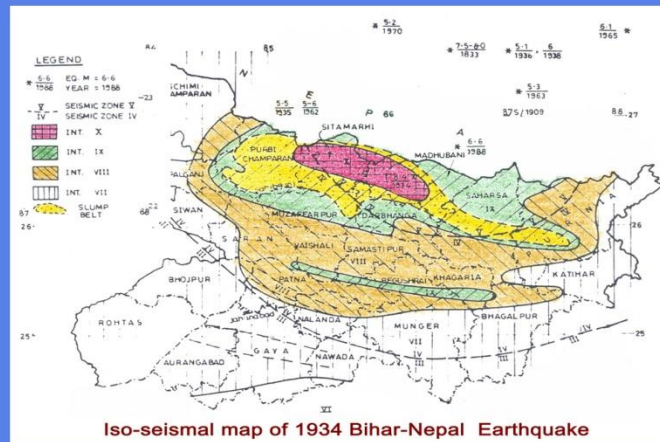




बिहार सरकार

DAMAGE SCENARIO UNDER HYPOTHETICAL RECURRENCE OF 1934 EARTHQUAKE INTENSITIES IN VARIOUS DISTRICTS IN BIHAR



August 2013



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**DAMAGE SCENARIO UNDER HYPOTHETICAL RECURRENCE OF
1934 EARTHQUAKE INTENSITIES IN VARIOUS DISTRICTS IN BIHAR**

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FOREWORD

Earthquake is a natural hazard that can neither be prevented nor predicted. It is generated by the process going on inside the earth, resulting in the movement of tectonic plates. It has been seen that wherever earthquake occurs, it occurs again and again. It is quite probable that an earthquake having the intensity similar to 1934 Bihar-Nepal earthquake may replicate again. Given the extent of urbanization and the pattern of development in the last several decades, the repeat of 1934 in future will be catastrophic in view of the increased population and the vulnerable assets.

Prof A.S.Arya, member, BSDMA has carried out a detailed analysis keeping in view the possible damage scenario under a hypothetical event, having intensity similar to 1934 earthquake.

Census of India 2011 has been used for the population and housing data, while the revised seismic zoning map of India is the basis for the maximum possible earthquake intensity in various blocks of Bihar.

Probable loss of human lives, probable number of housing, which will need reconstruction, or retrofitting has been computed for various districts and the blocks within the districts. The following grim picture of losses has emerged for the state of Bihar. Loss of human lives may be to the extent of 2,22,337, if earthquake occurs at night; but 72,766 if earthquake occurs during daytime. About 20 % of the total housing in Bihar will need re-construction whereas; about 45 % of the total housing in Bihar will need repairing and retrofitting.

The projected damage scenario highlights the absolute seriousness of the situation given the present building stock and demands that all new construction in Bihar, without any exception, must be earthquake resistant and the existing critical and large occupancy buildings need to be surveyed and retrofitted, if required.

I must complement Prof Arya for this pioneering work and also appreciate the work done by Mr Barun Kant Mishra in carrying out this study. I am sure this exercise will go a long way in creating awareness and education in the public about the gravity of emerging vulnerability in the state due to seismic hazard.

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Vice Chairman, BSDMA, Bihar



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PREFACE

During the past 180 years, Bihar has faced devastating earthquakes in 1833 and 1934, followed by a less damaging earthquake in 1988. The epicenter of 1833 earthquake was in central-east Nepal, which caused widespread damages at Monghyr, Muzaffarpur and other places in Bihar. Earthquake of magnitude 8.4 had occurred in 1934, having epicenter close to Bihar border in eastern Nepal, which devastated vast areas of North Bihar from East Champaran to Araria; severe damages were reported from Patna, Barh and Jamalpur also; Munghyr was completely ruined. In 1988, Earthquake of magnitude 6.6, epicenter at South-East Nepal, affected the districts of Darbhanga, Madhubani, Saharsa and Munger.

The object of this study is to estimate the probable damages and loss of lives that may occur in Bihar, if the 1934 earthquake intensity repeats. Therefore, hypothetical recurrence of postulated earthquake intensities in various districts and blocks of Bihar, have been analyzed based on Housing and population data of Census of India 2011.

