3	-0.48	0.76	0.2	0.8	6.97	2.44
4	*0.6*	*0.2*	*0.8*	*0.68*	*0.0*	*0.00*	*0.7*	*0.71*	*0.1*	*-0.92*	*0.87*	*0.2*	*1.9*	*2.67*	*3.30*
5	0.2	0.4	0.5	0.49	0.0	0.00	0.5	0.50	0.0	-0.74	0.91	0.0	0.2	4.67	3.90
6	*0.5*	*0.1*	*0.7*	*0.75*	*-0.1*	*-1.14*	*0.6*	*0.80*	*-0.1*	*-1.15*	*2.37*	*0.4*	*2.0*	*3.81*	*4.38*
7	0.5	0.2	0.7	0.89	0.0	-0.61	0.7	0.92	0.0	-0.70	1.94	0.5	2.1	5.33	5.90
8	*0.6*	*0.1*	*0.7*	*0.70*	*-0.1*	*-1.31*	*0.7*	*0.84*	*-0.1*	*-1.31*	*2.50*	*0.7*	*2.7*	*5.45*	*6.36*
9	0.6	0.3	0.8	1.33	0.0	0.00	0.8	1.35	0.5	-0.89	1.59	0.8	1.5	7.68	7.02
10	0.7	0.3	0.8	0.71	0.0	0.00	0.8	0.77	0.2	-0.93	0.87	0.4	2.0	4.00	7.64
11	**0.7**	**0.2**	**0.9**	**1.07**	**0.0**	**-1.61**	**0.8**	**1.19**	**0.0**	**-1.62**	**2.96**	**1.2**	**3.9**	**9.25**	**8.08**
12	***0.7***	***0.1***	***0.9***	***1.47***	***-0.2***	***-1.73***	***0.6***	***1.57***	***-0.2***	***-1.73***	***2.94***	***1.6***	***3.3***	***7.03***	***8.54***
13	***0.6***	***0.2***	***0.7***	***1.13***	***0.0***	***0.00***	***0.5***	***1.34***	***0.4***	***-0.84***	***1.55***	***0.8***	***0.6***	***5.27***	***9.02***
14	***0.6***	***0.1***	***0.7***	***0.58***	***0.0***	***-0.67***	***0.6***	***0.60***	***0.0***	***-1.12***	***1.82***	***0.5***	***2.4***	***4.57***	***9.60***
15	***0.6***	***0.2***	***0.7***	***0.48***	***0.0***	***0.00***	***0.5***	***0.99***	***0.2***	***-0.84***	***0.72***	***0.7***	***0.8***	***4.51***	***10.04***
16	***0.6***	***0.4***	***0.8***	***1.19***	***0.0***	***0.00***	***0.8***	***1.21***	***0.5***	***-0.74***	***1.45***	***0.5***	***1.9***	***8.74***	***10.54***
17	***0.8***	***0.1***	***0.9***	***1.18***	***-0.1***	***-1.74***	***0.9***	***1.20***	***-0.1***	***-1.74***	***2.83***	***0.9***	***8.6***	***6.13***	***11.38***
18	**0.8**	**0.4**	**1.3**	**1.79**	**0.0**	**-2.15**	**1.3**	**1.93**	**0.0**	**-2.15**	**2.87**	**2.1**	**2.4**	**9.69**	**11.90**
19	*0.9*	*0.2*	*1.1*	*1.28*	*-0.2*	*-1.96*	*1.0*	*1.32*	*-0.2*	*-2.02*	*2.46*	*1.8*	*10.8*	*6.71*	*12.74*
20	*0.8*	*-0.4*	*1.0*	*1.33*	*-1.2*	*-3.44*	*0.9*	*1.37*	*-1.2*	*-3.44*	*2.14*	*3.7*	*17.7*	*16.76*	*13.30*
21	***1.4***	***0.0***	***3.2***	***4.03***	***-1.8***	***-4.61***	***3.1***	***4.49***	***-1.7***	***-4.63***	***1.71***	***15.2***	***22.2***	***38.29***	***13.82***
22	***2.5***	***-0.1***	***4.4***	***5.59***	***-2.6***	***-5.68***	***4.4***	***5.59***	***-2.2***	***-6.03***	***1.61***	***23.5***	***30.5***	***39.78***	***14.36***
23	1.7	-0.8	3.6	4.39	-1.8	-3.88	3.6	4.39	-1.8	-4.32	1.53	15.7	31.5	38.80	14.92
24	***4.1***	***-5.3***	***6.9***	***7.98***	***-10.8***	***-12.79***	***6.7***	***8.05***	***-10.6***	***-13.20***	***1.17***	***120.2***	***233.5***	***145.54***	***15.46***
25	***10.1***	***-11.0***	***20.2***	***14.14***	***-21.3***	***-16.30***	***20.0***	***15.00***	***-20.9***	***-17.03***	***0.73***	***450.9***	***498.3***	***238.61***	***16.04***
26	***15.4***	***-10.5***	***27.6***	***15.84***	***-23.7***	***-16.23***	***27.0***	***16.59***	***-23.2***	***-16.64***	***0.62***	***466.2***	***429.7***	***313.31***	***16.64***
27	***26.0***	***-32.3***	***40.9***	***18.24***	***-47.6***	***-19.02***	***39.9***	***19.27***	***-44.4***	***-20.42***	***0.42***	***1109.8***	***1375.3***	***379.16***	***17.28***

Table 10. SE19-FA-6

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
28	***51.6***	***-38.8***	***68.3***	***17.44***	***-59.6***	***-15.92***	***62.2***	***19.65***	***-58.9***	***-16.77***	***0.26***	***1489.2***	***1240.5***	***493.27***	***18.10***
29	31.3	22.6	43.3	5.48	-31.2	0.85	43.3	5.48	21.0	-0.83	0.06	213.2	23.9	404.50	18.90
30	29.2	3.2	35.5	2.73	-3.8	-2.15	35.5	2.73	-3.5	-2.24	0.12	51.9	92.3	92.23	20.00
31	31.4	-2.0	43.7	5.36	-11.6	-2.67	43.5	5.40	-11.2	-2.72	0.15	139.9	170.7	188.53	21.20
32	19.6	5.8	27.8	2.58	-1.8	-1.75	27.8	2.58	-1.5	-1.76	0.15	47.9	35.7	150.80	21.92
33	26.1	-3.8	35.4	3.49	-13.4	-2.75	35.4	3.49	-12.8	-2.80	0.13	94.1	105.0	180.98	22.72
34	1.3	0.0	2.0	0.27	-4.0	-0.95	1.5	0.28	-4.0	-0.95	0.20	2.7	5.1	80.52	23.12
35	10.6	4.5	14.7	1.30	0.0	0.00	14.7	1.30	0.4	-0.97	0.09	13.5	20.9	87.00	24.30
36	10.1	-0.5	12.5	0.99	-6.6	-1.87	12.5	0.99	-6.6	-1.87	0.15	14.2	22.6	85.83	24.88
37	10.7	4.0	14.6	1.40	0.0	0.00	14.6	1.40	0.6	-0.95	0.10	14.0	13.4	103.18	25.92
38	9.1	-1.9	12.2	0.92	-11.6	-2.47	12.2	0.92	-11.6	-2.47	0.14	21.8	59.6	103.06	26.88
39	*25.7*	*-48.3*	*35.7*	*3.57*	*-66.1*	*-15.45*	*35.7*	*3.57*	*-63.7*	*-16.26*	*0.19*	*500.4*	*1136.9*	*373.97*	*28.28*
40	**106.8**	**-15.2**	**140.7**	**7.46**	**-40.7**	**0.33**	**81.6**	**16.71**	**-34.0**	**-3.87**	**0.04**	**1540.0**	**1021.5**	**616.49**	**29.68**
41	46.9	-9.7	57.6	2.00	-26.0	-2.76	57.6	2.00	-26.0	-2.85	0.06	154.6	169.7	217.17	31.18
42	17.2	0.7	22.9	0.91	-5.6	-1.17	22.8	0.97	-5.6	-1.17	0.07	24.3	22.4	227.52	31.82
43	28.1	12.4	36.3	1.35	0.0	0.00	35.4	1.38	6.0	-0.83	0.04	31.6	34.2	151.83	32.58
44	17.4	-14.1	18.2	0.24	-35.1	-3.77	18.2	0.24	-34.6	-3.83	0.08	83.0	152.4	242.76	33.24
45	63.2	28.6	79.5	2.85	-9.4	0.07	77.0	2.88	21.0	-1.15	0.03	148.6	119.7	294.26	34.46
46	45.8	27.5	51.8	1.12	0.0	0.00	51.8	1.12	17.6	-1.25	0.02	25.5	30.6	149.92	35.50
47	52.4	10.8	64.0	1.82	-3.2	-1.84	64.0	1.82	-3.1	-1.90	0.05	80.7	119.9	210.76	37.04
48	75.3	11.7	92.8	3.32	-4.4	-2.03	91.3	3.51	-4.4	-2.03	0.05	196.8	202.4	304.86	38.00
49	30.9	17.4	34.9	0.80	0.0	0.00	34.9	0.80	5.1	-1.31	0.02	21.4	24.7	191.01	38.60
50	39.8	6.3	47.9	1.28	-7.6	-2.11	47.5	1.32	-7.6	-2.11	0.06	60.7	73.7	207.76	39.30
51	29.2	19.3	35.7	0.99	0.0	0.00	35.7	0.99	14.1	-0.66	0.03	15.9	11.6	208.09	40.06
52	33.1	18.5	41.0	1.04	0.0	0.00	40.5	1.10	12.7	-0.91	0.03	18.6	22.1	115.82	40.84
53	33.3	18.2	39.8	1.04	0.0	0.00	39.8	1.04	11.5	-0.97	0.03	17.5	19.7	121.22	41.52
54	26.4	19.4	27.9	0.37	0.0	0.00	27.9	0.39	13.1	-0.83	0.01	6.3	7.5	85.41	42.16
55	20.5	14.4	20.6	0.06	0.0	0.00	20.6	0.06	0.8	-1.53	0.00	12.5	24.3	107.19	43.06
56	30.3	23.2	38.0	0.95	0.0	0.00	38.0	0.95	20.7	-0.56	0.03	13.8	14.2	101.85	44.18
57	35.0	25.6	41.5	1.18	0.0	0.00	41.5	1.18	22.6	-0.55	0.03	11.9	14.7	115.98	44.80

Table 10. SE19-FA-6

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
58	29.0	16.3	31.0	0.35	0.0	0.00	31.0	0.35	9.4	-1.07	0.01	10.7	13.7	87.60	45.36
59	23.8	20.1	24.7	0.30	0.0	0.00	24.7	0.30	15.6	-0.59	0.01	2.9	2.8	86.17	45.88
60	22.1	15.2	22.4	0.13	0.0	0.00	22.4	0.13	2.9	-1.43	0.01	10.7	15.9	115.79	46.44
61	25.2	16.6	28.7	0.60	0.0	0.00	28.3	0.60	11.4	-0.75	0.02	7.8	7.5	117.63	46.96
62	32.3	17.6	38.5	1.04	0.0	0.00	37.2	1.08	10.0	-1.00	0.03	20.0	22.1	127.82	47.66
63	34.0	17.6	40.5	1.08	0.0	0.00	40.4	1.12	8.3	-1.12	0.03	22.6	26.3	135.11	48.46
64	21.8	17.6	22.0	0.17	0.0	0.00	21.9	0.19	6.9	-1.20	0.01	6.7	9.1	146.45	48.98
65	47.6	-9.8	58.7	1.78	-27.6	-3.16	58.3	1.81	-27.0	-3.17	0.06	134.6	165.2	236.20	49.88
66	31.7	20.6	40.7	1.42	-5.0	0.09	40.5	1.43	14.6	-0.69	0.03	39.5	27.0	273.11	50.82
67	22.4	20.5	23.2	0.19	0.0	0.00	23.2	0.19	16.7	-0.50	0.01	1.3	1.3	60.33	51.30
68	25.8	19.9	30.6	0.71	0.0	0.00	30.5	0.71	16.3	-0.54	0.02	5.3	6.4	86.78	52.00
69	32.0	4.6	38.5	1.20	-8.0	-1.73	38.4	1.23	-8.0	-1.73	0.06	37.1	44.3	147.40	52.74
70	23.5	11.0	30.4	0.92	0.0	0.00	30.2	1.00	2.6	-0.99	0.03	19.8	20.1	157.80	53.50
71	21.4	6.2	23.9	0.56	-3.9	-1.41	23.8	0.60	-3.4	-1.43	0.07	17.5	21.9	152.02	54.12
72	30.8	21.2	39.1	1.37	0.0	0.00	39.1	1.37	20.0	-0.42	0.04	21.4	22.2	172.91	54.76
73	28.6	7.4	35.4	0.98	-3.8	-1.44	35.4	1.02	-3.8	-1.52	0.06	23.0	52.7	86.36	56.14
74	26.1	20.4	32.6	0.95	0.0	0.00	31.7	1.03	19.0	-0.35	0.03	11.5	6.1	87.28	56.98
75	22.9	17.2	25.1	0.36	0.0	0.00	25.0	0.38	13.7	-0.53	0.01	3.1	3.6	73.29	57.78
76	36.4	21.9	46.4	1.56	0.0	0.00	46.2	1.58	18.2	-0.63	0.03	27.7	34.2	140.02	58.46
77	28.8	10.7	32.2	0.59	-1.2	-1.45	32.2	0.59	-1.2	-1.45	0.06	20.9	45.8	137.13	59.46
78	35.3	16.2	45.2	1.44	0.0	0.00	43.6	1.49	10.3	-0.91	0.03	32.5	25.3	158.75	60.28
79	34.4	12.0	43.7	1.40	0.0	0.00	43.7	1.40	0.2	-1.43	0.03	34.8	39.5	171.32	61.10
80	22.3	20.7	24.8	0.43	0.0	0.00	24.8	0.43	20.0	-0.17	0.02	2.3	2.5	55.88	61.90
81	25.1	14.0	28.4	0.62	0.0	0.00	28.2	0.63	8.0	-0.83	0.02	8.7	11.3	61.19	62.80
82	24.1	14.5	26.5	0.54	0.0	0.00	26.5	0.54	8.7	-0.77	0.02	7.6	9.9	56.25	64.06
83	18.3	16.0	18.8	0.17	0.0	0.00	18.8	0.17	12.2	-0.56	0.01	1.6	1.8	43.24	64.74
84	16.8	16.3	16.8	0.04	0.0	0.00	16.8	0.04	12.0	-0.56	0.00	0.9	1.0	54.86	65.14
85	23.8	20.4	*28.2*	0.65	0.0	0.00	28.2	0.65	19.2	-0.29	0.02	4.3	5.3	84.20	66.18
86	21.8	18.1	21.9	0.09	0.0	0.00	21.8	0.10	13.7	-0.56	0.00	2.0	2.2	26.60	66.82
87	**19.9**	**18.5**	**20.5**	**0.14**	**0.0**	**0.00**	**20.5**	**0.14**	**16.9**	**-0.30**	**0.01**	**0.5**	**0.5**	**27.60**	**67.32**

Table 10. SE19-FA-6

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
88	**20.1**	**15.3**	**20.6**	**0.15**	**0.0**	**0.00**	**20.6**	**0.15**	**10.2**	**-0.72**	**0.01**	**3.6**	**4.8**	**29.53**	**68.64**
89	**22.8**	**15.4**	**25.1**	**0.42**	**0.0**	**0.00**	**24.8**	**0.43**	**10.2**	**-0.75**	**0.02**	**6.1**	**8.0**	**45.91**	**69.94**
90	**20.5**	**18.8**	**21.8**	**0.30**	**0.0**	**0.00**	**21.8**	**0.30**	**17.8**	**-0.23**	**0.01**	**1.2**	**1.2**	**45.59**	**70.48**
91	**23.9**	**16.8**	**26.2**	**0.51**	**0.0**	**0.00**	**26.2**	**0.51**	**11.8**	**-0.65**	**0.02**	**5.4**	**8.5**	**59.88**	**72.18**
92	**23.3**	**20.9**	**26.1**	**0.48**	**0.0**	**0.00**	**26.1**	**0.48**	**20.3**	**-0.21**	**0.02**	**2.2**	**2.4**	**64.07**	**72.70**
93	**25.5**	**17.3**	**29.7**	**0.73**	**0.0**	**0.00**	**29.7**	**0.74**	**13.5**	**-0.65**	**0.02**	**6.6**	**7.8**	**65.40**	**73.40**
94	**24.9**	**19.1**	**27.2**	**0.55**	**0.0**	**0.00**	**27.2**	**0.55**	**16.6**	**-0.45**	**0.02**	**4.0**	**4.3**	**69.87**	**73.98**
95	**24.5**	**14.8**	**27.8**	**0.59**	**0.0**	**0.00**	**27.8**	**0.59**	**8.4**	**-0.83**	**0.02**	**8.1**	**12.8**	**57.61**	**75.40**
96	24.0	19.6	27.8	0.56	0.0	0.00	27.8	0.57	15.9	-0.53	0.02	5.1	6.5	55.11	76.60
97	20.9	20.1	21.6	0.13	0.0	0.00	21.5	0.14	18.8	-0.23	0.01	0.3	0.4	26.67	77.06
98	***24.4***	***17.2***	***26.9***	***0.50***	***0.0***	***0.00***	***26.8***	***0.52***	***12.4***	***-0.68***	***0.02***	***6.0***	***9.3***	***34.10***	***80.28***
99	*23.0*	*20.1*	*24.8*	*0.40*	*0.0*	*0.00*	*24.8*	*0.42*	*18.8*	*-0.28*	*0.02*	*1.9*	*2.0*	*26.35*	*81.40*
100	*22.5*	*20.5*	*24.4*	*0.35*	*0.0*	*0.00*	*24.3*	*0.36*	*19.5*	*-0.23*	*0.01*	*1.2*	*1.3*	*28.06*	*82.56*
101	***21.3***	***19.1***	***22.2***	***0.16***	***0.0***	***0.00***	***22.2***	***0.16***	***16.2***	***-0.43***	***0.01***	***1.0***	***1.0***	***42.10***	***83.36***
102	***22.8***	***20.2***	***25.0***	***0.43***	***0.0***	***0.00***	***25.0***	***0.43***	***18.3***	***-0.31***	***0.02***	***1.6***	***1.7***	***43.31***	***84.02***
103	***21.7***	***17.6***	***22.7***	***0.21***	***0.0***	***0.00***	***22.6***	***0.21***	***12.7***	***-0.64***	***0.01***	***2.7***	***3.1***	***37.62***	***84.74***
104	***20.2***	***19.1***	***20.9***	***0.18***	***0.0***	***0.00***	***20.9***	***0.20***	***18.1***	***-0.21***	***0.01***	***0.4***	***0.5***	***33.34***	***85.82***
105	***21.0***	***20.7***	***24.4***	***0.36***	***0.0***	***0.00***	***24.4***	***0.38***	***17.7***	***-0.35***	***0.01***	***1.8***	***1.9***	***17.53***	***91.50***
106	***20.9***	***20.6***	***21.0***	***0.05***	***0.0***	***0.00***	***21.0***	***0.05***	***20.4***	***-0.10***	***0.00***	***0.0***	***0.0***	***5.02***	***91.96***
107	*20.8*	*20.1*	*20.8*	*0.02*	*0.0*	*0.00*	*20.7*	*0.02*	*18.9*	*-0.25*	*0.00*	*0.3*	*0.3*	*8.06*	*94.94*
108	20.2	19.8	20.2	0.03	0.0	0.00	20.2	0.03	19.0	-0.23	0.00	0.1	0.1	29.65	99.84

Table 11. SE19-FA-DL-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	71.4	-73.6	90.3	22.73	-97.1	-18.82	76.5	25.12	-50.4	-25.24	3.12	10739.2	10900.2	502.1	
1	***0.2***	***-0.1***	***0.4***	***0.71***	***-0.3***	***-0.97***	***0.3***	***0.73***	***-0.2***	***-1.02***	***2.27***	***0.5***	***1.4***	***6.67***	***0.46***
2	*-0.2*	*-0.5*	*0.0*	*0.00*	*-0.6*	*-0.23*	*-0.1*	*0.50*	*-0.4*	*-0.61*	*0.42*	*0.1*	*1.2*	*3.37*	*1.58*
3	0.0	0.0	0.0	-0.22	-0.5	0.02	0.0	0.42	-0.1	-0.23	0.45	0.1	0.2	7.68	1.98
4	0.1	-0.2	0.1	0.49	-0.3	-0.32	0.1	0.49	-0.2	-0.55	1.76	0.2	0.3	3.11	2.38
5	0.1	-0.3	0.2	0.53	-0.4	-0.37	0.2	0.53	-0.3	-0.52	1.58	0.3	0.5	7.49	2.84
6	-0.3	-0.4	0.0	0.00	-0.6	-0.47	-0.3	0.11	-0.5	-0.89	0.83	0.1	1.3	5.14	3.20
7	-0.1	-0.4	0.0	0.00	-0.5	-0.68	-0.3	0.45	-0.4	-0.71	1.24	0.3	0.4	2.92	3.68
8	*-0.2*	*-0.5*	*0.1*	*0.51*	*-0.6*	*-1.18*	*0.1*	*0.56*	*-0.6*	*-1.18*	*2.47*	*0.4*	*1.8*	*5.89*	*4.38*
9	-0.2	-0.5	0.0	0.00	-0.6	-0.83	-0.2	1.03	-0.5	-1.00	1.49	0.4	0.2	4.00	4.74
10	0.0	0.0	0.1	0.48	-0.4	0.19	0.1	0.48	-0.2	-0.31	0.57	0.1	0.2	5.65	5.38
11	0.0	-0.3	0.3	0.62	-0.5	-0.72	0.3	0.62	-0.3	-0.87	1.90	0.3	0.9	4.70	5.88
12	*0.0*	*-0.5*	*0.1*	*0.64*	*-0.7*	*-1.08*	*0.0*	*0.66*	*-0.6*	*-1.24*	*2.25*	*0.7*	*2.1*	*4.75*	*6.34*
13	-0.1	-0.3	0.2	1.16	-0.4	-0.33	0.0	1.32	-0.2	-0.97	2.53	0.6	0.1	6.14	7.04
14	0.1	-0.4	0.2	0.39	-0.5	-0.75	0.2	0.39	-0.4	-0.79	1.87	0.3	1.3	4.37	7.62
15	*0.1*	*-0.4*	*0.2*	*1.06*	*-0.8*	*-1.44*	*0.2*	*1.11*	*-0.3*	*-1.53*	*2.49*	*1.2*	*3.2*	*7.87*	*8.08*
16	*0.1*	*-0.5*	*0.2*	*1.58*	*-0.8*	*-1.59*	*0.0*	*1.72*	*-0.8*	*-1.68*	*2.95*	*1.6*	*2.3*	*8.32*	*8.54*
17	0.0	-0.3	0.2	1.32	-0.6	-1.06	0.0	1.72	-0.4	-1.45	2.86	1.3	0.3	5.78	8.98
18	0.0	-0.5	0.1	-0.16	-0.6	-1.02	-0.1	1.11	-0.6	-1.08	1.19	0.7	1.5	5.08	9.60
19	0.1	-0.3	0.1	0.27	-0.6	-0.40	0.0	1.21	-0.4	-1.34	1.03	1.0	0.9	6.99	10.02
20	0.1	-0.1	0.3	1.05	-0.3	0.39	0.2	1.32	-0.2	-0.95	1.25	0.6	0.4	6.86	10.56
21	0.1	0.1	0.2	0.38	0.0	0.00	0.1	0.52	0.1	-0.20	2.49	0.0	0.3	4.69	10.90
22	0.2	-0.4	0.3	0.50	-0.8	-1.36	0.3	0.97	-0.7	-1.65	1.64	1.1	6.9	6.16	11.38
23	**0.0**	**0.0**	**0.6**	**1.85**	**-0.5**	**-1.76**	**0.2**	**2.01**	**-0.4**	**-1.84**	**3.12**	**1.0**	**-1.3**	**8.13**	**11.90**
24	0.4	-0.1	0.6	1.20	-0.8	-2.00	0.5	1.30	-0.7	-2.01	2.27	1.9	8.4	10.14	12.74
25	*0.3*	*-0.8*	*0.3*	*0.89*	*-1.5*	*-3.41*	*0.1*	*1.50*	*-1.5*	*-3.41*	*2.29*	*3.3*	*13.5*	*15.18*	*13.30*
26	***0.8***	***-0.9***	***1.6***	***4.51***	***-1.8***	***-3.69***	***1.5***	***5.15***	***-1.8***	***-4.39***	***2.38***	***11.2***	***10.9***	***23.88***	***13.78***
27	0.4	-0.4	1.6	3.90	-1.3	-2.67	1.2	4.74	-1.1	-4.37	2.29	8.0	0.0	22.68	14.34

Table 11. SE19-FA-DL-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
28	0.3	-1.0	0.7	1.82	-1.5	-2.66	0.4	1.95	-1.4	-3.13	2.08	4.5	21.8	24.96	14.94
29	***1.3***	***-4.3***	***3.3***	***7.54***	***-7.1***	***-12.49***	***3.3***	***8.17***	***-7.0***	***-12.62***	***1.94***	***72.8***	***178.2***	***82.85***	***15.44***
30	***4.4***	***-8.1***	***10.7***	***15.06***	***-14.2***	***-17.83***	***10.5***	***15.62***	***-13.5***	***-17.87***	***1.32***	***282.9***	***338.8***	***144.40***	***15.98***
31	***9.1***	***-11.5***	***15.0***	***16.32***	***-17.7***	***-18.86***	***15.0***	***17.12***	***-17.7***	***-18.86***	***1.08***	***367.3***	***385.3***	***178.31***	***16.54***
32	***18.0***	***-23.4***	***26.5***	***20.65***	***-34.4***	***-22.65***	***25.6***	***21.12***	***-33.0***	***-23.98***	***0.71***	***945.5***	***1247.4***	***254.83***	***17.20***
33	***28.2***	***-40.5***	***43.9***	***22.57***	***-51.7***	***-24.48***	***38.5***	***23.79***	***-50.4***	***-25.24***	***0.49***	***1500.7***	***1370.0***	***337.82***	***17.96***
34	**39.9**	**-27.5**	**53.2**	**20.85**	**-40.9**	**-11.56**	**52.5**	**21.86**	**-40.6**	**-12.09**	**0.34**	**983.4**	**429.2**	**425.32**	**18.82**
35	18.1	-11.2	28.2	5.67	-24.3	0.59	28.2	5.67	-19.0	-3.49	0.10	209.3	164.6	227.40	19.98
36	14.2	-6.9	25.4	4.87	-14.4	-2.96	25.0	4.98	-14.4	-2.96	0.20	119.7	112.6	162.69	20.82
37	-5.8	-11.5	0.0	0.00	-21.0	-3.78	-5.8	0.08	-20.6	-3.82	0.18	29.5	76.3	150.94	21.20
38	11.4	-8.0	20.0	3.78	-16.0	-2.80	19.9	4.03	-15.9	-2.87	0.18	95.2	71.8	161.77	21.92
39	14.9	-18.7	23.8	4.66	-26.6	-4.73	23.5	4.71	-26.6	-4.98	0.19	149.8	165.6	193.55	22.68
40	-5.1	-9.3	0.0	0.00	-15.8	0.09	-1.2	1.71	-11.8	-1.25	0.01	21.4	10.1	142.47	24.02
41	-9.1	-10.6	0.0	0.00	-12.4	-1.22	-9.0	0.05	-12.4	-1.22	0.10	1.8	3.3	41.78	24.26
42	-4.5	-13.8	0.0	0.00	-20.9	-3.13	-0.7	1.60	-20.4	-3.16	0.15	26.1	44.2	108.50	24.88
43	-0.1	-3.0	6.3	2.43	-11.4	0.27	6.3	2.43	-3.6	-0.45	0.12	25.2	13.0	130.93	25.46
44	-1.7	-7.5	0.0	0.00	-11.9	-1.54	-1.5	0.35	-11.4	-1.63	0.13	7.7	13.3	63.37	25.90
45	-1.2	-14.2	4.4	1.85	-20.0	-3.08	4.1	1.94	-20.0	-3.08	0.20	32.2	79.3	94.04	26.80
46	14.7	7.2	23.0	4.90	-12.0	0.01	23.0	4.90	5.1	-0.93	0.14	80.8	61.8	135.47	27.50
47	13.3	-34.3	20.0	3.17	-48.4	-17.96	20.0	3.17	-48.4	-17.96	0.31	336.9	1062.8	331.03	28.26
48	***71.4***	***-73.6***	***90.3***	***22.73***	***-97.1***	***-18.82***	***76.5***	***25.12***	***-88.0***	***-20.15***	***0.22***	***2774.9***	***2409.7***	***502.11***	***29.20***
49	38.0	7.4	51.9	5.24	-67.4	0.49	51.6	5.73	0.0	-1.51	0.04	354.1	-1.7	360.03	30.40
50	25.9	-38.0	34.8	2.49	-48.9	-3.32	34.8	2.49	-47.8	-3.38	0.07	158.2	183.7	200.85	31.16
51	-4.4	-21.3	2.7	1.72	-33.8	0.08	2.7	1.72	-25.9	-1.34	0.05	47.6	38.9	237.72	31.82
52	2.4	-15.7	13.6	2.02	-23.1	-1.50	13.3	2.05	-23.1	-1.50	0.10	52.0	57.1	154.62	32.60
53	-9.9	-45.0	0.0	0.00	-57.1	-4.02	-9.2	0.43	-57.1	-4.02	0.07	92.0	175.6	194.33	33.20
54	36.0	-26.3	51.4	5.17	-41.1	0.08	51.3	5.44	-37.8	-2.61	0.06	293.4	246.7	281.18	34.44
55	-2.3	-24.3	5.4	1.42	-33.9	-2.14	5.1	1.49	-33.7	-2.20	0.09	49.9	57.5	163.00	35.50
56	7.6	-29.1	19.2	1.98	-40.8	-2.67	19.1	2.05	-40.5	-2.75	0.08	103.9	127.7	224.85	36.34
57	-19.8	-24.8	0.0	0.00	-28.7	-0.81	-18.3	0.55	-28.7	-0.83	0.03	5.1	2.7	84.12	37.04

Table 11. SE19-FA-DL-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
58	33.5	-45.5	45.5	4.31	-57.0	-4.12	45.5	4.31	-56.9	-4.26	0.08	281.9	304.6	273.88	37.96
59	-9.4	-25.4	0.0	0.00	-41.2	0.00	-3.2	1.64	-31.2	-1.36	0.00	46.5	40.0	225.31	38.58
60	-2.8	-39.8	8.0	1.87	-50.0	-3.13	7.6	1.91	-50.0	-3.13	0.09	95.7	118.7	197.12	39.28
61	-10.8	-19.0	0.0	0.00	-36.3	0.02	-1.5	1.67	-23.6	-0.80	0.00	34.4	20.9	225.62	40.04
62	-9.4	-25.5	0.2	1.55	-34.6	-1.73	0.0	1.61	-34.3	-1.75	0.09	29.3	37.1	120.16	40.88
63	-11.1	-25.1	0.0	0.00	-32.8	-1.54	-7.0	1.17	-32.8	-1.57	0.05	21.9	26.5	122.62	41.52
64	-15.8	-21.9	0.0	0.00	-26.5	-0.80	-11.6	0.87	-26.5	-0.80	0.03	8.0	7.8	102.81	42.12
65	-19.2	-28.3	0.0	0.00	-36.8	-1.84	-18.9	0.21	-36.6	-1.84	0.05	12.3	28.1	98.75	43.00
66	-11.4	-21.5	0.0	0.00	-28.7	-1.22	-3.5	1.40	-28.7	-1.22	0.04	24.4	23.4	115.00	44.24
67	-12.4	-18.8	0.0	0.00	-22.0	-0.61	-6.9	1.13	-22.0	-0.61	0.03	8.9	10.9	117.06	44.80
68	-15.1	-25.1	0.0	0.00	-32.9	-1.57	-12.7	0.50	-32.6	-1.58	0.05	12.3	19.1	103.00	45.36
69	-16.6	-26.8	0.0	0.00	-33.4	-1.59	-13.4	0.82	-33.4	-1.59	0.05	15.0	18.0	109.58	46.40
70	-13.5	-22.4	0.0	0.00	-25.9	-0.88	-7.9	1.21	-25.9	-0.88	0.03	13.5	11.3	122.68	46.96
71	-8.7	-26.1	0.0	0.00	-34.5	-1.72	-1.1	1.60	-34.2	-1.77	0.05	61.3	73.0	149.16	48.42
72	-17.6	-22.2	0.0	0.00	-28.3	-0.94	-14.9	0.64	-28.0	-0.96	0.03	6.7	6.0	101.41	48.96
73	5.1	-54.4	17.6	2.22	-67.5	-5.60	17.4	2.23	-66.8	-5.65	0.09	204.1	284.7	249.94	49.84
74	10.7	-6.5	23.8	2.63	-48.7	0.11	22.6	2.63	-11.5	-1.08	0.03	120.4	63.8	329.95	50.84
75	-4.5	-6.7	0.0	0.00	-10.0	-0.75	-4.4	0.17	-10.0	-0.75	0.08	1.5	2.2	61.06	51.30
76	1.5	-5.2	4.5	0.77	-10.6	-0.91	4.5	0.77	-10.6	-0.91	0.11	7.8	9.2	103.51	52.02
77	5.5	-24.3	13.3	1.44	-33.2	-2.01	13.3	1.55	-33.2	-2.01	0.07	50.9	60.4	138.43	52.72
78	0.0	-17.2	7.5	1.63	-24.8	-1.41	7.5	1.63	-24.4	-1.41	0.09	35.7	34.1	169.55	53.50
79	-6.5	-20.6	0.0	0.00	-29.0	-1.68	-2.0	0.99	-29.0	-1.68	0.06	21.0	26.7	151.13	54.12
80	-0.5	-10.6	14.5	1.96	-24.5	-1.49	14.0	1.99	-23.8	-1.52	0.09	76.5	96.9	177.92	57.22
81	-10.3	-12.9	0.0	0.00	-18.6	-1.02	-10.3	0.04	-18.4	-1.05	0.05	3.5	7.4	88.58	57.78
82	7.3	-7.8	19.5	2.27	-13.0	-1.03	19.5	2.27	-12.8	-1.04	0.10	42.0	46.8	152.27	58.50
83	-0.6	-14.6	0.2	0.45	-22.1	-1.47	0.2	0.45	-22.0	-1.49	0.09	16.1	47.4	90.30	59.40
84	11.7	-16.0	23.2	2.44	-26.1	-1.80	22.3	2.45	-26.1	-1.80	0.09	69.5	56.3	157.86	60.32
85	2.5	-20.6	8.7	1.38	-30.3	-1.95	8.1	1.42	-30.3	-1.95	0.09	41.7	50.1	173.30	61.02
86	-8.6	-15.9	0.0	0.00	-22.3	-1.16	-1.1	1.04	-22.3	-1.16	0.05	16.8	22.1	96.09	62.78
87	-5.4	-15.8	0.2	1.04	-20.7	-1.02	0.2	1.07	-20.7	-1.02	0.10	12.4	19.9	78.55	63.98

Table 11. SE19-FA-DL-1

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
88	-6.9	-11.3	0.0	0.00	-14.5	0.02	-3.7	0.85	-12.1	-0.27	0.00	4.4	2.5	67.56	64.62
89	-4.5	-12.3	1.3	1.14	-15.9	-0.59	1.3	1.14	-15.8	-0.62	0.10	9.1	13.0	71.88	66.24
90	-11.5	-13.4	0.0	0.00	-18.0	-0.83	-11.7	0.04	-18.0	-0.83	0.05	2.1	3.9	42.42	66.76
91	-9.2	-11.1	0.0	0.00	-12.7	0.04	-8.0	0.34	-11.4	-0.17	0.00	1.1	1.0	40.26	67.28
92	-9.4	-12.5	0.0	0.00	-14.7	-0.41	-7.9	0.32	-14.7	-0.41	0.03	1.3	1.4	27.05	67.98
93	-10.9	-13.7	0.0	0.00	-18.0	-0.79	-10.8	0.13	-17.9	-0.80	0.04	2.0	3.4	30.04	68.60
94	-7.0	-15.2	0.0	0.00	-20.4	-1.05	-4.2	0.63	-20.4	-1.05	0.05	7.1	12.6	54.93	69.90
95	-6.8	-9.4	0.0	0.00	-14.2	0.02	-3.9	0.76	-9.9	-0.17	0.00	3.5	2.9	69.30	70.46
96	-6.7	-13.7	0.0	0.00	-18.6	-0.85	-3.0	0.77	-18.4	-0.86	0.05	5.5	10.0	31.56	72.12
97	-6.5	-10.5	0.0	0.00	-13.0	0.04	-3.1	0.79	-11.8	-0.29	0.00	4.0	5.2	58.91	72.76
98	-5.7	-13.6	0.0	0.00	-18.0	-0.80	-2.9	0.80	-18.0	-0.80	0.04	5.5	7.0	66.83	73.40
99	-6.7	-12.7	0.0	0.00	-14.4	-0.47	-2.5	0.84	-14.2	-0.47	0.03	5.2	5.7	76.90	73.98
100	-6.3	-12.6	0.0	0.00	-16.3	-0.64	-3.7	0.69	-16.3	-0.64	0.04	4.6	5.5	58.80	74.68
101	-12.2	-15.2	0.0	0.00	-20.1	-1.01	-12.2	0.04	-19.9	-1.02	0.05	3.0	9.4	41.34	75.30
102	-6.3	-13.5	0.0	0.00	-17.2	-0.72	-2.1	0.92	-17.2	-0.72	0.04	7.7	9.9	57.26	76.58
103	0.0	-11.4	0.0	0.00	-12.6	0.01	-9.7	0.18	-12.2	-0.21	0.00	0.5	0.5	40.89	77.04
104	-7.4	-12.4	0.0	0.00	-15.4	-0.51	-4.5	0.60	-15.3	-0.51	0.03	3.1	5.2	32.19	78.26
105	-11.5	-13.5	0.0	0.00	-17.8	-0.79	-11.3	0.06	-17.6	-0.79	0.04	1.9	3.2	28.51	78.90
106	-12.8	-12.8	0.0	0.00	-14.5	-0.35	-12.9	0.04	-14.5	-0.36	0.02	0.2	0.3	21.60	79.32
107	-11.2	-13.4	0.0	0.00	-15.3	-0.44	-11.1	0.11	-15.2	-0.45	0.03	0.9	1.6	18.86	80.22
108	-7.7	-11.4	0.0	0.00	-12.9	0.02	-5.4	0.56	-12.9	-0.32	0.00	2.4	3.3	25.72	81.42
109	-8.6	-11.0	0.0	0.00	-11.9	-0.22	-7.2	0.34	-11.9	-0.23	0.02	1.3	1.4	31.43	82.56
110	-9.5	-12.1	0.0	0.00	-14.9	-0.44	-9.1	0.16	-14.8	-0.46	0.03	1.2	1.4	39.18	83.36
111	-9.1	-13.6	0.0	0.00	-17.6	-0.76	-6.0	0.50	-17.6	-0.76	0.04	4.5	5.9	43.52	84.70
112	-8.9	-9.2	0.0	0.00	-12.7	0.04	-6.6	0.42	-10.6	-0.13	0.00	2.0	2.2	46.28	86.88
113	0.0	-11.9	0.0	0.00	-13.5	-0.32	-6.7	0.41	-13.4	-0.32	0.02	1.1	1.5	14.67	89.28
114	-11.7	-11.8	0.0	0.00	-12.3	-0.16	-11.5	0.03	-12.3	-0.16	0.01	0.0	0.0	6.08	89.94
115	-10.0	-10.5	0.0	0.00	-11.6	0.02	-9.3	0.19	-10.6	-0.09	0.00	0.3	0.3	6.71	91.94
116	-10.3	-11.3	0.0	0.00	-12.1	-0.21	-10.1	0.07	-12.1	-0.21	0.02	0.2	0.2	5.02	93.12
117	-11.1	-11.4	0.0	0.00	-12.2	-0.21	-11.0	0.04	-12.2	-0.21	0.02	0.1	0.1	7.75	94.30

Table 11. SE19-FA-DL-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
118	-10.9	-11.1	0.0	0.00	-11.4	-0.11	-10.8	0.07	-11.4	-0.11	0.01	0.0	0.0	7.43	94.78
119	-10.8	-11.0	0.0	0.00	-11.2	-0.08	-10.7	0.07	-11.2	-0.08	0.01	0.0	0.0	4.06	95.48
120	-11.1	-11.5	0.0	0.00	-12.0	-0.18	-11.1	0.01	-11.9	-0.19	0.01	0.1	0.1	20.64	99.84

Table 12. SE19-FA-DL-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	77.1	-73.1	94.7	21.50	-93.6	-16.18	49.2	23.65	-39.6	-22.77	3.40	10081.1	10759.5	560.0	
1	***0.1***	***-0.3***	***0.4***	***0.60***	***-0.4***	***-0.85***	***0.4***	***1.10***	***-0.2***	***-0.94***	***1.82***	***0.6***	***1.7***	***4.24***	***0.48***
2	*-0.3*	*-0.4*	*0.0*	*0.00*	*-0.5*	*-0.60*	*-0.2*	*0.51*	*-0.5*	*-0.81*	*1.20*	*0.1*	*0.4*	*3.30*	*0.92*
3	*-0.4*	*-0.4*	*0.0*	*0.00*	*-0.6*	*-0.38*	*-0.3*	*0.18*	*-0.5*	*-0.67*	*0.67*	*0.0*	*0.5*	*4.00*	*1.64*
4	0.0	0.0	0.2	0.56	-0.3	0.12	0.1	0.68	-0.2	-0.40	0.90	0.2	0.8	5.19	2.44
5	0.0	-0.4	0.2	0.62	-0.5	-0.74	0.2	0.70	-0.4	-0.79	1.84	0.3	1.5	3.10	3.20
6	-0.2	-0.5	0.0	0.00	-0.6	-0.63	-0.1	0.53	-0.6	-0.63	1.06	0.2	0.3	4.69	3.74
7	*-0.1*	*-0.5*	*0.1*	*0.72*	*-0.6*	*-0.80*	*0.1*	*0.72*	*-0.6*	*-1.02*	*2.05*	*0.5*	*1.9*	*3.81*	*4.38*
8	-0.3	-0.5	0.0	0.00	-0.6	-0.60	-0.2	1.04	-0.6	-0.63	0.99	0.2	0.1	4.81	4.78
9	0.0	-0.3	0.1	0.79	-0.6	-0.16	0.0	0.87	-0.3	-0.65	1.38	0.3	1.7	4.89	5.90
10	0.0	-0.4	0.1	0.72	-0.6	-0.95	0.1	0.72	-0.6	-1.16	2.35	0.6	2.3	6.16	6.38
11	0.0	-0.3	0.2	1.39	-0.5	0.28	0.0	1.47	-0.1	-0.84	1.65	0.8	1.0	8.00	7.02
12	0.2	-0.3	0.2	0.12	-0.4	-0.58	0.2	0.69	-0.4	-0.76	1.14	0.3	1.7	5.32	7.64
13	0.1	-0.4	0.2	1.06	-0.6	-1.24	0.2	1.28	-0.6	-1.52	2.76	1.2	3.3	7.94	8.08
14	0.0	-0.4	0.3	1.51	-0.7	-1.48	0.0	1.67	-0.5	-1.49	3.16	1.3	2.2	7.41	8.54
15	-0.1	-0.4	0.1	1.12	-0.5	0.07	-0.2	1.43	-0.2	-0.93	1.93	0.8	0.3	4.89	9.00
16	0.0	-0.5	0.0	0.28	-0.7	-1.05	-0.2	0.73	-0.6	-1.09	1.91	0.4	2.0	3.94	9.62
17	0.0	-0.4	0.1	1.11	-0.5	-1.21	0.0	1.40	-0.3	-1.21	3.40	1.0	1.0	5.89	10.02
18	0.2	-0.5	0.4	1.25	-0.6	-1.60	0.1	1.30	-0.6	-1.70	2.96	1.6	8.2	6.86	11.38
19	**0.1**	**0.0**	**0.6**	**1.81**	**-0.4**	**0.02**	**0.5**	**1.91**	**-0.3**	**-1.80**	**1.77**	**1.2**	**0.3**	**9.27**	**11.90**
20	0.4	-0.3	0.6	0.98	-0.4	-0.79	0.5	1.04	-0.4	-1.89	1.73	1.3	7.9	4.24	12.72
21	*0.3*	*-0.9*	*0.4*	*1.43*	*-1.7*	*-3.03*	*0.4*	*1.50*	*-1.6*	*-3.28*	*2.08*	*3.7*	*15.7*	*18.67*	*13.32*
22	**1.2**	**-0.6**	**2.0**	**4.31**	**-1.7**	**-3.64**	**1.8**	**5.07**	**-1.7**	**-4.00**	**2.13**	**12.6**	**13.7**	**30.86**	**13.82**
23	**0.9**	**-0.7**	**2.1**	**4.52**	**-1.4**	**-2.89**	**2.1**	**5.02**	**-1.3**	**-4.28**	**2.12**	**11.4**	**7.4**	**25.08**	**14.34**
24	0.6	-0.6	1.2	2.20	-1.3	-2.49	0.7	2.42	-1.0	-2.62	1.88	4.9	19.9	15.56	14.96
25	***1.9***	***-4.8***	***4.0***	***7.64***	***-7.7***	***-12.24***	***4.0***	***7.66***	***-7.6***	***-12.29***	***1.70***	***82.1***	***182.6***	***106.86***	***15.46***
26	***6.6***	***-7.6***	***12.6***	***14.98***	***-15.8***	***-16.29***	***12.3***	***15.11***	***-15.5***	***-16.89***	***1.10***	***312.8***	***380.0***	***174.38***	***16.02***
27	***10.2***	***-10.0***	***17.6***	***17.18***	***-20.4***	***-17.20***	***17.6***	***17.18***	***-20.3***	***-17.97***	***0.91***	***395.8***	***448.7***	***234.51***	***16.60***

Table 12. SE19-FA-DL-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
28	***20.9***	***-25.5***	***31.3***	***20.87***	***-42.8***	***-22.16***	***30.3***	***21.53***	***-39.6***	***-22.77***	***0.58***	***1096.1***	***1446.6***	***331.60***	***17.26***
29	***38.1***	***-46.4***	***53.5***	***21.52***	***-64.8***	***-20.14***	***49.2***	***23.65***	***-63.3***	***-22.39***	***0.35***	***1752.1***	***1562.8***	***415.53***	***18.04***
30	37.5	-17.8	53.8	17.85	-38.2	0.75	52.7	17.91	-28.4	-4.56	0.19	665.7	231.7	476.27	18.96
31	5.0	-6.3	12.3	2.32	-14.9	0.11	11.9	2.34	-11.4	-1.87	0.08	47.4	61.5	149.61	20.02
32	19.5	-6.8	29.8	4.16	-15.6	-2.96	29.6	4.17	-15.6	-2.96	0.16	124.6	159.6	168.08	21.22
33	15.5	-3.5	23.6	3.08	-9.3	-2.17	23.6	3.33	-9.2	-2.24	0.16	66.8	49.6	155.32	21.92
34	0.0	-11.5	29.9	4.18	-20.3	-3.48	29.6	4.22	-20.1	-3.57	0.15	119.1	132.2	185.17	22.72
35	1.6	-3.6	6.0	1.51	-9.0	0.01	6.0	1.51	-6.3	-0.97	0.10	16.0	20.0	114.11	24.28
36	2.9	-7.2	7.0	1.52	-13.8	-2.22	6.5	1.53	-13.8	-2.29	0.18	19.5	30.6	100.65	24.90
37	3.9	-2.4	10.7	1.93	-5.7	-1.20	10.5	2.00	-5.6	-1.20	0.19	21.2	17.9	115.44	25.92
38	3.8	-7.0	8.3	1.46	-15.3	-2.54	8.1	1.50	-15.0	-2.56	0.17	24.0	64.6	96.20	26.86
39	20.2	-45.8	29.2	4.10	-60.0	-15.24	29.2	4.33	-60.0	-15.24	0.22	451.2	1044.3	340.87	28.30
40	***77.1***	***-73.1***	***94.7***	***21.50***	***-93.6***	***-16.18***	***85.3***	***23.13***	***-89.8***	***-17.88***	***0.20***	***2331.4***	***2142.9***	***560.01***	***29.28***
41	15.5	0.7	29.9	3.58	-68.0	0.13	27.5	3.59	-3.6	-1.18	0.04	210.9	12.0	323.34	30.36
42	21.2	-45.2	34.5	3.78	-58.6	-4.06	34.2	3.85	-57.9	-4.09	0.08	206.8	251.8	225.50	31.18
43	-11.1	-23.8	0.0	0.00	-40.4	0.13	-3.9	1.82	-30.0	-1.34	0.00	51.2	38.8	251.52	31.84
44	1.8	-18.1	10.8	2.25	-25.5	-1.59	10.8	2.25	-25.5	-1.59	0.11	59.6	66.9	157.99	32.60
45	-10.6	-43.3	0.0	0.00	-56.7	-3.77	-9.3	0.60	-56.6	-3.80	0.07	86.2	166.0	201.36	33.22
46	34.1	-19.9	48.1	4.95	-39.0	0.16	47.9	5.04	-32.5	-2.56	0.05	286.2	259.5	279.34	34.42
47	5.9	-16.7	13.8	1.73	-28.6	-2.28	13.6	1.74	-28.6	-2.28	0.09	58.5	70.2	174.38	35.52
48	16.2	-21.4	25.7	2.43	-34.5	-2.65	25.7	2.43	-33.8	-2.66	0.08	109.9	136.5	229.55	36.36
49	32.9	-41.4	49.3	5.03	-56.3	-4.22	49.0	5.14	-55.7	-4.24	0.09	322.1	355.2	274.51	37.98
50	-8.9	-19.2	1.0	1.71	-37.0	0.13	-0.3	1.73	-26.8	-1.28	0.04	49.4	40.3	234.06	38.60
51	5.1	-32.2	13.5	2.05	-44.2	-2.86	12.0	2.11	-43.9	-2.90	0.09	97.6	121.3	196.80	39.30
52	-3.9	-13.8	4.8	1.69	-28.2	0.06	4.3	1.73	-18.3	-0.85	0.05	35.7	22.3	226.44	40.08
53	-1.1	-15.9	7.5	1.77	-23.4	-1.34	7.4	1.82	-23.3	-1.40	0.10	26.1	33.6	119.19	40.88
54	-4.7	-16.3	3.7	1.48	-24.8	-1.48	3.7	1.48	-24.3	-1.49	0.10	22.8	28.6	120.14	41.54
55	-8.1	-13.7	0.0	0.00	-18.0	-0.74	-3.5	0.94	-17.9	-0.75	0.04	7.5	7.1	104.26	42.12
56	-10.8	-19.4	0.0	0.00	-28.0	-1.64	-10.1	0.29	-27.9	-1.69	0.06	11.4	25.1	96.46	43.02
57	-3.8	-11.9	4.5	1.65	-17.5	0.01	4.5	1.65	-15.9	-0.75	0.07	20.9	25.7	103.44	44.22

Table 12. SE19-FA-DL-2

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
58	-3.3	-11.3	5.2	1.61	-14.6	-0.71	5.1	1.65	-14.6	-0.71	0.12	12.5	17.3	111.89	44.82
59	-7.1	-17.6	0.0	0.00	-25.1	-1.47	-5.7	0.40	-25.1	-1.54	0.06	12.1	19.9	103.70	45.36
60	-7.2	-16.8	0.0	0.00	-24.5	-1.39	-3.3	0.98	-24.3	-1.41	0.06	15.4	13.9	112.18	46.44
61	-6.6	-15.0	0.0	0.00	-20.9	-1.03	-3.3	0.98	-20.9	-1.03	0.05	10.1	10.6	103.75	47.00
62	-2.8	-16.5	5.1	1.68	-24.6	-1.50	5.1	1.68	-24.6	-1.50	0.11	25.1	30.6	137.60	47.68
63	-1.2	-17.9	8.2	1.88	-26.5	-1.73	8.2	1.88	-26.5	-1.73	0.10	35.6	44.1	147.27	48.44
64	-10.4	-15.8	0.0	0.00	-21.4	-0.99	-6.7	0.72	-21.4	-0.99	0.05	6.8	4.6	102.68	48.98
65	9.4	-47.1	22.7	2.40	-61.5	-4.84	22.5	2.51	-61.0	-4.87	0.09	191.9	268.0	248.73	49.86
66	11.8	-3.0	24.9	2.61	-42.1	0.17	24.5	2.69	-9.3	-1.08	0.04	109.0	64.4	315.85	50.86
67	-1.4	-2.9	0.0	0.00	-7.2	-0.77	-1.2	0.11	-7.2	-0.77	0.11	1.4	1.6	58.73	51.34
68	3.5	-1.9	7.4	0.80	-3.9	-0.50	7.2	0.81	-3.9	-0.52	0.11	4.5	4.9	58.99	52.00
69	8.8	-17.2	17.7	1.85	-27.2	-1.95	17.7	1.85	-27.1	-2.01	0.08	48.5	61.6	140.21	52.74
70	3.4	-11.0	11.3	1.69	-18.7	-1.34	11.3	1.69	-18.5	-1.36	0.10	31.1	33.6	160.06	53.52
71	-1.4	-16.3	1.8	0.86	-24.9	-1.80	1.8	0.86	-24.9	-1.80	0.10	20.4	26.1	147.70	54.14
72	6.7	-2.0	15.9	1.96	-13.1	0.05	15.6	1.99	-6.2	-0.67	0.07	29.8	34.4	167.03	54.82
73	4.8	-12.1	11.6	1.38	-21.0	-1.59	11.6	1.38	-20.5	-1.62	0.09	23.2	57.8	88.07	56.04
74	3.3	-6.5	11.5	1.63	-12.0	-0.92	11.5	1.65	-12.0	-0.92	0.11	20.0	14.2	76.71	57.12
75	-5.1	-9.6	0.0	0.00	-15.5	-1.18	-5.0	0.08	-15.5	-1.20	0.08	4.3	4.6	97.51	57.84
76	7.4	-4.2	17.3	2.02	-7.4	0.01	17.3	2.09	-7.0	-0.80	0.08	26.3	33.7	143.34	58.46
77	4.9	-10.3	10.5	1.22	-16.4	-1.31	10.5	1.22	-16.1	-1.31	0.09	17.7	47.7	106.35	59.42
78	14.4	-13.4	25.1	2.60	-22.3	-1.85	24.4	2.62	-22.3	-1.90	0.09	68.0	62.8	158.50	60.32
79	7.1	-13.0	13.8	1.68	-23.0	-1.88	13.8	1.68	-23.0	-1.88	0.10	40.3	50.8	175.52	61.04
80	-1.1	-4.5	4.0	0.99	-11.0	0.05	3.8	1.00	-4.7	-0.19	0.06	6.8	10.0	84.94	61.92
81	-0.6	-9.4	3.8	0.94	-15.5	-1.05	3.8	0.94	-15.3	-1.07	0.10	7.7	9.7	54.54	62.84
82	-2.2	-8.5	2.3	0.81	-15.1	-1.00	2.2	0.82	-14.9	-1.00	0.10	7.3	9.2	48.77	64.12
83	-6.3	-8.9	0.0	0.00	-12.7	-0.72	-6.0	0.15	-12.7	-0.72	0.06	2.5	2.7	52.01	65.16
84	-1.7	-3.9	3.1	0.90	-7.9	0.00	3.0	0.93	-4.2	-0.14	0.08	4.3	5.4	78.61	66.14
85	-2.3	-6.4	0.0	0.00	-9.3	-0.48	-1.3	0.34	-9.1	-0.48	0.05	1.6	1.7	24.89	66.80
86	-3.6	-5.5	0.0	0.00	-6.3	-0.23	-2.7	0.26	-6.3	-0.23	0.04	0.7	0.7	27.36	67.32
87	-3.4	-6.4	0.0	0.00	-9.6	-0.50	-2.7	0.28	-9.6	-0.50	0.05	1.4	1.4	24.70	68.04

Table 12. SE19-FA-DL-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
88	-5.7	-7.5	0.0	0.00	-13.8	-0.92	-5.6	0.06	-13.8	-0.92	0.07	2.4	2.6	35.34	68.76
89	-2.3	-5.8	1.2	0.70	-12.6	-0.78	1.1	0.72	-12.5	-0.79	0.11	5.6	6.0	40.58	70.48
90	-2.3	-8.9	2.4	0.82	-14.2	-0.96	2.2	0.86	-14.2	-0.96	0.11	6.5	8.0	60.20	72.22
91	-3.3	-4.6	0.0	0.00	-7.6	0.04	-0.4	0.63	-4.7	-0.12	0.01	2.0	2.0	61.98	72.70
92	0.3	-6.8	5.1	1.10	-10.7	-0.64	5.0	1.10	-10.7	-0.70	0.11	7.2	8.9	62.87	73.42
93	-0.5	-4.9	3.5	0.90	-7.0	-0.36	3.5	0.90	-7.0	-0.36	0.12	4.2	4.7	67.88	74.00
94	-0.7	-6.5	3.7	0.92	-9.1	-0.53	3.7	0.92	-9.1	-0.53	0.11	4.6	5.7	53.85	74.66
95	-5.7	-9.0	0.0	0.00	-14.8	-0.98	-5.7	0.05	-14.8	-1.06	0.07	3.9	9.5	41.66	75.38
96	-0.4	-5.2	4.7	1.05	-8.0	-0.44	4.4	1.06	-7.9	-0.45	0.12	6.3	10.5	49.02	76.60
97	-2.9	-4.5	0.0	0.00	-5.0	-0.16	-2.4	0.22	-5.0	-0.18	0.03	0.5	0.5	29.91	77.04
98	-4.1	-6.7	3.2	0.80	-10.8	-0.66	3.0	0.81	-10.7	-0.67	0.10	5.4	8.7	33.97	79.40
99	-6.1	-6.7	0.0	0.00	-11.6	-0.74	-6.1	0.03	-11.6	-0.74	0.06	1.1	1.2	23.88	80.50
100	-2.8	-5.0	0.0	0.00	-6.7	-0.25	-0.8	0.46	-6.6	-0.26	0.04	2.7	2.8	27.88	82.54
101	-3.3	-5.9	0.0	0.00	-8.6	-0.43	-2.7	0.22	-8.5	-0.44	0.05	1.1	1.1	38.61	83.38
102	-2.8	-6.7	0.1	0.55	-11.9	-0.81	0.1	0.55	-11.9	-0.81	0.11	4.2	4.4	41.08	84.80
103	-4.7	-6.0	0.0	0.00	-7.2	-0.25	-4.5	0.14	-7.2	-0.26	0.04	0.4	0.4	25.72	85.86
104	-3.6	-4.5	0.0	0.00	-5.8	0.03	-2.7	0.27	-4.6	-0.10	0.00	0.5	0.5	18.94	86.88
105	-3.1	-5.8	0.0	0.00	-7.7	-0.33	-1.4	0.42	-7.7	-0.33	0.04	1.2	1.2	14.29	90.00
106	-4.2	-4.7	0.0	0.00	-5.6	0.01	-3.7	0.17	-4.8	-0.09	0.00	0.2	0.2	6.47	91.48
107	-4.4	-4.7	0.0	0.00	-5.0	-0.10	-4.3	0.09	-5.0	-0.10	0.02	0.0	0.0	4.64	91.96
108	0.0	-5.5	0.0	0.00	-6.5	-0.22	-4.5	0.05	-6.5	-0.22	0.03	0.2	0.2	4.89	93.32
109	-5.2	-5.4	0.0	0.00	-6.5	-0.21	-5.1	0.05	-6.3	-0.22	0.03	0.2	0.1	8.70	94.80

Table 13. SE19-FA-DL-3

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	78.5	-64.6	102.3	18.72	-89.8	-13.11	51.5	23.05	-43.0	-22.49	3.14	9388.3	9860.5	584.5	
1		***-0.3***	***0.4***	***0.77***	***-0.5***	***-1.06***	***0.4***	***1.27***	***-0.4***	***-1.08***	***2.10***	***0.7***	***2.2***	***5.89***	***0.50***
2	*-0.3*	*-0.4*	*0.0*	*0.00*	*-0.6*	*-0.72*	*-0.2*	*0.35*	*-0.5*	*-1.20*	*1.19*	*0.0*	*1.0*	*3.43*	*0.98*
3	-0.3	-0.4	0.0	0.00	-0.6	-1.13	-0.3	0.14	-0.6	-1.13	1.94	0.1	1.0	3.05	1.48
4	0.1	0.1	0.3	0.75	-0.4	0.14	0.2	0.76	-0.2	-0.42	0.91	0.3	0.8	6.73	2.44
5	*0.0*	*-0.4*	*0.2*	*0.68*	*-0.6*	*-1.30*	*0.2*	*0.72*	*-0.6*	*-1.30*	*2.37*	*0.2*	*2.1*	*4.43*	*3.18*
6	0.0	-0.3	0.1	0.14	-0.6	-0.80	-0.2	0.64	-0.6	-0.80	1.51	0.4	0.3	4.44	3.74
7	*0.0*	*-0.5*	*0.2*	*0.67*	*-0.6*	*-1.10*	*0.2*	*0.69*	*-0.6*	*-1.13*	*2.16*	*0.5*	*2.0*	*5.59*	*4.38*
8	-0.3	-0.4	0.0	0.00	-0.6	-0.55	-0.3	0.89	-0.6	-0.59	0.91	0.2	0.1	5.59	4.94
9	0.1	-0.4	0.3	0.79	-0.6	-0.94	0.2	0.86	-0.5	-0.95	2.10	0.5	1.8	8.70	5.92
10	0.1	-0.4	0.2	0.81	-0.6	-1.24	0.2	0.81	-0.5	-1.31	2.40	0.8	2.7	7.75	6.38
11	0.2	0.0	0.3	1.17	-0.4	-1.00	0.0	1.50	-0.4	-1.00	3.14	0.8	0.8	7.28	7.18
12	0.1	-0.3	0.3	0.82	-0.5	-1.17	0.2	0.88	-0.5	-1.17	2.46	0.3	1.7	5.52	7.66
13	***0.1***	***-0.4***	***0.4***	***1.32***	***-0.8***	***-1.48***	***0.4***	***1.32***	***-0.6***	***-1.51***	***2.47***	***1.2***	***3.9***	***10.48***	***8.08***
14	***0.2***	***-0.4***	***0.4***	***1.56***	***-0.8***	***-1.50***	***0.2***	***1.75***	***-0.8***	***-1.57***	***2.47***	***1.7***	***3.2***	***7.28***	***8.56***
15	0.1	-0.4	0.3	1.16	-0.5	-0.47	0.1	1.66	-0.2	-1.20	2.14	1.2	0.6	7.49	8.98
16	0.0	-0.5	0.1	0.08	-0.7	-1.08	-0.1	0.77	-0.6	-1.30	1.45	0.5	2.1	5.00	9.62
17	0.1	-0.5	0.2	0.64	-0.6	-0.87	0.0	1.38	-0.4	-1.31	2.10	1.2	1.0	6.78	10.02
18	0.1	0.1	0.3	1.33	-0.4	0.14	0.3	1.33	-0.1	-0.62	1.78	0.7	1.2	7.49	10.58
19	***0.3***	***-0.5***	***0.4***	***1.26***	***-0.9***	***-1.73***	***0.4***	***1.27***	***-0.9***	***-1.73***	***2.25***	***1.1***	***9.4***	***6.52***	***11.40***
20	**0.3**	**0.0**	**1.0**	**2.48**	**-0.6**	**-1.73**	**0.8**	**2.49**	**-0.5**	**-1.84**	**2.75**	**2.6**	**0.6**	**13.53**	**11.92**
21	0.5	-0.3	0.6	1.03	-0.8	-1.80	0.3	1.06	-0.6	-1.85	1.99	1.5	10.0	7.24	12.76
22	*0.2*	*-0.6*	*0.5*	*1.32*	*-1.8*	*-3.27*	*0.4*	*1.37*	*-1.8*	*-3.27*	*2.05*	*3.4*	*15.7*	*17.08*	*13.32*
23	***0.6***	***-1.0***	***2.0***	***4.33***	***-2.0***	***-4.05***	***1.9***	***4.75***	***-2.0***	***-4.05***	***2.11***	***12.1***	***15.5***	***28.00***	***13.80***
24	**0.7**	**-0.7**	**2.4**	**4.58**	**-1.9**	**-3.59**	**2.4**	**5.20**	**-1.8**	**-4.68**	**1.90**	**13.5**	**12.3**	**29.02**	**14.34**
25	0.7	-1.0	1.5	2.61	-1.7	-3.15	1.3	2.72	-1.7	-3.24	1.83	6.7	24.5	26.48	14.94
26	***2.2***	***-4.9***	***4.4***	***7.58***	***-9.4***	***-11.67***	***4.4***	***7.98***	***-9.2***	***-12.23***	***1.40***	***95.0***	***194.3***	***127.53***	***15.46***
27	***9.1***	***-10.1***	***13.6***	***14.81***	***-18.9***	***-15.89***	***13.4***	***15.41***	***-18.8***	***-16.69***	***0.94***	***361.2***	***419.8***	***197.99***	***16.02***
28	***11.1***	***-14.1***	***19.4***	***17.46***	***-24.2***	***-17.14***	***19.4***	***17.46***	***-23.8***	***-17.58***	***0.79***	***452.4***	***474.4***	***248.43***	***16.60***

Table 13. SE19-FA-DL-3

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
29	***23.2***	***-30.7***	***33.8***	***20.71***	***-47.4***	***-20.41***	***32.5***	***21.42***	***-43.0***	***-22.49***	***0.51***	***1177.5***	***1499.8***	***352.04***	***17.26***
30	***44.1***	***-53.1***	***58.1***	***21.64***	***-68.6***	***-19.70***	***51.5***	***23.05***	***-65.1***	***-21.02***	***0.33***	***1786.3***	***1543.9***	***447.68***	***18.04***
31	36.8	4.7	52.0	13.34	-46.1	0.11	51.3	13.41	-4.4	-2.62	0.13	478.9	117.7	466.60	18.98
32	16.6	6.6	22.4	1.91	0.0	0.00	22.4	1.91	0.2	-2.00	0.09	29.9	57.5	111.70	20.02
33	31.2	-1.1	39.9	5.29	-10.6	-2.93	39.9	5.52	-9.4	-2.94	0.16	136.9	179.1	166.24	21.20
34	23.1	4.6	30.4	3.38	-2.3	-2.04	30.4	3.38	-2.2	-2.04	0.17	66.6	46.6	158.37	21.92
35	1.6	-0.8	35.0	4.17	-15.2	-3.19	34.6	4.17	-14.6	-3.23	0.15	113.1	125.6	180.21	23.10
36	7.8	1.9	11.7	1.34	-1.5	-1.03	11.7	1.34	-1.5	-1.03	0.18	12.5	22.1	76.77	24.28
37	8.4	-1.1	11.9	1.26	-8.1	-1.97	11.9	1.26	-8.0	-2.04	0.16	17.0	25.3	96.84	24.90
38	9.0	6.7	13.2	1.54	0.0	0.00	13.2	1.54	6.4	-0.22	0.12	9.2	6.2	103.88	25.34
39	8.7	3.1	11.6	1.07	-0.4	-0.94	11.6	1.07	-0.4	-0.94	0.17	5.4	6.6	60.49	25.94
40	7.2	-4.0	10.0	0.86	-13.7	-2.77	10.0	0.86	-13.5	-2.80	0.15	24.5	63.6	104.65	26.88
41	25.6	-46.6	32.8	3.59	-64.9	-14.61	32.1	4.06	-64.7	-15.40	0.19	480.9	1047.1	382.40	28.30
42	***78.5***	***-64.6***	***102.3***	***18.72***	***-89.8***	***-13.11***	***84.4***	***20.87***	***-86.7***	***-13.97***	***0.17***	***2075.0***	***1793.4***	***584.52***	***29.32***
43	33.0	24.1	47.1	3.42	-59.5	0.30	47.1	3.56	23.6	-0.47	0.03	194.7	13.6	332.73	30.30
44	36.9	-40.2	48.2	3.32	-59.4	-4.21	47.8	3.37	-59.4	-4.21	0.07	192.8	228.4	235.38	31.20
45	-15.1	-28.4	0.0	0.00	-35.6	0.24	-8.2	1.19	-34.3	-1.33	0.01	32.2	28.1	236.33	31.82
46	-0.5	-14.4	9.3	1.61	-25.7	0.01	8.8	1.65	-20.7	-0.99	0.05	42.7	45.2	160.89	32.58
47	-8.3	-42.4	0.0	0.00	-57.5	-3.86	-7.1	0.42	-57.5	-3.86	0.07	80.5	152.8	212.99	33.22
48	38.6	-4.0	54.7	4.14	-37.5	0.11	54.7	4.14	-15.7	-1.79	0.04	214.9	178.6	284.23	34.46
49	15.5	-2.1	23.2	1.25	-11.5	-1.54	23.0	1.31	-11.5	-1.54	0.08	31.5	39.8	153.41	35.50
50	27.3	-11.7	37.4	2.19	-27.1	-2.08	37.4	2.19	-25.4	-2.11	0.07	92.0	113.7	212.60	36.46
51	-10.0	-11.7	0.0	0.00	-17.7	-0.82	-10.0	0.09	-17.4	-0.83	0.05	2.3	10.8	107.12	37.04
52	48.7	-28.6	62.7	4.94	-45.8	-3.09	62.7	4.94	-45.3	-3.09	0.07	278.9	295.7	289.75	38.00
53	-4.9	-20.0	0.0	0.00	-27.4	-1.31	-1.4	1.03	-27.4	-1.39	0.05	26.1	28.3	187.39	38.58
54	9.4	-23.8	15.5	1.50	-37.8	-2.33	14.9	1.50	-37.2	-2.37	0.07	70.8	87.6	205.11	39.30
55	1.0	-7.9	8.8	1.29	-19.5	0.14	7.9	1.30	-13.1	-0.69	0.04	23.0	14.7	217.52	40.06
56	5.2	-9.3	12.8	1.39	-16.5	-1.05	12.5	1.40	-16.4	-1.08	0.08	20.7	27.8	117.35	40.86
57	2.8	-10.3	10.3	1.20	-17.4	-1.12	10.3	1.20	-17.4	-1.12	0.08	17.1	20.8	117.92	41.52
58	-5.8	-15.3	1.7	0.58	-25.6	-1.59	1.7	0.58	-25.6	-1.59	0.08	19.1	30.5	98.23	43.04
59	1.5	-5.5	9.0	1.18	-13.4	0.04	9.0	1.18	-9.6	-0.56	0.05	14.8	17.3	102.04	44.20
60	3.7	-2.7	12.5	1.38	-5.7	-0.44	12.3	1.38	-5.3	-0.45	0.10	11.5	14.6	113.44	44.80

