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Soft Computation of Important Structures

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Abstract

Most of the cities are facing several challenges when responding to multiple concurrent fire emergency calls. The problem appears to arise more often than might be expected. The risk time period for predetermined short-term periods of incidents can be calculated. From this, one can selected whether the higher or the lower risk period to respond to multiple incidents more efficiently and effectively by solving municipality's existing resources. In this dissertation, survival analysis (the Kaplan-Meier estimator and Cox hazard model) is utilized to determine the time (Time of the day, day of the week and various season), when the risk of multiple emergencies was expected to be highest or lowest in Jaipur. Various types of incidents most likely to occur was also considered in the survival analysis. The case study in Jaipur observed that the area most needed help with multiple calls during summer weekends from 9 a.m. to 10 p.m. The study clearly demonstrates the potential to find out the risk intensity and hazard analysis based on a data-driven and scientific approach. For various load conditions, such as gravity load, the axial force, shear force, and bending moment of a wind load, hydrostatic load and a temperature load are compared. Wind load affects more the Axial Force, Shear Force & BM as compared to the hydrostatic load and temperature load.

1. Introduction

If flood occurs external lateral forces are generated when it is going normal then its ok but going beyond the limit for this, we have to analysis the axial, shear force and BM. Similarly for wind load, when wind is blowing at high velocity we have will analyse the for axial force, shear force and bending moment. Accidents like fire are unpredictable, When fire occur it will increase the temp of building while considering the temp we will analyze the structure for axial force, shear force and BM (Agnihotri, Jethoo, and Ramana).

Following are the important structures Hospital / police station, Bridges, Dams, Nuclear containment structures. Hospital building, if hospital building collapse, then it will disturb the medical facilities to the public (Ramana et al. Meena and Ramana Meena, Jethoo, and Ramana). For a better outcome of patient results which includes safety of the patient, the infrastructure design of the hospital plays a very important role (Surendranath and Ramana). We find these days huge amount of money is spent on building new hospital structures for catering to the people for their wellness and treatment of the various diseases. for bridge if it collapse then we can not cross the obstruction or it may take more time to cross it (Jamil, Ganguly, and Nower Li et al. Hossan and Nower). Bridges are an important part of a country's infrastructure because they enable raw materials and finished products to be transported to manufacturers, warehouses, retailers, dealers, supermarkets, and end-users (Li, Tang, and Xu). Bridges often make it easier for people to buy products and services both in their own communities and elsewhere. Water rate, depth, deposition patterns, and channel morphology can all be affected by bridges and culverts, and can change the river's flow regimes. As a result of these changes, the possibility of flooding and erosion can increase. During site activities, a variety of causes may have an effect on surface water quality (Agnihotri, Jethoo, Ramana, et al. Surendranath, Ramana, et al.).

If dam structure collapses it will flood nearby area and affect the irrigation. A dam can also be used to capture water or store water that can be spread equally between different areas. Dams are used to store water, whereas floodgates and levees (also known as dikes) are used to control or avoid water movement into certain land areas (Aciu et al.). Dams are crucial because they supply water for residential, industrial, and irrigation needs. Dams are mostly used to generate hydroelectric power to provide river navigation. Dams and their lakes offer fishing and boating opportunities. Floods are reduced or prevented, which benefits people (Almeshal et al. Pechorskaya et al. Jadhav and Shaikh).

Failure of nuclear containment structure will release gases which is harmful for the people. The containment system of a light-water reactor serves as both a deterrent to the spreading of fission products from the reactor into the atmosphere and as a protection to protect the radioactive components inside it from missiles such as from aircraft and errant turbine blades (Ye et al.). A gas-tight casing or other containment around a nuclear reactor to contain fission materials that would otherwise be released into the environment if an accident occurred. Enclosures of this kind are normally dome-shaped and constructed of steel-reinforced concrete (Kishanpuri and Sharma Liu, Ding, and Qiao A. A. Mohammed, I. I. Mohammed, and S. A. Mohammed).

2. Methodology

Analysis and design are done by using ETABS Software, different loads taken for analysis and design and with the help of IS 875 (part-3rd)analysis and design are done for wind load and for RCC we have used IS 456. Table 1. Describes different type of Loading Conditions.

