



# Blind Analysis Contest 2007

*Results of the Contest*



# Contest Categories

- Winner is selected for each of the four categories:
  - Category1 3D Analysis (Researcher)
  - Category2 3D Analysis (Practicing Engineer)
  - Category3 2D Analysis (Researcher)
  - Category4 2D Analysis (Practicing Engineer)



# Basic Contest Rules

- Responses to be predicted:
  - Maximum values of relative displacement from base, absolute acceleration and overturning moment at each floor  
(Y-direction for 2D Analysis; X- and Y-directions for 3D Analysis)
  - Maximum values of story shear, story drift angle and residual drift angle at each story  
(Y-direction for 2D Analysis; X- and Y-directions for 3D Analysis)
  - Maximum strain at a specified point of a column in 1st story
  - Collapse Time

- Definition of errors: RMS errors of story/floor responses

$$E_i = \sqrt{\sum_j (F_{i,j} - F_{i,j}^*)^2}$$

$F_{i,j}$  : Predicted response

$F_{i,j}^*$  : Measured (actual) response

- Points for each response:
  - 8pt. for smallest RMS errors, 5pt. for 2nd, 3pt. for 3rd, 1pt. for 4th
- The participant with maximum total points is awarded.



# Number of Participants

- 47 teams from 7 countries in total  
(7 teams participate in both 3D and 2D analysis.)

Table : Number of Participants

Country \ Category	3D-R	3D-P	2D-R	2D-P	TOTAL
Japan	6	5	4	2	17
U.S.	6	5	2	2	15
Taiwan	4	0	4	0	8
China	1	1	2	0	4
N.Z.	0	1	0	0	1
Italy	1	0	0	0	1
U.K.	0	0	0	1	1
TOTAL	18	12	12	5	47

3D : Three-dimensional Frame Analysis      2D : Plane Frame Analysis

R : Researcher                      P : Practicing Engineer



# Participants (1)

- **3D Analysis Researcher**

Matsumoto	Hiroshima University, Japan
Muramoto (+2)	Kyoto Institute of Technology, Japan
Nakamura (+9)	Takenaka Corporation, Japan
Yoshimatsu	Waseda University, Japan
Syugyo	Nagasaki University, Japan
Yasuda (+4)	Waseda University, Japan
Thiagarajan (+2)	University of Missouri, U.S.
Krishnan	California Institute of Technology, U.S.
Centeno (+2)	University of British Columbia, U.S.
Tagel-Din (+6)	Applied Science International, LLC, U.S.
Stojadinovic (+3)	University of California, U.S.
Qu (+1)	State University of New York, U.S.
Yang (+2)	National Center for Research on Earthquake Engineering, Taiwan
Weng (+3)	National Center for Research on Earthquake Engineering, Taiwan
Qiang (+2)	Sinotech Engineering Consultants, Inc, Taiwan
Wang (+4)	National Center for Research on Earthquake Engineering, Taiwan
Chen (+1)	South China University of Technology, China
Pinho (+1)	University of Pavia, Italy



## Participants (2)

- **3D Analysis Practicing Engineer**

Umemura (+2)	Ando Corporation, Japan
Ishida (+9)	Kajima Corporation, Japan
Terada (+4)	Shimizu Corporation, Japan
Komiya (+2)	Maeda Corporation, Japan
Nakagawa (+3)	Building Research Institute, Japan
Shama	Parsons, U.S.
Tremayne	Holmes Culley, U.S.
Rahimian (+2)	WSP Cantor Seinuk, U.S.
Almufti (+7)	Arup, U.S.
Ashrafi (+2)	Thornton Tomasetti Inc., U.S.
Kelly (+1)	Holmes Consulting Group, New Zealand
Jiao (+4)	The Architectural Design And Research Institute of Guangdong Province, China

- **2D Analysis Researcher**

Tsujimoto	Kyoto University, Japan
Syugyo	Nagasaki University, Japan
Sone (+9)	Takenaka Corporation, Japan



## Participants (3)

- **2D Analysis Researcher (continuation)**

Obayashi (+3)	Osaka City University, Japan
Krawinkler (+2)	Stanford University, U.S.
Qu (+1)	State University of New York, U.S.
Yang (+2)	National Center for Research on Earthquake Engineering, Taiwan
Qiang (+2)	Sinotech Engineering Consultants, Inc., Taiwan
Weng (+3)	National Center for Research on Earthquake Engineering, Taiwan
Wang (+4)	National Center for Research on Earthquake Engineering, Taiwan
Huang	South China University of Technology, China
LI	Hunan University, China

- **2D Analysis Practicing Engineer**

Kiryama (+4)	Asahi Kasei Homes, and Ebisu Building Laboratory, Japan
Tajimi (+5)	Japan
Ashrafi (+2)	Thornton Tomasetti Inc., U.S.
Maison (+2)	Structural Engineer, U.S.
Sullivan (+1)	Buro Happold ,U.K.



# Classification of Analysis Methods and Frame Models

		3-dimensional Analysis		Plane Frame Analysis	
		Researcher	Engineer	Researcher	Engineer
Types of Softwares	Commercial	6	8	3	1
	Research	9	2	8	1
	Personal	2	2	1	3
	Unknown	1	0	0	0
Model of Beams and Column	Line	5	2	2	3
	Line+hinge	3	6	4	2
	Line+fiber	5	0	5	0
	Line+hinge+fiber	2	0	1	0
	Shell	0	3	0	0
	Lumped mass	1	0	0	0
	Others	1	1	0	0
	Unknown	1	0	0	0



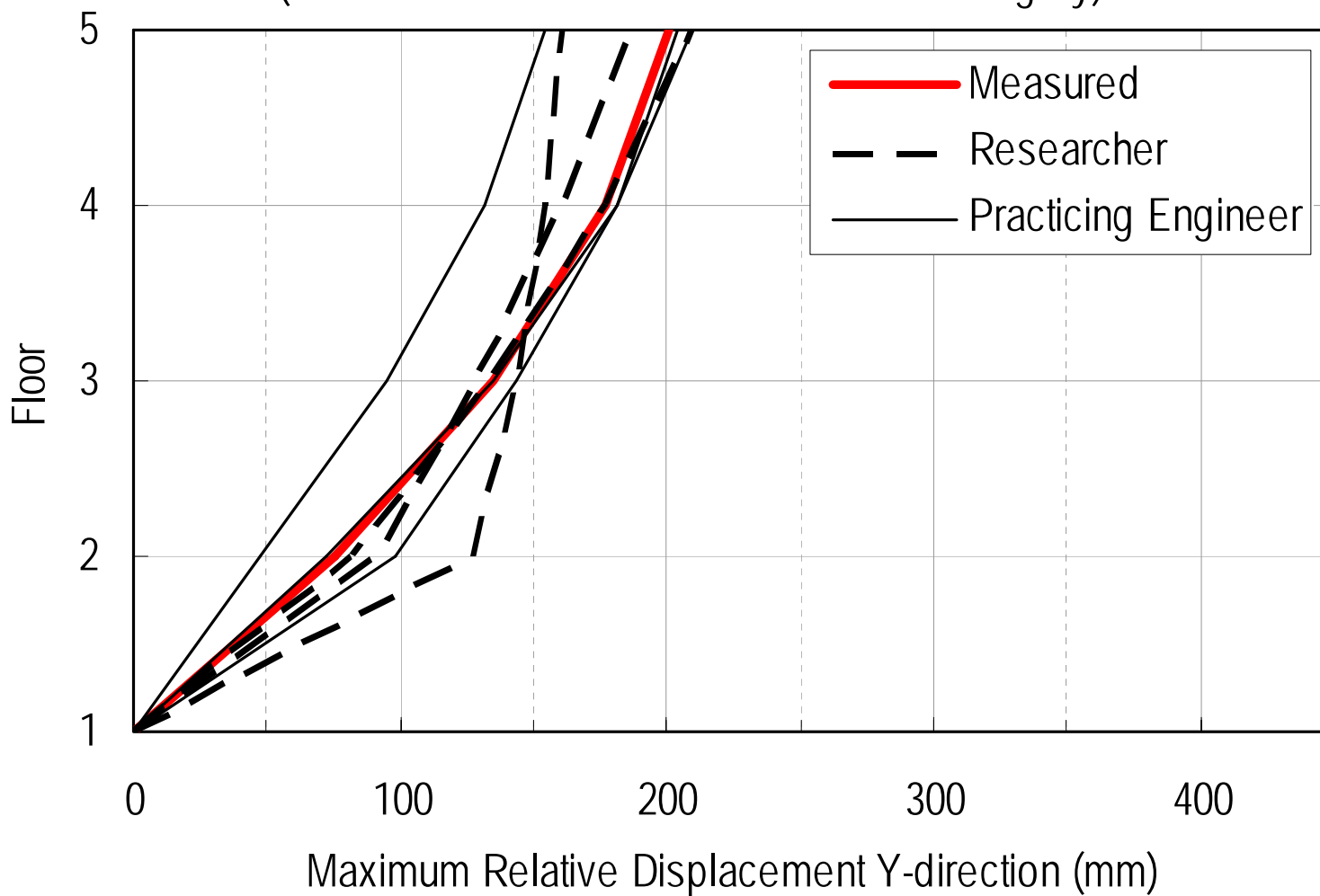


# 3D Analysis Results

(Measured and Best 3 teams)

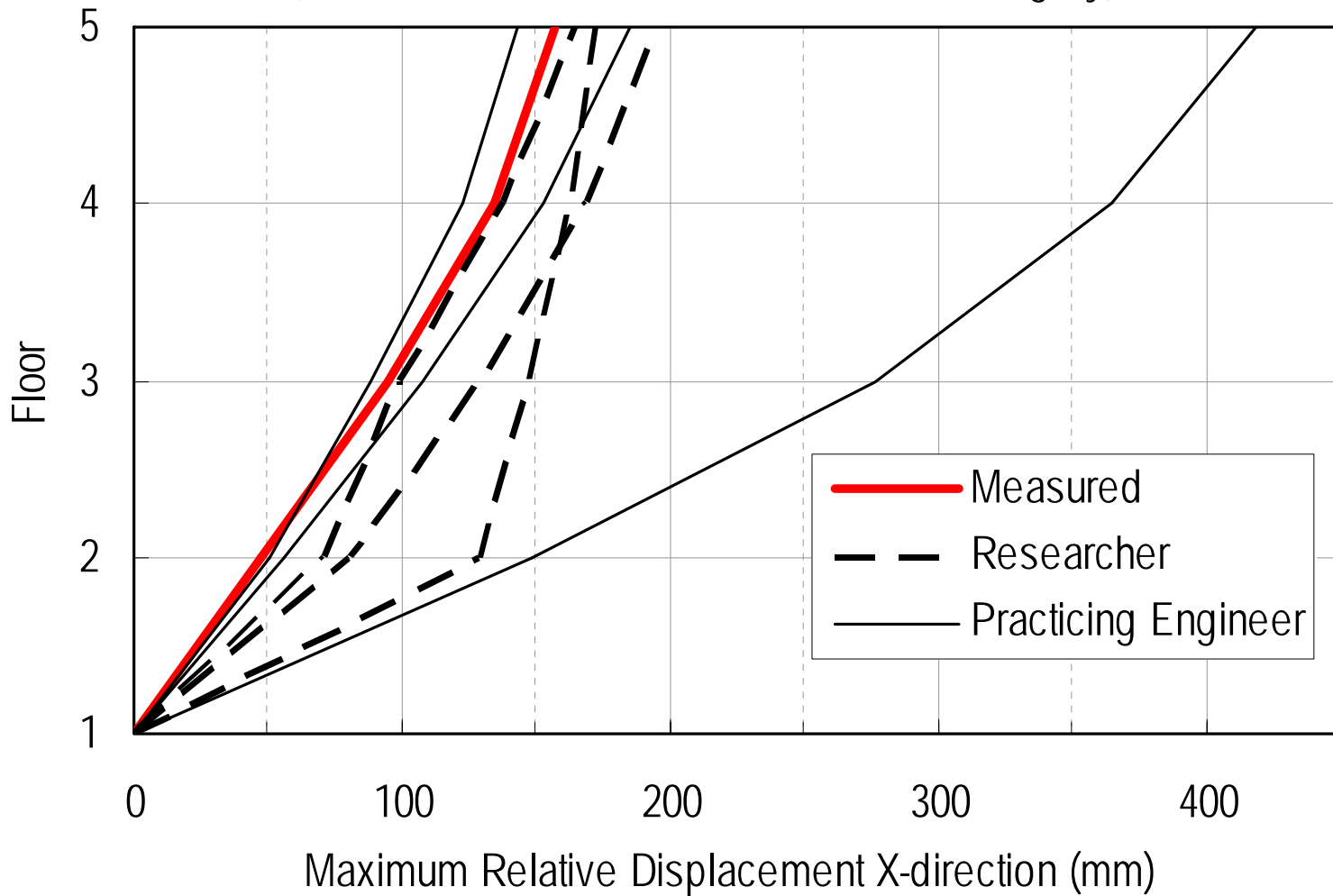


3D Analysis Blind Prediction Results  
Maximum Relative Displacement Y-direction  
(Measured and Best 3 Teams of Each Category)