Table 13. SE19-FA-DL-3

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
61	0.4	-10.8	3.0	0.40	-17.7	-1.13	3.0	0.42	-17.7	-1.13	0.07	9.7	13.6	88.58	45.36
62	-2.9	-7.4	0.0	0.00	-9.2	-0.38	-1.0	0.43	-9.2	-0.38	0.04	2.6	2.0	92.67	45.84
63	-3.5	-13.7	0.0	0.00	-23.1	-1.48	-3.0	0.23	-23.1	-1.48	0.06	11.2	13.6	103.00	46.44
64	-3.9	-9.1	0.0	0.00	-18.0	-1.00	-1.2	0.54	-18.0	-1.00	0.06	6.9	7.0	105.00	47.02
65	2.0	-10.2	8.1	1.10	-17.2	-1.00	8.1	1.10	-17.1	-1.05	0.08	15.4	18.1	125.41	47.66
66	5.6	-9.4	13.4	1.44	-19.2	-1.25	13.4	1.44	-19.2	-1.25	0.08	25.0	31.0	134.11	48.46
67	-4.3	-10.9	0.0	0.00	-18.9	-1.18	-3.8	0.26	-18.9	-1.18	0.06	5.9	6.5	128.46	48.98
68	18.7	-38.4	29.1	1.89	-53.2	-3.73	28.9	2.01	-52.9	-3.78	0.07	147.9	196.7	239.52	49.86
69	12.8	0.5	24.3	1.88	-33.7	0.06	22.6	1.88	-4.3	-0.76	0.03	66.1	40.6	291.75	50.82
70	3.4	0.5	3.6	0.13	-2.5	-0.50	3.6	0.14	-2.3	-0.50	0.10	1.3	1.4	61.66	51.30
71	7.6	1.3	11.4	0.71	-2.2	-0.55	11.4	0.71	-2.2	-0.55	0.09	5.0	6.1	77.09	52.00
72	11.5	-13.6	19.9	1.47	-25.6	-1.74	19.9	1.47	-25.3	-1.75	0.07	39.1	48.8	150.24	52.74
73	6.9	-7.4	13.4	1.29	-15.2	-1.06	13.0	1.29	-15.2	-1.06	0.08	23.4	23.5	160.46	53.50
74	3.7	-11.7	6.8	0.80	-20.3	-1.38	6.8	0.80	-20.3	-1.38	0.08	16.3	20.7	147.52	54.12
75	11.5	2.6	21.8	1.71	-8.7	0.05	21.3	1.71	-0.4	-0.51	0.05	26.7	28.4	170.75	54.80
76	10.3	-7.0	16.9	1.11	-17.8	-1.34	16.7	1.14	-17.4	-1.34	0.07	21.2	48.7	90.26	56.14
77	7.8	1.6	15.8	1.29	-5.4	0.07	15.8	1.31	-1.3	-0.44	0.06	13.7	8.6	82.17	57.06
78	0.0	-0.6	4.3	0.16	-5.6	-0.64	4.3	0.16	-5.6	-0.64	0.08	2.9	3.7	87.54	57.80
79	17.3	1.6	26.9	1.96	-3.4	-0.82	26.6	1.99	-3.1	-0.82	0.09	30.6	39.6	136.59	58.48
80	9.4	-5.0	12.5	0.60	-14.5	-1.27	12.5	0.60	-14.1	-1.28	0.07	15.8	42.2	121.35	59.44
81	18.0	-4.5	30.1	2.06	-12.1	-1.33	29.4	2.09	-12.1	-1.33	0.08	48.0	39.6	158.75	60.30
82	15.0	-7.3	22.0	1.44	-17.6	-1.57	22.0	1.44	-17.6	-1.57	0.08	35.1	42.2	171.59	61.04
83	6.5	2.2	10.6	0.79	-5.8	0.01	10.6	0.79	0.9	-0.27	0.05	5.7	6.8	69.28	61.94
84	5.6	-2.0	9.6	0.65	-9.2	-0.89	9.6	0.65	-9.0	-0.93	0.08	6.4	7.3	50.55	62.86
85	4.6	-2.1	7.9	0.57	-9.4	-0.90	7.9	0.57	-9.4	-0.90	0.09	6.1	7.1	50.42	64.14
86	-0.8	-2.4	0.0	0.00	-7.4	-0.65	-0.7	0.08	-7.4	-0.65	0.09	1.5	1.9	28.07	64.76
87	0.0	-2.3	0.0	0.00	-6.3	-0.54	-1.9	0.02	-6.1	-0.54	0.09	0.9	1.1	55.11	65.14
88	5.1	0.0	9.9	0.75	-4.0	-0.51	9.7	0.75	-4.0	-0.51	0.09	6.0	7.2	80.66	66.82
89	2.5	-1.6	2.6	0.13	-8.5	-0.86	2.5	0.15	-8.5	-0.86	0.09	4.1	4.3	35.94	68.76
90	1.9	0.3	6.6	0.46	-7.0	-0.72	6.6	0.46	-7.0	-0.72	0.09	4.7	4.9	43.73	70.50
91	2.3	1.7	3.5	0.24	0.0	0.00	3.4	0.25	1.4	-0.10	0.07	0.4	0.4	28.45	70.96
92	4.7	-2.1	8.1	0.60	-8.1	-0.79	8.0	0.60	-8.0	-0.82	0.09	4.5	4.8	54.54	72.24

Table 13. SE19-FA-DL-3

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
93	2.9	0.2	4.0	0.27	-1.0	0.01	3.9	0.29	-0.7	-0.22	0.05	1.0	1.1	57.39	72.72
94	6.2	0.5	9.9	0.73	-4.2	-0.55	9.9	0.73	-4.2	-0.55	0.09	4.8	5.2	64.26	73.42
95	0.0	1.7	9.6	0.69	-0.4	-0.31	9.5	0.71	-0.3	-0.31	0.10	3.3	3.6	67.06	73.98
96	6.6	1.0	10.6	0.72	-1.9	-0.38	10.6	0.78	-1.7	-0.39	0.09	3.7	4.2	57.32	74.68
97	4.2	0.7	8.0	0.61	-12.0	-1.11	8.0	0.61	-11.8	-1.12	0.09	8.9	11.0	55.13	76.56
98	0.0	1.9	4.2	0.24	0.0	0.00	4.2	0.25	1.7	-0.14	0.06	0.5	0.5	30.86	77.00
99	2.1	-0.5	9.6	0.69	-7.7	-0.79	9.6	0.70	-7.7	-0.79	0.09	6.5	8.9	32.51	80.80
100	1.9	0.5	2.8	0.18	-2.8	-0.36	2.6	0.18	-2.7	-0.37	0.10	1.4	1.4	30.87	81.92
101	1.1	-0.6	3.1	0.19	-4.8	-0.53	3.1	0.20	-4.8	-0.53	0.09	1.8	1.9	42.67	83.40
102	3.1	0.0	4.0	0.26	-2.4	-0.35	4.0	0.27	-2.4	-0.35	0.10	1.3	1.3	41.28	84.06
103	1.7	-0.8	1.9	0.11	-8.1	-0.83	1.9	0.11	-8.1	-0.83	0.09	2.5	2.6	36.80	84.90
104	-0.6	-0.8	0.0	0.00	-3.5	-0.36	-0.6	0.01	-3.4	-0.38	0.10	0.3	0.3	16.07	85.94
105	-0.4	-0.5	0.0	0.00	-0.9	-0.10	-0.4	0.02	-0.8	-0.11	0.11	0.0	0.0	8.42	86.26
106	1.0	0.1	1.2	0.08	-0.9	-0.20	1.1	0.09	-0.9	-0.20	0.13	0.2	0.2	13.11	86.94
107	1.5	1.4	2.0	0.12	0.0	0.00	2.0	0.14	1.3	-0.04	0.06	0.1	0.1	15.33	87.36
108	2.0	-0.4	2.7	0.19	-3.8	-0.41	2.7	0.19	-3.8	-0.43	0.09	1.0	1.0	9.56	90.30
109	-0.2	-0.2	0.0	0.00	-0.4	0.01	-0.4	0.01	-0.4	-0.03	0.02	0.0	0.0	4.25	90.62

Table 14. SE13-FA-1-A

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	1.8	-2.6	4.1	9.27	-4.7	-8.70	3.9	9.55	-4.5	-8.85	5.08	299.9	415.7	63.6	
1	***-0.1***	***-0.1***	***0.1***	***0.23***	***-0.4***	***-0.22***	***0.1***	***0.25***	***-0.3***	***-0.25***	***0.88***	***0.0***	***0.0***	***3.49***	***0.28***
2	*-0.1*	*-0.4*	*0.0*	*0.00*	*-0.5*	*-0.62*	*-0.1*	*0.06*	*-0.5*	*-0.63*	*1.19*	*0.1*	*0.2*	*3.29*	*0.70*
3	0.0	0.0	0.1	0.58	-0.3	0.13	0.1	0.58	-0.2	-0.42	1.08	0.2	0.3	7.11	1.26
4	**-0.2**	**-0.3**	**0.2**	**0.68**	**-0.5**	**-0.72**	**0.2**	**0.68**	**-0.4**	**-0.84**	**1.87**	**0.2**	**2.2**	**6.08**	**3.28**
5	*-0.4*	*-0.5*	*0.0*	*0.00*	*-0.6*	*-0.67*	*-0.3*	*0.45*	*-0.5*	*-0.94*	*1.15*	*0.2*	*1.3*	*3.99*	*4.06*
6	-0.1	-0.1	0.2	0.62	-0.4	0.12	0.1	0.64	-0.1	-0.52	0.78	0.2	0.6	5.84	4.96
7	**0.2**	**0.1**	**0.3**	**0.46**	**0.0**	**-0.36**	**0.2**	**0.86**	**0.0**	**-0.36**	**2.41**	**0.1**	**0.6**	**6.54**	**5.38**
8	***0.3***	***-0.7***	***0.8***	***1.75***	***-1.7***	***-2.82***	***0.7***	***1.75***	***-1.5***	***-2.96***	***1.88***	***3.5***	***9.7***	***17.84***	***5.86***
9	***1.2***	***-0.9***	***2.0***	***4.25***	***-2.1***	***-3.75***	***2.0***	***4.25***	***-2.0***	***-4.04***	***1.98***	***11.9***	***15.9***	***29.15***	***6.30***
10	0.5	-0.8	1.2	2.27	-1.3	-2.27	1.0	2.97	-1.2	-2.32	1.82	5.0	17.8	22.23	7.04
11	***1.2***	***-1.0***	***2.2***	***4.82***	***-3.1***	***-5.65***	***2.0***	***5.13***	***-3.1***	***-5.65***	***1.96***	***18.8***	***12.5***	***51.94***	***7.46***
12	***1.0***	***-1.5***	***3.1***	***6.39***	***-3.2***	***-5.86***	***3.0***	***6.44***	***-3.2***	***-5.86***	***1.94***	***24.6***	***19.7***	***54.23***	***7.84***
13	*0.5*	*-2.4*	*1.5*	*3.68*	*-4.2*	*-7.44*	*1.5*	*3.68*	*-4.2*	*-7.44*	*1.96*	*19.9*	*86.3*	*57.86*	*8.22*
14	***1.4***	***-2.6***	***4.1***	***9.27***	***-4.7***	***-8.70***	***3.9***	***9.55***	***-4.5***	***-8.85***	***2.04***	***47.1***	***7.1***	***63.56***	***8.72***
15	1.8	-1.8	3.8	7.61	-3.4	-6.33	3.7	8.27	-3.4	-6.33	1.95	33.0	-1.0	62.17	9.14
16	0.9	-0.5	2.2	4.47	-1.4	-2.71	2.1	4.50	-1.4	-2.82	1.99	11.8	6.3	40.48	9.52
17	0.7	-0.7	1.6	3.08	-1.9	-3.68	1.5	3.16	-1.9	-3.68	1.91	7.9	27.2	27.24	10.00
18	1.2	-0.7	2.8	5.30	-1.8	-4.13	2.8	5.30	-1.8	-4.13	2.05	14.8	4.0	38.80	10.48
19	0.4	-0.9	0.8	1.64	-2.1	-3.92	0.2	1.66	-2.1	-3.92	1.90	5.8	26.9	22.04	11.14
20	1.0	-1.4	1.9	4.47	-2.6	-4.60	1.6	4.61	-2.6	-4.60	2.00	14.5	11.7	32.83	11.58
21	0.7	-1.3	2.2	3.98	-2.5	-3.84	1.9	4.85	-2.3	-4.07	1.69	14.9	5.8	32.45	12.04
22	-0.6	-1.1	0.0	0.00	-1.2	-1.63	-0.2	1.57	-1.2	-1.63	1.36	1.2	-0.7	17.65	12.34
23	0.2	-0.6	0.6	1.86	-1.1	-2.28	0.4	2.35	-0.9	-2.30	2.38	3.6	1.9	12.32	12.82
24	0.4	-1.0	1.4	3.17	-2.1	-3.22	1.4	3.17	-2.1	-4.13	1.78	8.4	14.9	25.84	13.30
25	0.6	-0.2	1.4	2.74	-0.9	-2.34	1.4	3.40	-0.8	-2.36	2.15	5.8	1.3	24.83	13.70
26	0.1	-0.4	0.4	1.18	-0.7	-1.61	0.4	1.48	-0.6	-1.62	2.53	1.2	5.5	11.55	14.14
27	0.8	-1.0	1.7	3.75	-2.4	-4.30	1.7	3.75	-2.4	-4.30	1.96	10.7	18.0	27.18	14.58
28	0.0	-0.4	0.8	2.73	-0.8	-1.49	0.8	2.73	-0.7	-1.50	2.67	2.5	-5.2	25.34	14.90

Table 14. SE13-FA-1-A

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
29	0.4	-0.9	1.1	2.33	-1.8	-2.92	1.1	2.33	-1.8	-3.31	1.80	5.1	13.7	18.12	15.34
30	0.2	-0.2	0.9	1.80	-0.4	0.79	0.7	2.64	-0.2	-1.48	0.75	2.8	-2.6	18.54	15.94
31	0.0	-0.5	0.1	0.38	-0.7	-1.63	0.0	0.38	-0.6	-1.65	2.70	0.5	3.4	4.64	16.42
32	0.1	-0.6	0.1	0.74	-0.9	-2.05	-0.1	1.36	-0.9	-2.13	2.76	1.7	5.0	10.70	17.00
33	-0.2	-0.6	0.6	2.03	-0.8	-1.88	0.4	2.08	-0.8	-1.89	2.77	1.8	0.6	17.99	17.34
34	-0.4	-0.5	0.0	0.00	-0.7	-1.25	-0.1	1.35	-0.7	-1.25	1.76	0.4	0.5	6.27	17.68
35	0.1	0.1	0.2	0.65	-0.5	0.19	-0.1	1.12	0.0	-0.55	0.70	0.5	0.3	5.89	18.08
36	0.1	0.0	0.4	1.45	-0.2	-1.25	0.3	1.49	-0.2	-1.29	5.08	0.2	2.2	5.52	18.50
37	0.1	-0.5	0.6	1.53	-1.0	-2.20	0.6	1.53	-0.8	-2.34	2.37	2.0	6.8	10.60	18.90
38	0.2	-0.4	0.6	1.63	-0.5	-1.53	0.4	1.85	-0.5	-1.72	2.90	2.1	-0.2	13.33	19.26
39	0.2	-0.5	0.4	1.37	-0.6	-0.78	0.2	1.49	-0.3	-1.52	2.27	1.5	4.4	8.49	19.98
40	-0.5	-0.6	0.0	0.00	-0.7	-0.55	-0.5	0.28	-0.6	-0.57	0.81	0.0	0.4	2.54	20.28
41	0.0	0.0	0.2	0.73	-0.6	0.15	0.1	0.90	0.0	-0.70	0.74	0.5	0.8	8.06	20.92
42	0.0	-0.4	0.2	0.21	-0.6	-0.47	0.1	0.57	-0.3	-0.55	0.91	0.2	1.5	3.61	21.54
43	0.0	0.0	0.2	0.72	-0.4	0.42	0.0	0.82	-0.2	-0.55	0.58	0.4	0.5	5.51	21.92
44	0.0	-0.1	0.3	1.24	-0.3	-1.26	0.2	1.26	-0.2	-1.39	4.40	0.2	1.6	4.95	22.30
45	0.2	0.0	0.4	1.33	-0.1	-0.76	0.4	1.43	-0.1	-0.99	4.02	0.3	1.6	6.41	22.78
46	0.1	-0.4	0.3	0.84	-0.6	-1.20	0.2	0.86	-0.5	-1.36	2.34	0.6	2.6	3.62	23.18
47	0.1	-0.4	0.2	0.53	-0.6	-1.61	-0.1	0.91	-0.6	-1.69	2.57	0.7	4.0	5.99	23.84
48	-0.3	-0.5	0.0	0.00	-0.7	-0.84	-0.2	1.08	-0.6	-0.84	1.27	0.1	-1.2	4.12	24.16
49	-0.4	-0.6	0.0	0.00	-0.8	-1.20	-0.4	0.41	-0.7	-1.36	1.59	0.1	3.0	3.18	24.56
50	-0.6	-0.7	0.0	0.00	-0.8	-0.60	-0.5	0.61	-0.8	-0.63	0.75	0.0	-0.7	4.19	24.86
51	0.0	-0.3	0.3	0.92	-0.7	0.01	0.3	1.06	-0.2	-1.14	0.95	0.6	1.8	9.13	25.64
52	0.0	0.0	0.1	0.99	-0.3	0.16	0.1	0.99	-0.1	-0.59	1.73	0.3	1.0	6.50	26.16
53	0.1	-0.3	0.3	0.89	-0.4	-0.91	0.3	1.09	-0.2	-1.27	2.56	0.5	1.7	4.75	26.58
54	0.1	-0.3	0.2	0.86	-0.4	-0.52	0.2	0.90	-0.2	-0.88	2.17	0.4	1.4	4.38	27.36
55	-0.3	-0.5	0.0	0.00	-0.7	-1.57	-0.2	0.19	-0.7	-1.57	2.19	0.3	4.7	4.34	27.76
56	-0.4	-0.6	0.0	0.00	-0.7	-0.81	-0.1	1.37	-0.6	-0.94	1.23	0.2	-0.8	5.91	28.44
57	0.0	0.1	0.2	0.39	-0.4	0.15	0.0	0.62	-0.1	-0.74	0.38	0.2	1.7	5.26	29.28
58	0.0	-0.4	0.3	0.28	-0.6	-1.33	0.1	0.29	-0.5	-1.41	1.79	0.4	2.9	4.94	29.64
59	-0.4	-0.4	0.0	0.00	-0.6	-0.58	-0.2	0.85	-0.5	-0.61	0.98	0.1	-0.7	3.68	29.98

Table 14. SE13-FA-1-A

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
60	0.1	-0.4	0.1	0.20	-0.5	-0.46	0.1	0.75	-0.4	-0.87	1.09	0.4	3.0	5.72	31.52
61	0.0	-0.3	0.2	0.52	-0.4	-0.24	-0.1	0.79	-0.2	-0.57	1.35	0.5	0.4	5.70	32.02
62	-0.2	-0.4	0.0	0.00	-0.6	-0.66	-0.1	0.33	-0.5	-0.80	1.13	0.1	0.8	2.93	32.52
63	0.0	-0.1	0.0	0.07	-0.5	0.22	0.0	0.37	-0.1	-0.09	0.29	0.1	0.2	4.51	33.18
64	0.1	0.1	0.2	0.83	-0.1	0.14	0.2	0.83	-0.1	-0.73	2.13	0.1	0.7	4.83	33.76
65	0.1	0.1	0.2	0.50	-0.1	-0.29	0.2	0.55	-0.1	-0.29	3.14	0.0	0.2	2.67	34.10
66	0.1	-0.2	0.2	0.79	-0.4	-0.71	0.2	0.79	-0.2	-0.91	2.34	0.3	1.2	2.92	34.58
67	-0.2	-0.4	0.0	0.00	-0.6	-1.10	-0.2	0.05	-0.6	-1.24	1.84	0.2	2.9	4.19	34.92
68	-0.4	-0.4	0.0	0.00	-0.6	-0.52	-0.4	0.45	-0.6	-0.54	0.90	0.0	-0.4	2.79	35.26
69	-0.1	0.0	0.1	0.73	-0.4	0.11	0.1	0.74	0.0	-0.15	1.04	0.2	1.2	5.46	35.72
70	0.0	-0.3	0.2	0.50	-0.4	-0.77	0.1	0.59	-0.4	-0.79	1.99	0.2	3.2	3.24	36.68
71	-0.2	-0.3	0.0	0.00	-0.4	-0.45	-0.3	0.21	-0.4	-0.61	1.01	0.0	0.3	1.91	37.02
72	-0.3	-0.4	0.0	0.00	-0.6	-0.50	-0.3	0.07	-0.4	-0.82	0.88	0.1	1.4	2.85	37.56
73	0.0	-0.4	0.1	-0.01	-0.5	0.08	0.0	0.50	-0.4	-0.70	0.15	0.4	1.4	6.78	38.66
74	0.0	0.0	0.2	0.20	-0.4	0.06	0.0	0.31	-0.2	-0.18	0.26	0.1	0.2	4.83	39.38
75	-0.3	-0.3	0.3	0.75	-0.5	-0.85	0.2	1.01	-0.4	-0.91	2.11	0.3	3.1	3.81	40.80
76	-0.4	-0.5	0.0	0.00	-0.6	-0.56	-0.4	0.10	-0.6	-0.64	0.87	0.0	0.8	2.86	41.48
77	0.1	0.1	0.2	0.72	-0.5	0.25	0.2	0.72	0.0	-0.35	0.69	0.2	1.5	4.75	42.54
78	0.1	0.0	0.3	0.79	0.0	-0.44	0.2	0.84	0.0	-0.44	4.05	0.0	0.6	3.10	42.90
79	0.0	0.1	0.2	0.89	0.0	-0.39	0.2	0.89	0.1	-0.46	4.95	0.0	0.8	3.87	43.32
80	0.0	-0.3	0.2	0.26	-0.5	-0.83	0.2	0.36	-0.5	-0.83	1.55	0.1	1.2	2.73	43.90
81	-0.3	-0.3	0.0	0.00	-0.4	-0.50	-0.3	0.04	-0.4	-0.56	1.20	0.0	0.8	1.65	44.22
82	-0.3	-0.4	0.0	0.00	-0.5	-0.49	-0.3	0.13	-0.5	-0.76	0.94	0.1	0.5	1.97	44.64
83	-0.4	-0.5	0.0	0.00	-0.6	-0.55	-0.4	0.29	-0.6	-0.83	0.90	0.1	0.7	1.77	45.08
84	0.1	0.1	0.2	0.45	-0.5	0.03	0.2	0.71	0.1	-0.12	0.60	0.2	1.3	4.65	46.24
85	0.0	-0.3	0.2	0.23	-0.5	-0.87	0.1	0.24	-0.5	-0.91	1.72	0.2	1.2	4.50	46.72
86	-0.3	-0.3	0.0	0.00	-0.4	-0.59	-0.3	0.32	-0.4	-0.63	1.31	0.0	0.1	2.79	47.08
87	0.1	-0.4	0.1	0.34	-0.5	-0.36	0.1	0.45	-0.3	-0.64	1.12	0.3	1.4	4.19	48.08
88	0.0	-0.5	0.2	0.08	-0.6	-0.30	0.2	0.75	-0.3	-0.61	0.43	0.4	6.3	4.75	51.24
89	0.0	-0.1	0.2	0.72	-0.5	0.03	0.1	0.80	-0.1	-0.27	1.03	0.3	0.9	7.94	51.72
90	0.1	-0.4	0.3	0.18	-0.6	-0.34	0.1	0.61	-0.4	-0.73	0.63	0.3	3.4	4.25	54.66

Table 14. SE13-FA-1-A

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
91	0.0	-0.4	0.1	0.35	-0.5	-0.57	-0.1	0.52	-0.4	-0.60	1.51	0.3	0.8	4.70	55.86
92	0.1	-0.4	0.2	0.26	-0.6	-0.28	0.1	0.69	-0.4	-0.59	0.66	0.3	3.8	4.95	58.42
93	-0.1	-0.5	0.0	0.49	-0.6	-0.60	0.0	0.49	-0.5	-0.65	1.80	0.1	0.9	3.99	59.36
94	0.1	-0.4	0.2	0.31	-0.5	0.00	0.0	0.63	-0.4	-0.83	0.43	0.3	2.5	3.87	61.66
95	-0.4	-0.4	0.0	0.00	-0.6	-0.63	-0.3	0.06	-0.5	-0.90	1.12	0.1	1.3	3.60	62.00
96	-0.3	-0.5	0.0	0.00	-0.6	-0.36	-0.4	0.34	-0.6	-0.76	0.57	0.0	0.4	3.56	62.38
97	-0.1	-0.5	0.2	0.24	-0.5	-0.42	0.1	0.48	-0.4	-0.74	0.95	0.3	3.2	4.33	64.10
98	-0.4	-0.3	0.0	0.00	-0.5	-0.63	-0.4	0.01	-0.5	-0.63	1.16	0.0	0.5	4.06	64.80
99	0.1	-0.3	0.2	0.46	-0.4	-0.45	0.1	0.62	-0.4	-0.72	1.44	0.3	2.6	5.64	66.54
100	-0.3	-0.4	0.0	0.00	-0.5	-0.37	-0.3	0.08	-0.4	-0.56	0.72	0.1	1.3	3.56	68.12
101	-0.1	-0.2	0.1	0.21	-0.5	-0.44	0.0	0.52	-0.5	-0.44	1.06	0.2	0.4	3.56	69.46
102	-0.1	-0.2	0.1	0.35	-0.5	-0.20	0.0	0.36	-0.4	-0.49	0.97	0.1	0.3	4.05	70.30
103	0.1	-0.5	0.1	0.36	-0.6	-0.55	0.0	0.39	-0.5	-0.71	1.35	0.2	0.8	3.94	71.10
104	-0.4	-0.2	0.0	0.00	-0.5	-0.28	-0.4	0.04	-0.5	-0.28	0.52	0.0	0.0	3.86	71.44
105	0.0	0.1	0.2	0.57	-0.3	0.08	0.0	0.68	0.0	-0.23	1.05	0.1	1.1	3.93	72.18
106	0.1	-0.2	0.2	0.06	-0.5	-0.53	0.0	0.06	-0.3	-0.61	0.85	0.2	1.1	3.30	73.54

Table 15. SE13-FA-1-B

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	2.5	-2.4	5.0	8.69	-4.7	-11.49	4.7	12.07	-4.6	-11.66	3.81	370.4	424.4	78.2	
1	***0.3***	***0.1***	***0.3***	***0.00***	***-0.2***	***-0.34***	***0.2***	***0.17***	***-0.1***	***-0.65***	***0.79***	***0.0***	***0.4***	***5.40***	***0.70***
2	**0.5**	**0.3**	**0.5**	**-0.01**	**0.0**	**0.00**	**0.5**	**0.52**	**0.1**	**-0.46**	**0.01**	**0.2**	**0.3**	**6.48**	**1.24**
3	**0.6**	**0.1**	**0.8**	**0.21**	**0.0**	**0.00**	**0.7**	**0.53**	**0.1**	**-0.76**	**0.28**	**0.3**	**1.0**	**5.95**	**2.94**
4	0.1	0.2	0.2	-0.03	-0.1	-0.87	0.2	0.33	-0.1	-0.87	2.84	0.0	0.9	6.46	3.28
5	0.1	0.1	0.2	0.18	-0.1	-0.78	0.2	0.53	0.1	-0.83	3.48	0.0	0.8	2.98	3.70
6	0.1	0.0	0.2	0.14	-0.1	-0.51	0.0	0.24	0.0	-0.73	2.17	0.0	0.5	2.48	4.04
7	0.3	0.4	0.4	-0.01	-0.1	0.11	0.1	0.38	0.2	-0.42	0.25	0.1	0.1	3.42	4.36
8	0.4	0.4	0.5	0.44	0.0	0.00	0.5	0.56	0.3	-0.66	0.85	0.1	0.3	4.64	4.94
9	***0.9***	***-0.1***	***1.1***	***1.72***	***-0.9***	***-3.57***	***1.1***	***1.75***	***-0.9***	***-3.57***	***2.61***	***3.2***	***10.1***	***22.40***	***5.84***
10	***0.9***	***0.1***	***2.1***	***5.11***	***-1.3***	***-5.11***	***2.1***	***5.11***	***-1.3***	***-5.47***	***2.95***	***11.0***	***14.2***	***28.26***	***6.26***
11	0.8	0.6	1.3	3.74	0.0	0.00	1.3	3.91	0.2	-1.52	2.78	3.0	-7.4	21.72	6.64
12	0.5	0.0	0.8	0.71	-0.8	-2.59	0.8	0.72	-0.8	-3.32	2.00	1.9	24.8	19.24	7.04
13	*1.1*	*-1.5*	*2.0*	*5.89*	*-2.4*	*-7.59*	*1.7*	*6.17*	*-2.4*	*-7.59*	*3.03*	*18.2*	*18.4*	*36.07*	*7.42*
14	***2.1***	***-0.8***	***3.4***	***8.59***	***-2.8***	***-9.55***	***3.4***	***9.14***	***-2.8***	***-9.55***	***2.90***	***39.9***	***35.2***	***64.67***	***7.82***
15	***2.5***	***-2.4***	***3.5***	***8.33***	***-4.7***	***-11.49***	***3.5***	***8.33***	***-4.6***	***-11.66***	***2.41***	***55.2***	***140.9***	***74.49***	***8.20***
16	**2.5**	**-1.2**	**5.0**	**8.69**	**-3.6**	**-8.35**	**4.7**	**12.07**	**-3.6**	**-8.35**	**1.98**	**63.0**	**-36.8**	**78.23**	**8.70**
17	1.4	-1.3	3.3	5.96	-2.4	-5.98	2.9	7.17	-2.3	-6.05	2.10	26.0	-0.9	52.00	9.10
18	1.0	-0.1	2.5	4.70	-1.0	-4.01	2.3	4.88	-1.0	-4.01	2.52	11.5	6.6	39.94	9.50
19	1.8	0.2	2.8	4.40	-1.2	-4.07	2.7	4.44	-1.0	-4.24	2.15	11.1	27.9	33.78	9.98
20	1.3	0.2	2.8	4.35	-0.6	-3.64	2.3	5.09	-0.6	-3.80	2.34	10.8	-2.7	27.37	10.44
21	1.0	-0.4	1.5	1.74	-1.4	-4.68	1.4	1.76	-1.4	-4.68	2.25	6.4	29.8	28.96	11.12
22	1.8	-0.8	2.3	5.01	-1.9	-5.26	2.1	5.09	-1.7	-5.26	2.41	15.0	10.9	30.16	11.56
23	1.0	-0.3	2.2	4.00	-1.6	-4.21	2.0	4.98	-1.5	-4.65	2.19	12.9	2.9	25.83	12.02
24	0.0	-0.5	0.7	1.98	-1.3	-2.33	0.7	2.12	-1.3	-2.33	2.13	2.5	2.5	17.04	12.36
25	0.6	-0.1	1.4	2.78	-0.9	-2.96	1.3	3.30	-0.9	-3.03	2.48	5.5	1.5	19.38	12.82

Table 15. SE13-FA-1-B

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
26	0.8	-0.4	1.7	3.68	-1.4	-4.76	1.7	3.68	-1.2	-4.91	2.70	9.3	15.0	27.43	13.28
27	0.9	0.1	2.0	3.74	-0.5	-3.00	2.0	3.96	-0.5	-3.22	2.68	7.0	0.7	29.15	13.68
28	1.1	0.3	1.3	1.50	-0.4	-1.88	1.1	1.95	-0.3	-1.90	1.94	2.3	6.9	13.94	14.14
29	1.4	-0.4	2.4	4.47	-1.7	-5.14	2.4	4.47	-1.5	-5.38	2.34	13.4	20.8	27.88	14.56
30	0.9	0.2	1.6	3.54	-0.7	-2.05	1.6	3.54	-0.6	-2.12	2.39	4.5	-5.9	25.08	14.92
31	1.0	-0.4	1.8	3.11	-1.3	-4.17	1.8	3.11	-1.1	-4.25	2.33	7.4	16.6	21.16	15.32
32	0.7	0.6	1.4	1.59	0.0	0.08	1.3	3.36	0.7	-1.04	1.05	2.6	-5.6	22.31	16.06
33	0.8	0.4	0.9	0.48	-0.1	-1.58	0.8	0.69	-0.1	-1.58	2.10	0.7	4.0	7.62	16.44
34	0.7	0.2	0.8	0.20	-0.2	-1.66	0.7	1.62	-0.2	-1.66	1.87	1.4	3.4	8.19	17.00
35	0.2	-0.1	0.9	2.09	-0.6	-1.57	0.9	2.09	-0.6	-1.74	2.46	1.0	0.6	10.96	17.36
36	0.2	0.0	0.4	1.51	-0.4	-1.26	0.3	1.52	-0.2	-1.40	3.53	0.5	0.3	7.01	17.70
37	0.5	0.4	0.6	1.06	0.0	0.00	0.3	1.25	0.4	-0.92	1.72	0.6	0.2	7.68	18.08
38	0.8	0.8	1.0	1.46	0.0	0.00	0.9	1.50	0.5	-1.39	1.52	0.5	1.3	7.05	18.50
39	1.1	0.3	1.4	1.61	-0.4	-2.24	1.3	1.66	-0.3	-2.42	2.08	2.4	7.2	14.54	18.90
40	1.0	0.3	1.2	1.92	0.0	-1.51	1.2	2.17	0.2	-1.73	2.73	2.4	-0.3	10.16	19.28
41	1.0	0.4	1.2	1.58	0.0	-1.55	1.0	1.77	0.1	-1.66	2.52	2.0	2.9	8.74	19.72
42	0.5	0.0	0.5	0.38	-0.1	-0.37	0.5	0.38	0.0	-1.01	1.34	0.3	1.9	2.03	20.06
43	0.0	-0.1	0.1	0.43	-0.2	-0.53	-0.1	0.45	-0.2	-0.65	2.68	0.0	-0.3	3.11	20.46
44	0.4	0.5	0.5	0.65	-0.2	0.08	0.5	0.66	0.3	-0.67	0.78	0.2	0.5	8.83	20.92
45	0.6	0.1	0.7	0.26	-0.1	-0.43	0.6	0.48	0.3	-0.63	0.88	0.3	1.4	5.59	21.54
46	0.5	0.4	0.6	0.81	0.0	0.00	0.4	0.85	0.3	-0.77	1.45	0.3	0.2	4.64	21.92
47	0.7	0.6	0.9	1.15	0.0	0.00	0.8	1.20	0.3	-1.43	1.30	0.5	1.4	7.56	22.32
48	0.9	0.8	1.1	1.33	0.0	0.00	1.1	1.53	0.7	-1.24	1.19	0.3	1.1	7.49	22.76
49	1.0	0.4	1.2	0.85	0.0	0.00	1.2	0.85	0.3	-1.47	0.73	1.0	2.8	5.40	23.18
50	0.9	0.4	1.0	0.39	-0.1	-1.45	0.6	1.14	0.1	-1.52	1.64	0.8	3.7	6.86	23.86
51	0.3	0.2	0.6	1.25	0.0	0.00	0.6	1.25	0.1	-0.78	1.95	0.1	-1.6	4.88	24.20
52	0.3	-0.1	0.3	0.06	-0.3	-1.25	0.2	0.12	-0.2	-1.33	2.49	0.3	3.1	3.30	24.56
53	0.0	-0.1	0.1	0.67	-0.2	-0.62	0.1	0.67	-0.2	-0.62	3.81	0.1	-0.8	3.37	24.86

Table 15. SE13-FA-1-B

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
54	0.5	0.2	0.6	0.72	0.0	0.02	0.6	1.00	0.4	-1.31	1.12	0.3	1.3	5.84	25.64
55	0.7	0.8	0.8	1.02	0.0	0.00	0.8	1.02	0.6	-0.73	1.21	0.4	0.5	7.85	26.12
56	0.9	0.5	1.0	1.01	0.0	0.00	1.0	1.03	0.5	-1.40	0.99	0.6	1.6	3.43	26.58
57	0.7	0.8	0.9	-0.36	0.0	0.00	0.6	1.02	0.7	-0.69	0.42	0.1	0.0	3.81	26.90
58	1.0	0.4	1.0	0.81	0.0	0.00	1.0	0.81	0.7	-1.02	0.77	0.4	1.2	3.86	27.34
59	0.4	0.2	0.5	0.23	-0.1	-1.36	0.5	0.35	0.1	-1.42	2.67	0.2	4.8	6.41	27.76
60	0.2	0.3	0.6	1.59	0.0	0.00	0.6	1.59	0.1	-0.85	2.72	0.0	-2.0	5.33	28.16
61	0.8	0.8	0.8	0.60	-0.1	-1.00	0.1	0.78	0.0	-1.03	1.84	0.3	2.0	3.81	29.26
62	0.8	0.4	1.0	0.27	0.0	0.00	0.9	0.34	0.2	-1.32	0.28	0.3	2.8	5.32	29.62
63	0.3	0.1	0.6	0.86	0.0	0.00	0.6	0.86	0.1	-0.70	1.40	0.1	-0.6	5.45	29.98
64	0.8	0.5	0.8	0.22	0.0	0.00	0.7	0.63	0.3	-0.82	0.27	0.4	2.3	7.22	31.52
65	0.7	0.4	0.8	0.43	0.0	0.00	0.6	0.86	0.6	-0.75	0.55	0.4	0.3	3.94	31.94
66	0.7	0.4	0.8	0.21	0.0	0.00	0.5	0.27	0.4	-0.67	0.27	0.2	0.7	7.47	32.50
67	0.7	0.8	0.8	0.31	0.0	0.00	0.7	0.40	0.6	-0.28	0.39	0.1	0.1	5.76	33.36
68	0.8	0.7	0.9	0.77	0.0	0.00	0.9	0.77	0.7	-0.86	0.86	0.0	0.5	3.93	33.76
69	0.8	0.8	1.0	0.57	0.0	0.00	0.9	0.57	0.7	-0.59	0.57	0.1	0.3	4.76	34.08
70	0.8	0.5	0.9	0.55	0.0	0.00	0.9	0.56	0.6	-0.83	0.58	0.3	0.9	2.35	34.58
71	0.5	0.4	0.5	0.07	0.0	0.00	0.5	0.07	0.2	-1.25	0.13	0.1	2.8	3.55	34.92
72	0.0	0.0	0.4	0.19	-0.2	-0.57	0.3	0.51	-0.2	-0.57	1.25	0.0	-0.4	3.94	35.26
73	1.0	0.4	1.0	0.26	0.0	0.00	0.5	0.61	0.4	-0.81	0.25	0.6	3.3	7.67	36.68
74	0.4	0.3	0.5	0.14	0.0	0.00	0.3	0.27	0.2	-0.67	0.31	0.0	0.3	2.98	37.00
75	0.4	0.3	0.5	0.21	0.0	0.00	0.5	0.21	0.3	-0.80	0.45	0.0	1.3	3.17	37.56
76	0.0	0.8	0.8	-0.08	0.0	0.00	0.3	0.51	0.7	-0.13	0.10	0.1	0.4	4.75	38.26
77	0.8	0.4	0.9	0.04	0.0	0.00	0.8	0.05	0.4	-0.70	0.05	0.1	0.5	4.15	38.64
78	0.8	0.7	0.9	0.19	0.0	0.00	0.5	0.35	0.6	-0.23	0.21	0.1	0.1	3.62	39.38
79	0.9	0.5	1.1	0.81	0.0	0.00	1.0	0.88	0.7	-0.94	0.72	0.3	0.9	5.02	39.88
80	0.4	0.4	0.6	0.05	0.0	0.00	0.5	0.11	0.2	-0.89	0.09	0.0	1.7	4.94	40.80
81	0.0	0.2	0.5	0.14	0.0	0.00	0.3	0.18	0.2	-0.58	0.29	0.1	0.7	1.97	41.50

Table 15. SE13-FA-1-B

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
82	0.7	0.9	0.9	0.77	0.0	0.00	0.9	0.77	0.7	-0.61	0.87	0.1	0.8	7.05	42.56
83	0.9	0.9	1.0	0.69	0.0	0.00	0.9	0.71	0.8	-0.51	0.72	0.0	0.4	2.09	42.92
84	1.0	1.0	1.2	0.66	0.0	0.00	1.1	0.73	0.9	-0.50	0.57	0.1	0.6	3.93	43.32
85	1.0	0.4	1.1	0.29	0.0	0.00	1.0	0.31	0.5	-0.77	0.26	0.3	1.9	2.35	44.24
86	0.4	0.3	0.4	0.03	0.0	0.00	0.4	0.04	0.3	-0.64	0.09	0.0	0.5	1.52	44.62
87	0.4	0.3	0.4	0.20	0.0	0.00	0.4	0.22	0.3	-0.78	0.45	0.0	0.7	3.10	45.08
88	0.7	0.7	0.9	0.34	0.0	0.00	0.4	0.46	0.7	-0.18	0.39	0.1	0.2	4.25	45.80
89	0.8	0.9	1.0	0.53	0.0	0.00	0.9	0.58	0.8	-0.21	0.55	0.0	0.6	5.07	46.28
90	0.8	0.3	1.0	0.22	0.0	0.00	0.9	0.22	0.3	-0.83	0.21	0.2	1.0	3.37	46.70
91	0.4	0.4	0.5	0.28	0.0	0.00	0.5	0.28	0.3	-0.59	0.54	0.0	0.1	2.79	47.06
92	0.8	0.3	0.8	0.31	0.0	0.00	0.8	0.37	0.4	-0.64	0.36	0.3	1.2	5.38	48.08
93	0.0	0.8	1.0	-0.15	0.0	0.00	0.9	0.60	0.9	-0.16	0.16	0.1	1.1	5.32	49.10
94	1.0	-0.1	1.1	0.24	-0.1	-0.10	1.0	0.28	0.2	-0.56	0.28	0.4	4.3	4.45	51.20
95	0.6	0.6	0.7	-0.17	-0.1	0.18	0.6	0.49	0.6	-0.19	0.48	0.2	0.5	5.33	51.74
96	1.0	0.3	1.0	0.25	0.0	0.00	0.9	0.40	0.4	-0.63	0.25	0.3	2.0	4.44	54.00
97	0.4	0.2	0.4	0.07	0.0	0.00	0.4	0.07	0.3	-0.57	0.16	0.0	0.6	2.98	54.68
98	0.7	0.7	0.8	-0.07	0.0	0.00	0.7	0.36	0.7	-0.15	0.09	0.1	0.2	6.33	55.12
99	0.7	0.4	0.8	0.36	0.0	0.00	0.7	0.37	0.4	-0.61	0.44	0.2	0.5	4.19	55.84
100	0.7	0.8	0.9	0.22	0.0	0.00	0.8	0.59	0.7	-0.19	0.25	0.2	0.4	6.40	56.34
101	0.9	0.3	1.0	0.29	0.0	0.00	0.9	0.38	0.4	-0.51	0.29	0.3	2.7	4.89	58.40
102	0.7	0.4	0.8	-0.08	0.0	0.00	0.6	0.36	0.3	-0.59	0.11	0.2	0.7	5.02	59.58
103	0.7	0.7	0.8	-0.11	0.0	0.00	0.7	0.55	0.7	-0.17	0.15	0.1	0.4	5.14	59.96
104	0.8	0.4	1.0	0.20	0.0	0.00	0.9	0.42	0.3	-0.77	0.20	0.2	1.4	5.57	61.66
105	0.4	0.4	0.5	0.05	0.0	0.00	0.5	0.05	0.2	-0.76	0.11	0.1	1.2	1.46	62.02
106	0.2	0.1	0.4	0.31	0.0	0.00	0.4	0.31	0.0	-0.76	0.87	0.1	0.4	2.59	62.38
107	0.7	0.9	0.9	-0.03	0.0	0.00	0.2	0.43	0.7	-0.09	0.04	0.2	0.9	3.99	63.24
108	0.0	0.5	0.9	0.04	0.0	0.00	0.8	0.05	0.3	-0.66	0.04	0.2	1.5	3.87	64.08
109	0.0	0.3	0.4	0.00	0.0	0.00	0.3	0.04	0.1	-0.61	0.00	0.0	0.5	4.69	64.82

Table 15. SE13-FA-1-B

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
110	0.9	0.4	1.0	0.31	0.0	0.00	0.9	0.45	0.4	-0.66	0.30	0.3	1.7	6.90	66.54
111	0.7	0.7	0.8	0.18	0.0	0.00	0.6	0.40	0.3	-0.51	0.22	0.1	1.3	3.81	68.60
112	0.6	0.5	0.8	0.10	0.0	0.00	0.8	0.14	0.4	-0.49	0.12	0.0	0.1	4.37	69.42
113	0.6	0.4	0.9	0.12	0.0	0.00	0.8	0.29	0.4	-0.55	0.14	0.2	0.3	5.76	70.26
114	0.8	0.4	0.8	0.17	0.0	0.00	0.7	0.28	0.3	-0.63	0.21	0.2	0.7	3.61	71.10
115	0.4	0.5	0.5	-0.04	0.0	0.00	0.4	0.01	0.3	-0.31	0.10	0.0	0.0	2.91	71.44
116	0.7	0.6	0.9	0.58	0.0	0.00	0.9	0.58	0.7	-0.24	0.67	0.1	0.4	4.31	71.82
117	0.8	0.6	0.9	0.64	0.0	0.00	0.9	0.64	0.4	-0.57	0.69	0.2	1.3	4.79	73.50
118	0.8	0.8	0.8	-0.06	0.0	0.00	0.7	0.28	0.8	-0.07	0.07	0.0	0.1	3.81	73.94

Table 16. SE13-FA-2-A

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	25.9	-17.4	36.3	18.92	-29.9	-20.00	32.9	21.26	-28.8	-20.83	2.93	3709.0	4193.3	271.4	
1	***0.0***	***-0.4***	***0.2***	***0.69***	***-0.6***	***-1.34***	***0.1***	***1.08***	***-0.6***	***-1.48***	***2.37***	***1.2***	***2.4***	***6.33***	***0.56***
2	**0.2**	**0.0**	**0.4**	**1.61**	**-0.4**	**-0.06**	**0.4**	**1.61**	**-0.3**	**-1.78**	**1.97**	**0.8**	**2.1**	**12.03**	**1.06**
3	**0.2**	**-0.1**	**0.5**	**1.47**	**-0.3**	**-0.37**	**0.5**	**1.47**	**-0.2**	**-1.63**	**2.30**	**0.5**	**2.0**	**9.21**	**1.56**
4	0.3	0.2	0.5	1.47	0.0	0.00	0.5	1.47	0.1	-0.83	2.93	0.4	1.3	7.68	1.88
5	0.3	-0.1	0.7	1.57	-0.2	-1.02	0.7	1.57	0.0	-1.04	2.65	0.6	3.8	7.33	2.40
6	0.0	0.1	0.3	0.86	-0.2	-0.61	0.2	1.06	-0.1	-0.72	2.89	0.2	0.2	8.06	2.70
7	0.2	-0.2	0.2	0.05	-0.6	-2.03	0.2	0.05	-0.6	-2.03	2.44	0.5	3.9	9.56	2.94
8	0.1	-0.6	0.7	1.82	-1.4	-2.40	0.4	1.85	-1.4	-2.54	2.01	2.4	9.5	13.43	3.30
9	***0.3***	***-1.1***	***0.8***	***2.70***	***-1.9***	***-2.95***	***0.8***	***2.70***	***-1.8***	***-3.09***	***2.07***	***4.9***	***10.3***	***19.11***	***3.72***
10	***-0.5***	***-0.8***	***0.2***	***1.93***	***-1.1***	***-1.60***	***0.1***	***1.93***	***-1.1***	***-1.60***	***2.75***	***1.0***	***-4.5***	***18.43***	***4.10***
11	0.2	-0.2	0.6	1.85	-0.6	0.73	0.3	2.09	-0.4	-1.45	0.95	2.3	0.4	12.51	4.42
12	0.2	-0.2	0.7	1.65	-0.8	-2.15	0.7	1.65	-0.7	-2.32	2.57	1.5	3.4	8.38	4.94
13	*2.1*	-2.3	*3.6*	*6.34*	*-6.5*	*-12.06*	*3.5*	*6.37*	*-6.1*	*-12.38*	*1.82*	*58.0*	*140.4*	*118.62*	*5.88*
14	***6.9***	***-3.3***	***11.9***	***14.78***	***-9.8***	***-15.28***	***11.3***	***15.06***	***-9.3***	***-15.35***	***1.39***	***219.7***	***271.1***	***139.76***	***6.36***
15	***5.8***	***-3.2***	***12.0***	***14.16***	***-9.1***	***-13.15***	***12.0***	***14.16***	***-8.9***	***-13.20***	***1.29***	***154.0***	***229.6***	***140.78***	***7.00***
16	**8.2**	**-5.9**	**13.9**	**15.28**	**-11.1**	**-14.53**	**12.9**	**15.61**	**-11.0**	**-15.52**	**1.19**	**209.5**	**51.3**	**177.61**	**7.50**
17	7.5	-8.1	13.6	13.84	-14.8	-16.05	13.6	13.84	-14.7	-16.88	1.05	240.3	918.7	224.36	8.24
18	25.9	-17.4	36.3	18.92	-29.9	-20.00	32.9	21.26	-28.8	-20.83	0.59	1050.2	481.4	262.74	8.88
19	17.8	2.6	29.3	11.07	-11.5	0.74	29.1	11.14	-4.7	-3.83	0.25	234.6	107.7	271.40	9.62
20	5.3	-5.5	5.4	0.27	-16.1	-8.01	5.2	0.36	-16.1	-8.01	0.39	80.2	141.0	199.45	10.12
21	19.5	-4.1	29.9	10.07	-12.8	-6.52	29.8	10.59	-12.8	-6.52	0.39	217.0	169.1	242.54	10.80
22	6.2	-5.5	8.5	1.96	-15.1	-7.18	8.4	2.11	-14.9	-7.47	0.39	63.9	168.4	163.29	11.28
23	7.6	-6.3	14.8	3.72	-14.4	-5.66	14.7	3.80	-14.4	-5.66	0.32	82.2	95.6	176.47	12.38
24	17.2	1.1	28.5	10.98	-6.5	-3.78	28.4	11.16	-6.5	-3.78	0.42	174.9	89.5	176.60	13.08
25	2.3	0.6	2.4	-0.13	-3.6	-2.64	2.3	0.04	-3.6	-2.64	0.42	6.0	-0.5	65.91	13.44
26	8.5	-2.6	12.9	2.21	-8.4	-4.54	12.6	2.22	-8.4	-4.54	0.32	39.3	69.2	160.19	14.22
27	12.1	-1.5	19.7	4.58	-7.3	-3.95	19.4	4.62	-7.3	-3.95	0.32	71.2	88.6	194.75	14.90

Table 16. SE13-FA-2-A

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
28	16.0	-4.3	24.8	6.80	-11.3	-5.29	24.6	6.94	-11.2	-5.44	0.34	124.0	115.5	178.75	15.56
29	16.5	0.8	23.1	5.96	-5.8	-3.58	22.6	5.98	-5.8	-3.58	0.33	91.6	91.7	191.17	16.50
30	11.5	0.2	16.8	3.51	-6.4	-3.40	16.8	3.51	-5.9	-3.59	0.30	47.6	59.2	76.71	17.32
31	8.3	-1.4	13.6	2.48	-8.8	-4.58	13.5	2.53	-8.7	-4.67	0.32	46.3	79.0	94.68	19.04
32	8.3	-1.8	13.6	2.59	-8.0	-3.51	13.3	2.68	-7.9	-4.02	0.28	38.0	70.5	94.42	20.00
33	6.5	2.6	11.2	2.51	-0.6	0.02	11.1	2.55	0.6	-1.22	0.21	15.3	-10.7	64.77	21.58
34	7.0	3.8	11.9	2.30	0.0	0.00	11.6	2.42	1.0	-1.30	0.19	11.9	9.9	52.51	22.44
35	7.1	1.7	12.8	2.41	-1.9	-2.01	12.6	2.44	-1.8	-2.08	0.30	15.4	38.2	60.68	23.32
36	7.7	-1.6	14.0	2.79	-8.5	-4.23	13.7	2.84	-8.1	-4.29	0.31	38.5	74.1	83.99	24.08
37	10.0	-0.6	15.0	3.49	-6.2	-3.11	15.0	3.49	-6.2	-3.11	0.31	40.4	31.6	98.36	24.84
38	8.7	2.0	14.8	3.28	-2.6	-2.37	14.7	3.50	-2.6	-2.37	0.32	30.6	14.3	93.03	25.80
39	8.5	4.6	12.2	2.11	0.0	0.00	12.2	2.11	3.2	-0.93	0.17	10.8	14.2	73.15	26.76
40	7.8	1.7	9.8	1.27	-2.1	-2.10	9.8	1.32	-2.0	-2.10	0.28	10.7	50.3	56.58	27.88
41	7.9	1.1	14.5	2.87	-3.5	-2.39	14.3	3.21	-3.4	-2.46	0.29	26.5	9.0	74.55	28.66
42	9.2	0.9	14.1	2.83	-5.6	-3.29	14.0	2.88	-5.6	-3.29	0.31	30.7	67.6	70.00	29.70
43	7.7	3.2	12.4	2.15	0.0	0.00	12.0	2.47	0.7	-1.51	0.17	15.2	-0.8	59.98	30.96
44	4.5	2.7	4.7	0.25	0.0	0.00	4.7	0.26	0.1	-1.54	0.05	2.8	8.0	43.62	31.64
45	5.9	3.2	7.7	1.07	0.0	0.00	7.7	1.07	1.6	-1.07	0.14	4.3	5.3	43.88	32.66
46	6.1	4.8	7.5	0.89	0.0	0.00	7.3	0.90	4.3	-0.51	0.12	2.2	1.8	28.78	33.38
47	6.8	5.2	8.5	1.11	0.0	0.00	8.5	1.13	4.6	-0.46	0.13	2.1	4.4	26.67	34.12
48	6.6	1.9	8.6	1.08	-1.0	-1.61	8.6	1.14	-0.9	-1.85	0.28	7.1	37.1	39.59	35.06
49	7.8	3.9	12.9	2.62	0.0	0.00	12.1	2.65	1.2	-1.45	0.20	14.3	2.2	46.23	36.02
50	7.9	1.4	10.9	1.65	-3.6	-2.49	10.8	1.67	-3.4	-2.65	0.29	15.6	43.6	49.59	36.86
51	8.8	2.2	14.1	2.85	-2.8	-2.29	13.8	2.93	-2.6	-2.45	0.30	38.8	41.6	61.88	38.64
52	6.9	3.9	9.9	1.39	0.0	0.00	9.4	1.57	2.5	-0.93	0.14	6.9	3.7	40.73	39.44
53	7.5	3.6	10.0	1.50	0.0	0.00	9.9	1.52	1.0	-1.39	0.15	7.0	11.9	39.69	40.22
54	4.7	1.9	5.0	0.25	-1.9	-1.99	5.0	0.30	-1.8	-2.07	0.32	5.3	24.9	49.28	40.96
55	7.1	2.4	10.6	2.05	-0.2	-1.46	10.6	2.05	-0.2	-1.55	0.32	11.1	2.2	55.56	41.68
56	6.4	5.3	8.1	1.14	0.0	0.00	8.1	1.14	5.0	-0.39	0.14	3.4	9.3	33.40	42.92
57	7.3	2.9	9.7	1.39	0.0	0.00	9.7	1.40	1.2	-1.30	0.14	5.8	25.0	25.40	44.12

Table 16. SE13-FA-2-A

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
58	5.9	2.9	7.4	1.00	0.0	0.00	7.4	1.01	1.6	-0.96	0.13	3.3	1.8	25.97	45.18
59	6.1	5.7	7.4	0.74	0.0	0.00	7.0	0.87	5.7	-0.13	0.10	1.8	1.9	28.58	45.84
60	7.2	2.7	9.1	1.27	-0.8	-1.85	9.1	1.31	-0.8	-1.89	0.31	7.1	23.0	29.39	46.82
61	6.2	3.3	8.1	0.88	0.0	0.00	7.4	1.09	2.1	-0.88	0.11	4.1	6.9	29.83	48.04
62	6.1	5.0	7.5	0.85	0.0	0.00	7.3	0.90	4.7	-0.35	0.11	2.0	1.5	20.83	48.74
63	6.9	3.1	11.3	1.86	0.0	0.00	11.3	1.92	0.7	-1.67	0.16	9.2	30.1	29.91	50.18
64	4.0	2.3	4.2	0.22	0.0	0.00	4.2	0.23	0.2	-1.39	0.05	2.1	16.8	18.16	51.06
65	6.3	3.9	9.4	1.56	0.0	0.00	9.3	1.57	2.5	-1.05	0.17	6.2	4.4	22.55	52.06
66	6.2	5.7	6.9	0.49	0.0	0.00	6.8	0.63	5.7	-0.15	0.07	0.9	2.8	21.02	52.86
67	6.1	3.8	6.8	0.55	0.0	0.00	6.7	0.57	3.1	-0.71	0.08	1.4	8.0	10.51	54.12
68	4.8	3.6	5.1	0.34	0.0	0.00	5.1	0.39	2.4	-0.77	0.07	1.0	1.4	15.84	54.78
69	5.8	5.5	6.7	0.61	0.0	0.00	6.6	0.62	5.4	-0.13	0.09	1.0	1.4	19.88	55.30
70	5.6	3.7	5.9	0.22	0.0	0.00	5.8	0.24	2.9	-0.72	0.04	1.0	2.0	17.61	55.96
71	6.8	4.8	9.0	1.30	0.0	0.00	9.0	1.30	4.3	-0.57	0.14	3.2	7.7	24.64	56.76
72	0.0	3.4	5.9	0.24	0.0	0.00	5.8	0.24	2.5	-0.87	0.04	1.6	12.6	13.59	57.96
73	5.7	3.5	6.0	0.46	0.0	0.00	5.2	0.52	2.7	-0.79	0.08	1.8	4.0	13.37	59.44
74	6.4	5.0	7.5	0.85	0.0	0.00	7.4	0.94	4.5	-0.43	0.11	2.1	4.7	16.95	60.36
75	6.0	3.1	7.3	0.72	0.0	0.00	7.3	0.72	1.2	-1.28	0.10	3.1	14.4	12.83	62.00
76	4.2	3.6	4.3	0.29	0.0	0.00	4.3	0.30	3.4	-0.27	0.07	0.2	-0.6	10.83	62.46
77	6.2	3.3	7.2	0.85	0.0	0.00	7.2	0.90	2.0	-1.02	0.12	3.6	17.5	20.45	64.00
78	4.7	3.0	5.0	0.40	0.0	0.00	4.9	0.44	1.8	-0.84	0.08	1.2	1.4	18.99	64.72
79	6.1	3.5	6.8	0.61	0.0	0.00	6.8	0.61	1.7	-1.12	0.09	3.3	14.2	19.00	66.70
80	5.0	3.5	5.6	0.43	0.0	0.00	5.5	0.46	2.5	-0.77	0.08	1.2	1.8	17.14	67.44
81	4.1	3.2	4.1	0.12	0.0	0.00	4.1	0.14	2.1	-0.85	0.03	0.8	2.8	16.41	68.08
82	5.7	3.9	6.7	0.67	0.0	0.00	6.7	0.67	3.5	-0.57	0.10	2.8	4.8	17.04	70.22
83	5.7	3.5	6.2	0.39	0.0	0.00	6.2	0.47	2.1	-0.94	0.06	2.1	5.7	16.22	71.24
84	6.1	3.9	7.2	0.81	0.0	0.00	7.2	0.83	2.8	-0.79	0.11	2.6	9.2	16.34	72.92
85	4.4	4.1	4.5	0.15	0.0	0.00	4.4	0.17	3.6	-0.39	0.03	0.1	-0.1	8.32	73.56

Table 17. SE13-FA-2-B

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	24.1	-22.8	31.2	21.36	-33.0	-19.74	29.7	22.74	-31.0	-21.93	3.94	3949.9	4313.5	294.0	
1	***0.0***	***-0.3***	***0.3***	***1.21***	***-0.8***	***-1.48***	***0.2***	***1.31***	***-0.5***	***-1.63***	***2.57***	***1.2***	***3.1***	***10.41***	***0.56***
2	**0.1**	**-0.1**	**0.3**	**1.52**	**-0.6**	**-1.56**	**0.3**	**1.52**	**-0.4**	**-1.62**	**3.65**	**0.6**	**1.0**	**10.16**	**1.06**
3	**0.3**	**0.2**	**0.4**	**1.33**	**-0.4**	**-1.55**	**0.4**	**1.50**	**-0.2**	**-1.69**	**3.38**	**0.5**	**1.6**	**10.51**	**1.58**
4	**0.3**	**0.1**	**0.6**	**1.55**	**0.0**	**-1.07**	**0.6**	**1.55**	**0.1**	**-1.10**	**3.94**	**0.4**	**1.0**	**5.50**	**1.90**
5	0.2	-0.2	0.6	1.59	-0.3	-0.69	0.6	1.59	0.0	-1.38	2.46	0.6	3.1	5.21	2.36
6	0.2	0.0	0.2	0.60	-0.2	-1.06	0.1	1.28	-0.2	-1.33	3.34	0.7	0.4	6.08	2.70
7	-0.1	-0.3	0.1	0.50	-0.8	-1.52	0.1	0.50	-0.6	-1.67	2.27	0.3	2.8	8.13	2.94
8	*-0.1*	*-0.6*	*0.2*	*1.77*	*-1.4*	*-2.38*	*0.2*	*1.77*	*-1.3*	*-2.59*	*2.62*	*1.4*	*9.0*	*15.68*	*3.30*
9	*0.0*	*-1.3*	*0.6*	*2.76*	*-1.9*	*-3.50*	*0.6*	*2.76*	*-1.9*	*-3.50*	*2.47*	*4.6*	*11.0*	*18.62*	*3.70*
10	-0.7	-1.1	0.0	2.22	-1.5	-1.45	-0.1	2.44	-1.5	-1.46	2.39	1.4	-5.1	19.94	4.10
11	-0.3	-0.5	0.2	2.06	-1.1	-1.46	-0.1	2.41	-0.8	-1.61	2.72	2.3	0.2	14.38	4.44
12	-0.1	-0.6	0.1	1.67	-1.2	-2.24	0.1	1.67	-1.2	-2.31	2.96	1.1	2.9	8.95	4.94
13	**0.2**	**-0.1**	**0.9**	**2.02**	**-0.8**	**-2.17**	**0.9**	**2.88**	**-0.7**	**-2.25**	**2.46**	**3.1**	**3.6**	**19.00**	**5.40**
14	***2.3***	***-3.6***	***3.0***	***6.84***	***-6.2***	***-12.93***	***3.0***	***6.84***	***-6.2***	***-12.93***	***2.15***	***55.7***	***142.5***	***91.19***	***5.86***
15	***7.5***	***-4.5***	***11.1***	***15.24***	***-9.9***	***-16.14***	***11.0***	***16.09***	***-9.9***	***-16.14***	***1.49***	***237.6***	***272.3***	***127.51***	***6.34***
16	5.1	-3.4	10.3	13.66	-8.0	-11.98	10.2	13.83	-7.8	-12.01	1.40	136.1	168.6	135.13	7.02
17	***6.3***	***-5.1***	***11.3***	***14.45***	***-11.5***	***-15.93***	***11.1***	***15.69***	***-11.5***	***-15.93***	***1.33***	***200.2***	***86.5***	***199.97***	***7.50***
18	**7.7**	**-1.6**	**12.2**	**15.72**	**-7.1**	**-9.07**	**12.2**	**15.72**	**-7.1**	**-9.07**	**1.28**	**156.5**	**108.7**	**217.49**	**7.94**
19	*-1.5*	*-9.7*	*0.0*	*0.00*	*-15.6*	*-16.83*	*-1.5*	*0.35*	*-15.3*	*-17.69*	*1.08*	*136.3*	*853.9*	*197.42*	*8.24*
20	***24.1***	***-22.8***	***31.2***	***21.36***	***-33.0***	***-19.74***	***29.7***	***22.74***	***-31.0***	***-21.93***	***0.64***	***1080.9***	***508.5***	***261.28***	***8.86***
21	14.3	-3.0	24.2	11.59	-16.9	0.75	24.0	12.04	-11.2	-5.02	0.26	261.1	86.6	294.00	9.60
22	2.4	-14.0	3.5	1.34	-21.1	-9.48	2.7	1.48	-21.1	-9.48	0.44	101.8	184.8	170.73	10.10
23	16.9	-9.6	25.4	11.44	-16.7	-7.28	25.4	11.44	-16.7	-7.28	0.44	242.0	186.1	250.33	10.78
24	1.7	-8.9	6.7	2.83	-17.6	-6.91	6.7	2.83	-17.2	-7.19	0.40	74.5	166.0	157.54	11.28
25	2.7	-11.0	9.5	3.67	-17.1	-5.09	9.1	3.74	-16.8	-5.72	0.33	83.9	112.1	165.99	12.36
26	13.2	-5.4	23.4	11.53	-12.3	-4.67	23.4	11.53	-12.2	-4.85	0.45	186.7	90.1	171.02	13.04
27	-0.6	-3.1	0.0	0.00	-6.9	-2.31	-0.6	0.83	-6.9	-2.33	0.34	8.2	4.9	80.52	13.46
28	1.9	-4.5	5.2	1.90	-12.0	-4.77	5.2	1.90	-12.0	-4.77	0.39	32.8	71.3	180.78	14.22

