A new approach on pre-bent steel strips as seismic energy-dissipation devices

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Abstract

In this study, a new type of seismic energy-dissipative devices in the form of braces based on pre-bent strips has been utilized. In this approach, moment-resistance frame systems have been used in 5story and 2 bay frames. The height of stories and all spans length are 3m.In order to compare the response of models, braced (with damper) and unbraced (without damper), have been modeled. Pre-bent steel strips have been used in braced frames. Bilinear strain-stress model of mild steel has been used in this simulation. The responses of structures with dampers and without dampers under dynamic loading have been compared. The results show that seismic responses such as base shear, story acceleration, and story velocity of 3, 5 story frames with dampers have been improved (reduced). A series of time history inelastic dynamic analyses have been conducted and the results show the feasibility and effectiveness of using the utilized devices as seismic dampers to reduce structural responses such as base shear, acceleration, velocity, and displacement of stories. This new kind of dissipative devices control seismic damage and reduce story responses under cyclic loading.

Keywords: pre-bent strips, response of structure, damper, energy dissipation

1. Introduction

Vibration isolation via pre bent struts has studied in recent years [1-4].Isolation method used to reduce seismic responses of structure by suitable equipment. One of this equipment is energy dissipation device. Energy dissipaters are convenient option for earthquake-resistant design of buildings and the civil engineering construction since they absorb most of input energy. Pre bent struts are made of metallic strips bent into an arch shape whose stiffness decrees with increasing curvature of the arc. Virgin and Davis [1] developed a vibration isolation system using two parallel simply-supported buckled struts.Plaut*et al*.[2]considered a pre-bent column with clamped ends as the vibration isolator.
Plaut*et al*. [3] and Jeffers et al. [4] father investigated the control effectiveness of either a single-column isolator or double with viscoelastic filler on a horizontal rigid bar under simple-harmonic base motion in the vertical direction.Yen-Po Wang and *et al* [5].pre bent steel strips and investigated the fundamental principle of pre bent strip and its potential as a seismic damper.
Despite buckling being commonly conceived as an unstable structural behavior leading to lateral instability of axially loaded members, a pre-bent strip would become an excellent seismic energy dissipative device if deformed in a guided direction and range. The pre-bent strips investigated so far, however, were considered mostly as spring elements for vibration isolation of equipment. When axially loaded, the pre-bent strips are subjected to geometrically large lateral deformation that may in turn cause the material to deform in elastically, and become energy-dissipative under cyclic loads. This makes it a potential candidate for a seismic structural damper.
The purpose of this study is to utilize and pre bent steel strips as seismic damper by FEM in Abaqus .In this study 3, 5, 7 story frames with two spans (Figure) have been tested. In order to compare the results of seismic loading models have been simulated with and without damper. The seismic responses of these models such as base shear, acceleration, displacement and velocity analyzed to test the feasibility of pre-bent strips as seismic energy dissipater.