TABLE 1. Different type of Loading Conditions

Dead Load	**Live Load**	**Wind Load**	**Hydrostatic Load**	**Temperature Load**
Load f x V	3 kN/m2	3 kN/m2	1.5 m	27°**C**
			3 m	200°**C**
				400°**C**

3. Results and Discussion for Wind Load Case

3.1. Axial Force:

Axial force comparison of G+3, G+5 and G+10 buildings when dead load and live load is acted.

We got maximum axial forces at base of building due to dead load and live load are as G+3 has 640.5754KN (compression), G+5 has 960.8631KN (compression) and G+10 has 3753.189KN (compression)

3.2. Shear Force:

G+3 Building:

We got maximum shear force in beams at upper most story of the building due to dead load and live load is 62.355KN (compression) and max shear force in column at base story due to dead and wind in x-direction is 44.2881KN (compression)

G+5 Building:

We got maximum shear force in beams at upper most story of the building due to dead load and live load is 74.0889KN (compression) and max shear force in column at base story due to dead and wind in x-direction is 67.60KN (compression)

G+10 Building**:**

We got maximum shear force in beams at upper most story of the building due to dead load and live load is 146.922KN (compression) and max BM in column at base story due to dead and wind in x-direction is 325.9093KN (compression)

3.3. Bending Moment:

Maximum bending moment comparison of G+3, G+5 and G+10 buildings when all combinations are acting.

G+3 Building:

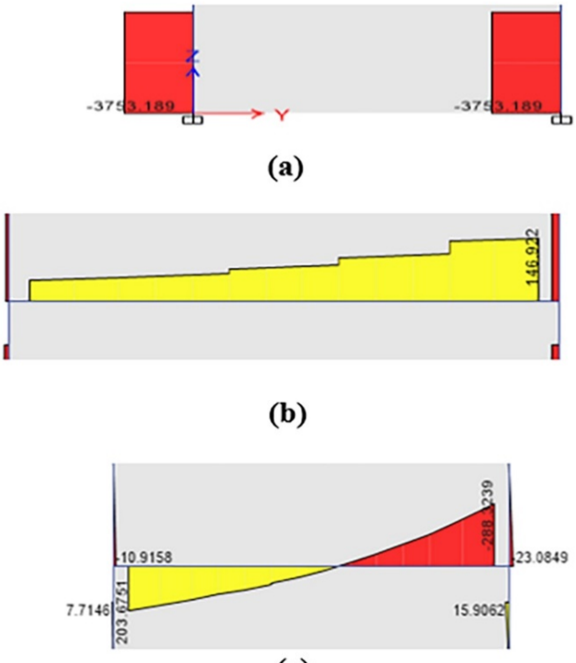
We got maximum bending moment (BM) in beams at upper most story of the building due to dead load and live load is 74. 66KN.m (tension) and max BM in column at base story due to dead and wind in x-direction is 94. 43KN.m (compression)

G+5 Building:

We got maximum bending moment (BM) in beams at upper most story of the building due to dead load and live load is 105. 05KN.m (tension) and max BM in column at base story due to dead and wind in x-direction is 156. 4691KN.m (compression)

G+10 Building:

We got maximum bending moment (BM) in beams at upper most story of the building due to dead load and live load is 288. 3239KN.m (compression) and max BM in column at base story due to dead and wind in x-direction is 892. 8011KN.m (compression). In Figure 1. the description of (a) Axial force (b) Shere Force (c) Bending Moment is given.



