

dba



May 27, 2025

Lennar Homes - Houston  
681 Greens Parkway Suite 200  
Houston, Texas 77067-4526

Attention: Stephanie Schwartzburg

### **INVESTIGATION REPORT**

RE: Foundation Investigation  
31049 Fairfield Maple Trail, Spring, TX 77386

**DATE OF INVESTIGATION:** April 15, 2025

#### **PURPOSE:**

The purpose of this investigation was to determine the current condition of the foundation.

#### **GENERAL PROPERTY DESCRIPTION:**

The structure is a two-story, wood-framed single-family residence with a post-tensioned slab-on-ground foundation and a composition shingle roof. For purposes of this report, the house faces north.

The home sits on a lot that slopes primarily downward to the northeast. A gutter-and-downspout system connects to a sub-surface drainage pipe system around the house. A sprinkler system is installed around the house.





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**OBSERVATIONS:**

1. Expansion joint separation and frieze trim separation along the west side of the home.
2. Masonry mortar separations are in the back porch's brick veneer.
3. Drywall cracks are in the walls and ceilings in the kitchen, nook, family room, master suite, and in multiple areas upstairs.

**PERFORMANCE OF SLAB-ON-GROUND FOUNDATIONS:**

The home is located in an area of expansive clay soils that tends to experience volumetric changes with changes in soil moisture content. When the moisture content of the soil increases, the soil expands, which can result in foundation upheaval. When the moisture content of the soil decreases, the soil shrinks, which results in foundation settlement. When the foundation movement results in higher elevations around the perimeter, the foundation has an "edge lift" condition. When the movement results in lower elevations around the perimeter, the foundation has a "center lift" or "edge drop" condition. If the foundation movement results in upward or downward movement on one side or a combination of upheaval on one side and settlement on the opposite side, tilt of the foundation occurs.

Foundations on expansive clays are designed to accommodate the swelling and shrinkage of the soil within a design deflection limit. The International Residential Code sets the maximum design deflection of residential floors at  $L/360$ , which is the industry standard for foundation design. The deflection is measured as a curvature of the foundation over a specified length ( $L$ ). Elevations are recorded at each end of the specified length and at the center to measure the depth of the curvature. The depth of the curvature is considered the deflection and should be no more than  $L/360$ .

Tilt is measured as a difference in the overall slope from level over a specified distance. It is not possible to design a ground supported slab against tilt. However, a slope of one percent measured from the edge of the foundation to the edge of the foundation along a line is considered the maximum tolerable slope and is the current industry standard.

**RELATIVE FOUNDATION ELEVATIONS**

Relative foundation elevations measured with a ZipLevel during the investigation. The elevation readings were recorded, and then corrections for changes in flooring height were made to allow comparison across the entire foundation. The results of the relative elevation survey are depicted in Exhibit EX1. The relative elevations are used in conjunction with the pattern of cosmetic distress to determine the extent of post-construction foundation movement.

The elevations across the slab vary by about 2.2 inches. Based on the relative foundation elevation survey, the foundation of the home slopes from all four corners downward toward the house's center by the stairs.

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**DISCUSSION:**

Based upon the foundation elevations recorded at the time of this inspection and pattern of cosmetic distress, the home has primarily experienced foundation settlement around the house's center. The foundation settlement can be attributed to a reduction in the soil moisture content beneath the house in combination with an imbalance in the soil moisture content around the perimeter. This area has recently been experiencing very dry climatic conditions that have resulted in deep drying and shrinking of the soils. This deep drying and shrinkage of the soils due to the recent dry climatic conditions in combination with the possible imbalance soil moisture content surrounding the home may have contributed to the foundation settlement that has occurred.

Based on review of the cosmetic distress and the elevations recorded in the field, it does not appear that the foundation has failed to support the structure. The deflection resulting from the foundation movement was measured to be within the code-imposed design deflection of  $L/360$  and the slope was measured to be within the accepted limit of one percent.

**CONCLUSIONS:**

Based upon the observations and information obtained in conjunction with this investigation, it is my opinion that:

1. The foundation of the home has not failed to support the structure, and no foundation repairs are recommended for structural purposes. The deflection resulting from the foundation movement was measured to be within the code-imposed design deflection of  $L/360$  and the slope was measured to be within the accepted limit of one percent.
2. In order to eliminate the possibility that a plumbing line leak may exist, it is recommended that a plumbing pressure test be performed on the domestic water supply lines and sanitary sewer lines by a third-party plumbing company that specializes in leak detection.
3. It is recommended to have an established and maintained drainage plan around the perimeter of the home. This includes maintaining positive drainage in the area adjacent to the home and minimizing any ponding of water near the home. This specifically includes the areas along the west and east sides of the home that do not appear to have adequate drainage to carry the water away from the home's foundation. This also includes clearing any drain inlets and debris in any piping to ensure the drainage plan is working as intended.
4. It is recommended to have a watering and maintenance program implemented. This would include reducing or increasing the watering around the perimeter of the home.
5. Homes located in this area are expected to experience foundation movement due to moisture changes in the soil. Cosmetic distress (for example tile cracks, separations in trim, separations

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in masonry expansion joints, masonry cracks, masonry mortar separations, separations in caulking, nail pops, drywall cracks, and drywall separations) associated with seasonal foundation movement in conjunction with thermal expansion and contraction of building materials is common in homes located in this area and repair of this type of distress is considered a normal maintenance item.

