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CKBF1

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## ***Impact of Using Knee Elements to Improve Cyclic Performance of Chevron & Diagonal Braced Steel Frames***

Seyed Mehdi Zahrai , Saeed Bahram Masjedbari

### ***ABSTRACT***

Braced frames have been known as frequently used earthquake resistant systems. If a limited length of a member in such a bracing system can undergo ductile behavior, the structure would sustain in a reliable performance, dissipating a large amount of seismic energy during earthquake. Knee Braced Frames, KBFs, are among the ductile systems having such mechanisms. In this paper, single-story single-bay steel Diagonal and Chevron Knee Braced Frames (DKBF & CKBF) with different configurations have been modeled using ANSYS software and their lateral behavior have been studied and compared. Comparing the hysteretic curves and ductility factors, better performance of CKBF compared with DKBF has been found due to its more knee elements and thus having higher damping. In two similar frame configurations, CKBF1 reaches to 25 mm displacement while DKBF2 displacement limits to 15 mm, such that following the same loading protocol, ductility factor of CKBF1 is 60% more than that of DKBF2. Comparing VonMises and shear stress contours for knee elements, shows the fact that the more symmetric the KBF, the more efficient the knee element in dissipating energy leading to using the whole section capacity.

**KEYWORDS :** Diagonal Bracing, Chevron Bracing, Knee element, Hysteretic curve, Stress Contour, Ductility

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$$\begin{aligned}
 & \left( \begin{array}{c} \vdots \\ \vdots \\ \vdots \end{array} \right) \left( \begin{array}{c} \vdots \\ \vdots \\ \vdots \end{array} \right) \\
 & \left[ \begin{array}{c} \vdots \\ \vdots \\ \vdots \end{array} \right] \\
 & \quad M_p/V_p \\
 & \quad M_p \quad V_p \quad / \quad M_p/V_p \\
 & \left[ \begin{array}{c} \vdots \\ \vdots \\ \vdots \end{array} \right] \left( \begin{array}{c} \vdots \\ \vdots \\ \vdots \end{array} \right) \\
 & - \left[ \begin{array}{c} \vdots \\ \vdots \\ \vdots \end{array} \right] \left[ \begin{array}{c} \vdots \\ \vdots \\ \vdots \end{array} \right] \left[ \begin{array}{c} \vdots \\ \vdots \\ \vdots \end{array} \right]
 \end{aligned}$$

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DKBF1			IPB 140	IPE 180	2UNP 100	IPE 140
DKBF2			IPB 140	IPE 200	2UNP 140	IPE 140
DKBF1			IPB 140	IPE 180	2UNP 100	IPE 140
DKBF2			IPB 140	IPE 180	2UNP 100	IPE 140

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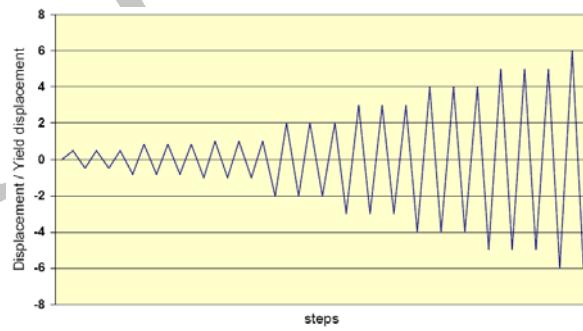
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$$F_u = 3700 \text{ kg/cm}^2; F_y = 2400 \text{ kg/cm}^2$$

