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Comparative Study on Effect of Buckling Resistant Bracing on the Performance of Staging Supported Overhead Water Tank

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Abstract - *Seismic force are very harmful to damage or completely destroy a RCC staging water tank. We all are aware about hysteresis loading compression and tension which show loop on the graph and this can be efficiently resist by BRBs(Buckling resistance bracings). For analysis of hysteresis seismic effect and resistance capacity of BRB in staging water tank the behavior of EWT with BRB should be compare with the ordinary staging water tank. The response spectrum method is good method can be applied to the models. The mode displacement are acquire by modeling the Structure in the Structure analysis software. The main motive was to compare the modified Structure with the ordinary Structure. Parameter has help in comparison of this models. There was significant decrease of Time period of EWT with BRB.*

1. INTRODUCTION

Nowadays seismic efficient structure are at priority of designing .Elevated Water tank are vulnerable to earthquake because it behave like an inverted pendulum. Such type of RCC staging water tank has less ductility to resist the inertia force generated due to weight of the water tank .To make the staging efficient to absorbs the seismic load proper dissipating system should be used in the staging. BRB(buckling resistance brace

1.1 Buckling resistance bracing

Normal braced does not give a good behaviour in compression.

Components of BRB are as follow.

1) Core

2) Wrapping sheet

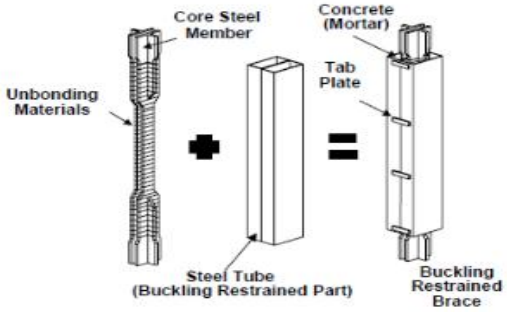
3) Sleeve casing

4) Infill Mortar

1) Core

The steel core is subjected to axial deformation due to elongation and compression in earthquake back and forth loading due shaking of earth crust. Core is the important part of BRB the area of core is decided according the story shear of the staging. The core function as dissipate the energy.

2) DE-bounding material- It is use to separate the steel core and concrete motor then only steel take part in resisting compression and tension loads .it is either elastic rubber or pad that is wrap on the steel core with taking care that it won't expel out of the area and the function of its can be utilize, concrete will not take part in compression or tension. Some time it is very important because if core is inelastic than it will dissipates energy by



elongation and compression of core. Epoxy resin, silicon resin, vinyl tapes, silicon rubber sheets, polythene film sheets, etc.

3) Sleeve casing- it is a steel tube which help the mortar do no failed in crushing and flexure. It increase the flexure strength of concrete as the hollow steel section with a good thickness will play an important role in buckling restrained of the core this property of resistance of casing is utilize for the purpose to improve the capacity of brace. It is prove in test that casing play an major role in the behavior of braces.

4) Infill Mortar- infill mortar is either sand and cement or lean concrete or ordinary concrete we use in RCC structure. Concrete is good in compressing and by the use of casing its capacity is use for the purpose in BRB. Mortar is also good but its hysteresis loop is not so good.

1.2 detail of BRB

The external jacket serve in restraining buckling of the steel core element.

The steel core is divided into three segments:

The yielding zone,

The transition zone and

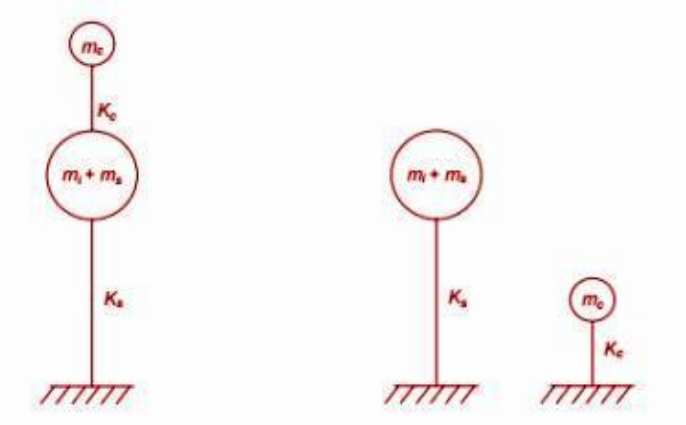
The connection zone.

The yielding zone has a reduced cross section and is fully restrained to in sure the occurrence of tensile and compressive yielding.

The transition zones are the segments of the brace directly on either side of the yielding zone. These segments have larger cross-sectional area than the yielding zone but are similarly restrained.

