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STRUCTURE RESPONSE CONTROL OF R.C.C. FRAME BUILDING USING DAMPERS

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ABSTRACT

InPresentday,thetallBuildingconstructionsareincreasingday-by-day.Recentlytheconstruction industry demands easy, economical, sustainable structures, which are more flexible,light in weight and having low damping value. The probability of failure is increases because oflower damping due to which vibration of building increases. To reduce the dynamic response ofstructure, it become important for structure consumes or dissipated this energy. There are varioustechniquesareusedtodecreasevibrationofstructureandthestructuralsystemhavebeenmodified with the use of mechanical means. Since mechanical means are the part of energydissipationsystem in thebuilding.

Passive control devices which imparts force that is developed in response to the motion of thestructure by absorbing some of the input energy, it reduces the energy dissipation demand on thestructure. Therefore no external power source is required to add energy to the structural system.Passive energy dissipating devices such as the metallic dampers, friction dampers, viscos-elasticdampers and fluid viscous dampers are in use, amongst fluid viscous dampers (FVDs) are foundto have desirable performance to control shock loads. These devices the motion of structure iscontrolledbyaddingdevices to thestructurein theform of stiffness and damping

Keywords: tall Building ,Seismic activities, Response Spectrum Method, fluid viscous dampers,TMD, VFD

INTRODUCTION

Earthquake is one of the major natural hazards to the life on the earth and has affected countless cities and villages of almost every continent. The damaged caused by earthquakes are mostly to man mad structures. Hundreds of small earthquakesoccur around the world every day and every year earthquakes take the lives of thousands of people. Therefore, it is necessary to design structures that are earthquake resistant. Earthquake engineering has gain lots of attention in recent years since it ensures design of safe structures which can safely withstand earthquakes of reasonable magnitude. Now a day uncountable high rise building has been constructed all over the world and the number is increasing day by day. This is not only due to concerned over high density of population in the cities. Construction of this high rise building the major task is to determine the performance of building under different types of loading i.e. Earthquake and wind force. Earthquake generally defined as perceptible shaking and vibration of the earthquake resulting from sudden release of energy in form of seismic wave. Wind force is defined as a body or a structure such as building a tower or a chimney when placed in where the flow of air will experience pressure and forces.As the seismic load acts a building structure is function of self- weight of structure. The structures are made comparatively light in weight for economic. But they have relatively low natural damping in result and structure become more unstable under earthquake load. In these study state of vibration can cause considerable discomfort and dangerous for building occupants. In general building structure having average damping is 5% of critical. Hence new modern construction of tall building is equipped with the manmade devices for vibration control by energy dissipation in such a way that the energy imposed on the structure by earthquake or wind load is dissipated. These manmade devices selected on the basis of particular types of damping devices, efficiency, compactness and weight, capital cost, operating cast and maintenance. The operation of these special devices in initiated by the motion of the structure, they reduce the overall response of the structure and thus meet earthquake resisting design of structure.A tuned mass damper (TMD) system is the most popular passive energy systems which consisting of a mass, a spring, and a damper attached to a vibrating system for reduce undesirable vibrations. And it adjusts the natural frequency of the TMD to be the same or close to the fundamental frequency of the structure. When the main structure is excited, the tuned mass damper through its inertial response will absorb energy and reduce the response of the structure.In the viscous fluid damper the fluid in the cylinder is nearly incompressible, and when the damper is subjected to a compressive force, the fluid volume inside the cylinder is decreased as a result of the piston rod area movement. It device attached to structure for enhancing theperformance because they are reduce the deformation demand and also transferred the force to the structure due to energy dissipation.

OBJECTIVE OF THEWORK

There are many techniques used for vibration control with help of dampers previously, much work has been done with or without dampers, but there are more field which more has to be done, such as use of two or more type's damper. Also, considering the suitability of those dampers for seismic mitigation.

- There are some evaluation needs to be done on various responses of structure, which are described as follow:-
- Comparison of more than one damper in RC building structure.
- Controlling different parameter in both types damper respectably displacement dependent dampers (TMD) and velocity dependent damper (VFD).
- There has been few works on real time history in India for both TMD and VFD.
- It is checking the optimum location of VFD for steel structure

Followingaremajorobjectives ofpresentworkof study:

1. Thefreevibrational analysisis doneofmodel withoutdamper, withTMDandwithVFDandcomparingtheircharacterstics.
2. Calculatetheoptimumdesignparameterfor bothTMDandVFD,andapplyingthisparameterfor timehistoryanalysis of structure.
3. Tounderstandthe usetheconceptof readymadeviscous fluidDamperandcomparetheseVFDwith Traditional Damperdeviceliketuned mass Damper.
4. ToDynamicanalysisisconducton thebuildingwithoutdamper,with TMDandwithVFD.
5. Comparativethedynamicbehaviorof timehistoryanalysisforbuildingwithout damper,withTMD and with VFDareanalyzed byusingreal timehistoryofIndia.

Behaviorofbuildingafter timehistoryanalysis, parametersselectedis responsespectrumacceleration, responsespectrumvelocity,base shear,base displacement, base velocityandthebase accelerationhas beencalculate withoutDamper, withTMDandwith VFD