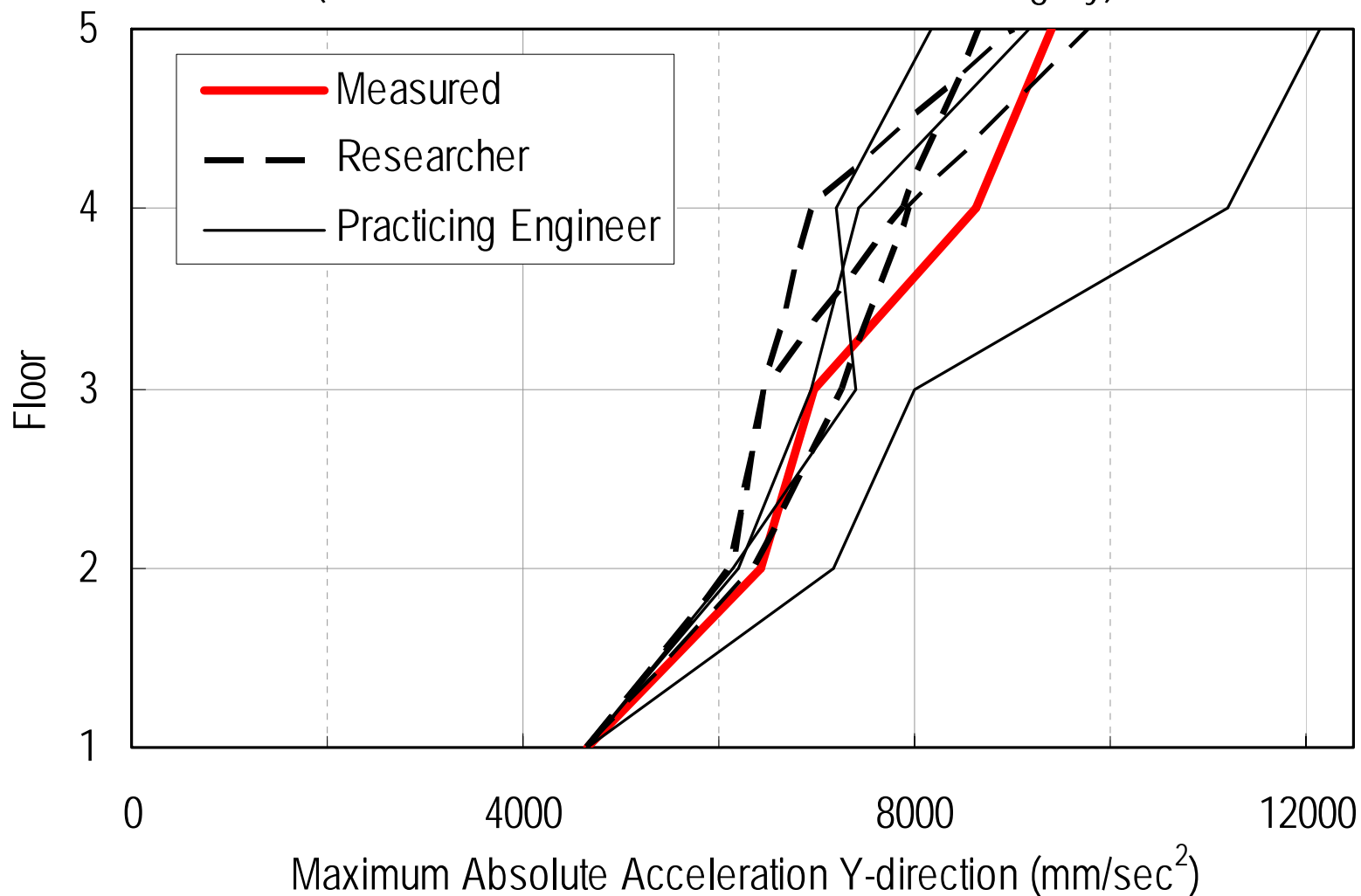


### 3D Analysis Blind Prediction Results Maximum Relative Displacement X-direction (Measured and Best 3 Teams of Each Category)



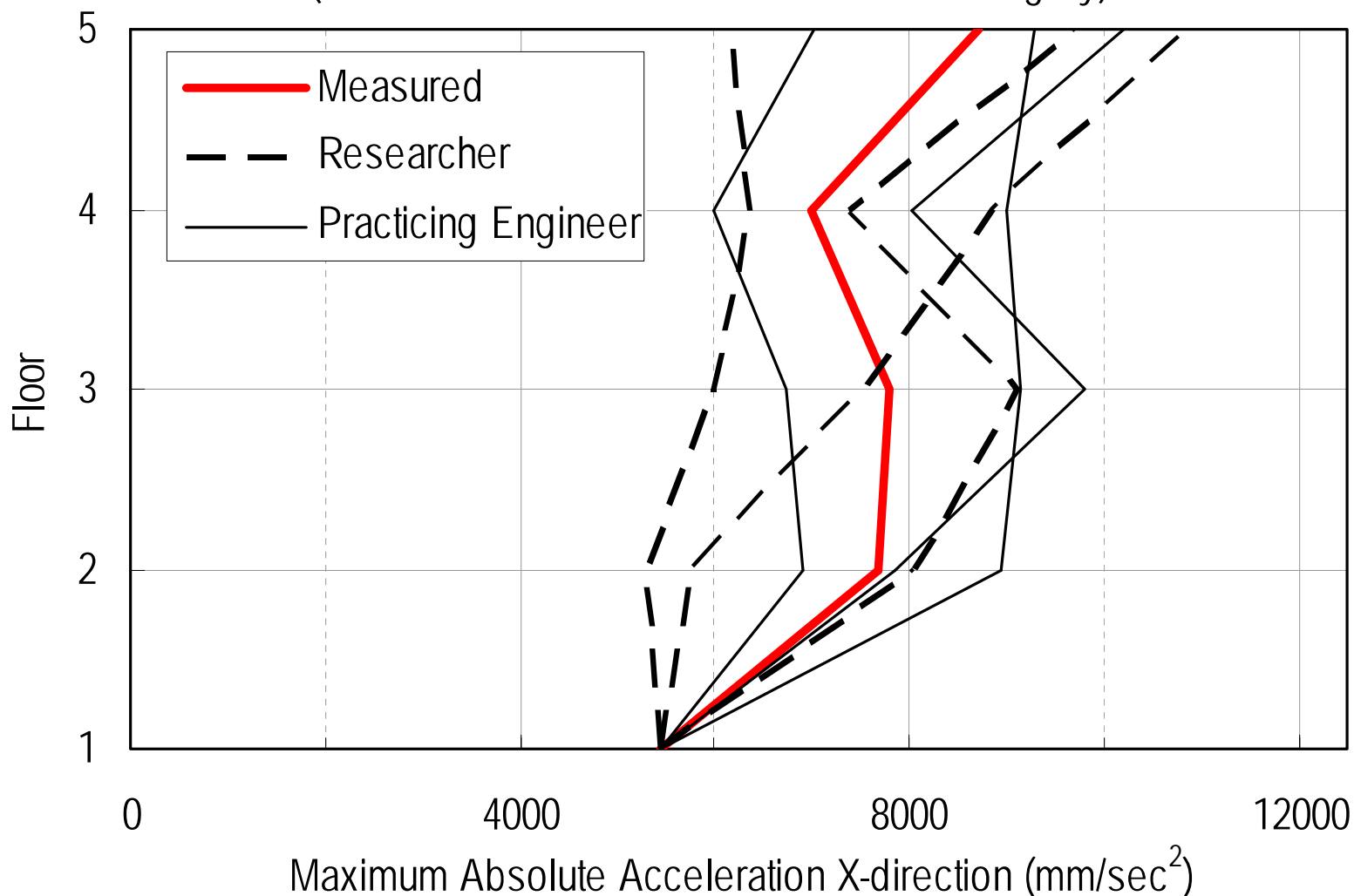


### 3D Analysis Blind Prediction Results Maximum Absolute Acceleration Y-direction (Measured and Best 3 Teams of Each Category)



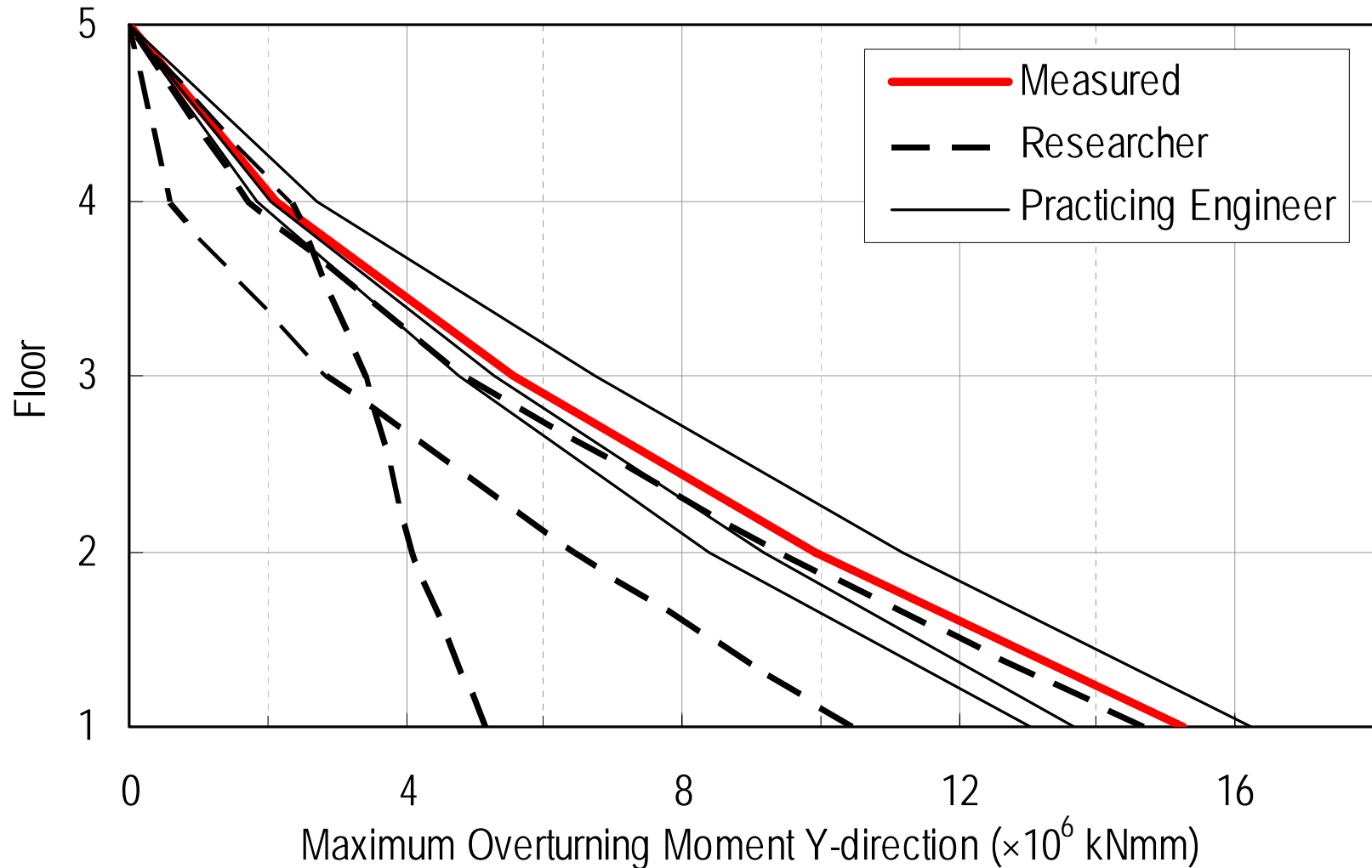


### 3D Analysis Blind Prediction Results Maximum Absolute Acceleration X-direction (Measured and Best 3 Teams of Each Category)