The connection zone is the portion of the e

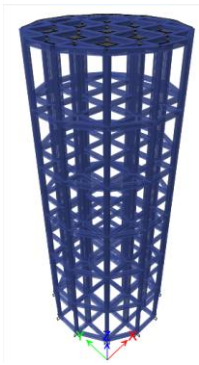
2. Modeling and analysis of water tank for

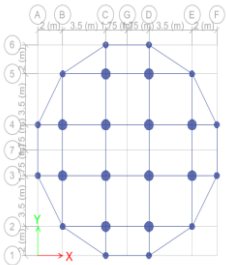


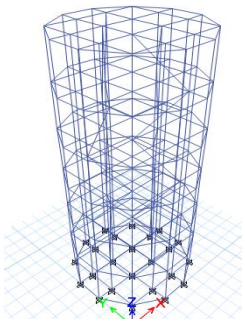
Two mass model idealization of the circular water tank is more appropriate as compared to a one-mass ealization. Two-mass idealization model for elevated water tank was proposed by Housner (1963) is use in most of the code as well as in Indian code of Practice The water exert the pressure on wall as well as base hydrodynamic pressure on the wall and on the base. Is code 1893(part-2) which also use the housner method of analysis the staging force acting due to seismic movement of the ground. The lower part of liquidis attached to the wall of tank and upper water act as free moving body having some stiffness .the lower part of water is known as impulsive move rigidly with the wall of the and act as rigid body as the container. Upper part of water is called as convective having stiffness Kc. calculated using the h/D ratio and used in finding the time period of convective water. Impulsive hydrodynamic pressure on tank wall and similarly on base Liquid mass in the upper region of tank undergoes sloshing motion. Spring mass model is adopted for ground supported tanks.

Table -1: Sample Table format

Preparation of Manuscript	
Diameter of outer column	425 mm
Diameter of inner column	600 mm
Size of bracing	300 *450
height of bay	5.83 m
height of staging	34.98
thickness of bottom slab	250 mm
thickness of top slab	200 mm







Base shear		
Base shear for impulsive =	327990.796	N
Base shear for convective =	83752.1527	N
Total Base shear =	338514.971	N
Base Moment		
Overturning moment because impulsiveMi=Ah[mi(hi*+hs)+ms hcg] g=	12543808.7	kN-m
height of cg of tank hcg =	40.49314	m
height due to base pressure hi* =	2.0625	m
hi* + hs =	37.0425	m
height of stagging of tank=	34.98	m
Overturning convective Mc= Ah mc (hc*+hs)g	6319937.44	kN-m
height due to base presure hc* =	5.5	m
	40.48	
Total overturning moment =	14045951.3	kN-m