$$E = 2.1 \times 10^6 \text{ kg/cm}^2; \nu = 0.3$$

E  $F_u$   $F_y$   
v

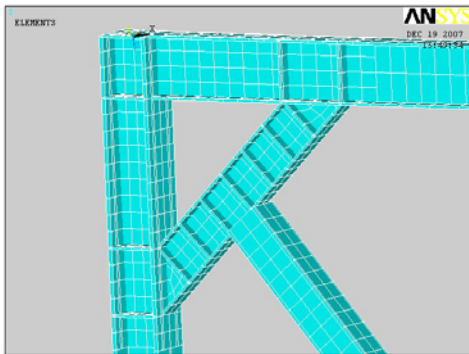
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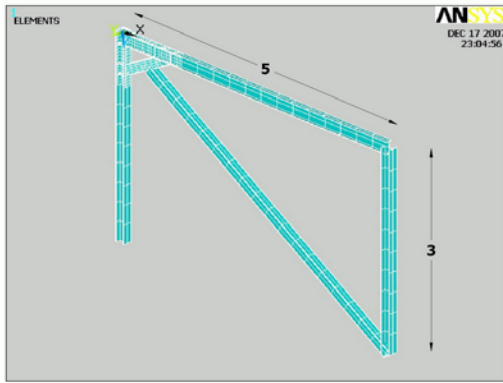
DKBF1



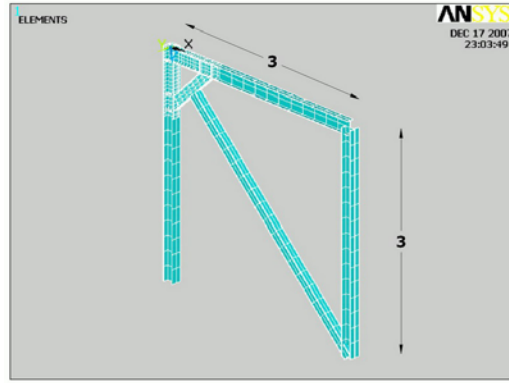
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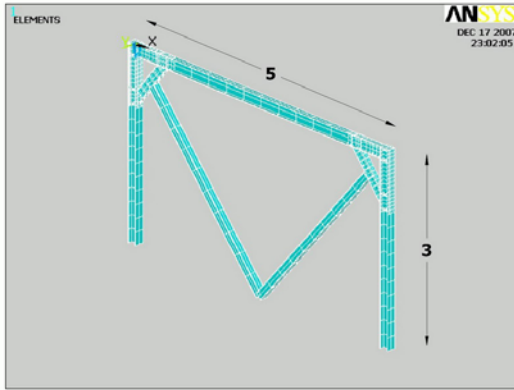
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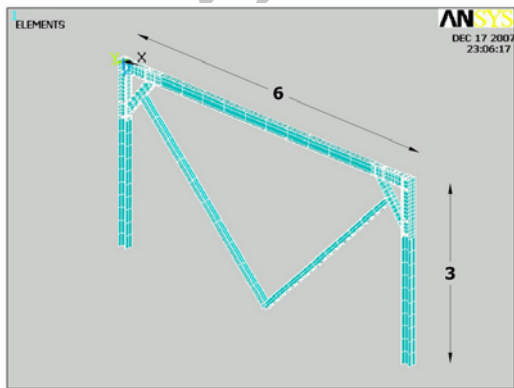


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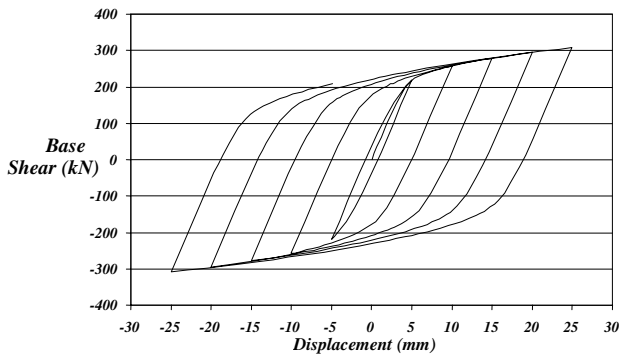
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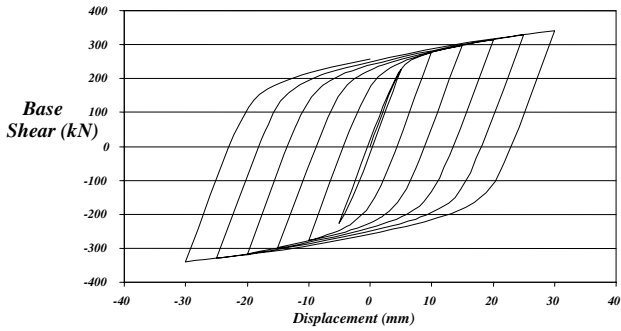