Result:-

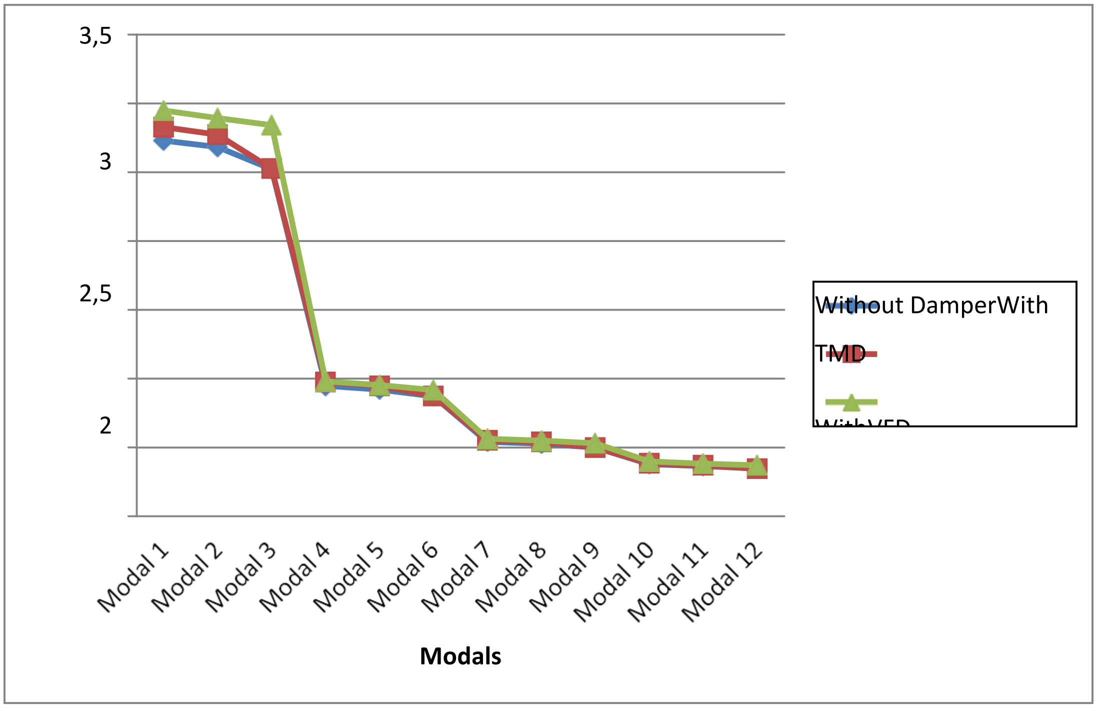

Figure1 ModalTimePeriodFordifferentModals

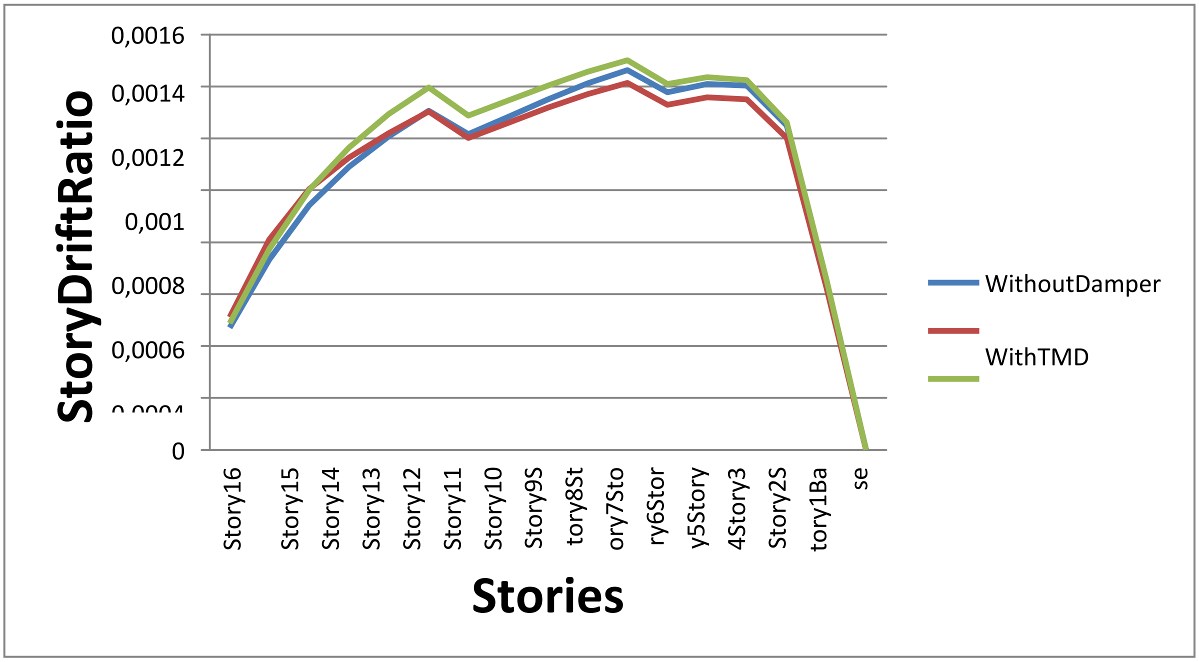

Figure2StoryDrift RatiosinXDirection

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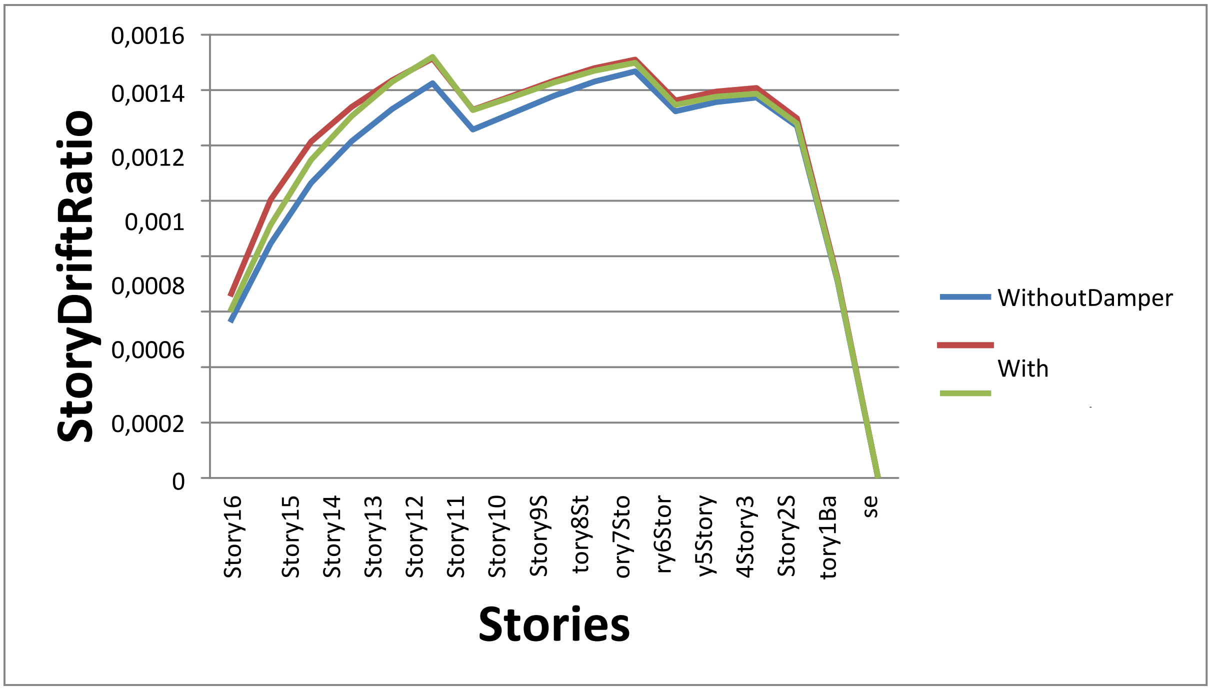