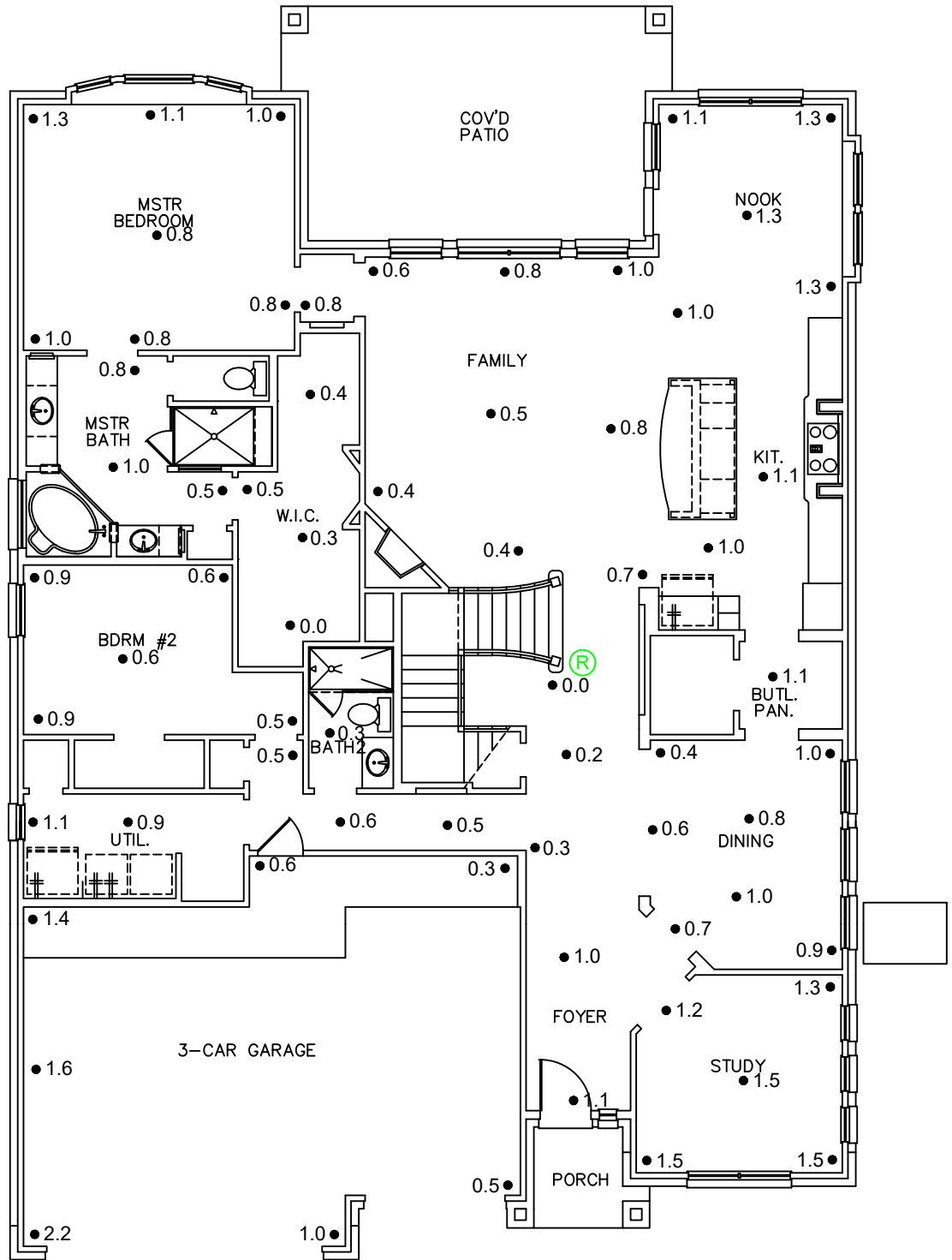
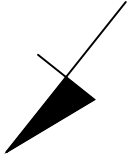
**LIMITATIONS:**

This inspection and report are limited to the conditions that relate to the purpose of the inspection as stated above. Not all the observations made at the time of the inspection or from previous inspections will necessarily be listed in this report. Opinions and comments stated in this report are based upon the apparent performance of the structure at the time of the investigation and the knowledge and experience of the inspector and reviewing engineer. No guarantee or warranty as to the future life or performance of the structure or any component thereof is intended or implied. Arcxis reserves the right to amend or supplement this letter if additional relevant information becomes available.