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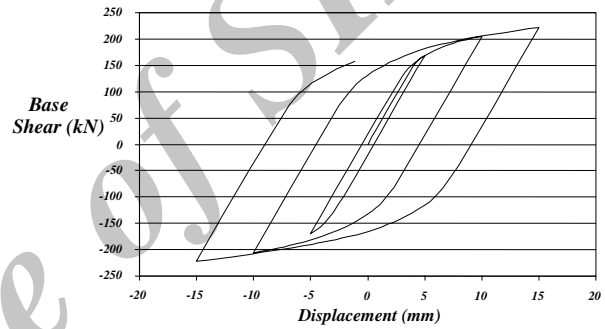
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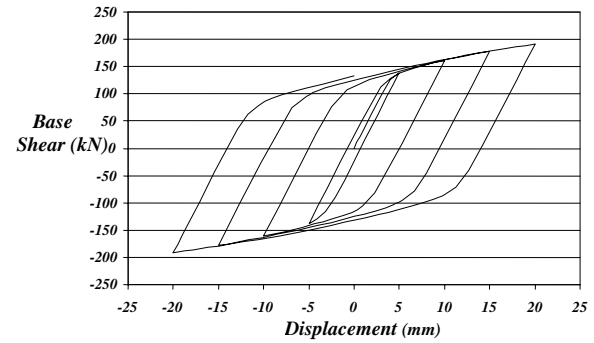
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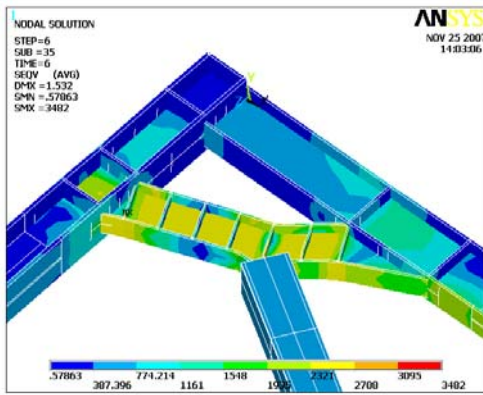
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 ( $\Delta_{max}$ )  
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 (B/H)

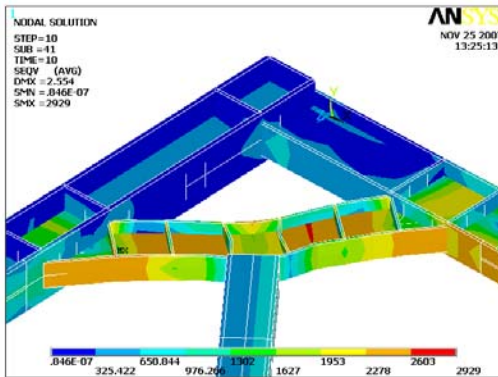
" $\mu = (\Delta_{max} / \Delta_y)$ "



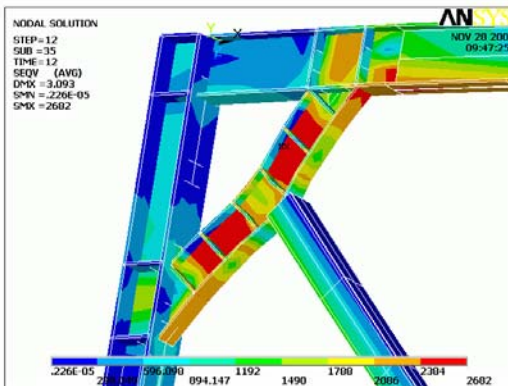
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CKBF1 : ( )