Figure3StoryDrift RatiosinYDirection

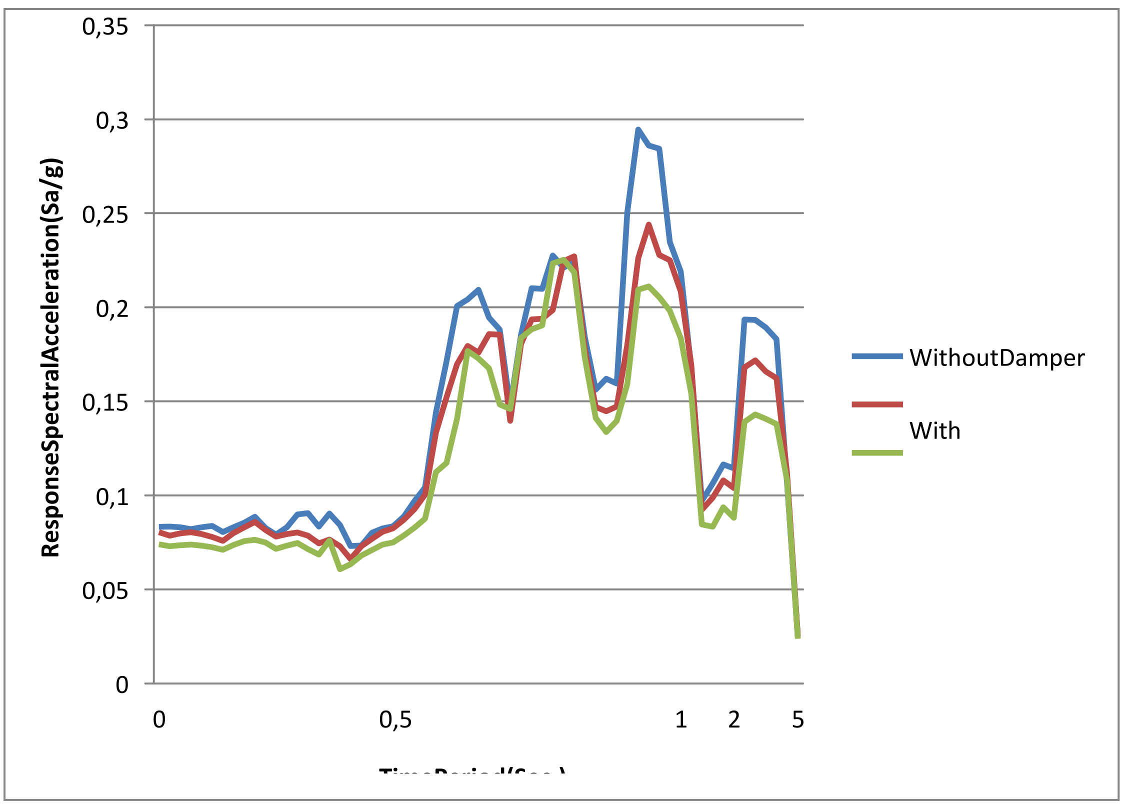

Figure4ResponseSpectralAcceleration(Sa/g)v/sTime Period(Sec.)in X Direction

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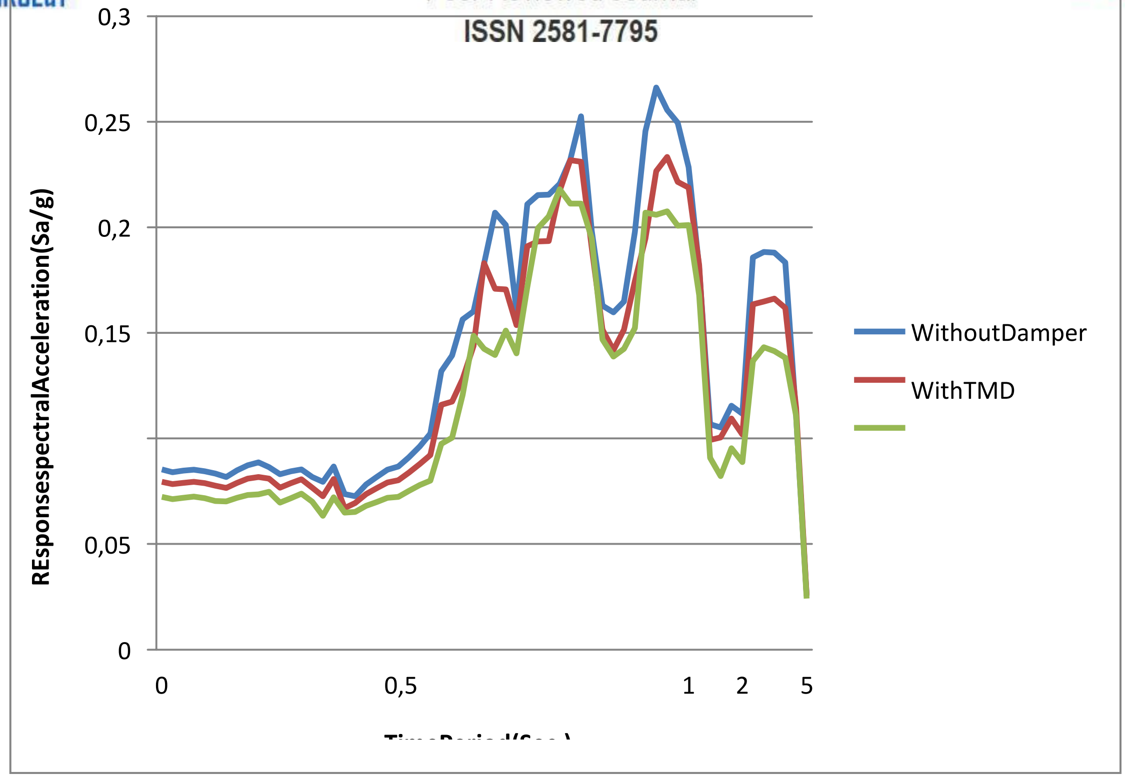