Report prepared by,

A handwritten signature in blue ink, appearing to read "Jordan Griffis".

Jordan Griffis, P.E.  
Forensic Engineer



LEGEND	
<span style="color: green;">Ⓡ</span>	REFERENCE POINT
+/- 0.0	04-15-2025 READING

0.0 REF - RELATIVE FOUNDATION ELEVATIONS RECORDED ON 04-15-2025

FOUNDATION INSPECTION EXHIBIT	N.T.S.	EX1
LENNAR HOUSTON/VILLAGE BUILDERS	04-15-2025	
31049 FAIRFIELD MAPLE TRAIL, SPRING, TX 77386	BMH	



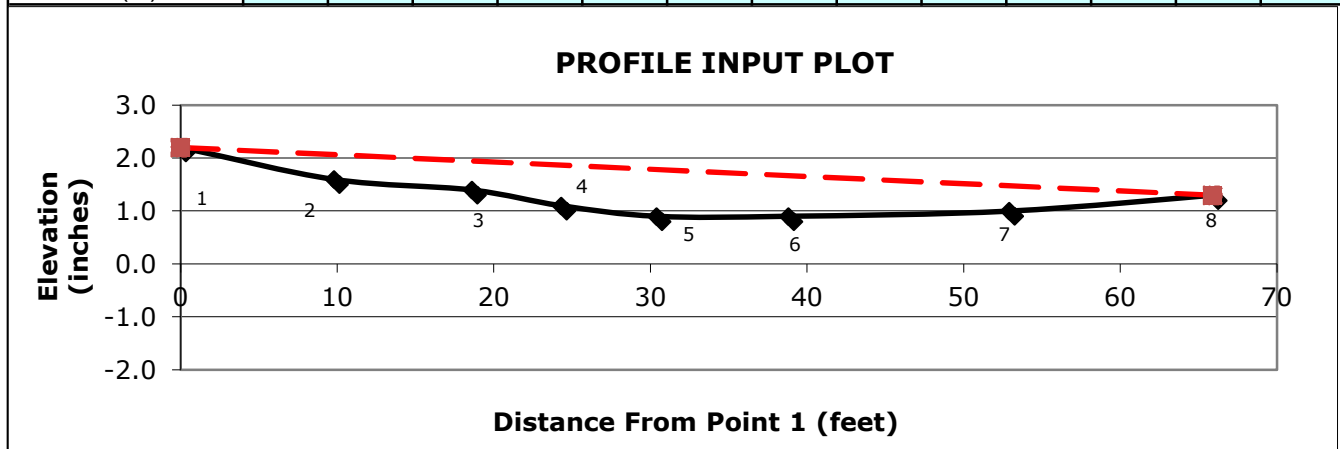
**Proprietary Calculation Spreadsheet for Document # FPA-SC-13-1  
Guidelines for the Evaluation of Foundation Movement for  
Residential And Other Low-Rise Buildings**

Lennar Houston/Village Builders	A-A	Foundation elevations recorded on April 15, 2025
31049 Fairfield Maple Trail, Spring, TX 77386		

**Instructions to Compute Deflection and Tilt**

- a) Input distances along profile into blue "L" cells from one edge of slab to the other.  
(Spacing may be unequal, first L must be zero, each successive L greater than the previous)
- b) Input elevations measured at each "L" into blue "Y" cells  
(Start with Point 1; For less than 13 data sets, extra L and Y cells **must** be "empty", not zero)

PROFILE INPUT											EFFECTIVE LENGTH (FT) =		25
POINT	1	2	3	4	5	6	7	8	9	10	11	12	13
L (ft)	0	9.8	18.6	24.3	30.4	38.8	52.9	65.9					
Y (in)	2.2	1.6	1.4	1.1	0.9	0.9	1.0	1.3					



PERFORMANCE OUTPUT RESULTS					
	ACTUAL	RESULT	PT. 1	PT. 2	PT. 3
Deflection 1 =	L / 894	40% OF L/360 LIMIT	1	5	8
Deflection 2 =	L / 1027	35% OF L/360 LIMIT	1	6	8
Deflection 3 =	L / 1030	35% OF L/360 LIMIT	1	4	8
Tilt =	0.11 %	11% OF 1% LIMIT			

"Deflection 1" is the maximum deflection computed in this profile.

User input is in the blue cells only and echoed in the Profile Input Plot. Output is in the yellow cells.

Deflection between points 1 and 3:  $Deflection = Y_2 - [Y_1 + (L_{12}/L)(Y_3 - Y_1)]$   
 Points 1 & 3 are end points of any intermediate span chosen by spreadsheet;  
 Point 2 is any point chosen by spreadsheet that falls in between 1 & 3,

Per FPA-SC-13-1, Deflection is calculated when the distance between Points 1 and 3 (effective length) is  $\geq$  to 20 feet. If this spreadsheet is used to check Deflection (i.e. curvature) per PTI-DC10.8-18, increase effective length to 25 feet.