Table 17. SE13-FA-2-B

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
29	9.6	-4.4	17.5	5.48	-11.7	-4.58	17.3	5.84	-11.6	-4.63	0.34	101.1	117.9	198.82	14.90
30	13.4	-4.7	21.2	8.16	-16.7	-6.59	21.2	8.16	-16.6	-6.74	0.39	290.3	262.9	204.28	16.44
31	4.9	-4.7	8.1	2.45	-11.4	-4.27	8.0	2.73	-11.4	-4.27	0.35	42.5	55.8	60.77	17.26
32	1.7	-0.4	3.9	1.89	-4.1	0.16	3.8	1.94	-0.9	-0.57	0.22	8.2	-4.7	52.13	17.80
33	3.7	-5.2	6.9	2.38	-11.1	-4.27	6.7	2.38	-11.1	-4.50	0.37	33.0	77.0	83.31	19.02
34	4.1	-4.3	7.8	2.37	-9.7	-3.49	7.0	2.63	-9.6	-3.62	0.34	32.9	57.2	94.76	19.98
35	1.8	-2.6	4.3	2.05	-4.7	-1.69	4.2	2.09	-4.5	-1.80	0.42	14.2	-9.5	55.75	21.56
36	1.6	-0.4	5.0	2.02	-2.1	0.09	5.0	2.02	-1.7	-1.14	0.27	8.8	7.7	41.60	22.40
37	4.2	-1.9	7.4	2.40	-4.5	-2.03	7.4	2.45	-4.5	-2.03	0.37	15.1	37.0	46.59	23.28
38	4.5	-5.7	8.7	2.76	-12.3	-4.85	8.6	2.84	-12.0	-4.87	0.36	43.7	83.0	73.41	24.04
39	6.6	-5.2	10.6	3.76	-10.3	-3.62	10.4	3.77	-10.2	-3.64	0.35	51.3	43.2	92.35	24.80
40	5.4	0.0	10.8	3.71	-3.7	0.13	10.7	3.89	-2.2	-1.74	0.25	31.9	6.4	94.04	25.76
41	5.1	1.2	8.0	2.31	-1.0	-1.57	8.0	2.31	-0.9	-1.58	0.43	11.9	14.2	55.23	26.36
42	2.2	1.3	2.3	0.28	0.0	0.00	2.3	0.34	1.1	-0.65	0.12	0.7	1.1	21.46	26.72
43	4.3	-0.8	5.7	1.38	-3.9	-2.02	5.7	1.38	-3.7	-2.03	0.35	11.1	48.4	53.72	27.88
44	4.8	-2.5	9.3	2.26	-6.4	-2.64	9.2	3.24	-6.3	-2.68	0.31	27.4	12.1	63.94	28.62
45	4.7	-2.3	8.6	2.66	-5.9	-2.43	8.4	2.79	-5.4	-2.66	0.35	24.9	49.2	63.88	29.68
46	3.6	-0.4	5.8	1.55	-3.2	-1.79	5.5	1.95	-2.9	-1.89	0.37	12.7	2.8	48.46	30.92
47	1.3	-0.6	1.7	0.55	-2.7	-1.65	1.7	0.55	-2.7	-1.65	0.50	3.6	8.5	41.40	31.62
48	3.1	1.5	4.1	1.40	0.0	0.00	4.1	1.40	0.9	-0.63	0.34	3.8	1.1	43.69	32.14
49	1.5	-0.3	1.6	0.12	-1.4	-0.99	1.6	0.12	-1.3	-1.16	0.37	1.9	6.0	20.71	32.60
50	2.6	0.5	3.6	1.14	-0.3	-0.91	3.4	1.16	-0.3	-0.91	0.52	3.4	2.3	24.07	33.34
51	2.9	1.5	4.0	1.12	0.0	0.00	4.0	1.22	1.2	-0.58	0.28	2.6	4.3	23.56	34.10
52	2.8	-1.2	4.4	1.21	-2.5	-1.32	4.4	1.21	-2.4	-1.61	0.37	5.8	30.6	16.95	35.02
53	3.3	0.9	6.0	1.99	-0.8	0.01	5.6	2.00	-0.4	-1.14	0.29	7.7	-0.1	29.65	35.96
54	3.6	-1.4	5.2	1.44	-5.3	-2.25	5.2	1.44	-5.2	-2.57	0.35	12.0	38.9	42.04	36.80
55	3.6	-1.1	5.8	1.92	-3.4	-1.78	5.8	2.00	-3.0	-1.82	0.41	11.7	9.1	45.66	37.66
56	4.5	-0.4	8.7	2.88	-4.3	-2.15	8.7	2.88	-4.1	-2.23	0.39	20.4	21.4	52.32	38.58
57	2.9	0.8	3.6	1.00	-0.2	0.10	3.3	1.09	0.5	-0.69	0.24	3.3	1.7	22.60	39.38
58	3.9	-0.5	5.6	1.62	-3.3	-1.80	5.6	1.62	-2.9	-1.92	0.38	9.1	15.6	32.89	40.08
59	3.8	-1.4	6.3	2.10	-3.8	-1.96	6.1	2.20	-3.6	-1.99	0.40	19.7	30.6	50.42	41.62

Table 17. SE13-FA-2-B

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
60	2.9	1.2	4.7	1.39	-0.6	0.10	4.1	1.58	0.8	-0.70	0.24	5.0	3.1	45.40	42.26
61	3.3	1.6	4.6	1.26	0.0	0.00	4.4	1.27	0.9	-0.78	0.27	3.0	6.3	24.51	42.92
62	3.7	0.4	5.1	1.39	-0.4	-1.02	5.0	1.41	-0.3	-1.05	0.44	4.2	19.8	19.45	44.08
63	1.7	0.1	2.4	0.73	-0.4	-0.86	2.4	0.73	-0.4	-0.92	0.57	1.6	-0.6	13.68	44.74
64	0.8	-0.2	1.0	0.26	-1.4	-1.15	1.0	0.26	-1.4	-1.15	0.59	1.3	4.0	25.00	45.18
65	2.6	1.7	3.5	0.91	0.0	0.00	3.0	1.05	1.6	-0.37	0.26	2.2	1.5	24.77	45.76
66	3.5	-0.3	4.4	1.23	-2.2	-1.47	4.3	1.23	-2.0	-1.64	0.41	5.6	17.5	22.04	46.74
67	2.2	-0.1	2.8	0.73	-0.3	-0.44	2.2	0.77	-0.2	-0.91	0.37	2.6	5.1	20.45	48.02
68	2.0	1.4	2.7	0.80	0.0	0.00	2.4	0.85	1.1	-0.42	0.29	1.4	0.6	14.99	48.70
69	3.8	-0.1	6.3	1.73	-1.4	-1.58	6.1	1.83	-1.4	-1.58	0.43	8.1	25.4	26.67	50.06
70	1.3	-0.3	1.7	0.55	-1.2	-0.84	1.6	0.57	-0.9	-0.99	0.49	1.7	12.0	15.43	51.02
71	2.7	1.0	4.0	1.33	-0.3	0.05	4.0	1.33	-0.1	-0.98	0.30	4.1	3.6	21.22	52.00
72	2.4	2.1	2.9	0.46	0.0	0.00	2.9	0.70	1.9	-0.28	0.16	0.8	2.1	15.68	52.46
73	2.5	0.2	2.9	0.63	-0.5	-0.96	2.9	0.63	-0.4	-1.00	0.47	1.7	9.6	9.12	54.10
74	1.3	0.1	1.6	0.57	-0.7	-0.79	1.6	0.59	-0.6	-0.92	0.57	1.1	1.6	13.56	54.72
75	2.2	1.3	2.9	0.88	0.0	0.00	2.8	0.89	0.9	-0.55	0.30	1.8	1.5	19.11	55.30
76	1.8	0.6	1.9	0.30	-0.1	-0.78	1.9	0.35	-0.1	-0.78	0.54	0.8	2.5	10.89	55.92
77	3.1	1.5	4.0	1.16	0.0	0.00	3.9	1.26	1.0	-0.73	0.29	3.0	5.4	20.00	56.64
78	2.5	0.2	2.8	0.56	-0.4	-0.60	2.7	0.57	-0.2	-0.89	0.36	1.9	13.8	12.10	57.92
79	1.2	1.0	1.6	0.57	0.0	0.00	1.5	0.60	0.8	-0.19	0.37	0.4	-2.0	12.58	58.38
80	1.8	0.4	2.2	0.62	-0.2	-0.78	2.2	0.63	-0.1	-0.81	0.59	1.2	4.5	12.51	59.38
81	2.1	1.9	2.6	0.78	0.0	0.00	2.5	0.78	1.6	-0.37	0.30	0.9	2.8	12.51	60.28
82	2.4	-0.2	2.6	0.22	-0.9	-1.23	2.6	0.46	-0.9	-1.23	0.41	2.1	12.7	8.13	62.10
83	0.0	-0.2	0.1	0.11	-0.3	-0.41	0.1	0.11	-0.3	-0.41	1.20	0.1	0.7	9.04	62.44
84	2.6	0.1	3.1	0.93	-0.5	-0.48	3.1	0.97	-0.3	-1.05	0.40	3.6	15.3	18.81	64.02
85	0.7	-0.2	1.1	0.42	-1.0	-0.82	1.0	0.45	-0.9	-0.95	0.62	0.9	2.1	12.10	64.64
86	1.9	1.3	2.3	0.69	0.0	0.00	2.0	0.73	1.2	-0.36	0.30	1.2	0.8	12.38	65.18
87	2.6	0.7	3.0	0.62	0.0	-0.94	2.6	0.78	0.0	-0.94	0.51	2.1	10.5	10.10	66.64
88	0.0	0.4	1.5	0.35	-0.4	-0.94	1.5	0.41	-0.3	-0.96	0.68	0.8	2.4	8.95	67.30
89	0.0	0.1	1.0	0.28	-0.6	-0.62	1.0	0.28	-0.6	-0.89	0.55	0.7	2.8	9.91	68.02
90	1.7	0.8	2.2	0.60	0.0	0.00	1.8	0.62	0.8	-0.49	0.27	1.1	1.9	11.94	69.30

Table 17. SE13-FA-2-B

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
91	1.8	0.8	1.9	0.34	0.0	0.00	1.9	0.44	0.4	-0.68	0.17	0.9	1.9	7.56	70.08
92	1.6	0.3	1.7	0.09	-0.4	-0.73	1.6	0.30	-0.3	-0.92	0.39	1.2	4.9	11.37	71.16
93	0.0	0.7	2.2	0.00	0.0	0.00	2.1	0.57	0.6	-0.70	0.00	1.4	7.2	10.47	73.50
94	1.7	1.5	2.0	0.43	0.0	0.00	1.9	0.45	1.5	-0.26	0.22	0.3	0.6	10.64	74.02

Table 18. SE03-PA-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	14.7	-11.7	41.1	5.41	-24.3	-5.84	20.3	7.41	-14.6	-6.94	1.37	1487.6	2141.5	211.2	
1	***0.8***	***0.6***	***1.2***	***0.79***	***-0.1***	***-0.18***	***1.2***	***0.79***	***0.3***	***-0.47***	***0.75***	***0.3***	***0.9***	***6.71***	***0.76***
2	*0.6*	*0.0*	*0.6*	*0.02*	*-0.3*	*-0.80*	*0.6*	*0.03*	*-0.3*	*-0.80*	*0.90*	*0.3*	*0.6*	*7.16*	*1.14*
3	***0.7***	***0.4***	***1.0***	***0.79***	***-0.2***	***-0.88***	***1.0***	***0.79***	***-0.2***	***-0.88***	***1.37***	***0.7***	***1.0***	***19.05***	***1.52***
4	*0.0*	*-0.4*	*0.9*	*0.53*	*-2.2*	*-2.18*	*0.9*	*0.53*	*-2.0*	*-2.21*	*0.89*	*1.8*	*10.4*	*39.37*	*1.92*
5	***2.0***	***0.1***	***4.1***	***2.77***	***-1.4***	***-1.96***	***3.8***	***2.79***	***-1.4***	***-2.13***	***0.85***	***8.4***	***7.2***	***38.93***	***2.54***
6	***1.7***	***-2.0***	***3.5***	***2.28***	***-4.1***	***-3.44***	***3.5***	***2.28***	***-4.1***	***-3.44***	***0.76***	***13.0***	***40.4***	***80.25***	***3.26***
7	***3.9***	***-5.9***	***10.4***	***5.52***	***-11.8***	***-5.87***	***10.2***	***5.86***	***-11.5***	***-6.28***	***0.51***	***85.0***	***104.4***	***114.07***	***3.84***
8	*5.0*	*-11.7*	*10.3*	*4.67*	*-20.9*	*-5.97*	*10.2*	*5.81*	*-14.6*	*-6.94*	*0.34*	*141.1*	*172.1*	*105.80*	*5.00*
9	**8.3**	**-8.6**	**17.6**	**7.00**	**-16.9**	**-4.43**	**14.3**	**7.31**	**-16.9**	**-4.43**	**0.33**	**126.4**	**164.8**	**128.20**	**6.02**
10	*8.6*	*-8.8*	*16.9*	*5.91*	*-24.3*	*-5.84*	*16.9*	*5.91*	*-23.8*	*-6.11*	*0.28*	*127.0*	*119.8*	*133.67*	*7.20*
11	2.7	-6.6	3.8	1.60	-13.7	-2.81	3.5	1.72	-13.7	-2.81	0.25	33.3	154.0	132.49	8.18
12	**14.7**	**-5.2**	**41.1**	**5.41**	**-10.7**	**-2.37**	**20.3**	**7.41**	**-10.5**	**-2.40**	**0.15**	**225.3**	**210.9**	**211.20**	**9.60**
13	0.9	0.1	1.5	1.02	-4.4	0.04	1.4	1.04	-0.2	-0.53	0.17	3.6	-3.7	42.42	10.06
14	0.8	-1.3	1.3	0.62	-2.6	-1.06	1.3	0.62	-2.2	-1.13	0.43	2.5	24.7	23.69	10.88
15	0.0	-4.2	7.6	1.66	-8.2	-2.03	7.4	1.73	-8.2	-2.05	0.23	22.7	26.8	45.61	12.04
16	4.5	-2.7	7.4	1.76	-4.3	-1.39	7.4	1.81	-4.2	-1.51	0.27	16.7	28.4	44.64	13.10
17	-2.1	-2.8	0.0	0.00	-3.9	-1.16	-2.1	0.20	-3.7	-1.18	0.30	0.8	6.1	25.21	13.50
18	5.5	-7.7	6.8	1.62	-16.6	-3.35	6.6	1.67	-16.5	-3.49	0.21	42.0	85.2	142.39	14.24
19	11.5	-10.3	38.5	4.55	-22.1	-4.67	38.5	4.55	-21.9	-4.70	0.15	155.7	180.4	205.49	15.32
20	8.5	-6.0	19.7	2.67	-10.6	-2.19	13.8	2.98	-10.3	-2.28	0.16	61.8	48.9	130.56	16.14
21	1.4	0.4	2.2	0.86	-5.1	0.07	2.2	0.94	-0.3	-0.83	0.11	3.8	4.3	48.52	17.16
22	4.7	-7.4	6.0	1.36	-13.2	-2.60	6.0	1.36	-13.1	-2.66	0.21	25.6	86.6	69.17	18.22
23	11.3	-7.3	25.8	3.02	-19.2	-3.86	25.3	3.13	-19.2	-3.86	0.15	92.2	110.6	87.31	19.56
24	5.5	-4.6	10.4	1.82	-7.0	-1.67	10.2	2.00	-6.9	-1.68	0.20	26.7	27.9	69.14	20.72
25	4.5	-5.7	11.8	2.08	-10.4	-2.24	10.9	2.10	-10.4	-2.24	0.19	32.2	53.7	66.38	21.78
26	8.1	-6.1	18.5	2.70	-12.4	-2.48	18.5	2.70	-12.4	-2.58	0.17	53.0	76.5	89.79	23.00
27	4.0	-3.7	5.7	1.21	-5.9	-1.46	5.7	1.39	-5.7	-1.49	0.23	16.7	21.2	52.32	24.04

Table 18. SE03-PA-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
28	8.7	-8.6	20.4	2.80	-22.9	-4.80	19.2	2.81	-22.9	-4.80	0.18	83.5	193.6	77.66	25.40
29	5.8	-6.1	12.4	1.50	-12.3	-2.43	12.2	2.23	-12.2	-2.48	0.16	39.2	48.3	77.97	27.30
30	4.4	0.6	8.2	1.39	-5.2	0.01	7.6	1.59	-0.1	-0.81	0.10	12.5	5.6	48.64	29.24
31	0.7	0.4	0.8	0.09	-0.4	-0.75	0.8	0.13	-0.3	-0.77	0.68	0.3	3.8	13.43	29.66
32	2.7	-3.4	3.7	0.98	-5.4	-1.29	3.7	0.98	-5.0	-1.43	0.25	8.0	45.1	19.84	31.44
33	4.0	-1.1	7.5	1.35	-2.9	0.15	7.3	1.43	-1.7	-1.12	0.12	11.7	16.5	29.86	33.00
34	0.4	-0.6	0.9	0.58	-1.3	-0.87	0.1	0.62	-1.3	-0.87	0.66	1.1	4.9	11.18	34.46
35	2.3	-0.6	2.8	0.82	-1.8	-1.08	2.7	0.85	-1.8	-1.08	0.42	3.7	16.4	12.03	36.12
36	1.1	-0.2	1.7	0.56	-1.2	-0.90	1.2	0.68	-1.2	-0.94	0.49	1.8	11.6	9.31	37.88
37	0.6	0.1	1.1	0.51	-0.4	-0.54	1.1	0.51	-0.4	-0.56	0.71	0.6	0.1	8.19	39.04
38	1.9	0.7	2.5	0.78	0.0	0.00	2.4	0.82	0.2	-0.61	0.31	1.7	8.9	10.01	40.38
39	1.6	1.4	2.0	0.53	0.0	0.00	2.0	0.53	1.4	-0.16	0.27	0.3	1.9	6.35	41.40
40	1.3	0.8	1.6	0.17	0.0	0.00	1.6	0.20	0.2	-0.63	0.11	0.2	1.4	6.71	42.18
41	1.5	1.1	1.9	0.44	0.0	0.00	1.8	0.44	0.4	-0.58	0.24	0.4	1.3	6.57	44.08
42	1.5	0.9	2.4	0.73	0.0	0.00	2.4	0.74	0.4	-0.55	0.30	1.2	6.3	9.46	48.72
43	1.5	1.0	2.1	0.61	0.0	0.00	2.1	0.63	0.4	-0.52	0.29	0.5	1.8	7.66	49.94
44	1.4	0.8	*2.0*	0.53	0.0	0.00	1.9	0.54	0.1	-0.70	0.27	0.4	2.9	5.73	51.40
45	0.9	0.9	1.0	0.10	0.0	0.00	1.0	0.18	0.8	-0.04	0.10	0.0	-0.1	3.81	51.74
46	**1.4**	**1.1**	**1.8**	**0.44**	**0.0**	**0.00**	**1.7**	**0.45**	**0.3**	**-0.59**	**0.25**	**0.4**	**1.8**	**6.48**	**54.00**
47	**1.6**	**1.0**	**2.3**	**0.75**	**0.0**	**0.00**	**2.3**	**0.75**	**0.5**	**-0.49**	**0.32**	**0.5**	**2.2**	**8.13**	**55.26**
48	**1.4**	**0.8**	**1.7**	**0.39**	**0.0**	**0.00**	**1.7**	**0.40**	**0.1**	**-0.67**	**0.23**	**0.4**	**1.5**	**6.79**	**56.82**
49	**1.1**	**0.9**	**1.5**	**0.26**	**0.0**	**0.00**	**1.3**	**0.31**	**0.5**	**-0.50**	**0.17**	**0.2**	**0.4**	**6.21**	**58.04**

Table 19. SE03-PA-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	40.7	15.3	60.9	4.14	-3.0	-7.70	37.3	7.46	-2.3	-8.42	0.45	1503.1	2114.2	216.6	
1	***15.3***	***15.2***	***15.6***	***0.49***	***0.0***	***0.00***	***15.6***	***0.56***	***15.2***	***-0.10***	***0.03***	***3.6***	***3.8***	***3.54***	***3.64***
2	15.2	15.2	15.7	0.60	0.0	0.00	15.6	0.60	15.0	-0.36	0.04	0.1	0.5	3.80	4.08
3	15.2	14.6	15.2	0.03	0.0	0.00	15.2	0.03	14.3	-0.73	0.00	0.2	0.6	6.65	4.46
4	**15.3**	**15.0**	**15.6**	**0.67**	**0.0**	**0.00**	**15.6**	**0.67**	**14.4**	**-0.84**	**0.04**	**0.6**	**0.9**	**19.08**	**4.84**
5	0.0	14.0	15.4	0.45	0.0	0.00	15.4	0.45	12.5	-2.32	0.03	2.4	10.5	41.02	5.24
6	**16.0**	**13.9**	**18.7**	**2.58**	**0.0**	**0.00**	**18.7**	**2.58**	**12.9**	**-2.39**	**0.14**	**8.2**	**7.8**	**41.97**	**5.86**
7	*16.0*	*13.7*	*17.7*	*1.90*	*0.0*	*0.00*	*17.7*	*1.90*	*10.0*	*-3.56*	*0.11*	*12.6*	*39.0*	*103.21*	*6.60*
8	**19.0**	**10.4**	**24.7**	**5.19**	**0.0**	**0.00**	**24.3**	**5.72**	**3.7**	**-7.29**	**0.21**	**77.8**	**105.0**	**118.58**	**7.16**
9	**18.9**	**14.8**	**25.8**	**5.98**	**0.0**	**0.00**	**25.6**	**6.11**	**15.1**	**-1.34**	**0.23**	**37.2**	**5.1**	**116.08**	**7.58**
10	*18.9*	*7.0*	*25.2*	*4.89*	*-3.0*	*-7.70*	*25.0*	*4.91*	*-2.3*	*-8.42*	*0.45*	*89.8*	*159.5*	*93.28*	*8.28*
11	**26.0**	**7.3**	**34.0**	**6.54**	**-1.6**	**-6.94**	**29.4**	**7.06**	**-1.6**	**-6.94**	**0.38**	**136.0**	**159.0**	**129.10**	**9.08**
12	14.8	11.3	16.2	1.35	0.0	0.00	16.2	1.57	10.7	-1.33	0.08	9.4	-25.4	85.24	9.64
13	25.8	8.0	33.3	5.91	-2.7	-7.52	32.9	5.99	-2.7	-7.52	0.37	106.5	126.6	136.68	10.48
14	20.7	7.3	24.4	2.74	0.0	0.00	24.4	2.74	3.4	-3.44	0.11	49.4	177.8	141.92	11.46
15	**40.7**	**14.7**	**57.4**	**4.55**	**0.0**	**0.00**	**37.3**	**7.46**	**13.4**	**-1.54**	**0.08**	**221.9**	**197.1**	**206.43**	**12.34**
16	15.1	10.2	15.3	0.06	0.0	0.00	15.0	0.16	5.5	-2.83	0.00	14.5	16.7	41.97	12.90
17	**15.5**	**14.4**	**17.0**	**1.17**	**0.0**	**0.00**	**17.0**	**1.24**	**14.1**	**-0.55**	**0.07**	**5.6**	**-4.7**	**48.51**	**13.40**
18	14.9	12.7	15.4	0.42	0.0	0.00	15.3	0.45	11.2	-1.27	0.03	3.0	25.8	32.16	14.20
19	20.1	10.8	22.6	1.68	0.0	0.00	22.2	1.70	6.4	-2.72	0.07	24.8	31.9	54.54	15.34
20	20.0	12.4	23.4	1.76	0.0	0.00	23.2	1.86	10.0	-1.80	0.08	21.4	29.0	56.39	16.42
21	12.9	12.5	13.1	0.15	0.0	0.00	13.0	0.16	10.9	-1.25	0.01	1.0	6.2	36.93	16.84
22	19.8	7.7	21.2	1.51	0.0	0.00	21.1	1.51	0.5	-5.06	0.07	39.5	111.1	121.22	17.52
23	**40.5**	**7.1**	**60.9**	**4.14**	**-1.6**	**-6.33**	**54.6**	**4.49**	**-1.3**	**-6.42**	**0.17**	**184.0**	**200.3**	**216.60**	**18.60**
24	28.3	10.4	40.3	2.58	0.0	0.00	40.0	2.84	6.8	-2.38	0.06	74.0	51.1	141.00	19.46
25	13.1	12.9	13.9	0.71	0.0	0.00	13.8	0.77	12.7	-0.22	0.05	1.2	-1.5	43.01	19.84
26	16.1	13.9	16.9	0.93	0.0	0.00	16.6	1.05	13.3	-0.84	0.05	3.8	6.3	23.18	20.50
27	18.0	9.5	20.3	1.22	0.0	0.00	20.1	1.26	4.0	-3.28	0.06	22.7	91.3	64.52	21.50

Table 19. SE03-PA-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
28	28.9	8.1	39.6	2.68	0.0	0.00	38.5	2.69	0.7	-4.90	0.07	83.2	94.3	77.03	22.76
29	20.3	12.1	23.3	1.49	0.0	0.00	23.1	1.63	10.5	-1.58	0.06	21.8	16.6	71.64	24.02
30	23.0	9.9	26.2	1.81	0.0	0.00	26.2	1.87	6.4	-2.51	0.07	30.9	53.5	59.86	25.06
31	25.7	9.7	33.0	2.39	0.0	0.00	32.9	2.50	5.5	-2.82	0.07	51.5	68.7	77.66	26.26
32	17.3	11.9	18.5	1.10	0.0	0.00	18.2	1.29	9.5	-1.69	0.06	13.0	20.3	44.01	27.32
33	26.1	7.1	35.2	2.57	-1.5	-6.24	35.1	2.58	-1.4	-6.36	0.24	75.5	169.2	71.82	28.56
34	21.6	8.9	26.7	1.91	0.0	0.00	26.7	1.99	4.4	-3.06	0.07	39.9	41.7	69.85	30.50
35	15.8	13.6	16.8	0.88	0.0	0.00	15.4	1.06	12.9	-0.79	0.05	5.9	-8.5	33.76	31.88
36	13.8	12.6	13.8	0.13	0.0	0.00	13.8	0.13	11.5	-1.08	0.01	1.1	7.7	6.78	32.52
37	12.7	12.5	12.9	0.13	0.0	0.00	12.8	0.15	11.6	-0.89	0.01	0.3	4.6	13.49	32.98
38	15.4	11.5	16.6	0.90	0.0	0.00	16.5	0.99	9.9	-1.53	0.05	5.9	40.9	18.18	34.70
39	16.6	13.1	18.6	1.06	0.0	0.00	16.2	1.17	12.2	-1.20	0.06	7.7	11.6	23.37	36.36
40	15.1	13.5	15.3	0.26	0.0	0.00	14.9	0.54	13.1	-0.84	0.02	1.6	5.6	15.23	37.78
41	16.2	13.1	17.0	0.76	0.0	0.00	16.7	0.83	12.6	-0.99	0.05	3.1	14.5	10.03	39.50
42	15.5	13.5	16.0	0.61	0.0	0.00	15.9	0.66	12.8	-0.91	0.04	2.1	11.6	12.70	41.22
43	14.5	13.8	14.8	0.32	0.0	0.00	14.7	0.32	13.5	-0.55	0.02	0.5	0.3	6.52	42.36
44	14.9	14.3	16.8	0.76	0.0	0.00	16.6	0.86	13.9	-0.72	0.05	2.8	12.0	11.81	45.54
45	14.9	14.4	15.2	0.34	0.0	0.00	15.2	0.41	13.8	-0.60	0.02	0.4	1.3	6.78	47.40
46	15.4	14.4	*15.9*	0.55	0.0	0.00	15.9	0.62	14.0	-0.55	0.03	0.8	3.4	9.50	49.94
47	15.3	15.3	15.8	0.53	0.0	0.00	15.7	0.53	15.3	-0.05	0.03	0.3	1.3	7.60	50.62
48	**15.2**	**14.6**	**15.3**	**0.04**	**0.0**	**0.00**	**15.3**	**0.05**	**14.1**	**-0.54**	**0.00**	**0.3**	**1.2**	**4.50**	**52.10**
49	**15.2**	**14.6**	**15.7**	**0.51**	**0.0**	**0.00**	**15.7**	**0.51**	**14.2**	**-0.50**	**0.03**	**0.5**	**1.6**	**7.09**	**53.28**
50	**15.2**	**14.3**	**15.6**	**0.42**	**0.0**	**0.00**	**15.5**	**0.43**	**14.0**	**-0.63**	**0.03**	**0.6**	**2.6**	**5.14**	**54.74**
51	**14.4**	**14.4**	**14.4**	**-0.02**	**0.0**	**0.00**	**14.4**	**0.03**	**14.2**	**-0.23**	**0.00**	**0.0**	**0.0**	**3.40**	**55.12**
52	**15.0**	**14.5**	**15.3**	**0.34**	**0.0**	**0.00**	**15.1**	**0.35**	**13.9**	**-0.57**	**0.02**	**0.4**	**1.7**	**5.64**	**57.32**
53	**14.8**	**14.8**	**15.8**	**0.44**	**0.0**	**0.00**	**15.8**	**0.52**	**14.2**	**-0.50**	**0.03**	**0.7**	**2.0**	**8.95**	**59.12**

Table 20. SE07-PA-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	39.2	-19.7	78.7	3.19	-72.6	-4.34	13.2	7.85	-21.1	-8.48	2.52	3569.7	4920.4	440.9	
1	***0.4***	***-0.8***	***2.3***	***3.32***	***-4.0***	***-3.65***	***2.3***	***3.46***	***-4.0***	***-3.71***	***1.09***	***8.2***	***23.0***	***43.56***	***11.80***
2	0.2	-0.4	0.7	1.97	-1.8	-1.74	0.7	1.98	-1.6	-1.86	1.44	2.9	7.3	23.47	12.28
3	0.3	-0.4	1.9	2.35	-0.7	-1.12	1.8	3.36	-0.7	-1.14	1.32	4.2	2.2	30.33	12.96
4	0.1	-0.6	0.6	1.67	-1.3	-1.77	0.6	1.67	-1.3	-1.77	1.86	1.4	6.0	14.32	13.34
5	0.2	-0.5	0.9	1.75	-1.2	-1.63	0.9	1.90	-1.1	-1.71	1.61	2.4	1.7	15.84	13.84
6	0.2	-0.6	0.5	1.61	-1.9	-1.79	0.3	1.66	-1.6	-1.90	1.43	2.1	9.2	17.93	14.30
7	0.3	-0.4	1.4	1.89	-2.7	-2.19	1.0	2.45	-2.7	-2.26	0.99	4.6	3.7	34.84	14.90
8	0.6	-0.7	2.0	3.00	-3.0	-2.40	2.0	3.11	-3.0	-2.40	1.09	6.8	8.2	32.11	15.30
9	**0.1**	**0.0**	**0.5**	**1.76**	**-0.3**	**0.43**	**0.4**	**1.81**	**-0.1**	**-0.66**	**1.70**	**1.2**	**0.1**	**18.33**	**15.64**
10	*0.2*	*-0.7*	*0.7*	*1.54*	*-2.1*	*-1.72*	*0.7*	*1.58*	*-1.7*	*-2.00*	*1.18*	*2.3*	*5.9*	*22.80*	*16.04*
11	***-0.1***	***-0.3***	***0.1***	***1.37***	***-0.9***	***-1.14***	***0.1***	***1.37***	***-0.9***	***-1.14***	***2.52***	***0.6***	***0.3***	***21.21***	***16.28***
12	**0.4**	**-0.6**	**1.6**	**2.40**	**-2.3**	**-1.98**	**1.5**	**2.62**	**-2.2**	**-2.08**	**1.12**	**3.9**	**14.1**	**23.75**	**16.80**
13	-0.4	-0.7	0.3	1.71	-1.7	-1.72	0.2	1.74	-1.6	-1.82	1.72	1.2	1.7	19.49	17.22
14	0.4	-0.7	2.0	3.08	-3.6	-2.71	1.7	3.12	-3.3	-2.80	1.04	7.7	14.7	28.26	17.74
15	0.6	0.0	1.5	2.10	-0.6	-1.28	1.4	2.64	-0.6	-1.28	1.57	2.9	-4.9	20.45	18.24
16	0.0	-0.5	0.2	0.68	-2.3	-1.97	0.2	0.68	-2.2	-2.01	1.05	1.2	19.8	29.01	18.82
17	***0.7***	***-0.8***	***4.6***	***4.78***	***-4.2***	***-3.64***	***4.5***	***5.19***	***-4.2***	***-3.97***	***0.96***	***19.7***	***35.6***	***46.49***	***19.58***
18	0.5	0.1	3.0	3.80	-2.6	-2.24	3.0	3.80	-2.5	-2.37	1.09	8.9	-11.5	45.28	20.04
19	*0.5*	*-4.7*	*4.0*	*4.27*	*-16.2*	*-7.14*	*4.0*	*4.31*	*-15.8*	*-7.56*	*0.56*	*71.0*	*213.5*	*105.16*	*20.86*
20	***9.4***	***-19.7***	***19.5***	***6.92***	***-72.6***	***-4.34***	***13.2***	***7.85***	***-21.1***	***-8.48***	***0.12***	***453.6***	***637.9***	***422.93***	***22.02***
21	**39.2**	**-2.8**	**78.7**	**3.19**	**-18.9**	**-1.84**	**30.1**	**7.61**	**-15.2**	**-2.02**	**0.05**	**376.7**	**225.3**	**440.88**	**23.02**
22	19.1	-16.4	45.7	1.66	-52.8	-3.10	28.1	2.98	-52.5	-3.21	0.05	166.1	271.8	263.33	24.52
23	11.2	5.2	38.2	2.36	-13.8	0.09	33.8	2.54	5.0	-0.58	0.04	57.5	37.2	192.66	25.52
24	10.5	-7.7	21.0	1.76	-32.5	-2.11	19.8	1.93	-30.5	-2.24	0.07	69.9	168.1	164.97	27.16
25	9.2	-3.8	45.1	1.80	-24.1	-1.93	23.8	3.03	-22.8	-2.03	0.05	92.0	76.3	256.54	28.26
26	-3.0	-2.9	0.0	0.00	-7.5	-1.06	-3.0	0.02	-7.4	-1.07	0.14	2.2	5.6	117.48	28.56
27	11.7	-4.1	43.6	2.06	-48.8	-2.96	28.0	2.74	-48.8	-2.96	0.05	117.4	210.0	289.37	29.92

Table 20. SE07-PA-1

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
28	6.8	-4.8	61.3	2.79	-24.6	-1.92	42.4	3.08	-23.5	-2.11	0.05	113.2	88.9	294.67	31.04
29	6.4	-4.0	11.0	1.38	-25.3	-1.97	10.5	1.51	-25.3	-1.97	0.09	41.4	65.2	161.27	32.02
30	6.3	-5.3	15.8	1.54	-19.1	-1.70	15.4	2.11	-18.7	-1.95	0.09	42.4	43.5	158.05	32.74
31	4.4	-7.1	49.1	2.02	-50.3	-3.27	47.9	2.70	-50.3	-3.27	0.05	129.4	157.0	283.20	33.88
32	5.5	-2.3	19.3	1.23	-15.6	-1.69	17.0	2.19	-15.6	-1.69	0.08	41.8	50.9	224.42	34.62
33	5.4	-4.1	6.5	1.20	-25.8	-1.91	6.1	1.32	-24.3	-2.00	0.10	35.4	59.4	281.80	35.32
34	9.3	-5.2	57.5	2.05	-72.0	-3.99	46.0	3.50	-69.4	-5.04	0.05	209.0	308.5	353.57	36.42
35	15.0	-0.8	71.2	2.31	-7.8	-1.24	66.0	3.67	-7.3	-1.25	0.05	93.1	68.2	415.80	37.76
36	10.4	-8.6	33.5	1.55	-52.5	-2.64	31.7	2.09	-50.4	-2.92	0.05	99.8	165.4	258.07	38.88
37	10.9	-4.1	45.7	1.77	-31.6	-1.80	36.7	2.51	-31.3	-2.20	0.05	85.5	95.1	206.49	40.24
38	0.0	-3.8	0.0	0.00	-6.8	-0.91	-1.9	0.17	-6.7	-0.96	0.13	2.0	14.1	82.79	40.66
39	7.9	-2.8	41.5	2.01	-12.6	-1.43	25.3	2.32	-11.6	-1.45	0.06	54.9	63.0	172.91	41.68
40	9.0	-6.6	27.5	1.51	-58.2	-3.25	26.8	1.86	-57.7	-3.32	0.06	102.3	187.6	245.87	42.82
41	6.6	-1.1	36.5	1.33	-23.2	-1.74	28.3	2.56	-22.8	-1.79	0.05	61.5	48.3	213.30	44.28
42	9.1	-3.4	31.3	1.44	-26.9	-1.83	23.4	2.23	-26.0	-2.05	0.06	59.3	90.7	181.29	45.44
43	7.2	-2.9	32.5	1.83	-29.7	-1.73	20.5	1.97	-28.4	-2.27	0.06	64.4	82.3	137.79	46.64
44	9.5	-4.3	24.7	1.41	-22.9	-1.68	12.3	1.99	-21.7	-1.76	0.06	47.6	107.8	173.55	48.28
45	8.2	-8.3	46.3	1.87	-43.5	-2.49	41.4	2.74	-43.5	-2.49	0.05	95.3	122.4	240.67	49.74
46	7.5	-2.4	30.8	1.42	-14.5	-1.45	24.9	2.45	-14.3	-1.50	0.06	44.0	51.9	194.59	51.02
47	0.0	-1.2	8.8	1.32	-7.7	-1.06	8.2	1.35	-7.6	-1.27	0.14	15.2	15.7	93.13	51.82
48	7.6	-2.6	*12.0*	1.31	-12.0	-1.34	10.2	1.69	-11.7	-1.47	0.11	22.2	61.3	97.47	53.18
49	7.3	2.4	14.5	1.24	-1.0	0.08	11.8	1.56	1.3	-0.53	0.07	15.3	14.4	91.31	54.40
50	**7.1**	**-3.7**	**9.3**	**1.42**	**-22.6**	**-1.77**	**9.3**	**1.42**	**-22.3**	**-1.80**	**0.10**	**26.6**	**80.6**	**142.88**	**55.64**
51	**7.3**	**-0.2**	**20.2**	**1.64**	**-2.8**	**-0.78**	**12.1**	**1.98**	**-2.3**	**-0.89**	**0.11**	**26.0**	**13.1**	**132.95**	**57.16**
52	**7.2**	**-4.9**	**18.7**	**1.46**	**-36.5**	**-2.20**	**17.8**	**1.56**	**-36.5**	**-2.20**	**0.07**	**53.8**	**121.0**	**142.68**	**58.58**
53	**6.5**	**-5.9**	**42.3**	**1.61**	**-29.6**	**-1.94**	**35.4**	**2.32**	**-29.1**	**-2.02**	**0.05**	**72.3**	**87.9**	**145.94**	**60.12**
54	7.8	-1.8	21.2	1.32	-15.8	-1.49	12.9	1.98	-15.7	-1.59	0.08	36.4	59.1	130.30	61.46
55	5.6	-1.7	8.9	1.46	-12.8	-1.36	8.9	1.46	-12.5	-1.48	0.13	19.6	19.6	111.00	62.32
56	***7.5***	***-0.1***	***26.2***	***1.52***	***-11.2***	***-1.30***	***21.5***	***1.92***	***-10.8***	***-1.45***	***0.08***	***36.8***	***42.9***	***143.07***	***63.40***
57	*4.9*	*-1.2*	*7.3*	*1.17*	*-14.1*	*-1.51*	*5.7*	*1.21*	*-14.1*	*-1.51*	*0.13*	*16.7*	*53.8*	*69.68*	*64.78*
58	***5.9***	***-0.6***	***8.6***	***1.23***	***-3.3***	***-0.93***	***8.4***	***1.38***	***-3.2***	***-0.95***	***0.18***	***11.8***	***11.7***	***67.50***	***66.10***

Table 21. SE07-PA-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	37.7	-24.7	91.5	3.15	-60.8	-3.44	26.9	10.06	-17.2	-9.56	2.08	3826.0	5225.0	407.3	
1	***0.2***	***-0.7***	***2.4***	***3.57***	***-3.6***	***-3.95***	***2.4***	***3.57***	***-3.6***	***-3.95***	***1.25***	***8.9***	***26.3***	***41.24***	***0.78***
2	0.1	-0.8	0.9	2.17	-1.6	-1.82	0.8	2.23	-1.6	-1.82	1.54	3.4	7.5	26.79	1.24
3	0.4	-0.1	1.9	2.90	-0.5	0.26	1.7	3.36	-0.3	-0.86	1.10	3.9	1.2	30.21	1.62
4	0.1	-0.7	0.3	0.51	-0.8	-1.51	0.2	0.64	-0.8	-1.52	1.86	1.0	3.1	7.47	1.94
5	-0.1	-0.8	0.6	1.84	-1.4	-1.63	0.5	1.90	-1.0	-1.73	1.70	1.8	6.0	17.36	2.32
6	0.2	-0.5	0.8	1.76	-1.1	-1.45	0.8	1.80	-0.7	-1.66	1.71	2.4	1.2	15.05	2.82
7	0.1	-0.6	0.4	1.67	-1.6	-1.75	0.3	1.71	-1.5	-1.87	1.70	2.2	8.8	15.18	3.28
8	0.2	-0.7	0.9	2.24	-2.1	-2.24	0.8	2.29	-2.1	-2.24	1.49	4.2	3.8	27.11	3.86
9	0.0	-0.2	1.7	2.79	-2.9	-2.53	1.7	2.89	-2.7	-2.77	1.16	8.7	10.9	35.37	4.62
10	0.2	-0.7	0.7	1.62	-1.8	-1.94	0.6	1.67	-1.2	-2.02	1.44	2.6	6.4	23.05	5.02
11	0.3	-1.0	1.6	2.63	-2.0	-1.91	1.5	2.75	-1.7	-2.22	1.25	5.7	14.7	26.04	5.76
12	-0.7	-1.0	0.0	0.00	-1.7	-1.61	-0.1	1.63	-1.5	-1.69	0.96	0.7	2.4	12.86	6.18
13	0.2	-0.7	1.7	2.99	-3.3	-2.62	1.6	3.01	-3.2	-2.88	1.12	7.7	13.8	26.54	6.70
14	0.1	0.0	0.7	1.96	-0.5	0.55	0.7	2.08	-0.1	-0.29	1.15	1.7	-4.5	17.08	7.12
15	0.0	-0.6	0.2	0.94	-1.0	-1.49	0.2	0.95	-0.9	-1.57	2.08	0.8	3.0	7.28	7.48
16	-0.4	-0.8	0.0	0.00	-2.3	-2.10	-0.4	0.39	-2.1	-2.20	0.91	1.3	18.5	26.03	7.80
17	***0.8***	***-1.0***	***4.5***	***5.06***	***-3.7***	***-4.06***	***4.4***	***5.20***	***-3.7***	***-4.06***	***1.11***	***20.2***	***36.6***	***49.66***	***8.58***
18	0.9	-0.1	2.8	3.77	-2.3	-2.50	2.8	3.77	-2.3	-2.50	1.23	9.4	-9.6	43.50	9.02
19	*0.6*	*-4.3*	*3.6*	*3.99*	*-13.4*	*-8.26*	*3.5*	*3.99*	*-13.0*	*-8.28*	*0.72*	*61.5*	*197.3*	*84.01*	*9.80*
20	***3.5***	***-19.1***	***12.9***	***7.65***	***-39.3***	***-5.55***	***12.8***	***8.02***	***-17.2***	***-9.56***	***0.25***	***285.8***	***540.7***	***266.48***	***10.88***
21	**37.7**	**-17.2**	**91.5**	**3.15**	**-33.0**	**-3.38**	**26.9**	**10.06**	**-32.1**	**-4.89**	**0.05**	**538.5**	**325.3**	**407.29**	**12.00**
22	10.4	-16.6	42.9	1.39	-38.7	-4.36	27.7	3.01	-36.1	-5.27	0.07	156.9	241.0	278.59	13.00
23	5.0	-2.2	6.5	1.49	-12.5	0.17	4.9	1.58	-2.3	-1.44	0.07	16.7	11.6	202.12	13.46
24	12.4	-2.6	33.9	1.71	-5.6	-1.65	17.6	2.00	-5.5	-1.81	0.09	60.9	50.8	129.66	14.50
25	9.3	-9.4	26.9	1.83	-20.3	-2.38	26.5	2.09	-19.2	-2.68	0.09	75.2	126.3	168.72	15.58
26	3.0	-5.6	4.5	1.29	-13.1	-1.98	4.2	1.33	-11.1	-2.21	0.18	28.5	61.4	162.75	16.14
27	13.3	-4.7	42.2	1.71	-26.2	-2.63	30.8	2.68	-25.4	-3.21	0.06	107.8	102.4	249.05	17.20

Table 21. SE07-PA-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
28	1.9	-0.4	2.5	0.73	-2.1	0.46	2.1	0.96	-0.7	-1.09	0.06	5.6	4.8	110.49	17.50
29	8.2	-16.1	46.0	1.91	-32.2	-3.87	7.8	2.17	-32.2	-3.87	0.07	125.6	259.2	267.65	18.78
30	11.6	-4.0	83.4	2.94	-20.4	-2.02	82.4	3.59	-19.2	-3.13	0.05	152.7	108.7	338.12	20.04
31	7.5	-7.9	8.8	1.36	-19.8	-2.58	6.9	1.52	-19.8	-2.58	0.14	42.0	83.4	147.08	20.92
32	6.1	-3.5	27.2	1.45	-11.8	-1.93	24.1	2.09	-10.7	-2.20	0.09	55.0	39.4	184.64	21.70
33	*4.6*	*-17.2*	*49.6*	*2.14*	*-44.2*	*-4.39*	*48.7*	*2.18*	*-39.4*	*-5.06*	*0.07*	*157.0*	*207.7*	*311.21*	*22.78*
34	8.9	0.5	40.4	1.34	-10.3	0.16	36.8	2.77	-0.4	-1.40	0.02	50.7	43.1	325.83	23.52
35	4.6	-7.9	5.5	1.07	-26.2	-2.65	5.3	1.13	-26.2	-2.65	0.12	45.7	90.7	268.80	24.28
36	*8.7*	*-24.7*	*67.8*	*1.96*	*-60.8*	*-3.44*	*10.1*	*3.26*	*-41.7*	*-5.24*	*0.04*	*211.4*	*278.6*	*388.00*	*25.32*
37	9.4	-4.9	68.4	2.14	-19.0	0.47	64.5	2.89	-6.9	-2.25	0.02	95.5	77.2	360.67	26.56
38	5.7	-16.1	34.0	1.68	-52.2	-3.08	26.7	1.82	-50.2	-3.27	0.06	106.7	192.4	274.08	27.82
39	5.4	-6.9	54.0	2.00	-26.7	-1.40	49.3	2.21	-20.4	-2.39	0.04	100.4	90.4	274.64	29.18
40	-4.8	-7.0	0.0	0.00	-10.6	-1.36	-4.8	0.20	-9.3	-1.87	0.13	6.4	31.5	90.61	29.64
41	7.3	-3.6	46.0	1.85	-5.2	-1.64	42.9	1.96	-5.2	-1.65	0.07	56.2	59.9	171.07	30.58
42	6.0	-13.4	25.8	1.52	-59.7	-3.26	18.8	1.76	-59.0	-3.63	0.06	101.7	218.6	268.38	31.76
43	10.3	-10.2	47.6	1.56	-25.1	-1.64	33.6	2.60	-23.6	-2.08	0.04	80.3	51.1	272.35	33.24
44	8.3	-13.9	26.6	1.66	-21.6	-1.42	24.9	1.73	-19.4	-2.14	0.06	61.6	90.0	169.12	34.28
45	5.8	-8.1	31.2	1.66	-30.2	-1.58	28.2	1.81	-29.3	-2.26	0.05	70.5	95.6	133.40	35.58
46	7.0	-0.7	25.9	1.66	-5.2	0.03	25.7	1.85	-1.8	-1.30	0.05	31.7	40.8	139.64	36.48
47	-0.2	-4.6	0.0	0.00	-17.0	-1.59	-0.1	0.30	-15.3	-2.00	0.09	21.1	71.7	151.38	37.22
48	5.5	-3.5	48.6	1.93	-42.7	-2.32	46.9	2.29	-42.7	-2.56	0.05	95.4	127.4	209.28	38.74
49	7.4	-5.3	33.9	1.66	-12.4	-1.35	31.7	2.07	-12.2	-1.98	0.07	52.9	55.9	191.29	39.94
50	5.2	-6.2	6.6	1.24	-7.7	-1.38	6.4	1.39	-7.2	-1.71	0.18	18.1	21.9	66.61	40.72
51	6.7	-1.0	14.3	1.47	-5.2	0.01	5.8	1.51	-2.6	-1.63	0.07	19.8	25.9	108.84	41.54
52	-0.7	-3.6	0.0	0.00	-8.3	-1.38	-0.6	0.33	-7.7	-2.04	0.17	7.8	43.4	79.43	42.10
53	5.1	1.3	13.9	1.50	-2.1	0.10	12.1	1.59	1.3	-0.67	0.09	15.8	15.5	90.49	43.24
54	5.5	-4.8	7.4	1.00	-15.7	-1.53	5.9	1.50	-13.7	-2.20	0.11	24.5	81.0	118.17	44.56
55	5.9	-1.4	22.2	1.37	-2.7	-1.16	21.4	1.72	-1.6	-1.50	0.10	28.3	12.3	133.10	45.56
56	-0.1	-0.7	0.3	0.52	-2.9	-1.43	0.1	0.54	-2.9	-1.54	0.62	2.1	8.1	24.83	46.06
57	5.8	-6.6	18.5	1.31	-32.5	-1.99	15.6	1.68	-31.6	-2.15	0.06	55.9	119.6	140.72	47.52

Table 21. SE07-PA-2

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
58	8.1	-3.6	42.8	1.92	-26.4	-1.76	40.3	1.95	-25.1	-2.16	0.05	73.3	88.9	131.32	49.10
59	3.8	-6.7	21.3	1.40	-13.0	-1.57	18.5	1.82	-12.0	-1.87	0.09	59.2	90.1	123.32	51.22
60	5.4	-2.4	31.0	1.72	-8.1	-1.52	23.7	1.93	-8.0	-1.93	0.08	40.8	46.3	145.67	52.30
61	5.1	-4.1	8.0	1.18	-11.3	-1.47	6.6	1.36	-11.2	-1.87	0.14	21.9	56.9	54.02	53.66
62	5.8	-0.7	6.8	1.09	-3.0	0.17	6.6	1.50	-1.7	-1.19	0.09	9.9	5.0	60.01	54.64
63	-0.3	-0.9	0.0	0.00	-2.6	-1.28	-0.3	0.27	-2.5	-1.34	0.50	1.0	8.7	28.26	55.06
64	6.7	-4.9	14.1	1.20	-10.6	-1.40	13.6	1.56	-10.0	-1.85	0.11	29.1	35.9	59.79	56.16
65	5.3	-4.2	22.8	1.39	-39.8	-2.11	21.6	1.71	-38.5	-2.41	0.06	65.9	130.4	176.72	57.72
66	6.5	-0.1	16.5	1.46	-1.5	-1.12	16.1	1.71	-1.2	-1.15	0.14	19.7	-0.1	149.49	58.44
67	1.4	-2.5	2.1	0.62	-3.8	-1.11	1.9	0.73	-3.2	-1.61	0.29	5.5	10.9	13.56	59.16
68	-1.6	-2.0	0.0	0.00	-2.4	0.06	-2.0	0.25	-2.3	-0.71	0.02	0.2	1.2	9.97	59.62
69	0.0	-6.0	13.6	1.46	-31.9	-2.14	8.7	1.59	-31.7	-2.26	0.08	49.5	117.1	189.88	61.12
70	6.8	-3.2	46.9	2.07	-16.9	-1.66	45.0	2.14	-16.2	-1.94	0.06	89.6	117.8	202.44	64.06
71	5.6	-4.0	20.6	1.33	-15.2	-1.78	17.6	1.79	-15.2	-1.78	0.09	39.6	53.2	64.07	65.52
72	1.6	0.0	2.2	0.58	-3.2	0.19	1.4	0.75	-1.0	-0.99	0.07	2.8	4.4	46.30	66.24

Table 22. SE19-PA-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	39.7	-47.7	60.2	2.34	-133.7	-1.61	25.1	7.33	-19.5	-8.96	1.18	2748.2	3623.1	460.8	
1	***0.4***	***0.1***	***0.9***	***0.57***	***-0.4***	***-0.77***	***0.9***	***0.57***	***-0.4***	***-0.77***	***0.99***	***0.2***	***2.2***	***7.18***	***1.64***
2	**0.7**	**0.6**	**1.0**	**0.45**	**0.0**	**0.00**	**0.9**	**0.52**	**0.4**	**-0.17**	**0.47**	**0.2**	**0.6**	**6.16**	**2.42**
3	**0.6**	**0.1**	**1.0**	**0.57**	**-0.3**	**-0.90**	**1.0**	**0.57**	**-0.3**	**-0.92**	**1.10**	**0.4**	**2.0**	**7.35**	**3.30**
4	0.8	0.4	0.8	0.55	0.0	0.00	0.8	0.62	0.1	-0.49	0.66	0.4	0.3	8.11	3.98
5	0.7	0.1	1.0	0.53	-0.3	-0.84	1.0	0.54	-0.3	-0.84	1.07	0.4	1.1	7.35	4.50
6	0.2	0.3	0.3	-0.03	-0.1	-0.49	0.3	0.14	-0.1	-0.49	1.02	0.0	0.0	4.13	5.12
7	**0.7**	**0.4**	**1.0**	**0.43**	**-0.1**	**-0.55**	**0.9**	**0.54**	**-0.1**	**-0.55**	**0.93**	**0.3**	**1.2**	**7.35**	**6.02**
8	0.6	0.0	0.9	0.49	-0.3	-1.01	0.9	0.49	-0.3	-1.01	1.18	0.4	1.4	8.38	6.46
9	***1.1***	***0.3***	***1.5***	***0.89***	***0.0***	***0.00***	***1.5***	***1.00***	***0.1***	***-0.79***	***0.58***	***1.2***	***2.2***	***11.81***	***7.02***
10	1.0	0.3	1.3	0.62	-0.1	-0.83	1.2	0.64	-0.1	-0.83	1.01	0.6	1.7	8.30	7.70
11	1.0	0.2	1.4	0.77	-0.4	-1.11	1.4	0.81	-0.3	-1.12	1.08	1.2	2.9	14.38	8.18
12	***1.2***	***0.0***	***1.7***	***1.15***	***-0.5***	***-1.27***	***1.7***	***1.15***	***-0.5***	***-1.27***	***1.08***	***1.9***	***3.4***	***14.86***	***8.66***
13	**1.1**	**0.8**	**1.3**	**0.74**	**0.0**	**0.00**	**1.2**	**0.95**	**0.5**	**-0.44**	**0.57**	**0.7**	**0.5**	**14.92**	**9.16**
14	0.9	0.3	1.2	0.56	-0.2	-0.80	1.2	0.56	-0.2	-0.93	0.96	0.5	1.5	8.45	9.72
15	***0.7***	***0.6***	***1.0***	***0.49***	***0.0***	***0.00***	***0.9***	***0.60***	***0.5***	***-0.22***	***0.48***	***0.3***	***0.3***	***7.35***	***10.10***
16	***1.2***	***0.7***	***1.7***	***1.00***	***0.0***	***0.00***	***1.6***	***1.00***	***0.3***	***-0.87***	***0.60***	***0.7***	***2.3***	***8.00***	***10.62***
17	***1.1***	***-0.2***	***1.5***	***0.81***	***-1.0***	***-1.72***	***1.5***	***0.84***	***-1.0***	***-1.73***	***0.98***	***1.6***	***9.5***	***16.09***	***11.46***
18	***2.4***	***0.3***	***4.4***	***2.19***	***-0.9***	***-1.86***	***4.4***	***2.19***	***-0.9***	***-1.98***	***0.76***	***8.1***	***8.1***	***29.55***	***12.08***
19	1.7	0.1	2.5	1.05	-0.8	-1.53	2.5	1.05	-0.8	-1.53	0.79	2.7	10.5	19.37	12.86
20	*2.7*	*-0.9*	*4.1*	*1.88*	-2.8	*-2.83*	*4.0*	*1.91*	-2.8	*-2.83*	*0.68*	*9.3*	*18.5*	*47.12*	*13.40*
21	***3.5***	***-0.3***	***6.4***	***2.70***	***-3.2***	***-3.17***	***6.2***	***2.89***	***-3.2***	***-3.17***	***0.61***	***17.2***	***17.7***	***57.72***	***13.96***
22	***4.8***	***-1.1***	***9.1***	***3.49***	***-4.4***	***-3.98***	***8.9***	***3.73***	***-4.1***	***-4.05***	***0.55***	***29.7***	***39.6***	***75.25***	***14.54***
23	5.3	-0.8	7.8	2.70	-3.8	-3.36	7.7	2.86	-3.8	-3.36	0.52	19.7	20.4	79.95	15.06
24	***8.7***	***-2.4***	***12.9***	***4.58***	***-9.1***	***-6.06***	***12.9***	***4.58***	***-9.0***	***-6.36***	***0.48***	***69.4***	***93.3***	***146.49***	***15.58***
25	***13.8***	***-4.1***	***21.8***	***6.26***	***-13.0***	***-7.17***	***21.7***	***6.69***	***-11.5***	***-7.22***	***0.39***	***143.8***	***160.9***	***171.45***	***16.16***
26	11.9	-2.8	17.9	4.45	-6.4	-3.04	17.9	4.45	-4.7	-3.10	0.31	68.3	49.2	183.63	16.68
27	***16.1***	***-34.6***	***28.7***	***6.95***	***-61.7***	***-2.56***	***25.1***	***7.33***	***-19.5***	***-8.96***	***0.11***	***345.8***	***401.2***	***272.73***	***17.48***
28	4.7	-14.2	12.0	2.83	-30.8	-1.89	12.0	2.83	-29.0	-1.98	0.11	106.2	113.4	296.42	18.20

Table 22. SE19-PA-1

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
29	3.0	-1.5	7.0	1.90	-10.4	0.29	7.0	1.90	-1.9	-0.80	0.09	19.9	14.5	175.90	18.86
30	7.4	-11.1	14.8	3.14	-28.5	-1.59	14.8	3.14	-12.9	-1.98	0.11	61.6	117.3	154.50	20.12
31	11.0	-6.5	25.5	5.42	-25.5	-1.51	25.5	5.42	-12.9	-1.86	0.14	115.2	136.0	212.00	21.34
32	4.1	-6.5	7.4	1.53	-14.8	-1.43	7.4	1.53	-13.1	-1.64	0.13	29.2	35.0	132.84	21.94
33	10.4	-9.5	23.1	4.36	-31.7	-1.75	23.1	4.36	-31.2	-1.99	0.11	91.7	124.5	182.82	23.20
34	**6.5**	**-5.0**	**13.2**	**2.20**	**-11.0**	**-1.32**	**13.2**	**2.24**	**-10.2**	**-1.50**	**0.15**	**45.5**	**56.4**	**110.47**	**24.92**
35	5.8	2.5	7.9	1.39	-3.2	0.02	7.9	1.39	1.7	-0.60	0.12	8.1	6.8	94.87	25.36
36	5.3	-1.7	7.0	1.14	-4.4	-1.10	7.0	1.14	-4.2	-1.18	0.20	8.7	12.4	47.18	25.92
37	5.1	-3.7	7.8	1.29	-14.9	-1.46	7.7	1.34	-12.6	-1.58	0.12	23.7	50.5	101.98	26.96
38	*11.0*	*-47.7*	*21.1*	*3.43*	*-133.7*	*-1.61*	*21.1*	*3.76*	*-107.6*	*-3.15*	*0.03*	*280.5*	*366.9*	*460.79*	*28.62*
39	-11.9	-18.6	0.0	0.00	-52.2	-1.02	-13.0	1.09	-31.0	-1.36	0.02	44.5	79.8	358.65	29.68
40	10.6	-34.5	28.2	4.95	-96.7	-1.18	27.9	5.04	-21.8	-1.91	0.05	154.3	238.4	232.47	32.00
41	-8.2	-11.9	0.0	0.00	-30.4	0.06	-7.6	0.55	-15.3	-0.93	0.00	7.1	11.6	209.89	32.48
42	3.5	-11.0	6.7	1.37	-54.5	-1.29	6.6	1.47	-27.7	-1.29	0.04	40.3	57.4	228.92	33.44
43	12.2	-3.5	27.9	4.50	-41.2	-1.02	27.9	4.50	-40.2	-1.16	0.08	79.7	98.8	228.16	34.78
44	6.8	-2.6	13.0	1.67	-14.6	-0.70	12.3	1.76	-13.6	-0.87	0.09	21.4	24.2	155.00	35.54
45	11.8	-4.5	26.6	4.12	-58.5	-1.42	26.6	4.12	-31.7	-1.70	0.07	77.1	167.0	356.11	37.18
46	**39.7**	**5.2**	**60.2**	**2.34**	**-18.6**	**-1.06**	**33.0**	**6.81**	**-8.6**	**-1.11**	**0.04**	**214.6**	**210.4**	**348.36**	**38.08**
47	17.9	4.0	19.0	1.06	-10.0	-0.84	16.9	1.45	-5.3	-0.96	0.07	26.3	31.3	184.09	38.64
48	25.3	1.4	28.9	1.31	-27.3	-0.83	21.8	1.90	-14.1	-1.11	0.04	53.4	64.4	190.21	39.44
49	7.2	1.4	8.9	0.60	-10.2	-0.70	8.8	0.74	-9.5	-0.84	0.07	7.8	11.2	99.76	40.12
50	14.3	2.4	21.6	1.18	-6.9	-0.77	18.4	1.37	-4.7	-0.93	0.07	23.5	28.6	113.82	40.90
51	10.2	1.1	18.2	0.94	-9.3	-0.79	16.3	1.32	-7.2	-0.90	0.06	18.3	23.7	105.41	41.58
52	6.3	2.4	8.4	0.70	-6.0	-0.74	8.2	0.70	-6.0	-0.74	0.10	5.4	7.6	79.31	42.22
53	3.0	1.3	3.1	0.06	-15.2	-0.92	2.8	0.06	-15.0	-0.94	0.05	4.5	14.3	94.17	43.16
54	5.0	3.7	7.0	0.56	0.0	0.00	6.8	0.62	3.3	-0.26	0.08	1.9	0.1	74.93	43.52
55	9.3	2.2	16.9	1.14	-1.8	-0.65	16.6	1.19	-1.1	-0.73	0.10	12.5	18.1	89.38	44.22
56	9.3	3.9	18.6	0.99	0.0	0.00	15.6	1.32	0.6	-0.58	0.05	14.2	18.8	112.13	44.82
57	7.9	2.0	9.3	0.71	-11.2	-0.82	8.8	0.72	-5.6	-0.85	0.07	7.8	12.7	91.50	45.46
58	4.6	3.0	5.3	0.30	-0.8	-0.54	5.1	0.34	-0.7	-0.57	0.14	1.9	2.7	59.78	45.88
59	5.2	1.9	6.7	0.51	-12.3	-0.86	6.7	0.51	-12.0	-0.88	0.07	5.4	9.3	106.68	46.50

Table 22. SE19-PA-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
60	7.9	2.2	10.5	0.81	-6.0	-0.70	10.5	0.92	-4.1	-0.78	0.09	8.2	9.0	98.81	47.02
61	12.1	1.6	20.0	1.27	-10.0	-0.74	16.8	1.40	-4.4	-0.91	0.07	20.7	24.8	132.02	47.72
62	11.4	3.0	19.1	1.08	-11.9	-0.83	17.0	1.40	-6.4	-0.91	0.06	19.7	26.5	131.19	48.60
63	3.1	2.3	3.1	0.02	-8.3	-0.76	3.1	0.02	-7.9	-0.81	0.07	2.6	7.4	134.18	49.00
64	24.5	1.4	41.7	1.41	-50.5	-1.10	33.7	2.00	-32.9	-1.35	0.03	78.2	97.9	206.56	50.18
65	3.4	1.8	3.7	0.16	-8.7	-0.71	3.7	0.18	-7.6	-0.72	0.07	2.8	6.9	71.06	50.86
66	0.0	3.0	4.9	0.26	-0.3	-0.44	4.9	0.33	-0.1	-0.46	0.14	1.4	1.2	62.61	51.32
67	9.6	1.8	12.1	0.86	-3.3	-0.61	12.0	0.88	-2.2	-0.67	0.10	7.3	10.2	100.48	52.04
68	11.2	0.6	18.8	1.03	-24.5	-0.92	16.9	1.25	-19.0	-0.98	0.05	22.6	31.2	156.14	52.86
69	8.9	0.9	12.3	0.94	-11.4	-0.84	12.0	1.00	-11.4	-0.84	0.08	12.0	14.4	129.66	53.56
70	7.6	0.8	10.7	0.87	-15.7	-0.87	9.6	0.89	-12.5	-0.87	0.07	10.6	14.3	154.81	54.20
71	11.4	6.9	23.8	0.89	0.0	0.00	18.4	1.44	6.2	-0.31	0.04	21.0	23.5	154.43	54.76
72	0.0	1.3	19.3	0.83	-18.6	-0.97	17.4	1.16	-18.4	-1.01	0.05	17.0	53.1	95.69	56.30
73	7.5	3.6	19.5	1.01	-4.0	-0.71	17.9	1.12	-3.5	-0.76	0.07	13.9	11.4	107.17	57.84
74	8.8	2.4	30.4	1.29	-24.1	-1.00	19.2	1.45	-23.4	-1.03	0.04	37.1	74.6	156.30	59.60
75	9.4	4.3	23.1	1.13	-3.5	-0.63	17.1	1.31	-3.1	-0.74	0.07	19.6	12.4	141.92	60.32
76	13.3	2.3	28.1	1.09	-16.1	-0.80	26.1	1.37	-10.1	-0.90	0.04	29.4	38.8	158.62	61.38
77	6.6	4.9	10.1	0.72	0.0	0.00	9.3	0.77	4.0	-0.27	0.07	3.0	3.7	60.71	61.94
78	7.3	2.3	11.6	0.75	-7.8	-0.75	11.5	0.81	-7.4	-0.79	0.08	6.2	11.8	67.33	62.88
79	6.6	3.4	12.2	0.79	-5.0	-0.72	12.1	0.82	-4.4	-0.72	0.09	6.7	12.6	60.87	64.10
80	5.4	3.9	7.8	0.57	0.0	0.00	7.6	0.60	0.8	-0.44	0.07	2.0	1.8	46.49	64.72
81	5.1	3.7	*5.6*	0.22	0.0	0.00	5.6	0.22	0.8	-0.46	0.04	0.8	1.0	41.78	65.14
82	6.2	3.9	14.8	0.89	0.0	0.00	13.9	0.94	1.0	-0.48	0.06	6.8	11.0	73.79	66.28
83	**4.1**	**3.5**	**4.1**	**-0.01**	**-2.9**	**-0.68**	**4.1**	**0.03**	**-2.1**	**-0.68**	**0.10**	**1.4**	**2.9**	**36.39**	**66.86**
84	**5.2**	**3.9**	**5.9**	**0.29**	**0.0**	**0.00**	**5.8**	**0.30**	**2.7**	**-0.33**	**0.05**	**0.6**	**0.6**	**29.08**	**67.34**
85	**5.0**	**3.4**	**6.1**	**0.29**	**-0.2**	**-0.55**	**6.0**	**0.30**	**-0.2**	**-0.55**	**0.13**	**1.2**	**1.6**	**23.75**	**68.04**
86	**4.2**	**2.7**	**4.3**	**0.08**	**-2.8**	**-0.66**	**4.3**	**0.08**	**-2.8**	**-0.67**	**0.10**	**1.4**	**3.1**	**34.23**	**68.66**
87	**6.4**	**2.6**	**10.5**	**0.75**	**-6.4**	**-0.74**	**10.0**	**0.76**	**-5.4**	**-0.75**	**0.09**	**5.2**	**11.7**	**59.22**	**70.00**
88	**6.3**	**5.0**	**8.6**	**0.59**	**0.0**	**0.00**	**8.3**	**0.63**	**4.4**	**-0.22**	**0.07**	**1.8**	**1.6**	**53.59**	**70.48**
89	**7.3**	**2.3**	**10.8**	**0.74**	**-3.7**	**-0.68**	**10.7**	**0.78**	**-3.4**	**-0.72**	**0.10**	**4.8**	**11.5**	**42.19**	**72.16**
90	**7.2**	**5.2**	**13.0**	**0.82**	**0.0**	**0.00**	**12.8**	**0.87**	**4.5**	**-0.26**	**0.06**	**5.2**	**6.6**	**62.71**	**72.76**

