

# [Abstract mean to dissipate energy. this principle](https://assignbuster.com/abstract-mean-to-dissipate-energy-this-principle/)

ABSTRACTConventionalmethods of seismic reintegration with concrete shear walls or rigid steelbracing are considered expensive and tedious.

The schedule and tight budgetmeant that these conventional options are not feasible. The principle offriction brake is most widely adopted available method to extract kineticenergy from a moving body. It is the most reliable, effective and economicalmean to dissipate energy. This principle of friction brake have inspired thedevelopment of friction dampers. Similar to automobiles, the motion ofvibrating building can be slowed down by dissipating energy in friction.

Several types of friction dampers have been developed. For frame buildings, these are available for tension cross bracing, single diagonal bracing, chevronbracing, and friction connectors at expansion joints to avoid pounding. Thepaper gives the study of different literature investigation taken on frictiondamper. —————————————————————————————————————————————I. INTRODUCTIONNow-a-days, structural control is an advanced technology in the field of engineering to equipenergy dissipation devices or control systems into structures to reduceexcessive structural vibration, enhance human comfort and prevent catastrophicstructural failure due to strong winds and earthquakes. Structural controltechnology can also be used for retrofitting of historical structuresespecially against earthquakes. The approach to vibration control of structuresis with vibration damping that is added to a structure either passively oractively. This damping dissipates some of the vibration energy of a structureby either transforming it to heat or transferring it directly to a connectedstructure.

By utilizing viscoelastic material as well as dashpots, andappending the structures with control devices are the most common ways ofadding damping treatment to structures. Effective damping can result byproperly treating the structure, which is not damped adequately withviscoelastic materials. In addition, viscous dampers, tuned-mass dampers, friction dampers, dynamic absorbers, shunted piezoceramics dampers, andmagnetic dampers are other mechanisms that are used for passive vibrationcontrol.

FRICTIONDAMPERFor centuries, mechanical engineers have successfullyused the concept of the friction brake to control the motion of machinery andautomobiles. This concept is widely used to extract kinetic energy from amoving body as it is the most effective, reliable and economical mean todissipate energy. The development of friction-damping devices was pioneered inthe late seventies (Pall 1979, Pall 1981).

Friction dampers suitable fordifferent types of construction have been developed for 1) Concrete shear walls, both precast and cast-in-place (Pall 1980, Pall 198l); 2) Braced steel/concreteframes (Pall 1982); 3) Low-rise buildings (Pall 1981); and 4) Clad-frameconstruction (Pall 1989). Patented Pall friction-dampers are available for: tensioncross bracing; single diagonal bracing; chevron bracing; cladding connections; and friction base isolators. These friction dampers meet a high standard ofquality control.

Every damper is load tested to ensure proper slip load beforeit is shipped to site. Pall friction-dampers are simple and fool-proof inconstruction and inexpensive in cost. Basically, these consist of series ofsteel plates which are specially treated to develop most reliable friction. These plates are clamped together with high strength steel bolts and allowed toslip at a predetermined load. Cyclic dynamic laboratory tests have beenconducted on specimen friction-damping devices (Pall 1980, Filiatrault 1986). Their performance is reliable, repeatable and possess large rectangularhysteresis loops with negligible fade over several cycles of reversals that canbe encountered in successive earthquakes.

Fig. Concordia’sLibrary Building Connected with Pall Friction Damper  II. LITERATURE REVIEWImad H. Mualla and Borislav Belev (2002) investigatedthe performance of a friction damper installed in a single storey steel framesubjected to seismic loading.  Numericalsimulations based on non-linear time history analysis were used to evaluate theseismic behavior of steel frames with inserted FDD. The governing parameterswere identified and their influence was traced and summarized along withimplications for practical design. The results showed that the friction damper can be used improve the dynamicresponse of innovative structures as well as the existing building compared tothe conventional design. W.

L. He et. al. (2003) demonstrated semi activefriction dampers (SAFD) to be more effective than passive friction dampers inreducing the structural response due to earthquakes.

The motion of frictiondampers, either passive or semi active, involves sticking and slipping phases. Twobuildings, a six-story base-isolated building and a three-story fixed basebuilding model, have been used to demonstrate the performance of the proposedcontrol strategies using different far-field and near-field earthquakes. Further, the performances of various combinations of passive and semi activeenergy dissipation devices have been evaluated and compared. Based on numericalsimulation results, it was demonstrated that the proposed semi active frictioncontrol strategies are very effective. A. V. Bhaskararaoand R.

S. Jangid (2004) investigated on seismicresponses of two adjacent structures which was modelled as single degree offreedom (SDOF) structures connected with a friction damper. Friction dampersconnected to two numerical models were also proposed for multi degree offreedom structures (MDOF) as the process involved was quite cumbersome as somedampers were required to be vibrated in sliding phase and the rest innon-sliding phase. They found that the two numerical models were predicting thedynamic behavior of the two connected SDOF structures accurately. The resultsshowed that if the slip force of the friction dampers was selected appropriatelythe different fundamental frequencies of adjacent structures can effectivelyreduce earthquake-induced responses of either structure. They further concludedthat lesser dampers at appropriate locations can significantly reduce theearthquake response of the combined system rather than connecting the dampersat all floors.