*This spreadsheet is provided to FPA members as a courtesy, with no guarantee of its accuracy. This spreadsheet has not been subjected to peer review and may be revised by the FPA-SC without notice from time to time by changing the revision date. Section 6 of FPA-SC-13-1 provides definitions and further information on the calculations performed. FPA-SC-13-1 takes precedence over this spreadsheet in case of a conflict.*

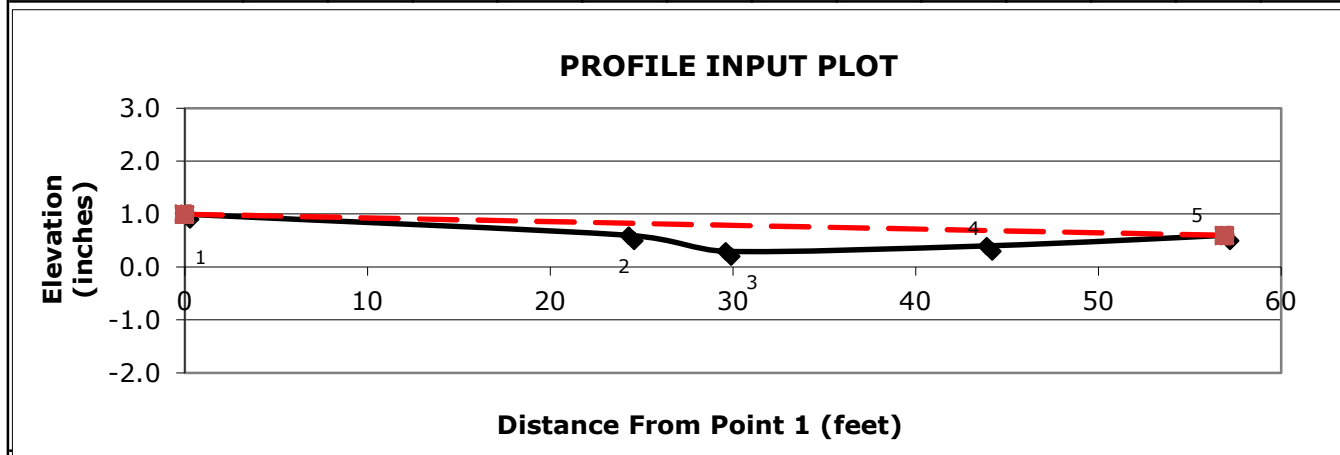
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Residential And Other Low-Rise Buildings**

Lennar Houston/Village Builders	B-B	Foundation elevations recorded on April 15, 2025
31049 Fairfield Maple Trail, Spring, TX 77386		

**Instructions to Compute Deflection and Tilt**

- a) Input distances along profile into blue "L" cells from one edge of slab to the other.  
(Spacing may be unequal, first L must be zero, each successive L greater than the previous)
- b) Input elevations measured at each "L" into blue "Y" cells  
(Start with Point 1; For less than 13 data sets, extra L and Y cells **must** be "empty", not zero)

PROFILE INPUT												EFFECTIVE LENGTH (FT) =	20
POINT	1	2	3	4	5	6	7	8	9	10	11	12	13
L (ft)	0	24.3	29.6	43.9	56.9								
Y (in)	1.0	0.6	0.3	0.4	0.6								



PERFORMANCE OUTPUT RESULTS					
	ACTUAL	RESULT	PT. 1	PT. 2	PT. 3
Deflection 1 =	L / 1304	28% OF L/360 LIMIT	2	3	5
Deflection 2 =	L / 1388	26% OF L/360 LIMIT	1	3	5
Deflection 3 =	L / 1783	20% OF L/360 LIMIT	1	3	4
Tilt =	0.06 %	6% OF 1% LIMIT			

"Deflection 1" is the maximum deflection computed in this profile.