Table 22. SE19-PA-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
91	**8.8**	**3.5**	**12.5**	**0.75**	**-3.5**	**-0.69**	**11.6**	**0.82**	**-2.9**	**-0.74**	**0.09**	**6.3**	**8.8**	**70.04**	**73.46**
92	**6.7**	**3.4**	**10.9**	**0.72**	**0.0**	**0.00**	**10.2**	**0.76**	**0.5**	**-0.53**	**0.07**	**4.7**	**5.6**	**68.47**	**74.02**
93	7.5	2.6	10.8	0.72	-5.6	-0.73	10.1	0.76	-5.5	-0.77	0.09	6.4	14.6	57.49	75.44
94	8.5	3.4	11.1	0.72	-2.3	-0.65	9.7	0.78	-2.2	-0.67	0.10	6.2	10.0	59.03	76.66
95	***4.4***	***3.7***	***4.6***	***0.11***	***0.0***	***0.00***	***4.5***	***0.14***	***2.2***	***-0.33***	***0.02***	***0.3***	***0.3***	***24.00***	***77.10***
96	***6.5***	***3.6***	***9.5***	***0.65***	***-0.5***	***-0.55***	***9.2***	***0.69***	***-0.4***	***-0.55***	***0.12***	***2.9***	***6.2***	***31.37***	***78.32***
97	*3.9*	*3.8*	*4.0*	*0.04*	*-2.2*	*-0.63*	*4.0*	*0.04*	*-1.8*	*-0.66*	*0.11*	*1.1*	*2.9*	*28.00*	*79.40*
98	***4.4***	***3.3***	***4.5***	***0.05***	***0.0***	***0.00***	***4.5***	***0.05***	***0.5***	***-0.52***	***0.01***	***0.8***	***1.7***	***23.80***	***80.28***
99	***7.0***	***4.1***	***9.7***	***0.69***	***0.0***	***0.00***	***9.3***	***0.72***	***1.7***	***-0.46***	***0.07***	***2.7***	***4.6***	***30.21***	***81.48***
100	***5.3***	***4.4***	***6.2***	***0.28***	***0.0***	***0.00***	***6.2***	***0.28***	***3.8***	***-0.22***	***0.05***	***0.4***	***0.4***	***27.36***	***81.94***
101	***5.5***	***4.5***	***7.0***	***0.38***	***0.0***	***0.00***	***7.0***	***0.40***	***2.6***	***-0.36***	***0.05***	***0.7***	***0.8***	***24.76***	***82.68***
102	*5.0*	*3.5*	*5.3*	*0.12*	*-0.2*	*-0.55*	*5.3*	*0.12*	*-0.1*	*-0.56*	*0.12*	*1.0*	*1.4*	*41.30*	*83.40*
103	6.2	4.3	8.5	0.59	0.0	0.00	8.5	0.59	1.8	-0.41	0.07	1.8	2.4	41.81	84.08
104	5.3	3.6	6.1	0.24	-2.9	-0.67	6.1	0.26	-2.9	-0.67	0.10	1.9	3.5	44.32	84.78
105	5.4	4.7	6.8	0.40	0.0	0.00	6.8	0.40	3.9	-0.21	0.06	0.7	0.7	32.30	85.82
106	6.4	5.4	7.9	0.54	0.0	0.00	7.8	0.54	4.9	-0.18	0.07	0.7	1.3	15.68	86.92
107	4.8	4.6	7.9	0.49	0.0	0.00	7.9	0.52	1.1	-0.46	0.06	1.1	1.9	11.87	91.58

Table 23. SE19-PA-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	-32.6	-44.3	66.2	1.73	-123.6	-3.17	22.8	7.32	-13.0	-7.07	1.45	3341.8	4095.6	528.2	
1	***0.5***	***0.3***	***0.9***	***0.51***	***0.0***	***-0.67***	***0.9***	***0.53***	***0.0***	***-0.78***	***1.20***	***-0.1***	***2.1***	***5.97***	***1.62***
2	**0.7**	**0.6**	**1.0**	**0.45**	**0.0**	**0.00**	**1.0**	**0.52**	**0.5**	**-0.26**	**0.46**	**0.2**	**0.6**	**5.51**	**2.44**
3	0.8	0.3	1.0	0.52	0.0	0.00	0.9	0.53	0.0	-0.83	0.52	0.3	1.7	4.38	3.28
4	0.7	0.5	0.8	0.40	0.0	0.00	0.8	0.40	0.1	-0.63	0.52	0.2	0.3	5.21	3.86
5	0.8	0.2	0.9	0.55	-0.2	*-1.04*	0.9	0.55	-0.2	*-1.04*	*1.45*	0.5	*1.6*	5.00	*4.44*
6	***0.8***	***0.3***	***1.0***	***0.53***	***0.0***	***0.00***	***0.9***	***0.58***	***0.1***	***-0.61***	***0.54***	***0.3***	***1.2***	***7.68***	***5.96***
7	0.8	*0.1*	*1.0*	0.56	-0.2	*-1.11*	*1.0*	0.59	-0.2	*-1.12*	*1.40*	0.6	*2.3*	*7.18*	*6.42*
8	***1.0***	***0.3***	***1.6***	***1.25***	***-0.1***	***-1.04***	***1.6***	***1.25***	***0.1***	***-1.18***	***1.34***	***1.6***	***2.3***	***10.92***	***6.96***
9	0.9	0.3	1.0	0.50	0.0	-0.91	0.9	0.61	0.0	-0.91	1.32	0.5	1.4	7.81	7.70
10	*1.0*	0.2	*1.3*	0.87	*-0.4*	*-1.41*	*1.2*	*0.91*	*-0.4*	*-1.42*	*1.32*	*1.5*	*3.7*	*15.02*	*8.16*
11	***1.1***	***-0.1***	***1.8***	***1.44***	***-0.8***	***-1.76***	***1.6***	***1.46***	***-0.7***	***-1.79***	***1.21***	***2.9***	***4.7***	***16.07***	***8.64***
12	***1.0***	***0.2***	***1.6***	***1.39***	***-0.1***	***-1.05***	***1.6***	***1.44***	***0.1***	***-1.06***	***1.44***	***1.8***	***1.0***	***18.13***	***9.10***
13	***0.8***	***0.2***	***1.0***	***0.50***	***-0.2***	***-0.89***	***1.0***	***0.51***	***-0.2***	***-0.98***	***1.13***	***0.6***	***2.0***	***6.94***	***9.66***
14	***0.9***	***0.5***	***1.2***	***0.63***	***0.0***	***0.00***	***1.0***	***0.83***	***0.3***	***-0.61***	***0.51***	***0.7***	***0.6***	***10.39***	***10.12***
15	***1.0***	***0.4***	***1.4***	***0.92***	***0.0***	***0.00***	***1.4***	***0.93***	***0.2***	***-1.06***	***0.66***	***0.7***	***2.0***	***10.40***	***10.60***
16	***1.0***	***0.1***	***1.3***	***0.78***	***-0.8***	***-1.65***	***1.3***	***0.78***	***-0.8***	***-1.76***	***1.15***	***1.6***	***9.2***	***18.03***	***11.46***
17	***2.3***	***-0.1***	***3.7***	***2.33***	***-1.3***	***-2.25***	***3.7***	***2.37***	***-1.3***	***-2.25***	***0.91***	***7.5***	***6.9***	***24.57***	***12.04***
18	1.4	0.1	2.1	1.19	-0.7	-1.54	1.8	1.28	-0.7	-1.54	1.00	2.6	9.0	24.07	12.84
19	*2.1*	*-1.3*	*3.1*	*1.80*	*-3.1*	*-3.16*	*3.1*	*1.91*	*-3.1*	*-3.22*	*0.79*	*9.6*	*21.7*	*45.59*	*13.38*
20	***2.5***	***-1.2***	***5.7***	***3.34***	***-4.6***	***-4.27***	***5.7***	***3.52***	***-4.6***	***-4.27***	***0.73***	***23.7***	***26.3***	***63.18***	***13.94***
21	***3.6***	***-2.9***	***9.0***	***4.82***	***-6.9***	***-5.20***	***8.8***	***5.17***	***-6.8***	***-5.50***	***0.63***	***45.7***	***56.5***	***84.88***	***14.52***
22	3.8	-3.1	8.1	4.01	-6.8	-5.12	8.0	4.31	-6.8	-5.12	0.61	35.4	35.1	97.54	15.06
23	***7.3***	***-6.7***	***12.5***	***6.17***	***-13.3***	***-6.60***	***11.1***	***6.27***	***-13.0***	***-7.07***	***0.50***	***98.9***	***116.8***	***155.58***	***15.58***
24	***11.1***	***-8.5***	***19.1***	***6.75***	***-16.8***	***-6.84***	***15.8***	***7.28***	***-14.9***	***-7.06***	***0.38***	***155.2***	***163.2***	***190.88***	***16.16***
25	8.6	-4.6	13.7	3.84	-8.5	-2.48	13.7	3.84	-7.9	-2.78	0.29	59.2	42.9	176.09	16.68
26	***14.8***	***-43.9***	***26.5***	***5.57***	***-62.0***	***-2.87***	***22.8***	***7.32***	***-19.9***	***-7.05***	***0.10***	***302.7***	***384.0***	***254.76***	***17.44***
27	5.5	*-15.9*	*17.9*	*3.78*	*-38.7*	0.02	*17.5*	*4.11*	*-8.6*	*-2.43*	0.07	*123.2*	*122.8*	*324.69*	*18.20*

Table 23. SE19-PA-2

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
28	**0.2**	**-4.7**	**3.2**	**2.11**	**-12.5**	**0.20**	**3.2**	**2.11**	**-5.8**	**-1.09**	**0.12**	**21.3**	**18.6**	**158.94**	**18.84**
29	3.6	-12.4	10.7	2.60	-28.3	-1.95	10.5	2.65	-27.1	-2.17	0.12	69.3	120.7	120.92	20.08
30	9.4	-8.9	25.0	4.75	-12.3	-1.62	22.7	5.06	-9.9	-1.77	0.17	102.1	103.4	200.92	20.84
31	-8.8	-10.3	0.0	0.00	-28.9	-1.91	-8.8	0.04	-27.7	-1.99	0.07	26.5	50.8	144.15	21.32
32	4.9	-10.6	6.7	1.64	-16.6	-1.55	6.7	2.22	-9.5	-1.75	0.14	39.5	41.1	140.30	21.92
33	**10.0**	**-8.3**	**20.9**	**3.52**	**-28.4**	**-1.81**	**20.9**	**3.52**	**-27.3**	**-1.97**	**0.11**	**95.2**	**121.8**	**176.72**	**23.18**
34	5.6	-6.4	9.0	2.01	-8.1	-1.25	8.9	2.10	-6.9	-1.35	0.19	27.6	31.2	113.41	24.26
35	3.2	-9.6	4.2	1.49	-14.9	-1.63	4.2	1.49	-14.9	-1.63	0.16	26.7	35.7	81.88	24.90
36	**2.5**	**-1.2**	**5.0**	**1.53**	**-8.1**	**0.04**	**4.3**	**1.73**	**-1.7**	**-0.87**	**0.11**	**12.4**	**10.4**	**97.10**	**25.36**
37	1.9	-7.1	2.8	1.22	-9.2	-1.29	2.8	1.22	-9.0	-1.45	0.21	12.8	17.5	42.53	25.90
38	2.8	-7.2	3.7	1.37	-15.8	-1.66	3.3	1.53	-15.5	-1.66	0.16	25.8	55.3	87.19	26.92
39	*6.6*	*-44.3*	*20.3*	*3.13*	*-123.6*	*-3.17*	*20.1*	*3.28*	*-109.5*	*-3.69*	*0.04*	*277.5*	*412.0*	*528.19*	*28.56*
40	**17.5**	**-16.6**	**31.3**	**4.55**	**-34.1**	**0.40**	**27.5**	**4.69**	**-16.2**	**-2.01**	**0.06**	**173.2**	**132.7**	**514.46**	**29.44**
41	-3.6	-8.8	0.0	0.00	-14.9	0.04	-0.7	1.24	-10.1	-1.16	0.00	15.1	11.4	81.90	30.26
42	15.2	-40.1	30.5	4.04	-77.6	-2.09	29.6	4.25	-15.0	-2.49	0.06	168.3	219.6	213.17	31.34
43	-32.6	-33.6	0.0	0.00	-46.2	-1.31	-32.6	0.17	-45.6	-1.46	0.03	7.7	36.3	185.74	31.84
44	9.9	-7.2	17.1	2.04	-30.0	0.27	16.0	2.18	-7.9	-0.58	0.04	60.0	47.7	217.14	32.52
45	0.4	-24.9	1.2	1.05	-57.6	-1.50	1.0	1.12	-56.0	-1.84	0.04	61.5	101.1	234.36	33.36
46	**11.1**	**-13.1**	**34.1**	**3.99**	**-38.2**	**-1.37**	**30.1**	**4.48**	**-29.4**	**-1.38**	**0.07**	**130.8**	**134.8**	**253.05**	**34.66**
47	2.1	-9.0	7.5	1.41	-19.0	-1.16	6.6	1.51	-16.0	-1.23	0.10	27.1	33.9	150.56	35.52
48	8.9	-12.4	25.7	2.43	-46.3	-1.38	23.5	2.78	-20.6	-1.50	0.05	90.7	160.2	202.88	37.08
49	**-1.7**	**-5.7**	**66.2**	**1.73**	**-21.6**	**-0.57**	**37.1**	**5.10**	**37.6**	**-2.35**	**0.03**	**244.2**	**257.6**	**315.25**	**38.04**
50	13.6	-6.0	14.5	0.73	-12.8	-0.78	14.4	0.81	-10.3	-0.84	0.06	21.6	25.4	147.07	38.60
51	20.0	-16.3	26.1	1.14	-28.4	-0.94	21.9	1.40	-24.9	-1.01	0.04	53.1	60.2	191.99	39.34
52	3.9	-11.4	4.1	0.39	-16.4	-0.71	4.1	0.39	-16.2	-0.71	0.05	13.2	15.5	167.39	40.04
53	13.4	-5.4	14.0	0.78	-10.6	0.04	12.5	0.85	-6.7	-0.59	0.03	17.7	20.2	85.99	40.82
54	14.2	-6.9	18.3	0.80	-9.7	-0.62	14.9	1.08	-9.1	-0.64	0.05	23.5	27.2	112.49	41.50
55	5.1	-6.2	5.5	0.40	-9.2	-0.66	4.9	0.50	-9.2	-0.66	0.07	9.4	10.9	78.68	42.10
56	-2.6	-13.4	0.0	0.00	-21.2	-0.95	-2.4	0.26	-21.2	-0.95	0.04	10.2	17.2	82.36	43.06
57	-1.7	-5.8	0.0	0.00	-11.9	0.07	-1.8	0.36	-6.2	-0.51	0.01	3.3	3.3	83.82	43.52

Table 23. SE19-PA-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
58	9.7	-0.3	10.7	0.74	-5.0	0.00	10.4	0.74	-0.5	-0.34	0.05	9.9	11.6	81.90	44.16
59	14.8	0.9	19.0	0.97	0.0	0.00	16.5	1.12	0.4	-0.42	0.05	17.3	21.9	107.51	44.78
60	7.6	-9.8	8.1	0.56	-13.5	-0.67	7.7	0.60	-12.9	-0.73	0.06	12.3	14.6	66.04	45.36
61	-0.9	-7.5	0.0	0.00	-9.1	-0.57	-2.8	0.35	-8.9	-0.58	0.06	4.9	5.6	76.40	45.84
62	-2.6	-12.4	0.0	0.00	-20.6	-0.95	-2.0	0.27	-19.7	-0.99	0.05	10.3	14.1	98.23	46.44
63	1.7	-9.8	2.1	0.35	-14.2	-0.70	0.6	0.52	-14.1	-0.70	0.06	10.4	11.2	107.24	46.98
64	10.8	-8.3	12.2	0.57	-12.6	-0.64	10.3	0.92	-12.5	-0.72	0.05	19.6	22.1	113.79	47.66
65	12.4	-10.4	16.0	0.71	-13.8	-0.70	12.4	1.00	-12.9	-0.73	0.05	23.6	27.5	126.68	48.42
66	-2.9	-10.4	0.0	0.00	-17.2	-0.88	-3.1	0.35	-17.1	-0.91	0.05	8.2	10.5	98.75	48.98
67	17.6	-37.0	31.9	1.26	-51.4	-1.26	22.8	1.39	-50.3	-1.41	0.03	82.4	98.2	191.45	49.92
68	-2.8	-16.2	0.0	0.00	-32.9	0.00	-6.4	1.09	-19.7	-0.99	0.00	29.2	31.4	213.08	50.78
69	-9.9	-13.3	0.0	0.00	-15.0	0.15	-9.0	0.75	-14.6	-0.74	0.01	4.4	4.6	65.37	51.28
70	-4.0	-14.4	0.0	0.00	-18.5	-0.76	-3.4	1.09	-18.2	-1.11	0.04	14.0	18.6	82.42	52.02
71	2.6	-19.9	5.4	1.17	-35.3	-1.27	5.1	1.27	-28.2	-1.50	0.06	44.8	55.5	152.15	52.78
72	3.8	-13.6	5.0	1.09	-19.3	-0.94	5.0	1.09	-17.5	-0.94	0.08	19.1	19.8	164.94	53.50
73	0.5	-16.3	1.3	0.54	-24.7	-1.16	1.1	0.61	-24.0	-1.38	0.07	17.7	23.0	140.14	54.14
74	9.6	-0.7	16.4	1.09	-13.4	0.00	13.0	1.37	-0.4	-0.26	0.04	22.1	24.1	162.98	54.74
75	8.7	-15.5	12.7	0.96	-24.0	-1.35	12.7	1.08	-23.1	-1.44	0.06	20.4	50.0	75.67	56.14
76	6.9	0.4	10.9	0.93	-14.1	0.01	10.7	1.13	0.0	-0.23	0.04	12.2	6.9	85.92	56.96
77	4.2	-6.8	5.2	0.59	-7.7	-0.38	5.2	0.59	-7.4	-0.39	0.08	4.6	5.8	34.08	57.76
78	6.1	-1.5	23.4	1.19	-6.1	0.06	19.8	1.27	-1.4	-0.29	0.04	22.3	30.7	138.94	58.42
79	7.0	-15.4	10.6	0.75	-25.9	-1.30	10.4	0.83	-22.9	-1.42	0.06	21.1	47.3	123.44	59.48
80	10.1	-8.0	20.7	1.25	-12.8	0.13	19.4	1.37	-7.8	-0.41	0.03	23.1	16.6	155.96	60.24
81	12.0	-13.8	22.8	1.16	-20.7	-1.23	18.6	1.27	-20.7	-1.23	0.05	29.2	35.1	158.24	61.06
82	-0.3	-3.0	0.2	0.33	-12.9	0.06	0.2	0.37	-3.2	-0.24	0.02	3.0	3.3	54.42	61.92
83	4.3	-10.9	5.3	0.56	-12.6	-0.58	5.3	0.56	-11.7	-0.61	0.06	7.8	9.2	46.62	62.76
84	3.1	-10.7	3.6	0.44	-13.0	-0.62	3.5	0.49	-12.8	-0.65	0.06	8.4	10.1	49.72	64.02
85	-4.9	-9.8	0.0	0.00	-11.2	-0.54	-4.8	0.26	-11.0	-0.58	0.05	3.0	3.3	39.37	64.64
86	-6.6	-9.5	0.0	0.00	-10.8	-0.53	-6.1	0.21	-10.7	-0.54	0.05	1.8	2.0	33.57	65.10
87	3.9	2.1	5.1	0.49	-8.8	0.06	5.0	0.54	1.7	-0.19	0.03	4.7	5.2	80.00	65.68

Table 23. SE19-PA-2

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
88	3.3	-1.2	4.2	0.49	-1.7	-0.22	4.2	0.49	-0.9	-0.23	0.12	1.4	1.6	24.07	66.16
89	0.7	-5.7	1.2	0.33	-6.7	-0.35	1.1	0.33	-6.7	-0.35	0.09	2.2	2.4	22.16	66.72
90	-1.1	-3.5	0.0	0.00	-5.2	0.07	-0.6	0.32	-3.7	-0.25	0.01	1.6	1.8	26.29	67.30
91	-1.1	-5.8	0.0	0.00	-7.0	-0.37	-0.4	0.32	-7.0	-0.37	0.05	2.0	2.2	24.70	67.94
92	-3.9	-9.3	0.0	0.00	-11.0	-0.56	-3.4	0.25	-10.8	-0.58	0.05	2.9	3.4	22.03	68.56
93	2.3	-9.4	3.1	0.44	-10.6	-0.56	2.8	0.46	-10.6	-0.56	0.07	6.8	7.9	36.36	69.88
94	**-0.8**	**-1.7**	**0.0**	**0.00**	**-8.9**	**0.01**	**-0.1**	**0.35**	**-4.4**	**-0.26**	**0.00**	**3.5**	**3.8**	**39.75**	**71.00**
95	**3.0**	**-9.3**	**3.9**	**0.44**	**-11.3**	**-0.55**	**3.9**	**0.52**	**-10.9**	**-0.57**	**0.07**	**5.9**	**7.5**	**33.08**	**72.16**
96	**0.8**	**-2.8**	**1.4**	**0.37**	**-8.6**	**0.11**	**1.3**	**0.38**	**-3.3**	**-0.25**	**0.03**	**3.4**	**3.6**	**61.66**	**72.72**
97	**5.3**	**-7.4**	**6.4**	**0.63**	**-8.1**	**-0.40**	**5.8**	**0.63**	**-8.1**	**-0.40**	**0.07**	**6.4**	**7.4**	**49.85**	**73.36**
98	**4.2**	**-4.6**	**5.1**	**0.51**	**-6.5**	**0.04**	**5.1**	**0.56**	**-5.0**	**-0.31**	**0.04**	**5.7**	**6.3**	**65.21**	**73.96**
99	**4.7**	**-5.3**	**5.6**	**0.59**	**-6.3**	**-0.34**	**5.3**	**0.60**	**-5.7**	**-0.35**	**0.08**	**5.8**	**6.5**	**56.96**	**74.60**
100	**-3.6**	**-10.5**	**0.0**	**0.00**	**-13.9**	**-0.69**	**-3.3**	**0.23**	**-13.9**	**-0.69**	**0.05**	**3.9**	**6.7**	**28.19**	**75.38**
101	**4.1**	**-4.0**	**4.9**	**0.50**	**-10.0**	**0.03**	**4.7**	**0.55**	**-4.6**	**-0.29**	**0.03**	**5.8**	**6.5**	**46.93**	**76.52**
102	**0.1**	**-1.2**	**1.0**	**0.35**	**-3.6**	**0.04**	**1.0**	**0.35**	**-1.6**	**-0.20**	**0.07**	**1.5**	**1.6**	**31.57**	**77.04**
103	**4.0**	**-3.4**	**5.1**	**0.54**	**-4.1**	**-0.29**	**4.9**	**0.58**	**-4.1**	**-0.29**	**0.09**	**3.8**	**5.5**	**29.64**	**78.18**
104	**-1.6**	**-6.8**	**0.0**	**0.00**	**-8.2**	**-0.44**	**-1.0**	**0.30**	**-8.2**	**-0.44**	**0.05**	**2.2**	**2.4**	**17.34**	**78.84**
105	**-6.1**	**-6.9**	**0.0**	**0.00**	**-8.2**	**-0.42**	**-5.9**	**0.13**	**-8.2**	**-0.42**	**0.05**	**0.4**	**0.5**	**21.34**	**79.32**
106	-5.4	-8.5	0.0	0.00	-9.8	-0.45	-4.9	0.21	-8.9	-0.48	0.05	1.5	2.0	17.78	80.22
107	0.0	-3.8	0.8	0.37	-8.2	0.02	0.4	0.37	-4.4	-0.28	0.04	3.0	3.2	24.51	81.40
108	***-0.3***	***-1.6***	***0.4***	***0.36***	***-3.4***	***0.09***	***0.4***	***0.37***	***-2.0***	***-0.20***	***0.07***	***1.2***	***1.3***	***27.94***	***81.92***
109	*0.2*	*-2.6*	*1.2*	*0.38*	*-3.3*	*-0.22*	*1.2*	*0.39*	*-3.2*	*-0.26*	*0.13*	*1.2*	*1.4*	*21.78*	*82.56*
110	***-1.4***	***-5.7***	***0.0***	***0.00***	***-6.4***	***-0.31***	***-0.7***	***0.31***	***-6.3***	***-0.33***	***0.05***	***1.5***	***1.6***	***22.04***	***83.32***
111	***1.2***	***-3.4***	***2.1***	***0.42***	***-5.2***	***0.06***	***2.1***	***0.44***	***-4.0***	***-0.26***	***0.05***	***3.0***	***3.2***	***39.33***	***83.98***
112	***-0.7***	***-8.2***	***0.1***	***0.33***	***-9.6***	***-0.46***	***-0.1***	***0.34***	***-9.5***	***-0.52***	***0.08***	***3.5***	***3.8***	***25.08***	***84.68***
113	***-2.9***	***-4.4***	***0.0***	***0.00***	***-7.7***	***0.05***	***-2.2***	***0.30***	***-4.8***	***-0.26***	***0.01***	***1.4***	***1.5***	***34.80***	***85.80***
114	***-1.5***	***-2.0***	***0.0***	***0.00***	***-4.2***	***0.00***	***-0.5***	***0.35***	***-2.2***	***-0.16***	***0.00***	***0.9***	***1.0***	***15.08***	***86.92***
115	***0.1***	***-4.4***	***1.0***	***0.37***	***-5.1***	***-0.29***	***1.0***	***0.39***	***-4.9***	***-0.30***	***0.11***	***1.7***	***1.8***	***14.38***	***89.22***
116	***-3.9***	***-4.0***	***0.0***	***0.00***	***-4.2***	***0.05***	***-3.5***	***0.19***	***-4.1***	***-0.06***	***0.01***	***0.1***	***0.1***	***10.26***	***89.82***
117	*0.0*	*-2.4*	*0.0*	*0.00*	*-3.9*	*0.02*	*-1.3*	*0.32*	*-2.4*	*-0.08*	*0.01*	*0.5*	*0.5*	*7.22*	*91.48*

Table 23. SE19-PA-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
118	0.0	-2.4	0.0	0.00	-2.6	-0.11	-1.9	0.13	-2.6	-0.11	0.04	0.0	0.0	3.99	91.98
119	-2.3	-3.4	0.0	0.00	-4.0	-0.20	-2.2	0.05	-3.6	-0.23	0.05	0.2	0.3	5.84	93.04
120	-3.2	-3.4	0.0	0.00	-4.0	-0.20	-2.9	0.14	-4.0	-0.23	0.05	0.1	0.1	7.62	94.30
121	-3.2	-3.4	0.0	0.00	-3.9	-0.18	-2.7	0.20	-3.9	-0.20	0.05	0.1	0.1	27.94	99.86

Table 24. SE19-PA-3

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	28.5	-53.0	68.0	1.25	-133.6	-2.85	30.2	7.40	-19.9	-7.95	1.28	3177.9	4040.6	526.3	
1	***0.6***	***0.1***	***0.8***	***0.59***	***-0.3***	***-0.69***	***0.8***	***0.59***	***-0.3***	***-0.74***	***1.08***	***0.5***	***2.6***	***8.56***	***1.56***
2	0.5	0.5	0.8	0.50	0.0	0.00	0.8	0.50	0.3	-0.21	0.64	0.2	0.5	6.97	2.42
3	*0.6*	*0.1*	*0.8*	*0.53*	*-0.4*	*-0.85*	*0.8*	*0.54*	*-0.4*	*-0.85*	*1.09*	*0.3*	*2.0*	*4.62*	*3.26*
4	0.2	0.2	0.8	0.55	-0.2	-0.62	0.7	0.57	-0.2	-0.62	1.28	0.5	0.4	5.45	3.90
5	***0.2***	***0.4***	***0.9***	***0.55***	***-0.5***	***-0.94***	***0.8***	***0.55***	***-0.4***	***-0.94***	***1.12***	***0.6***	***1.6***	***7.62***	***5.08***
6	**0.6**	**0.1**	**0.9**	**0.54**	**-0.1**	**-0.55**	**0.9**	**0.54**	**-0.1**	**-0.57**	**1.07**	**0.4**	**1.2**	**6.47**	**5.94**
7	***0.6***	***0.0***	***0.9***	***0.52***	***-0.5***	***-1.01***	***0.9***	***0.52***	***-0.5***	***-1.02***	***1.11***	***0.6***	***2.0***	***9.59***	***6.42***
8	**1.2**	**0.3**	**1.7**	**1.07**	**-0.2**	**-0.88**	**1.6**	**1.08**	**-0.2**	**-0.98**	**1.05**	**1.6**	**2.3**	**12.76**	**6.98**
9	***0.9***	***0.3***	***1.0***	***0.31***	***-0.2***	***-0.82***	***0.9***	***0.52***	***-0.1***	***-0.85***	***0.95***	***0.5***	***1.5***	***9.97***	***7.68***
10	*1.1*	*0.0*	*1.4*	*0.81*	*-0.6*	*-1.17*	*1.3*	*0.82*	*-0.6*	*-1.17*	*0.99*	*1.4*	*3.2*	*12.60*	*8.14*
11	***1.4***	***0.0***	***1.9***	***1.23***	***-0.8***	***-1.39***	***1.8***	***1.23***	***-0.7***	***-1.39***	***0.97***	***2.6***	***3.8***	***16.00***	***8.64***
12	*1.2*	*0.8*	*1.5*	*0.66*	*0.0*	*0.00*	*1.4*	*1.02*	*0.5*	*-0.63*	*0.45*	*1.0*	*0.6*	*15.49*	*9.12*
13	***1.0***	***0.4***	***1.4***	***0.54***	***-0.1***	***-0.86***	***1.3***	***0.55***	***-0.1***	***-0.86***	***0.94***	***0.6***	***1.7***	***10.20***	***9.68***
14	***1.1***	***0.9***	***1.3***	***0.63***	***0.0***	***0.00***	***1.2***	***0.68***	***0.6***	***-0.46***	***0.50***	***0.5***	***0.4***	***9.46***	***10.10***
15	*1.1*	*0.6*	*1.7*	*0.87*	*0.0*	*0.00*	*1.7*	*0.89*	*0.2*	*-0.92*	*0.52*	*0.7*	*1.9*	*8.42*	*10.60*
16	***1.0***	***0.1***	***1.4***	***0.68***	***-1.1***	***-1.56***	***1.4***	***0.68***	***-1.0***	***-1.58***	***0.91***	***1.6***	***8.9***	***20.65***	***11.46***
17	***3.1***	***0.2***	***4.5***	***2.21***	***-1.2***	***-1.96***	***4.5***	***2.21***	***-1.2***	***-1.98***	***0.74***	***8.7***	***7.9***	***27.62***	***12.06***
18	1.8	0.3	2.6	1.08	-0.9	-1.43	2.6	1.09	-0.9	-1.43	0.72	2.7	9.8	19.24	12.84
19	*2.8*	*-0.6*	*4.4*	*1.96*	*-3.6*	*-2.60*	*4.4*	*2.04*	*-3.4*	*-2.73*	*0.57*	*11.0*	*17.3*	*56.77*	*13.40*
20	***0.5***	***-1.7***	***6.3***	***2.79***	***-3.6***	***-1.63***	***6.3***	***2.79***	***-3.6***	***-1.63***	***0.44***	***7.4***	***6.3***	***51.37***	***13.96***
21	***3.1***	***-0.9***	***6.5***	***2.28***	***-5.1***	***-2.79***	***6.5***	***2.28***	***-5.1***	***-2.79***	***0.44***	***14.8***	***20.2***	***68.71***	***14.56***
22	2.0	-1.6	4.4	1.50	-4.4	-2.36	4.2	1.56	-4.4	-2.36	0.44	9.0	12.3	67.06	15.04
23	***5.7***	***-7.0***	***10.7***	***4.22***	***-13.0***	***-4.81***	***10.4***	***4.35***	***-11.9***	***-5.09***	***0.38***	***60.3***	***76.8***	***131.83***	***15.56***
24	***5.8***	***-5.8***	***16.7***	***6.42***	***-16.9***	***-6.23***	***16.5***	***6.60***	***-16.4***	***-6.30***	***0.38***	***104.2***	***120.7***	***167.67***	***16.16***
25	4.2	-6.2	11.8	3.52	-10.1	-2.57	11.4	3.52	-10.1	-2.57	0.28	39.0	27.7	170.83	16.66
26	***10.1***	***-27.2***	***24.3***	***6.67***	***-63.9***	***-3.18***	***18.3***	***7.27***	***-19.9***	***-7.95***	***0.11***	***376.4***	***462.3***	***330.90***	***17.46***
27	***9.4***	***-18.3***	***24.7***	***6.12***	***-37.0***	***-2.41***	***23.5***	***6.56***	***-36.9***	***-2.60***	***0.14***	***140.7***	***115.2***	***339.00***	***18.22***

Table 24. SE19-PA-3

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
28	-6.2	-8.7	0.0	0.00	-15.7	0.06	-4.8	0.60	-10.2	-0.58	0.00	3.8	4.2	131.00	18.84
29	2.8	-12.0	13.0	2.16	-23.7	-1.71	13.0	2.16	-23.2	-1.79	0.11	42.6	82.5	122.68	20.06
30	**6.8**	**-14.8**	**25.7**	**5.97**	**-39.3**	**-2.66**	**25.7**	**6.34**	**-39.3**	**-2.66**	**0.13**	**109.8**	**157.0**	**199.07**	**21.30**
31	3.3	-5.1	8.6	1.66	-11.3	0.02	8.6	1.66	-8.4	-0.85	0.08	18.4	4.7	179.76	21.88
32	9.3	-14.8	21.3	4.37	-42.4	-2.89	21.3	4.37	-42.4	-2.89	0.11	87.6	134.1	160.21	23.16
33	5.4	-5.7	15.1	2.46	-11.9	0.06	15.1	2.53	-10.1	-0.96	0.09	30.0	28.4	141.25	24.32
34	**0.4**	**-6.5**	**2.2**	**0.63**	**-15.8**	**-1.14**	**2.0**	**0.68**	**-15.5**	**-1.25**	**0.10**	**12.6**	**17.4**	**89.79**	**24.94**
35	-0.9	-2.9	2.1	0.70	-4.9	0.16	2.0	0.71	-3.4	-0.26	0.08	4.2	3.4	83.50	25.32
36	-0.7	-5.8	2.7	0.62	-8.8	-0.68	2.6	0.72	-8.5	-0.77	0.11	5.4	7.2	54.22	25.92
37	-0.9	-8.5	2.2	0.58	-23.5	-1.73	1.7	0.69	-22.3	-1.74	0.09	19.6	42.4	114.43	26.98
38	*8.7*	*-53.0*	*19.6*	*3.91*	*-133.6*	*-2.85*	*19.5*	*3.93*	*-115.0*	*-4.75*	*0.04*	*371.4*	*505.8*	*526.31*	*28.54*
39	8.0	-18.1	18.9	3.69	-41.8	0.03	18.8	3.85	-36.3	-1.55	0.06	145.2	126.4	518.92	29.60
40	**11.9**	**-36.9**	**26.8**	**6.25**	**-125.4**	**-2.79**	**26.8**	**6.25**	**-125.4**	**-2.79**	**0.06**	**193.8**	**340.7**	**289.31**	**31.92**
41	4.7	-19.6	12.7	2.27	-60.6	-1.39	12.5	2.31	-37.2	-1.75	0.05	98.5	87.8	286.30	33.40
42	7.0	-11.1	20.6	3.83	-41.5	-1.52	20.4	3.89	-41.5	-1.52	0.09	113.7	130.0	228.60	34.62
43	4.3	-8.8	11.5	1.80	-21.6	-1.08	11.4	1.84	-20.8	-1.21	0.09	34.1	38.6	159.87	35.52
44	5.7	-11.9	20.8	4.28	-60.0	-1.52	20.8	4.28	-59.2	-1.71	0.07	80.9	174.6	250.58	37.08
45	**28.5**	**-1.3**	**68.0**	**1.25**	**-19.8**	**-1.24**	**30.2**	**7.40**	**1.6**	**-1.32**	**0.03**	**226.8**	**233.1**	**335.20**	**38.04**
46	11.2	-2.6	14.6	1.30	-14.2	-1.07	14.6	1.30	-7.9	-1.39	0.08	30.6	36.7	181.04	38.60
47	10.3	-7.8	25.9	1.57	-31.3	-1.18	22.1	1.81	-26.0	-1.44	0.05	63.6	73.5	195.14	39.38
48	2.2	-6.2	3.7	0.67	-15.6	-0.98	3.7	0.67	-15.6	-1.02	0.09	15.6	19.6	129.54	40.06
49	10.5	-6.8	15.9	1.34	-11.9	-0.89	15.0	1.34	-10.3	-0.93	0.08	26.7	31.4	105.65	40.84
50	9.2	-4.8	13.4	1.14	-13.7	-0.90	13.3	1.29	-13.3	-1.01	0.08	24.4	29.1	114.40	41.54
51	2.1	-5.3	3.3	0.47	-10.6	-0.74	3.3	0.57	-7.3	-0.91	0.09	9.3	12.2	78.42	42.10
52	-2.3	-6.4	0.0	0.00	-20.4	-1.12	-1.5	0.42	-18.2	-1.12	0.05	11.6	20.0	90.71	43.10
53	-1.0	-3.0	0.5	0.48	-5.0	0.19	-0.3	0.58	-4.4	-0.44	0.05	3.5	2.5	71.77	43.52
54	8.1	-1.7	11.0	0.99	-3.6	-0.65	10.4	1.11	-2.6	-0.69	0.11	11.8	14.8	72.58	44.16
55	7.6	-1.8	16.7	1.47	-3.9	-0.65	15.6	1.50	-3.5	-0.84	0.10	18.1	23.3	113.73	44.78
56	3.9	-6.6	4.6	0.48	-15.3	-0.91	4.6	0.48	-14.2	-1.02	0.07	12.2	16.9	88.61	45.38
57	0.2	-4.5	0.8	0.43	-7.2	-0.74	0.3	0.53	-7.1	-0.77	0.15	4.4	4.8	82.36	45.84

Table 24. SE19-PA-3

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
58	-0.7	-7.3	0.0	0.33	-18.1	-1.00	0.0	0.33	-17.6	-1.08	0.07	10.7	15.2	106.81	46.44
59	3.3	-6.0	4.9	0.64	-11.2	-0.80	4.9	0.64	-11.1	-0.89	0.09	11.8	13.2	103.70	46.96
60	9.6	-6.6	15.5	1.28	-13.6	-0.88	15.1	1.45	-13.1	-0.93	0.07	26.1	29.4	117.79	47.66
61	9.0	-6.7	15.0	1.12	-16.1	-1.05	14.8	1.46	-16.1	-1.05	0.07	26.5	32.8	125.92	48.46
62	-2.9	-6.0	0.0	0.00	-16.3	-1.01	-2.3	0.39	-16.2	-1.02	0.06	7.5	10.3	135.95	48.98
63	9.4	-12.1	32.0	1.69	-57.8	-1.56	21.1	2.15	-57.7	-1.59	0.04	81.4	104.4	227.40	50.04
64	0.1	-6.1	1.3	0.41	-14.3	-0.84	1.1	0.58	-12.0	-0.84	0.08	11.7	11.2	143.13	50.82
65	-3.4	-6.2	0.0	0.00	-8.4	-0.56	-2.8	0.50	-8.4	-0.56	0.07	1.9	2.0	56.39	51.28
66	0.0	-4.5	4.7	0.56	-7.2	-0.72	2.7	0.61	-6.8	-0.78	0.11	8.2	10.5	63.06	51.98
67	11.4	-9.9	15.3	1.32	-29.8	-1.27	14.5	1.48	-28.5	-1.44	0.06	36.4	45.4	153.16	52.80
68	4.7	-6.8	7.2	0.71	-15.5	-0.88	7.0	0.81	-15.5	-0.95	0.07	17.4	20.7	147.83	53.50
69	4.7	-8.1	6.7	0.57	-19.4	-1.02	6.5	0.73	-19.0	-1.07	0.06	19.7	23.7	150.25	54.14
70	10.7	-0.7	18.9	1.50	-5.1	0.08	17.7	1.64	-0.9	-0.60	0.06	23.0	26.9	162.62	54.76
71	8.2	-8.0	11.8	0.94	-21.5	-1.10	11.4	1.08	-20.4	-1.24	0.06	21.8	48.9	78.48	56.20
72	8.3	2.0	11.4	0.94	-6.6	0.03	9.8	1.11	1.2	-0.35	0.05	11.5	7.1	80.77	56.96
73	5.5	-2.4	6.9	0.50	-4.6	-0.57	6.8	0.50	-4.4	-0.64	0.09	4.7	6.0	50.55	57.76
74	9.3	-2.6	25.2	1.45	-5.4	-0.59	18.7	1.86	-4.8	-0.82	0.07	29.7	40.9	127.95	58.46
75	5.6	-8.3	6.3	0.44	-23.0	-1.16	6.1	0.55	-21.0	-1.35	0.05	19.4	47.0	142.81	59.48
76	8.5	-6.2	22.6	1.61	-11.4	-0.76	21.1	1.80	-11.2	-0.91	0.07	34.1	27.4	158.10	60.28
77	0.2	-1.8	20.0	1.43	-23.1	-1.28	17.9	1.68	-23.1	-1.28	0.06	39.5	48.0	164.66	61.92
78	4.4	-5.9	5.6	0.52	-10.9	-0.77	4.6	0.53	-10.9	-0.79	0.08	8.8	12.1	62.24	62.78
79	1.5	-2.8	6.3	0.53	-8.8	-0.78	5.1	0.56	-8.2	-0.81	0.09	13.2	18.0	56.39	64.64
80	-0.4	-2.4	0.1	0.21	-4.5	-0.53	-0.1	0.23	-4.5	-0.53	0.16	1.1	1.3	38.20	65.10
81	8.0	3.2	9.8	0.92	-1.7	0.08	9.4	0.97	3.6	-0.29	0.07	6.6	8.5	76.01	65.68
82	4.4	1.1	5.0	0.22	-0.7	-0.36	4.9	0.22	0.0	-0.40	0.10	1.4	1.5	26.60	66.20
83	2.0	-3.3	2.2	0.08	-5.3	-0.55	2.2	0.11	-4.8	-0.62	0.08	2.6	3.2	28.00	66.72
84	0.5	-1.0	1.7	0.35	-2.7	0.01	1.7	0.35	-1.7	-0.29	0.08	1.2	1.3	28.13	67.30
85	0.5	-2.4	1.6	0.33	-4.6	-0.49	1.6	0.34	-4.2	-0.52	0.13	1.6	2.1	25.46	67.96
86	-0.5	-4.3	0.0	0.00	-7.5	-0.56	-0.4	0.19	-6.4	-0.73	0.07	2.5	3.8	26.48	68.56
87	3.9	3.3	*5.2*	0.42	-3.8	0.06	4.4	0.48	3.2	-0.05	0.04	3.0	4.4	32.45	69.24

Table 24. SE19-PA-3

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
88	3.3	-4.6	3.7	0.12	-8.5	-0.74	3.6	0.15	-8.4	-0.76	0.07	4.4	6.3	45.73	69.90
89	**2.5**	**0.0**	**3.5**	**0.41**	**-3.7**	**0.13**	**1.6**	**0.44**	**-0.7**	**-0.31**	**0.04**	**3.0**	**3.2**	**48.90**	**70.48**
90	**2.0**	**1.2**	**3.1**	**0.36**	**0.0**	**0.00**	**3.1**	**0.39**	**0.7**	**-0.13**	**0.12**	**0.7**	**0.8**	**26.16**	**70.96**
91	**5.0**	**-4.0**	**6.5**	**0.50**	**-6.3**	**-0.59**	**5.2**	**0.55**	**-5.7**	**-0.69**	**0.09**	**5.8**	**9.2**	**29.46**	**72.12**
92	**5.0**	**1.3**	**6.4**	**0.51**	**-3.3**	**0.05**	**5.5**	**0.55**	**0.5**	**-0.31**	**0.05**	**4.6**	**5.3**	**59.79**	**72.72**
93	**7.5**	**-4.5**	**9.1**	**0.79**	**-6.4**	**-0.70**	**8.4**	**0.90**	**-6.4**	**-0.70**	**0.10**	**8.1**	**10.2**	**47.25**	**73.36**
94	**5.3**	**-0.6**	**7.3**	**0.67**	**-3.5**	**0.00**	**7.2**	**0.67**	**-2.9**	**-0.49**	**0.06**	**6.7**	**7.6**	**70.88**	**73.98**
95	**6.1**	**-2.3**	**7.4**	**0.56**	**-4.6**	**-0.57**	**7.2**	**0.68**	**-3.8**	**-0.57**	**0.09**	**6.3**	**7.5**	**54.79**	**74.62**
96	**-1.3**	**-5.5**	**0.0**	**0.00**	**-10.1**	**-0.69**	**-1.1**	**0.10**	**-9.9**	**-0.79**	**0.07**	**3.4**	**7.9**	**32.55**	**75.36**
97	**5.3**	**-2.2**	**7.1**	**0.58**	**-4.8**	**0.12**	**6.9**	**0.65**	**-3.7**	**-0.57**	**0.04**	**7.6**	**9.5**	**49.72**	**76.54**
98	**1.0**	**-0.1**	**1.9**	**0.31**	**-1.4**	**0.04**	**1.3**	**0.31**	**-0.7**	**-0.19**	**0.08**	**0.8**	**0.9**	**34.48**	**77.02**
99	0.1	-3.6	6.4	0.46	-6.3	-0.59	6.2	0.53	-6.2	-0.73	0.08	6.2	9.0	30.86	78.84
100	-2.8	-3.3	0.0	0.00	-4.8	-0.39	-2.7	0.05	-4.8	-0.39	0.08	0.2	0.3	22.61	79.30
101	***-2.0***	***-3.5***	***0.0***	***0.00***	***-5.5***	***-0.48***	***-1.6***	***0.16***	***-5.3***	***-0.49***	***0.09***	***0.8***	***1.8***	***19.94***	***80.20***
102	*3.8*	*-0.1*	*4.8*	*0.45*	*-3.2*	*0.03*	*4.8*	*0.45*	*-1.0*	*-0.35*	*0.05*	*3.2*	*3.8*	*25.34*	*81.40*
103	*2.4*	*1.4*	*3.5*	*0.30*	*0.0*	*0.00*	*3.3*	*0.31*	*0.9*	*-0.17*	*0.09*	*0.7*	*0.8*	*25.91*	*81.90*
104	***2.9***	***0.6***	***4.1***	***0.29***	***-0.7***	***-0.25***	***3.8***	***0.38***	***-0.5***	***-0.30***	***0.12***	***1.1***	***1.2***	***22.87***	***82.58***
105	***1.6***	***-1.5***	***2.1***	***0.15***	***-3.6***	***-0.42***	***2.0***	***0.15***	***-3.0***	***-0.49***	***0.10***	***1.4***	***1.6***	***34.01***	***83.34***
106	*1.8*	*-3.9*	*4.6*	*0.39*	*-6.7*	*-0.62*	*4.4*	*0.45*	*-6.4*	*-0.68*	*0.09*	*6.0*	*7.4*	*39.27*	*84.68*
107	***0.4***	***-0.8***	***1.5***	***0.31***	***-3.3***	***0.11***	***0.9***	***0.37***	***-1.4***	***-0.20***	***0.04***	***1.4***	***1.5***	***39.65***	***85.78***
108	***1.8***	***0.8***	***2.9***	***0.34***	***-0.6***	***0.01***	***1.9***	***0.39***	***0.5***	***-0.13***	***0.10***	***0.8***	***1.0***	***15.24***	***86.88***
109	*1.9*	*-1.1*	*3.2*	*0.37*	*-3.3*	*-0.38*	*3.1*	*0.40*	*-3.3*	*-0.42*	*0.12*	*1.4*	*1.9*	*15.01*	*90.02*
110	***0.0***	***-0.5***	***0.6***	***0.14***	***-1.0***	***0.02***	***0.5***	***0.18***	***-0.6***	***-0.07***	***0.08***	***0.1***	***0.2***	***7.03***	***91.42***
111	***-0.2***	***-0.5***	***0.0***	***0.00***	***-0.7***	***-0.08***	***-0.1***	***0.08***	***-0.7***	***-0.08***	***0.11***	***0.0***	***0.0***	***4.76***	***91.96***
112	*-0.4*	*-0.9*	*0.0*	*0.00*	*-2.1*	*-0.23*	*-0.3*	*0.05*	*-2.0*	*-0.26*	*0.11*	*0.2*	*0.2*	*7.35*	*94.38*
113	-0.8	-0.8	0.0	0.00	-1.4	-0.14	-0.8	0.01	-1.3	-0.16	0.10	0.0	0.0	4.19	94.94
114	0.0	-1.4	0.0	0.00	-2.0	-0.19	-0.7	0.01	-1.8	-0.24	0.10	0.1	0.1	27.93	99.84

Table 25. SE19-PA-4

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	40.4	-51.7	74.1	2.66	-103.9	-3.97	15.1	9.43	-24.1	-9.05	4.26	3614.3	4477.4	570.5	
1	***0.4***	***0.1***	***0.7***	***0.96***	***0.0***	***-0.90***	***0.6***	***1.00***	***0.0***	***-0.95***	***2.66***	***0.2***	***1.5***	***4.75***	***0.50***
2	*0.1*	*0.1*	*0.2*	*0.42*	*-0.2*	*-0.51*	*0.2*	*0.50*	*0.0*	*-0.81*	*2.58*	*0.1*	*1.2*	*4.51*	*1.64*
3	0.5	0.4	0.6	0.71	0.0	0.00	0.6	0.71	0.2	-0.45	1.19	0.2	0.8	5.33	2.42
4	***0.5***	***0.0***	***0.7***	***0.72***	***-0.1***	***-0.76***	***0.7***	***0.72***	***0.0***	***-0.87***	***1.92***	***0.3***	***1.8***	***3.93***	***3.20***
5	0.3	0.0	0.4	0.54	-0.1	-0.61	0.4	0.54	-0.1	-0.69	2.30	0.2	0.4	5.40	3.74
6	*0.4*	*0.0*	*0.6*	*0.71*	*-0.2*	*-1.05*	*0.5*	*0.73*	*-0.1*	*-1.09*	*2.29*	*0.5*	*2.1*	*4.08*	*4.38*
7	0.2	0.3	0.3	0.90	-0.1	-0.58	0.3	0.90	0.0	-0.59	4.26	0.3	0.1	4.76	4.98
8	***0.5***	***0.0***	***0.6***	***0.64***	***-0.1***	***-0.63***	***0.6***	***0.89***	***0.2***	***-0.79***	***1.81***	***0.4***	***1.7***	***5.00***	***5.88***
9	0.4	0.0	0.6	0.66	-0.2	-1.19	0.5	0.72	-0.1	-1.23	2.46	0.6	2.5	4.76	6.36
10	0.5	0.2	0.7	1.29	0.0	0.00	0.4	1.37	0.2	-0.98	1.95	0.7	0.9	5.78	7.00
11	0.0	0.1	0.6	0.63	-0.1	-0.84	0.6	0.65	0.0	-0.85	2.18	0.4	1.8	4.88	7.62
12	***0.5***	***0.0***	***0.7***	***1.15***	***-0.3***	***-1.51***	***0.7***	***1.31***	***-0.3***	***-1.51***	***2.58***	***1.3***	***3.9***	***7.81***	***8.08***
13	***0.6***	***0.1***	***0.9***	***1.65***	***-0.5***	***-1.72***	***0.6***	***1.84***	***-0.5***	***-1.72***	***2.29***	***2.0***	***3.4***	***10.22***	***8.56***
14	***0.5***	***0.1***	***0.8***	***1.61***	***-0.1***	***-0.88***	***0.6***	***1.85***	***0.1***	***-1.41***	***2.88***	***1.4***	***0.7***	***7.05***	***8.98***
15	***0.5***	***0.1***	***0.6***	***0.68***	***-0.2***	***-1.20***	***0.4***	***1.07***	***-0.2***	***-1.21***	***2.48***	***0.6***	***2.1***	***5.83***	***9.62***
16	***0.5***	***0.1***	***0.7***	***1.11***	***0.0***	***-1.03***	***0.6***	***1.35***	***0.1***	***-1.26***	***2.81***	***1.0***	***1.0***	***6.27***	***10.02***
17	**0.6**	**0.4**	**0.7**	**1.30**	**0.0**	**0.00**	**0.7**	**1.30**	**0.4**	**-0.66**	**1.73**	**0.6**	**1.3**	**6.97**	**10.56**
18	0.6	0.1	0.8	1.06	-0.4	-1.58	0.8	1.15	-0.4	-1.59	2.23	1.0	8.4	6.79	11.40
19	**0.7**	**0.2**	**1.4**	**2.39**	**-0.3**	**-2.03**	**1.3**	**2.46**	**-0.2**	**-2.14**	**2.66**	**2.5**	**0.5**	**10.41**	**11.92**
20	*0.6*	*0.0*	*0.9*	*1.48*	*-0.7*	*-2.15*	*0.9*	*1.48*	*-0.7*	*-2.15*	*2.30*	*2.2*	*10.3*	*10.10*	*12.74*
21	*0.6*	*-0.3*	*0.9*	*1.23*	*-1.4*	*-3.39*	*0.5*	*1.62*	*-1.4*	*-3.49*	*2.07*	*3.7*	*15.5*	*22.03*	*13.30*
22	***0.9***	***-0.3***	***3.2***	***4.28***	***-2.5***	***-4.65***	***3.0***	***4.66***	***-2.4***	***-4.71***	***1.56***	***15.1***	***21.8***	***36.77***	***13.82***
23	***1.7***	***-1.3***	***5.0***	***5.59***	***-4.5***	***-5.76***	***4.6***	***5.67***	***-4.0***	***-6.10***	***1.20***	***29.5***	***35.1***	***52.83***	***14.38***
24	***1.4***	***-0.8***	***5.2***	***5.52***	***-5.0***	***-5.83***	***4.5***	***5.62***	***-5.0***	***-6.08***	***1.11***	***29.0***	***56.3***	***78.16***	***14.96***
25	***7.5***	***-10.3***	***12.6***	***8.03***	***-21.2***	***-7.19***	***11.2***	***8.29***	***-9.2***	***-8.56***	***0.45***	***206.4***	***210.3***	***183.20***	***15.56***
26	***8.0***	***-9.6***	***19.6***	***6.62***	***-17.5***	***-5.09***	***15.1***	***9.43***	***-17.2***	***-5.52***	***0.32***	***175.8***	***151.4***	***227.78***	***16.16***
27	**3.5**	**-6.9**	**5.4**	**2.43**	**-10.5**	**-3.19**	**5.4**	**2.43**	**-8.4**	**-3.27**	**0.35**	**40.5**	**57.6**	**144.27**	**16.64**

Table 25. SE19-PA-4

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
28	***18.1***	***-37.8***	***30.6***	***5.15***	***-53.4***	***-4.14***	***20.0***	***7.92***	***-24.1***	***-9.05***	***0.11***	***425.9***	***522.9***	***251.72***	***17.38***
29	**11.8**	**-8.9**	**42.0**	**3.40**	**-32.0**	**0.20**	**31.8**	**5.84**	**-14.6**	**-3.73**	**0.04**	**200.8**	**158.9**	**351.66**	**18.16**
30	4.9	-2.2	8.9	1.61	-5.9	0.25	8.3	1.90	-2.9	-1.75	0.09	23.1	26.0	138.53	18.76
31	4.5	-8.1	15.5	2.33	-19.4	-2.36	15.5	2.33	-17.1	-3.12	0.13	60.8	104.6	73.98	19.98
32	7.7	-3.7	30.4	3.18	-6.7	0.20	28.5	3.30	-5.4	-1.91	0.08	70.8	77.7	175.01	20.80
33	-3.2	-10.7	0.0	0.00	-22.0	-2.85	-3.4	0.40	-22.0	-2.85	0.13	34.7	71.1	136.78	21.22
34	6.3	-6.7	17.8	2.32	-9.8	-1.48	17.5	2.56	-8.2	-2.26	0.14	46.3	34.1	157.48	21.88
35	5.9	-7.8	24.5	2.77	-22.9	-2.46	23.2	2.85	-21.0	-3.09	0.11	82.0	102.9	178.37	22.84
36	-6.7	-7.2	0.0	0.00	-9.0	-1.71	-7.2	0.16	-8.8	-1.76	0.19	1.9	12.8	54.16	23.06
37	2.9	-2.0	12.5	1.99	-6.1	0.28	12.5	1.99	-3.3	-1.58	0.09	24.0	26.3	109.33	24.02
38	4.3	-6.1	7.3	1.28	-12.6	-1.87	7.1	1.52	-12.4	-2.47	0.16	31.9	48.4	96.60	24.88
39	3.4	-5.8	10.0	1.85	-7.9	-1.75	6.9	2.03	-6.9	-2.08	0.20	29.1	32.1	106.79	25.86
40	1.9	-6.3	6.9	1.44	-12.3	-1.97	5.7	1.49	-12.2	-2.24	0.18	27.7	65.7	89.40	26.82
41	*6.8*	*-51.7*	*26.8*	*2.88*	*-103.9*	*-3.97*	*25.9*	*3.05*	*-60.8*	*-5.48*	*0.05*	*343.6*	*545.0*	*496.57*	*28.46*
42	**40.4**	**10.0**	**73.3**	**2.48**	**-41.2**	**0.17**	**49.0**	**4.55**	**9.8**	**-0.95**	**0.02**	**219.1**	**117.6**	**570.48**	**29.40**
43	11.2	9.3	11.2	0.28	0.0	0.00	11.2	0.28	7.5	-0.99	0.02	2.9	4.3	55.80	29.64
44	13.7	8.9	15.2	0.75	0.0	0.00	14.8	0.93	9.4	-0.99	0.05	7.6	8.9	47.70	30.22
45	25.8	-22.1	51.9	1.99	-46.5	-1.74	50.0	2.08	-45.8	-2.00	0.04	117.9	149.5	186.75	31.26
46	-10.2	-13.9	0.0	0.00	-31.5	-1.45	-10.2	0.58	-30.9	-1.69	0.05	21.0	40.5	190.15	31.86
47	16.6	0.4	24.9	1.61	-10.4	0.48	17.2	1.67	0.2	-0.75	0.03	50.1	43.4	195.77	32.48
48	8.7	-15.8	9.6	1.29	-50.2	-2.00	9.4	1.33	-50.2	-2.00	0.06	58.4	101.8	242.98	33.34
49	16.9	-7.0	49.0	1.99	-16.3	-1.07	42.2	2.09	-14.9	-1.26	0.05	79.8	71.5	259.14	34.52
50	10.6	-5.8	11.5	1.14	-16.1	-1.08	6.5	1.18	-15.5	-1.24	0.08	26.8	37.7	147.65	35.50
51	13.5	-7.5	31.5	1.82	-31.3	-1.72	28.2	1.93	-31.3	-1.72	0.06	64.6	115.5	210.49	37.00
52	**23.6**	**-6.9**	**74.1**	**2.66**	**-29.0**	**-1.48**	**69.7**	**2.80**	**-28.6**	**-1.66**	**0.04**	**131.4**	**146.4**	**294.16**	**38.10**
53	0.8	-6.3	1.6	0.54	-23.3	-1.29	0.8	0.60	-22.8	-1.34	0.07	16.9	26.5	211.26	38.62
54	14.2	-5.1	23.3	1.69	-27.8	-1.32	17.8	1.79	-26.9	-1.49	0.06	53.2	63.3	217.30	39.36
55	9.6	-4.8	11.8	0.88	-8.6	-0.74	10.0	1.33	-7.9	-0.89	0.08	21.1	19.6	167.13	39.98
56	11.0	-5.1	16.4	1.24	-12.9	-0.95	16.3	1.33	-11.0	-1.11	0.07	51.0	63.9	117.22	41.52
57	4.4	-4.5	5.7	1.04	-8.5	-0.84	5.7	1.04	-7.5	-0.88	0.13	12.0	14.3	91.72	42.08

Table 25. SE19-PA-4

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
58	0.1	-3.5	0.5	0.51	-15.9	-1.18	0.4	0.61	-15.9	-1.18	0.10	9.2	21.1	98.49	43.06
59	9.9	-2.2	14.3	0.99	-5.0	-0.64	13.8	1.35	-3.0	-0.90	0.08	23.7	26.6	94.54	44.18
60	9.2	-1.3	15.1	1.26	-2.8	-0.68	14.5	1.37	-2.2	-0.80	0.11	18.6	23.4	113.73	44.76
61	3.9	-5.6	5.5	1.07	-15.1	-1.14	5.5	1.07	-13.0	-1.19	0.11	14.4	21.4	93.87	45.38
62	2.1	-2.4	3.0	0.87	-4.0	-0.75	3.0	0.94	-3.1	-0.78	0.23	6.4	5.8	98.93	45.82
63	2.2	-4.1	3.0	0.86	-15.6	-1.10	2.0	0.88	-15.6	-1.15	0.11	12.2	18.4	111.06	46.44
64	7.7	-4.4	9.1	0.89	-7.4	-0.78	7.7	1.07	-6.7	-0.90	0.10	15.7	15.8	113.28	46.94
65	10.9	-3.9	17.7	1.43	-13.5	-1.13	16.5	1.46	-13.5	-1.13	0.08	29.0	34.3	131.89	47.68
66	10.6	-5.3	16.4	1.24	-13.9	-1.08	15.9	1.47	-13.8	-1.16	0.08	27.1	34.4	131.70	48.44
67	1.2	-4.4	1.6	0.80	-11.9	-1.01	1.4	0.82	-11.9	-1.01	0.13	8.5	11.1	107.49	48.96
68	13.2	-8.4	36.3	1.47	-55.1	-1.91	28.5	1.92	-52.7	-2.43	0.04	85.5	120.6	253.24	50.02
69	7.9	-3.4	12.2	0.97	-5.1	-0.62	11.6	1.32	-4.4	-0.82	0.09	18.6	9.7	191.36	50.72
70	2.3	-2.0	3.5	0.73	-3.6	-0.63	3.1	0.98	-3.3	-0.74	0.19	5.7	6.8	53.93	51.26
71	6.7	-4.0	7.7	0.83	-8.0	-0.83	7.3	1.07	-7.9	-0.89	0.11	13.1	17.5	80.71	52.00
72	10.1	-4.5	15.3	1.13	-26.7	-1.37	14.9	1.46	-25.6	-1.48	0.06	34.8	46.6	162.18	52.80
73	8.4	-4.3	13.8	1.32	-10.6	-0.92	11.1	1.44	-7.8	-0.94	0.09	23.5	23.8	153.87	53.48
74	7.7	-3.4	10.1	0.91	-18.1	-0.99	8.6	1.09	-17.9	-1.21	0.07	23.0	28.2	160.27	54.16
75	9.6	1.5	22.0	1.50	0.0	0.43	20.6	1.79	1.2	-0.52	0.05	25.9	29.6	170.61	54.74
76	5.5	-4.3	12.4	1.10	-18.3	-1.18	12.4	1.10	-17.7	-1.22	0.07	19.7	56.0	83.44	56.16
77	9.3	1.6	16.9	1.21	-2.6	0.15	16.6	1.43	1.3	-0.51	0.05	18.6	10.9	87.95	56.96
78	3.7	-3.8	4.9	0.61	-6.3	-0.76	4.4	0.95	-5.7	-0.84	0.12	6.0	10.5	49.02	57.74
79	11.6	-1.6	27.1	1.59	-2.9	-0.60	25.9	1.80	-2.5	-0.76	0.07	31.8	43.4	134.37	58.44
80	7.4	-4.0	8.3	0.76	-20.8	-1.29	8.2	0.95	-20.8	-1.29	0.07	20.2	56.9	154.37	59.48
81	14.3	-4.5	29.0	1.83	-8.7	-0.93	27.2	1.95	-8.7	-0.93	0.07	39.1	28.2	174.13	60.28
82	6.5	-5.0	21.5	1.36	-20.8	-1.22	20.6	1.63	-20.3	-1.46	0.06	34.7	45.8	166.31	61.18
83	4.4	-0.6	6.4	0.83	-4.3	0.05	5.9	0.99	-0.8	-0.57	0.07	7.5	8.8	56.06	61.90
84	4.1	-4.6	6.0	0.73	-11.1	-0.91	5.2	1.07	-9.4	-0.98	0.10	11.2	19.5	76.90	62.78
85	7.1	-3.4	9.2	0.90	-6.5	-0.78	8.5	1.07	-6.3	-0.85	0.11	13.6	20.5	75.63	63.96
86	4.6	-2.2	5.7	0.99	-3.2	-0.65	5.7	0.99	-2.9	-0.65	0.18	8.3	7.8	51.88	64.60
87	0.8	-2.1	1.4	0.65	-3.6	-0.72	1.4	0.65	-3.6	-0.72	0.27	2.8	3.4	35.52	65.08