(a)

(b)

(c)

FIGURE 1. **(a) Axial force (b) Shere Force (c) Bending Moment**

3.4. Steel Reinforcement:

Steel Reinforced (G+3 Building):

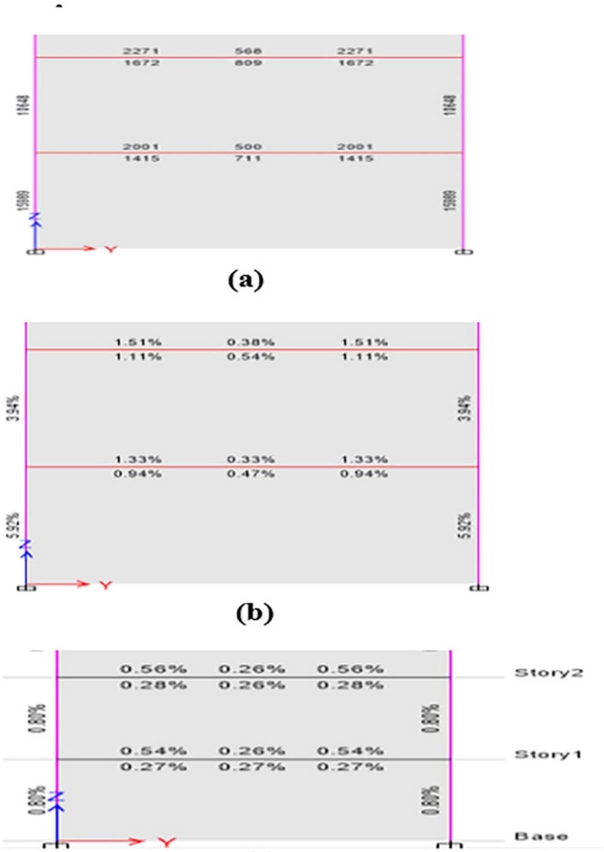
Maximum steel in G+3 building in bottom most story column is 0.80%(2160mm^2) and in story-1 is 0.27%(398mm^2) in bottom of beam and 0.39%(592mm^2) in top of beam

Steel Reinforced (G+5 Building):

Maximum steel in G+5 building in bottom most story column is 0.80%(2160mm^2) and in story-2 is 0.28%(421mm^2) in bottom of beam and 0.56%(843mm^2) in top of beam.

Steel Reinforced (G+10 Building):

Maximum steel in G+10 building in bottom most story column is 5.92% (15989mm^2) and in story-2 is 0.94% (1415mm^2) in bottom of beam and 1.33% (2001mm^2) in top of beam. Figure 2. shows (a) Steel Reinforced of G+3 (b) Steel Reinforced of G+5 (c) Steel Reinforced of G+3 and in Table 2. wind case Comparison of Forces is elaborated.



(a)

(b)

(c)

FIGURE 2. **(a)Steel Reinforced of G+3 (b) Steel Reinforced of G+5 (c) Steel Reinforced of G+3**

TABLE 2. Wind case Comparison of Forces

			G+3	G+5	G+10
Axial force (KN)			-640.57	-960.86	-3753.19
Shear force (KN)	**Beam**		62.355	74.09	146.92
	Column		-44.288	-67.60	-113.26
Bending moment (KN. m)	**Beam**	**Sagging**	53.63	53.65	203.67
		Hogging	74.66	105.05	288.24
	Column		-94.43	-156.469	-892.80
Steel (%)	**Beam**	**Top**	0.39	0.56	1.33
		Bottom	0.27	0.28	0.94
	Column		0.80	0.80	5.92

TABLE 3. Hydro-static case Comparison of forces

			G+3		G+5		G+10	
			1.5m	**3m**	**1.5m**	**3m**	**1.5m**	**3m**
Axial force (KN)			480.43	480.47	800.71	800.76	1601	1602.38
Shear force (KN)	**Beam**		69.98	69.98	69.97	69.97	69.9	70.01
Bending moment (KN.m)	**Beam**	**Sagging**	53.95	53.95	53.87	53.87	53.88	53.88
		Hogging	50.86	50.86	50.94	50.94	50.95	50.95
Steel (%)	**Beam**	**Top**	0.34	0.34	0.34	0.34	0.34	0.34
		Bottom	0.26	0.26	0.26	0.26	0.26	0.26
	Column		0.80	0.80	0.80	0.80	0.8	0.8