Figure5ResponseSpectralAcceleration(Sa/g)v/sTime Period(Sec.)in Y Direction

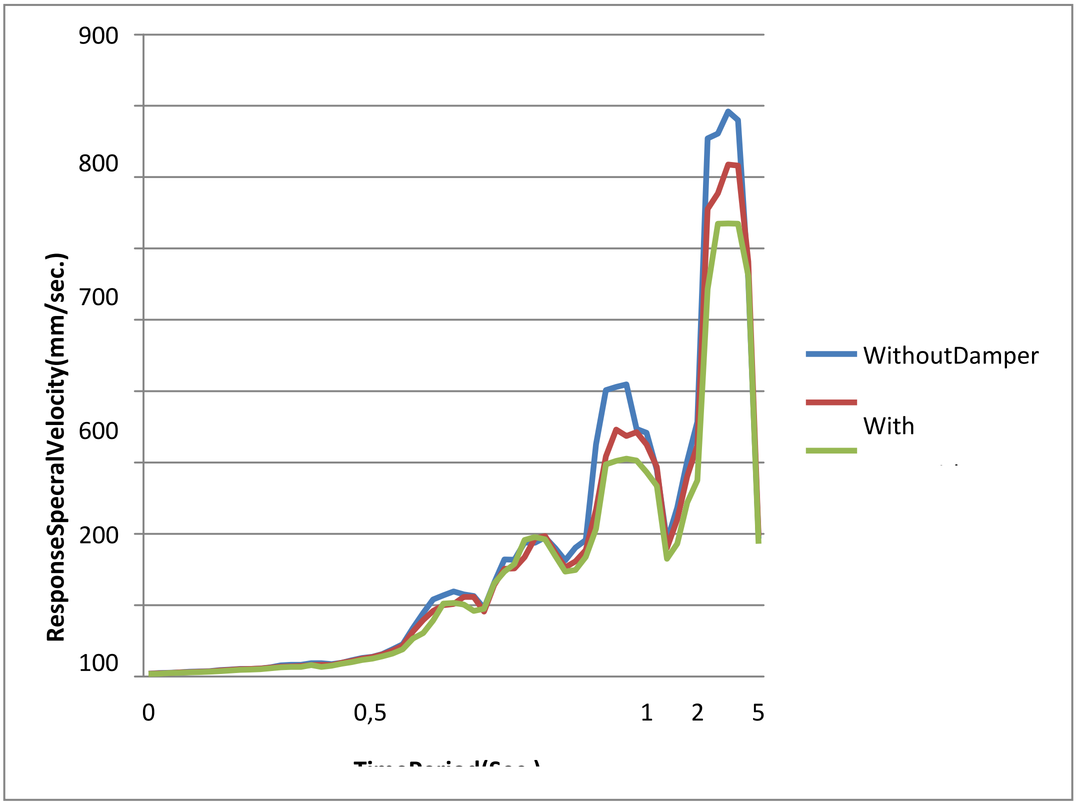

Figure4.6ResponseSpectralVelocity (mm/Sec.)v/sTimePeriod(Sec.)in X Direction

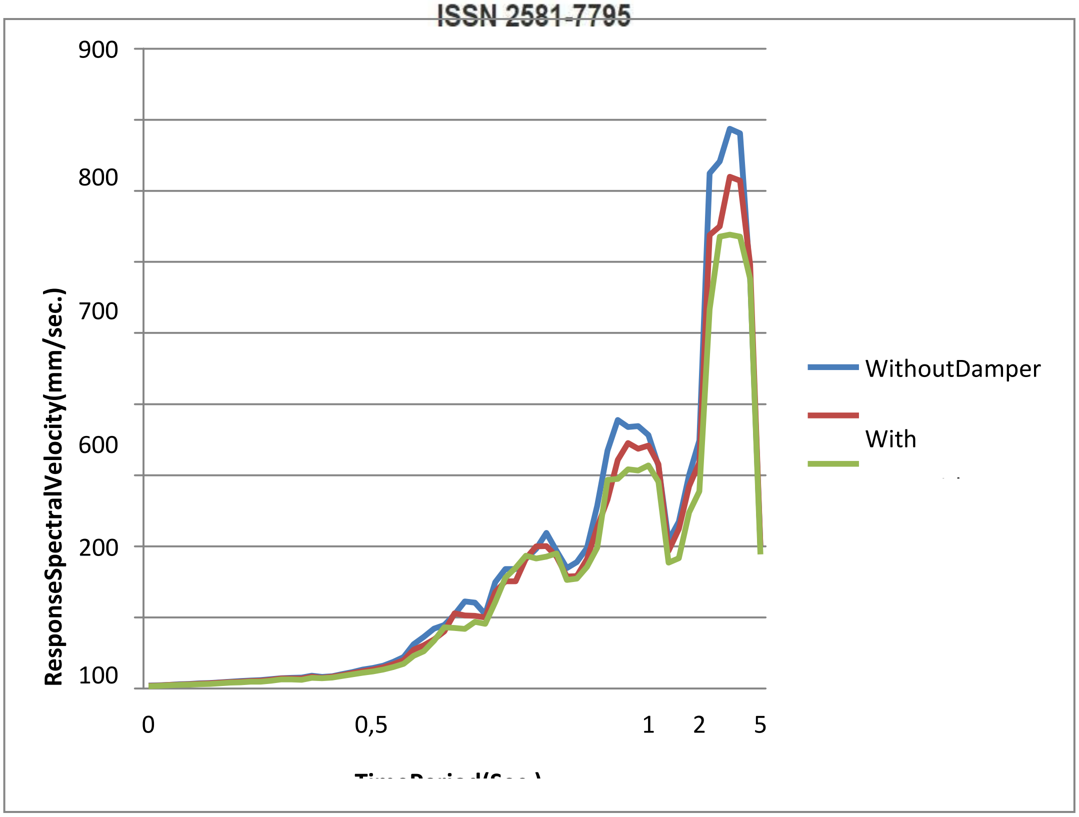

Figure7ResponseSpectralVelocity (mm/Sec.)v/sTimePeriod(Sec.)in X Direction

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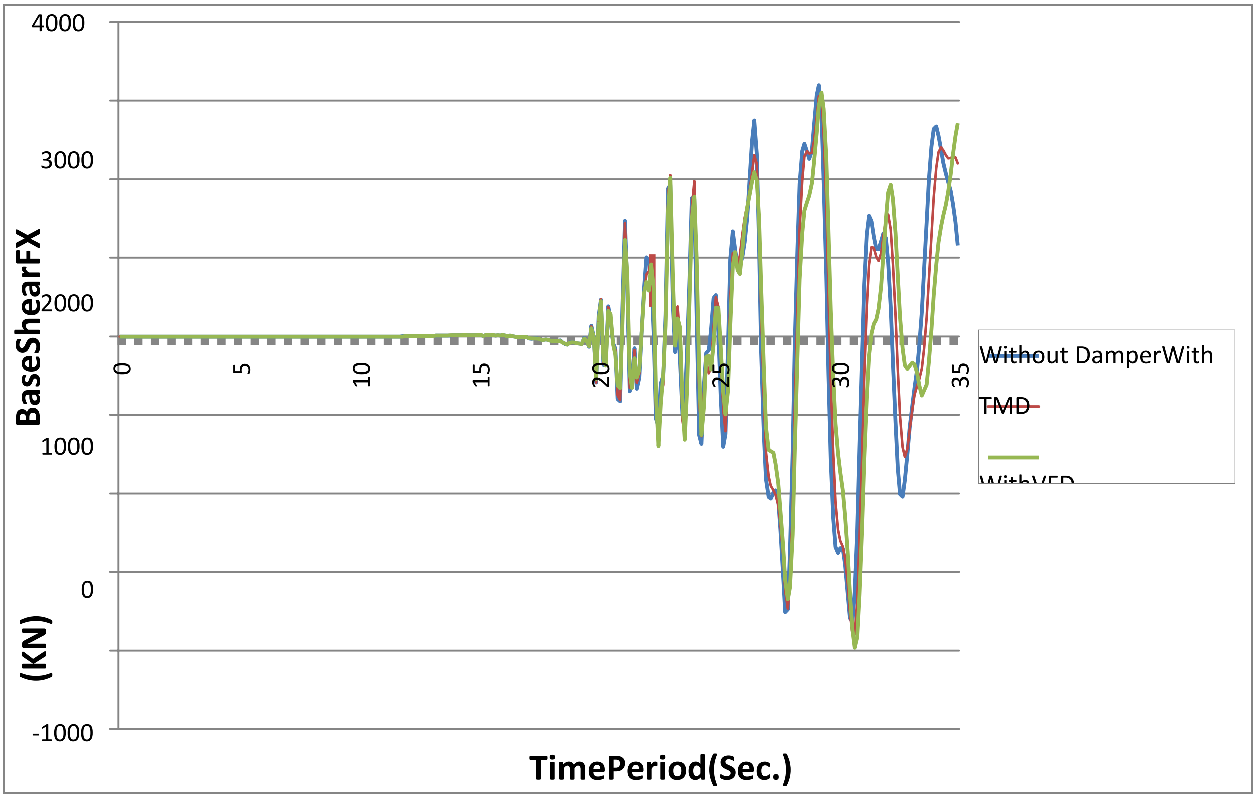