Table 25. SE19-PA-4

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
88	6.9	1.6	10.0	0.90	-1.3	0.19	8.9	0.97	1.9	-0.40	0.06	9.6	12.8	69.47	65.66
89	2.6	-1.5	3.3	0.70	-2.3	-0.59	3.3	0.70	-1.9	-0.62	0.23	2.5	3.4	21.73	66.14
90	0.5	-3.1	1.0	0.60	-5.4	-0.79	1.0	0.60	-5.4	-0.79	0.22	3.5	5.3	32.39	66.70
91	1.7	-1.1	2.6	0.58	-2.4	0.11	2.0	0.97	-1.9	-0.61	0.10	3.6	4.3	38.89	67.30
92	0.9	-2.2	1.6	0.58	-4.0	-0.73	1.5	0.66	-3.9	-0.73	0.23	3.1	4.7	26.79	67.88
93	0.6	-3.4	*1.6*	0.66	-5.6	-0.79	1.5	0.70	-5.4	-0.81	0.20	4.3	6.4	29.71	68.50
94	3.2	0.5	4.9	0.64	-2.9	0.02	4.5	1.01	0.3	-0.50	0.08	4.8	8.2	29.07	69.26
95	**0.7**	**-2.5**	**1.1**	**0.25**	**-9.3**	**-0.93**	**1.0**	**0.26**	**-8.7**	**-0.99**	**0.11**	**5.0**	**9.7**	**60.74**	**69.92**
96	**4.9**	**0.5**	**5.9**	**0.88**	**-1.4**	**0.26**	**3.7**	**0.94**	**0.5**	**-0.44**	**0.09**	**6.5**	**6.2**	**56.07**	**70.44**
97	**2.6**	**0.5**	**3.5**	**0.79**	**0.0**	**0.00**	**3.2**	**0.81**	**0.3**	**-0.44**	**0.22**	**1.9**	**2.7**	**22.80**	**70.96**
98	**3.5**	**-3.6**	**5.0**	**1.01**	**-7.7**	**-0.78**	**5.0**	**1.01**	**-7.2**	**-0.90**	**0.14**	**7.5**	**13.7**	**28.31**	**71.90**
99	**3.9**	**-1.2**	**6.6**	**0.90**	**-3.5**	**0.05**	**5.8**	**0.97**	**-1.8**	**-0.63**	**0.08**	**8.0**	**10.6**	**51.62**	**72.72**
100	**5.5**	**-3.3**	**6.3**	**0.90**	**-8.6**	**-0.91**	**5.6**	**0.96**	**-7.2**	**-0.95**	**0.12**	**10.7**	**14.5**	**73.72**	**73.40**
101	**5.7**	**-2.5**	**7.1**	**0.90**	**-4.0**	**-0.63**	**7.1**	**1.05**	**-3.4**	**-0.78**	**0.14**	**9.9**	**11.2**	**76.39**	**73.96**
102	**5.2**	**-3.5**	**6.3**	**0.83**	**-6.8**	**-0.78**	**5.9**	**0.94**	**-6.0**	**-0.92**	**0.12**	**10.1**	**13.1**	**55.56**	**74.62**
103	**-1.5**	**-3.7**	**0.0**	**0.00**	**-8.5**	**-0.90**	**-1.8**	**0.22**	**-8.2**	**-0.92**	**0.11**	**3.4**	**10.1**	**37.27**	**75.30**
104	5.1	-3.3	7.2	0.82	-5.7	-0.71	6.8	0.99	-4.1	-0.80	0.12	12.5	16.4	52.38	76.54
105	0.7	-1.1	1.3	0.53	-2.5	0.11	0.7	0.68	-1.4	-0.51	0.11	2.1	2.3	40.03	77.00
106	***2.9***	***-2.6***	***4.2***	***0.65***	***-3.5***	***-0.65***	***3.6***	***1.05***	***-2.3***	***-0.71***	***0.17***	***5.5***	***9.7***	***26.48***	***78.12***
107	*0.8*	*-3.0*	*1.2*	*0.43*	*-4.7*	*-0.74*	*0.9*	*0.71*	*-4.7*	*-0.74*	*0.20*	*3.6*	*5.3*	*28.69*	*78.78*
108	***-0.7***	***-1.6***	***0.0***	***0.00***	***-2.4***	***0.06***	***-0.3***	***0.43***	***-2.2***	***-0.56***	***0.02***	***0.8***	***0.8***	***30.66***	***79.26***
109	***0.4***	***-1.6***	***0.9***	***0.43***	***-2.6***	***-0.62***	***0.7***	***0.62***	***-2.5***	***-0.64***	***0.31***	***2.0***	***3.2***	***21.35***	***80.18***
110	***2.9***	***-2.2***	***3.8***	***0.69***	***-3.5***	***-0.63***	***3.3***	***0.91***	***-3.1***	***-0.72***	***0.18***	***5.1***	***8.4***	***23.05***	***81.38***
111	***1.4***	***-0.7***	***2.0***	***0.55***	***-1.7***	***0.11***	***1.6***	***0.81***	***-1.1***	***-0.51***	***0.12***	***2.4***	***2.9***	***30.04***	***81.90***
112	***1.0***	***-2.0***	***1.8***	***0.62***	***-2.8***	***-0.55***	***1.7***	***0.68***	***-2.7***	***-0.68***	***0.25***	***2.4***	***3.5***	***21.46***	***82.50***
113	***0.2***	***-2.6***	***0.6***	***0.35***	***-4.2***	***-0.74***	***0.3***	***0.52***	***-4.2***	***-0.74***	***0.23***	***2.4***	***3.7***	***29.46***	***83.30***
114	*3.5*	*-2.2*	*4.5*	*0.77*	*-3.4*	*-0.62*	*4.1*	*0.92*	*-3.2*	*-0.74*	*0.18*	*6.2*	*8.0*	*42.93*	*83.96*
115	0.9	-3.3	1.4	0.57	-6.8	-0.82	0.9	0.75	-6.7	-0.84	0.17	4.7	7.9	42.42	84.66
116	2.9	-0.1	3.5	0.62	-2.3	0.08	3.2	0.93	-0.7	-0.45	0.09	4.1	4.5	48.08	85.78
117	0.8	-0.3	1.9	0.70	-0.7	-0.44	1.8	0.71	-0.7	-0.49	0.44	1.3	2.6	14.89	86.88

Table 25. SE19-PA-4

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
118	0.9	0.3	1.7	0.71	-0.2	0.08	1.7	0.71	0.2	-0.27	0.34	0.6	1.2	14.54	87.40
119	0.7	-1.7	1.3	0.49	-2.7	-0.61	1.2	0.49	-2.6	-0.64	0.28	1.3	2.8	6.79	88.54
120	-1.1	-1.1	0.0	0.00	-1.5	0.00	-1.0	0.15	-1.2	-0.07	0.00	0.0	0.0	6.79	89.08
121	0.2	0.0	1.2	0.46	-1.1	0.01	1.0	0.60	-0.3	-0.25	0.20	0.6	1.3	9.31	91.50
122	0.1	-0.1	0.3	0.19	-0.4	-0.26	0.3	0.19	-0.4	-0.26	0.63	0.1	0.1	4.88	91.98
123	0.1	-0.8	0.1	0.05	-1.6	-0.49	0.0	0.07	-1.3	-0.52	0.32	0.4	0.7	5.13	93.02
124	-0.5	-0.5	0.0	0.00	-1.3	-0.45	-0.3	0.19	-1.3	-0.46	0.36	0.1	0.2	8.30	94.28
125	-0.2	-0.4	0.0	0.21	-0.6	-0.13	0.0	0.21	-0.6	-0.18	0.55	0.1	0.1	6.55	94.76
126	-0.3	-0.3	0.1	0.22	-0.4	-0.06	0.1	0.24	-0.4	-0.07	0.55	0.0	0.0	4.95	95.32
127	-0.3	-0.3	0.0	0.00	-0.4	-0.06	-0.1	0.13	-0.4	-0.06	0.15	0.0	0.0	2.22	96.06
128	-0.2	-0.6	0.0	0.00	-1.1	-0.42	-0.3	0.07	-1.1	-0.43	0.38	0.1	0.1	25.97	99.84

Table 26. SE19-PA-5

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	31.3	-33.9	62.0	3.80	-114.1	-3.09	25.8	7.44	-17.7	-9.75	1.93	4077.5	4968.3	541.3	
1	***0.6***	***0.1***	***0.9***	***0.69***	***-0.1***	***-0.78***	***0.9***	***0.69***	***-0.1***	***-0.84***	***1.43***	***0.5***	***1.3***	***8.11***	***0.56***
2	*0.2*	*0.3*	*0.3*	*0.23*	*-0.1*	*-0.68*	*0.3*	*0.23*	*-0.1*	*-0.74*	*1.93*	*0.1*	*1.3*	*4.74*	*1.66*
3	0.7	0.6	0.9	0.46	0.0	0.00	0.8	0.48	0.4	-0.33	0.54	0.1	0.4	5.76	2.46
4	***0.7***	***0.3***	***0.8***	***0.44***	***0.0***	***-0.76***	***0.8***	***0.50***	***0.0***	***-0.79***	***1.35***	***0.3***	***1.8***	***3.81***	***3.28***
5	*0.4*	*-0.1*	*0.8*	*0.51*	*-1.1*	*-1.72*	*0.8*	*0.57*	*-1.1*	*-1.72*	*1.13*	*0.7*	*1.4*	*14.60*	*3.82*
6	**1.1**	**0.5**	**1.2**	**0.37**	**-0.1**	**-0.80**	**0.8**	**1.21**	**0.0**	**-0.84**	**0.84**	**1.4**	**2.1**	**10.26**	**4.48**
7	**0.6**	**0.7**	**0.8**	**0.34**	**0.0**	**0.00**	**0.8**	**0.34**	**0.3**	**-0.34**	**0.40**	**0.0**	**0.0**	**6.60**	**5.10**
8	1.0	0.5	1.2	0.49	0.0	0.00	1.2	0.49	0.2	-0.64	0.40	0.3	1.0	6.97	5.98
9	***0.9***	***0.2***	***1.3***	***0.50***	***-0.3***	***-1.05***	***1.3***	***0.50***	***-0.3***	***-1.05***	***0.99***	***0.6***	***2.0***	***9.02***	***6.44***
10	**1.1**	**0.3**	**1.9**	**1.18**	**-0.4**	**-1.17**	**1.9**	**1.18**	**-0.2**	**-1.28**	**1.00**	**1.8**	**2.6**	**13.14**	**7.00**
11	0.8	0.3	1.5	0.71	-0.1	-0.65	1.3	0.81	0.0	-0.68	0.85	0.7	1.5	11.49	7.68
12	1.0	-0.1	1.6	0.87	-0.7	-1.43	1.5	0.91	-0.6	-1.48	0.98	1.5	3.8	12.95	8.16
13	***1.2***	***-0.2***	***2.3***	***1.43***	***-1.2***	***-1.82***	***2.1***	***1.49***	***-1.1***	***-1.83***	***0.94***	***3.2***	***4.9***	***21.53***	***8.66***
14	***1.0***	***0.2***	***1.9***	***1.10***	***-0.2***	***-1.17***	***1.8***	***1.43***	***-0.2***	***-1.20***	***1.07***	***1.9***	***0.7***	***22.35***	***9.16***
15	***0.9***	***0.2***	***1.2***	***0.57***	***-0.3***	***-0.98***	***1.2***	***0.57***	***-0.3***	***-1.07***	***0.99***	***0.7***	***2.1***	***9.48***	***9.68***
16	***1.0***	***0.5***	***1.4***	***0.72***	***0.0***	***0.00***	***1.3***	***0.81***	***0.1***	***-0.79***	***0.51***	***0.7***	***0.5***	***11.43***	***10.14***
17	***1.1***	***0.5***	***1.5***	***0.76***	***-0.2***	***-1.26***	***1.5***	***0.78***	***-0.2***	***-1.26***	***1.17***	***0.9***	***1.5***	***11.83***	***10.64***
18	1.1	-0.2	1.4	0.60	-1.1	-1.61	1.4	0.60	-1.1	-1.61	0.89	1.4	8.7	19.37	11.46
19	***1.9***	***-0.3***	***4.2***	***2.48***	***-2.1***	***-2.94***	***4.1***	***2.59***	***-2.0***	***-2.96***	***0.86***	***9.0***	***7.7***	***30.61***	***12.06***
20	1.5	0.2	2.8	1.63	-0.5	-1.36	2.6	1.66	-0.5	-1.36	0.89	3.3	7.5	30.35	12.80
21	*1.7*	*-1.2*	*2.9*	*1.74*	*-3.3*	*-3.53*	*2.9*	*1.74*	*-3.2*	*-3.68*	*0.85*	*8.4*	*22.7*	*53.65*	*13.38*
22	***2.8***	***-1.5***	***6.5***	***3.51***	***-5.3***	***-4.99***	***6.0***	***3.75***	***-5.1***	***-5.03***	***0.72***	***26.2***	***29.9***	***74.30***	***13.94***
23	***3.1***	***-1.8***	***10.4***	***4.86***	***-7.3***	***-5.70***	***10.1***	***5.13***	***-7.3***	***-6.14***	***0.60***	***49.7***	***60.1***	***97.55***	***14.54***
24	3.4	-1.8	9.3	4.04	-7.1	-5.46	9.0	4.42	-7.1	-5.46	0.58	38.6	31.9	102.81	15.08
25	***6.1***	***-2.4***	***13.2***	***5.70***	***-11.4***	***-7.43***	***12.4***	***5.79***	***-11.4***	***-7.43***	***0.53***	***84.8***	***101.9***	***165.67***	***15.60***
26	***10.0***	***-5.5***	***20.9***	***6.21***	***-14.3***	***-7.80***	***19.5***	***7.04***	***-11.9***	***-7.97***	***0.40***	***152.4***	***162.6***	***187.77***	***16.16***
27	9.1	-2.1	17.2	4.82	-8.1	-3.73	17.2	4.82	-8.1	-3.73	0.34	66.1	43.2	186.88	16.70

Table 26. SE19-PA-5

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
28	***16.8***	***-33.9***	***27.7***	***6.25***	***-56.3***	***-2.24***	***25.8***	***7.44***	***-17.7***	***-9.75***	***0.10***	***352.5***	***448.3***	***289.29***	***17.44***
29	**16.8**	**-17.3**	**27.6**	**6.16**	**-31.6**	**-2.21**	**27.6**	**6.16**	**-8.6**	**-3.89**	**0.14**	**222.9**	**202.5**	**334.45**	**18.20**
30	1.0	-2.6	2.7	1.40	-14.3	0.05	2.1	1.57	-4.5	-1.35	0.08	17.5	16.4	156.26	18.82
31	9.5	-11.6	14.8	2.26	-19.1	-2.19	14.4	2.29	-12.4	-2.61	0.13	72.4	111.8	80.77	20.00
32	17.4	-12.0	27.5	5.49	-24.5	-2.09	27.5	5.49	-14.0	-2.40	0.15	130.0	163.5	173.30	21.26
33	8.2	-7.8	13.9	2.00	-10.3	-1.89	13.4	2.13	-9.5	-1.97	0.16	48.5	45.0	146.45	21.88
34	16.7	-11.6	25.2	4.19	-28.5	-2.37	24.9	4.20	-28.2	-2.42	0.12	109.2	137.3	175.71	23.12
35	6.8	-2.4	11.8	1.74	-9.6	0.02	10.3	1.83	-3.9	-1.40	0.08	30.2	31.0	123.44	24.26
36	6.4	-7.7	8.0	1.52	-13.3	-1.90	7.8	1.64	-13.2	-1.96	0.16	32.2	42.2	85.83	24.90
37	**4.3**	**1.4**	**7.7**	**1.56**	**-6.3**	**0.08**	**7.4**	**1.63**	**0.8**	**-0.82**	**0.11**	**13.4**	**10.4**	**103.31**	**25.36**
38	4.3	-4.0	5.3	1.10	-6.6	-1.60	5.1	1.15	-5.4	-1.75	0.23	13.0	18.7	46.86	25.90
39	3.9	-6.7	7.1	1.41	-12.6	-1.78	7.1	1.58	-11.2	-1.91	0.16	28.6	62.6	81.01	26.86
40	*14.5*	*-32.5*	*23.9*	*3.55*	*-114.1*	*-3.09*	*23.8*	*3.78*	*-89.5*	*-4.12*	*0.05*	*331.2*	*470.8*	*541.27*	*28.56*
41	**22.8**	**-17.6**	**40.4**	**4.37**	**-28.4**	**-1.44**	**30.8**	**6.60**	**-6.3**	**-2.00**	**0.08**	**248.8**	**200.7**	**512.12**	**29.56**
42	-0.4	-4.6	0.6	1.02	-17.4	0.06	-0.1	1.04	-5.7	-1.26	0.05	11.2	8.9	92.80	30.26
43	13.4	-21.2	37.2	3.58	-64.7	-2.20	37.2	3.58	-10.3	-2.56	0.06	155.5	226.9	208.96	31.82
44	16.6	3.1	32.5	2.41	-18.2	0.11	32.5	2.61	3.1	-0.86	0.05	60.8	48.7	214.06	32.54
45	9.8	-19.4	10.7	1.14	-50.3	-1.82	9.5	1.15	-50.3	-1.82	0.05	67.4	103.8	219.99	33.36
46	19.7	-15.1	40.6	3.90	-29.8	-1.46	39.5	4.37	-29.5	-1.66	0.08	115.6	117.6	246.00	34.54
47	7.1	-10.5	9.9	1.23	-15.4	-1.63	9.9	1.23	-15.4	-1.63	0.11	33.2	42.8	121.92	35.48
48	18.2	-11.9	33.2	2.27	-36.3	-1.51	32.8	2.45	-35.7	-1.66	0.05	95.9	148.4	221.23	37.08
49	**31.3**	**-16.5**	**62.0**	**3.80**	**-51.9**	**-1.40**	**43.8**	**5.56**	**-9.8**	**-2.04**	**0.05**	**229.0**	**258.6**	**310.03**	**38.20**
50	-15.4	-12.0	0.0	0.00	-36.7	-1.32	-15.4	0.02	-31.8	-1.77	0.04	16.8	35.2	242.03	38.66
51	11.6	-8.7	18.7	0.97	-27.9	-1.35	16.1	1.57	-13.0	-1.51	0.05	63.0	72.2	238.51	39.36
52	9.6	-6.1	11.9	1.12	-7.5	-1.32	11.3	1.30	-7.4	-1.45	0.13	26.3	27.7	188.66	39.92
53	8.6	-8.0	16.4	1.34	-15.4	-1.27	16.4	1.34	-7.1	-1.56	0.08	72.0	86.3	118.39	41.52
54	5.1	-6.5	6.1	1.04	-7.5	-1.07	5.8	1.18	-6.5	-1.41	0.15	16.9	20.1	103.82	42.04
55	-5.7	-9.6	2.0	0.51	-11.8	-1.27	1.6	0.80	-11.4	-1.44	0.13	15.5	28.8	61.34	42.94
56	7.1	3.5	10.3	1.04	-8.6	0.03	9.9	1.29	3.2	-0.67	0.05	12.2	9.0	92.27	43.52
57	9.5	-4.7	14.5	1.06	-5.9	-1.22	14.2	1.33	-5.9	-1.42	0.11	20.1	25.0	67.33	44.18

Table 26. SE19-PA-5

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
58	8.3	-2.5	14.1	1.24	-4.0	-1.19	12.7	1.32	-3.2	-1.20	0.13	22.2	26.6	110.68	44.78
59	4.0	-7.4	4.7	0.72	-14.2	-1.43	4.2	0.96	-14.1	-1.65	0.11	21.5	31.7	90.74	45.36
60	3.7	-0.8	5.4	1.12	-5.8	0.17	5.4	1.12	-1.1	-1.03	0.08	9.3	8.1	106.67	45.82
61	4.1	-6.8	5.0	0.92	-13.9	-1.32	4.9	1.00	-13.8	-1.57	0.12	21.2	28.0	102.87	46.42
62	9.3	-4.1	10.6	1.12	-6.9	-1.24	10.5	1.17	-6.9	-1.39	0.13	21.7	22.2	112.24	46.96
63	11.9	-8.5	18.6	1.36	-12.8	-1.45	18.2	1.47	-12.1	-1.46	0.09	38.3	43.3	108.33	47.66
64	10.8	-8.8	16.7	1.18	-14.1	-1.52	16.5	1.36	-13.8	-1.79	0.09	37.9	46.0	133.99	48.42
65	1.6	-9.0	1.9	0.63	-10.6	-1.52	1.0	0.70	-10.6	-1.52	0.17	15.0	19.6	89.44	48.90
66	17.2	-14.7	37.0	2.11	-60.9	-2.09	27.3	2.20	-60.9	-2.09	0.04	110.0	139.1	238.13	50.06
67	1.7	-7.2	2.1	0.61	-11.0	0.06	1.6	0.75	-8.8	-1.34	0.04	13.6	16.9	165.42	50.72
68	4.4	0.2	5.1	0.84	-5.8	0.10	5.1	1.07	-0.4	-0.84	0.07	7.9	7.0	74.55	51.26
69	7.0	-7.3	9.6	0.97	-8.2	-1.03	8.7	1.08	-7.8	-1.60	0.11	19.1	23.7	62.61	51.96
70	10.9	-8.6	15.8	1.06	-26.2	-1.37	15.3	1.31	-11.5	-1.61	0.06	48.8	59.5	152.91	52.80
71	9.2	-8.1	12.8	1.01	-10.6	-1.36	11.6	1.20	-10.5	-1.41	0.10	28.4	33.1	162.66	53.44
72	6.9	-4.8	12.6	1.20	-15.7	-1.53	12.6	1.20	-15.7	-1.53	0.10	34.8	39.2	152.08	54.16
73	10.6	1.6	23.3	1.72	-1.8	0.21	23.3	1.72	0.9	-0.92	0.06	28.6	31.5	160.21	54.78
74	8.2	-7.2	11.8	1.03	-15.1	-1.25	11.8	1.09	-14.7	-1.55	0.08	27.5	60.8	67.18	56.06
75	9.7	-1.4	13.7	1.12	-6.3	0.01	12.8	1.23	-1.6	-1.05	0.06	18.8	13.6	66.55	56.98
76	2.9	-3.2	3.0	0.54	-4.8	-1.07	2.7	0.73	-4.4	-1.34	0.21	6.7	13.2	34.14	57.72
77	16.4	-2.6	29.6	1.84	-3.6	-1.09	26.9	1.90	-3.3	-1.16	0.09	41.6	51.1	132.95	58.46
78	5.6	-5.2	6.0	0.73	-19.1	-1.37	5.4	1.16	-13.2	-1.55	0.08	27.6	65.7	135.99	59.48
79	13.6	-7.4	29.0	1.86	-9.6	-1.42	26.9	1.99	-6.9	-1.48	0.08	49.2	39.4	166.24	60.28
80	13.1	-9.3	20.7	1.37	-21.0	-1.53	19.9	1.44	-21.0	-1.53	0.07	48.2	57.4	157.99	61.10
81	3.6	-0.7	4.3	0.75	-8.4	0.01	4.2	0.78	-0.5	-0.91	0.06	6.4	7.9	46.37	61.92
82	5.1	-6.9	6.6	0.78	-9.1	-1.41	6.3	0.99	-9.1	-1.41	0.14	15.8	27.4	51.18	62.72
83	8.9	-2.8	13.2	1.07	-5.7	0.13	13.2	1.19	-4.1	-1.12	0.05	18.7	26.8	88.77	63.90
84	6.0	-1.5	8.5	0.95	-2.3	-0.74	5.6	1.13	-1.7	-1.10	0.16	12.1	10.7	49.53	64.60
85	1.7	-2.5	2.1	0.48	-3.0	-0.86	1.8	0.67	-2.7	-1.21	0.26	4.7	5.7	25.84	65.06
86	7.0	1.3	10.4	0.97	-2.1	0.05	10.4	1.13	0.6	-0.85	0.07	10.7	13.6	71.06	65.72
87	2.0	-1.1	2.6	0.48	-1.7	-0.76	2.5	0.48	-1.6	-1.01	0.29	2.8	4.7	22.17	66.12

Table 26. SE19-PA-5

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
88	2.1	-1.9	2.7	0.64	-3.4	-0.97	2.7	0.64	-3.2	-1.19	0.27	5.1	7.9	29.82	66.68
89	3.9	-0.6	4.7	0.89	-1.4	0.25	4.2	0.91	-1.0	-0.91	0.11	6.0	6.5	43.75	67.30
90	2.3	-0.7	2.9	0.61	-2.2	-0.95	2.5	0.69	-2.1	-1.06	0.31	4.1	6.7	27.56	67.86
91	3.1	-2.1	3.9	0.78	-3.9	-1.13	3.9	0.78	-3.9	-1.18	0.24	7.1	9.6	30.23	68.50
92	4.2	0.8	5.7	0.95	-1.5	0.32	5.2	1.02	-0.1	-0.82	0.09	6.0	8.4	36.23	69.32
93	0.9	-5.5	1.0	0.11	-7.3	-1.33	1.0	0.13	-7.1	-1.51	0.17	6.9	15.2	36.51	69.82
94	7.5	2.0	9.7	0.88	-4.9	0.07	8.7	1.14	1.5	-0.68	0.06	10.1	8.7	70.88	70.50
95	3.4	1.7	*4.5*	0.77	0.0	0.00	4.5	0.77	1.1	-0.76	0.17	2.1	3.0	21.73	71.00
96	4.7	-4.5	5.8	0.89	-6.4	-1.24	5.8	0.89	-6.4	-1.43	0.18	10.3	18.1	27.30	71.74
97	**5.2**	**-1.3**	**6.6**	**0.91**	**-3.8**	**0.13**	**4.8**	**0.99**	**-2.7**	**-1.09**	**0.07**	**10.0**	**11.3**	**46.35**	**72.76**
98	**5.6**	**-5.9**	**6.4**	**0.70**	**-7.9**	**-1.21**	**6.2**	**1.04**	**-5.8**	**-1.44**	**0.13**	**14.9**	**19.8**	**51.69**	**73.36**
99	**6.9**	**-1.3**	**9.4**	**0.99**	**-4.7**	**0.01**	**8.8**	**1.05**	**-2.6**	**-1.07**	**0.07**	**13.3**	**14.0**	**85.28**	**73.98**
100	**5.4**	**-4.7**	**7.5**	**0.86**	**-6.1**	**-1.41**	**6.0**	**1.05**	**-6.1**	**-1.41**	**0.17**	**14.5**	**18.2**	**60.83**	**74.58**
101	**-0.1**	**-4.7**	**0.1**	**0.32**	**-6.0**	**-0.92**	**-0.2**	**0.57**	**-5.3**	**-1.42**	**0.21**	**5.4**	**11.8**	**44.13**	**75.18**
102	**4.6**	**1.8**	**6.1**	**0.90**	**-4.3**	**0.08**	**5.5**	**1.03**	**1.5**	**-0.63**	**0.08**	**6.0**	**6.4**	**41.47**	**75.92**
103	**4.3**	**-3.3**	**5.5**	**0.90**	**-5.0**	**-1.20**	**5.3**	**0.94**	**-4.9**	**-1.33**	**0.20**	**8.4**	**12.3**	**35.69**	**76.52**
104	**2.9**	**1.1**	**3.6**	**0.63**	**-2.6**	**0.34**	**2.6**	**0.83**	**0.6**	**-0.68**	**0.05**	**3.8**	**3.6**	**51.05**	**77.04**
105	**3.8**	**-0.3**	**5.2**	**0.95**	**-0.9**	**-0.75**	**5.1**	**0.98**	**-0.5**	**-0.89**	**0.28**	**4.7**	**10.3**	**20.32**	**78.06**
106	**2.5**	**-2.6**	**3.3**	**0.68**	**-3.4**	**-0.84**	**3.2**	**0.77**	**-2.5**	**-1.14**	**0.23**	**5.7**	**8.2**	**23.75**	**78.76**
107	**1.1**	**0.2**	**1.5**	**0.51**	**-2.0**	**0.05**	**1.3**	**0.62**	**-0.4**	**-0.70**	**0.13**	**1.7**	**1.7**	**35.50**	**79.28**
108	2.1	-0.4	2.6	0.57	-1.3	-0.75	2.5	0.63	-0.7	-0.91	0.34	2.9	4.5	22.42	79.86
109	0.0	-0.1	0.1	0.22	-0.5	-0.25	0.0	0.23	-0.4	-0.27	0.88	0.1	0.0	9.37	80.16
110	***2.3***	***1.6***	***2.9***	***0.58***	***0.0***	***0.00***	***2.8***	***0.65***	***1.4***	***-0.34***	***0.20***	***1.3***	***2.0***	***19.94***	***80.72***
111	***3.5***	***-1.8***	***4.3***	***0.80***	***-2.5***	***-0.70***	***4.3***	***0.80***	***-2.2***	***-0.99***	***0.22***	***4.8***	***7.5***	***18.42***	***81.36***
112	***2.7***	***0.7***	***3.4***	***0.72***	***-1.5***	***0.12***	***3.3***	***0.79***	***0.1***	***-0.79***	***0.12***	***3.4***	***4.0***	***31.94***	***81.92***
113	***2.8***	***-0.4***	***3.5***	***0.77***	***-1.1***	***-0.90***	***3.5***	***0.77***	***-0.9***	***-0.90***	***0.37***	***3.3***	***4.9***	***23.50***	***82.48***
114	***1.8***	***-0.9***	***2.3***	***0.56***	***-2.2***	***-0.79***	***1.8***	***0.62***	***-1.4***	***-0.98***	***0.30***	***3.1***	***5.8***	***22.87***	***83.28***
115	***4.8***	***-1.2***	***7.0***	***0.92***	***-2.7***	***-0.96***	***6.2***	***1.08***	***-2.4***	***-1.03***	***0.20***	***9.6***	***11.5***	***41.60***	***83.98***
116	***2.2***	***-3.9***	***2.8***	***0.67***	***-5.1***	***-0.95***	***2.8***	***0.67***	***-4.7***	***-1.18***	***0.21***	***7.0***	***11.0***	***26.48***	***84.60***
117	***3.7***	***1.0***	***5.3***	***0.92***	***-3.5***	***0.20***	***5.0***	***1.01***	***0.6***	***-0.71***	***0.08***	***5.7***	***6.0***	***47.38***	***85.38***

Table 26. SE19-PA-5

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
118	*1.1*	*1.3*	*1.3*	*-0.05*	*0.0*	*0.00*	*1.2*	*0.13*	*0.7*	*-0.41*	*0.04*	*0.0*	*0.1*	*7.81*	*85.80*
119	2.3	1.8	2.9	0.56	0.0	0.00	2.9	0.58	1.5	-0.34	0.19	0.6	1.1	12.29	86.28
120	2.3	1.1	2.9	0.53	0.0	0.00	2.8	0.55	0.7	-0.57	0.19	0.8	1.4	11.11	86.88
121	2.2	1.7	2.9	0.54	0.0	0.00	2.7	0.55	1.3	-0.49	0.19	0.7	1.3	11.68	87.46
122	2.0	0.7	2.4	0.38	-0.1	-0.68	2.4	0.38	0.0	-0.76	0.43	0.8	3.1	8.45	88.40
123	1.8	1.5	2.3	0.45	0.0	0.00	2.3	0.50	1.0	-0.39	0.19	0.5	0.6	7.53	89.96
124	1.7	1.6	2.2	0.42	0.0	0.00	2.2	0.42	1.4	-0.15	0.19	0.1	0.5	5.26	90.70
125	1.6	0.9	1.7	0.04	0.0	0.00	1.7	0.13	0.3	-0.61	0.03	0.3	0.8	5.95	92.50
126	1.1	1.1	1.1	0.05	0.0	0.00	1.1	0.05	0.5	-0.44	0.04	0.1	0.2	5.73	93.02
127	1.4	1.3	1.7	0.20	0.0	0.00	1.6	0.22	0.8	-0.36	0.12	0.1	0.1	7.28	94.28
128	1.6	1.4	2.0	0.33	0.0	0.00	1.9	0.33	1.3	-0.14	0.17	0.1	0.1	7.30	94.76

Table 27. SE19-PA-6

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	27.6	-42.6	70.1	2.94	-119.5	-2.83	16.7	9.98	-10.0	-8.57	2.72	3673.7	4753.9	549.2	
1	***0.4***	***0.0***	***0.6***	***1.02***	***-0.1***	***-0.79***	***0.6***	***1.02***	***0.0***	***-0.87***	***2.45***	***0.4***	***1.7***	***4.32***	***0.52***
2	*0.0*	*-0.1*	*0.1*	*0.40*	*-0.2*	*-0.40*	*0.0*	*0.45*	*-0.2*	*-0.82*	*2.13*	*0.1*	*0.5*	*4.19*	*0.98*
3	*-0.1*	*0.0*	*0.0*	*0.00*	*-0.3*	*-0.75*	*-0.1*	*0.02*	*-0.3*	*-0.75*	*2.31*	*0.0*	*0.8*	*4.44*	*1.66*
4	0.3	0.2	0.4	0.70	-0.1	-0.49	0.4	0.70	-0.1	-0.49	2.49	0.2	0.7	6.03	2.46
5	*0.3*	*-0.2*	*0.4*	*0.66*	*-0.3*	*-0.66*	*0.4*	*0.66*	*-0.2*	*-0.83*	*1.90*	*0.2*	*1.7*	*3.05*	*3.24*
6	0.1	-0.1	0.3	0.56	-0.3	-0.63	0.2	0.58	-0.3	-0.63	2.11	0.2	0.4	4.57	3.78
7	*0.2*	*-0.2*	*0.3*	*0.78*	*-0.4*	*-0.97*	*0.3*	*0.78*	*-0.4*	*-1.04*	*2.26*	*0.6*	*2.1*	*5.21*	*4.40*
8	*0.2*	*-0.2*	*0.4*	*0.74*	*-0.4*	*-1.27*	*0.4*	*0.96*	*-0.4*	*-1.27*	*2.37*	*1.1*	*4.5*	*5.00*	*6.38*
9	*0.2*	*0.0*	*0.5*	*1.36*	*-0.2*	*-0.38*	*0.3*	*1.44*	*0.0*	*-0.92*	*2.63*	*0.7*	*1.0*	*6.48*	*7.04*
10	0.3	*-0.2*	0.4	0.65	-0.3	*-0.64*	0.4	*0.65*	-0.2	-0.82	1.89	0.4	1.8	3.67	7.66
11	*0.3*	*-0.3*	*0.5*	*1.24*	*-0.6*	*-1.56*	*0.4*	*1.29*	*-0.5*	*-1.68*	*2.72*	*1.3*	*3.9*	*7.75*	*8.10*
12	*0.3*	*-0.3*	*0.6*	*1.54*	*-0.6*	*-1.81*	*0.3*	*1.73*	*-0.6*	*-1.81*	*2.65*	*1.7*	*3.1*	*7.05*	*8.56*
13	***0.3***	***-0.2***	***0.5***	***1.11***	***-0.3***	***-0.67***	***0.3***	***1.69***	***-0.2***	***-1.18***	***2.13***	***1.1***	***0.4***	***7.49***	***9.00***
14	***0.2***	***-0.2***	***0.3***	***0.41***	***-0.4***	***-1.16***	***0.1***	***0.74***	***-0.4***	***-1.19***	***2.19***	***0.4***	***2.1***	***3.93***	***9.64***
15	***0.4***	***-0.1***	***0.4***	***1.05***	***-0.4***	***-0.85***	***0.3***	***1.29***	***-0.2***	***-1.19***	***2.35***	***1.0***	***1.1***	***6.29***	***10.06***
16	***0.3***	***0.0***	***0.5***	***1.18***	***-0.1***	***0.30***	***0.4***	***1.32***	***0.0***	***-0.65***	***1.39***	***0.6***	***1.4***	***8.20***	***10.58***
17	***0.3***	***-0.3***	***0.5***	***1.14***	***-0.5***	***-1.49***	***0.5***	***1.14***	***-0.5***	***-1.72***	***2.46***	***1.1***	***7.7***	***5.91***	***11.40***
18	**0.3**	**0.0**	**1.0**	**1.98**	**-0.5**	**-2.06**	**1.0**	**2.08**	**-0.5**	**-2.07**	**2.66**	**1.5**	**1.1**	**9.12**	**11.94**
19	*0.5*	*-0.1*	*0.7*	*1.31*	*-0.8*	*-2.06*	*0.6*	*1.45*	*-0.7*	*-2.07*	*2.32*	*2.0*	*10.0*	*8.19*	*12.76*
20	*0.3*	*-0.7*	*0.6*	*1.25*	*-1.8*	*-3.03*	*0.4*	*1.47*	*-1.8*	*-3.09*	*1.74*	*3.7*	*15.7*	*21.79*	*13.34*
21	***1.1***	***-1.1***	***2.8***	***4.01***	***-3.7***	***-4.41***	***2.1***	***4.67***	***-3.4***	***-4.53***	***1.30***	***16.7***	***23.9***	***44.02***	***13.86***
22	***1.4***	***-1.5***	***4.9***	***5.94***	***-6.3***	***-5.90***	***4.8***	***6.02***	***-5.4***	***-5.91***	***1.05***	***36.6***	***45.9***	***64.14***	***14.44***
23	***0.9***	***-1.4***	***5.6***	***6.28***	***-8.0***	***-6.53***	***5.1***	***6.34***	***-7.7***	***-6.53***	***0.94***	***42.9***	***71.3***	***111.38***	***15.02***
24	***4.8***	***-10.0***	***13.6***	***8.76***	***-24.2***	***-6.21***	***12.4***	***9.28***	***-10.0***	***-8.57***	***0.40***	***213.8***	***204.4***	***201.53***	***15.62***
25	**6.2**	**-9.3**	**14.6**	**8.57**	**-22.3**	**-5.44**	**14.6**	**8.57**	**-22.3**	**-5.44**	**0.38**	**121.6**	**110.8**	**212.92**	**16.22**
26	*0.8*	*-4.7*	*3.9*	*2.47*	*-11.9*	*-2.27*	*3.9*	*2.47*	*-10.8*	*-2.40*	*0.30*	*28.6*	*32.4*	*174.43*	*16.70*
27	***10.0***	***-42.6***	***21.7***	***9.10***	***-82.1***	***-2.95***	***16.7***	***9.98***	***-27.7***	***-8.43***	***0.12***	***392.9***	***508.5***	***350.90***	***17.50***

Table 27. SE19-PA-6

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
28	0.0	-26.0	8.5	6.14	-41.4	-1.64	8.5	6.14	-30.1	-2.82	0.16	175.0	156.0	365.06	18.20
29	-6.7	-11.6	0.0	0.00	-22.5	0.19	-3.8	2.93	-12.6	-1.55	0.01	25.9	21.2	184.53	18.80
30	-3.8	-19.5	0.4	3.22	-41.8	-2.03	0.3	3.32	-40.7	-2.54	0.12	65.8	136.9	132.21	20.06
31	5.9	-14.8	16.4	7.15	-45.2	-2.29	16.4	7.47	-43.7	-2.67	0.15	158.4	220.4	196.85	21.34
32	-1.2	-11.2	6.9	3.56	-17.4	-1.33	6.5	3.73	-15.7	-1.53	0.20	52.0	22.1	190.37	21.94
33	-0.1	-20.5	11.7	4.92	-49.9	-2.14	11.7	4.92	-49.3	-2.83	0.11	98.9	164.6	173.80	23.10
34	**-6.4**	**-13.2**	**2.4**	**3.69**	**-18.3**	**0.17**	**2.0**	**3.81**	**-16.7**	**-1.47**	**0.17**	**52.1**	**43.1**	**140.33**	**24.26**
35	-7.0	-14.1	0.0	0.00	-30.2	-1.88	-4.4	2.63	-29.9	-1.93	0.06	30.4	47.7	121.36	25.00
36	-9.5	-14.1	0.0	0.00	-21.4	-1.56	-5.7	2.57	-21.2	-1.56	0.07	23.9	27.2	94.70	25.96
37	-9.1	-14.6	0.0	0.00	-25.7	-1.67	-4.9	2.66	-25.7	-1.67	0.07	23.7	63.9	104.97	26.92
38	0.1	-9.8	10.9	5.85	-12.2	0.18	10.5	5.95	-10.5	-0.99	0.25	72.9	74.8	136.69	27.52
39	*-4.6*	*-24.1*	*2.4*	*3.22*	*-119.5*	*-2.83*	*2.4*	*3.22*	*-89.3*	*-4.45*	*0.05*	*227.8*	*381.6*	*549.24*	*28.58*
40	**15.9**	**-13.2**	**39.9**	**3.97**	**-37.5**	**-1.62**	**19.2**	**8.68**	**-35.7**	**-1.73**	**0.07**	**251.4**	**216.7**	**503.30**	**29.72**
41	2.1	-18.6	27.6	2.97	-80.5	-2.20	25.4	3.02	-72.6	-2.69	0.05	130.4	231.5	225.74	31.84
42	6.6	-9.3	34.1	3.68	-14.2	0.03	33.3	3.68	-9.7	-0.68	0.08	89.0	72.2	254.44	32.58
43	-5.9	-12.2	0.0	0.00	-63.1	-1.96	-5.2	0.99	-63.1	-1.96	0.03	34.0	90.6	274.83	33.42
44	**10.4**	**-12.0**	**40.5**	**4.22**	**-40.1**	**-1.17**	**38.7**	**4.72**	**-29.8**	**-1.70**	**0.07**	**119.9**	**118.9**	**283.15**	**34.70**
45	-1.3	-10.5	7.9	1.57	-22.5	-1.03	6.9	1.68	-22.2	-1.26	0.09	28.5	33.6	153.54	35.54
46	3.2	-13.4	22.5	2.49	-47.9	-1.21	17.3	2.63	-47.0	-1.99	0.05	69.2	154.2	207.84	36.98
47	**27.6**	**-10.5**	**70.1**	**2.94**	**-46.4**	**-1.53**	**44.7**	**4.70**	**-46.4**	**-1.53**	**0.04**	**254.2**	**283.7**	**292.35**	**38.68**
48	5.2	-11.6	15.6	1.57	-33.2	-1.35	10.4	1.97	-31.8	-1.51	0.06	46.0	52.8	234.00	39.38
49	0.9	-9.0	6.1	1.14	-14.4	-0.83	4.1	1.33	-13.5	-0.92	0.10	20.3	19.5	169.16	40.04
50	3.1	-9.9	11.1	1.29	-19.2	-1.11	10.2	1.35	-19.2	-1.11	0.08	26.8	35.3	118.82	40.90
51	0.0	-9.8	6.9	1.07	-19.2	-0.91	6.6	1.13	-19.1	-1.09	0.08	22.2	28.2	113.79	41.56
52	-2.0	-9.6	0.0	0.00	-14.3	-0.91	-0.3	1.05	-14.3	-0.91	0.06	12.3	14.5	88.65	42.12
53	-6.2	-9.5	0.0	0.00	-21.6	-1.18	-5.6	0.77	-21.6	-1.19	0.05	8.9	22.3	104.27	43.08
54	1.1	-7.4	9.1	1.17	-10.8	-0.73	8.8	1.29	-10.1	-0.75	0.10	22.8	25.1	94.93	44.22
55	0.1	-6.9	9.1	1.11	-8.8	-0.65	8.4	1.24	-8.6	-0.71	0.10	16.3	21.5	118.30	44.80
56	-2.0	-9.6	0.0	0.00	-21.1	-0.98	-0.7	0.99	-20.6	-1.29	0.05	13.2	21.4	102.96	45.42
57	-3.5	-7.1	0.0	0.00	-9.3	-0.63	-4.2	1.04	-9.1	-0.67	0.07	7.1	5.7	91.48	45.86

Table 27. SE19-PA-6

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
58	-3.4	-11.0	0.0	0.00	-21.6	-1.13	-3.7	0.91	-20.7	-1.19	0.05	11.3	17.8	111.10	46.46
59	0.9	-8.8	3.5	1.04	-12.9	-0.78	1.3	1.17	-12.7	-0.88	0.11	14.6	14.3	110.68	46.98
60	-0.9	-11.2	11.7	1.43	-19.7	-1.24	11.7	1.43	-19.7	-1.24	0.09	25.7	31.7	126.87	47.70
61	1.2	-8.4	10.4	1.12	-19.7	-0.98	8.9	1.46	-18.8	-1.33	0.07	23.4	31.5	135.06	48.50
62	-5.0	-8.7	0.0	0.00	-17.7	-1.04	-4.5	0.89	-17.7	-1.09	0.06	9.4	11.7	124.52	49.00
63	4.0	-13.9	30.9	1.77	-61.7	-1.29	28.9	1.83	-58.3	-2.25	0.03	71.0	106.6	255.52	50.06
64	-2.0	-10.0	3.7	0.67	-13.1	-0.79	3.2	1.15	-12.9	-0.80	0.09	14.5	7.3	168.78	50.78
65	-5.0	-8.2	0.0	0.00	-10.2	-0.62	-4.3	0.85	-9.7	-0.69	0.06	5.0	5.8	53.28	51.30
66	-0.9	-9.9	1.6	0.79	-13.6	-0.79	-3.5	0.95	-13.5	-0.87	0.10	11.7	15.8	76.90	52.02
67	0.6	-11.4	9.8	1.08	-32.3	-1.30	8.4	1.36	-30.6	-1.43	0.06	30.3	42.7	166.72	52.82
68	-0.1	-10.7	8.5	0.92	-16.3	-1.06	8.4	1.35	-16.3	-1.06	0.08	20.0	20.5	158.47	53.50
69	-0.9	-10.0	4.4	0.95	-23.7	-1.10	2.5	1.03	-22.7	-1.25	0.07	20.7	26.7	154.11	54.18
70	-2.1	-10.4	16.9	1.56	-24.8	-1.20	13.3	1.70	-24.5	-1.29	0.07	37.0	85.0	177.93	56.16
71	-0.8	-6.0	13.9	1.36	-8.7	0.16	13.8	1.51	-5.9	-0.45	0.05	18.5	9.6	99.76	57.02
72	-4.7	-9.7	0.0	0.00	-13.2	-0.79	-4.5	0.53	-12.9	-0.82	0.06	4.3	8.9	60.39	57.78
73	-0.1	-7.5	21.6	1.46	-8.2	-0.60	19.6	1.69	-8.2	-0.60	0.07	26.4	38.6	134.11	58.46
74	-0.6	-10.8	1.4	0.84	-27.6	-1.29	-0.1	0.90	-25.9	-1.32	0.07	17.9	59.9	154.43	59.50
75	-1.2	-9.7	25.9	1.56	-12.3	-0.82	22.1	1.86	-12.3	-0.82	0.06	34.3	20.5	187.05	60.30
76	0.0	-9.9	14.7	1.32	-30.3	-1.43	12.8	1.56	-28.1	-1.44	0.06	31.9	47.4	156.45	61.28
77	-2.1	-4.7	2.5	0.87	-9.2	0.06	2.5	0.93	-4.9	-0.24	0.07	8.3	8.1	67.02	61.92
78	-1.8	-9.2	1.3	0.81	-17.2	-1.07	-0.3	0.88	-17.2	-1.07	0.10	10.4	19.6	76.90	62.82
79	-2.6	-9.5	3.9	0.82	-12.8	-0.77	3.3	1.00	-12.6	-0.79	0.10	13.1	19.4	68.09	64.00
80	-2.3	-7.9	0.0	0.00	-9.2	-0.65	-2.3	0.87	-9.2	-0.65	0.07	7.3	7.0	50.55	64.64
81	-5.5	-8.4	0.0	0.00	-10.3	-0.68	-5.0	0.77	-10.3	-0.71	0.07	3.3	4.0	36.60	65.12
82	-4.1	-7.6	3.3	0.82	-9.0	-0.60	-4.8	0.93	-8.8	-0.65	0.12	10.5	15.3	71.77	66.18
83	-5.7	-8.9	0.0	0.00	-11.8	-0.76	-5.3	0.67	-11.7	-0.77	0.06	3.5	5.4	34.61	66.74
84	-4.7	-7.9	0.0	0.00	-8.7	-0.64	-4.0	0.86	-8.7	-0.64	0.07	4.1	5.0	35.66	67.32
85	-5.6	-8.8	0.0	0.00	-10.5	-0.74	-5.1	0.69	-10.5	-0.74	0.07	3.0	4.8	27.19	67.90
86	-5.9	-9.4	0.0	0.00	-12.5	-0.82	-5.1	0.80	-12.5	-0.82	0.07	4.4	6.7	30.35	68.56
87	-3.3	-6.2	0.0	0.00	-8.9	0.02	-5.1	0.84	-6.3	-0.41	0.00	5.0	8.6	29.02	69.28

Table 27. SE19-PA-6

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
88	-5.8	-9.9	0.0	0.00	-15.7	-1.01	-5.5	0.29	-15.7	-1.07	0.06	4.6	10.4	62.71	69.92
89	-3.1	-5.7	*0.7*	0.78	-8.5	0.09	-2.0	0.98	-6.0	-0.40	0.08	8.8	9.2	60.68	71.00
90	0.0	-9.2	0.0	0.00	-13.5	-0.90	-1.7	0.84	-13.5	-0.90	0.07	6.9	13.1	30.66	71.94
91	**-3.0**	**-7.3**	**0.4**	**0.77**	**-9.3**	**-0.10**	**-5.1**	**0.88**	**-8.4**	**-0.62**	**0.09**	**7.9**	**10.6**	**49.97**	**72.76**
92	**-2.2**	**-9.6**	**0.1**	**0.76**	**-14.4**	**-1.00**	**-4.2**	**0.93**	**-14.4**	**-1.00**	**0.12**	**10.1**	**14.2**	**72.15**	**73.42**
93	**-2.4**	**-8.0**	**1.7**	**0.75**	**-9.1**	**-0.68**	**-5.0**	**0.97**	**-9.1**	**-0.68**	**0.13**	**9.9**	**10.5**	**76.90**	**73.98**
94	**-2.8**	**-9.0**	**0.9**	**0.79**	**-12.5**	**-0.79**	**-4.0**	**0.89**	**-12.2**	**-0.83**	**0.12**	**9.9**	**12.7**	**54.61**	**74.66**
95	**-7.8**	**-10.0**	**0.0**	**0.00**	**-14.3**	**-0.96**	**-7.8**	**0.31**	**-14.2**	**-1.01**	**0.07**	**3.1**	**10.8**	**39.56**	**75.30**
96	**-3.3**	**-9.1**	**1.6**	**0.79**	**-12.3**	**-0.75**	**-2.5**	**0.93**	**-12.3**	**-0.81**	**0.11**	**12.0**	**16.2**	**49.47**	**76.58**
97	**-5.5**	**-7.7**	**0.0**	**0.00**	**-8.2**	**0.12**	**-5.3**	**0.83**	**-7.8**	**-0.50**	**0.01**	**2.7**	**2.7**	**39.62**	**77.02**
98	**-4.0**	**-8.8**	**0.0**	**0.00**	**-10.4**	**-0.70**	**-4.5**	**0.87**	**-10.1**	**-0.71**	**0.07**	**5.3**	**10.2**	**26.48**	**78.16**
99	-5.8	-9.4	0.0	0.00	-11.6	-0.81	-5.4	0.77	-11.6	-0.81	0.07	3.9	5.7	30.28	78.82
100	-7.2	-8.3	0.0	0.00	-8.9	0.06	-6.9	0.57	-8.5	-0.53	0.01	1.0	0.9	30.67	79.28
101	***-6.3***	***-8.3***	***0.0***	***0.00***	***-9.4***	***-0.58***	***-5.9***	***0.70***	***-9.3***	***-0.63***	***0.06***	***1.9***	***3.6***	***21.03***	***80.18***
102	*-4.1*	*-8.0*	*0.0*	*0.00*	*-9.6*	*-0.67*	*-5.1*	*0.85*	*-9.4*	*-0.69*	*0.07*	*5.6*	*8.9*	*27.30*	*81.42*
103	*-5.1*	*-7.4*	*0.0*	*0.00*	*-7.7*	*-0.48*	*-4.4*	*0.82*	*-7.4*	*-0.50*	*0.06*	*2.7*	*3.2*	*30.23*	*81.92*
104	*-5.4*	*-8.1*	*0.0*	*0.00*	*-9.2*	*-0.65*	*-5.1*	*0.73*	*-8.9*	*-0.67*	*0.07*	*2.4*	*3.7*	*24.57*	*82.54*
105	***-6.3***	***-8.6***	***0.0***	***0.00***	***-10.8***	***-0.74***	***-6.0***	***0.58***	***-10.7***	***-0.75***	***0.07***	***2.6***	***4.2***	***36.64***	***83.34***
106	***-3.2***	***-8.2***	***0.0***	***0.00***	***-9.2***	***-0.66***	***-2.0***	***0.84***	***-9.2***	***-0.66***	***0.07***	***6.6***	***7.9***	***43.05***	***83.98***
107	***-5.3***	***-9.1***	***0.0***	***0.00***	***-13.5***	***-0.95***	***-4.9***	***0.79***	***-13.5***	***-0.95***	***0.07***	***5.0***	***8.6***	***44.51***	***84.70***
108	***-4.4***	***-6.6***	***0.0***	***0.00***	***-8.2***	***0.23***	***-5.3***	***0.86***	***-7.0***	***-0.42***	***0.03***	***4.6***	***4.7***	***49.66***	***85.78***
109	***-5.2***	***-6.5***	***0.0***	***0.00***	***-6.9***	***-0.35***	***-4.4***	***0.72***	***-6.9***	***-0.37***	***0.05***	***1.5***	***2.7***	***13.91***	***86.92***
110	*-5.3*	*-5.6*	*0.0*	*0.00*	*-6.3*	*0.04*	*-4.6*	*0.68*	*-5.6*	*-0.08*	*0.01*	*0.7*	*1.1*	*11.37*	*87.38*
111	-5.4	-8.2	0.0	0.00	-9.4	-0.60	-4.7	0.61	-9.2	-0.65	0.06	1.6	3.3	7.66	88.58
112	-6.5	-6.8	0.0	0.00	-8.0	0.04	-5.8	0.60	-6.9	-0.12	0.01	0.8	1.6	8.36	91.48
113	-6.7	-6.9	0.0	0.00	-7.0	-0.12	-6.3	0.27	-7.0	-0.15	0.02	0.0	0.0	4.13	91.98
114	0.0	-7.5	0.0	0.00	-8.4	-0.42	-6.6	0.17	-8.3	-0.45	0.05	0.3	0.4	5.78	93.30
115	-7.3	-7.6	0.0	0.00	-8.4	-0.55	-7.3	0.09	-8.4	-0.55	0.07	0.2	0.2	7.79	94.32
116	-7.2	-7.3	0.0	0.00	-7.7	-0.26	-7.1	0.19	-7.7	-0.26	0.03	0.1	0.1	6.60	94.82

Table 28. SE19-PA-DL-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	70.3	-54.8	114.9	14.24	-92.9	-11.03	82.2	16.99	-48.0	-15.58	3.50	8099.3	8941.0	503.0	
1	***0.4***	***-0.1***	***0.7***	***0.81***	***-0.3***	***-0.58***	***0.6***	***0.91***	***-0.2***	***-0.93***	***1.42***	***0.5***	***1.4***	***6.60***	***0.58***
2	-0.1	0.0	0.0	0.12	-0.3	-0.93	0.0	0.17	-0.3	-0.96	3.50	0.1	0.8	5.26	1.00
3	0.0	-0.1	0.0	0.00	-0.3	-0.84	-0.1	0.08	-0.2	-0.92	3.10	0.0	0.8	2.16	1.50
4	0.4	0.3	0.5	0.72	-0.2	-0.05	0.4	0.80	0.2	-0.38	1.05	0.3	0.9	5.27	2.44
5	*0.4*	*-0.2*	*0.6*	*0.43*	*-0.3*	*-0.86*	*0.5*	*0.76*	*-0.3*	*-1.04*	*1.45*	*0.3*	*1.8*	*4.75*	*3.22*
6	*-0.1*	*0.0*	*0.3*	*0.58*	*-0.4*	*-0.24*	*0.2*	*0.61*	*-0.3*	*-0.62*	*1.25*	*0.0*	*0.1*	*4.76*	*3.96*
7	*0.2*	*-0.4*	*0.4*	*0.78*	*-0.5*	*-1.14*	*0.3*	*0.82*	*-0.5*	*-1.14*	*2.31*	*0.5*	*1.8*	*4.62*	*4.42*
8	-0.2	-0.2	0.0	0.00	-0.4	-0.44	-0.1	0.91	-0.3	-0.58	1.04	0.1	0.1	5.40	4.98
9	0.3	-0.1	0.5	0.82	-0.3	-0.57	0.3	0.97	-0.2	-0.71	1.87	0.5	2.0	5.08	5.92
10	0.3	-0.3	0.4	0.80	-0.4	-1.21	0.4	0.85	-0.4	-1.25	2.41	0.8	2.6	6.90	6.40
11	0.3	-0.1	0.5	1.47	-0.2	0.20	0.3	1.50	0.1	-0.86	1.80	1.1	1.6	6.73	7.02
12	0.4	-0.1	0.5	0.32	-0.3	-0.98	0.5	0.76	-0.1	-1.00	1.61	0.5	2.1	5.27	7.66
13	0.4	-0.2	0.6	1.36	-0.4	-1.47	0.6	1.36	-0.4	-1.53	2.78	1.4	3.8	7.35	8.10
14	*0.3*	*-0.2*	*0.6*	*1.54*	*-0.5*	*-1.65*	*0.3*	*1.66*	*-0.5*	*-1.65*	*2.83*	*1.8*	*3.2*	*8.76*	*8.58*
15	0.2	-0.2	0.4	1.15	-0.4	-0.76	0.2	1.55	0.0	-0.92	2.43	1.0	0.7	5.52	9.02
16	*0.2*	*-0.3*	*0.4*	*0.58*	*-0.5*	*-1.19*	*0.1*	*0.67*	*-0.5*	*-1.19*	*1.94*	*0.6*	*2.4*	*4.89*	*9.64*
17	0.2	-0.3	0.4	1.17	-0.4	-0.73	0.2	1.35	-0.2	-1.07	2.58	0.9	1.0	6.22	10.04
18	0.4	0.3	0.5	1.21	-0.2	0.09	0.4	1.22	0.1	-0.50	1.51	0.6	1.6	7.85	10.60
19	***0.4***	***-0.3***	***0.7***	***1.15***	***-0.5***	***-0.91***	***0.6***	***1.27***	***-0.4***	***-1.74***	***1.72***	***1.4***	***8.3***	***5.07***	***11.42***
20	**0.5**	**0.2**	**1.0**	**2.04**	**-0.2**	**0.47**	**0.9**	**2.12**	**-0.1**	**-1.89**	**1.29**	**2.0**	**1.3**	**10.89**	**11.92**
21	0.7	-0.1	0.8	0.97	-0.4	-1.83	0.7	1.09	-0.4	-1.90	2.30	1.6	8.7	4.57	12.74
22	*0.5*	*-0.9*	*0.8*	*1.40*	*-1.6*	*-3.04*	*0.8*	*1.43*	*-1.5*	*-3.10*	*1.90*	*4.3*	*15.6*	*17.84*	*13.34*
23	***0.8***	***-0.8***	***2.3***	***3.88***	***-2.3***	***-3.99***	***2.1***	***4.57***	***-2.0***	***-4.04***	***1.69***	***14.0***	***18.8***	***33.08***	***13.84***
24	***1.7***	***-0.9***	***3.3***	***5.37***	***-2.8***	***-4.82***	***3.2***	***5.54***	***-2.5***	***-5.12***	***1.67***	***20.4***	***23.0***	***31.99***	***14.38***
25	1.2	-0.8	2.5	4.10	-2.1	-3.02	2.3	4.30	-1.6	-3.59	1.55	13.2	24.9	32.00	14.96
26	***2.1***	***-3.9***	***5.4***	***7.31***	***-12.6***	***-10.35***	***5.4***	***7.31***	***-11.8***	***-10.56***	***0.98***	***102.2***	***200.4***	***162.94***	***15.52***
27	***5.6***	***-11.2***	***20.2***	***12.66***	***-27.5***	***-13.10***	***20.0***	***12.70***	***-26.5***	***-13.79***	***0.54***	***400.0***	***446.1***	***260.29***	***16.12***

Table 28. SE19-PA-DL-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
28	**6.2**	**-9.4**	**25.4**	**12.33**	**-25.5**	**-10.84**	**25.3**	**13.34**	**-25.1**	**-11.30**	**0.45**	**312.2**	**211.1**	**293.65**	**16.72**
29	***9.9***	***-18.1***	***30.2***	***13.64***	***-50.2***	***-14.89***	***29.3***	***13.78***	***-48.0***	***-15.58***	***0.36***	***647.9***	***957.0***	***442.76***	***17.38***
30	***39.8***	***-29.9***	***64.9***	***14.20***	***-65.2***	***-13.87***	***54.9***	***15.72***	***-65.2***	***-13.87***	***0.22***	***1116.6***	***936.5***	***479.19***	***18.20***
31	12.4	-7.4	36.3	5.50	-22.9	0.25	36.3	5.52	-15.8	-2.62	0.09	148.8	22.0	374.33	19.98
32	10.7	-8.3	23.8	5.22	-18.3	-3.79	23.8	5.22	-18.3	-3.79	0.21	98.7	109.5	152.40	20.86
33	-7.7	-10.1	0.0	0.00	-18.7	-3.69	-7.7	0.02	-18.6	-3.71	0.20	16.3	71.2	151.38	21.20
34	11.4	-11.2	23.6	5.42	-19.9	-3.98	23.6	5.42	-19.8	-4.09	0.22	108.2	85.0	167.54	21.94
35	11.3	-13.3	24.4	5.56	-26.8	-5.78	24.4	5.56	-26.3	-6.01	0.22	138.6	169.3	206.88	22.72
36	0.7	-3.8	7.6	2.05	-9.7	0.24	7.6	2.05	-6.2	-1.04	0.10	23.0	5.9	160.25	24.02
37	-3.3	-4.7	0.0	0.00	-6.8	-1.07	-3.2	0.13	-6.8	-1.07	0.16	1.8	3.1	43.37	24.28
38	1.1	-7.5	4.9	1.49	-14.5	-2.69	4.9	1.53	-14.5	-2.69	0.22	21.7	37.3	107.51	24.90
39	3.4	0.1	10.4	2.55	-5.5	0.18	10.2	2.57	-0.2	-0.31	0.15	19.4	11.9	119.63	25.46
40	1.0	-5.0	1.8	0.52	-8.1	-1.40	1.8	0.52	-8.1	-1.40	0.19	6.7	11.8	53.40	25.90
41	0.0	-8.3	7.0	1.77	-15.9	-3.00	6.8	1.86	-15.9	-3.00	0.21	27.4	74.5	102.55	26.84
42	7.8	2.2	24.8	5.70	-6.2	0.26	24.4	5.97	0.1	-0.90	0.18	73.2	72.9	127.32	27.56
43	6.5	-23.5	13.2	2.15	-49.6	-12.88	13.2	2.15	-49.0	-12.97	0.24	276.4	918.0	405.39	28.32
44	***70.3***	***-54.8***	***114.9***	***14.24***	***-92.9***	***-11.03***	***82.2***	***16.99***	***-77.5***	***-12.33***	***0.12***	***2018.1***	***1687.7***	***503.05***	***29.42***
45	23.7	-35.3	50.5	3.11	-66.3	-7.43	50.0	3.65	-66.3	-7.43	0.09	366.2	308.7	338.28	31.22
46	5.7	-17.1	26.5	2.96	-31.2	-2.55	26.3	3.00	-31.2	-2.64	0.10	126.1	92.3	336.80	32.70
47	-15.3	-26.6	0.0	0.00	-47.6	-4.51	-15.1	0.11	-47.0	-4.56	0.09	59.8	207.1	261.75	33.22
48	33.2	-24.3	71.5	6.24	-54.1	-5.28	68.4	6.50	-54.1	-5.28	0.09	406.9	358.8	325.25	34.52
49	8.5	-8.0	26.3	2.50	-21.0	0.10	25.5	2.53	-20.5	-1.71	0.05	68.4	53.3	171.47	35.56
50	8.7	-18.1	22.4	2.24	-38.5	-3.33	22.4	2.24	-38.4	-3.45	0.09	80.9	128.5	194.65	36.40
51	-7.8	-10.5	0.0	0.00	-16.1	0.16	-3.7	0.77	-10.7	-0.26	0.01	5.5	-11.9	104.53	37.00
52	19.1	-31.0	49.9	4.11	-63.2	-7.21	48.7	4.32	-63.0	-7.39	0.10	285.8	378.7	317.18	38.02
53	9.8	-25.3	33.2	3.07	-47.9	-4.30	32.9	3.18	-47.2	-4.34	0.09	169.0	157.8	315.09	39.36
54	2.1	-13.2	11.3	1.53	-22.5	-1.47	11.2	1.59	-22.2	-1.47	0.09	45.0	39.8	230.12	40.90
55	-1.6	-12.4	4.7	1.06	-20.2	-1.24	4.3	1.07	-19.6	-1.25	0.09	16.6	20.9	116.59	41.54
56	-3.5	-10.9	0.7	0.84	-13.6	-0.68	0.7	0.84	-13.6	-0.68	0.11	7.3	6.8	103.76	42.10
57	-7.2	-14.5	0.0	0.00	-23.8	-1.57	-6.4	0.29	-23.6	-1.58	0.07	10.3	23.2	96.28	43.04

Table 28. SE19-PA-DL-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
58	0.2	-10.0	8.6	1.36	-13.1	-0.74	8.6	1.39	-12.9	-0.77	0.10	18.2	21.8	105.78	44.22
59	-0.5	-7.2	7.7	1.25	-9.2	-0.49	7.4	1.29	-9.1	-0.51	0.10	9.6	12.7	112.46	44.80
60	-3.0	-12.2	0.0	0.00	-20.0	-1.30	-0.7	0.54	-20.0	-1.30	0.06	10.2	16.2	98.93	45.38
61	-4.5	-7.0	0.0	0.00	-10.1	0.08	-0.8	0.75	-8.1	-0.27	0.01	4.0	1.7	101.67	45.84
62	-4.2	-11.7	0.0	0.00	-21.4	-1.39	-1.9	0.54	-21.1	-1.39	0.07	9.7	12.9	103.88	46.46
63	-3.2	-10.9	1.1	0.85	-16.1	-0.88	1.0	0.89	-15.9	-0.90	0.10	9.1	8.9	108.33	47.00
64	-0.2	-12.5	9.0	1.42	-19.3	-1.22	8.8	1.45	-19.2	-1.24	0.09	19.6	24.2	123.66	47.68
65	1.0	-13.2	11.7	1.61	-22.3	-1.54	11.5	1.61	-22.3	-1.54	0.09	27.2	34.9	138.81	48.46
66	-5.7	-12.5	0.0	0.00	-17.0	-0.90	-4.3	0.48	-17.0	-0.90	0.05	5.9	6.2	91.02	48.96
67	9.6	-28.9	27.7	2.75	-60.5	-6.91	26.9	2.83	-60.3	-7.07	0.11	183.9	320.8	347.11	49.90
68	18.8	-3.9	49.4	4.22	-22.1	0.22	48.9	4.47	-10.0	-1.07	0.06	148.9	62.6	382.14	51.32
69	6.0	0.0	11.1	0.96	-3.0	-0.54	10.6	0.98	-2.8	-0.54	0.11	7.9	7.5	87.73	52.02
70	7.5	-13.3	18.2	1.53	-26.1	-2.09	18.2	1.53	-25.8	-2.11	0.08	42.1	56.1	159.62	52.76
71	5.2	-7.4	16.3	1.57	-14.2	-1.01	16.2	1.70	-13.8	-1.07	0.08	27.5	24.6	173.11	53.52
72	1.0	-11.8	5.9	0.83	-20.5	-1.53	5.9	0.83	-20.5	-1.60	0.09	17.3	24.0	150.31	54.14
73	6.6	-1.0	22.2	2.10	-8.6	0.02	21.7	2.13	-2.8	-0.46	0.07	28.7	32.9	173.74	54.82
74	4.5	-8.7	9.6	0.83	-18.2	-1.44	9.6	0.83	-18.0	-1.46	0.08	15.9	46.6	70.68	56.08
75	4.9	-3.6	16.1	1.51	-7.5	0.08	15.9	1.54	-6.5	-0.61	0.06	17.6	11.1	81.60	57.12
76	-2.2	-6.8	0.0	0.00	-11.2	-0.84	-1.9	0.12	-11.2	-0.84	0.08	3.4	5.5	75.44	57.80
77	8.3	-4.2	23.6	2.24	-7.9	-0.78	23.1	2.28	-7.9	-0.79	0.10	29.1	40.5	146.57	58.50
78	1.3	-7.7	4.8	0.52	-16.9	-1.37	4.8	0.52	-16.8	-1.41	0.09	12.9	43.0	108.78	59.44
79	9.8	-8.1	28.0	2.50	-21.7	-1.84	27.7	2.56	-21.7	-1.84	0.09	54.0	47.0	171.45	60.36
80	4.8	-10.3	13.1	1.30	-22.2	-1.80	13.0	1.32	-22.1	-1.85	0.09	29.2	38.9	174.24	61.06
81	0.0	-3.3	8.4	1.01	-8.5	0.11	8.2	1.02	-4.1	-0.32	0.05	8.5	10.4	82.41	61.96
82	0.0	-7.9	4.1	0.62	-13.6	-0.94	4.1	0.62	-13.1	-0.96	0.09	7.1	8.1	56.83	62.84
83	-0.3	-7.2	4.2	0.70	-13.2	-0.92	4.1	0.71	-13.2	-0.92	0.09	7.4	8.7	49.02	64.12
84	-4.7	-6.4	0.0	0.00	-11.0	-0.70	-4.4	0.17	-10.9	-0.72	0.06	1.8	2.0	36.00	64.82
85	-6.3	-6.5	0.0	0.00	-11.1	-0.72	-6.3	0.00	-11.1	-0.72	0.07	1.1	1.2	58.92	65.18
86	-0.2	-2.0	4.7	0.77	-5.2	0.08	4.6	0.78	-2.1	-0.11	0.07	4.1	4.9	76.64	66.14
87	-1.9	-3.9	0.8	0.37	-7.1	-0.46	0.8	0.37	-7.1	-0.46	0.11	2.5	2.7	27.81	67.30