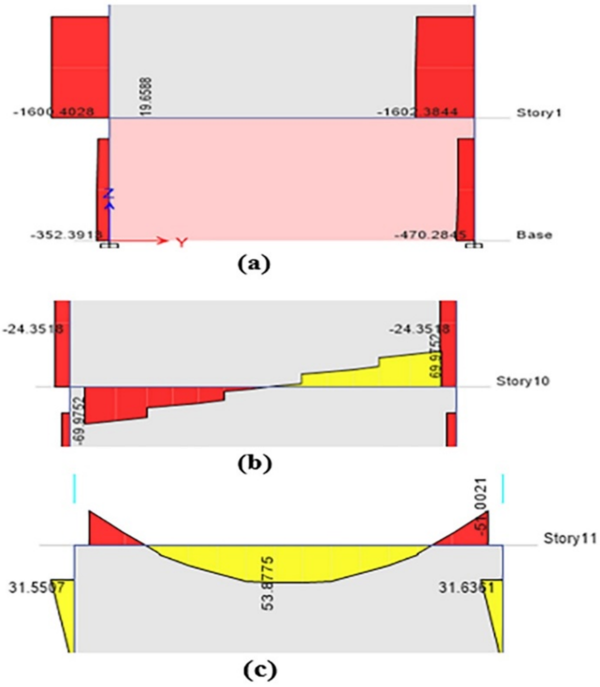


FIGURE 3. (a) AF Diagram (b) SF Diagram (c) BM Diagram

3.5. Hydrostatic Pressure Case:

Axial Force:

G+3 Building:

Axial force comparison of G+3 building with 1.5m and 3m water level. Maximum axial force above base story due to wall at base story. Almost same results for 1.5m and 3m water level which is 480.43KN.

G+5 Building:

Axial force comparison of G+5 building with 1.5m and 3m water level. Maximum axial force above base story due to wall at base story. Almost same results for 1.5m and 3m water level which is 800.7KN.

G+10 Building:

Similarly, Axial force comparison of G+10 building with 1.5m and 3m water level. Maximum axial force above base story due to wall at base story. Almost same results for 1.5m and 3m water level which is 1850KN.

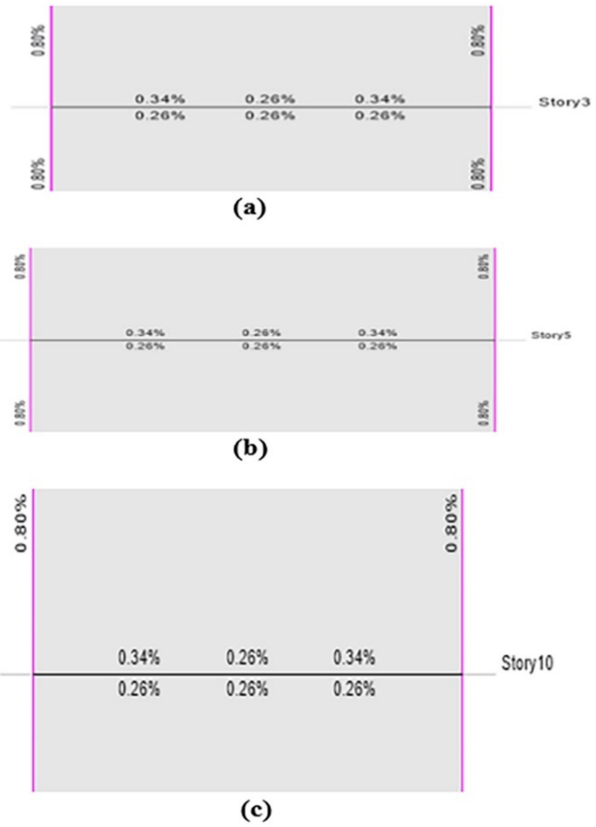
4. Hydrostatic Pressure Case

4.1. Hydrostatic pressure case: Shear Force:

G+3 Building:

Max shear force (SF) in G+3 building when water level at 3m and 1.5m is almost same as 69.98KN.