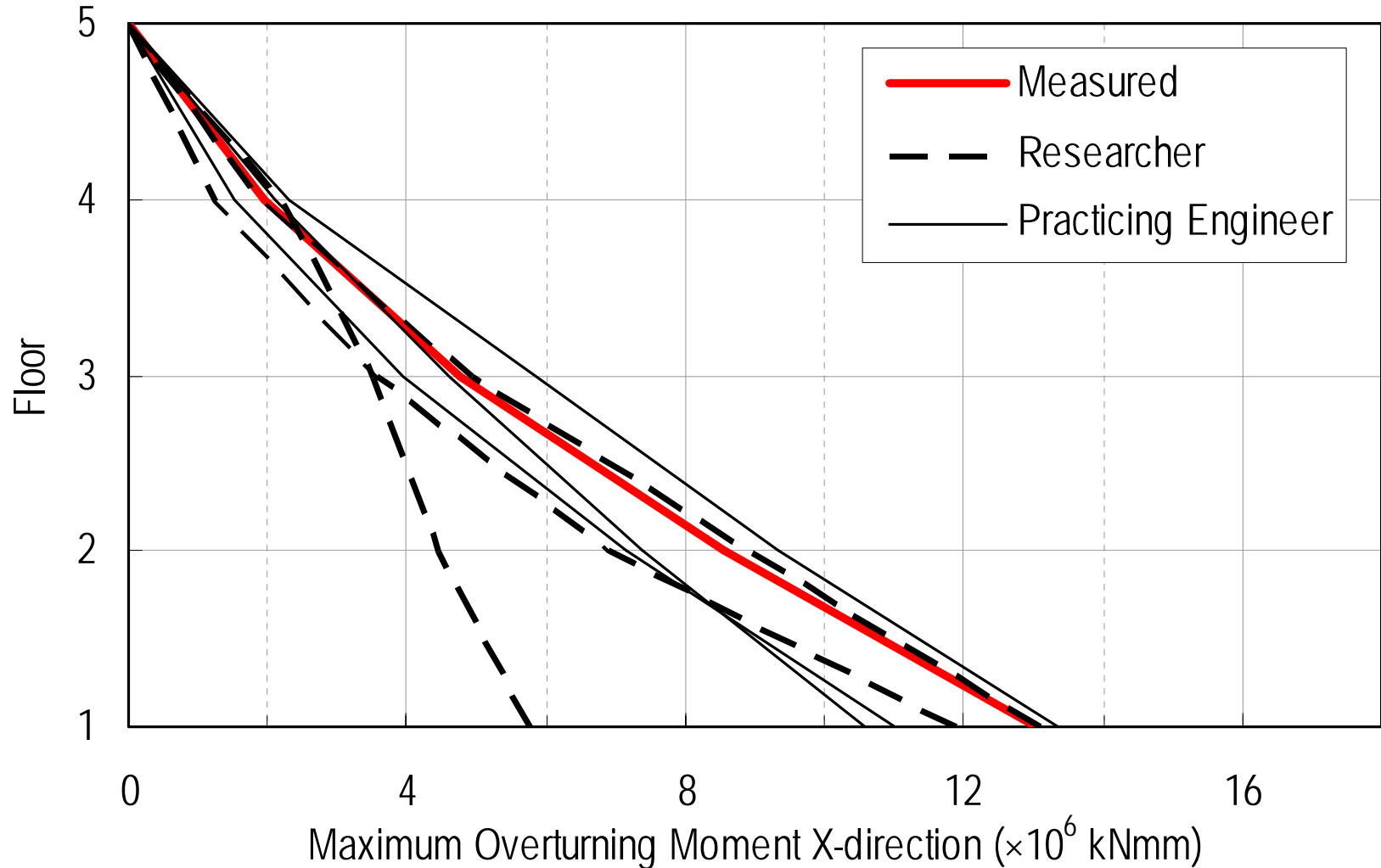


3D Analysis Blind Prediction Results  
Maximum Overturning Moment Y-direction  
(Measured and Best 3 Teams of Each Category)



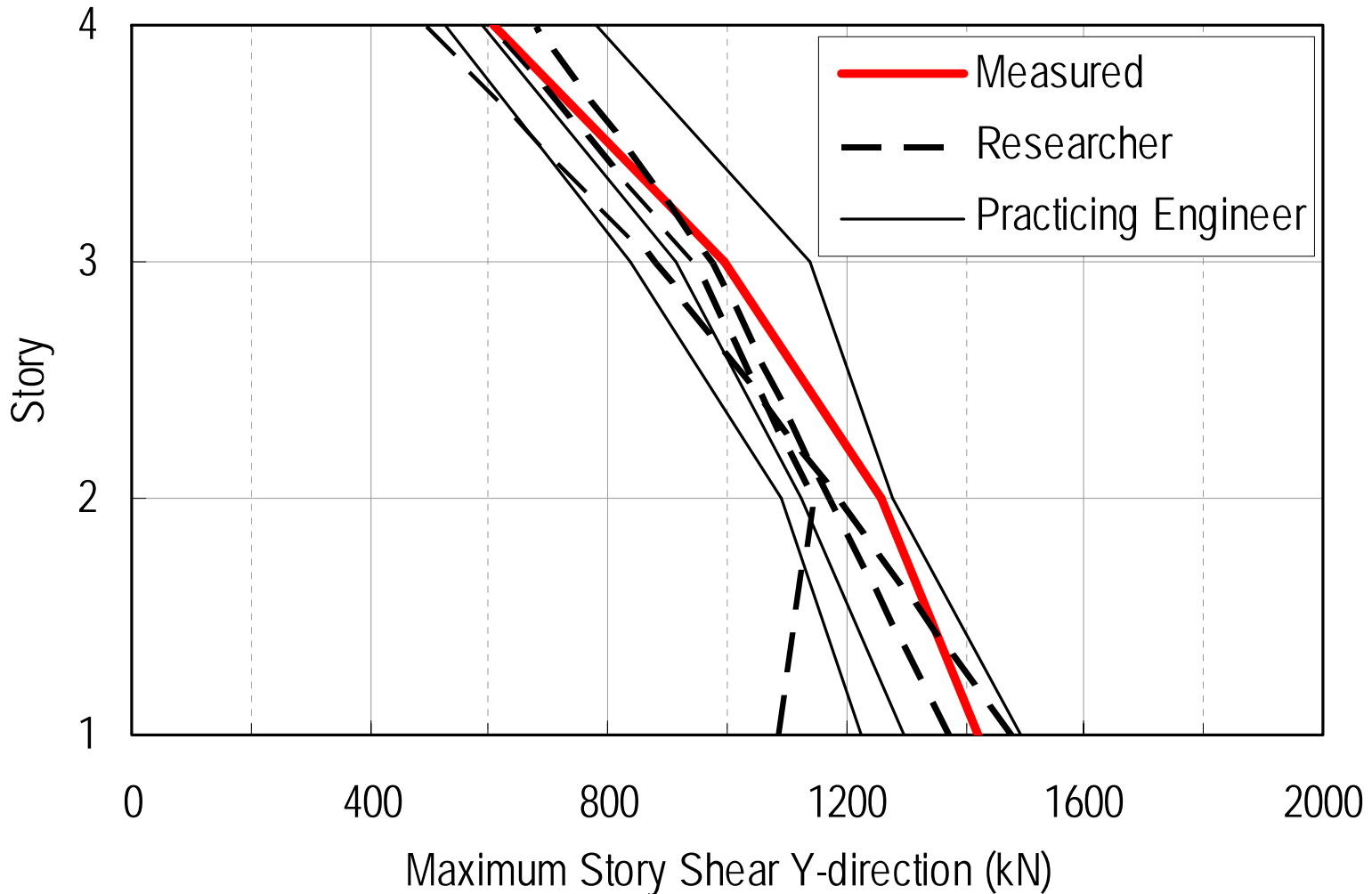


3D Analysis Blind Prediction Results  
Maximum Overturning Moment X-direction  
(Measured and Best 3 Teams of Each Category)





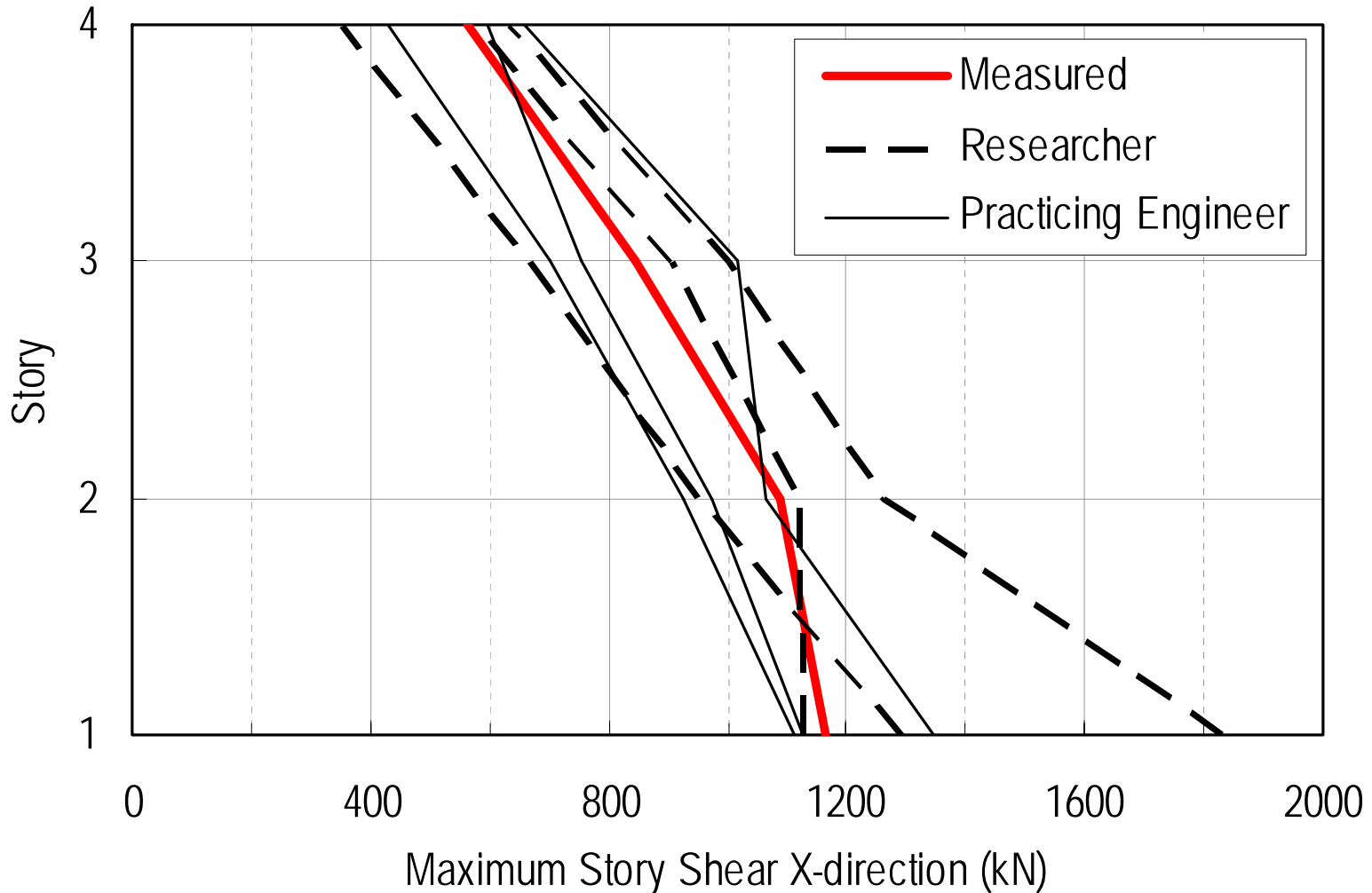
3D Analysis Blind Prediction Results  
Maximum Story Shear Y-direction  
(Measured and Best 3 Teams of Each Category)