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Deflection between points 1 and 3:  $Deflection = Y_2 - [Y_1 + (L_{12}/L)(Y_3 - Y_1)]$   
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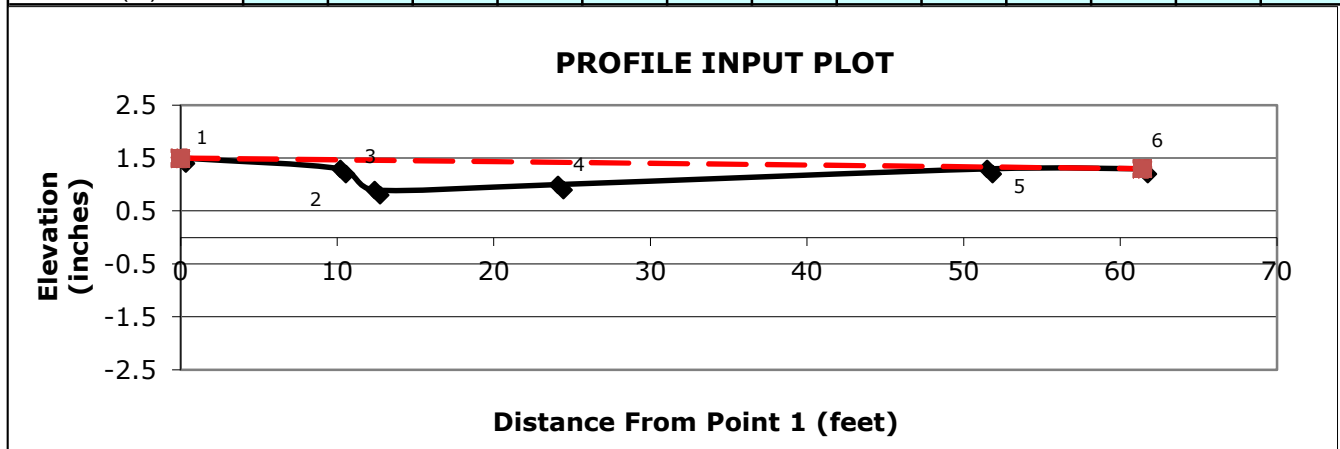
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Lennar Houston/Village Builders	C-C	Foundation elevations recorded on April 15, 2025
31049 Fairfield Maple Trail, Spring, TX 77386		

**Instructions to Compute Deflection and Tilt**

- a) Input distances along profile into blue "L" cells from one edge of slab to the other.  
(Spacing may be unequal, first L must be zero, each successive L greater than the previous)
- b) Input elevations measured at each "L" into blue "Y" cells  
(Start with Point 1; For less than 13 data sets, extra L and Y cells **must** be "empty", not zero)

PROFILE INPUT											EFFECTIVE LENGTH (FT) =		25
POINT	1	2	3	4	5	6	7	8	9	10	11	12	13
L (ft)	0	10.2	12.4	24.1	51.5	61.4							
Y (in)	1.5	1.3	0.9	1.0	1.3	1.3							



PERFORMANCE OUTPUT RESULTS					
	ACTUAL	RESULT	PT. 1	PT. 2	PT. 3
Deflection 1 =	L / 1120	32% OF L/360 LIMIT	1	3	5
Deflection 2 =	L / 1239	29% OF L/360 LIMIT	2	3	5
Deflection 3 =	L / 1317	27% OF L/360 LIMIT	1	3	6
Tilt =	0.03 %	3% OF 1% LIMIT			

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Deflection between points 1 and 3:  $Deflection = Y_2 - [Y_1 + (L_{12}/L)(Y_3 - Y_1)]$   
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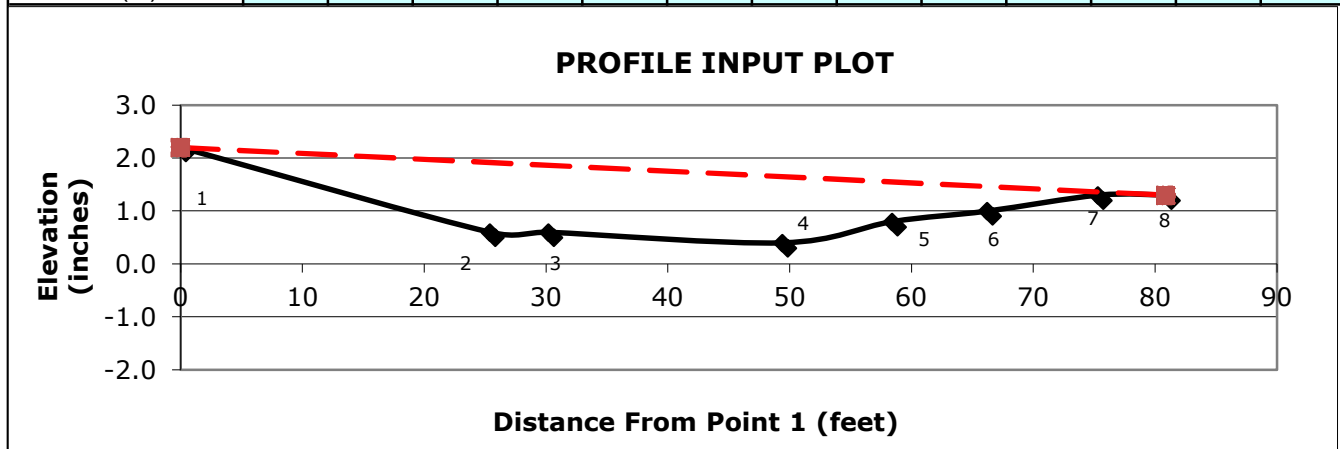
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Lennar Houston/Village Builders	D-D	Foundation elevations recorded on April 15, 2025
31049 Fairfield Maple Trail, Spring, TX 77386		