Figure8BaseShear (KN)v/sTime Period (Sec.)in XDirection

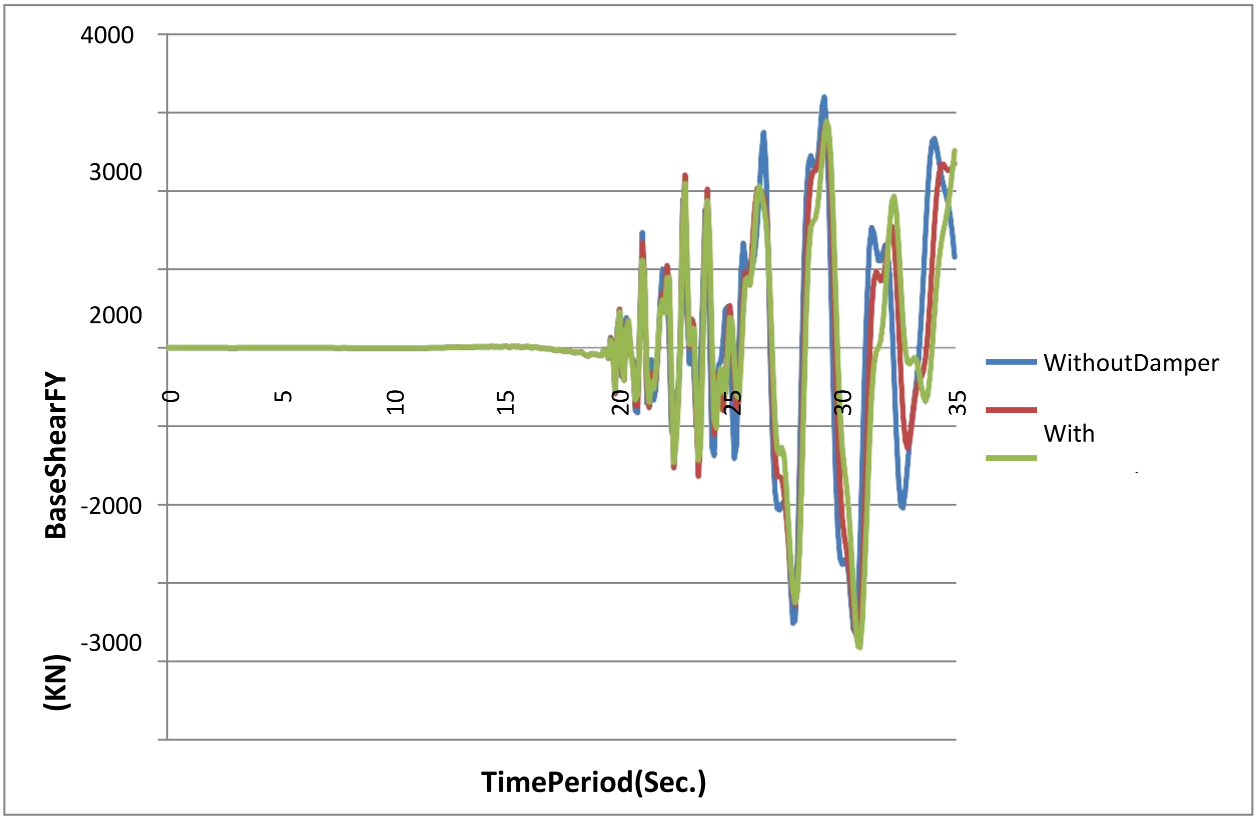

Figure9BaseShear (KN)v/sTime Period (Sec.)in YDirection

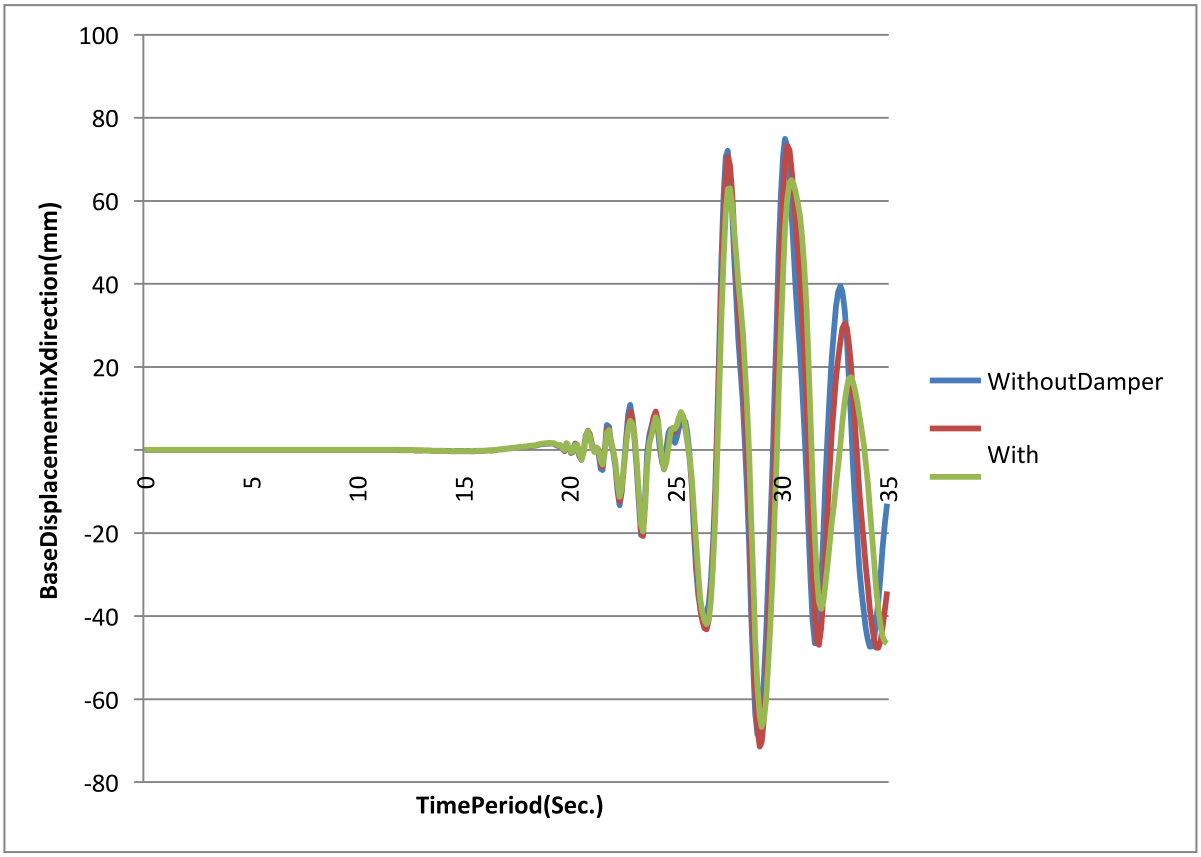

Figure10Base Displacement (mm) v/sTimePeriod (Sec.)in XDirection

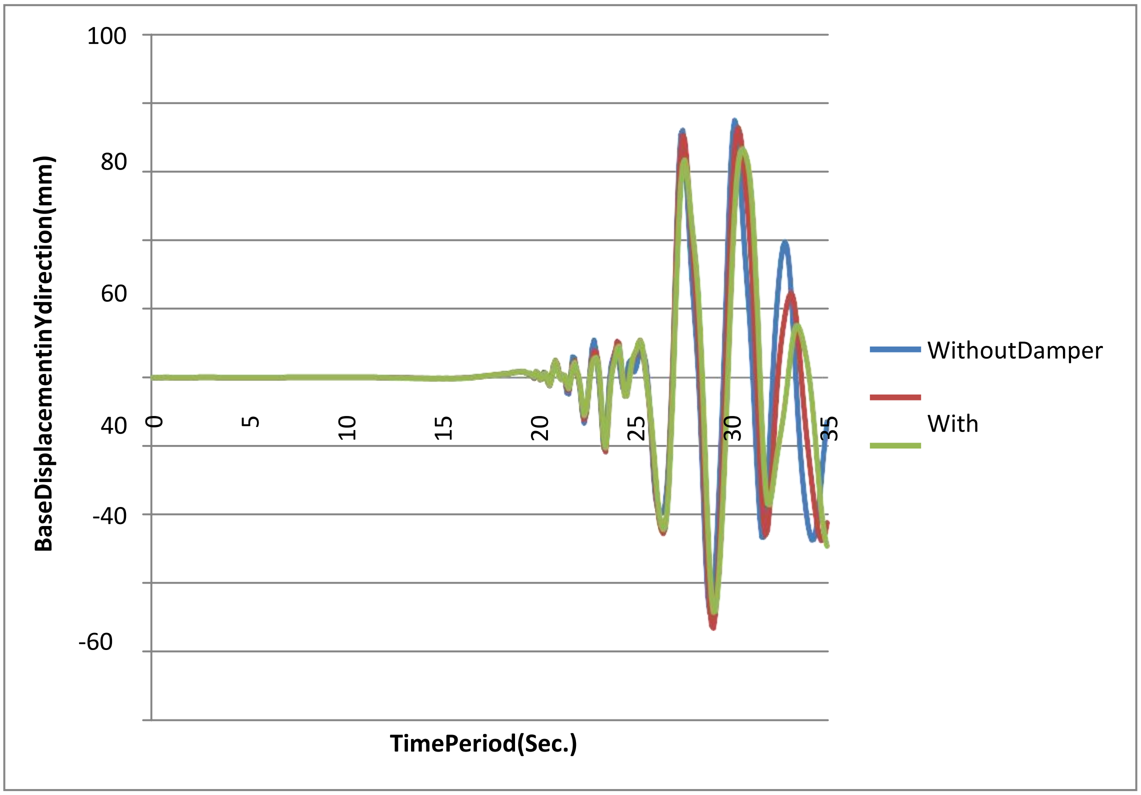

Figure11Base Displacement (mm) v/sTimePeriod (Sec.)in YDirection

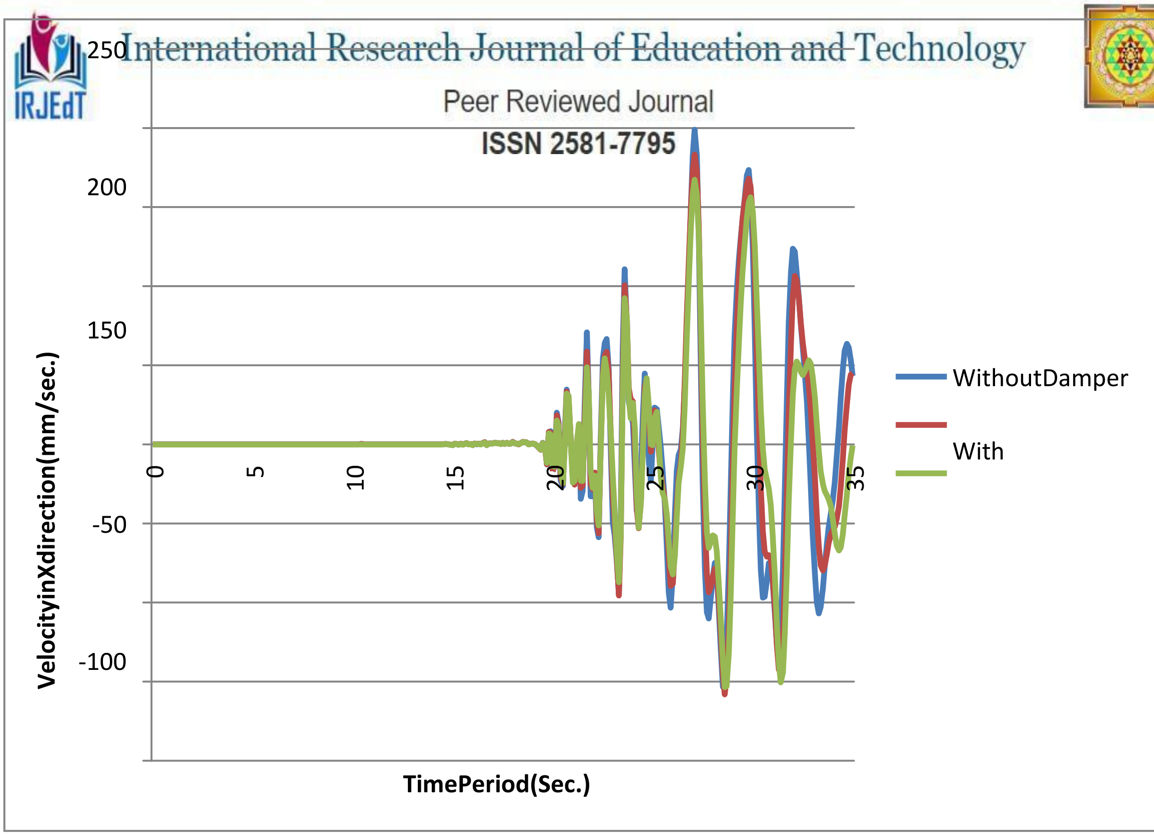

Figure12Base Velocity(mm/Sec.) v/sTimePeriod (Sec.)in XDirection

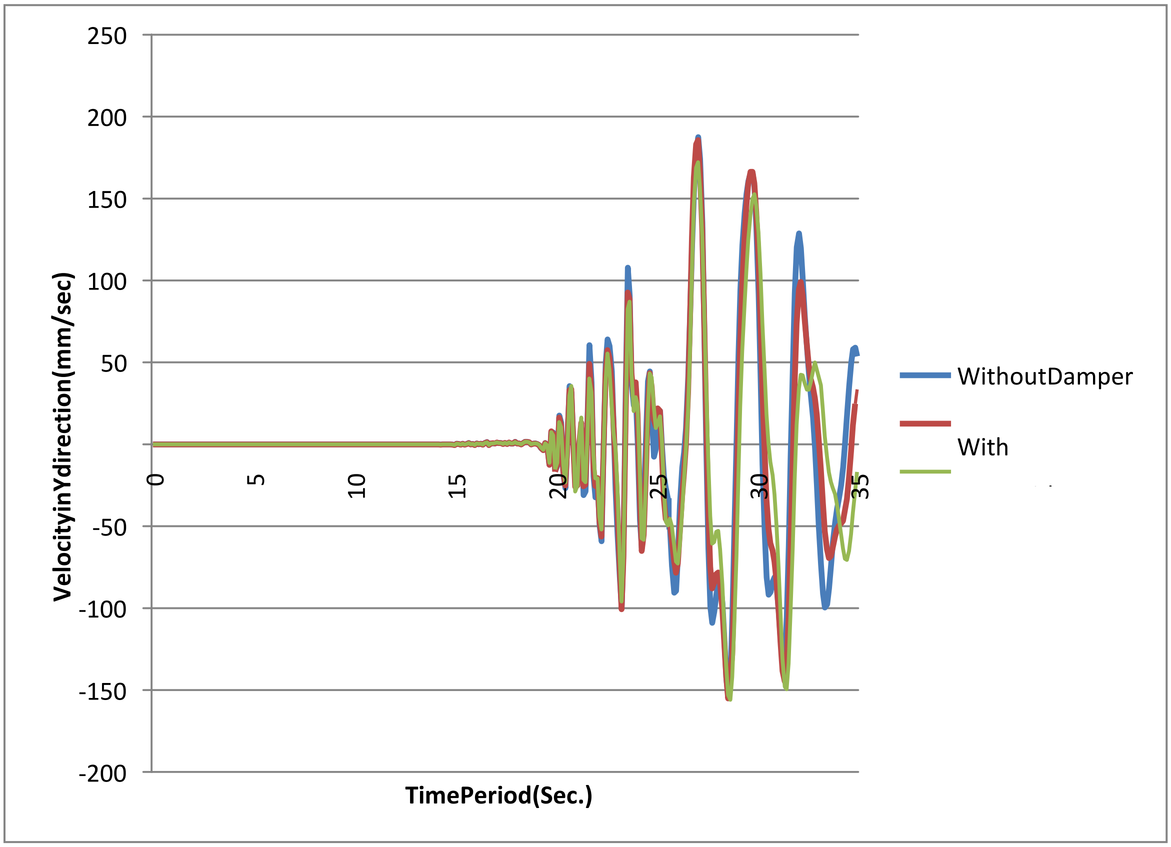

Figure13Base Velocity(mm/Sec.) v/sTimePeriod (Sec.)in YDirection

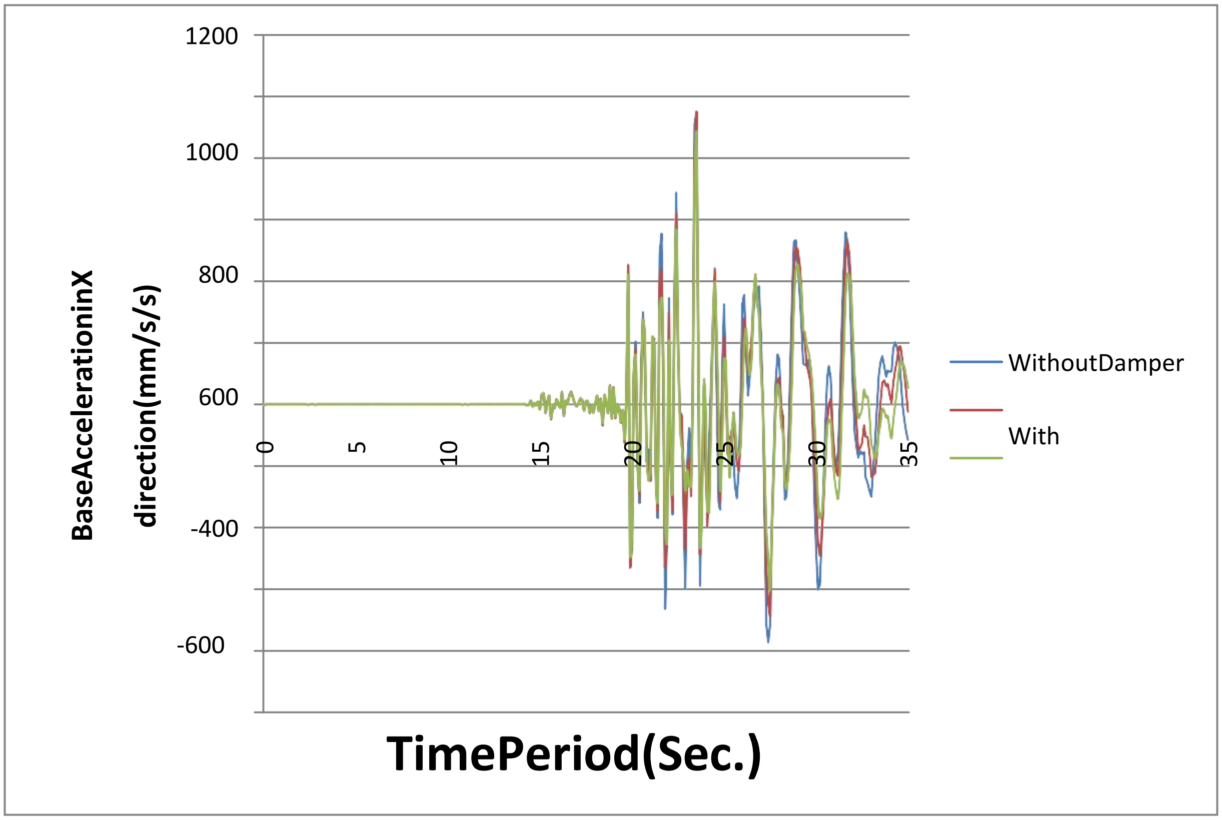

Figure14BaseAcceleration(mm/s/s) v/sTimePeriod (Sec.)in XDirection

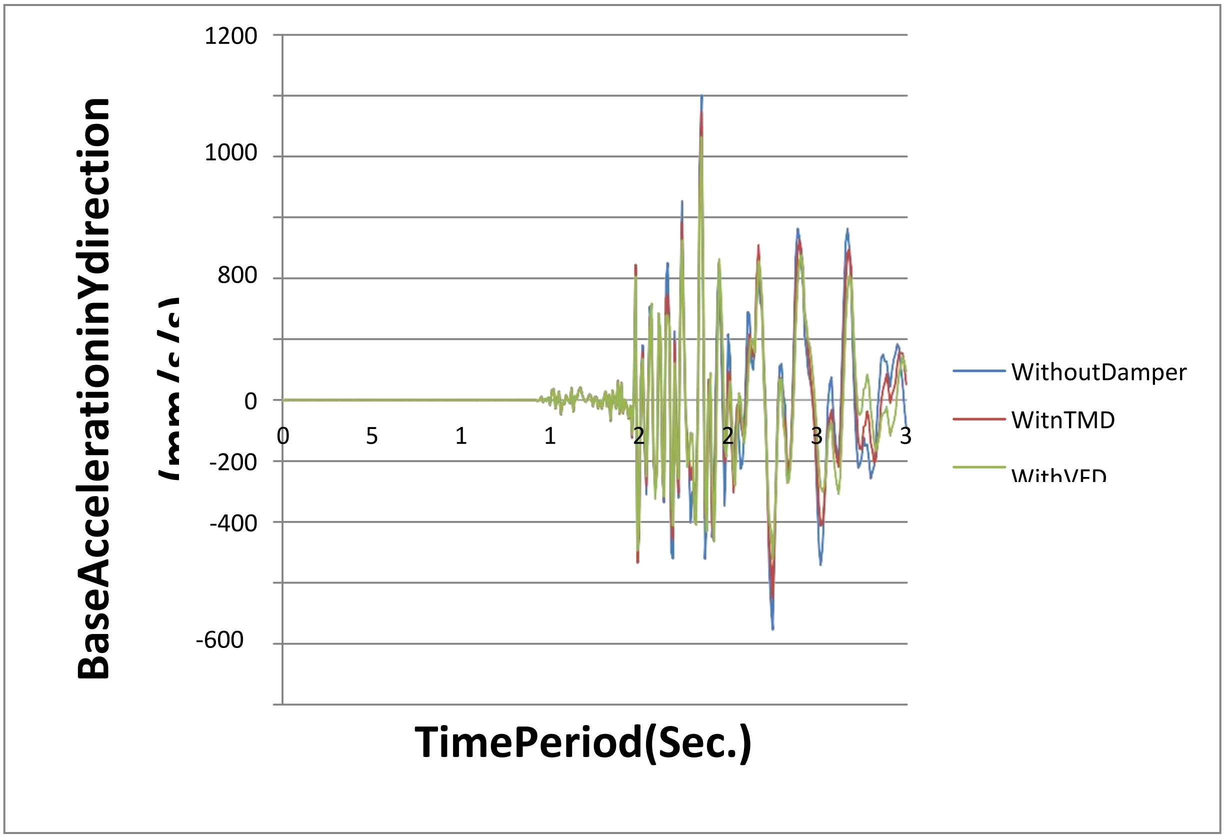

Figure15BaseAcceleration(mm/s/s) v/sTimePeriod (Sec.)in YDirection