CKBF2 : ( )

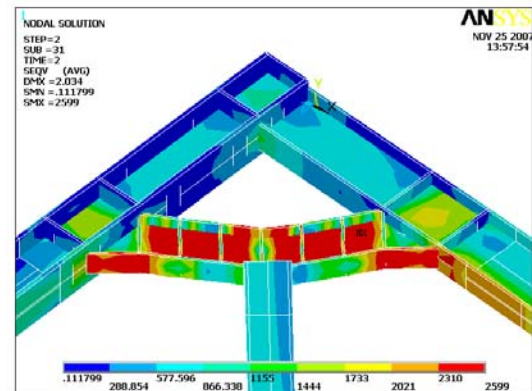
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DKBF1 : ( )

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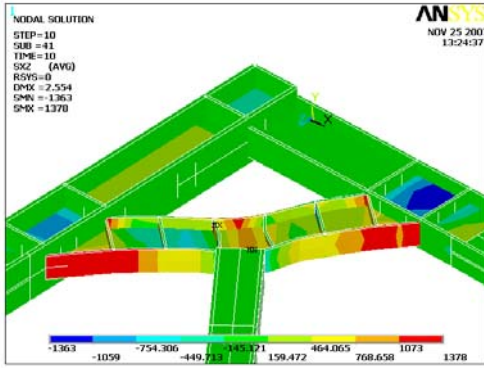
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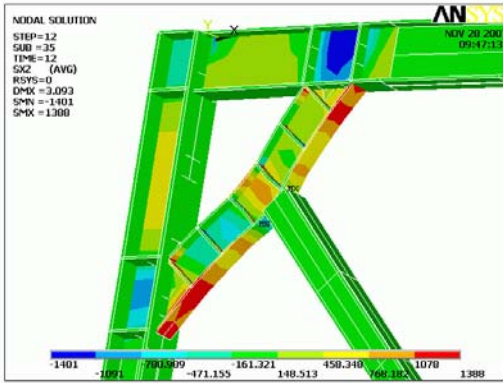
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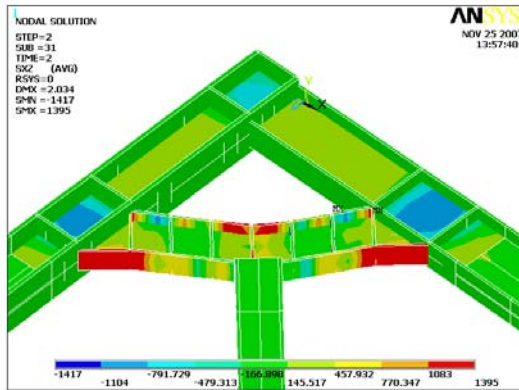
نمونه مورد بررسی	$\Delta_{max} (mm)$	$\Delta_y (mm)$	$\mu$
DKBF1	/	/	/
DKBF2	/	/	/
CKBF1	/	/	/
CKBF2	/	/	/



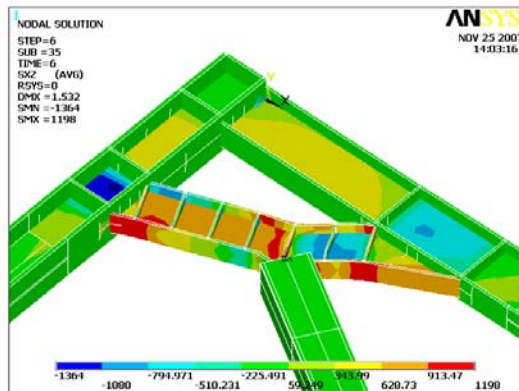
CKBF1 : ( )



CKBF2 : ( )



DKBF1 : ( )



DKBF2 : ( )

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		CKBF2	CKBF1
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Centrically Braced Frame, CBF  
 Eccentrically Braced Frame, EBF  
 Link Beam  
 Knee-Braced-Frame, KBF  
 SHELL ELEMENT  
 BEAM ELEMENT