Table 2: base shear in excel sheet

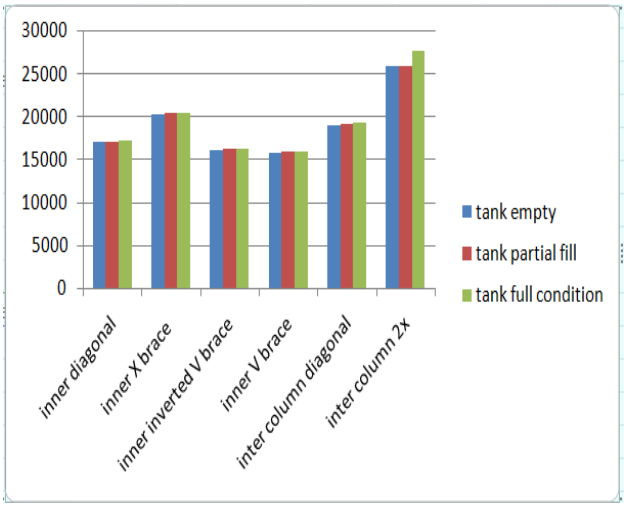


Fig 5.12 Chart of stiffness part1

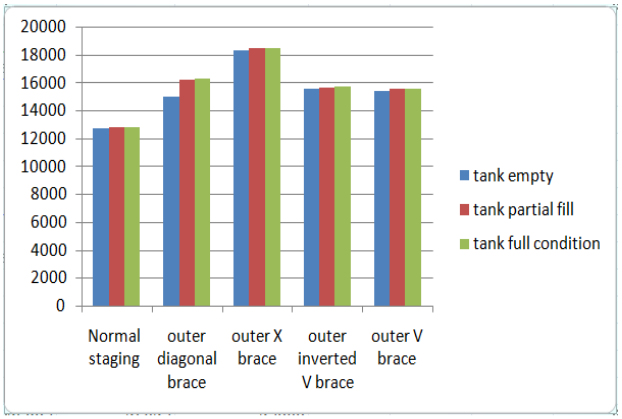


Fig 5.12 Chart of stiffness part2

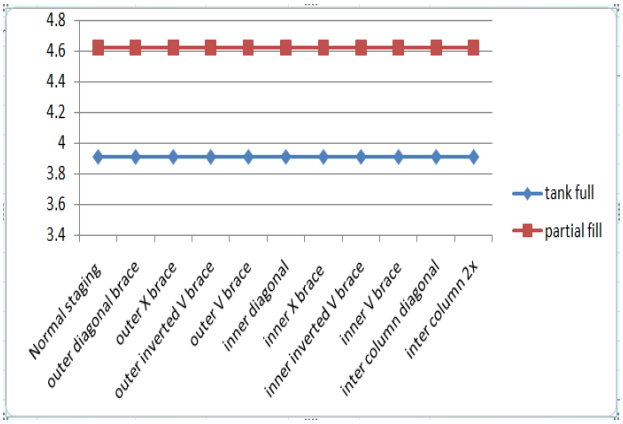


Fig 5.12 Chart of convective time period

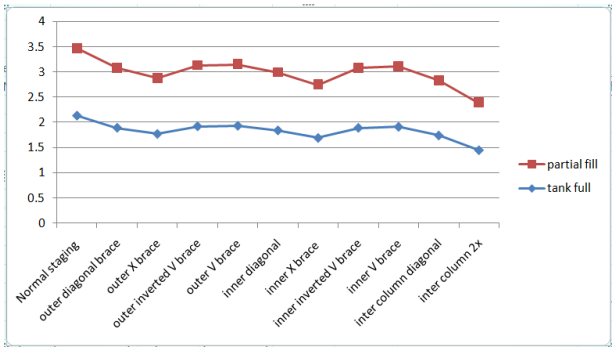


Fig 5.12 Chart of impulsive time period

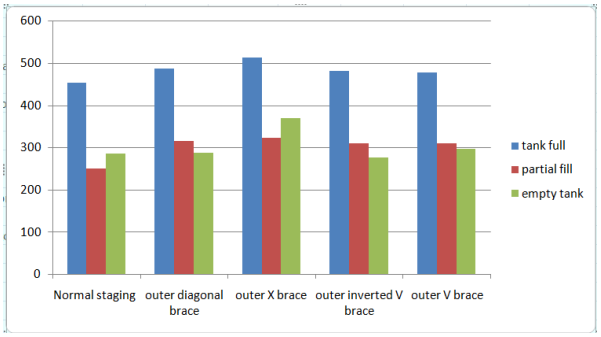


Fig 5.12 Chart of Base shear part 1

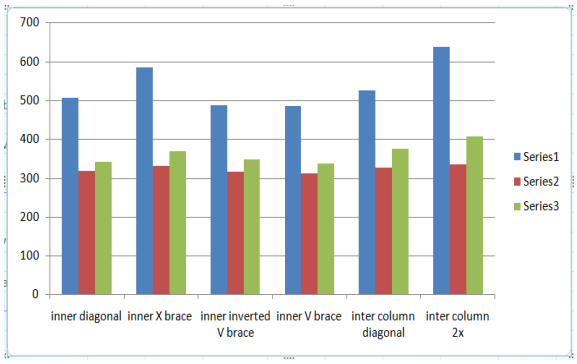


Fig 5.12 Chart of Base shear part 2

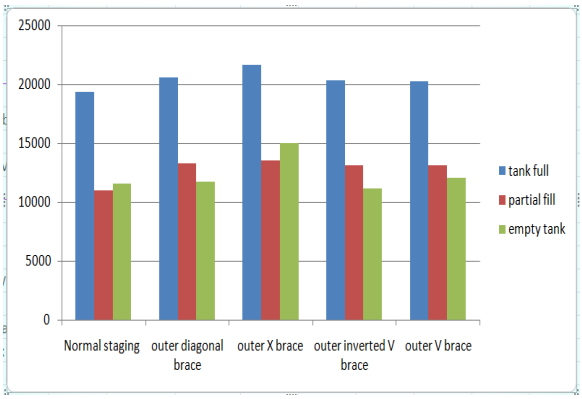


Fig 5.12 Chart of Base moment part 1

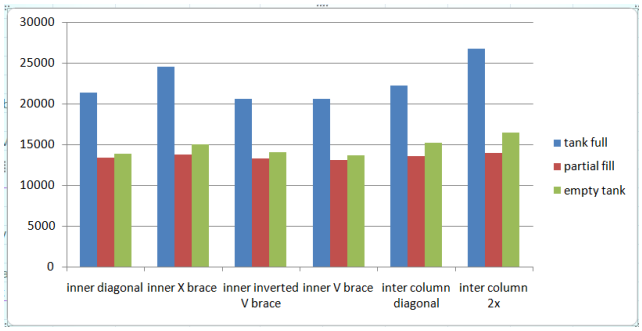


Fig 5.12 Chart of Base moment part 2

3. CONCLUSIONS

The stiffness of the circular water tank with inter column X-bracing configuration is maximum is around 27808 kN-m.

The type of bracing configurations does not affect the natural time period in convective mode for a given depth of water, as the h/D is constant for a particular depth of water.

The base moment is more of tank full condition compare to partial fill and empty condition.

The base shear is maximum of tank full condition compare to partial filland empty condition.

Time period of inter column X is maximum base shear and base moment of inter column X is maximum in all condition

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