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(2008) investigated on recentdevelopments and current codal practices in the application of passive energydissipation systems for seismic protection of structures. The emphasis is onthe application of passive energy dissipation systems within the framing ofbuilding structures. Extensive topics were discussed  which included basic principles of energydissipation systems, descriptions of the mechanical behavior and mathematicalmodeling of selected passive energy dissipation devices, advantages and disadvantagesof these devices, development of guidelines and design philosophy for analysisand design of structures employing energy dissipation devices, and designconsiderations that were unique to structures with energy dissipation devices. Fig. Frame connectedwithout and with passive energy dissipation devices.

Fig. Reduction ofdesign demand due to effective damping. They concluded that thebasic characteristics of the device in terms of its displacement and velocitydependence must be considered in the analysis and design process as explained inthe 2003 NEHRP Recommended Provisions and the 2005 ASCE/SEI 7-05 standard. TheProvisions permit linear static and dynamic analysis under certain conditions.

These methods make use of equivalent linear properties from an assumedelastoplastic pushover capacity curve along with an effective damping ratio topredict the response of the structure. A selection of recent applications ofpassive energy dissipation systems is also presented. Songye Zhu and Yunfeng Zhang (2008) investigated on aspecial type of bracing element termed self-centering friction damping brace(SFDB) for use in seismic-resistant concentrically braced frame (CBF) systems. The SFDB is a passive energy dissipation device with its core re-centeringcomponent made of stranded super elastic nitinol wires while enhanced energydissipation mechanism of the SFDB is achieved through friction.

A comparativestudy of SFDB frame and buckling restrained braced (BRB) frame was carried out, which is based on nonlinear dynamic analysis of two prototype CBF buildings, athree and a six-storey steel frame. The results of the nonlinear time-historyand pushover analysis showed that the SFDB frame can achieve a seismic responselevel comparable to that of the BRB frame while having significantly reducedresidual drifts. The SFDB thus has a potential to establish a new type of CBFsystem with self-centering capability. Fig. Static pushoveranalysis of six-story BRB frame and SFDB frame You-Lin XU and C.

L. Ng(2008) preformed an experiment on control of seismicresponse of a building complex with the use of variable friction damper. Buildingcomplex consisted of a 3-storey podium structure coupled and a 12-storeybuilding.

The performance test was conducted under constant or varying voltage toidentify motion-independent characteristics on the piezo-driven variablefriction damper. Two classes of semi active controllers; local-feedbackcontroller and global-feedback controller, together with a closed-loop operatingscheme was proposed for real-time operation of the damper as percharacterization results. Finally, the building complex was tested in rigid-coupled, uncoupled, semi active damper-coupled, and passive damper-coupledconfigurations. Also the variable friction damper’s performance was examinedfor the building complex and results were compared. The results showed thatsemi active coupling control was promising for reducing seismic responses ofboth buildings.

Brian G. Morgen and Yahya C. Kurama (2008) evaluatedseismic response of unbonded post-tensioned precast concrete moment frames thatused friction dampers at selected beam ends. The parameters investigated includedthe number of stories, number and strength of the dampers, and amount ofpost-tensioning. Nonlinear static and dynamic time history analysis ofprototype structures showed that the dampers provided a considerable amount ofenergy dissipation to a frame, while the post-tensioning force provided arestoring effect resulting in self-centering capability.

The seismic design ofthe structures to achieve target displacement-based performance objectives wascritically evaluated based on the analysis results. The dynamic analysisresults also indicated that, in comparison with post-tensioned precast concreteframes, fully emulative structures that used only mild steel reinforcementthrough the beam-column joints have undergone smaller peak lateraldisplacements; however, they accumulate significant residual displacements atthe end of a ground motion, indicating a larger amount of damage in thestructure. The peak displacement demands for fully post-tensioned frameswithout friction dampers are significantly larger than frames with frictiondampers.

Usha K and Dr. H. R. Prabhakara (2017) analyzed twomodels (i. e. G+3 and G+7) equivalentstatic method, response spectrum method and time history method.

The modelingand analysis was done with SAP 2000 v 14 software and the results that were, seismic parameters such as Time period, Base shear, Lateral displacement andInter storey drift were tabulated and then comparative study of structures withand without Friction dampers has been done. They concluded that lateraldisplacements due to earthquake forces were reduced by providing frictiondampers and the storey drift also reduces shear resistance of the buildingincreases.  III. CONCLUSIONTheseismic performance of the frame can be considerably enhanced by the inclusionof friction damper in the structural system. The dissipation characteristics ofthe friction damper are reliable and the devices are not damaged by largeloads.

By confining the energy dissipation to the friction damper which arespecifically designed to perform under extreme loading conditions withoutsustaining damage, the main structural elements are able to remain elastic. Fromthe literature study it is found that the device provides a significantincrease in the available damping within the structure and that leads to adirect improvement in performance.