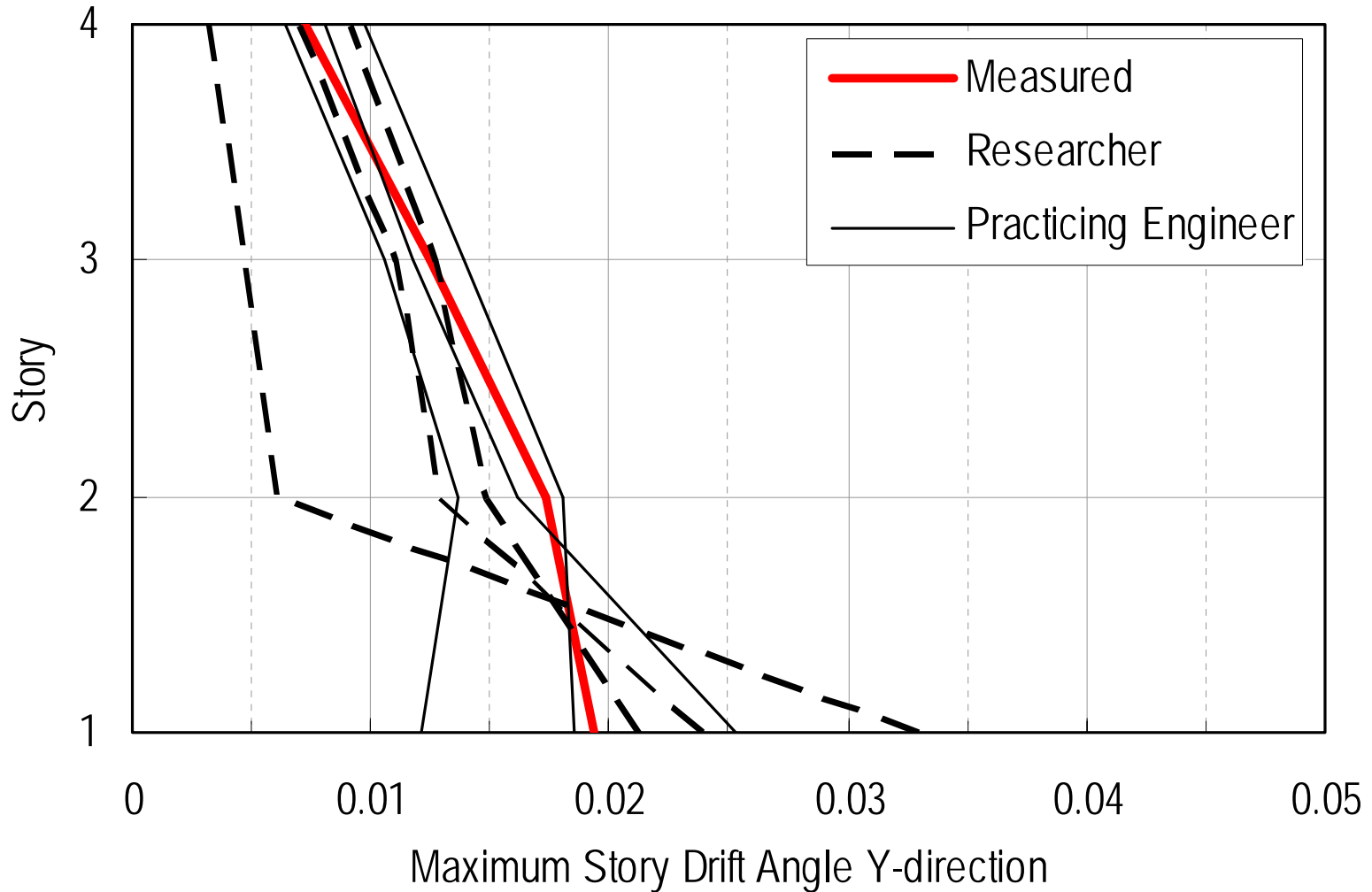


3D Analysis Blind Prediction Results  
Maximum Story Shear X-direction  
(Measured and Best 3 Teams of Each Category)



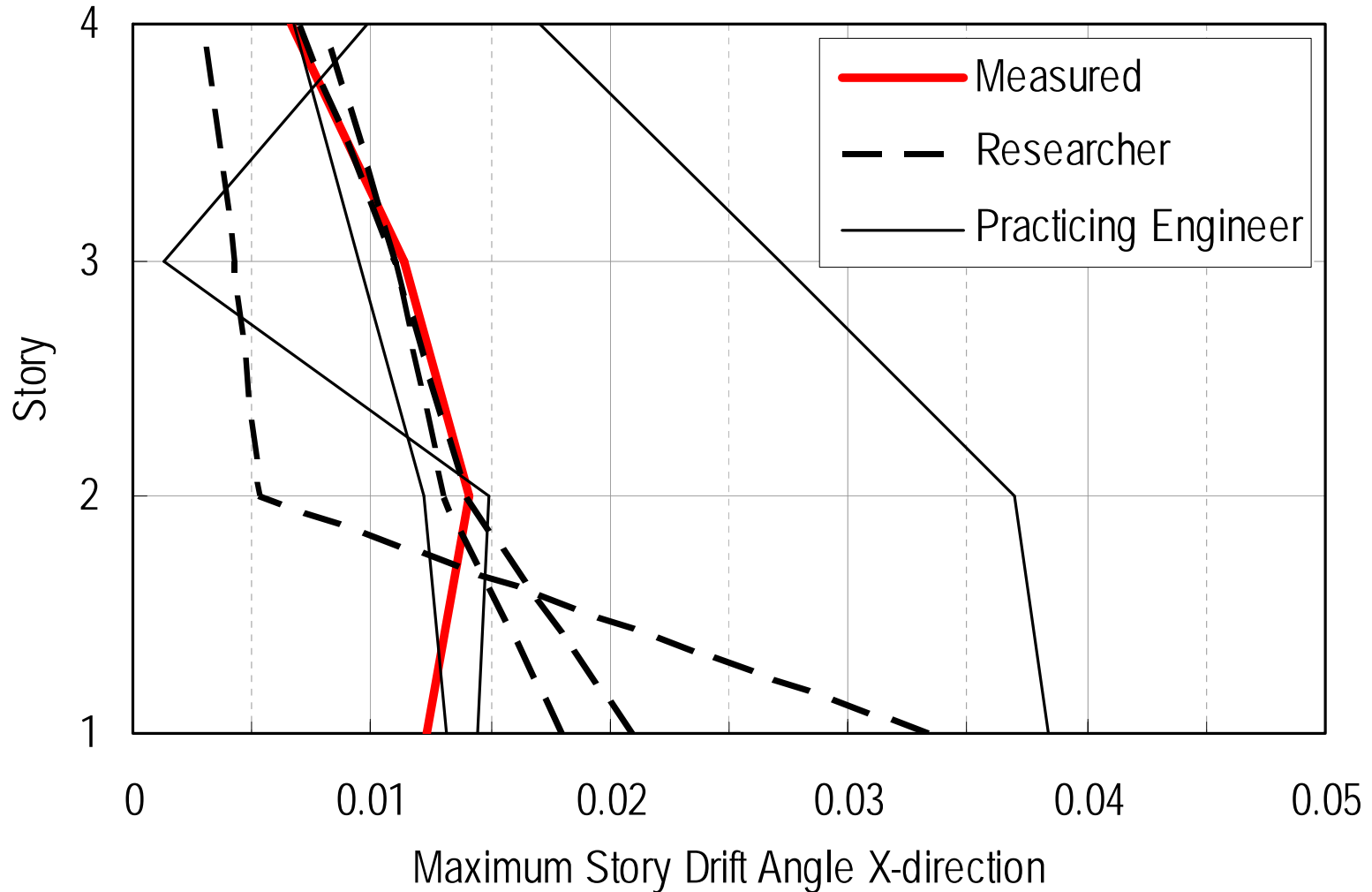


3D Analysis Blind Prediction Results  
Maximum Story Drift Angle Y-direction  
(Measured and Best 3 Teams of Each Category)



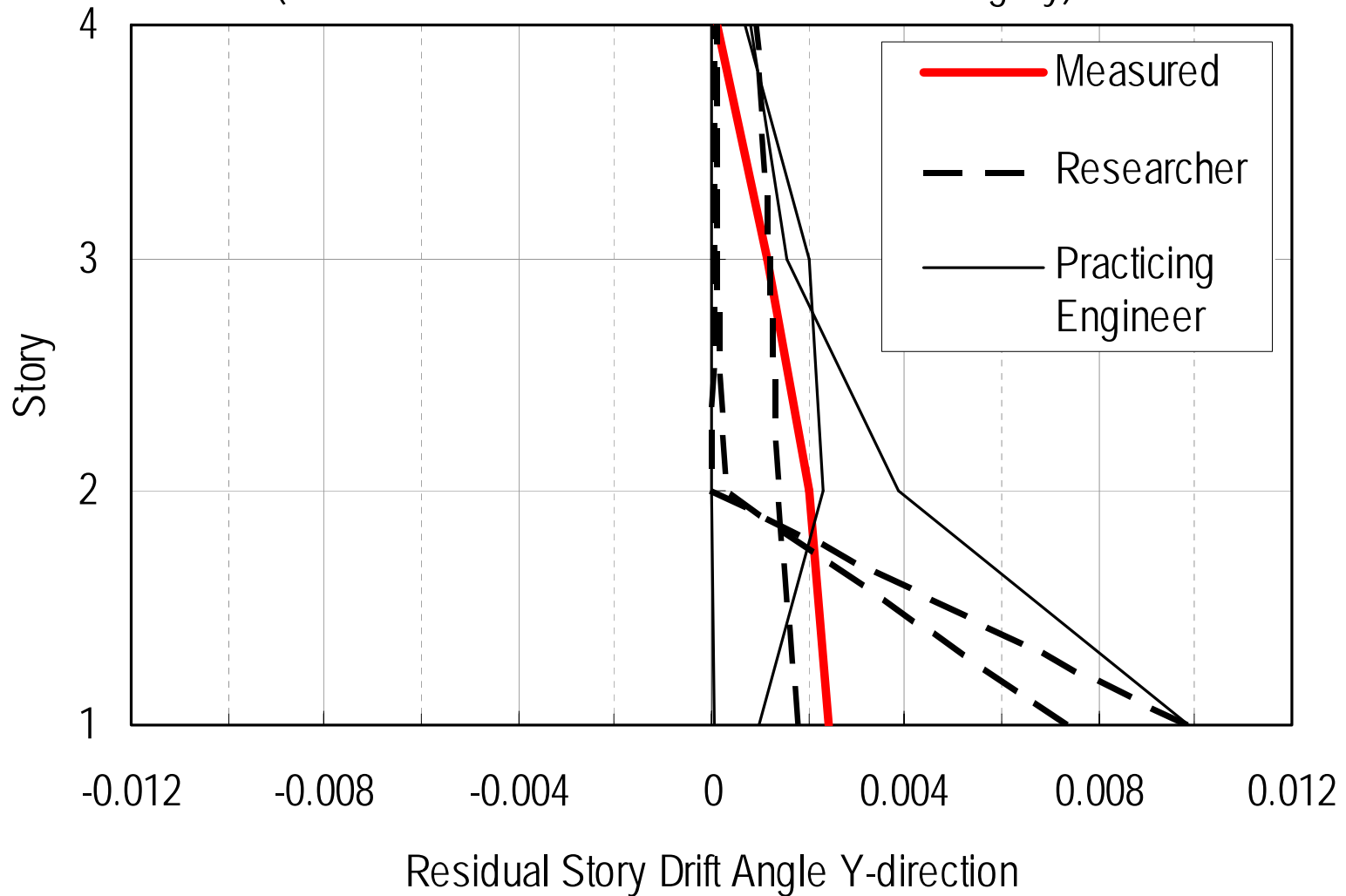


3D Analysis Blind Prediction Results  
Maximum Story Drift Angle X-direction  
(Measured and Best 3 Teams of Each Category)