Table 28. SE19-PA-DL-1

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
88	-2.1	-5.1	0.0	0.00	-7.3	-0.46	-0.6	0.34	-7.3	-0.46	0.06	1.4	1.5	25.53	68.00
89	-3.7	-6.7	0.0	0.00	-11.5	-0.81	-3.4	0.14	-11.5	-0.81	0.07	2.5	2.7	27.81	68.72
90	-1.0	-6.5	3.2	0.63	-10.1	-0.70	3.2	0.64	-10.0	-0.70	0.10	4.9	5.3	38.58	69.96
91	0.2	-7.0	4.6	0.76	-12.3	-0.85	4.5	0.77	-12.1	-0.86	0.10	7.8	8.8	56.37	72.24
92	-1.9	-3.7	0.5	0.46	-5.9	0.06	0.4	0.48	-4.1	-0.18	0.06	1.8	1.8	58.21	72.72
93	0.4	-5.4	5.9	0.88	-8.8	-0.60	5.9	0.88	-8.8	-0.61	0.10	6.1	7.2	62.27	73.42
94	0.3	-4.1	5.1	0.79	-5.1	-0.30	4.9	0.79	-5.0	-0.34	0.11	4.0	4.5	67.90	73.98
95	0.2	-4.9	5.4	0.82	-7.1	-0.47	5.3	0.85	-7.1	-0.47	0.10	4.5	5.4	53.85	74.66
96	-4.1	-8.2	0.0	0.00	-14.0	-0.99	-4.1	0.06	-13.9	-1.00	0.07	4.2	9.2	42.06	75.38
97	0.4	-5.3	5.1	0.78	-7.3	-0.49	5.0	0.79	-7.1	-0.52	0.10	6.2	9.5	57.34	76.58
98	-2.4	-3.8	0.0	0.00	-4.6	0.02	-1.6	0.26	-4.2	-0.18	0.00	0.6	0.6	32.38	77.04
99	-0.2	-4.0	4.2	0.65	-5.8	-0.38	4.2	0.69	-5.8	-0.38	0.10	3.3	4.9	31.35	78.24
100	-1.4	-4.2	0.2	0.39	-10.1	-0.70	0.2	0.39	-10.1	-0.70	0.11	5.1	6.0	25.34	81.42
101	-1.8	-3.5	0.5	0.40	-4.2	-0.20	0.4	0.44	-4.2	-0.20	0.13	1.5	1.6	27.37	82.56
102	0.0	-5.4	0.0	0.00	-7.2	-0.45	-1.3	0.26	-7.1	-0.45	0.06	1.2	1.3	33.46	83.36
103	-1.5	-4.0	1.3	0.51	-4.9	-0.27	1.1	0.53	-4.7	-0.27	0.13	1.7	1.9	41.78	84.00
104	-1.9	-6.0	0.0	0.00	-10.4	-0.74	-0.6	0.33	-10.4	-0.75	0.07	2.8	3.0	35.50	84.78
105	-3.6	-5.0	0.0	0.00	-5.9	-0.29	-3.1	0.18	-5.8	-0.30	0.05	0.5	0.5	29.52	85.84
106	-2.5	-4.5	0.2	0.39	-6.2	-0.36	0.1	0.39	-6.2	-0.36	0.12	1.7	1.9	17.27	89.36
107	-4.4	-4.5	0.0	0.00	-5.1	-0.18	-4.4	0.01	-5.0	-0.19	0.04	0.0	0.0	4.06	89.96
108	0.0	-3.3	0.0	0.00	-4.5	0.01	-2.3	0.21	-3.5	-0.07	0.00	0.2	0.2	6.98	91.46
109	-3.1	-3.4	0.0	0.00	-3.5	-0.06	-2.8	0.12	-3.5	-0.09	0.02	0.0	0.0	4.69	91.96
110	-3.9	-4.1	0.0	0.00	-5.0	-0.24	-3.1	0.07	-4.9	-0.25	0.05	0.3	0.3	8.38	94.34
111	-3.7	-4.0	0.0	0.00	-4.2	-0.12	-3.8	0.06	-4.2	-0.12	0.03	0.0	0.0	5.72	94.80
112	-3.9	-4.3	0.0	0.00	-4.9	-0.21	-3.6	0.07	-4.8	-0.22	0.04	0.1	0.1	18.18	99.86

Table 29. SE19-PA-DL-2

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	68.0	-55.1	111.5	14.32	-93.8	-12.16	53.3	17.70	-42.6	-17.86	2.93	9171.4	9880.0	504.7	
1	***0.6***	***0.1***	***0.8***	***0.46***	***-0.1***	***-0.91***	***0.8***	***0.57***	***-0.1***	***-0.91***	***1.45***	***0.6***	***1.3***	***6.88***	***0.52***
2	*0.5*	*0.5*	*0.6*	*0.27*	*-0.2*	*-0.61*	*0.2*	*0.46*	*-0.2*	*-0.63*	*1.09*	*0.2*	*1.2*	*7.98*	*2.02*
3	0.6	0.2	0.6	0.22	0.0	0.00	0.6	0.33	0.3	-0.45	0.35	0.1	0.2	5.27	2.40
4	0.5	0.1	0.6	0.40	0.0	-0.48	0.6	0.40	0.1	-0.57	1.30	0.2	0.4	4.38	2.86
5	*0.4*	*0.0*	*0.6*	*0.36*	*-0.2*	*-0.65*	*0.3*	*0.58*	*-0.1*	*-0.86*	*1.23*	*0.7*	*1.9*	*4.88*	*3.70*
6	0.4	0.4	0.4	0.24	0.0	0.00	0.3	0.48	0.3	-0.38	0.61	0.1	0.0	4.88	4.02
7	*0.4*	*0.0*	*0.6*	*0.37*	*-0.3*	*-0.95*	*0.6*	*0.37*	*-0.3*	*-0.98*	*1.52*	*0.4*	*1.4*	*4.19*	*4.42*
8	0.1	0.0	0.3	0.73	-0.2	-0.64	0.3	0.78	-0.1	-0.64	2.93	0.2	0.2	5.59	4.86
9	0.4	0.4	0.5	0.33	-0.1	0.02	0.5	0.33	0.4	-0.23	0.49	0.1	0.2	5.38	5.42
10	0.6	0.2	0.7	0.57	0.0	-0.65	0.7	0.57	0.2	-0.86	1.66	0.4	0.9	5.83	5.90
11	*0.5*	*-0.1*	*0.7*	*0.68*	*-0.3*	*-1.21*	*0.5*	*0.69*	*-0.3*	*-1.21*	*1.81*	*0.9*	*2.3*	*6.73*	*6.38*
12	**0.8**	**0.2**	**1.0**	**1.17**	**0.0**	**0.00**	**0.9**	**1.20**	**0.1**	**-1.19**	**1.18**	**1.3**	**0.8**	**8.55**	**6.92**
13	0.7	0.6	0.7	0.32	0.0	0.00	0.5	0.54	0.5	-0.26	0.44	0.2	0.0	7.43	7.28
14	0.8	0.2	0.8	0.42	0.0	-0.84	0.8	0.42	0.0	-0.85	1.54	0.3	1.2	3.99	7.66
15	***0.8***	***0.1***	***1.1***	***1.09***	***-0.6***	***-1.70***	***1.0***	***1.15***	***-0.6***	***-1.70***	***1.68***	***2.0***	***4.1***	***12.16***	***8.12***
16	***1.1***	***0.0***	***1.5***	***1.39***	***-0.9***	***-1.93***	***1.4***	***1.72***	***-0.9***	***-2.00***	***1.39***	***3.7***	***4.8***	***14.54***	***8.62***
17	**1.0**	**0.1**	**1.6**	**1.84**	**-0.4**	**-1.54**	**1.4**	**1.90**	**-0.4**	**-1.75**	**1.64**	**3.2**	**1.6**	**17.91**	**9.06**
18	1.0	0.2	1.2	0.84	-0.1	-0.75	1.0	1.24	0.1	-1.27	1.16	1.6	2.0	9.91	9.58
19	0.9	0.2	1.0	0.62	0.0	0.00	0.8	0.89	0.1	-1.06	0.61	0.9	0.6	6.48	10.06
20	1.0	0.4	1.2	1.07	0.0	0.00	1.2	1.12	0.3	-1.12	0.86	1.2	1.3	9.84	10.56
21	0.9	0.8	1.2	0.76	0.0	0.00	1.1	0.93	0.6	-0.69	0.62	0.6	0.4	8.19	10.96
22	1.1	0.3	1.2	0.72	-0.4	-1.59	1.2	0.72	-0.4	-1.61	1.41	1.3	7.6	11.97	11.44
23	***1.8***	***0.1***	***2.6***	***2.32***	***-1.0***	***-2.28***	***2.5***	***2.37***	***-0.8***	***-2.30***	***1.31***	***5.7***	***3.3***	***17.65***	***12.00***
24	0.0	1.2	1.9	1.45	0.0	0.00	1.8	1.75	0.8	-0.87	0.75	1.8	0.7	21.59	12.42
25	1.4	0.3	1.6	0.62	-0.3	-1.69	1.6	0.62	-0.2	-1.73	1.19	1.8	7.5	13.46	12.84
26	***1.6***	***-0.8***	***2.6***	***2.22***	***-3.4***	***-3.46***	***2.5***	***2.31***	***-3.4***	***-3.46***	***0.94***	***10.8***	***23.0***	***49.20***	***13.38***
27	***2.5***	***-1.8***	***4.9***	***4.33***	***-5.4***	***-4.35***	***4.5***	***4.43***	***-5.2***	***-4.60***	***0.85***	***29.5***	***29.9***	***64.39***	***13.92***

Table 29. SE19-PA-DL-2

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
28	***3.3***	***-1.5***	***7.7***	***6.04***	***-7.7***	***-5.58***	***7.7***	***6.32***	***-7.6***	***-6.00***	***0.75***	***54.7***	***63.1***	***83.12***	***14.52***
29	*3.3*	*-2.2*	*7.2*	*5.63*	*-8.6*	*-6.22*	*7.0*	*5.86*	*-8.3*	*-6.26*	*0.75*	*52.8*	*58.0*	*119.89*	*15.06*
30	***8.1***	***-6.7***	***12.8***	***8.56***	***-16.2***	***-10.11***	***12.1***	***9.01***	***-15.5***	***-10.49***	***0.64***	***149.8***	***180.8***	***200.03***	***15.58***
31	***12.7***	***-11.1***	***20.4***	***11.57***	***-22.0***	***-12.13***	***20.1***	***11.98***	***-21.5***	***-12.40***	***0.56***	***270.8***	***298.2***	***214.82***	***16.14***
32	8.5	-9.8	20.2	11.12	-18.7	-9.09	20.2	11.12	-18.4	-9.41	0.52	194.2	132.5	253.81	16.70
33	***10.4***	***-20.8***	***26.8***	***13.20***	***-44.8***	***-17.27***	***26.8***	***13.20***	***-42.6***	***-17.86***	***0.43***	***622.2***	***1052.8***	***401.47***	***17.34***
34	***34.6***	***-32.4***	***68.8***	***16.48***	***-69.1***	***-16.23***	***53.3***	***17.70***	***-64.5***	***-17.15***	***0.24***	***1439.5***	***1203.8***	***459.49***	***18.18***
35	19.9	8.9	44.0	7.03	-23.8	0.61	43.9	7.09	6.6	-0.93	0.09	169.3	-37.6	410.34	19.12
36	9.9	-2.1	9.9	0.15	-9.5	-2.37	9.8	0.18	-9.1	-2.40	0.13	24.7	34.2	81.98	19.68
37	1.2	0.1	1.6	0.26	-0.6	0.11	0.9	0.34	-0.5	-0.69	0.07	1.2	3.7	58.17	19.98
38	15.6	-6.7	26.9	4.91	-16.9	-4.00	26.9	5.10	-16.9	-4.00	0.20	121.0	183.6	144.59	21.20
39	15.1	-4.6	26.8	5.31	-16.1	-3.70	26.3	5.32	-15.9	-3.74	0.21	112.2	85.4	177.48	21.96
40	14.1	-6.1	27.1	5.35	-23.6	-5.20	27.1	5.35	-23.6	-5.43	0.21	139.1	158.7	202.31	22.76
41	7.1	1.1	11.8	2.15	-3.6	0.30	11.8	2.15	-2.5	-1.53	0.12	23.3	6.3	107.89	24.02
42	1.9	1.1	1.9	0.20	-0.9	-0.98	1.9	0.21	-0.9	-0.99	0.42	1.4	2.7	35.62	24.28
43	9.1	4.8	14.9	2.89	-11.5	-2.95	14.9	2.89	-11.5	-2.95	0.22	50.6	58.0	119.95	25.50
44	5.7	0.4	5.8	0.24	-3.1	-1.69	5.8	0.24	-3.0	-1.70	0.22	7.3	14.7	55.74	25.90
45	7.7	-2.2	12.8	2.06	-11.2	-3.00	12.8	2.32	-11.2	-3.00	0.21	33.6	85.8	103.87	26.84
46	15.5	4.9	29.2	6.31	-0.2	0.36	29.2	6.31	1.0	-1.58	0.20	86.8	66.8	120.97	27.58
47	12.3	-19.4	16.0	2.05	-47.9	-11.86	15.8	2.09	-47.5	-12.00	0.22	286.0	864.9	412.87	28.34
48	***68.0***	***-55.1***	***111.5***	***14.32***	***-93.8***	***-12.16***	***84.7***	***17.40***	***-86.3***	***-13.72***	***0.13***	***1976.3***	***1742.5***	***504.71***	***29.40***
49	33.5	-24.4	63.0	5.00	-58.2	-7.00	63.0	5.05	-58.2	-7.00	0.10	391.6	280.8	349.33	31.22
50	12.8	-16.2	29.6	2.76	-38.3	-4.44	29.0	2.94	-38.0	-4.50	0.11	188.1	310.0	332.04	33.22
51	41.5	-22.7	74.1	7.48	-58.7	-7.54	71.5	7.94	-58.0	-7.68	0.11	500.1	482.9	313.63	34.46
52	24.7	-6.6	47.1	3.67	-23.7	-2.69	47.0	3.80	-23.7	-2.69	0.09	156.0	85.5	248.73	35.60
53	9.5	-12.0	17.4	1.56	-33.0	-3.74	16.7	1.62	-32.9	-3.86	0.11	81.9	144.7	191.96	36.36
54	3.0	-2.0	8.9	1.33	-9.2	0.06	8.6	1.35	-2.8	-0.49	0.07	12.7	-19.3	129.09	37.04
55	31.9	-25.0	52.1	4.54	-63.7	-8.48	51.4	4.68	-62.9	-9.10	0.11	349.2	465.0	344.64	38.02
56	24.1	-20.7	40.6	3.63	-50.2	-5.87	40.6	3.63	-50.2	-5.87	0.10	243.5	212.7	334.20	39.38
57	3.1	-1.2	10.8	1.62	-15.8	0.07	10.8	1.62	-1.5	-0.29	0.06	21.7	-3.4	240.51	39.90

Table 29. SE19-PA-DL-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
58	5.4	-11.4	12.7	1.67	-28.9	-2.88	12.6	1.67	-28.9	-2.95	0.11	46.8	58.1	152.27	40.94
59	1.2	-7.5	6.5	1.25	-16.3	-1.63	6.3	1.28	-16.3	-1.63	0.13	21.9	24.6	145.35	41.54
60	0.6	-6.1	5.3	1.18	-10.4	-1.05	5.3	1.18	-10.4	-1.05	0.14	12.0	11.5	106.79	42.12
61	0.0	-9.6	0.0	0.00	-18.8	-1.85	-2.2	0.37	-18.7	-1.89	0.10	12.0	29.4	99.06	43.02
62	4.1	-6.4	9.5	1.59	-15.1	-1.62	9.4	1.60	-14.9	-1.66	0.13	27.8	23.5	117.63	44.26
63	2.4	-4.7	7.6	1.24	-9.4	-1.08	7.3	1.26	-9.3	-1.08	0.14	13.0	15.2	120.33	44.84
64	-1.1	-7.1	0.3	0.49	-17.6	-1.89	0.1	0.50	-17.6	-1.89	0.13	13.5	26.5	113.16	45.38
65	1.8	-7.9	6.3	1.27	-17.2	-1.85	6.3	1.27	-17.2	-1.85	0.13	22.4	23.5	118.11	46.44
66	4.5	-6.5	9.0	1.50	-9.9	-1.12	8.9	1.54	-9.9	-1.12	0.14	17.1	13.9	121.98	46.98
67	5.5	-10.7	13.1	1.85	-22.0	-2.33	13.0	1.87	-21.8	-2.40	0.12	37.2	44.8	151.01	47.70
68	0.0	-8.1	14.2	1.94	-18.4	-1.97	13.8	1.95	-18.3	-2.02	0.12	37.0	42.6	156.59	48.46
69	-0.9	-6.3	2.1	0.80	-9.8	-0.95	2.1	0.80	-9.8	-0.95	0.15	7.4	6.5	96.53	48.94
70	16.8	-23.6	31.5	2.96	-61.4	-8.46	31.3	3.13	-60.8	-8.54	0.12	252.3	437.9	387.79	49.90
71	27.2	-0.1	61.1	5.75	-15.4	0.12	60.8	5.85	-8.6	-1.78	0.07	217.4	81.2	411.86	51.30
72	14.6	5.9	21.1	1.47	0.0	0.00	20.8	1.53	1.9	-0.90	0.07	20.0	13.0	110.97	52.04
73	14.4	-8.5	21.0	1.48	-24.6	-2.98	21.0	1.54	-24.0	-3.03	0.10	61.0	84.3	186.92	52.76
74	14.6	-0.9	25.5	2.18	-6.9	-1.35	25.0	2.27	-6.8	-1.37	0.11	45.5	32.4	197.17	53.52
75	8.3	-5.3	12.1	0.93	-15.4	-2.08	12.1	0.93	-15.2	-2.12	0.11	26.4	36.4	161.93	54.14
76	17.2	4.7	29.7	2.61	-1.8	0.20	29.3	2.64	-0.4	-0.99	0.08	45.7	41.8	181.67	54.90
77	8.2	-2.4	9.8	0.45	-10.4	-1.72	9.1	0.50	-10.2	-1.74	0.11	15.8	48.6	58.04	55.98
78	12.2	0.0	20.7	1.56	-6.9	-1.35	20.6	1.61	-6.9	-1.43	0.11	26.6	13.4	68.83	57.26
79	0.0	-1.1	0.0	0.01	-6.4	-1.20	0.0	0.01	-6.4	-1.23	0.19	2.8	9.0	71.96	57.78
80	16.3	0.6	31.7	2.68	-6.6	-1.49	31.7	2.83	-6.2	-1.53	0.11	51.0	54.0	148.79	58.56
81	4.0	-4.0	4.3	0.26	-13.9	-2.09	4.3	0.26	-13.8	-2.16	0.13	16.3	49.6	59.50	59.36
82	17.2	-7.0	32.3	2.72	-22.1	-2.77	31.5	2.75	-21.9	-2.79	0.10	79.2	67.6	188.72	60.36
83	12.1	-5.4	17.5	1.42	-16.9	-2.22	17.3	1.49	-16.4	-2.26	0.11	39.5	49.4	192.09	61.04
84	9.6	0.2	14.5	1.18	-4.7	-0.97	14.3	1.22	-4.3	-0.98	0.11	16.4	12.5	99.69	62.08
85	2.4	-3.8	3.0	0.24	-9.0	-1.36	3.0	0.24	-9.0	-1.36	0.13	6.7	16.7	83.74	62.76
86	9.7	-1.6	16.4	1.35	-7.7	-1.28	15.6	1.36	-7.7	-1.28	0.11	21.2	28.6	91.95	63.98
87	8.2	3.5	12.3	1.04	-0.3	0.08	12.2	1.12	1.9	-0.50	0.08	8.8	4.3	75.12	64.70

Table 29. SE19-PA-DL-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
88	4.8	2.6	5.3	0.24	0.0	0.00	5.3	0.24	0.9	-0.57	0.04	1.6	1.7	38.67	65.12
89	8.8	0.4	13.6	1.12	-2.8	-0.82	13.6	1.16	-2.5	-0.83	0.12	9.8	14.1	67.25	66.18
90	3.7	0.7	4.6	0.36	-2.0	-0.73	4.6	0.36	-2.0	-0.73	0.16	2.4	2.7	42.12	66.76
91	4.7	1.2	5.7	0.42	-1.7	-0.70	5.2	0.42	-1.5	-0.70	0.15	3.7	5.1	37.21	67.94
92	4.2	0.8	4.8	0.35	-2.8	-0.83	4.8	0.37	-2.7	-0.84	0.15	3.1	4.3	32.43	68.58
93	6.7	-1.5	9.0	0.72	-6.5	-1.15	8.7	0.72	-6.5	-1.17	0.12	8.9	18.3	66.57	69.88
94	8.7	4.2	13.3	1.00	-0.1	0.05	12.9	1.18	3.5	-0.37	0.07	8.6	5.7	72.14	70.58
95	5.2	3.9	5.3	0.13	0.0	0.00	5.3	0.13	3.3	-0.37	0.02	0.5	0.6	18.73	71.02
96	6.7	0.1	8.4	0.58	-4.5	-0.98	8.4	0.58	-4.5	-0.99	0.12	6.2	10.8	34.96	71.90
97	7.4	1.6	10.7	0.87	-1.7	-0.77	10.7	0.90	-1.7	-0.77	0.13	7.4	7.9	59.06	72.82
98	5.3	-1.6	7.1	0.56	-6.0	-1.14	7.1	0.56	-5.9	-1.15	0.13	6.9	10.3	72.27	73.40
99	8.9	1.9	12.3	1.09	-0.9	-0.69	12.3	1.09	-0.7	-0.72	0.13	9.3	8.5	84.84	74.02
100	6.3	0.0	8.7	0.71	-4.7	-1.00	8.7	0.71	-4.4	-1.04	0.13	7.2	9.3	52.26	74.68
101	1.2	-0.7	1.3	0.10	-4.6	-0.91	1.2	0.11	-4.6	-0.95	0.17	2.2	8.1	34.16	75.30
102	7.7	5.1	11.1	0.91	0.0	0.00	11.0	0.94	4.7	-0.23	0.08	5.5	5.8	49.28	75.98
103	5.8	0.1	6.0	0.10	-4.2	-0.94	5.8	0.14	-4.2	-0.94	0.10	4.4	5.7	47.25	76.58
104	4.4	3.1	5.5	0.46	0.0	0.00	5.4	0.46	2.8	-0.21	0.08	1.4	0.9	48.70	77.02
105	6.3	1.1	8.3	0.64	-2.2	-0.75	8.2	0.67	-1.9	-0.78	0.13	4.5	8.9	33.15	78.18
106	4.5	1.3	5.5	0.47	-1.3	-0.62	5.5	0.47	-1.3	-0.67	0.16	2.8	3.0	33.82	78.86
107	2.4	1.5	2.6	0.15	0.0	0.00	2.6	0.16	0.6	-0.37	0.06	0.3	0.4	18.88	79.30
108	3.7	3.3	4.6	0.32	-0.1	-0.48	4.6	0.33	-0.1	-0.49	0.17	1.7	2.8	23.94	80.74
109	4.6	1.0	6.3	0.46	-1.2	-0.61	6.3	0.49	-1.1	-0.68	0.14	2.6	3.6	33.46	81.44
110	4.0	2.7	4.9	0.34	0.0	0.00	4.6	0.36	2.1	-0.30	0.07	0.9	0.9	34.08	81.94
111	4.1	1.8	4.9	0.33	0.0	0.00	4.9	0.35	0.2	-0.51	0.07	1.3	1.9	20.70	82.58
112	3.3	1.0	3.6	0.16	-1.3	-0.67	3.6	0.19	-1.3	-0.68	0.17	1.5	2.6	37.27	83.34
113	6.5	1.7	8.5	0.73	-1.0	-0.67	8.5	0.73	-0.8	-0.68	0.15	4.5	5.0	47.25	84.06
114	3.6	-0.1	4.2	0.26	-3.8	-0.91	4.1	0.27	-3.7	-0.94	0.15	3.2	6.1	45.99	84.68
115	5.5	2.9	8.1	0.67	0.0	0.00	7.8	0.71	1.6	-0.39	0.08	3.4	3.0	52.26	85.86
116	4.7	3.6	5.4	0.30	0.0	0.00	5.3	0.32	2.9	-0.28	0.06	0.6	0.8	15.81	86.96
117	4.4	2.2	5.2	0.27	0.0	0.00	5.1	0.28	0.6	-0.49	0.05	1.2	2.5	13.46	88.62

Table 29. SE19-PA-DL-2

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
118	3.7	3.8	4.7	0.25	0.0	0.00	4.4	0.25	3.3	-0.09	0.05	0.4	0.7	8.76	90.66
119	3.9	3.3	4.0	0.12	0.0	0.00	4.0	0.12	2.8	-0.20	0.03	0.1	0.1	5.21	91.58
120	3.5	2.8	3.5	0.02	0.0	0.00	3.4	0.04	1.7	-0.35	0.01	0.3	0.5	5.84	93.34
121	2.9	2.8	3.0	0.01	0.0	0.00	3.0	0.03	1.9	-0.29	0.00	0.1	0.1	8.17	94.34
122	3.2	3.0	3.2	0.06	0.0	0.00	3.2	0.07	2.7	-0.16	0.02	0.0	0.0	7.87	94.82
123	3.1	2.7	3.3	0.06	0.0	0.00	3.2	0.06	2.2	-0.27	0.02	0.1	0.1	18.81	99.86

Table 30. SE19-PA-DL-3

Cycle #	(+)δ_o	(-)δ_o	(+)δ_i	(+)P_i	(-)δ_i	(-)P_i	(+)δ_{max}	(+)P_{max}	(-)δ_{max}	(-)P_{max}	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	63.8	-68.6	108.6	16.75	-114.6	-12.58	96.1	18.78	-42.8	-18.21	3.02	10594.6	11462.2	484.5	
1	***0.4***	***-0.1***	***0.5***	***0.49***	***-0.3***	***-0.82***	***0.4***	***0.61***	***-0.2***	***-0.95***	***1.58***	***0.6***	***1.3***	***5.95***	***0.46***
2	*-0.1*	*-0.2*	*0.0*	*0.00*	*-0.6*	*-0.60*	*-0.1*	*0.50*	*-0.5*	*-0.63*	*1.07*	*0.1*	*1.1*	*4.05*	*1.64*
3	0.0	0.0	0.1	0.25	-0.2	-0.17	0.1	0.27	0.0	-0.27	1.43	0.0	0.1	6.08	2.00
4	0.1	-0.2	0.2	0.34	-0.3	-0.50	0.2	0.34	-0.3	-0.51	1.64	0.1	0.2	4.13	2.40
5	0.1	-0.3	0.3	0.37	-0.4	-0.51	0.2	0.38	-0.3	-0.59	1.45	0.2	0.4	7.41	2.84
6	*-0.2*	*-0.4*	*0.0*	*0.00*	*-0.7*	*-0.93*	*-0.1*	*0.13*	*-0.7*	*-0.93*	*1.42*	*0.1*	*1.4*	*4.64*	*3.22*
7	0.0	-0.4	0.0	0.34	-0.6	-0.92	-0.1	0.68	-0.6	-1.00	1.95	0.6	0.6	4.31	3.66
8	0.1	-0.1	0.1	0.19	-0.4	0.11	-0.1	0.62	-0.1	-0.54	0.17	0.2	0.0	5.35	4.02
9	*0.1*	*-0.5*	*0.2*	*0.32*	*-0.7*	*-1.01*	*0.1*	*0.38*	*-0.6*	*-1.07*	*1.43*	*0.4*	*1.5*	*5.52*	*4.38*
10	-0.1	-0.4	0.0	0.76	-0.6	-0.67	-0.1	0.89	-0.5	-0.91	2.53	0.4	0.2	6.86	4.80
11	-0.1	0.1	0.1	0.34	-0.4	0.06	0.1	0.34	0.1	-0.19	0.54	0.1	0.1	4.51	5.40
12	0.1	-0.4	0.3	0.40	-0.5	-0.94	0.2	0.62	-0.4	-1.00	1.79	0.4	1.0	4.46	5.86
13	*0.1*	*-0.5*	*0.2*	*0.60*	*-0.8*	*-1.38*	*0.1*	*0.89*	*-0.8*	*-1.48*	*1.91*	*1.1*	*2.5*	*8.45*	*6.34*
14	0.2	-0.2	0.5	1.27	-0.4	-1.19	0.2	1.45	-0.3	-1.26	2.80	0.9	-0.2	8.06	6.88
15	0.1	-0.2	0.3	0.16	-0.5	-0.74	0.1	0.18	-0.5	-0.81	1.13	0.4	1.2	5.07	7.64
16	*0.1*	*-0.4*	*0.4*	*1.14*	*-1.0*	*-1.82*	*0.3*	*1.14*	*-0.8*	*-1.92*	*2.11*	*1.5*	*3.9*	*11.53*	*8.08*
17	***0.3***	***-0.5***	***0.9***	***1.72***	***-1.4***	***-2.18***	***0.8***	***1.82***	***-1.4***	***-2.18***	***1.72***	***2.6***	***4.0***	***16.34***	***8.56***
18	**0.3**	**-0.4**	**1.1**	**2.06**	**-1.3**	**-1.97**	**0.9**	**2.23**	**-1.2**	**-2.11**	**1.73**	**2.9**	**1.4**	**14.48**	**9.00**
19	0.2	-0.4	0.8	1.82	-0.8	-1.66	0.5	1.85	-0.6	-1.79	2.29	1.9	0.9	15.75	9.46
20	0.1	-0.4	0.2	0.16	-0.5	-0.46	-0.2	0.57	-0.3	-0.64	1.00	0.3	-0.3	6.22	10.06
21	0.2	-0.4	0.4	0.84	-0.4	-1.10	0.4	0.94	-0.3	-1.14	2.55	0.6	1.0	10.13	10.54
22	0.2	0.3	0.5	1.00	-0.2	0.20	0.5	1.00	-0.1	-0.84	1.17	0.5	0.4	9.91	10.92
23	0.4	-0.4	0.6	0.91	-0.8	-1.83	0.6	0.91	-0.8	-1.86	1.98	1.3	7.0	7.09	11.38
24	**0.2**	**-0.2**	**1.1**	**2.07**	**-1.0**	**-2.23**	**0.9**	**2.13**	**-1.0**	**-2.23**	**2.09**	**2.1**	**-0.7**	**11.05**	**11.92**
25	0.4	0.4	0.9	1.75	-0.1	-1.29	0.8	1.79	-0.1	-1.29	3.02	1.1	0.2	9.97	12.32
26	0.6	-0.2	0.9	1.31	-1.2	-2.23	0.8	1.31	-1.2	-2.23	1.63	2.0	10.0	15.68	12.76
27	*0.4*	*-0.9*	*1.1*	*1.77*	*-2.2*	*-3.74*	*0.8*	*2.00*	*-2.2*	*-3.93*	*1.68*	*5.6*	*17.0*	*24.13*	*13.30*

Table 30. SE19-PA-DL-3

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
28	***0.6***	***-1.0***	***3.1***	***4.69***	***-3.5***	***-5.54***	***2.8***	***4.98***	***-3.2***	***-5.57***	***1.56***	***18.0***	***22.6***	***41.40***	***13.82***
29	***1.2***	***-1.6***	***4.7***	***5.98***	***-4.5***	***-6.30***	***4.6***	***6.09***	***-4.1***	***-6.96***	***1.34***	***31.2***	***30.0***	***51.82***	***14.36***
30	1.1	-1.7	4.4	5.46	-4.0	-6.18	3.7	5.59	-3.8	-6.18	1.40	25.5	35.9	49.47	14.92
31	***3.2***	***-4.6***	***7.7***	***7.85***	***-14.2***	***-12.60***	***7.5***	***8.26***	***-12.9***	***-12.76***	***0.93***	***135.5***	***234.5***	***177.86***	***15.50***
32	***6.2***	***-11.8***	***24.4***	***12.69***	***-26.0***	***-15.62***	***24.1***	***13.33***	***-24.7***	***-15.87***	***0.56***	***450.1***	***469.4***	***264.92***	***16.10***
33	**9.5**	**-8.6**	**27.1**	**12.97**	**-23.1**	**-12.08**	**26.5**	**13.68**	**-22.6**	**-12.12**	**0.50**	**321.2**	**197.6**	**289.53**	**16.70**
34	***9.6***	***-24.9***	***29.7***	***13.22***	***-44.7***	***-16.89***	***28.9***	***13.53***	***-42.8***	***-18.21***	***0.40***	***652.6***	***1013.1***	***366.01***	***17.32***
35	***35.9***	***-40.6***	***66.2***	***15.74***	***-67.5***	***-15.64***	***63.2***	***17.17***	***-65.5***	***-16.26***	***0.23***	***1318.9***	***1131.3***	***453.40***	***18.14***
36	16.2	7.5	39.1	6.17	-32.2	0.35	39.0	6.20	6.9	-0.51	0.08	180.4	-10.6	408.81	19.04
37	8.4	-8.9	9.3	0.81	-15.3	-3.06	9.0	0.82	-15.3	-3.06	0.16	36.3	48.5	84.12	19.64
38	-4.1	-6.0	0.0	0.00	-7.2	0.08	-3.6	0.84	-6.2	-0.74	0.01	2.7	-0.7	72.52	19.96
39	8.0	-12.2	16.1	4.30	-20.9	-5.28	16.0	4.47	-20.8	-5.40	0.26	107.3	123.6	123.70	20.76
40	-3.9	-10.9	0.0	0.00	-16.4	-3.59	-2.6	1.64	-16.3	-3.82	0.22	26.0	58.4	122.43	21.18
41	6.4	-13.2	14.0	4.59	-23.8	-6.12	14.0	4.59	-23.1	-6.15	0.28	123.3	150.4	158.12	21.88
42	8.4	-17.4	27.5	6.56	-32.7	-8.37	25.7	6.70	-32.7	-8.37	0.25	256.2	283.1	230.19	22.68
43	1.8	-3.5	9.9	3.54	-13.6	0.08	9.5	3.68	-4.9	-1.39	0.15	43.9	-12.0	201.74	23.84
44	-1.8	-4.5	0.0	0.00	-5.5	-1.42	-1.7	0.59	-5.4	-1.42	0.26	3.0	4.6	33.91	24.24
45	1.5	-9.8	3.8	2.02	-17.1	-4.39	3.8	2.02	-17.1	-4.39	0.31	40.1	72.3	119.21	24.86
46	3.8	-4.6	11.4	4.11	-7.0	0.60	10.3	4.15	-6.9	-1.89	0.19	49.4	25.7	137.97	25.50
47	-3.8	-6.6	0.0	0.00	-10.2	-2.43	-3.7	0.21	-10.2	-2.43	0.24	7.9	22.1	56.18	25.84
48	1.0	-9.3	7.6	3.21	-13.7	-3.25	7.6	3.21	-13.5	-3.34	0.30	41.4	95.4	83.63	26.72
49	6.7	-6.8	16.9	4.86	-12.0	-2.99	16.2	4.94	-11.6	-3.07	0.27	81.9	41.6	94.57	27.52
50	4.7	-19.0	12.1	3.68	-48.1	-12.97	11.9	3.91	-47.4	-13.80	0.28	318.4	1032.8	407.04	28.30
51	***63.8***	***-68.6***	***108.6***	***16.75***	***-114.6***	***-12.58***	***96.1***	***18.78***	***-104.6***	***-14.62***	***0.13***	***2285.8***	***1983.1***	***484.50***	***29.38***
52	24.5	-31.4	64.1	4.58	-73.5	-6.98	63.8	5.06	-72.6	-7.10	0.08	392.0	260.4	374.16	31.24
53	10.3	-15.5	25.8	2.76	-30.0	-3.85	24.4	2.79	-29.9	-3.99	0.12	122.6	98.3	312.86	32.64
54	-10.0	-24.3	0.0	0.00	-38.3	-5.68	-9.4	0.69	-38.1	-5.75	0.15	69.6	248.7	221.04	33.16
55	32.0	-28.3	67.3	7.29	-60.3	-8.45	62.7	8.05	-59.9	-8.55	0.12	524.4	540.7	305.75	34.38
56	19.0	-17.5	50.5	4.33	-36.4	-4.11	49.3	4.80	-36.4	-4.11	0.10	203.0	103.9	276.36	35.58
57	2.9	-18.6	9.8	1.68	-36.0	-4.68	9.5	1.72	-35.5	-4.82	0.14	88.4	166.4	211.90	36.28

Table 30. SE19-PA-DL-3

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
58	-0.1	-9.6	8.1	2.08	-15.6	0.15	8.0	2.11	-11.3	-1.20	0.08	30.5	-18.3	146.13	37.04
59	17.0	-30.5	43.9	4.71	-64.1	-9.94	43.4	4.82	-63.5	-10.10	0.14	377.7	546.9	377.19	37.96
60	18.5	-22.8	46.7	4.89	-52.9	-7.14	45.7	4.92	-52.9	-7.14	0.12	299.6	253.9	388.54	39.34
61	3.4	-17.7	18.4	2.47	-29.2	-3.59	18.0	2.49	-28.9	-3.61	0.13	99.7	68.1	288.35	40.86
62	0.7	-12.4	10.1	2.06	-18.1	-2.01	9.4	2.17	-18.0	-2.10	0.14	46.7	43.5	170.82	41.50
63	-2.3	-11.6	1.1	1.30	-14.5	-1.51	1.0	1.30	-14.4	-1.59	0.18	17.4	19.2	100.58	42.06
64	-5.4	-14.7	0.0	0.00	-19.7	-2.27	-4.4	0.73	-19.5	-2.29	0.12	16.5	36.9	78.00	42.94
65	0.2	-4.2	7.9	2.08	-13.0	0.04	7.9	2.08	-4.5	-0.46	0.10	22.0	11.4	110.68	43.54
66	-1.2	-12.7	2.2	1.05	-16.5	-2.02	1.8	1.09	-16.5	-2.02	0.16	18.4	22.0	88.73	44.18
67	0.7	-9.6	7.4	1.88	-14.0	-1.68	6.9	1.89	-14.0	-1.68	0.17	27.3	30.3	122.24	44.82
68	-5.1	-12.4	0.0	0.00	-20.1	-2.45	-4.6	0.60	-20.1	-2.45	0.12	17.6	38.2	109.66	45.32
69	-1.3	-13.4	6.2	1.94	-19.6	-2.31	6.2	1.94	-19.3	-2.35	0.16	37.4	38.9	130.17	46.38
70	0.5	-10.1	8.5	2.01	-13.5	-1.57	7.9	2.17	-13.5	-1.57	0.16	30.9	24.4	129.29	46.96
71	0.7	-14.8	8.4	2.01	-25.2	-3.04	8.2	2.04	-24.9	-3.07	0.15	48.8	62.9	163.74	47.66
72	2.2	-13.0	14.4	2.55	-22.2	-2.61	14.2	2.59	-22.0	-2.63	0.14	62.6	67.5	172.25	48.42
73	-3.9	-10.4	0.0	0.00	-13.7	-1.27	-0.6	1.20	-13.7	-1.32	0.09	13.3	10.4	108.97	48.92
74	9.5	-30.4	25.4	3.04	-61.7	-9.86	25.4	3.30	-61.2	-9.95	0.15	278.3	537.4	373.63	49.84
75	29.1	-12.4	66.9	7.72	-30.7	-2.79	64.8	8.40	-30.6	-2.88	0.11	326.6	146.2	438.07	51.28
76	3.7	-4.2	13.5	1.96	-9.7	0.22	13.1	2.00	-6.6	-1.09	0.08	29.1	15.3	132.57	52.00
77	3.9	-17.6	11.5	1.87	-33.8	-4.18	11.5	1.87	-33.7	-4.30	0.13	78.6	121.6	192.85	52.72
78	0.0	-13.9	23.6	2.73	-22.5	-2.65	21.9	2.92	-22.4	-2.78	0.12	110.7	102.9	219.33	54.10
79	7.2	-5.8	24.9	2.94	-10.2	0.20	22.6	3.12	-9.3	-1.48	0.08	67.9	61.0	193.45	54.86
80	-0.3	-9.8	1.2	0.69	-15.6	-2.08	0.9	0.74	-15.5	-2.12	0.16	17.7	52.4	69.79	55.86
81	2.3	-10.2	7.0	1.54	-15.3	-2.01	6.7	1.57	-15.1	-2.05	0.16	26.8	16.2	59.94	57.00
82	-3.3	-8.2	0.0	0.00	-11.4	-1.21	-2.3	0.74	-11.3	-1.29	0.11	7.7	10.6	66.00	57.74
83	7.2	-9.9	20.7	2.76	-18.8	-2.43	20.3	2.81	-18.7	-2.43	0.13	65.2	70.6	133.67	58.52
84	-3.0	-10.9	0.0	0.00	-18.7	-2.31	-2.5	0.68	-18.4	-2.41	0.12	17.5	47.1	95.06	59.30
85	4.6	-17.8	18.7	2.30	-31.0	-3.70	17.0	2.48	-30.9	-3.86	0.12	88.2	96.3	196.30	60.30
86	6.4	-11.8	19.1	2.56	-21.0	-2.48	18.7	2.70	-21.0	-2.48	0.13	72.7	68.7	228.16	61.02
87	-0.9	-8.8	2.1	1.16	-12.8	-1.49	2.1	1.16	-12.5	-1.51	0.18	16.0	15.8	87.35	61.98

Table 30. SE19-PA-DL-3

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
88	-3.3	-10.5	0.0	0.00	-14.9	-1.74	-2.5	0.71	-14.8	-1.75	0.12	11.3	23.7	79.50	62.72
89	2.2	-9.3	8.6	1.74	-14.0	-1.66	7.8	1.78	-13.6	-1.72	0.15	28.7	35.1	92.96	63.90
90	-0.4	-7.7	3.1	1.25	-9.8	-1.10	2.7	1.26	-9.8	-1.10	0.18	12.9	10.0	59.12	64.66
91	-5.2	-7.4	0.0	0.00	-8.9	-0.83	-4.9	0.35	-8.9	-0.83	0.09	2.1	2.7	38.61	65.08
92	0.5	-8.0	4.4	1.33	-10.0	-1.13	4.3	1.37	-10.0	-1.13	0.17	13.8	19.2	67.46	66.12
93	-3.6	-7.3	0.0	0.00	-9.0	-0.92	-2.5	0.69	-9.0	-0.92	0.10	3.9	4.5	41.53	66.70
94	-2.6	-6.4	0.0	0.00	-7.5	-0.75	-1.8	0.69	-7.4	-0.76	0.10	3.8	4.0	33.97	67.32
95	-4.3	-7.2	0.0	0.00	-8.8	-0.89	-4.0	0.35	-8.8	-0.91	0.10	2.5	4.5	28.26	67.86
96	-3.6	-7.9	0.0	0.00	-10.3	-1.17	-2.6	0.63	-10.3	-1.17	0.11	5.4	7.5	33.27	68.50
97	-1.3	-9.3	1.0	0.97	-12.8	-1.51	0.9	0.99	-12.7	-1.56	0.18	12.1	24.4	58.74	69.82
98	0.4	-5.1	6.2	1.59	-8.0	0.13	5.3	1.61	-6.8	-0.82	0.10	14.8	10.9	78.61	70.58
99	-4.1	-5.4	0.0	0.00	-6.0	-0.49	-4.1	0.19	-6.0	-0.49	0.08	0.5	0.7	15.87	70.98
100	-1.9	-8.5	0.0	0.00	-11.6	-1.41	-0.8	0.68	-11.6	-1.41	0.12	8.3	15.8	38.10	71.74
101	-0.4	-7.5	1.7	1.01	-10.7	-1.33	1.4	1.05	-10.4	-1.36	0.19	10.6	10.9	50.36	72.78
102	-2.4	-9.2	0.0	0.00	-13.2	-1.67	-0.5	0.81	-13.2	-1.67	0.13	10.9	16.4	74.17	73.36
103	1.8	-6.7	6.2	1.61	-9.6	-1.23	5.6	1.61	-9.6	-1.23	0.18	17.0	15.7	90.04	74.00
104	-2.1	-8.3	0.5	0.87	-12.0	-1.46	0.5	0.87	-11.9	-1.49	0.19	10.1	14.1	56.75	74.60
105	-4.7	-8.7	0.0	0.00	-11.1	-1.09	-3.8	0.50	-11.0	-1.21	0.10	4.8	9.3	47.56	75.24
106	-1.2	-4.3	2.0	1.13	-7.9	0.04	2.0	1.13	-5.3	-0.52	0.11	7.2	7.2	42.50	75.96
107	-3.0	-8.3	0.0	0.00	-10.8	-1.23	-2.9	0.32	-10.4	-1.26	0.11	5.4	8.7	41.59	76.50
108	-1.8	-6.7	0.4	0.88	-8.4	-0.87	-0.8	0.89	-8.3	-0.88	0.20	8.6	12.7	53.66	78.08
109	-2.5	-7.2	0.0	0.00	-9.2	-0.99	-1.9	0.68	-9.2	-0.99	0.11	5.2	6.4	33.89	78.78
110	-4.2	-5.5	0.0	0.00	-6.5	0.06	-3.8	0.48	-5.9	-0.36	0.01	1.1	0.7	34.80	79.26
111	-3.7	-6.5	0.0	0.00	-7.6	-0.72	-3.4	0.47	-7.6	-0.72	0.09	2.0	3.1	21.02	80.14
112	-3.8	-4.7	0.0	0.00	-6.3	0.05	-3.3	0.52	-4.8	-0.28	0.01	1.1	1.5	20.70	80.70
113	-2.4	-7.0	0.0	0.00	-8.8	-0.95	-1.6	0.66	-8.7	-0.95	0.11	4.0	5.9	31.62	81.38
114	-2.8	-4.8	0.0	0.00	-6.5	0.06	-1.6	0.71	-5.2	-0.44	0.01	2.5	2.3	38.89	81.90
115	0.0	-6.4	0.0	0.00	-7.4	-0.67	-2.6	0.45	-7.2	-0.71	0.09	2.1	3.0	20.64	82.50
116	-3.8	-6.9	0.0	0.00	-8.4	-0.88	-3.8	0.39	-8.4	-0.88	0.10	2.6	4.3	29.85	83.28
117	-1.6	-6.9	1.2	1.04	-9.5	-1.01	1.2	1.04	-9.1	-1.13	0.19	8.5	9.7	44.47	84.00

Table 30. SE19-PA-DL-3

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
118	-3.4	-8.0	0.0	0.00	-10.5	-1.19	-3.1	0.55	-10.4	-1.23	0.11	5.3	9.0	42.67	84.62
119	-1.8	-5.7	1.0	1.02	-7.2	0.08	0.3	1.04	-6.3	-0.68	0.12	6.4	5.8	49.67	85.80
120	-3.8	-4.2	0.0	0.00	-5.4	0.03	-3.6	0.33	-4.3	-0.16	0.01	0.4	0.5	17.86	86.22
121	-3.4	-5.1	0.0	0.00	-5.5	-0.36	-3.0	0.43	-5.2	-0.38	0.07	0.7	1.0	11.49	86.88
122	-3.1	-3.9	0.0	0.00	-4.9	0.05	-2.9	0.45	-4.1	-0.22	0.01	0.7	0.8	14.50	87.42
123	-3.5	-5.8	0.0	0.00	-6.7	-0.59	-3.2	0.33	-6.7	-0.62	0.09	1.2	2.7	9.33	88.42
124	-3.9	-3.9	0.0	0.00	-5.7	0.01	-3.7	0.35	-4.6	-0.22	0.00	0.6	0.9	9.69	90.62
125	-4.2	-4.5	0.0	0.00	-5.0	-0.24	-3.7	0.25	-4.9	-0.26	0.05	0.1	0.1	6.33	91.52
126	-4.4	-4.5	0.0	0.00	-5.0	-0.27	-4.3	0.12	-5.0	-0.27	0.05	0.1	0.1	4.83	92.02
127	-4.5	-5.3	0.0	0.00	-5.9	-0.43	-4.5	0.01	-5.7	-0.44	0.07	0.4	0.6	5.33	93.02
128	-4.9	-5.1	0.0	0.00	-5.7	-0.38	-4.6	0.13	-5.7	-0.38	0.07	0.1	0.1	7.81	94.28
129	0.0	-4.7	0.0	0.00	-5.0	0.04	-4.4	0.21	-4.9	-0.17	0.01	0.1	0.1	7.92	94.76
130	-4.6	-4.7	0.0	0.00	-4.8	-0.08	-4.3	0.20	-4.8	-0.09	0.02	0.0	0.0	5.64	95.38
131	-4.7	-4.7	0.0	0.00	-4.8	-0.06	-4.6	0.06	-4.6	-0.07	0.01	0.0	0.0	4.94	96.10
132	-4.6	-5.0	0.0	0.00	-5.6	-0.33	-4.6	0.02	-5.5	-0.34	0.06	0.1	0.1	17.27	99.84

Table 31. SE13-PA-1-A

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	2.8	-3.6	8.2	6.53	-9.9	-6.98	7.9	6.70	-9.4	-7.34	1.92	333.7	448.5	91.5	
1		***0.1***	***0.1***	***-0.04***	***-0.2***	***-0.26***			***-0.1***	***-0.52***	***0.86***	***0.0***	***0.1***	***3.93***	***0.22***
2	**0.2**	**0.1**	**0.2**	**0.09**	**-0.1**	**-0.51**	**0.2**	**0.10**	**-0.1**	**-0.51**	**1.80**	**0.0**	**0.1**	**7.56**	**0.70**
3	**0.5**	**0.4**	**0.7**	**0.31**	**0.0**	**0.00**	**0.5**	**0.35**	**0.3**	**-0.30**	**0.46**	**0.1**	**0.2**	**6.10**	**1.22**
4	**0.6**	**0.1**	**0.8**	**0.21**	**-0.1**	**-0.64**	**0.7**	**0.41**	**-0.1**	**-0.68**	**0.97**	**0.2**	**1.0**	**5.45**	**2.92**
5	*0.2*	*0.0*	*0.2*	*0.15*	*-0.3*	*-0.84*	*0.2*	*0.25*	*-0.2*	*-0.85*	*1.92*	*0.2*	*1.8*	*6.48*	*3.74*
6	*0.0*	*-0.1*	*0.1*	*0.07*	*-0.3*	*-0.57*	*0.1*	*0.07*	*-0.3*	*-0.58*	*1.78*	*0.0*	*0.2*	*4.37*	*4.12*
7	0.5	0.5	0.7	0.46	-0.1	-0.06	0.7	0.54	0.5	-0.25	0.62	0.1	0.4	5.78	4.94
8	**0.6**	**0.5**	**0.9**	**0.63**	**0.0**	**0.00**	**0.8**	**0.69**	**0.4**	**-0.45**	**0.71**	**0.1**	**0.6**	**5.40**	**5.40**
9	***0.7***	***-0.4***	***1.6***	***1.57***	***-1.8***	***-2.34***	***1.5***	***1.59***	***-1.6***	***-2.43***	***1.16***	***3.6***	***8.2***	***27.24***	***5.86***
10	***1.7***	***-0.6***	***3.3***	***3.13***	***-2.7***	***-2.98***	***2.8***	***3.18***	***-2.7***	***-3.17***	***1.02***	***11.1***	***16.0***	***37.23***	***6.36***
11	***1.8***	***-1.2***	***3.4***	***3.14***	***-3.2***	***-3.44***	***3.4***	***3.36***	***-3.1***	***-3.47***	***0.99***	***11.9***	***30.1***	***35.46***	***6.98***
12	***2.3***	***-1.0***	***4.7***	***4.57***	***-3.7***	***-4.03***	***4.5***	***4.80***	***-3.7***	***-4.03***	***1.03***	***19.9***	***1.5***	***46.93***	***7.48***
13	*1.5*	*-1.9*	*3.3*	*2.71*	*-4.9*	*-4.32*	*3.3*	*2.90*	*-4.7*	*-4.47*	*0.85*	*16.0*	*64.7*	*59.25*	*8.22*
14	***1.8***	***-3.6***	***8.2***	***6.53***	***-9.9***	***-6.98***	***7.9***	***6.70***	***-9.4***	***-7.34***	***0.75***	***69.1***	***46.5***	***89.47***	***8.82***
15	1.4	-1.5	5.9	4.21	-4.1	-2.63	5.4	4.55	-3.8	-2.73	0.69	22.0	-2.7	91.53	9.46
16	2.1	-2.8	4.2	2.81	-6.6	-3.73	4.2	2.85	-6.5	-4.12	0.61	20.2	38.4	62.93	10.04
17	2.8	-2.5	6.9	4.95	-6.0	-3.63	6.9	4.95	-5.9	-3.83	0.67	28.5	25.4	70.23	10.66
18	1.5	-2.8	5.2	3.50	-6.6	-4.00	5.2	3.50	-6.5	-4.26	0.64	24.0	36.1	64.07	11.22
19	1.5	-1.1	4.0	3.05	-2.4	-1.75	3.9	3.14	-2.1	-1.86	0.75	11.5	-4.1	64.17	11.72
20	-0.2	-1.7	0.3	0.91	-3.1	-1.90	0.3	0.91	-3.0	-1.92	0.83	2.4	12.8	25.78	12.28
21	1.1	-1.4	3.3	2.53	-3.5	-2.22	3.2	2.66	-3.5	-2.22	0.70	9.4	3.4	39.56	12.90
22	1.7	-1.3	3.6	2.53	-3.2	-2.08	3.6	2.53	-2.6	-2.27	0.68	9.9	11.6	46.94	13.42
23	0.5	-0.8	1.5	1.30	-1.5	-0.93	1.1	1.41	-1.3	-1.22	0.75	3.0	5.7	28.89	14.12
24	1.7	-1.5	3.5	2.24	-3.7	-2.25	3.2	2.34	-3.7	-2.28	0.63	8.4	15.2	33.25	14.70
25	1.5	-1.4	2.9	2.02	-4.5	-2.59	2.8	2.04	-4.2	-2.63	0.63	9.7	14.0	34.01	15.40
26	1.5	-2.0	4.4	2.99	-4.7	-2.45	4.0	3.03	-4.4	-3.03	0.60	14.7	15.8	39.40	16.04
27	0.9	-0.7	2.3	1.94	-1.6	-1.29	2.3	2.00	-1.3	-1.36	0.81	5.7	1.3	41.53	16.56
28	0.9	-1.4	1.8	1.51	-3.1	-1.98	1.6	1.56	-3.0	-2.12	0.71	5.4	8.1	24.19	17.06

Table 31. SE13-PA-1-A

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
29	0.0	-0.7	0.3	1.01	-1.2	-0.61	0.2	1.04	-1.1	-0.62	1.08	0.9	-1.0	20.08	17.68
30	-0.1	-0.4	0.1	0.42	-0.6	0.13	0.1	0.43	-0.4	-0.30	0.39	0.3	0.4	7.92	18.10
31	0.2	-0.6	1.3	1.21	-1.3	-0.87	1.2	1.27	-1.2	-0.95	0.81	1.4	4.9	13.37	18.96
32	-0.3	-0.8	0.5	0.48	-1.5	-1.07	0.3	0.65	-1.5	-1.07	0.79	0.9	4.3	9.53	19.92
33	-0.5	-0.8	0.0	0.00	-1.1	-0.42	-0.3	0.37	-1.1	-0.42	0.39	0.1	-0.2	8.38	20.44
34	0.1	-0.6	0.5	0.71	-1.1	-0.62	0.5	0.71	-1.1	-0.62	0.83	0.7	2.5	10.03	21.54
35	0.0	-0.2	0.5	0.72	-0.4	0.16	0.5	0.72	-0.3	-0.37	0.62	0.5	0.6	9.20	21.96
36	0.2	0.1	0.7	0.70	-0.3	-0.36	0.7	0.70	-0.2	-0.36	1.15	0.3	0.8	10.60	22.36
37	0.2	-0.3	1.1	1.07	-1.1	-1.10	1.1	1.07	-1.1	-1.10	1.01	0.7	2.4	9.46	22.88
38	-0.2	-0.6	0.0	0.00	-1.2	-0.85	-0.2	0.20	-1.2	-0.85	0.72	0.2	1.6	10.70	23.28
39	0.1	-0.6	0.7	0.81	-2.0	-1.48	0.6	0.81	-2.0	-1.49	0.84	1.8	6.0	14.95	23.90
40	0.1	-0.8	0.3	0.93	-1.6	-1.00	0.3	0.93	-1.6	-1.00	1.04	1.1	2.0	12.27	24.62
41	0.1	-0.5	0.6	0.73	-1.1	-0.82	0.5	0.76	-1.0	-0.99	0.89	1.0	1.7	11.68	25.70
42	0.4	-0.2	1.0	0.99	-0.9	-0.99	0.9	1.04	-0.9	-0.99	1.04	1.2	1.8	13.02	26.22
43	0.1	-0.4	0.7	0.73	-0.6	-0.46	0.7	0.73	-0.5	-0.59	0.89	0.5	1.0	13.14	26.80
44	0.2	-0.9	0.6	0.62	-1.6	-1.18	0.5	0.63	-1.6	-1.18	0.82	0.9	6.1	14.99	27.82
45	0.1	-0.6	0.5	0.59	-1.3	-0.86	0.5	1.16	-1.3	-0.90	0.78	1.4	0.8	16.79	28.44
46	0.1	-0.6	0.6	0.49	-1.2	-0.89	0.5	0.54	-1.2	-0.90	0.77	0.8	4.3	8.95	29.68
47	0.2	-0.5	0.7	0.63	-1.0	-0.60	0.5	0.64	-1.0	-0.65	0.76	0.6	2.4	10.10	31.54
48	0.2	-0.6	0.2	0.21	-1.0	-0.68	0.1	0.48	-1.0	-0.69	0.72	0.5	1.2	7.16	32.56
49	0.1	0.0	0.2	0.11	-0.5	0.08	-0.1	0.30	-0.1	-0.08	0.04	0.2	0.2	6.48	33.16
50	0.3	0.0	0.6	0.60	-0.2	-0.36	0.6	0.60	-0.2	-0.36	1.23	0.2	0.6	5.33	33.78
51	0.2	-0.7	0.6	0.55	-1.0	-0.45	0.6	0.55	-0.9	-0.63	0.63	0.5	4.0	6.35	35.02
52	0.2	-0.4	0.7	0.68	-1.0	-0.77	0.6	0.70	-1.0	-0.77	0.84	0.7	4.2	7.37	36.74
53	-0.3	-0.7	0.0	0.00	-1.3	-0.77	-0.2	0.25	-1.0	-0.79	0.60	0.2	1.5	8.32	37.60
54	0.2	0.0	0.5	0.68	-0.5	0.10	0.2	0.72	-0.2	-0.29	0.56	0.6	0.7	8.38	38.18
55	0.0	-0.5	0.2	0.10	-0.8	-0.41	0.1	0.10	-0.8	-0.49	0.54	0.2	0.3	7.05	38.74
56	0.0	0.0	0.3	0.18	-0.4	0.00	0.1	0.27	-0.1	-0.15	0.27	0.1	0.1	5.58	39.36
57	-0.2	-0.5	0.8	0.72	-1.3	-0.88	0.7	0.73	-1.2	-0.90	0.77	0.7	4.1	11.84	40.86
58	-0.2	-0.9	0.1	0.58	-1.1	-0.58	0.1	0.59	-1.1	-0.64	1.00	0.5	0.7	7.03	41.52
59	0.2	0.0	0.5	0.35	-0.6	0.03	0.4	0.42	-0.1	-0.14	0.30	0.3	1.3	7.62	42.58

Table 31. SE13-PA-1-A

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
60	0.2	0.1	0.4	0.39	0.0	0.00	0.4	0.40	0.1	-0.08	0.90	0.0	0.9	4.76	43.34
61	0.0	-0.5	0.3	0.10	-1.1	-0.71	0.1	0.11	-1.0	-0.76	0.61	0.3	1.9	5.02	44.02
62	-0.3	-0.6	0.0	0.00	-1.1	-0.65	-0.3	0.17	-0.9	-0.66	0.62	0.2	1.2	5.95	45.14
63	0.0	-0.4	0.5	0.42	-0.9	-0.64	0.4	0.44	-0.9	-0.68	0.78	0.5	2.2	6.54	46.76
64	-0.4	-0.3	0.0	0.00	-0.6	-0.24	-0.4	0.06	-0.5	-0.24	0.41	0.0	0.0	5.02	47.14
65	0.1	-0.5	0.2	0.26	-1.0	-0.58	0.2	0.31	-0.9	-0.59	0.71	0.3	1.3	6.29	48.02
66	0.2	0.0	0.7	0.70	-0.6	0.09	0.7	0.70	-0.1	-0.25	0.48	0.2	1.7	6.21	49.22
67	0.1	-0.5	0.4	0.29	-1.0	-0.63	0.4	0.32	-0.9	-0.70	0.67	0.3	1.5	6.65	50.02
68	-0.4	-0.7	0.0	0.00	-1.0	-0.56	-0.2	0.16	-1.0	-0.67	0.54	0.2	2.6	5.91	51.32
69	0.1	0.0	0.5	0.59	-0.6	0.04	0.4	0.62	-0.2	-0.33	0.52	0.3	0.9	10.78	51.86
70	0.2	0.0	0.7	0.51	-0.2	-0.27	0.6	0.58	-0.2	-0.29	0.92	0.1	0.6	7.09	52.36
71	0.1	-0.6	0.4	0.35	-0.9	-0.54	0.3	0.35	-0.9	-0.54	0.69	0.3	2.1	5.46	54.68
72	0.2	-0.4	0.3	0.26	-0.8	-0.45	0.2	0.37	-0.6	-0.48	0.65	0.4	0.6	6.21	55.96
73	0.2	0.0	0.5	0.53	-0.4	0.04	0.5	0.54	0.0	-0.20	0.52	0.2	0.7	6.35	56.48
74	0.2	-0.5	0.4	0.48	-0.9	-0.52	0.4	0.48	-0.8	-0.55	0.76	0.3	2.6	3.80	57.94
75	-0.5	-0.5	0.0	0.00	-0.9	-0.41	-0.4	0.01	-0.9	-0.41	0.46	0.0	0.1	4.06	58.50
76	0.1	-0.6	0.3	0.27	-0.9	-0.54	0.2	0.39	-0.9	-0.54	0.65	0.5	1.0	6.16	59.44
77	0.2	0.1	0.4	0.43	-0.6	0.01	0.3	0.47	0.1	-0.06	0.42	0.2	0.7	6.16	60.08
78	0.1	-0.6	0.4	0.27	-1.0	-0.64	0.3	0.28	-0.9	-0.65	0.69	0.3	2.8	5.78	62.52
79	-0.1	-0.4	0.4	0.10	-1.0	-0.42	0.3	0.50	-0.8	-0.60	0.39	0.8	5.3	7.81	66.72
80	-0.3	-0.4	0.0	0.00	-0.8	-0.53	-0.3	0.02	-0.8	-0.54	0.63	0.1	1.0	3.80	68.18
81	0.3	-0.2	0.3	0.29	-0.5	-0.26	0.3	0.38	-0.4	-0.40	0.66	0.3	0.4	4.95	69.48
82	-0.1	-0.3	0.1	0.12	-0.7	-0.39	0.1	0.14	-0.7	-0.40	0.66	0.0	0.0	4.83	70.46
83	0.0	-0.6	0.2	0.19	-0.9	-0.57	0.2	0.19	-0.9	-0.63	0.68	0.2	0.7	5.60	71.20
84	0.1	-0.3	0.4	0.43	-0.8	-0.42	0.3	0.49	-0.7	-0.48	0.69	0.4	1.9	5.78	73.60

Table 32. SE13-PA-1-B

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	4.4	2.4	9.5	5.62	-7.4	-6.07	7.0	5.71	-7.2	-6.59	2.76	321.4	434.7	86.5	
1	***0.2***	***0.2***	***0.3***	***0.13***	***-0.1***	***-0.35***	***0.2***	***0.17***	***0.0***	***-0.61***	***1.13***	***0.0***	***0.4***	***4.32***	***0.70***
2	**0.5**	**0.4**	**0.6**	**0.47**	**0.0**	**0.00**	**0.6**	**0.48**	**0.2**	**-0.43**	**0.80**	**0.2**	**0.3**	**5.64**	**1.24**
3	**0.6**	**0.1**	**0.8**	**0.51**	**0.0**	**0.00**	**0.7**	**0.53**	**0.0**	**-0.73**	**0.67**	**0.3**	**1.1**	**5.21**	**2.94**
4	*0.1*	*0.1*	*0.3*	*0.27*	*-0.2*	*-0.73*	*0.3*	*0.27*	*0.0*	*-0.79*	*2.34*	*0.0*	*0.8*	*2.60*	*3.28*
5	0.2	0.0	0.4	0.41	-0.1	-0.80	0.2	0.44	-0.1	-0.81	2.76	0.1	0.9	3.23	3.70
6	0.2	0.0	0.3	0.14	-0.1	-0.41	0.2	0.19	-0.1	-0.62	1.37	0.0	0.4	5.40	4.08
7	0.5	0.4	0.6	0.55	0.0	0.00	0.6	0.55	0.4	-0.47	0.93	0.2	0.4	4.51	4.96
8	0.5	0.5	0.7	0.44	0.0	0.00	0.7	0.76	0.5	-0.38	0.64	0.0	0.5	5.02	5.42
9	***0.9***	***-0.1***	***1.5***	***1.60***	***-1.5***	***-2.76***	***1.4***	***1.67***	***-1.3***	***-2.85***	***1.46***	***3.8***	***9.2***	***29.01***	***5.86***
10	***2.0***	***0.3***	***3.4***	***3.48***	***-2.0***	***-3.20***	***3.1***	***3.51***	***-2.0***	***-3.54***	***1.24***	***12.6***	***17.1***	***33.25***	***6.36***
11	1.9	0.2	3.4	3.20	-1.5	-2.78	3.4	3.47	-1.4	-2.91	1.23	9.3	18.7	27.87	7.00
12	*2.0*	*0.4*	*3.3*	*3.38*	*-2.5*	*-3.84*	*3.0*	*3.74*	*-2.4*	*-3.93*	*1.24*	*13.2*	*4.3*	*50.99*	*7.48*
13	**2.2**	**1.1**	**4.2**	**3.86**	**-0.8**	**-2.65**	**3.6**	**3.97**	**-0.8**	**-2.65**	**1.29**	**11.2**	**7.5**	**50.61**	**7.90**
14	*1.0*	*-1.0*	*1.3*	*0.23*	*-3.6*	*-4.58*	*1.3*	*0.44*	*-3.4*	*-4.60*	*0.97*	*9.3*	*60.9*	*50.99*	*8.24*
15	***4.4***	***-2.2***	***9.5***	***5.62***	***-7.4***	***-6.07***	***7.0***	***5.71***	***-7.2***	***-6.59***	***0.69***	***64.9***	***39.6***	***86.52***	***8.84***
16	3.5	0.8	6.8	3.53	-1.1	-2.46	6.5	3.89	-1.0	-2.58	0.75	18.2	-1.9	83.69	9.46
17	3.8	0.2	6.3	2.97	-4.3	-4.10	6.1	3.06	-4.3	-4.10	0.67	19.7	40.5	62.71	10.06
18	4.2	0.3	9.0	4.70	-3.6	-3.56	9.0	4.70	-3.3	-3.80	0.66	30.3	25.0	73.09	10.68
19	4.2	0.2	7.2	3.19	-4.5	-4.35	7.1	3.49	-4.5	-4.35	0.64	26.0	40.5	62.17	11.24
20	3.4	0.7	6.4	3.43	-0.7	-2.23	6.4	3.43	-0.5	-2.41	0.80	13.6	-1.9	69.80	11.72
21	2.3	0.8	3.2	1.53	-0.5	-2.04	3.1	1.57	-0.5	-2.11	0.96	3.9	13.9	28.45	12.28
22	3.0	1.1	5.1	2.44	-1.1	-2.33	4.8	2.65	-0.8	-2.46	0.77	8.8	1.5	35.12	12.90
23	3.5	0.3	5.8	2.90	-2.0	-2.66	5.8	2.90	-1.6	-3.02	0.72	12.6	16.3	44.91	13.42
24	2.7	1.4	4.0	1.60	0.0	0.00	3.8	1.90	0.7	-1.85	0.40	4.8	4.3	34.26	14.12
25	2.7	1.1	4.3	1.98	-1.4	-2.45	4.3	1.98	-1.1	-2.58	0.79	6.9	14.0	26.92	14.68
26	2.4	0.8	2.9	1.43	-0.8	-2.08	2.5	1.56	-0.7	-2.20	0.94	4.3	6.5	18.50	15.36
27	3.2	1.1	4.4	2.11	-1.2	-2.46	4.3	2.23	-1.0	-2.64	0.82	8.1	9.1	26.80	16.02
28	2.8	1.1	4.0	1.96	-0.3	-1.91	4.0	2.09	0.0	-2.06	0.91	5.2	4.7	28.51	16.52