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(Spacing may be unequal, first L must be zero, each successive L greater than the previous)
- b) Input elevations measured at each "L" into blue "Y" cells  
(Start with Point 1; For less than 13 data sets, extra L and Y cells **must** be "empty", not zero)

PROFILE INPUT											EFFECTIVE LENGTH (FT) =		25
POINT	1	2	3	4	5	6	7	8	9	10	11	12	13
L (ft)	0	25.4	30.2	49.4	58.4	66.2	75.3	80.9					
Y (in)	2.2	0.6	0.6	0.4	0.8	1.0	1.3	1.3					



PERFORMANCE OUTPUT RESULTS					
	ACTUAL	RESULT	PT. 1	PT. 2	PT. 3
Deflection 1 =	L / 697	52% OF L/360 LIMIT	1	2	7
Deflection 2 =	L / 697	52% OF L/360 LIMIT	1	2	6
Deflection 3 =	L / 707	51% OF L/360 LIMIT	1	2	5
Tilt =	0.09 %	9% OF 1% LIMIT			

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Deflection between points 1 and 3:  $Deflection = Y_2 - [Y_1 + (L_{12}/L)(Y_3 - Y_1)]$   
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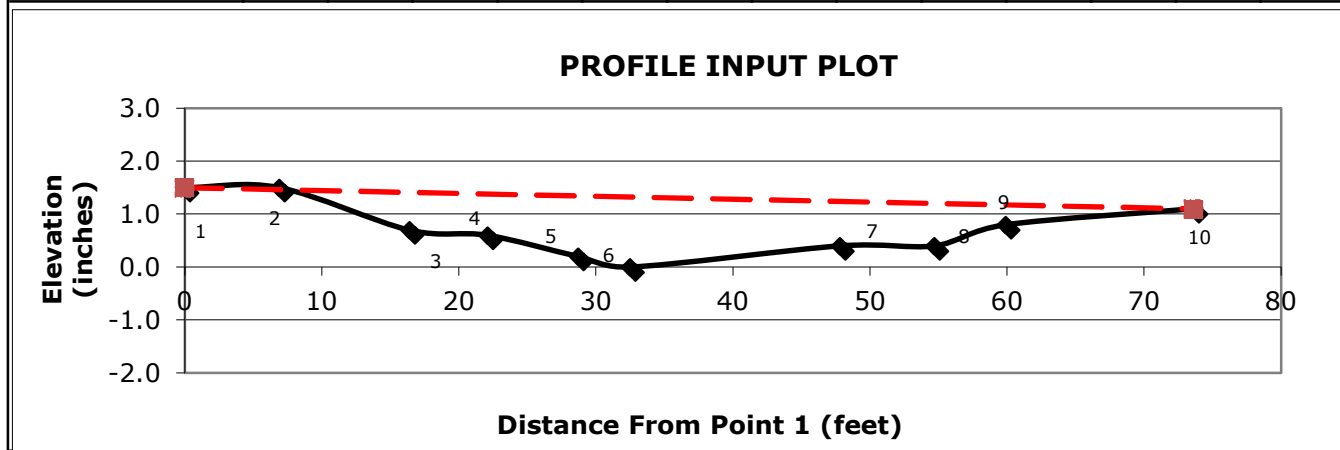
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Lennar Houston/Village Builders	E-E	Foundation elevations recorded on April 15, 2025
31049 Fairfield Maple Trail, Spring, TX 77386		

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(Start with Point 1; For less than 13 data sets, extra L and Y cells **must** be "empty", not zero)

PROFILE INPUT												EFFECTIVE LENGTH (FT) =	20
POINT	1	2	3	4	5	6	7	8	9	10	11	12	13
L (ft)	0	6.9	16.4	22.1	28.7	32.5	47.8	54.7	59.9	73.6			
Y (in)	1.5	1.5	0.7	0.6	0.2	0.0	0.4	0.4	0.8	1.1			



PERFORMANCE OUTPUT RESULTS					
	ACTUAL	RESULT	PT. 1	PT. 2	PT. 3
Deflection 1 =	L / 547	66% OF L/360 LIMIT	2	6	9
Deflection 2 =	L / 594	61% OF L/360 LIMIT	4	6	7
Deflection 3 =	L / 594	61% OF L/360 LIMIT	2	6	10
Tilt =	0.05 %	5% OF 1% LIMIT			