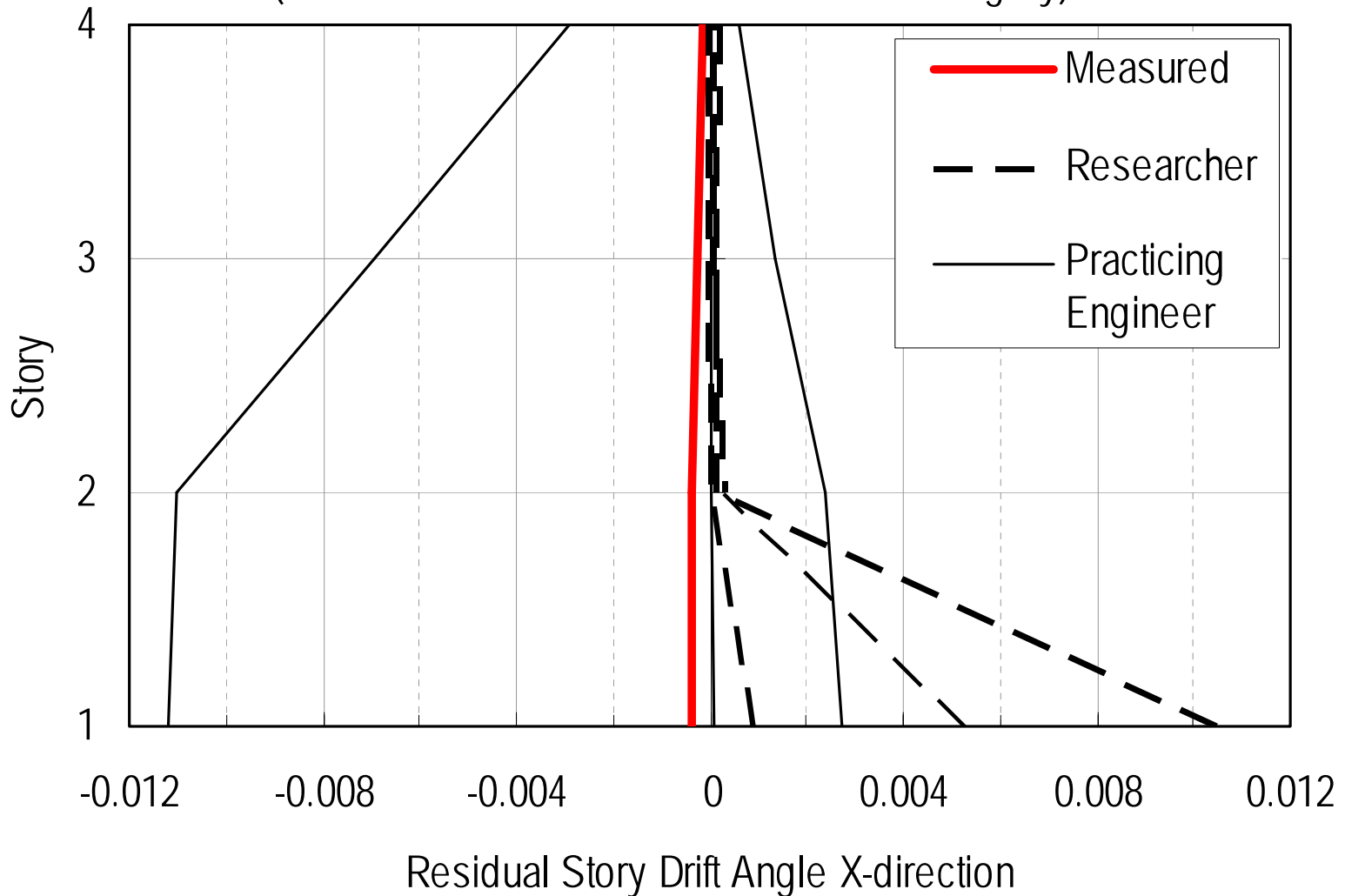


3D Analysis Blind Prediction Results  
Residual Story Drift Angle Y-direction  
(Measured and Best 3 Teams of Each Category)



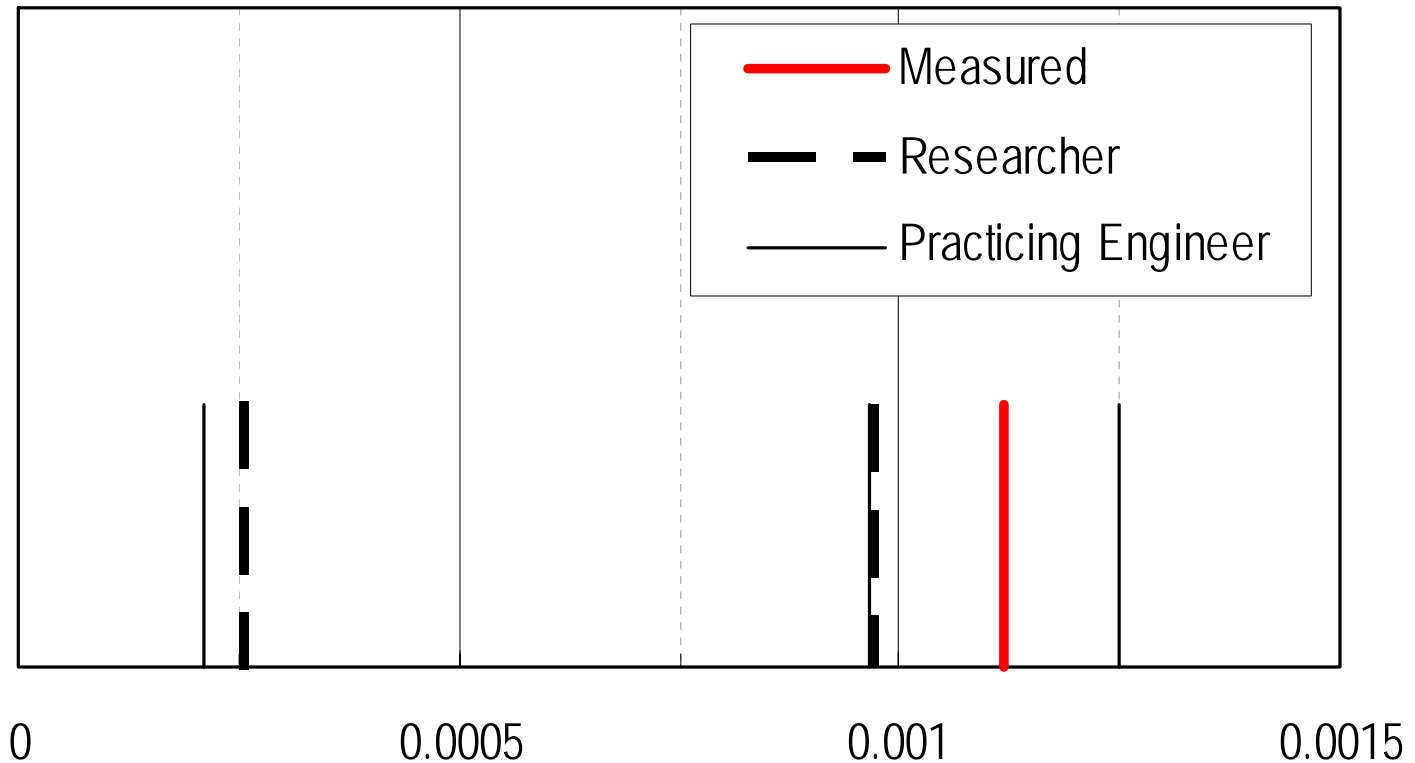


3D Analysis Blind Prediction Results  
Residual Story Drift Angle X-direction  
(Measured and Best 3 Teams of Each Category)





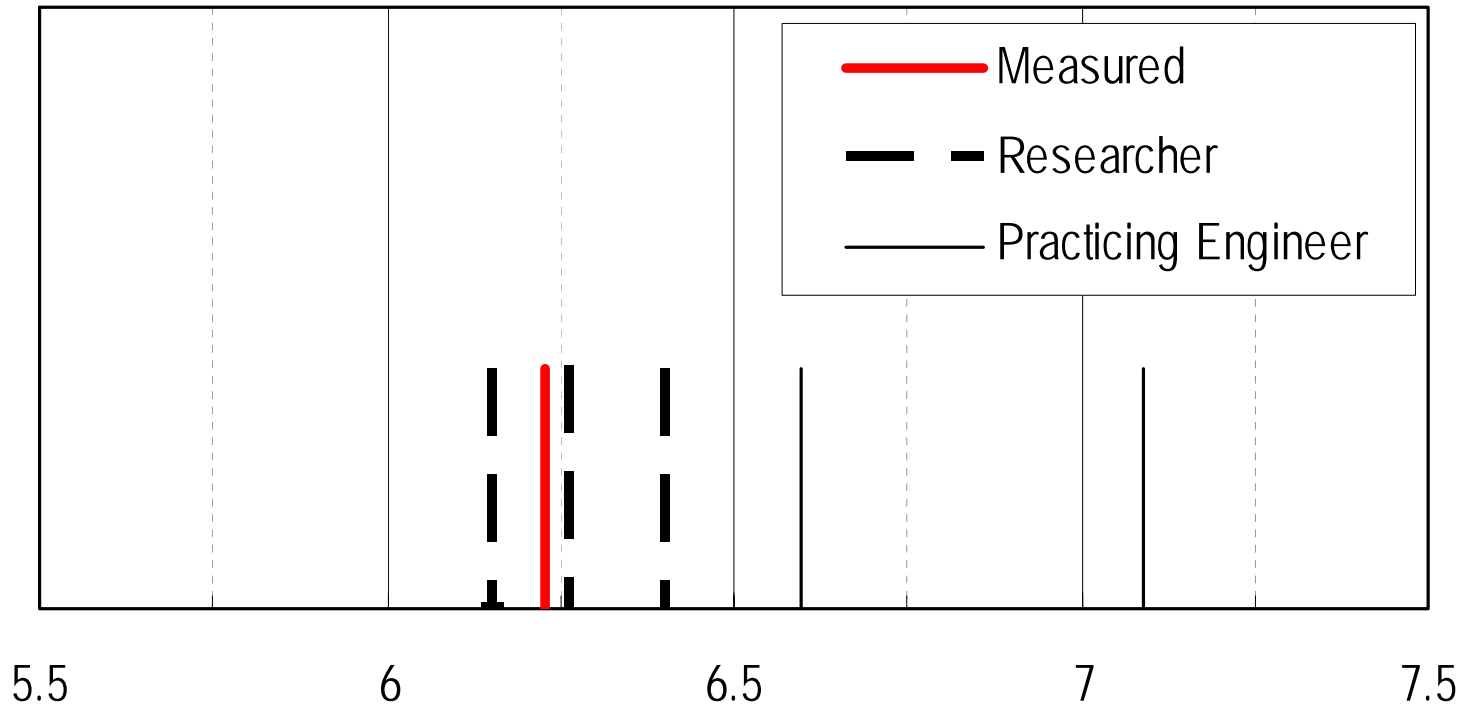
3D Analysis Blind Prediction Results  
Axial Strain at the Column  
(Measured and Best 3 Teams of Each Category)



Axial Strain at the Column  
One of the Researchers made no Answer.