Table 32. SE13-PA-1-B

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
29	2.5	0.4	4.0	1.98	-1.7	-2.59	4.0	1.98	-1.5	-2.77	0.81	7.5	11.7	29.64	17.06
30	2.1	1.2	2.9	1.66	0.0	0.00	2.7	1.70	1.1	-1.00	0.56	2.4	-2.1	26.48	17.62
31	1.8	1.7	2.1	0.64	0.0	0.00	2.0	0.73	1.5	-0.42	0.30	0.4	0.2	9.94	18.10
32	2.5	2.1	2.8	1.09	0.0	0.00	2.8	1.33	1.6	-0.99	0.39	0.8	2.3	9.22	18.60
33	2.4	1.5	2.5	0.35	0.0	0.00	2.5	0.40	1.2	-1.10	0.14	0.6	2.2	10.47	18.96
34	1.9	1.8	2.3	0.79	0.0	0.00	2.2	0.80	1.7	-0.27	0.34	0.1	-0.3	10.99	19.30
35	2.2	1.5	2.4	0.45	0.0	0.00	2.4	0.48	1.1	-1.16	0.19	0.6	4.2	9.88	19.88
36	1.4	1.2	1.6	0.47	0.0	0.00	1.6	0.47	0.8	-0.82	0.29	0.1	0.4	6.03	20.30
37	1.8	1.3	2.1	0.50	0.0	0.00	2.0	0.52	1.2	-0.66	0.24	0.4	1.9	4.94	21.52
38	1.8	1.6	2.1	0.63	0.0	0.00	2.1	0.76	1.5	-0.62	0.29	0.4	0.4	7.25	21.96
39	2.0	1.9	2.5	0.91	0.0	0.00	2.3	0.91	1.5	-0.88	0.37	0.4	1.1	9.33	22.36
40	2.5	1.8	2.9	1.21	0.0	0.00	2.9	1.21	1.3	-1.43	0.42	1.1	2.7	9.06	22.86
41	2.0	1.5	2.3	0.84	0.0	0.00	2.3	0.84	1.1	-1.05	0.36	0.6	1.9	8.93	23.26
42	2.3	1.4	2.6	0.76	0.0	0.00	2.4	0.88	0.5	-1.57	0.29	1.7	5.4	12.80	23.86
43	1.4	1.1	2.1	1.00	0.0	0.00	2.1	1.00	0.6	-1.18	0.48	0.4	1.5	10.10	24.60
44	1.8	1.4	2.0	0.64	0.0	0.00	1.9	0.65	1.2	-0.94	0.31	0.5	0.7	6.67	25.68
45	2.1	1.7	2.4	0.90	0.0	0.00	2.4	0.99	1.5	-1.03	0.37	0.8	1.5	11.43	26.18
46	2.1	1.6	2.7	0.97	0.0	0.00	2.6	0.97	1.4	-1.16	0.36	1.0	1.8	11.62	26.64
47	2.3	1.7	2.4	0.31	0.0	0.00	2.0	0.52	1.6	-0.66	0.13	0.6	1.1	8.23	27.46
48	1.7	1.2	1.7	-0.10	0.0	0.00	1.7	0.01	0.7	-1.44	0.06	0.6	5.3	9.40	27.80
49	1.9	1.3	2.3	1.37	0.0	0.00	2.2	1.38	1.3	-0.91	0.60	1.2	-0.2	12.22	28.40
50	2.1	1.5	2.2	0.24	0.0	0.00	2.0	0.51	1.2	-1.12	0.11	0.7	4.0	8.13	29.66
51	1.6	1.4	1.9	0.43	0.0	0.00	1.8	0.61	1.4	-0.15	0.23	0.0	-0.7	5.67	30.00
52	2.1	1.7	2.3	0.69	0.0	0.00	2.2	0.71	1.4	-0.75	0.30	0.4	2.6	9.46	31.54
53	2.1	1.7	2.3	0.37	0.0	0.00	2.2	0.71	1.6	-0.57	0.16	0.5	0.5	7.37	32.02
54	1.8	1.6	1.9	0.23	0.0	0.00	1.9	0.25	1.4	-0.60	0.12	0.1	0.8	3.56	32.56
55	0.0	1.9	2.2	0.23	0.0	0.00	1.9	0.27	1.8	-0.16	0.11	0.1	0.1	4.05	33.30
56	2.0	2.0	2.4	0.63	0.0	0.00	2.4	0.63	1.8	-0.46	0.27	0.1	0.6	4.38	33.78
57	2.2	1.4	2.5	0.50	0.0	0.00	2.4	0.57	1.4	-0.80	0.20	0.7	4.0	5.72	35.00
58	1.9	1.9	2.1	0.57	0.0	0.00	2.0	0.60	1.7	-0.40	0.27	0.2	0.4	9.06	35.80
59	2.2	2.2	2.6	0.80	0.0	0.00	2.6	0.80	2.0	-0.35	0.31	0.2	1.0	6.52	36.30

Table 32. SE13-PA-1-B

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
60	2.3	1.6	2.4	0.16	0.0	0.00	2.3	0.16	1.2	-0.98	0.07	0.4	2.1	6.65	36.74
61	1.8	1.5	1.9	0.37	0.0	0.00	1.9	0.37	1.3	-0.61	0.19	0.2	1.0	6.48	37.60
62	1.9	2.1	2.2	0.49	0.0	0.00	2.0	0.52	2.0	-0.10	0.22	0.2	0.6	6.67	38.16
63	2.1	1.7	2.2	0.11	0.0	0.00	2.1	0.14	1.4	-0.54	0.05	0.1	0.4	5.78	38.70
64	2.0	2.0	2.2	0.07	0.0	0.00	2.1	0.23	1.8	-0.19	0.03	0.1	0.1	5.46	39.38
65	2.2	1.7	2.6	0.80	0.0	0.00	2.6	0.82	1.6	-0.94	0.31	0.6	1.6	4.94	39.94
66	1.9	1.5	2.0	-0.05	0.0	0.00	2.0	0.39	1.2	-0.90	0.02	0.3	2.3	5.65	40.82
67	1.7	1.2	1.8	0.11	0.0	0.00	1.8	0.49	0.9	-0.71	0.06	0.2	0.6	3.67	41.50
68	2.1	2.1	2.2	0.45	0.0	0.00	2.2	0.45	2.0	-0.17	0.20	0.3	1.1	5.72	42.62
69	2.3	2.4	2.5	0.39	0.0	0.00	2.4	0.45	2.2	-0.17	0.15	0.1	0.8	8.17	43.34
70	2.2	1.5	2.4	0.12	0.0	0.00	2.3	0.17	1.4	-0.75	0.05	0.3	2.4	5.57	44.68
71	1.7	1.4	1.7	0.04	0.0	0.00	1.6	0.14	1.2	-0.71	0.03	0.1	0.6	5.02	45.12
72	2.2	1.7	2.5	0.71	0.0	0.00	2.5	0.71	1.4	-0.67	0.29	0.5	2.2	6.22	46.76
73	1.7	1.7	1.7	-0.01	0.0	0.00	1.7	0.09	1.5	-0.42	0.01	0.0	0.1	3.61	47.16
74	2.0	1.5	2.2	0.34	0.0	0.00	2.2	0.35	1.5	-0.52	0.15	0.2	1.1	4.48	48.20
75	2.0	2.0	2.1	0.31	0.0	0.00	2.1	0.31	1.9	-0.10	0.15	0.1	0.2	5.27	48.66
76	2.2	2.1	2.5	0.72	0.0	0.00	2.4	0.73	1.9	-0.38	0.29	0.1	1.2	5.78	49.22
77	2.3	1.2	2.5	0.42	0.0	0.00	2.5	0.42	1.3	-0.73	0.17	0.5	4.4	5.19	51.22
78	1.9	1.9	2.0	0.51	0.0	0.00	2.0	0.51	1.8	-0.25	0.25	0.2	0.6	9.33	51.78
79	2.1	2.0	2.3	0.43	0.0	0.00	2.2	0.44	2.0	-0.16	0.19	0.1	0.5	3.75	52.26
80	2.1	2.1	2.4	0.41	0.0	0.00	2.3	0.43	2.1	-0.14	0.18	0.0	0.2	4.19	52.92
81	2.1	1.6	2.3	0.21	0.0	0.00	2.3	0.29	1.4	-0.53	0.09	0.2	1.3	3.81	54.06
82	1.6	1.6	1.6	0.04	0.0	0.00	1.6	0.04	1.4	-0.54	0.02	0.1	0.5	3.68	54.74
83	1.9	1.9	2.1	0.26	0.0	0.00	2.0	0.36	1.9	-0.07	0.12	0.1	0.2	4.43	55.18
84	2.0	1.5	2.1	0.26	0.0	0.00	2.1	0.27	1.5	-0.54	0.12	0.2	0.5	2.20	55.90
85	2.1	1.5	2.3	0.42	0.0	0.00	2.2	0.49	1.6	-0.45	0.18	0.5	3.2	5.97	58.48
86	2.1	1.6	2.3	0.37	0.0	0.00	2.0	0.42	1.4	-0.74	0.16	0.7	3.0	5.70	61.72
87	1.6	1.4	1.7	0.04	0.0	0.00	1.6	0.05	1.3	-0.71	0.03	0.2	1.1	4.62	62.10
88	1.5	1.3	1.5	0.16	0.0	0.00	1.5	0.16	1.2	-0.54	0.11	0.1	0.2	3.35	62.50
89	2.0	1.4	2.2	0.34	0.0	0.00	1.9	0.42	1.4	-0.59	0.15	0.5	3.2	5.91	64.74
90	2.1	2.0	2.3	0.46	0.0	0.00	2.3	0.46	2.0	-0.23	0.20	0.2	1.2	4.06	66.08

Table 32. SE13-PA-1-B

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
91	2.1	1.7	2.2	0.07	0.0	0.00	2.2	0.12	1.4	-0.67	0.03	0.2	0.7	2.79	66.64
92	0.0	1.6	1.8	0.04	0.0	0.00	1.7	0.11	1.5	-0.55	0.02	0.1	0.9	2.79	68.18
93	2.0	1.7	2.1	0.39	0.0	0.00	2.1	0.41	1.5	-0.42	0.19	0.2	0.4	4.51	69.44
94	2.0	1.8	2.1	0.15	0.0	0.00	2.0	0.22	1.5	-0.41	0.07	0.1	0.2	4.12	70.32
95	2.0	1.5	2.1	0.20	0.0	0.00	2.1	0.27	1.3	-0.58	0.09	0.2	0.8	4.35	71.14
96	1.4	1.5	1.6	0.03	0.0	0.00	1.6	0.04	1.5	-0.07	0.02	0.0	0.0	3.68	71.36
97	2.1	1.8	2.3	0.34	0.0	0.00	2.1	0.49	1.5	-0.54	0.15	0.3	1.8	4.94	73.62

Table 33. SE13-PA-2-A

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	16.5	-35.4	33.3	5.23	-67.6	-4.03	24.5	10.06	-17.0	-9.58	1.05	1948.4	2561.2	446.1	
1	***0.0***	***-0.5***	***0.1***	***0.21***	***-1.0***	***-0.62***	***0.1***	***0.21***	***-0.9***	***-0.63***	***0.75***	***0.2***	***0.4***	***4.88***	***0.24***
2	*-0.2*	*-0.8*	*0.0*	*0.33*	*-1.2*	*-0.78*	*0.0*	*0.34*	*-1.1*	*-0.80*	*0.92*	*0.4*	*1.3*	*12.80*	*0.70*
3	***0.6***	***-0.5***	***1.4***	***1.29***	***-1.6***	***-1.25***	***1.3***	***1.41***	***-1.5***	***-1.28***	***0.85***	***2.6***	***3.9***	***23.88***	***1.24***
4	**0.8**	**0.1**	**1.8**	**1.58**	**-0.5**	**-0.69**	**1.8**	**1.61**	**-0.4**	**-0.70**	**0.95**	**2.2**	**2.3**	**22.63**	**1.72**
5	0.6	-0.4	1.3	0.98	-1.1	-1.08	1.1	1.03	-1.0	-1.18	0.85	1.3	4.5	12.99	2.44
6	0.5	-0.7	0.6	0.78	-1.3	-1.12	0.5	0.85	-1.2	-1.13	1.01	1.1	1.9	13.14	2.96
7	*0.0*	*-1.2*	*0.2*	*0.49*	*-2.0*	*-1.51*	*0.2*	*0.49*	*-2.0*	*-1.51*	*0.94*	*1.4*	*6.0*	*17.91*	*3.34*
8	*0.0*	*-1.3*	*0.7*	*1.23*	-2.6	*-1.75*	*0.6*	*1.28*	*-2.5*	*-1.77*	*0.89*	*2.5*	*8.2*	*20.83*	*3.86*
9	0.1	-0.5	0.3	0.54	-0.9	0.18	0.3	1.31	-0.9	-0.64	0.29	1.1	-3.0	15.30	4.38
10	0.3	-0.3	1.3	1.37	-1.3	-1.31	1.3	1.37	-1.3	-1.31	1.05	1.6	3.1	21.97	5.00
11	**0.9**	**-0.9**	**2.4**	**1.70**	**-1.9**	**-1.87**	**2.1**	**1.72**	**-1.9**	**-1.87**	**0.83**	**3.3**	**6.0**	**41.30**	**5.48**
12	***1.3***	***-3.2***	***6.7***	***4.91***	***-9.4***	***-6.83***	***6.7***	***4.91***	***-9.3***	***-6.98***	***0.73***	***46.0***	***67.8***	***142.62***	***5.94***
13	***4.8***	***-5.8***	***10.5***	***7.19***	***-12.2***	***-7.89***	***10.5***	***7.19***	***-11.7***	***-8.13***	***0.66***	***88.6***	***125.0***	***143.34***	***6.46***
14	***7.6***	***-22.1***	***15.4***	***7.85***	***-37.2***	***-5.87***	***14.0***	***8.48***	***-17.0***	***-9.58***	***0.26***	***304.0***	***424.1***	***264.45***	***7.16***
15	***9.3***	***-35.4***	***16.9***	***8.27***	***-67.6***	***-4.03***	***16.7***	***8.46***	***-42.1***	***-6.27***	***0.15***	***328.7***	***469.7***	***366.11***	***8.40***
16	**15.5**	**11.6**	**33.3**	**5.23**	**-27.0**	**0.16**	**24.5**	**10.06**	**12.0**	**-0.83**	**0.08**	**256.1**	**75.5**	**446.09**	**9.48**
17	16.5	-14.6	21.1	2.41	-36.1	-2.38	21.0	2.55	-34.1	-3.03	0.08	96.1	106.4	156.91	10.28
18	-2.4	-5.2	0.0	0.00	-12.2	0.03	-1.4	1.28	-6.0	-1.10	0.00	9.6	8.8	106.10	10.70
19	3.8	-14.4	6.0	1.98	-32.1	-2.51	6.0	1.98	-31.4	-2.75	0.12	69.7	133.1	98.74	11.68
20	2.5	-14.4	5.8	2.20	-24.4	-2.04	5.6	2.41	-24.3	-2.32	0.14	56.2	55.2	135.32	12.48
21	0.0	-10.3	15.3	2.92	-23.2	-2.28	12.2	3.05	-22.8	-2.49	0.13	92.5	93.8	158.10	13.80
22	-8.7	-10.9	0.0	0.00	-18.6	-1.91	-8.7	0.10	-17.8	-2.03	0.10	13.7	22.2	148.47	14.24
23	1.2	-11.2	2.8	1.75	-13.5	-1.77	2.7	1.75	-13.5	-1.77	0.22	28.2	44.5	144.27	14.88
24	8.0	-8.6	13.1	2.95	-11.7	-1.56	13.1	2.95	-10.9	-1.65	0.18	54.5	46.4	144.17	15.56
25	5.3	-10.4	8.7	2.30	-12.1	-1.68	8.7	2.30	-12.1	-1.70	0.19	38.1	55.8	126.11	16.52
26	3.8	-8.6	7.2	2.09	-10.0	-1.35	6.6	2.22	-9.6	-1.54	0.20	31.6	36.1	85.28	17.32
27	-3.5	-3.8	0.0	0.00	-8.0	0.05	-2.8	0.93	-4.1	-0.36	0.01	2.3	-1.8	44.07	17.72

Table 33. SE13-PA-2-A

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
28	-2.2	-3.3	0.0	0.00	-4.0	-0.76	-1.7	1.04	-3.9	-0.83	0.19	1.8	3.2	19.07	18.16
29	3.1	-9.9	6.0	1.96	-19.0	-2.12	6.0	1.96	-17.6	-2.17	0.16	38.2	64.6	60.33	19.26
30	-0.1	-9.2	0.5	1.19	-13.9	-1.79	-0.3	1.41	-13.8	-1.82	0.21	21.4	47.2	66.55	20.18
31	0.3	-5.6	2.5	1.42	-8.5	0.03	1.9	1.71	-6.1	-1.23	0.13	15.7	12.2	52.64	21.56
32	0.9	-2.1	2.7	1.57	-5.1	0.19	2.5	1.70	-2.3	-1.03	0.18	10.1	10.1	45.78	22.38
33	3.0	-6.6	5.0	1.85	-8.0	-1.34	4.8	1.88	-7.6	-1.35	0.25	17.3	34.3	42.23	23.32
34	1.8	-9.7	3.5	1.71	-15.0	-1.80	3.5	1.71	-13.3	-1.97	0.19	28.8	46.1	62.77	24.14
35	-1.2	-8.3	0.0	0.00	-10.0	-1.30	-0.5	1.40	-9.7	-1.43	0.13	13.7	19.0	73.47	24.80
36	0.8	-5.9	3.0	1.72	-7.7	0.25	2.5	1.80	-7.0	-1.34	0.14	17.3	13.0	55.87	25.76
37	0.3	-2.0	1.6	1.39	-5.3	0.10	1.3	1.44	-2.5	-0.99	0.19	6.7	10.0	46.84	26.26
38	-0.1	-8.6	0.9	1.26	-10.7	-1.47	0.9	1.26	-10.2	-1.59	0.24	16.9	47.7	40.83	27.88
39	1.2	-5.4	3.2	1.81	-7.8	0.18	3.1	1.84	-5.5	-1.29	0.15	16.0	5.6	56.26	28.60
40	0.8	-10.3	2.5	1.51	-14.6	-1.84	2.3	1.62	-14.6	-1.87	0.20	25.0	52.0	43.20	29.80
41	3.2	-7.6	5.5	1.95	-9.6	-1.46	5.3	2.07	-9.4	-1.56	0.23	26.1	25.0	50.99	30.96
42	-6.3	-7.6	0.0	0.00	-9.5	-1.40	-6.2	0.19	-9.5	-1.42	0.15	2.6	8.8	35.43	31.60
43	-2.4	-2.9	0.0	0.00	-6.9	0.25	-1.8	1.08	-3.3	-0.59	0.04	2.9	0.7	47.12	32.10
44	-2.6	-4.5	0.0	0.00	-5.3	-0.88	-2.4	0.35	-5.3	-0.93	0.16	1.6	5.4	12.13	32.60
45	-1.8	-3.1	0.0	0.00	-4.2	0.15	-1.5	1.06	-3.5	-0.78	0.04	3.0	2.1	22.55	33.22
46	-1.2	-2.2	0.0	0.00	-3.0	0.03	-0.4	1.13	-2.9	-0.77	0.01	2.3	4.4	19.05	33.84
47	-0.7	-7.0	0.0	1.08	-8.3	-1.27	0.0	1.18	-8.1	-1.32	0.28	8.1	33.9	19.88	35.04
48	1.8	-2.9	3.9	1.82	-6.5	0.16	3.8	1.89	-3.4	-1.14	0.16	14.1	7.9	37.47	35.96
49	0.5	-7.7	1.2	1.32	-10.5	-1.54	1.2	1.32	-10.4	-1.64	0.25	14.2	33.0	29.65	36.88
50	-1.9	-6.1	0.0	0.00	-7.4	-1.16	-1.1	1.18	-7.3	-1.23	0.16	7.5	8.5	37.97	37.68
51	1.1	-5.1	3.7	1.79	-6.2	-1.15	3.7	1.79	-5.9	-1.26	0.30	15.7	20.3	44.39	38.64
52	-1.8	-2.8	0.0	0.00	-4.8	0.14	-1.5	0.83	-3.2	-0.68	0.03	2.2	2.1	20.76	39.36
53	0.6	-5.1	1.7	1.50	-6.1	-1.15	1.7	1.50	-5.9	-1.27	0.34	9.2	14.2	25.34	40.06
54	-3.9	-8.0	0.0	0.00	-9.5	-1.45	-3.8	0.36	-9.4	-1.49	0.15	5.7	20.1	33.91	40.92
55	-1.1	-5.1	0.0	0.00	-7.4	0.09	-0.1	1.37	-5.7	-1.14	0.01	7.8	4.0	44.58	41.58
56	0.2	-1.3	1.1	1.33	-4.7	0.02	1.1	1.40	-2.1	-0.79	0.22	5.1	9.9	25.65	42.84
57	0.1	-6.3	1.1	1.28	-7.6	-1.19	1.1	1.28	-7.4	-1.31	0.29	8.7	25.9	19.69	44.10

Table 33. SE13-PA-2-A

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
58	-2.7	-3.7	0.0	0.00	-6.1	0.05	-2.0	0.87	-4.2	-0.81	0.01	2.4	-0.9	20.46	44.74
59	-3.2	-4.8	0.0	0.00	-5.6	-0.90	-3.2	0.39	-5.3	-0.95	0.16	1.3	3.6	14.00	45.16
60	-1.9	-2.0	0.0	0.00	-4.5	0.10	-1.8	0.93	-2.3	-0.35	0.02	1.9	1.5	21.35	45.68
61	-1.5	-5.3	0.0	0.00	-6.2	-1.07	-1.0	0.93	-6.1	-1.08	0.17	3.8	14.5	12.07	46.78
62	-2.7	-3.9	0.0	0.00	-5.0	0.02	-2.6	0.60	-4.4	-0.82	0.00	1.7	6.3	14.19	48.00
63	-2.2	-2.3	0.0	0.00	-3.6	0.06	-2.3	0.82	-2.4	-0.29	0.02	1.1	0.2	13.91	48.64
64	0.0	-3.1	1.5	1.47	-3.8	-0.87	1.5	1.47	-2.8	-1.05	0.43	5.8	23.9	16.95	50.02
65	-2.5	-4.0	0.0	0.00	-4.5	-0.96	-2.2	0.63	-4.3	-0.98	0.21	1.5	13.2	9.65	51.04
66	-0.8	-1.9	0.0	0.00	-3.7	0.08	0.0	1.24	-2.6	-0.84	0.02	3.4	2.4	19.18	51.96
67	-1.1	-1.4	0.0	0.00	-2.0	-0.59	-0.7	0.87	-2.0	-0.63	0.29	0.8	2.7	10.67	52.44
68	-1.2	-1.3	0.0	0.00	-1.6	-0.28	-0.7	0.70	-1.6	-0.31	0.18	0.2	0.9	8.19	52.94
69	-1.9	-3.1	0.0	0.00	-3.9	-0.92	-0.6	0.70	-3.8	-0.94	0.24	1.7	8.9	11.49	54.10
70	-2.6	-3.2	0.0	0.00	-4.0	-0.89	-2.1	0.65	-4.0	-0.92	0.22	0.7	1.6	12.03	54.68
71	-1.1	-1.6	0.0	0.00	-3.1	0.02	-1.0	0.97	-2.3	-0.70	0.01	1.9	1.6	15.20	55.28
72	-1.5	-2.5	0.0	0.00	-3.0	-0.77	-1.2	0.47	-2.9	-0.80	0.26	0.7	2.8	8.45	55.88
73	-0.7	-1.4	0.4	1.16	-2.3	0.11	0.4	1.16	-1.8	-0.62	0.40	2.2	4.8	16.13	56.56
74	-0.8	-2.6	0.0	0.00	-3.1	-0.70	-0.4	0.83	-2.2	-0.76	0.22	1.5	14.0	13.59	57.90
75	-2.4	-2.7	0.0	0.00	-3.1	-0.49	-2.0	0.72	-3.0	-0.52	0.16	0.2	-2.1	8.76	58.42
76	-1.6	-2.5	0.0	0.00	-2.9	-0.65	-1.4	0.71	-2.8	-0.75	0.22	0.9	4.3	9.25	59.36
77	-1.5	-1.6	0.0	0.00	-2.5	0.11	-1.2	0.78	-1.7	-0.29	0.05	0.7	3.0	8.04	60.20
78	-1.3	-3.6	0.0	0.00	-4.3	-1.05	-1.2	0.42	-4.2	-1.07	0.24	1.8	11.1	5.89	61.82
79	-3.6	-3.8	0.0	0.00	-4.2	-0.42	-3.5	0.06	-4.1	-0.43	0.10	0.1	2.0	5.27	62.12
80	-3.8	-4.1	0.0	0.00	-4.3	-0.35	-3.7	0.18	-4.2	-0.36	0.08	0.1	0.2	5.13	62.44
81	-1.2	-3.0	0.0	0.00	-3.9	0.09	-1.1	0.96	-3.6	-0.94	0.02	3.2	16.0	17.72	63.96
82	0.0	-3.8	0.0	0.00	-4.5	-0.86	-2.6	0.52	-4.4	-0.93	0.19	0.8	1.8	9.84	64.58
83	-2.3	-2.3	0.0	0.00	-3.7	0.03	-2.3	0.72	-2.5	-0.38	0.01	0.9	0.4	13.08	65.14
84	-1.2	-1.4	0.0	0.00	-2.3	0.05	-0.8	0.94	-1.6	-0.34	0.02	0.9	3.8	11.65	65.64
85	-0.9	-2.7	0.0	0.00	-3.2	-0.80	-0.3	0.97	-3.1	-0.86	0.25	1.6	8.3	11.59	66.62
86	-2.4	-3.0	0.0	0.00	-3.6	-0.81	-2.0	0.55	-3.5	-0.83	0.22	0.5	2.0	8.30	67.26
87	-2.8	-3.0	0.0	0.00	-3.9	-0.78	-2.5	0.38	-3.7	-0.80	0.20	0.3	2.4	9.12	68.00

Table 33. SE13-PA-2-A

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
88	-1.8	-2.5	0.0	0.00	-2.9	0.14	-2.1	0.70	-2.8	-0.59	0.05	1.0	2.1	8.74	69.28
89	-1.7	-2.6	0.0	0.00	-3.2	-0.76	-1.5	0.48	-3.2	-0.76	0.24	0.8	2.2	7.75	70.04
90	-1.8	-3.1	0.0	0.00	-3.7	-0.90	-2.0	0.46	-3.7	-0.90	0.24	1.1	5.3	7.81	71.14
91	-1.9	-2.5	0.0	0.00	-3.1	-0.76	-2.0	0.67	-3.1	-0.76	0.25	1.0	7.8	10.51	73.48

Table 34. SE13-PA-2-B

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
	mm	mm	mm	kN	mm	kN	mm	kN	mm	kN	kN/mm	J	J	mm/s	s
Sum/Max	26.2	-35.8	44.0	4.00	-56.5	-4.79	23.9	9.93	-25.2	-9.36	1.54	2008.0	2609.0	424.9	
1	***-0.1***	***-0.6***	***0.1***	***0.18***	***-1.0***	***-0.82***	***0.1***	***0.18***	***-0.8***	***-0.84***	***0.93***	***0.2***	***0.7***	***5.78***	***0.22***
2	**-0.1**	**-0.7**	**0.2**	**0.58**	**-0.9**	**-0.52**	**-0.1**	**0.73**	**-0.7**	**-0.89**	**1.01**	**0.9**	**1.7**	**8.06**	**0.70**
3	***0.3***	***-0.6***	***1.0***	***1.61***	***-1.2***	***-1.19***	***1.0***	***1.61***	***-1.0***	***-1.48***	***1.26***	***2.4***	***3.9***	***20.90***	***1.22***
4	**0.5**	**0.1**	**1.7**	**1.76**	**-0.9**	**-1.42**	**1.5**	**1.77**	**-0.9**	**-1.42**	**1.25**	**2.5**	**2.3**	**19.95**	**1.68**
5	0.2	-0.4	0.7	0.61	-0.8	-1.18	0.5	0.71	-0.8	-1.18	1.18	0.7	3.6	7.68	2.46
6	0.1	-0.6	0.3	0.96	-1.1	-1.17	0.3	0.96	-1.1	-1.39	1.54	0.9	2.5	13.94	2.96
7	*0.0*	*-1.0*	*0.4*	*1.05*	*-1.8*	*-1.79*	*0.4*	*1.05*	*-1.8*	*-1.79*	*1.32*	*1.5*	*6.7*	*15.39*	*3.34*
8	*-0.2*	*-1.3*	*0.9*	*1.64*	*-2.7*	*-1.95*	*0.9*	*1.64*	*-2.6*	*-2.00*	*1.01*	*3.0*	*8.6*	*17.78*	*3.84*
9	-0.1	-0.6	0.6	1.18	-1.0	0.27	0.1	1.57	-1.0	-1.22	0.59	1.8	-1.8	14.25	5.00
10	**0.5**	**-0.1**	**1.8**	**1.79**	**-1.7**	**-1.98**	**1.7**	**1.86**	**-1.7**	**-1.98**	**1.07**	**3.2**	**5.6**	**37.94**	**5.50**
11	***3.9***	***-4.3***	***7.4***	***5.09***	***-10.1***	***-6.80***	***7.4***	***5.09***	***-10.1***	***-6.80***	***0.68***	***53.0***	***74.3***	***138.37***	***5.96***
12	***4.7***	***-4.4***	***10.6***	***6.08***	***-10.9***	***-6.44***	***10.3***	***6.44***	***-10.3***	***-7.08***	***0.58***	***78.3***	***104.5***	***147.02***	***6.50***
13	***6.7***	***-13.3***	***14.6***	***7.27***	***-32.2***	***-7.99***	***13.9***	***7.35***	***-25.2***	***-9.36***	***0.33***	***270.0***	***455.5***	***305.61***	***7.18***
14	***12.2***	***-35.8***	***19.6***	***8.37***	***-56.5***	***-4.79***	***16.0***	***8.41***	***-33.6***	***-8.52***	***0.17***	***361.8***	***468.0***	***301.24***	***8.38***
15	**26.2**	**20.9**	**44.0**	**4.00**	**-29.4**	**0.54**	**23.9**	**9.93**	**20.6**	**-0.60**	**0.05**	**278.4**	**92.8**	**424.90**	**9.50**
16	24.5	-16.8	29.6	2.60	-31.2	-1.93	28.4	2.75	-28.2	-3.14	0.07	103.8	109.0	144.80	10.26
17	-0.5	-2.8	0.0	0.62	-14.0	0.23	-4.0	0.78	-3.9	-1.38	0.03	7.9	9.6	130.11	10.72
18	7.9	-6.9	11.0	1.75	-24.3	-2.37	9.8	1.83	-22.3	-2.44	0.12	64.6	125.6	114.40	11.72
19	5.0	-8.0	11.1	2.44	-20.2	-2.21	10.8	2.57	-18.4	-2.24	0.15	53.7	55.9	142.27	12.52
20	13.4	-4.0	18.3	2.79	-21.3	-2.20	16.9	3.36	-20.7	-2.47	0.13	89.3	87.6	161.01	13.86
21	-1.0	-5.8	0.0	0.00	-8.5	-1.90	-1.1	0.27	-8.5	-1.90	0.22	9.6	18.7	104.90	14.22
22	7.1	-3.3	12.4	2.41	-11.3	-1.92	11.8	2.55	-8.0	-2.08	0.18	40.4	55.3	148.47	14.96
23	10.5	-4.2	17.0	3.22	-7.7	-1.72	16.6	3.35	-7.4	-1.91	0.20	49.4	40.9	148.97	15.58
24	7.5	-2.9	14.0	2.79	-7.5	-1.72	14.0	2.79	-3.3	-1.86	0.21	37.0	58.2	133.48	16.58
25	8.8	-1.7	14.6	2.68	-6.7	-1.67	14.0	2.94	-3.8	-1.75	0.20	36.9	40.1	94.55	17.42
26	3.4	2.2	3.9	0.83	-0.7	0.14	2.9	0.92	1.5	-0.93	0.15	3.4	-1.6	44.32	18.18
27	6.5	-4.5	11.9	2.33	-18.8	-2.33	11.5	2.40	-18.8	-2.33	0.15	41.9	75.4	77.03	19.32

Table 34. SE13-PA-2-B

Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
28	5.7	-2.4	9.1	1.69	-10.3	-1.62	9.1	1.71	-10.1	-1.84	0.17	26.9	50.6	88.55	20.28
29	6.6	-2.3	11.0	2.19	-6.9	-1.68	10.4	2.40	-6.3	-1.71	0.22	25.2	21.6	63.31	21.60
30	5.7	1.5	9.6	1.75	-1.3	0.05	9.2	1.96	-1.0	-1.31	0.16	14.7	12.8	59.97	22.48
31	6.0	0.8	9.0	1.46	-1.3	-1.25	8.9	1.47	1.4	-1.29	0.26	11.3	23.9	51.82	23.36
32	6.9	-2.2	10.3	1.76	-11.3	-1.81	10.3	1.90	-10.5	-2.02	0.17	28.4	48.3	75.50	24.22
33	3.7	-1.0	6.1	1.22	-3.0	-1.15	6.1	1.22	-2.4	-1.33	0.26	10.4	12.4	71.58	24.84
34	5.6	-0.1	8.9	1.81	-4.9	-1.57	8.6	1.86	-4.9	-1.57	0.24	17.8	13.2	53.47	25.86
35	5.6	2.5	6.0	0.81	0.0	0.00	5.9	1.06	1.2	-1.24	0.14	7.1	11.4	47.82	26.82
36	5.5	-0.9	6.8	1.11	-5.1	-1.47	6.8	1.11	-4.6	-1.56	0.22	13.0	43.0	59.54	27.94
37	6.0	0.2	10.1	2.24	-2.6	-1.24	9.9	2.24	-2.3	-1.34	0.27	16.9	4.0	61.31	28.70
38	5.8	-3.5	10.4	1.97	-14.3	-2.06	10.0	1.98	-13.7	-2.09	0.16	31.5	66.7	67.67	29.92
39	9.3	-1.7	15.3	2.70	-10.7	-1.82	14.1	3.03	-10.6	-1.95	0.17	41.7	39.6	76.58	31.18
40	2.1	1.1	2.3	0.43	-1.1	0.06	2.3	0.47	0.0	-0.97	0.11	1.6	2.9	38.42	31.64
41	3.6	2.5	4.0	0.83	0.0	0.00	4.0	0.83	2.1	-0.71	0.21	2.1	1.4	27.44	32.12
42	2.9	1.6	3.3	0.36	0.0	0.00	3.2	0.39	0.4	-1.06	0.11	1.4	6.1	18.24	32.62
43	0.0	3.0	5.5	0.94	0.0	0.00	5.0	1.05	2.2	-0.95	0.17	3.6	2.3	24.45	33.30
44	4.7	3.9	6.0	1.01	0.0	0.00	5.9	1.01	3.4	-0.78	0.17	2.0	3.5	17.65	34.12
45	6.3	0.8	11.5	2.33	-3.6	-1.33	11.2	2.41	-3.4	-1.35	0.24	27.4	46.0	46.29	36.10
46	5.4	-0.1	6.6	1.01	-4.4	-1.53	6.5	1.03	-4.4	-1.53	0.23	12.0	28.2	40.35	36.96
47	5.2	0.1	6.2	1.15	-1.7	-1.17	6.2	1.15	-1.1	-1.23	0.30	8.8	9.0	39.46	37.72
48	6.2	-0.1	10.2	1.96	-4.1	-1.45	10.2	1.96	-3.3	-1.50	0.24	17.3	23.8	47.13	38.74
49	5.1	3.5	6.0	0.91	0.0	0.00	5.5	1.02	2.7	-0.92	0.15	3.9	2.9	35.72	39.42
50	6.4	1.2	8.7	1.38	-1.3	-1.16	8.6	1.46	-0.9	-1.25	0.26	9.6	13.8	33.53	40.22
51	2.5	-0.9	2.8	0.30	-3.9	-1.42	2.8	0.30	-3.9	-1.45	0.25	6.1	20.9	43.01	41.00
52	4.7	2.1	6.6	1.27	0.0	0.02	6.5	1.29	0.9	-1.12	0.19	6.7	2.6	48.14	41.66
53	4.6	4.0	5.5	0.92	0.0	0.00	4.7	0.97	3.5	-0.53	0.17	2.4	2.3	25.08	42.26
54	5.5	4.0	6.7	1.08	0.0	0.00	6.7	1.10	3.4	-0.90	0.16	2.5	5.7	20.59	42.92
55	5.6	3.3	7.4	1.16	0.0	0.00	7.4	1.16	2.4	-0.94	0.16	3.5	19.5	21.35	44.12
56	4.3	2.9	5.0	0.88	0.0	0.00	4.9	0.89	2.0	-0.93	0.17	1.4	-1.1	14.19	44.76
57	3.6	2.4	3.8	0.40	0.0	0.00	3.8	0.46	1.2	-1.03	0.10	1.2	3.4	18.46	45.20

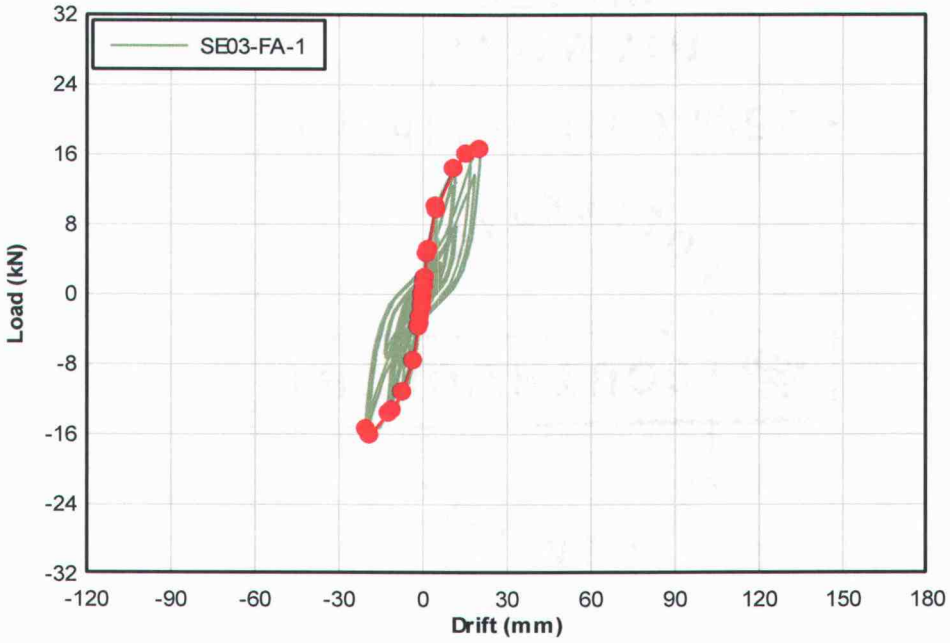
Table 34. SE13-PA-2-B

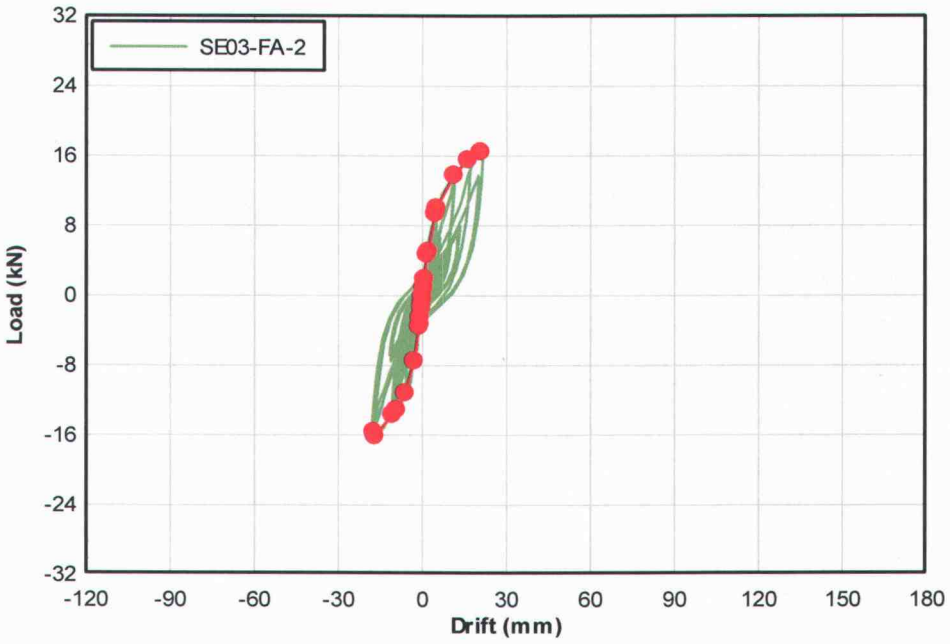
Cycle #	$(+)\delta_o$	$(-)\delta_o$	$(+)\delta_i$	$(+)P_i$	$(-)\delta_i$	$(-)P_i$	$(+)\delta_{max}$	$(+)P_{max}$	$(-)\delta_{max}$	$(-)P_{max}$	K_i	E_i	E Input	V_{max}	Time
58	4.7	4.2	5.6	0.93	0.0	0.00	5.3	1.01	3.9	-0.44	0.16	2.0	1.3	21.85	45.80
59	5.7	1.2	6.7	1.01	-1.2	-1.19	6.6	1.06	-0.6	-1.20	0.28	6.8	17.1	19.05	46.86
60	4.4	2.8	4.8	0.68	0.0	0.00	4.6	0.75	2.5	-0.82	0.14	2.5	6.3	16.38	48.04
61	4.3	3.8	4.9	0.79	0.0	0.00	4.4	0.83	3.5	-0.42	0.16	1.2	0.1	11.65	48.70
62	6.0	1.8	8.6	1.51	0.0	0.00	8.6	1.51	2.2	-1.25	0.17	8.3	24.5	22.80	50.16
63	5.0	3.4	6.8	1.06	-0.4	-1.01	6.7	1.20	0.0	-1.09	0.29	6.8	16.9	23.56	52.04
64	5.0	4.7	5.4	0.74	0.0	0.00	5.2	0.81	4.4	-0.32	0.14	0.8	2.1	20.26	52.54
65	5.0	3.0	5.4	0.58	0.0	0.00	5.4	0.59	2.2	-0.95	0.11	1.7	9.5	12.73	54.14
66	3.7	2.9	4.3	0.73	0.0	0.00	4.3	0.73	2.0	-0.87	0.17	1.0	1.3	14.00	54.74
67	4.4	4.0	5.5	0.89	0.0	0.00	5.4	0.93	3.3	-0.72	0.16	1.7	1.3	17.21	55.34
68	4.2	3.2	4.4	0.25	0.0	0.00	4.4	0.25	2.7	-0.83	0.06	0.6	2.6	14.50	55.92
69	5.2	4.5	6.5	1.04	0.0	0.00	6.4	1.09	3.6	-0.79	0.16	2.4	4.5	17.10	56.66
70	3.6	3.5	5.6	0.59	0.0	0.00	4.2	0.72	2.2	-0.84	0.11	2.0	11.6	13.14	58.42
71	4.3	3.2	4.9	0.70	0.0	0.00	4.7	0.72	2.7	-0.84	0.14	1.1	4.4	10.60	59.38
72	4.5	4.4	5.1	0.74	0.0	0.00	5.0	0.75	3.8	-0.40	0.15	0.7	2.0	9.31	60.30
73	4.8	4.7	5.1	0.45	0.0	0.00	5.0	0.48	4.6	-0.14	0.09	0.1	1.4	6.52	60.90
74	0.0	2.9	5.3	0.49	0.0	0.00	5.3	0.50	1.8	-1.07	0.09	1.7	9.8	9.52	61.86
75	3.0	2.3	3.0	0.04	0.0	0.00	3.0	0.08	2.2	-0.37	0.01	0.1	1.6	5.52	62.44
76	4.8	2.8	5.4	0.90	0.0	0.00	5.2	0.91	2.5	-1.01	0.17	3.2	13.9	19.07	64.00
77	3.0	2.6	3.5	0.39	0.0	0.00	3.4	0.40	1.6	-0.88	0.11	0.6	2.2	16.85	64.64
78	4.3	3.9	4.8	0.71	0.0	0.00	4.4	0.80	3.6	-0.46	0.15	1.3	0.5	13.94	65.20
79	4.7	4.3	5.4	0.85	0.0	0.00	5.4	0.86	4.0	-0.26	0.16	0.6	3.5	10.92	65.70
80	5.0	3.6	5.5	0.68	0.0	0.00	5.5	0.68	3.0	-0.83	0.12	1.2	6.5	10.29	66.64
81	0.0	3.2	4.3	0.54	0.0	0.00	4.3	0.54	2.4	-0.88	0.12	0.7	2.1	9.78	67.32
82	3.4	2.9	3.8	0.38	0.0	0.00	3.7	0.42	2.3	-0.79	0.10	0.4	2.5	10.89	68.04
83	4.3	3.7	4.7	0.63	0.0	0.00	4.2	0.70	3.2	-0.50	0.14	0.9	1.5	13.46	69.32
84	0.0	3.5	4.4	0.30	0.0	0.00	4.4	0.36	2.9	-0.69	0.07	0.5	1.9	8.25	70.08
85	4.1	3.1	4.2	0.22	0.0	0.00	4.1	0.34	2.3	-0.90	0.05	0.9	5.0	9.85	71.18
86	0.0	3.4	4.6	0.61	0.0	0.00	4.4	0.73	3.2	-0.70	0.13	1.2	6.3	11.97	73.48

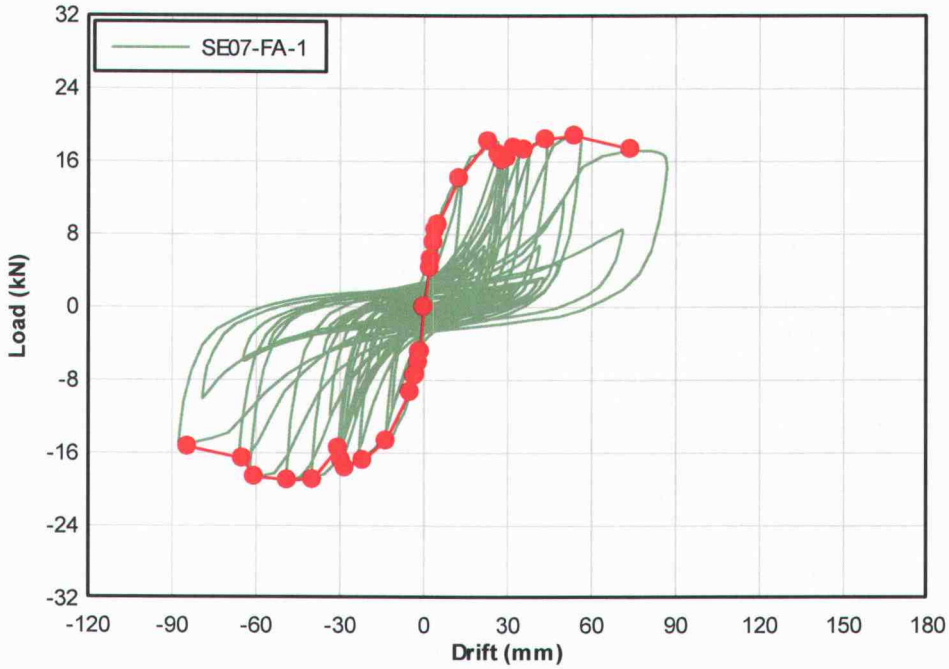
APPENDIX E: LOAD DEFLECTION PLOTS

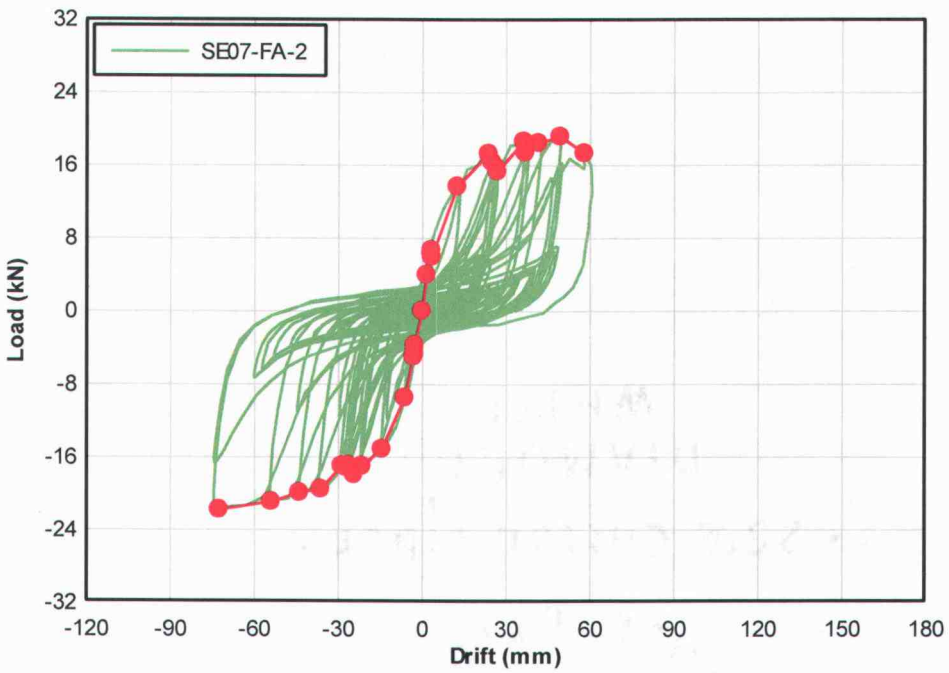
EARTHQUAKE TEST HYSTERESIS AND BACKBONE CURVES

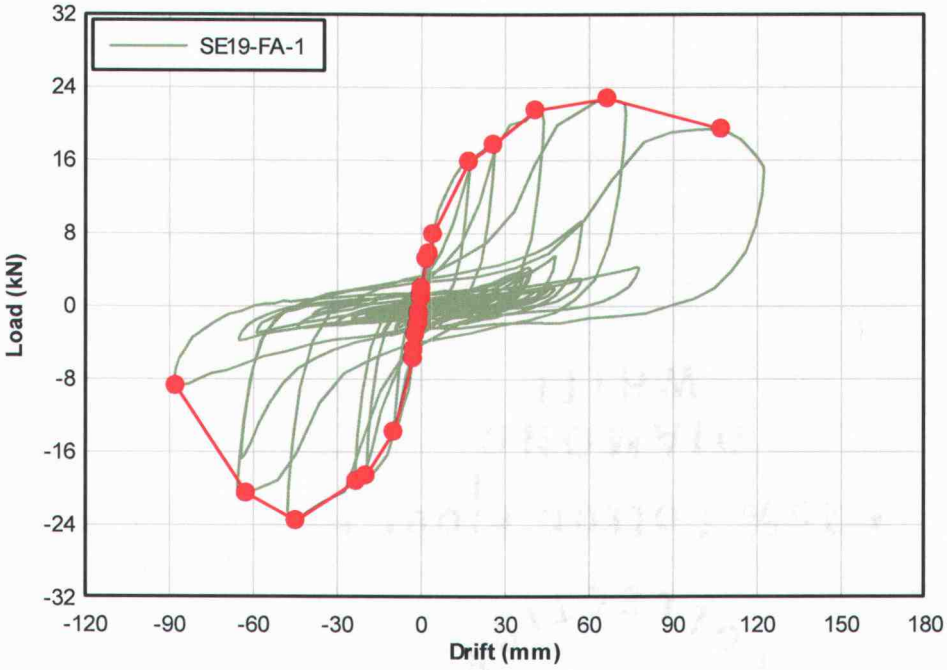
Fully Anchored Walls

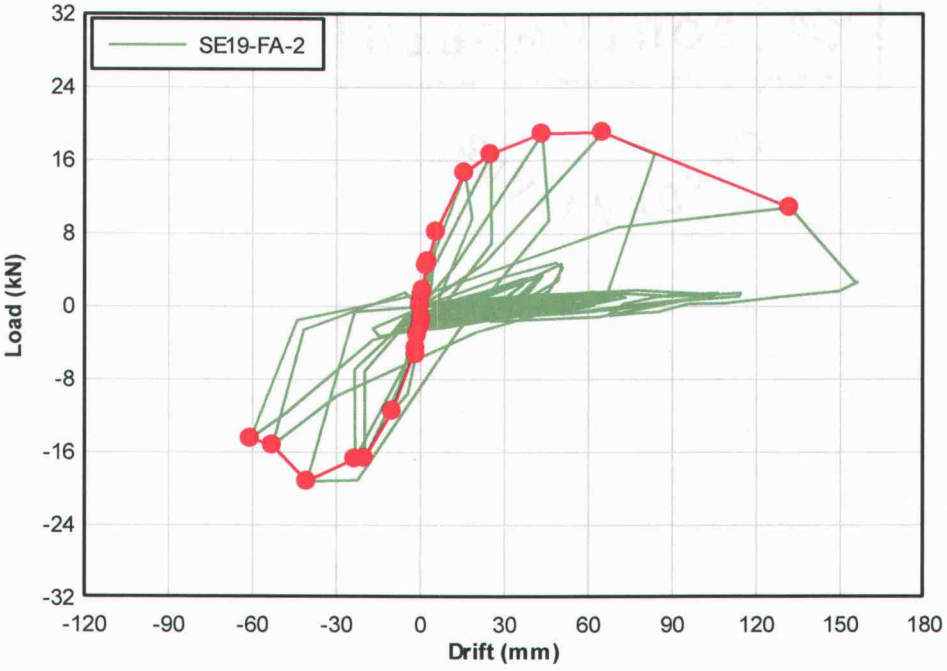


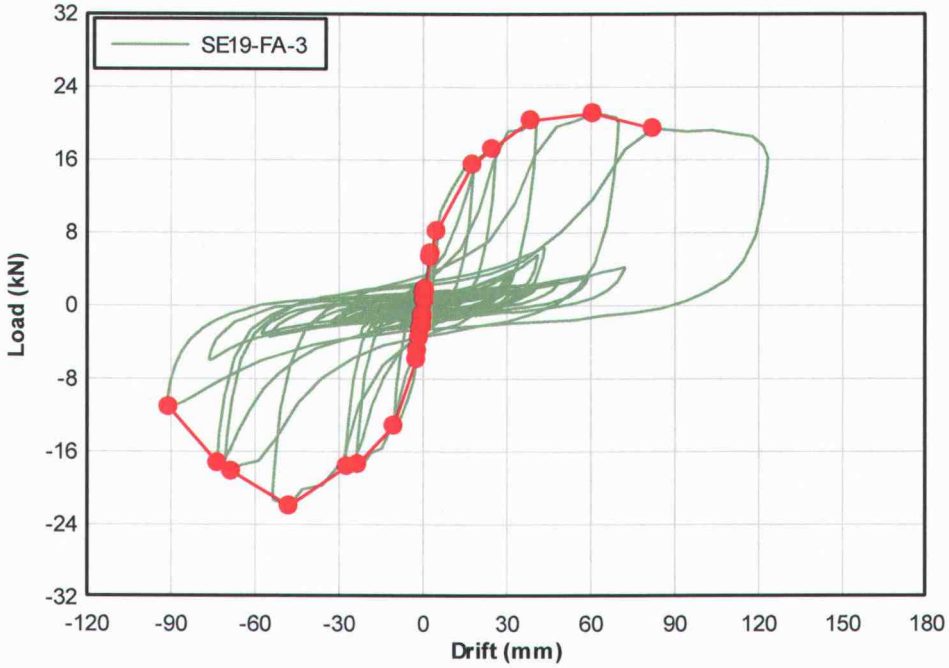


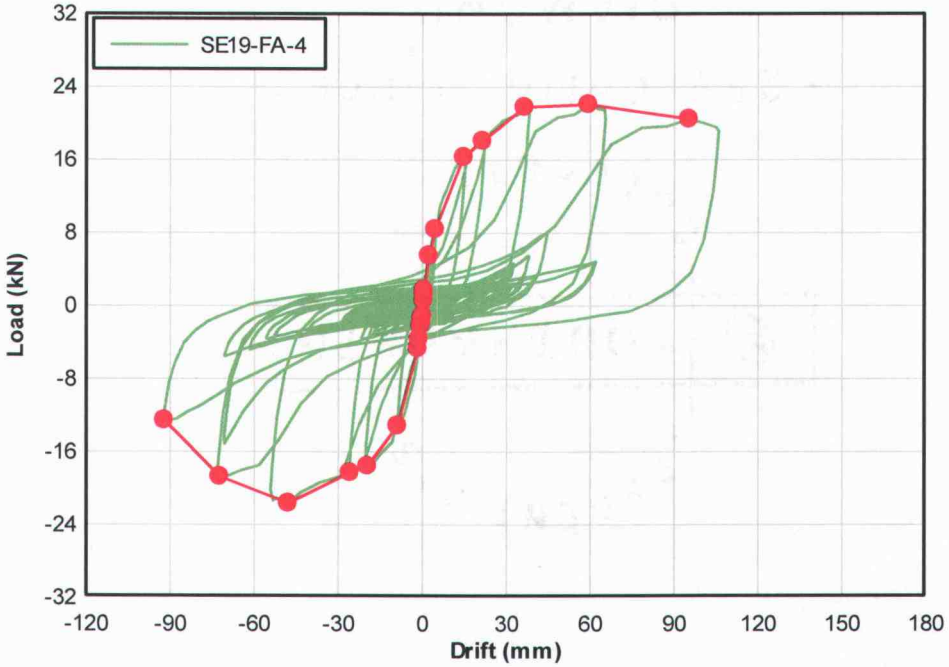

SE07-FA-1
Load (kN)
Drift (mm)
32
24
16
8
0
-8
-16
-24
-32
-120
-90
-60
-30
0
30
60
90
120
150
180

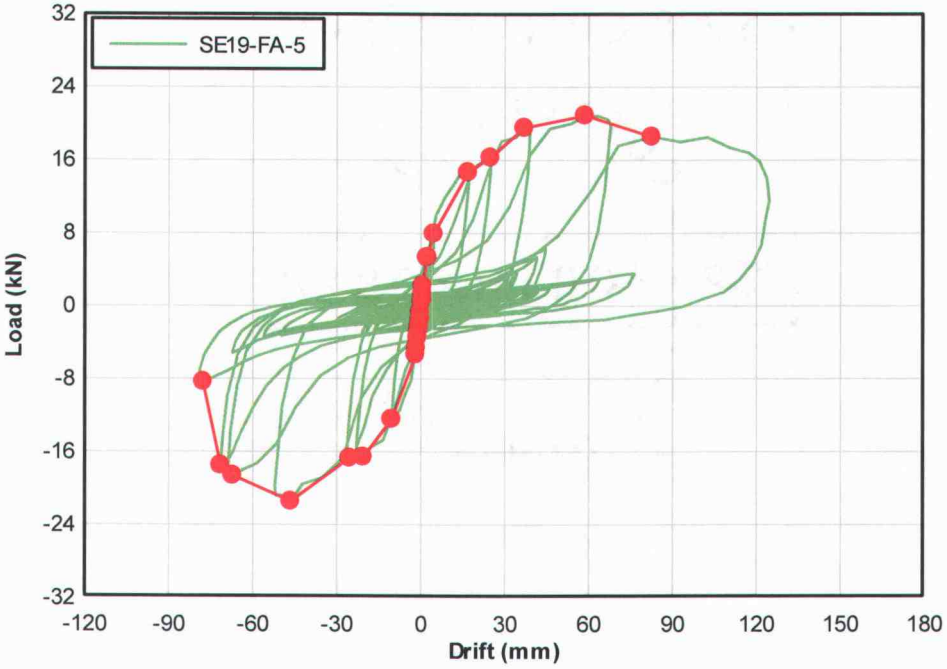

SE07-FA-2
Load (kN)
Drift (mm)
32
24
16
8
0
-8
-16
-24
-32
-120
-90
-60
-30
0
30
60
90
120
150
180

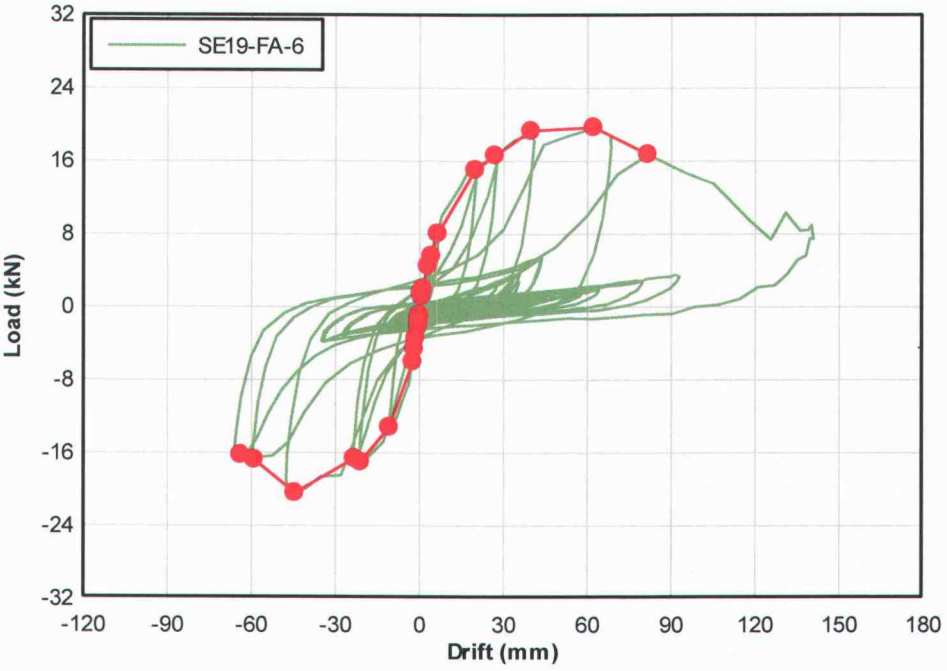

SE19-FA-1
Load (kN)
Drift (mm)
32
24
16
8
0
-8
-16
-24
-32
-120
-90
-60
-30
0
30
60
90
120
150
180

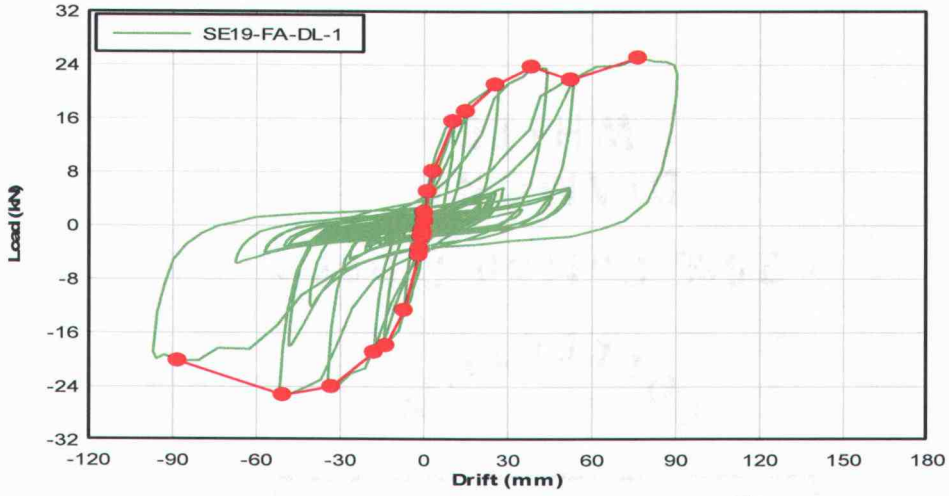

SE19-FA-2
Load (kN)
Drift (mm)
32
24
16
8
0
-8
-16
-24
-32
-120
-90
-60
-30
0
30
60
90
120
150
180

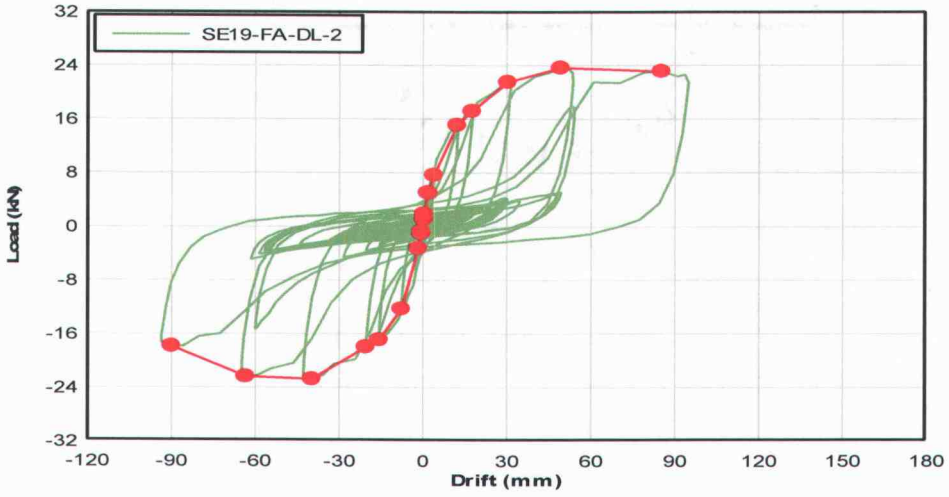

SE19-FA-3
Load (kN)
Drift (mm)
32
24
16
8
0
-8
-16
-24
-32
-120
-90
-60
-30
0
30
60
90
120
150
180

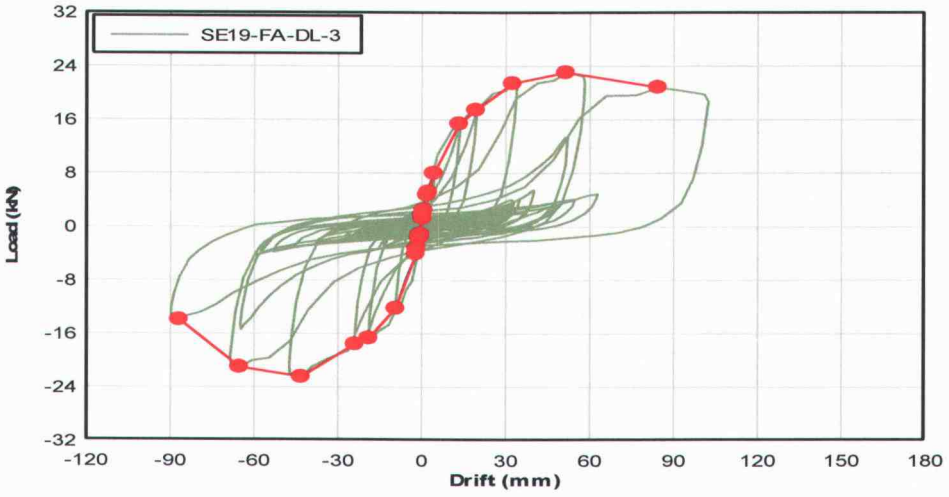

SE19-FA-4
Load (kN)
Drift (mm)
32
24
16
8
0
-8
-16
-24
-32
-120
-90
-60
-30
0
30
60
90
120
150
180