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Deflection between points 1 and 3:  $Deflection = Y_2 - [Y_1 + (L_{12}/L)(Y_3 - Y_1)]$   
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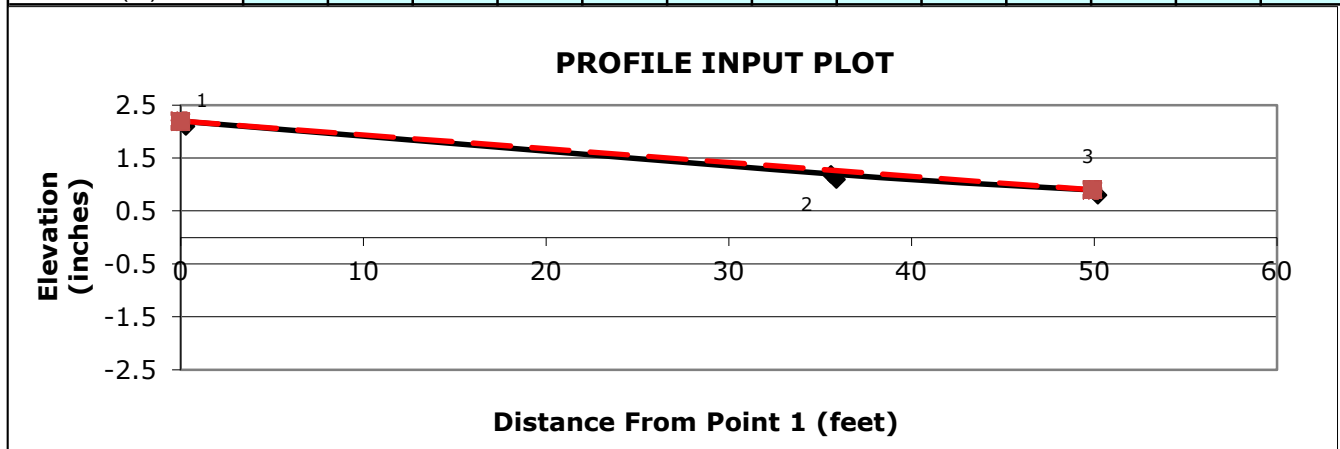
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(Start with Point 1; For less than 13 data sets, extra L and Y cells **must** be "empty", not zero)

PROFILE INPUT											EFFECTIVE LENGTH (FT) =		25
POINT	1	2	3	4	5	6	7	8	9	10	11	12	13
L (ft)	0	35.6	49.9										
Y (in)	2.2	1.2	0.9										



PERFORMANCE OUTPUT RESULTS					
	ACTUAL	RESULT	PT. 1	PT. 2	PT. 3
Deflection 1 =	L / 8254	4% OF L/360 LIMIT	1	2	3
Deflection 2 =	L / #####	0% OF L/360 LIMIT	1	2	4
Deflection 3 =	L / #####	0% OF L/360 LIMIT	1	2	4
Tilt =	0.22 %	22% OF 1% LIMIT			

"Deflection 1" is the maximum deflection computed in this profile.

User input is in the blue cells only and echoed in the Profile Input Plot. Output is in the yellow cells.

Deflection between points 1 and 3:  $Deflection = Y_2 - [Y_1 + (L_{12}/L)(Y_3 - Y_1)]$   
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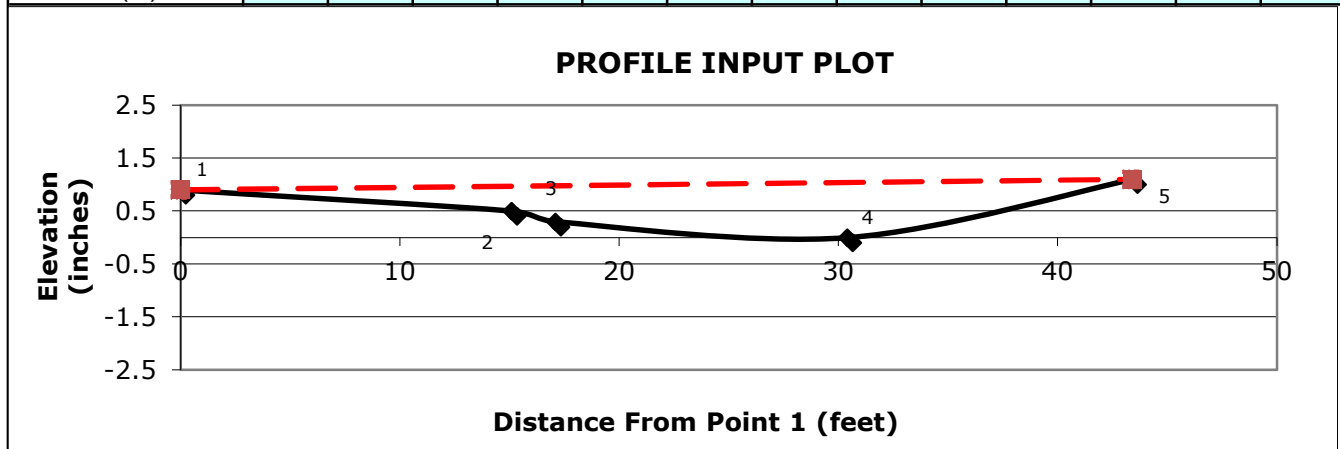
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(Start with Point 1; For less than 13 data sets, extra L and Y cells **must** be "empty", not zero)