3D Analysis Blind Prediction Results  
Time at which any story-drift-angle  
reaches 0.13 or -0.13 rad  
(Measured and Best 3 Teams of Each Category)



Time at which any story-drift-angle reaches 0.13 or -0.13 rad(sec)  
One of the Practicing Engineers answered that any  
story-drift-angle didn't reach 0.13 or -0.13 rad.



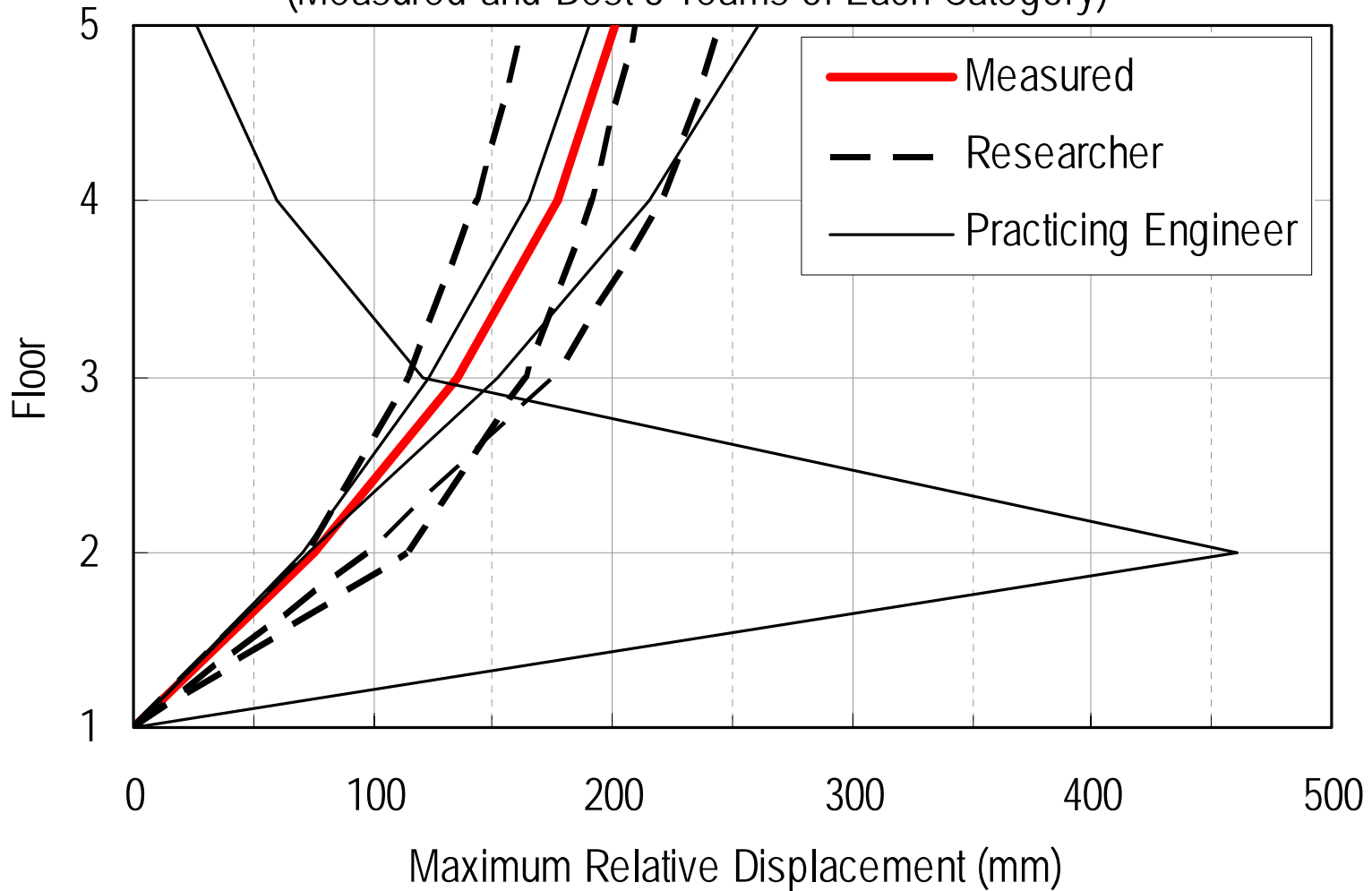
# 2D Analysis Results

(Measured and Best 3 teams)



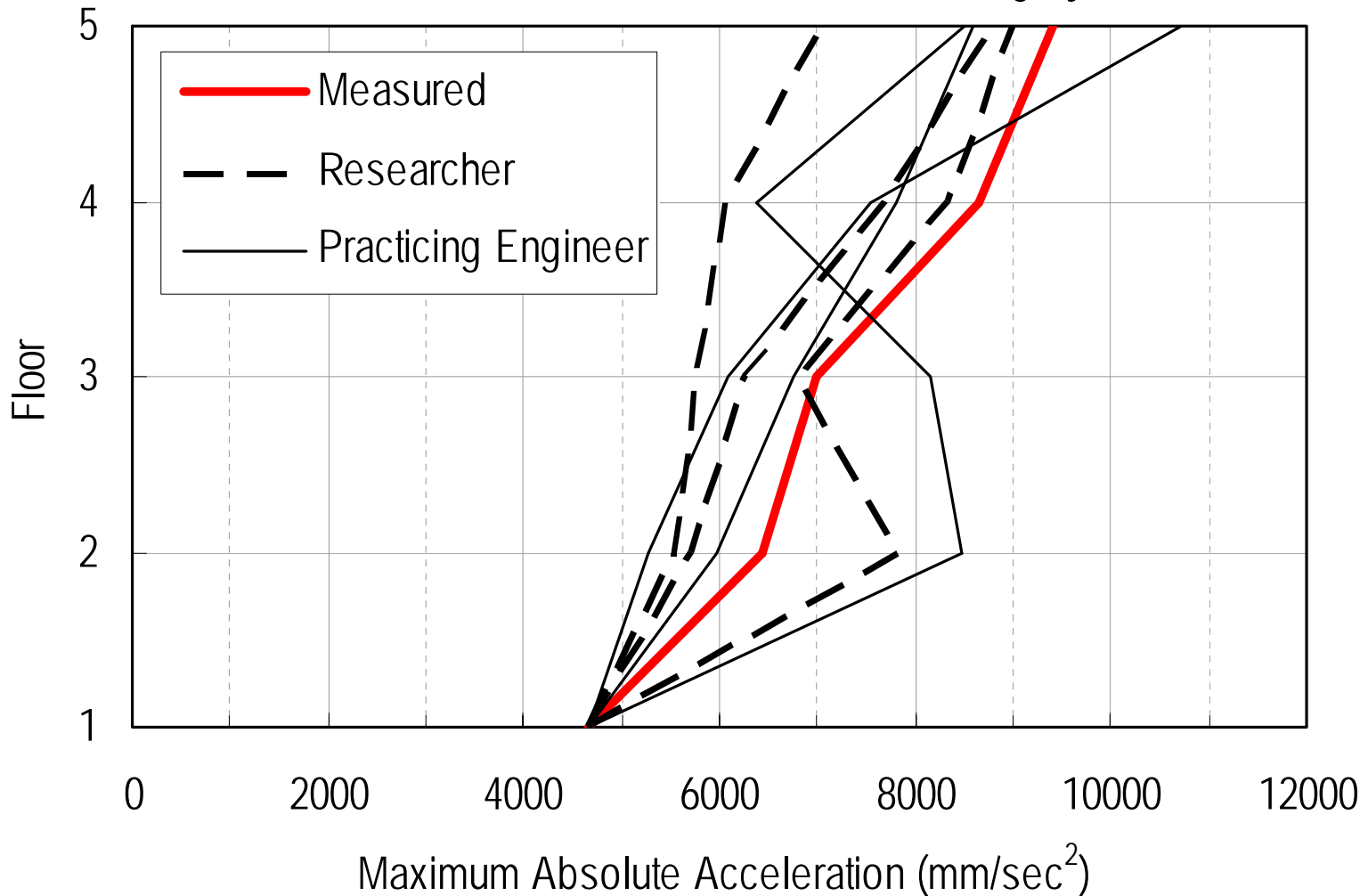


2D Analysis Blind Prediction Results  
Maximum Relative Displacement  
(Measured and Best 3 Teams of Each Category)



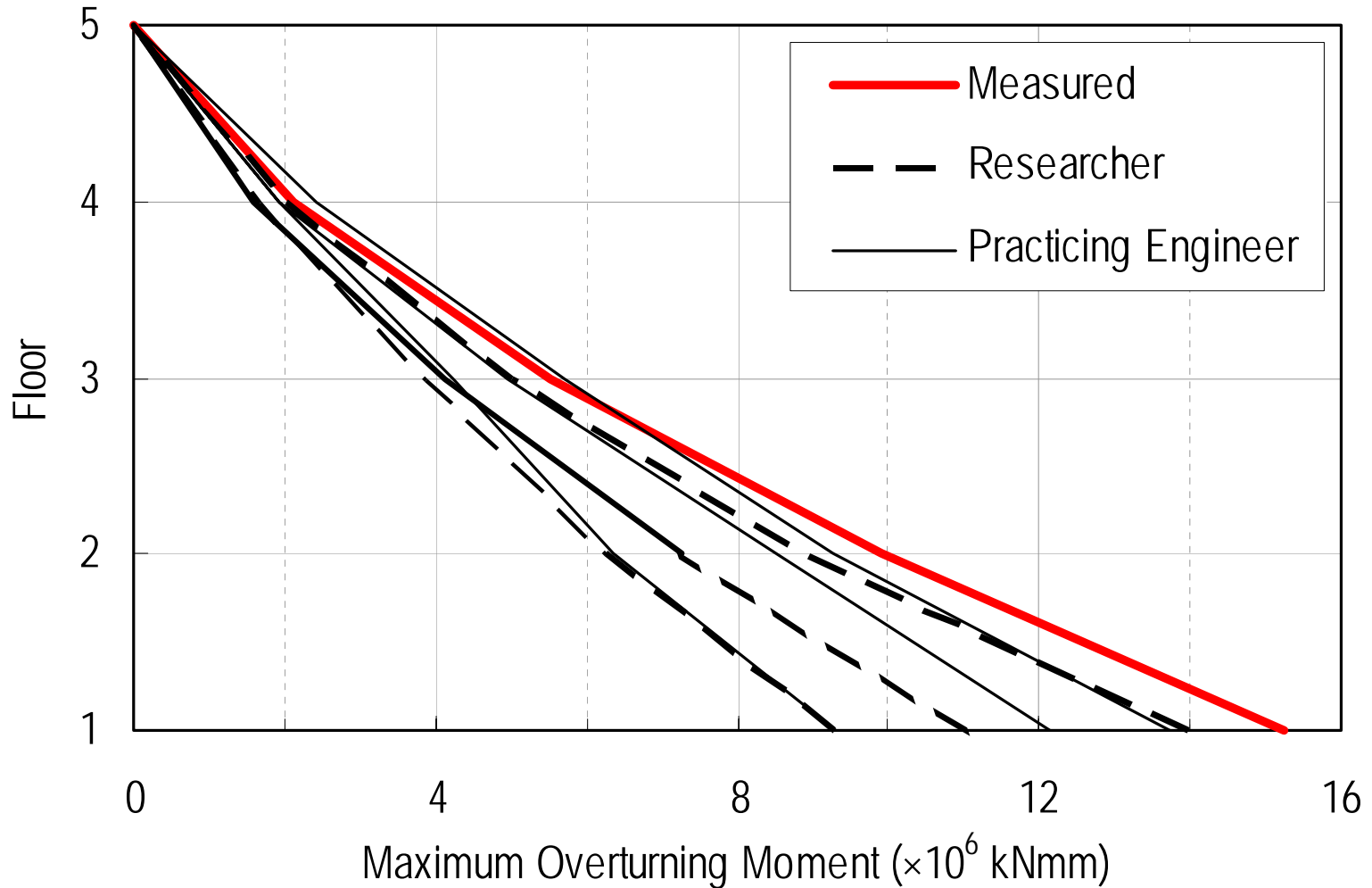


2D Analysis Blind Prediction Results  
Maximum Absolute Acceleration  
(Measured and Best 3 Teams of Each Category)