G+5 Building:

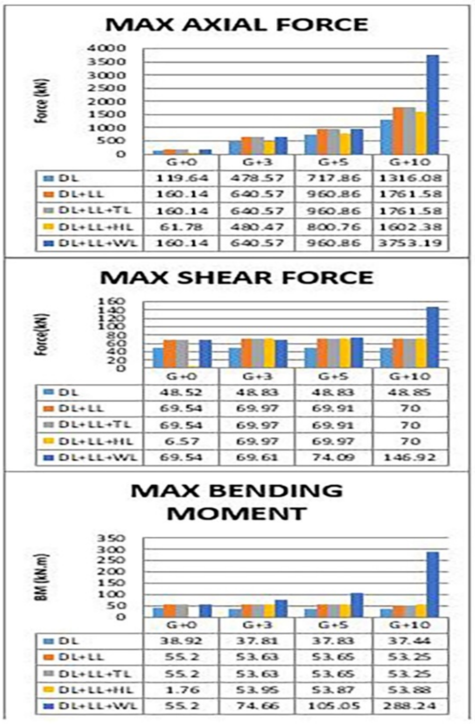


(a)

(b)

(c)

FIGURE 4. **Steel Reinforcement a) G+3 Building b) G+5 Building c) G+10 Building**



MAX AXIAL FORCE

	G+0	G+3	G+5	G+10
DL	119.64	478.57	717.86	1316.08
DL+LL	160.14	640.57	960.86	1761.58
DL+LL+TL	160.14	640.57	960.86	1761.58
DL+LL+HL	61.78	480.47	800.76	1602.38
DL+LL+WL	160.14	640.57	960.86	3753.19

MAX SHEAR FORCE

	G+0	G+3	G+5	G+10
DL	48.52	48.83	48.83	48.85
DL+LL	69.54	69.97	69.91	70
DL+LL+TL	69.54	69.97	69.91	70
DL+LL+HL	6.57	69.97	69.97	70
DL+LL+WL	69.54	69.61	74.09	146.92

MAX BENDING MOMENT

	G+0	G+3	G+5	G+10
DL	38.92	37.81	37.83	37.44
DL+LL	55.2	53.63	53.65	53.25
DL+LL+TL	55.2	53.63	53.65	53.25
DL+LL+HL	1.76	53.95	53.87	53.88
DL+LL+WL	55.2	74.66	105.05	288.24

FIGURE 5. **Axial, Shear & Bending Moment Diagrams**

Max shear force (SF) in G+5 building when water level at 3m and 1.5m is almost same as 69.975KN.

G+10 Building:

Max shear force (SF) in G+10 building when water level at 3m and 1.5m is almost same as 82.93KN.

4.2. Bending Moment:

G+3 Building:

Max bending moment in G+3 building when water level at 3m is 53.95KN (tension) and water level at 1.5m is 53.95KN (Sagging).

G+5 Building:

Max BM in G+5 building when water level at 3m is 53.95KN (tension) and water level at 1.5m is 53.8773KN (Sagging).

G+10 Building:

Max BM in G+10 building when water level at 3m and 1.5m is almost same 53.8775KN. Figure 3. shows (a) AF Diagram (b) SF Diagram (c) BM Diagram.

4.3. Steel Reinforcement:

G+3 Building:

We got the maximum steel reinforcement at story-3 in both the case (at 3m and 1.5m water level) is almost same which is 0.34% (510mm^2) upper side of beam and 0.26% (388mm^2) bottom side of beam.

G+5 Building:

We got the maximum steel reinforcement at story-5 in both the case (at 3m and 1.5m water level) is almost same which is 0.34% (510mm^2) upper side of beam and 0.26% (388mm^2) bottom side of beam.

G+10 Building:

We got the maximum steel reinforcement at story-10 in both the case (at 3m and 1.5m water level) is almost same which is 0.34% (510mm^2) upper side of beam and 0.26% (388mm^2) bottom side of beam. Table 3. Describes the Hydro-static case comparison of forces. Table 3. Describes Hydro-static case comparison of forces and in Figure 4. Steel Reinforcement in terms of a) G+3 Building b) G+5 Building c) G+10 Building is shown and in Figure 5. Reflects Axial, Shear & Bending Moment Diagrams.

5. Conclusion

In this Paper it can be stated that the wind load affects more the Axial Force, Shear Force & BM as compared to the hydrostatic load and temperature load & the Hydrostatic load does not affect for 1.5m and 3m WT & the Temperature load does not affect Axial Force, Shear Force and BM

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