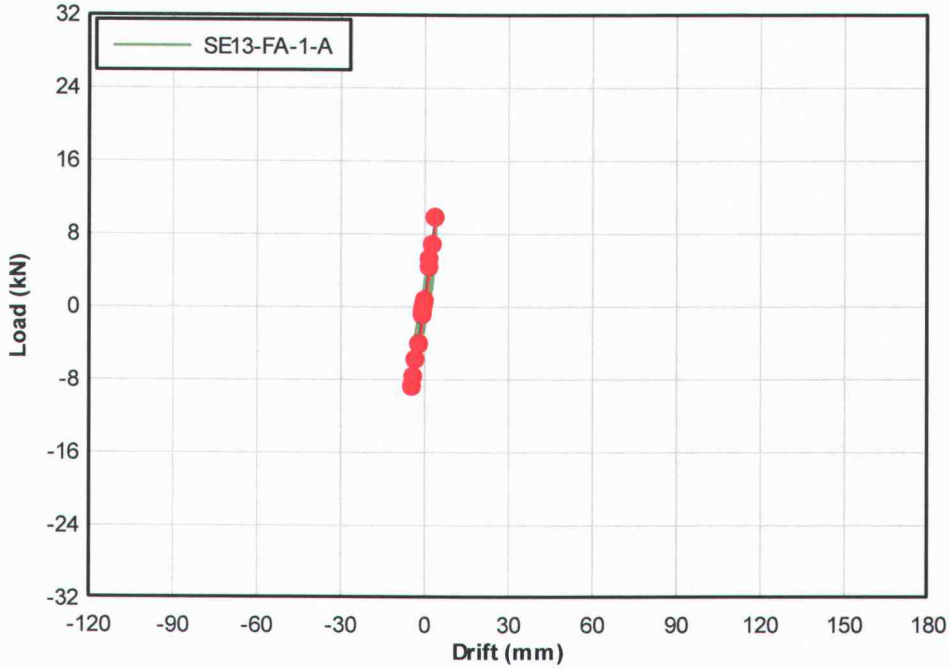

SE19-FA-5
Load (kN)
Drift (mm)
32
24
16
8
0
-8
-16
-24
-32
-120
-90
-60
-30
0
30
60
90
120
150
180

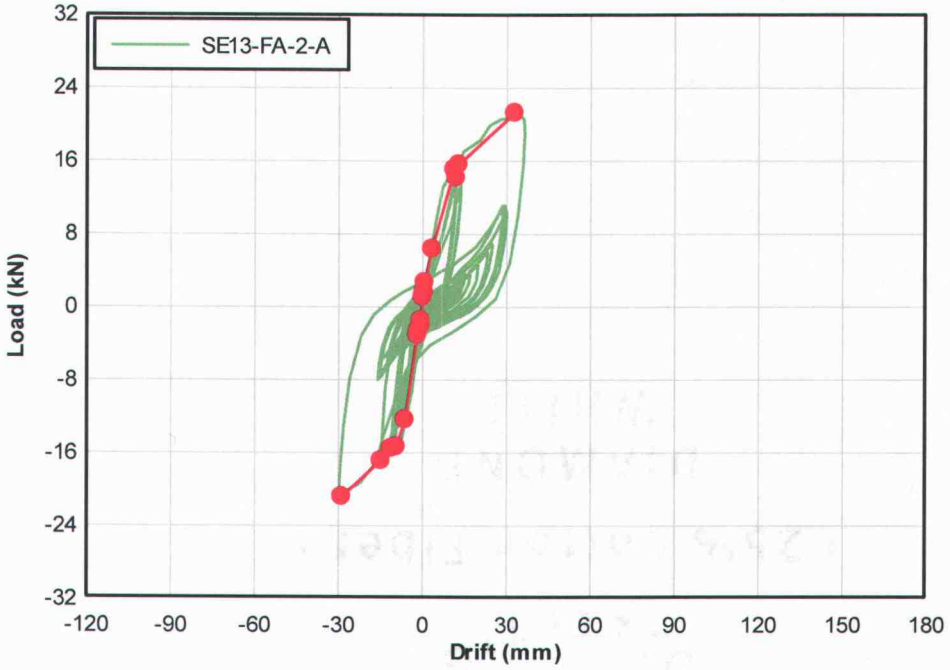

SE19-FA-6
Load (kN)
Drift (mm)
32
24
16
8
0
-8
-16
-24
-32
-120
-90
-60
-30
0
30
60
90
120
150
180

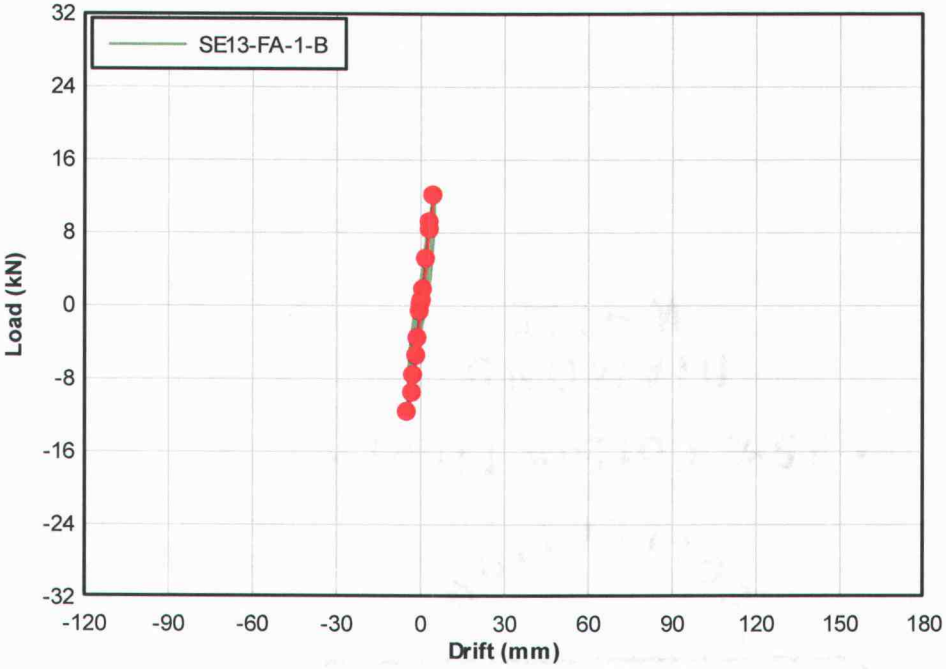

SE19-FA-DL-1
Load (kN)
Drift (mm)
32
24
16
8
0
-8
-16
-24
-32
-120
-90
-60
-30
0
30
60
90
120
150
180

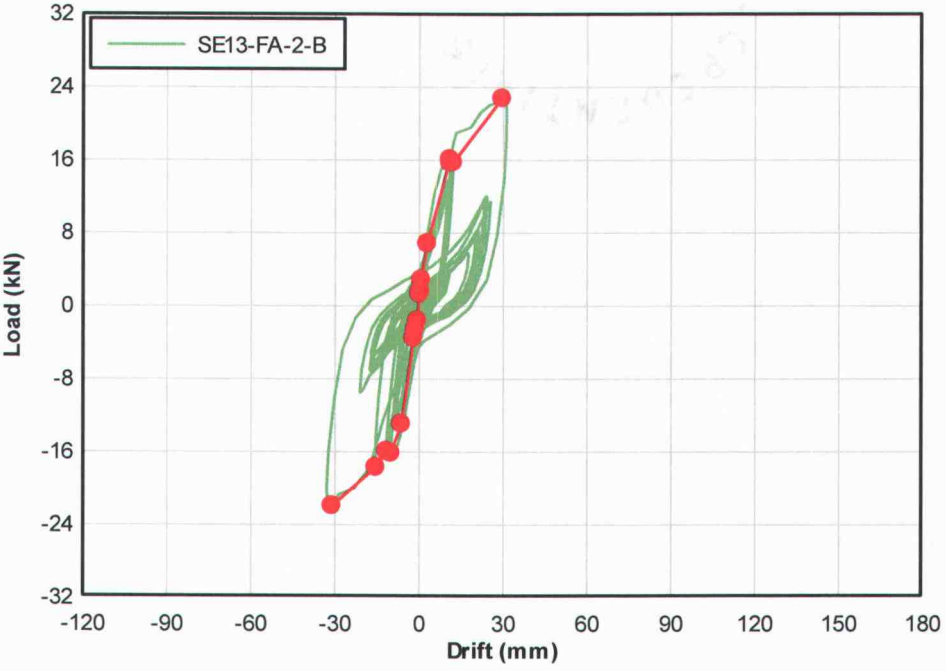

SE19-FA-DL-2
Load (kN)
Drift (mm)
32
24
16
8
0
-8
-16
-24
-32
-120
-90
-60
-30
0
30
60
90
120
150
180


SE19-FA-DL-3
Load (kN)
Drift (mm)
32
24
16
8
0
-8
-16
-24
-32
-120
-90
-60
-30
0
30
60
90
120
150
180

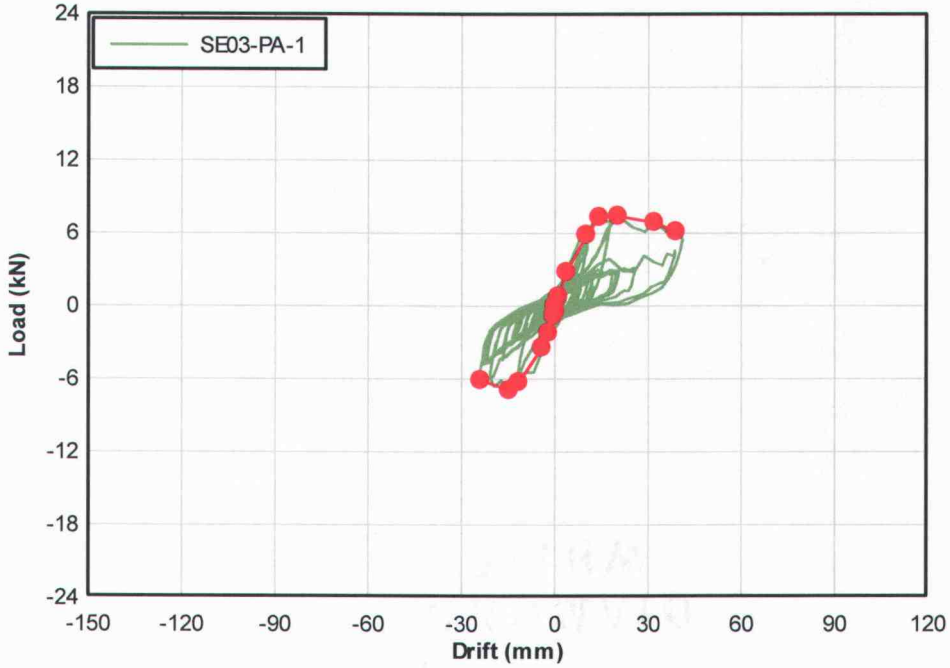

SE13-FA-1-A
Load (kN)
32
24
16
8
0
-8
-16
-24
-32
-120
-90
-60
-30
0
30
60
90
120
150
180
Drift (mm)

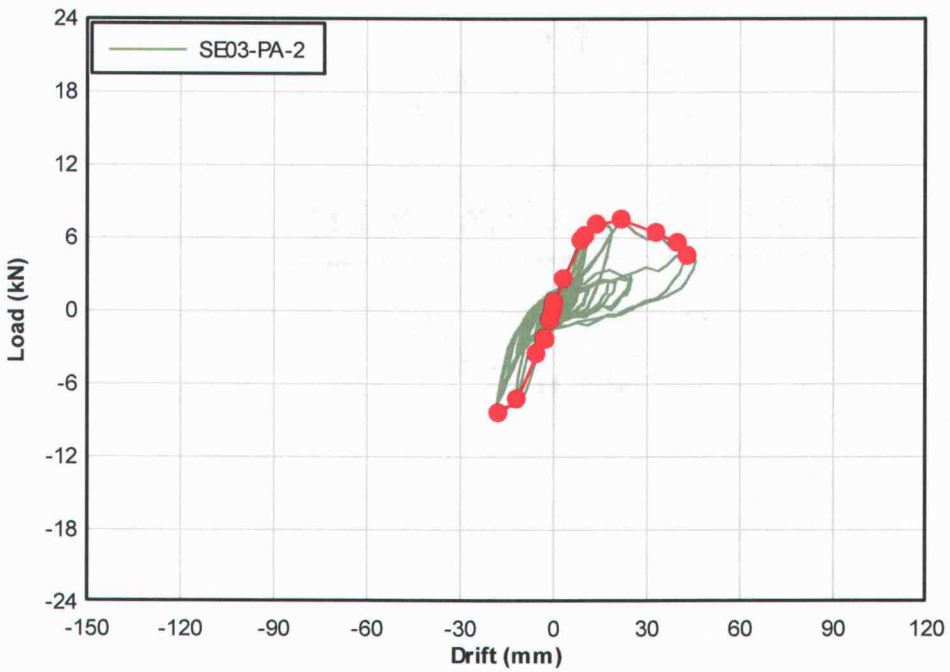

SE13-FA-2-A
Load (kN)
32
24
16
8
0
-8
-16
-24
-32
-120
-90
-60
-30
0
30
60
90
120
150
180
Drift (mm)

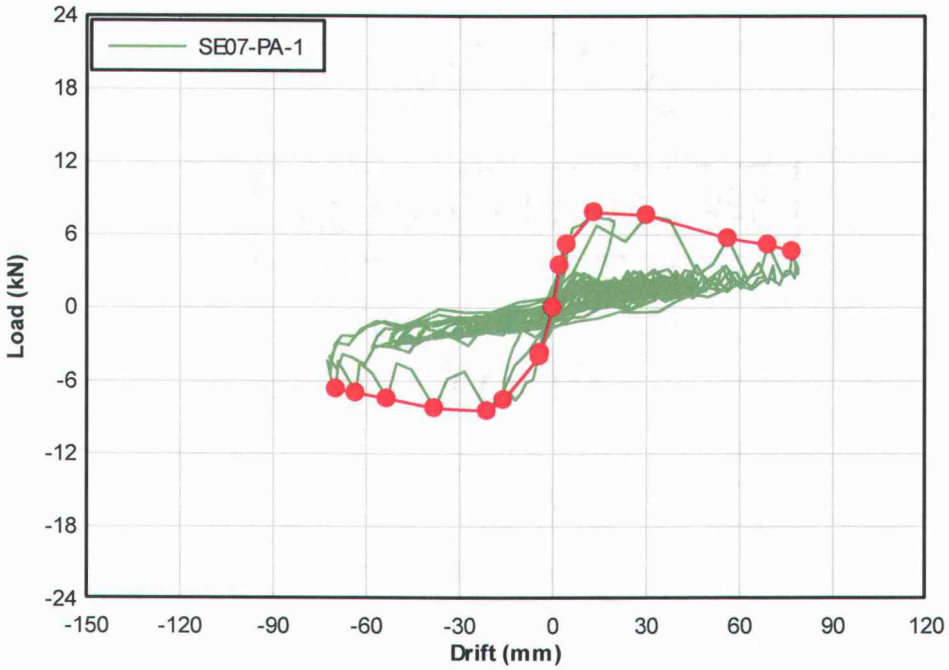

SE13-FA-1-B
Load (kN)
32
24
16
8
0
-8
-16
-24
-32
-120
-90
-60
-30
0
30
60
90
120
150
180
Drift (mm)

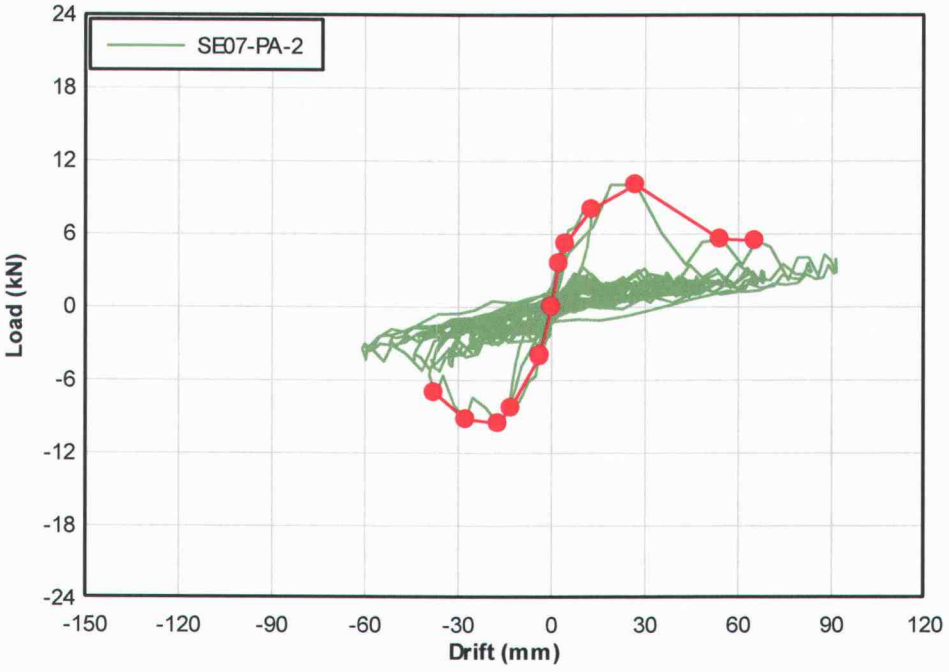

SE13-FA-2-B
Load (kN)
32
24
16
8
0
-8
-16
-24
-32
-120
-90
-60
-30
0
30
60
90
120
150
180
Drift (mm)

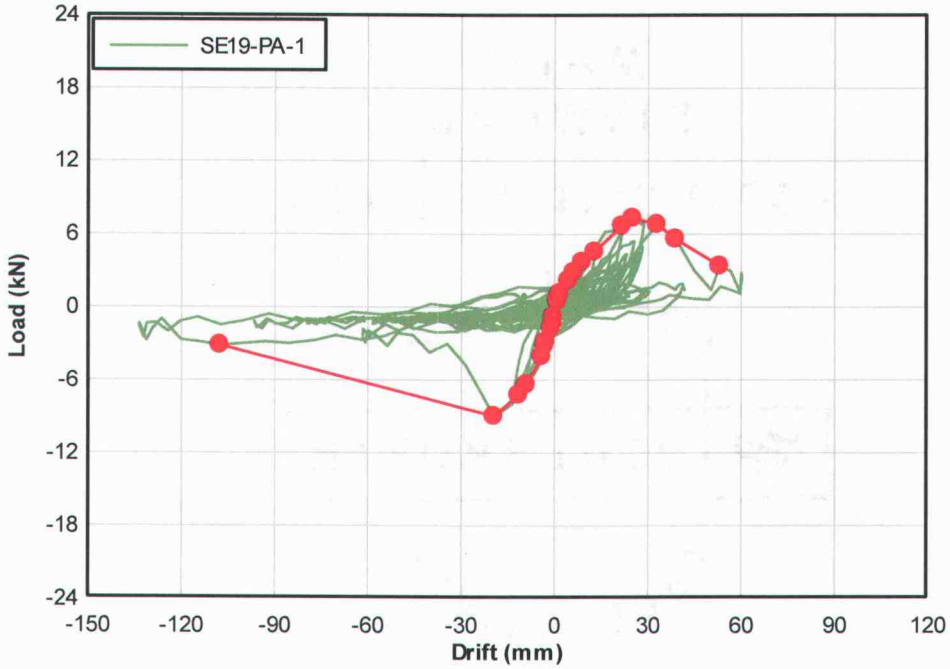
Partially Anchored Walls

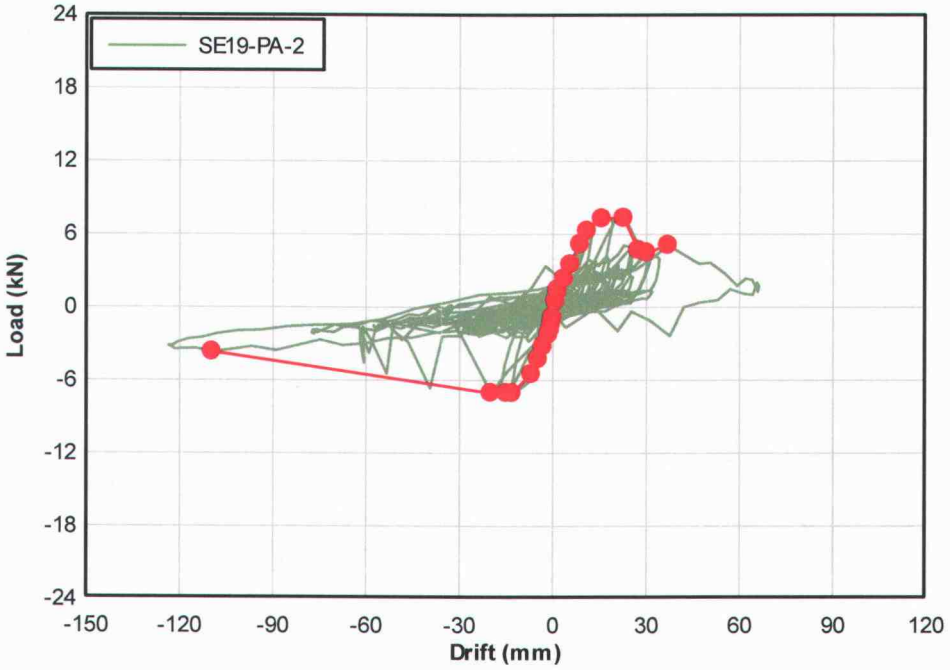


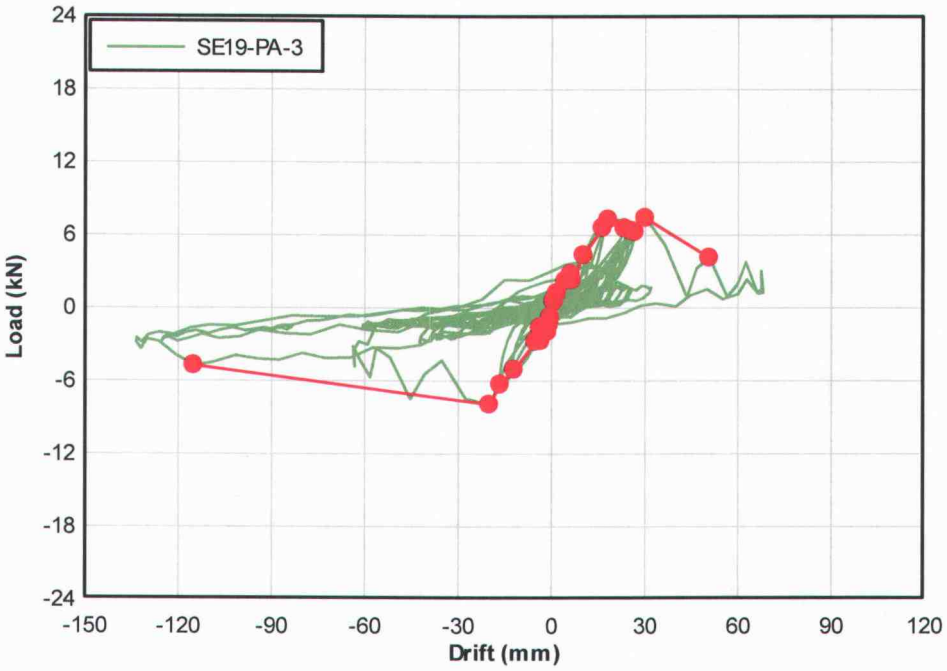


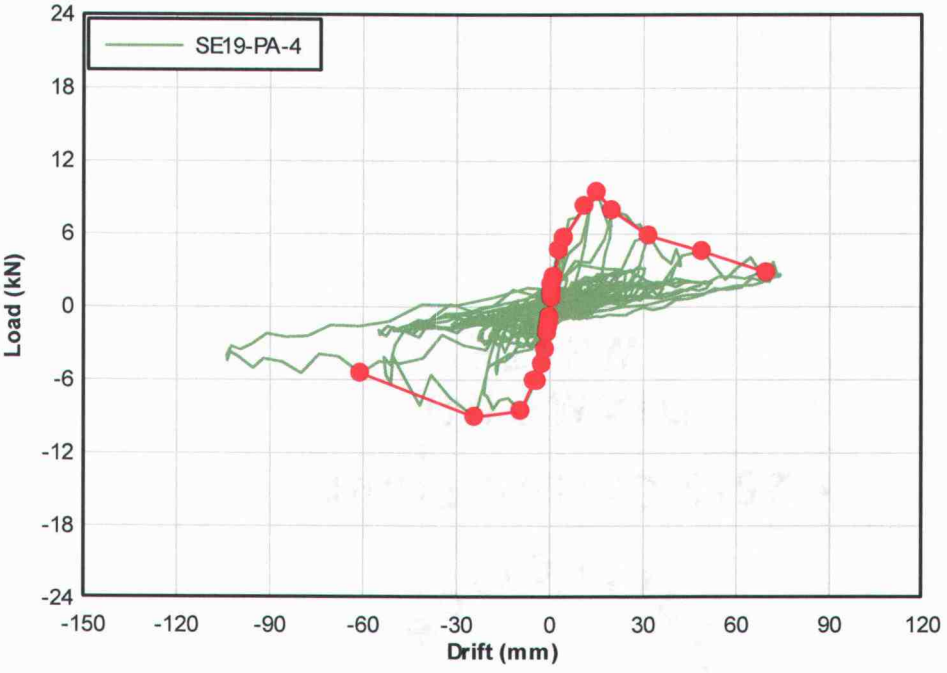

SE07-PA-1
Load (kN)
Drift (mm)
24
18
12
6
0
-6
-12
-18
-24
-150
-120
-90
-60
-30
0
30
60
90
120

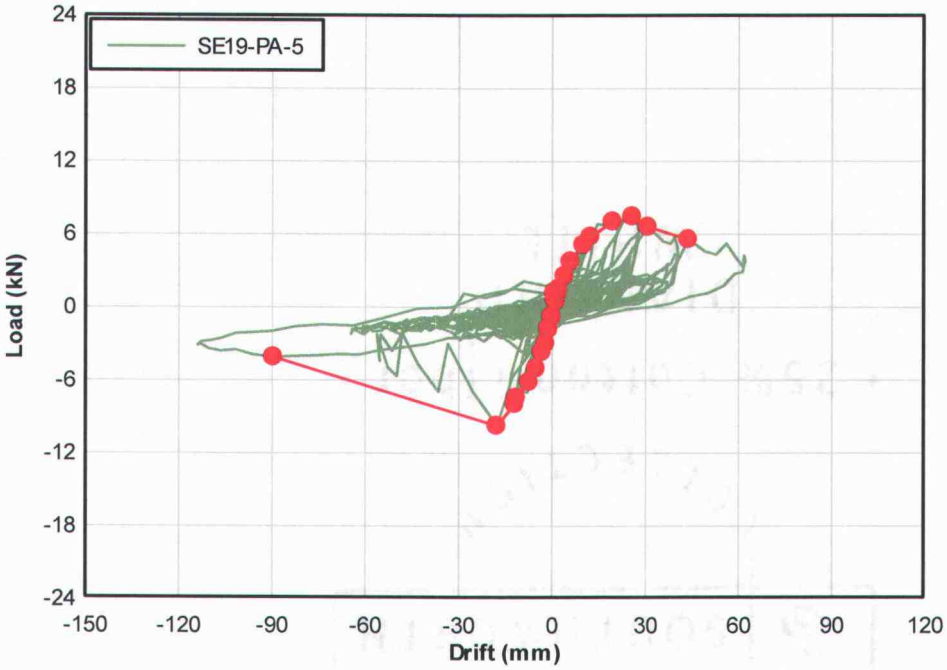

SE07-PA-2
Load (kN)
Drift (mm)
24
18
12
6
0
-6
-12
-18
-24
-150
-120
-90
-60
-30
0
30
60
90
120

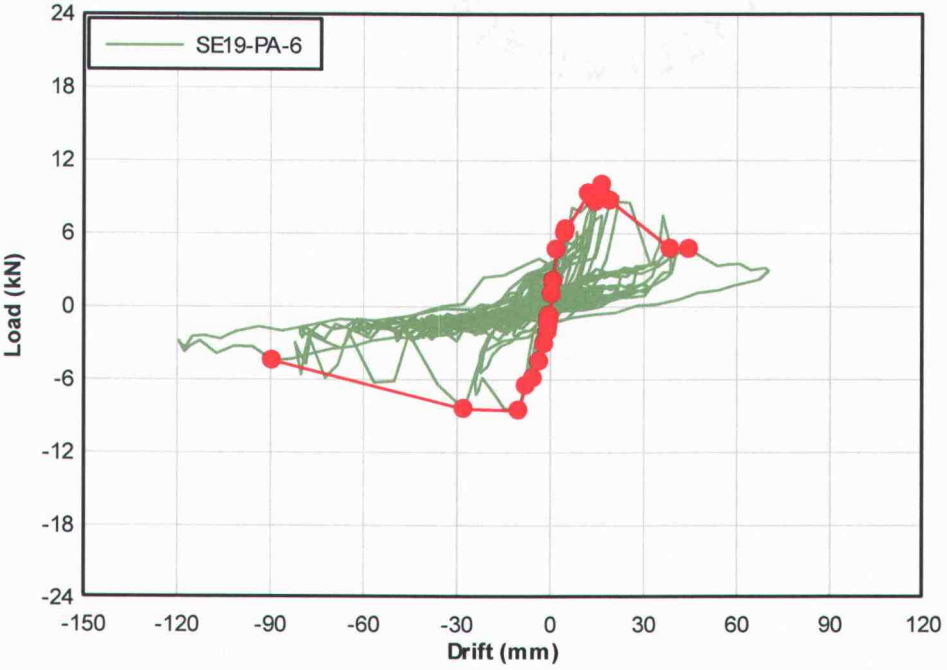

SE19-PA-1
Load (kN)
Drift (mm)
24
18
12
6
0
-6
-12
-18
-24
-150
-120
-90
-60
-30
0
30
60
90
120

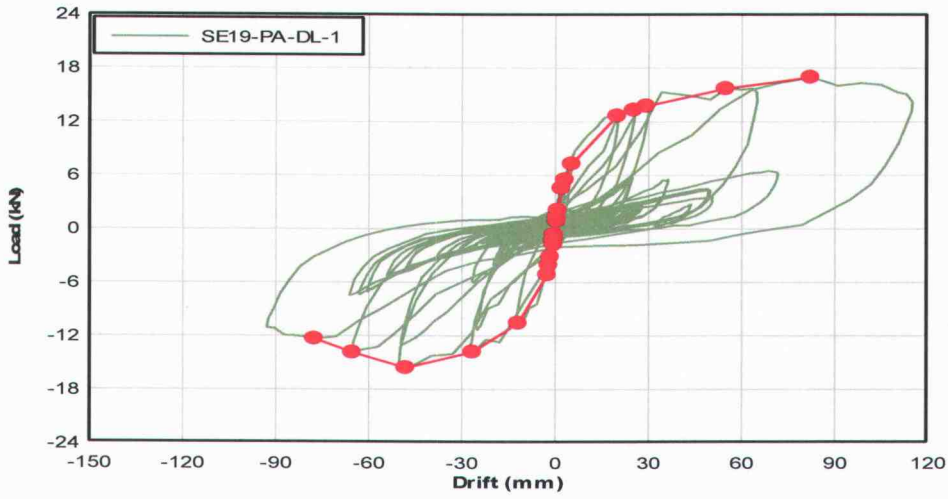

SE19-PA-2
Load (kN)
Drift (mm)
24
18
12
6
0
-6
-12
-18
-24
-150
-120
-90
-60
-30
0
30
60
90
120

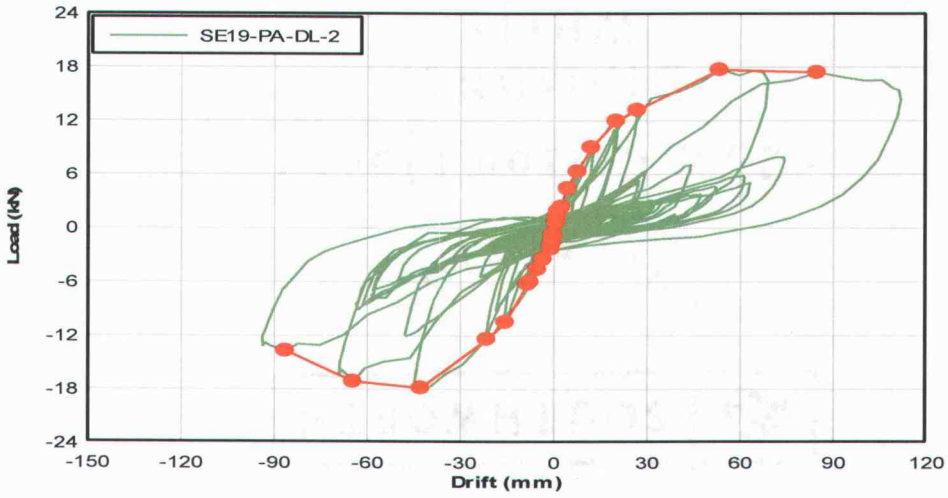

SE19-PA-3
Load (kN)
Drift (mm)
24
18
12
6
0
-6
-12
-18
-24
-150
-120
-90
-60
-30
0
30
60
90
120

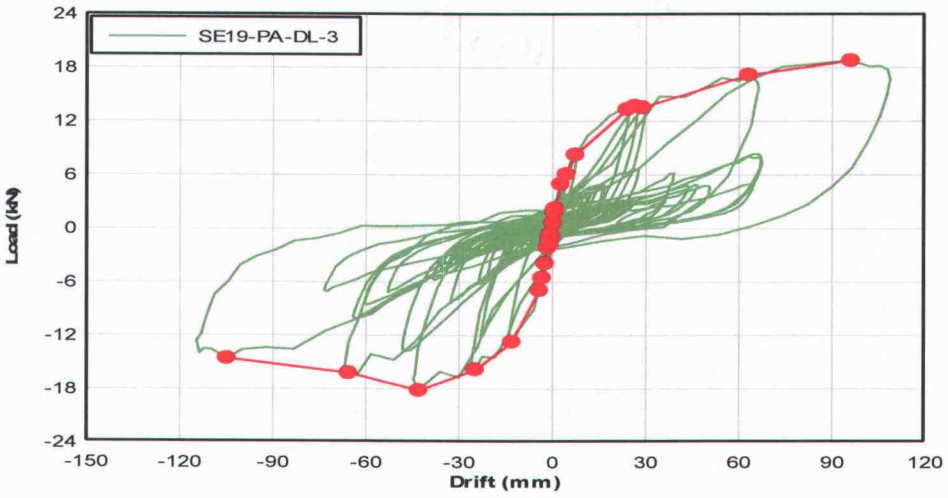

SE19-PA-4
Load (kN)
Drift (mm)
24
18
12
6
0
-6
-12
-18
-24
-150
-120
-90
-60
-30
0
30
60
90
120

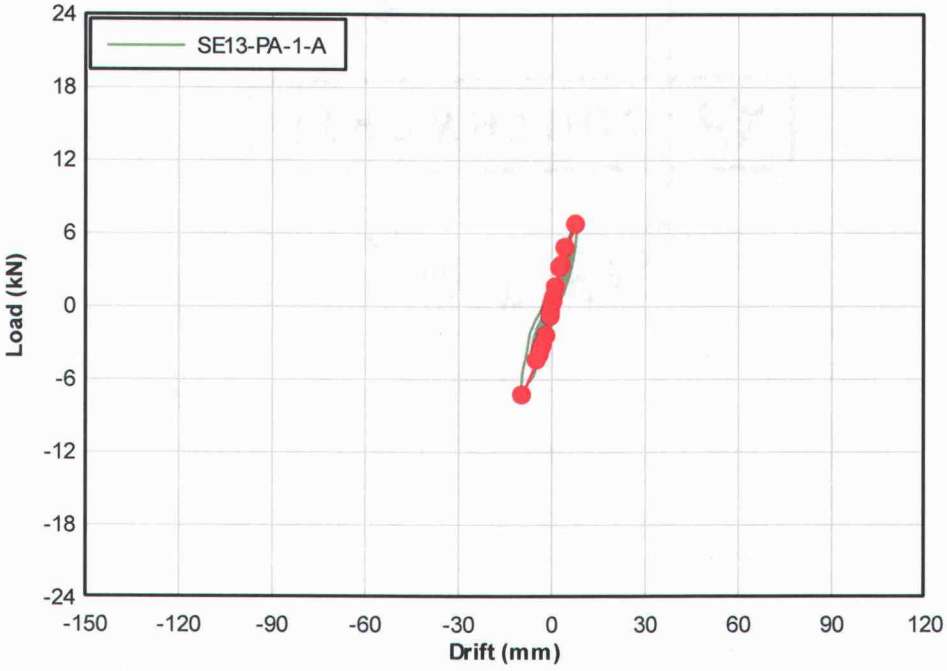

SE19-PA-5
Load (kN)
Drift (mm)
24
18
12
6
0
-6
-12
-18
-24
-150
-120
-90
-60
-30
0
30
60
90
120

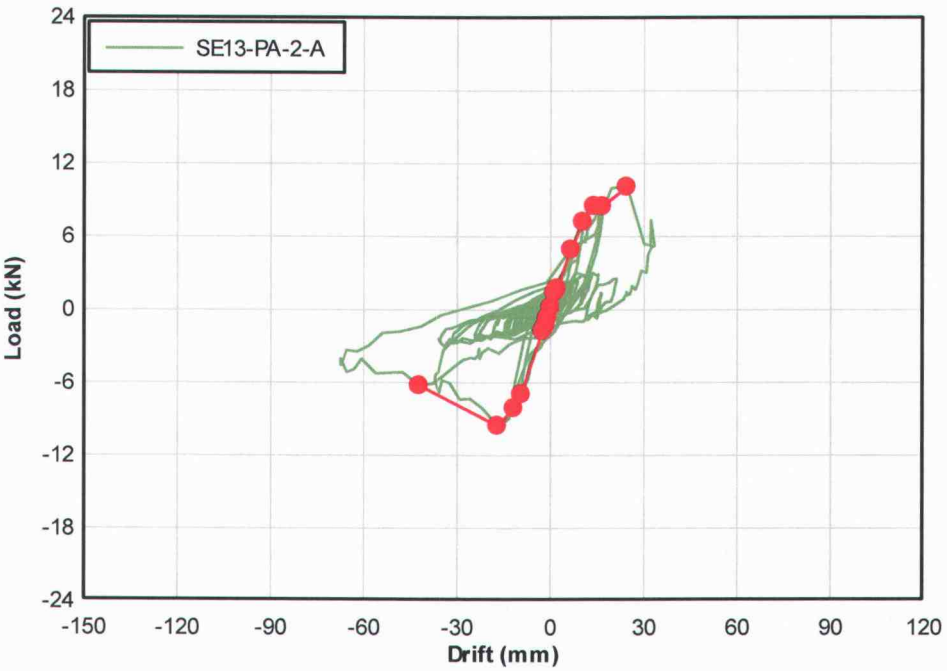

SE19-PA-6
Load (kN)
Drift (mm)
24
18
12
6
0
-6
-12
-18
-24
-150
-120
-90
-60
-30
0
30
60
90
120

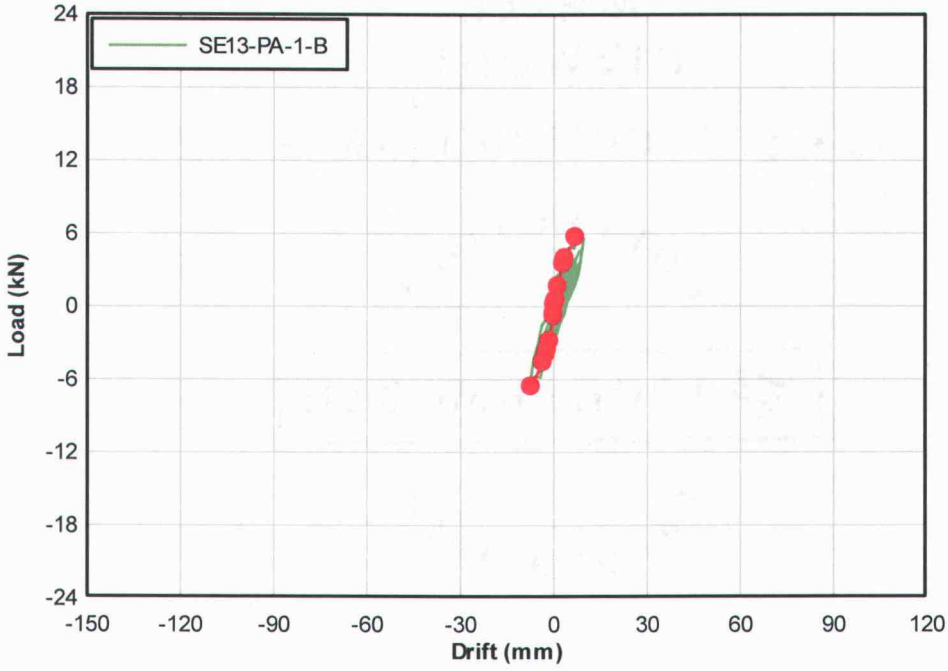

SE19-PA-DL-1
Load (kN)
24
18
12
6
0
-6
-12
-18
-24
-150
-120
-90
-60
-30
0
30
60
90
120
Drift (mm)

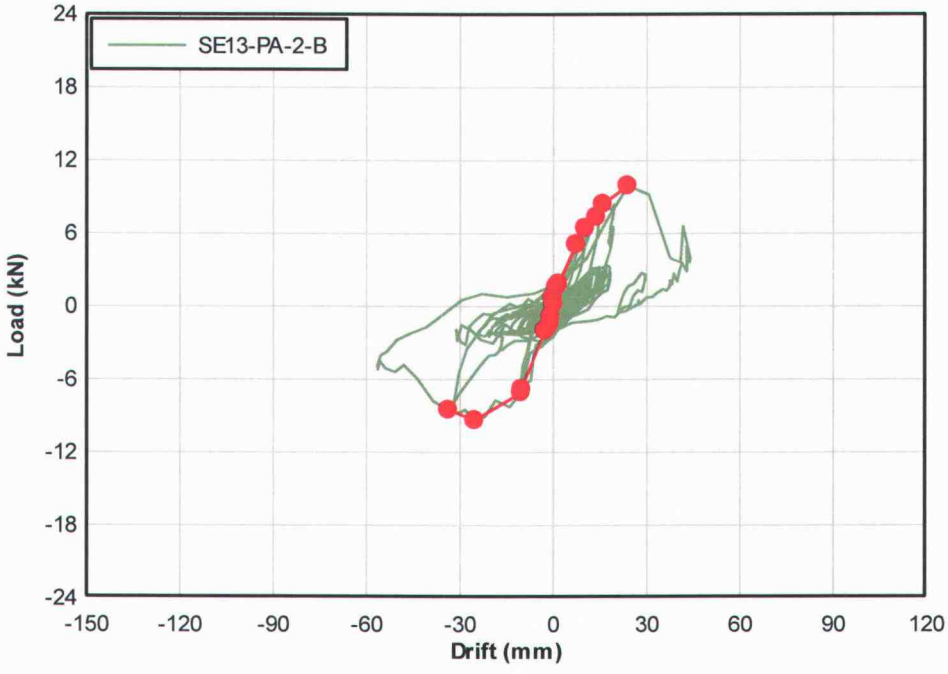

SE19-PA-DL-2
Load (kN)
24
18
12
6
0
-6
-12
-18
-24
-150
-120
-90
-60
-30
0
30
60
90
120
Drift (mm)


SE19-PA-DL-3
Load (kN)
24
18
12
6
0
-6
-12
-18
-24
-150
-120
-90
-60
-30
0
30
60
90
120
Drift (mm)


SE13-PA-1-A
Load (kN)
24
18
12
6
0
-6
-12
-18
-24
-150
-120
-90
-60
-30
0
30
60
90
120
Drift (mm)


SE13-PA-2-A
Load (kN)
24
18
12
6
0
-6
-12
-18
-24
-150
-120
-90
-60
-30
0
30
60
90
120
Drift (mm)


SE13-PA-1-B
Load (kN)
Drift (mm)
24
18
12
6
0
-6
-12
-18
-24
-150
-120
-90
-60
-30
0
30
60
90
120


SE13-PA-2-B
Load (kN)
Drift (mm)
24
18
12
6
0
-6
-12
-18
-24
-150
-120
-90
-60
-30
0
30
60
90
120

APPENDIX F: LUMBER DATA (MOE, MC, SG)

	MC (%)	MOE (ksi)	SG (ρ/ρ_{water})
AVG	11	1.65	0.499
STDEV	1.9	0.37	0.043
COV (%)	17.3	22.4	8.7
MAX	20	2.67	0.668
MIN	7	0.14	0.397
Board No.	**MC (%)**	**MOE (ksi)**	**SG (ρ/ρ_{water})**
1	13	1.22	0.447
2	10	1.74	0.473
3	14	1.60	0.474
4	14	1.69	0.500
5	10	1.08	0.450
6	13	1.23	0.465
7	11	1.09	0.478
8	11	1.46	0.453
9	11	1.61	0.477
10	12	1.37	0.518
11	12	1.25	0.506
12	13	1.15	0.456
13	13	1.39	0.522
14	15	1.74	0.517
15	14	1.30	0.499
16	12	1.21	0.479
17	9	1.66	0.444
18	12	1.53	0.528
19	12	1.11	0.477
20	9	2.05	0.540
21	12	1.71	0.513
22	11	1.41	0.432
23	12	1.50	0.464
24	10	1.23	0.440
25	13	1.66	0.490
26	14	1.50	0.527
27	14	1.82	0.517
28	11	1.44	0.465
29	14	1.87	0.526
30	12	1.18	0.485
31	13	1.57	0.474
32	11	1.24	0.432
33	10	1.40	0.455
34	11	1.38	0.431
35	15	2.39	0.613

36	10	1.34	0.441
37	11	1.40	0.467
38	10	1.51	0.478
39	11	1.78	0.483
40	12	1.32	0.473
41	13	1.68	0.517
42	12	1.60	0.497
43	11	1.07	0.473
44	12	1.27	0.485
45	11	1.54	0.476
46	12	0.93	0.496
47	13	1.45	0.533
48	10	1.11	0.477
49	12	1.07	0.508
50	11	1.18	0.513
51	13	1.16	0.501
52	14	2.35	0.583
53	14	1.81	0.522
54	13	2.06	0.528
55	14	1.61	0.474
56	10	1.08	0.459
57	12	1.17	0.500
58	12	1.67	0.497
59	13	1.45	0.470
60	15	1.69	0.529
61	15	1.69	0.501
62	13	1.57	0.477
63	14	1.79	0.519
64	13	2.11	0.558
65	11	1.44	0.465
66	9	1.55	0.481
67	13	2.38	0.613
68	11	0.90	0.505
69	12	1.63	0.474
70	12	1.85	0.541
71	10	1.04	0.464
72	12	1.50	0.451
73	13	1.38	0.477
74	13	1.45	0.481
75	15	1.93	0.513
76	14	1.80	0.519
77	16	1.82	0.499
78	14	1.63	0.485
79	15	1.96	0.573
80	15	1.97	0.531

81	12	1.44	0.464
82	20	1.74	0.600
83	12	1.16	0.438
84	12	1.34	0.513
85	12	1.43	0.440
86	13	1.87	0.545
87	14	1.54	0.526
88	15	1.71	0.506
89	10	1.29	0.450
90	13	1.73	0.491
91	17	1.68	0.538
92	13	1.52	0.497
93	14	1.36	0.473
94	11	1.21	0.426
95	11	1.01	0.486
96	10	1.36	0.505
97	14	1.91	0.501
98	10	1.26	0.459
99	11	1.81	0.500
100	10	1.34	0.437
101	12	1.61	0.483
102	12	1.76	0.537
103	10	1.73	0.460
104	13	1.51	0.478
105	14	1.97	0.551
106	10	1.58	0.481
107	11	1.42	0.504
108	11	1.57	0.463
109	10	1.37	0.479
110	11	1.59	0.496
111	10	1.24	0.473
112	11	1.39	0.442
113	12	1.81	0.499
114	12	1.82	0.541
115	11	1.80	0.481
116	11	1.42	0.458
117	11	1.33	0.515
118	12	1.62	0.501
119	10	1.44	0.491
120	10	1.57	0.458
121	11	1.87	0.522
122	12	0.99	0.479
123	12	1.39	0.459
124	14	2.16	0.544
125	11	1.92	0.515

126	11	1.41	0.544
127	14	2.43	0.567
128	13	1.65	0.531
129	10	1.62	0.458
130	10	1.24	0.453
131	11	1.98	0.526
132	12	1.68	0.518
133	14	1.76	0.545
134	14	2.51	0.574
135	11	1.65	0.479
136	14	2.35	0.577
137	12	1.78	0.478
138	11	1.63	0.526
139	12	1.95	0.517
140	10	1.58	0.476
141	12	0.99	0.494
142	10	1.63	0.465
143	14	2.01	0.585
144	11	1.38	0.449
145	11	1.06	0.481
146	15	2.35	0.585
147	12	1.85	0.503
148	12	0.99	0.491
149	12	0.99	0.515
150	12	1.75	0.518
151	11	1.39	0.509
152	11	1.20	0.444
153	11	1.99	0.537
154	10	1.19	0.492
155	10	1.47	0.514
156	13	2.47	0.587
157	11	1.25	0.476
158	12	1.71	0.538
159	12	1.61	0.535
160	13	2.04	0.542
161	11	1.25	0.476
162	13	2.47	0.587
163	10	1.47	0.514
164	12	1.75	0.518
165	12	1.71	0.538
166	12	1.61	0.535
167	12	1.72	0.547
168	11	1.78	0.509
169	9	1.43	0.438
170	11	1.79	0.519

171	10	1.16	0.465
172	9	1.40	0.441
173	9	1.51	0.437
174	11	2.01	0.556
175	10	1.31	0.506
176	13	2.25	0.585
177	11	1.61	0.546
178	9	1.17	0.450
179	11	1.63	0.524
180	11	1.86	0.541
181	11	1.56	0.474
182	10	1.37	0.451
183	11	2.10	0.569
184	11	1.68	0.503
185	11	2.37	0.559
186	10	1.44	0.454
187	8	1.37	0.472
188	10	1.48	0.442
189	10	1.77	0.511
190	11	1.44	0.460
191	10	1.73	0.469
192	10	1.81	0.463
193	11	1.53	0.456
194	9	1.26	0.417
195	13	2.22	0.586
196	9	2.17	0.563
197	9	1.55	0.545
198	9	2.04	0.551
199	9	1.73	0.492
200	8	1.45	0.458
201	9	2.17	0.563
202	9	1.73	0.523
203	9	1.83	0.542
204	9	2.26	0.615
205	9	1.76	0.510
206	9	1.94	0.545
207	9	1.75	0.549
208	9	1.42	0.451
209	9	2.00	0.569
210	9	1.24	0.476
211	9	1.62	0.495
212	9	1.32	0.496
213	9	1.84	0.537
214	9	2.41	0.611
215	9	1.87	0.610

216	9	1.72	0.487
217	9	2.07	0.604
218	9	1.55	0.532
219	9	1.88	0.556
220	9	2.53	0.668
221	9	2.20	0.551
222	9	1.93	0.517
223	9	1.93	0.517
224	7	1.54	0.442
225	8	1.96	0.494
226	8	1.54	0.449
227	9	2.40	0.533
228	9	1.50	0.453
229	10	2.02	0.533
230	10	2.11	0.515
231	7	1.13	0.427
232	10	1.67	0.535
233	8	0.14	0.460
234	9	1.39	0.481
235	11	2.23	0.508
236	10	2.20	0.511
237	10	1.92	0.526
238	8	1.55	0.453
239	8	1.19	0.454
240	9	2.22	0.520
241	9	2.26	0.560
242	9	1.69	0.481
243	11	2.67	0.583
244	9	2.26	0.526
245	9	1.70	0.467
246	9	1.44	0.436
247	11	1.85	0.485
248	9	1.36	0.476
249	9	1.29	0.403
250	11	2.26	0.538
251	10	1.57	0.470
252	10	1.86	0.487
253	8	1.76	0.467
254	10	1.66	0.465
255	8	1.24	0.409
256	10	1.82	0.523
257	10	1.53	0.477
258	11	1.18	0.455
259	11	1.96	0.518
260	11	2.02	0.523

261	9	1.17	0.397
262	10	1.68	0.460
263	10	2.10	0.492
264	10	1.95	0.519
265	8	1.50	0.450
266	12	1.78	0.511
267	10	2.32	0.527
268	10	1.37	0.478
269	11	2.07	0.514
270	10	1.99	0.520

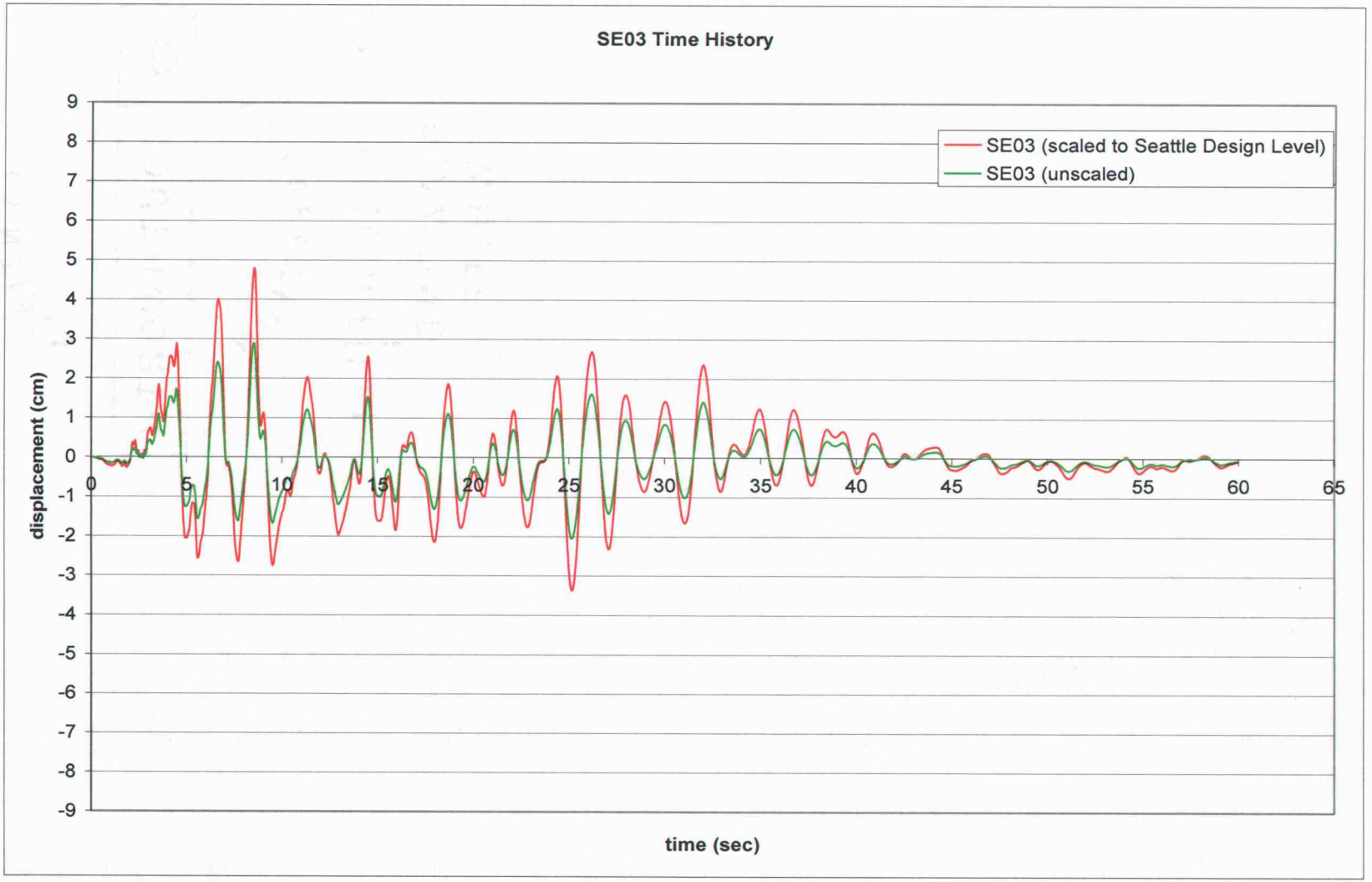
APPENDIX G: STATISTICAL COMPARISON OF LUMBER DATA

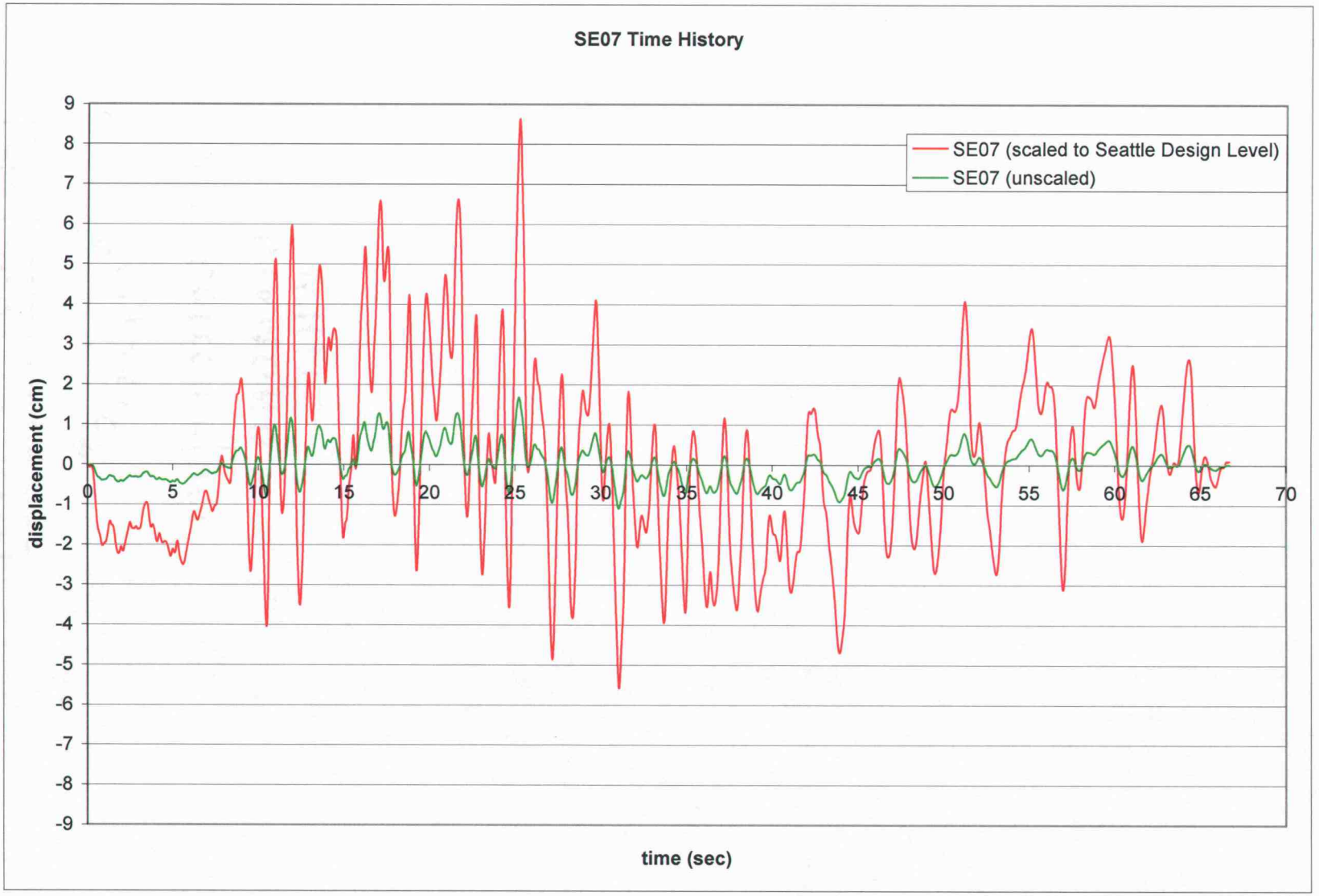
The following is a statistical comparison of modulus of elasticity (MOE) and specific gravity (SG) for 2x4 lumber from both Phases of this project:

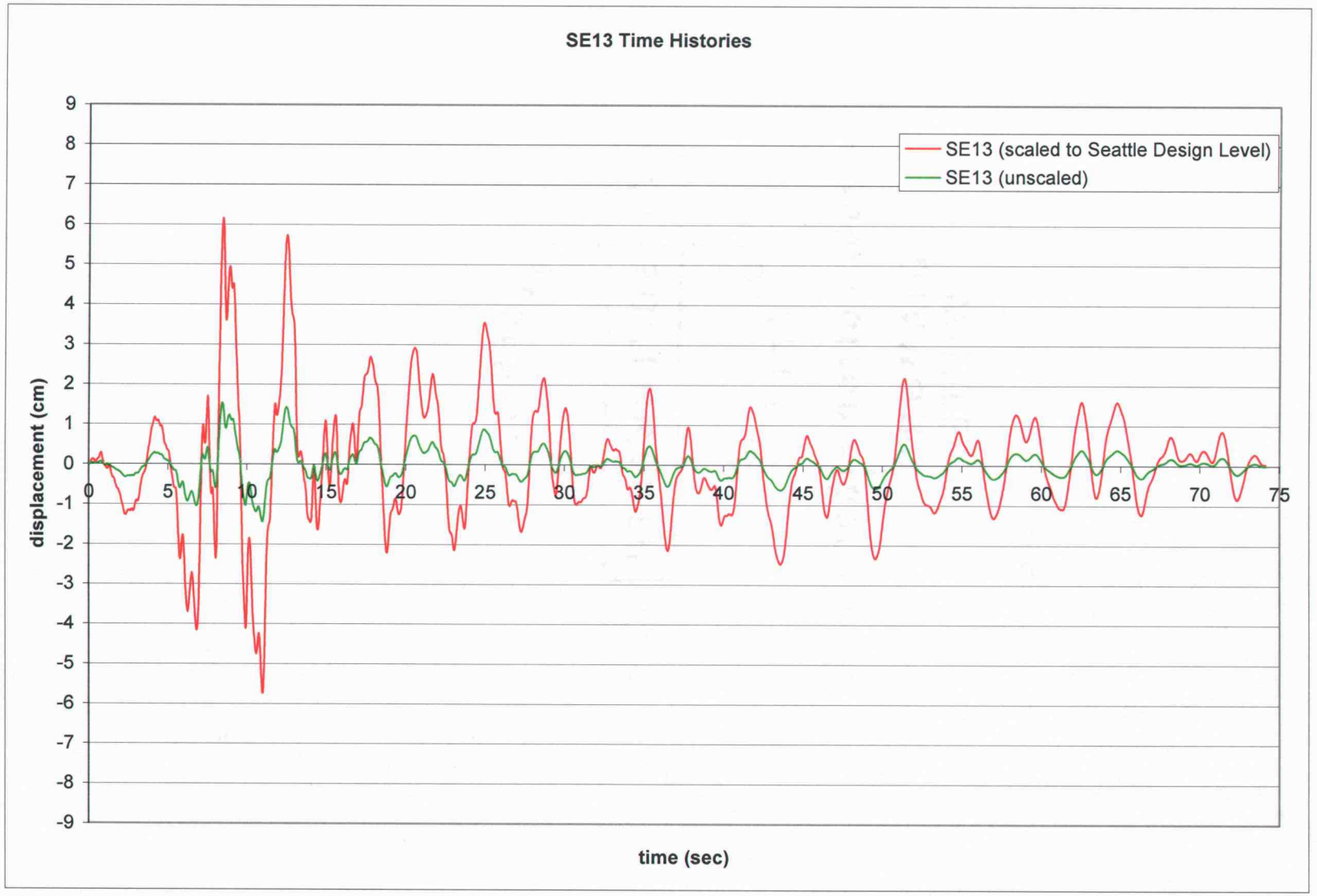
Parameter	Phase I (Seaders 2004)		Phase II		P values[1]	
	n=297		*n=270*		F-test: Variance Test ($H_o:\sigma_1^2=\sigma_2^2$)	T-test: Mean Test ($H_o:\mu_1=\mu_2$)
	Avg. (μ_1)	Std. Dev. (σ_1)	Avg. (μ_2)	Std. Dev. (σ_2)		
MOE (*ksi*)	1.78	0.39	1.65	0.37	2.3E-01	**8.4E-06**
SG	0.512	0.054	0.499	0.043	**5.0E-04**	**6.5E-03**[2]

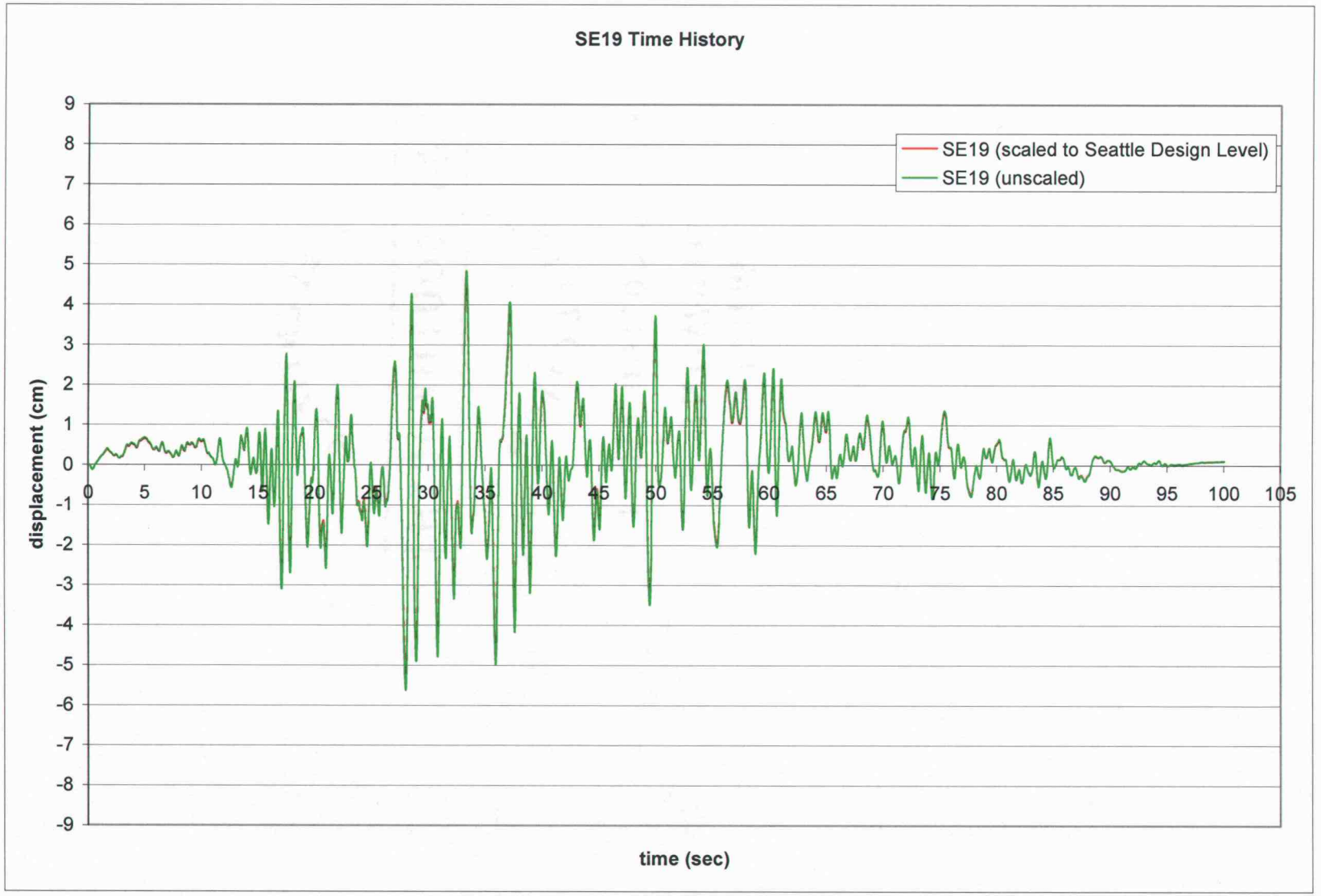
[1]Bold values indicate statistically significant differences.
[2]T-test assuming unequal variances was used.

The statistical tests were conducted at a level of significance of 0.1 (α=0.1) and they show that MOE and SG for 2x4 lumber from Phase I of this project was statistically greater than that used in this study (Phase II).


SE03 Time History
SE03 (scaled to Seattle Design Level)
SE03 (unscaled)
displacement (cm)
time (sec)
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
0
5
10
15
20
25
30
35
40
45
50
55
60
65


SE07 Time History
SE07 (scaled to Seattle Design Level)
SE07 (unscaled)
displacement (cm)
time (sec)
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70


SE13 Time Histories
SE13 (scaled to Seattle Design Level)
SE13 (unscaled)
displacement (cm)
time (sec)
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75


SE19 Time History
SE19 (scaled to Seattle Design Level)
SE19 (unscaled)
displacement (cm)
time (sec)
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105