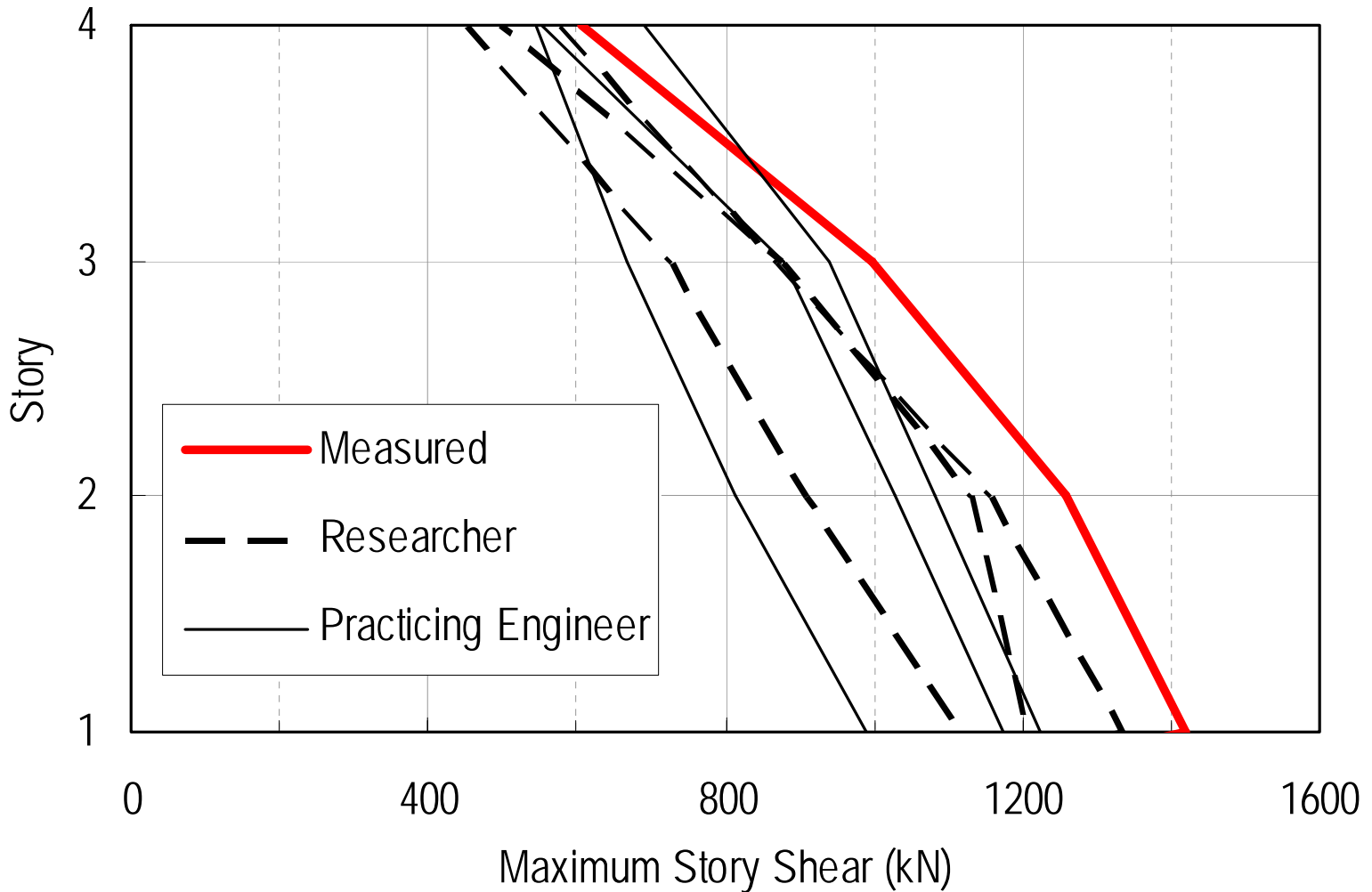


2D Analysis Blind Prediction Results  
Maximum Overturning Moment  
(Measured and Best 3 Teams of Each Category)



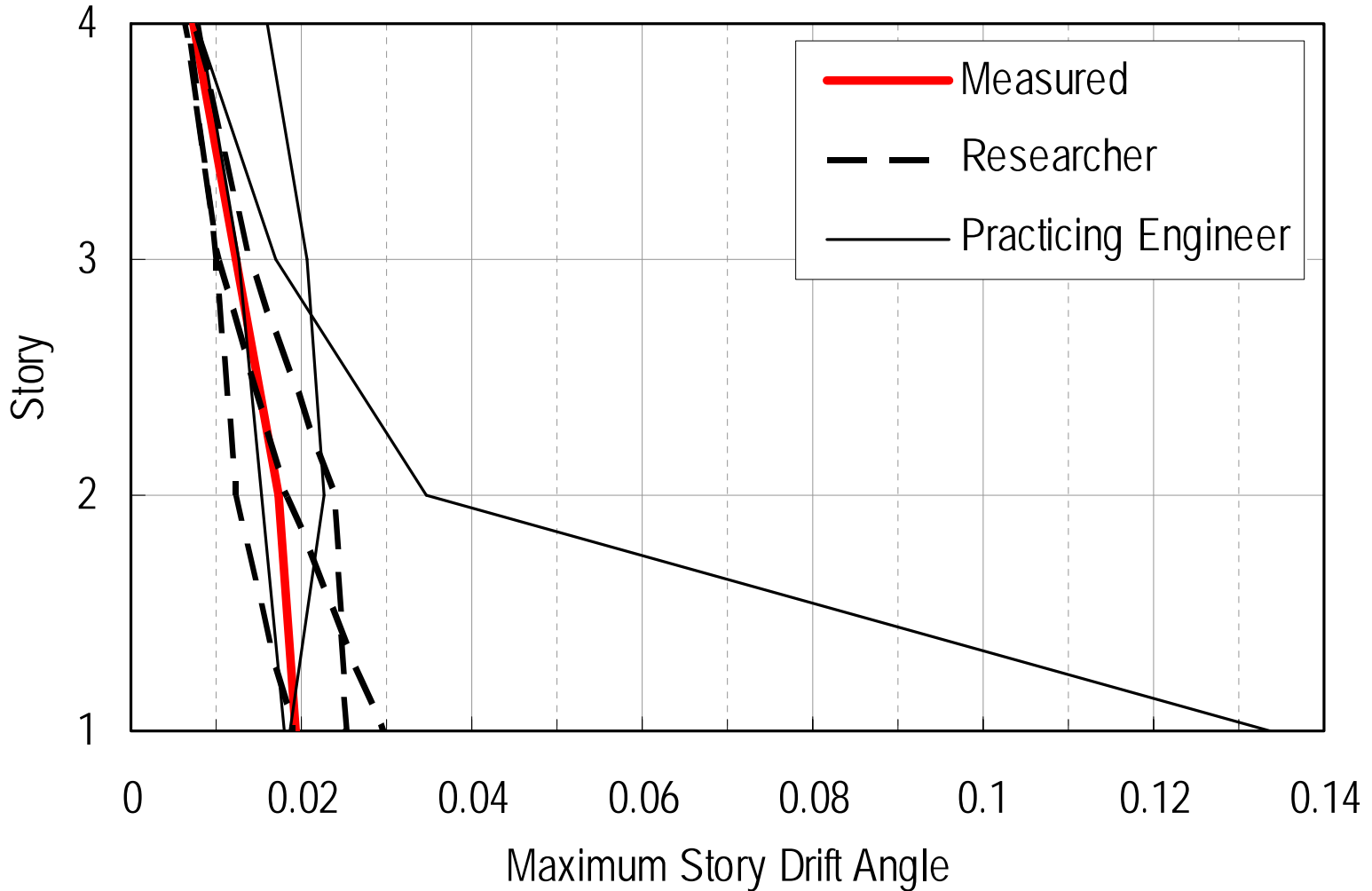


## 2D Analysis Blind Prediction Results Maximum Story Shear (Measured and Best 3 Teams of Each Category)





2D analysis Blind Prediction Results  
Maximum Story Drift Angle  
(Measured and Best 3 Teams of Each Category)