Conclusions are carried out:

This study explains the behavior of dampers on structural system under the performance ofdynamicloads from whichthe followingconclusioncan bedrawn,based onthe result:

1. The analysis shows that the time period of structure increases when TMD and VFD aremounted because of these frequencies of structure reduces when compared with bareframe structure. As the frequency of structure reduces the dynamic effect on building alsoreduces.
2. Thevalueofresponsespectrumaccelerationundertimehistoryanalysistherearereduction about 17.34% of model TMD and 26.46% of model VFD as compare to modelwithoutanydamperinXdirection.Similarly,Thevalueofresponsespectrumacceler

ation under time history analysis there are reduction about 10.90% of model TMDand18.46%of modelVFD as comparetomodelwithout anydamperin Ydirection.

3. The value of response spectrum velocity under time history analysis there are reductionabout9.06%ofmodelTMDand18.92%ofmodelVFDascomparetomodelwithoutany damper in X direction. And reduction about 8.60% of model TMD and 22.9% ofmodelVFD ascompareto model without anydamperin Ydirection.
4. There was reduction of 4.38% in value of base shear in model with TMD and reductionabout 9.38% in model with VFD in X direction and reduction of 10.94% in value of baseshear in model with TMD and reduction about 15.94% in model with VFD in X directionalthoughtheseismicweightinmodelTMDandinmodelVFDareincreaseswithrespectedto model without anydampers.
5. On observing the base acceleration value under time history analysis, there was reduction2%inmodelTMDandaboutreduction7.68%inmodelwithVFDinXdirectionfor the same coefficient of damping for both. And similarly the reduction 5.56 in model TMDandabout reduction 13.75%in model with VFD inY direction.
6. Thevalueofbasedisplacementunder timehistoryanalysisthere arereductionabout2.96 %ofmodelTMDand11.94%ofmodelVFDascomparetomodelwithoutanydamperinXdirection.Similarly,The valueof base displacementunder timehistory analysistherearereductionabout2.54%ofmodelTMDand13.27%ofmodelVFDascomparetomodel without anydamperin Y direction.
7. AftercomparingallmodelsithasbeenobservedthattheVFD’sgavemaximumreduction in responses (Base Shear, Displacement, Velocity, Acceleration) with comparetoTMD model for samedampingcoefficient.

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