PROFILE INPUT													EFFECTIVE LENGTH (FT) =	25
POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	
L (ft)	0	15.1	17.1	30.4	43.4									
Y (in)	0.9	0.5	0.3	0.0	1.1									



PERFORMANCE OUTPUT RESULTS					
	ACTUAL	RESULT	PT. 1	PT. 2	PT. 3
Deflection 1 =	L / 412	87% OF L/360 LIMIT	2	4	5
Deflection 2 =	L / 448	80% OF L/360 LIMIT	3	4	5
Deflection 3 =	L / 501	72% OF L/360 LIMIT	1	4	5
Tilt =	0.04 %	4% OF 1% LIMIT			

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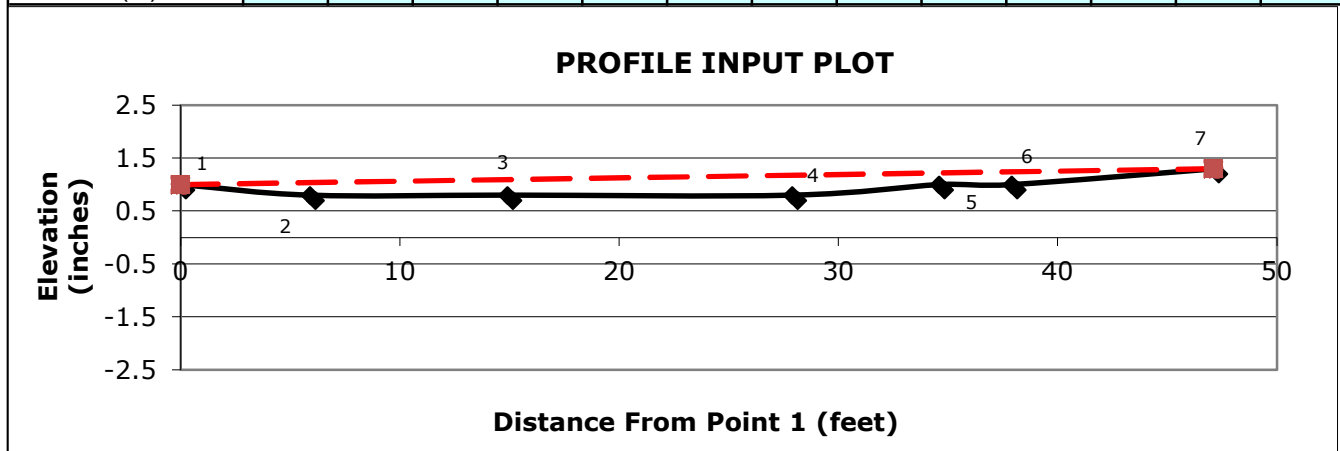
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POINT	1	2	3	4	5	6	7	8	9	10	11	12	13
L (ft)	0	5.9	14.9	27.9	34.6	37.9	47.1						
Y (in)	1.0	0.8	0.8	0.8	1.0	1.0	1.3						



PERFORMANCE OUTPUT RESULTS					
	ACTUAL	RESULT	PT. 1	PT. 2	PT. 3
Deflection 1 =	L / 1496	24% OF L/360 LIMIT	1	4	7
Deflection 2 =	L / 1852	19% OF L/360 LIMIT	2	4	7
Deflection 3 =	L / 1914	19% OF L/360 LIMIT	3	4	7
Tilt =	0.05 %	5% OF 1% LIMIT			

"Deflection 1" is the maximum deflection computed in this profile.

User input is in the blue cells only and echoed in the Profile Input Plot. Output is in the yellow cells.

Deflection between points 1 and 3:  $Deflection = Y_2 - [Y_1 + (L_{12}/L)(Y_3 - Y_1)]$   
 Points 1 & 3 are end points of any intermediate span chosen by spreadsheet;  
 Point 2 is any point chosen by spreadsheet that falls in between 1 & 3,

Per FPA-SC-13-1, Deflection is calculated when the distance between Points 1 and 3 (effective length) is  $\geq$  to 20 feet. If this spreadsheet is used to check Deflection (i.e. curvature) per PTI-DC10.8-18, increase effective length to 25 feet.

*This spreadsheet is provided to FPA members as a courtesy, with no guarantee of its accuracy. This spreadsheet has not been subjected to peer review and may be revised by the FPA-SC without notice from time to time by changing the revision date. Section 6 of FPA-SC-13-1 provides definitions and further information on the calculations performed. FPA-SC-13-1 takes precedence over this spreadsheet in case of a conflict.*