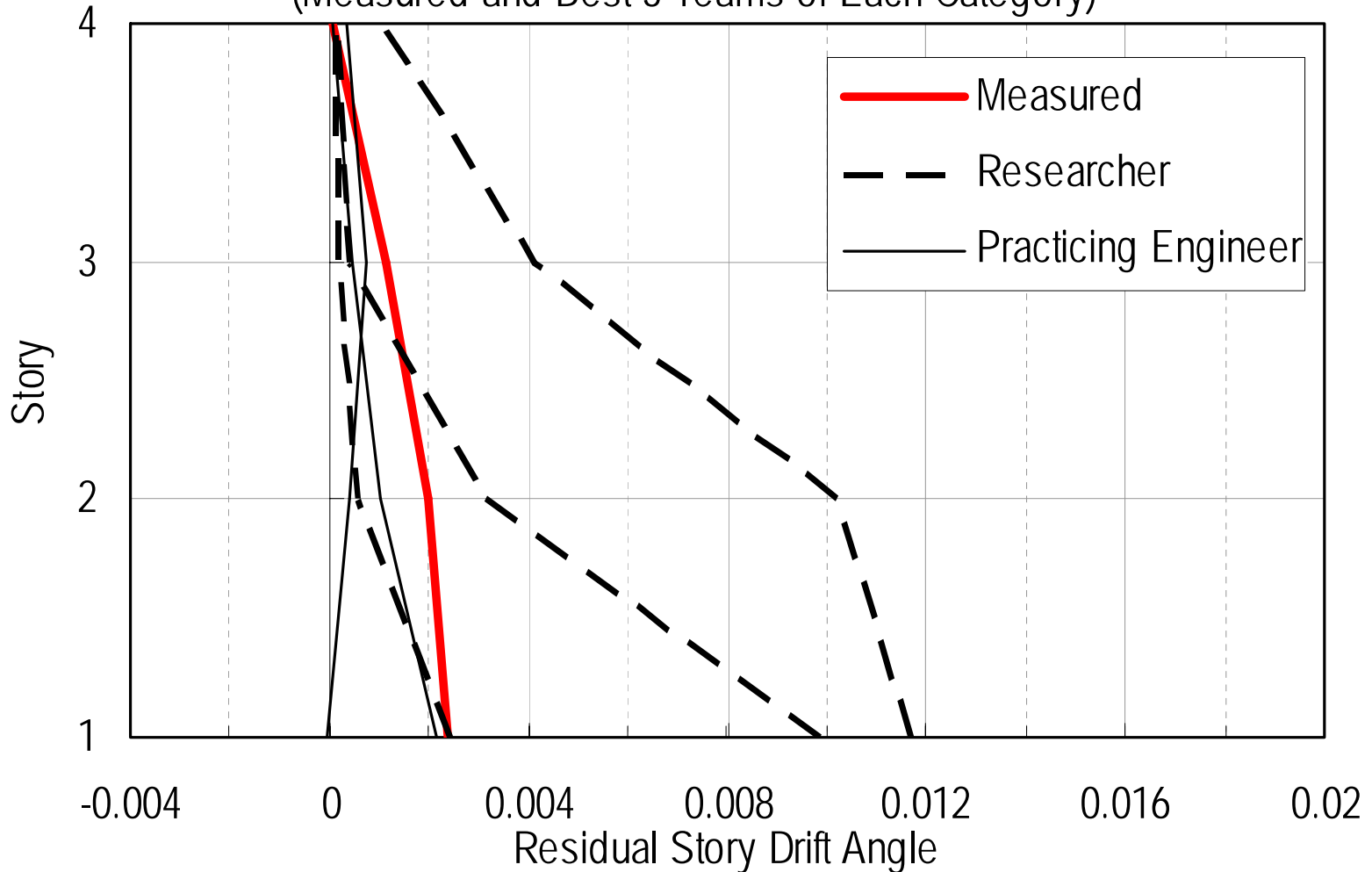




## 2D Analysis Blind Prediction Results

### Residual Story Drift Angle

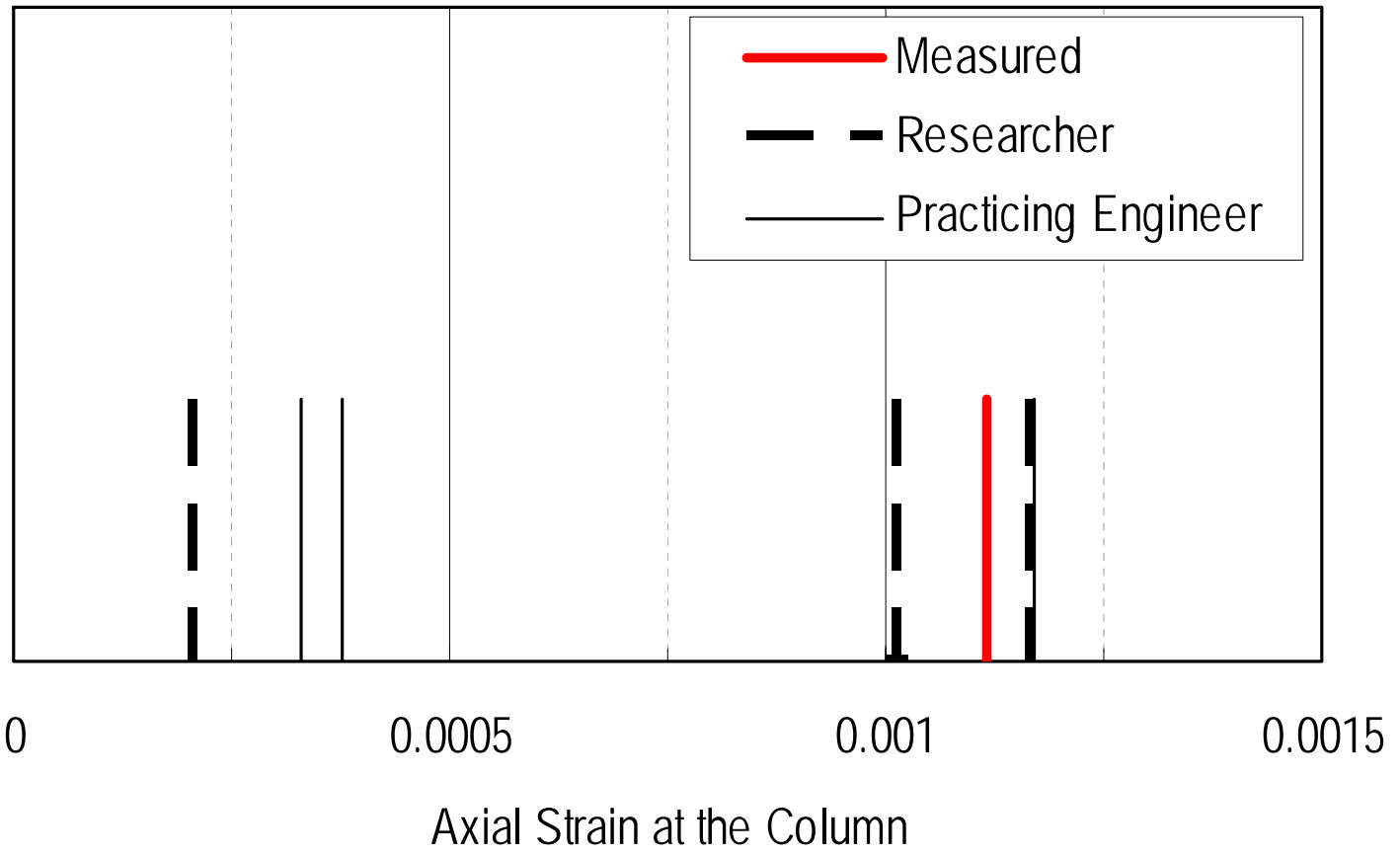
(Measured and Best 3 Teams of Each Category)



One of the Practicing Engineers made no Answer.

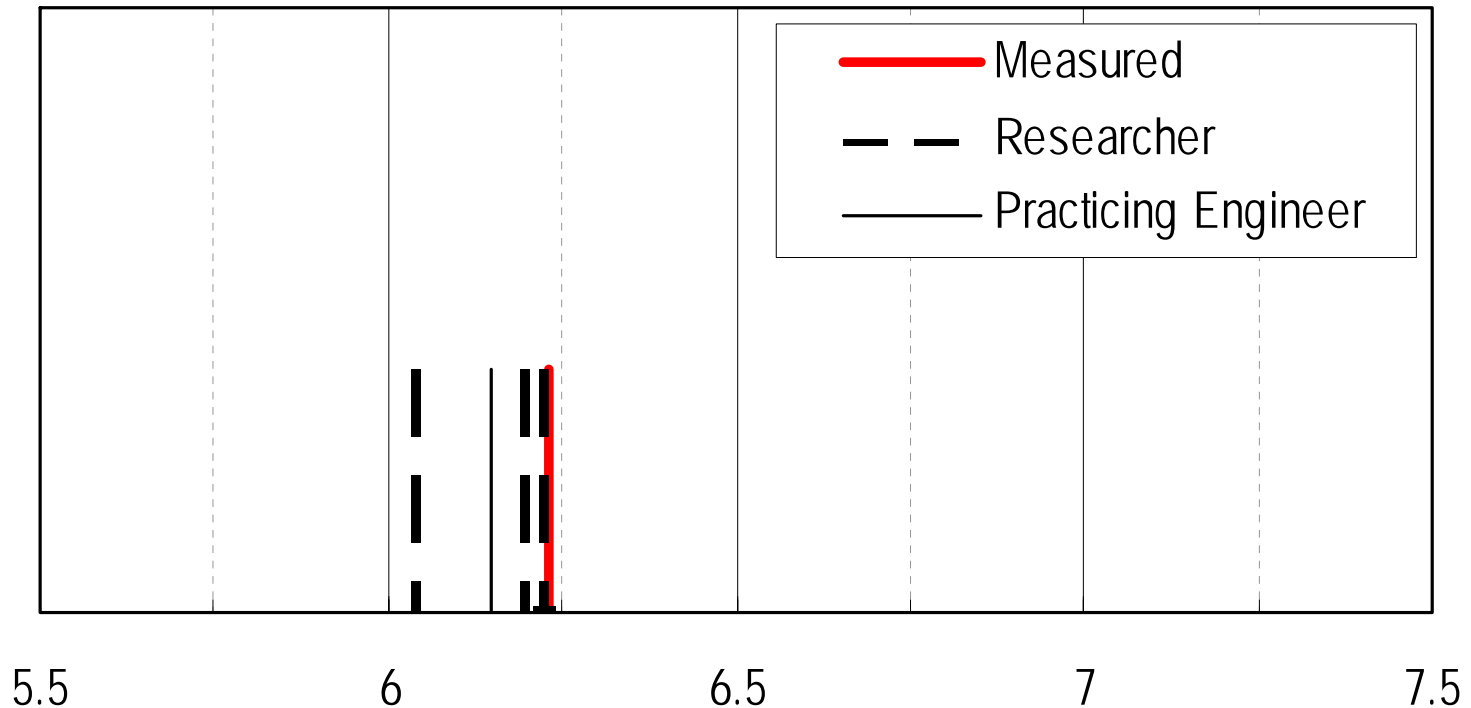


2D Analysis Blind Prediction Results  
Axial Strain at the Column  
(Measured and Best 3 Teams of Each Category)





2D Analysis Blind Prediction Results  
Time at which any story-drift-angle  
reaches 0.13 or -0.13 rad  
(Measured and Best 3 Teams of Each Category)



Time at which any story-drift-angle reaches 0.13 or -0.13 rad(sec)  
Two of the Practicing Engineers answered that any  
story-drift-angle didn't reach 0.13 or -0.13 rad.





## ~ Winners ! ~

Winners will be invited to and will be awarded at the 14th World Conference on Earthquake Engineering(WCEE),2008,Beijing,P.R.China.

### Category1 3D Analysis Researcher

Ganesh Thiagarajan, Rini Mitra, and Shivaji E Jagtap  
University of Missouri, Kansas City, U.S.

Yuan-Sen Yang, Min-Lang Lin, and Zheng-Kuan Lee  
National Center for Research on Earthquake Engineering , Taiwan

### Category2 3D Analysis Practicing Engineer

Yoshiyuki Komiya , Takeyoshi Fujinami , and Yasunobu Nose  
Maeda Corporation , Japan

### Category3 2D Analysis Researcher

Takayuki Sone , Masashi Yamamoto, Yukio Ohmiya, and another 7 people  
Takenaka Technical Research Institute, Japan

### Category4 2D Analysis Practicing Engineer

Shinichi Kiriya, Shinji Nakata, Atsuo Washizu, and another 2 people  
Asahi Kasei Homes Corporation, and Ebisu Building Laboratory, Japan



## **Category1 (3D Analysis, Researcher) Best 3 Teams**

**Winner (42 pt.)**

Ganesh Thiagarajan, Rini Mitra, and Shivaji E. Jagtap  
University of Missouri, Kansas City, U.S.

**Winner (42 pt.)**

Yuan-Sen Yang, Min-Lang Lin, and Zheng-Kuan Lee  
National Center for Research on Earthquake Engineering, Taiwan

**3rd-place (26 pt.)**

Chen Xuwei, and Peng Qiaobin  
Tall Building Structure Research Institute, South China  
University of Technology, Guang Zhou, China



## Category2 (3D Analysis, Practicing Engineer) Best 3 Teams

Winner (57 pt.)

Yoshiyuki Komiya ,Takeyoshi Fujinami ,and Yasunobu Nose  
Maeda Corporation , Japan

2nd-place (39 pt.)

Ayman Shama  
Parsons, U.S.

3rd-place (37 pt.)

Ali Ashrafi, Elisabeth Malsch , and Navid Allahverdi  
Thornton Tomasetti Inc., U.S.



## Category3 (2D Analysis, Researcher) Best 3 Teams

### Winner (37 pt.)

Takayuki Sone, Masashi Yamamoto, Yukio Ohmiya, and another 7  
Takenaka Technical Research Institute, Japan

### 2nd-place (24 pt.)

Yuan-Tao Weng, Bo-Zhou Lin, Jui-Liang Lin, and Yi-Jer Yu  
National Center for Research on Earthquake Engineering, Taiwan

### 3rd-place (18 pt.)

Yuan-Sen Yang, Zheng-Kuan Lee, and Min-Lang Lin  
National Center for Research on Earthquake Engineering , Taiwan



## **Category4 (2D Analysis, Practicing Engineer) Best 3 Teams**

### **Winner (37 pt.)**

Shinichi Kiriya, Shinji Nakata, Atsuo Washizu, and another 2  
Asahi Kasei Homes Corporation, and Ebisu Building Laboratory, Japan

### **2nd-place (35 pt.)**

Ali Ashrafi , Elisabeth Malsch , and Navid Allahverdi  
Thornton Tomasetti Inc., U.S.

### **3rd-place (22 pt.)**

Hiroshi Tajimi, Ogihara Yukio, and another 4  
Parsons, and Nihon University, Japan



# Category4 (2D Analysis, Practicing Engineer) Special Participant Team

## Special Participant Team (39pt.)

Bruce Maison\*, Kazuhiko Kasai\*\*, and Gregory Deierlein\*\*\*

\* Structural Engineer, U.S.

\*\* Tokyo Institute of Technology, Japan

\*\*\* Stanford University

The Maison, Kasai, and Deierlein team had the best predictions for the category of 2D-Analysis by Practicing Engineers. The team faithfully followed contest rules, but they are closely associated with the NEES/E-Defense Collaborative Research Program on Steel Structures. Thus, so to avoid any appearance of impropriety, the team has respectfully declined the monetary award.