For computation of probable building damage in a given area, a relation has been established with building types and seismic intensities. The building types based on wall material of 2011 Census have been correlated to the building types defined under MSK 1964 intensities, such as Type-A (Un-burnt brick houses, clay houses), Type-B (ordinary burnt brick buildings), Type-C1 (wood), Type-C2 (concrete) and Type-X (grass / plastic / bamboo / polythene / G.I. / asbestos sheets). Seismic intensity zones are V, IV and III as per the Seismic zoning map of India (IS:1893-2002).

Damage grades are adopted from G1 (slight damage) to G5 (total damage). Numerical values have been assigned to different damage grades in different Seismic intensity zones. Number of housing under damage grade of G5, G4, G3 and G2 have been computed for various districts and blocks, placed in different Seismic zones.

Risk of loss of human lives is based on the damage grade, the average population per house, the time of occurrence of earthquake, the type of construction and type of the roof of the collapsed houses. Losses of human lives are considered under damage grades of Collapse and Destruction (G5 and G4) and under grades G3 and G2 assumed nil.

Type of roof was considered R1(Light weight pitched roofs), R2 (Pitched roofs with heavy weight covering) and R3 (Heavy flat roofs consisting of wood joists carrying bricks and earth fill, stone slabs, RB or RC roof slabs). A life loss Reduction Factor for a district is based on Light roof housing type R1 and R2. For occurrence of Earthquake at a favorable time, life loss reduction factor for clear weather and daytime has also been considered.

During the postulated earthquake, a large number of losses of human lives are noticed and a huge number of re-construction and repair of houses will be required. Therefore, to reduce the trauma during post disaster, it is the time to determine that whatever is built now, must be earthquake resistant! And the most critical buildings needed for human survival must be surveyed and retrofitted.

Assistance provided by Shri. Barun Kant Mishra, Private Secretary to the Member, BSDMA throughout this study is gratefully acknowledged.

Dr. Anand S. Arya,
Member, BSDMA, Bihar

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DAMAGE SCENARIO UNDER HYPOTHETICAL RECURRENCES OF 1934 EARTHQUAKE INTENSITIES IN VARIOUS DISTRICTS IN BIHAR

1. INTRODUCTION

The aim of this document is to look at the damage scenarios in various Blocks and Districts of Bihar during a hypothetical earthquake having intensity similar to 1934 Bihar-Nepal earthquake if it recurs in the years soon following the Census year 2011. The 1934 Earthquake had serious impact on the population of Bihar. Incidentally, seismic zoning map of Bihar closely follows the intensity Iso-seismals of earthquake of 1934. See Fig. 1 and Fig. 3 for comparison.

Housing and population data required for working out Damage Scenarios is based on 2011 Census of India. Building types stipulated in 2011 Census have been correlated to the building types defined under MSK intensities so as to achieve the number of Census houses having various Damage Grades in different Seismic Zones. Human lives are lost under damage grades of Collapse and Destruction (**G5** and **G4**). In the post earthquake situation, buildings under damage grades of Collapse and Destruction will need **reconstruction** while buildings under damage grades of moderate damage **G2** and heavy damage **G3** may be repaired and retrofitted.

2. THREE DAMAGING EARTHQUAKES IN THE TERRITORY OF BIHAR

2.1 Damage Scenario observed in 1833 Bihar-Nepal earthquake

This is mentioned as a violent earthquake in Mallet's Earthquake Catalogue of the British Association. It had shaken the eastern India and Nepal between 5.30 to 8.00 PM on Aug. 26, 1833. The epicenter of the earthquake is stated as about $27\frac{1}{2}^{\circ}\text{N}$ 86.5°E and Magnitude $7\frac{1}{2}$ to 8 in the earthquake catalogue prepared by the India Meteorology Department, Govt. of India. It will thus be at about 100 km north of Indian border, inside Nepal. Widespread damage occurred in Nepal killing 414 persons. In India water was thrown out of tanks 1.2 m deep at Muzaffarpur, a Chasm of considerable size was formed in the earth at Chapra and many houses were destroyed and damaged at Monghyr, Rangpur, Muzaffarpur and other places. No loss of life was reported in India.

2.2 Damage Scenario observed in 1934 Bihar-Nepal earthquake

This earthquake of Magnitude estimated between 8.3 and 8.6 (assigned 8.4) had occurred on 15th January 1934 with origin time and location assigned as 14 h 13 min 25 sec Indian Standard time at 26.6°N Lat. 86.2°E long.

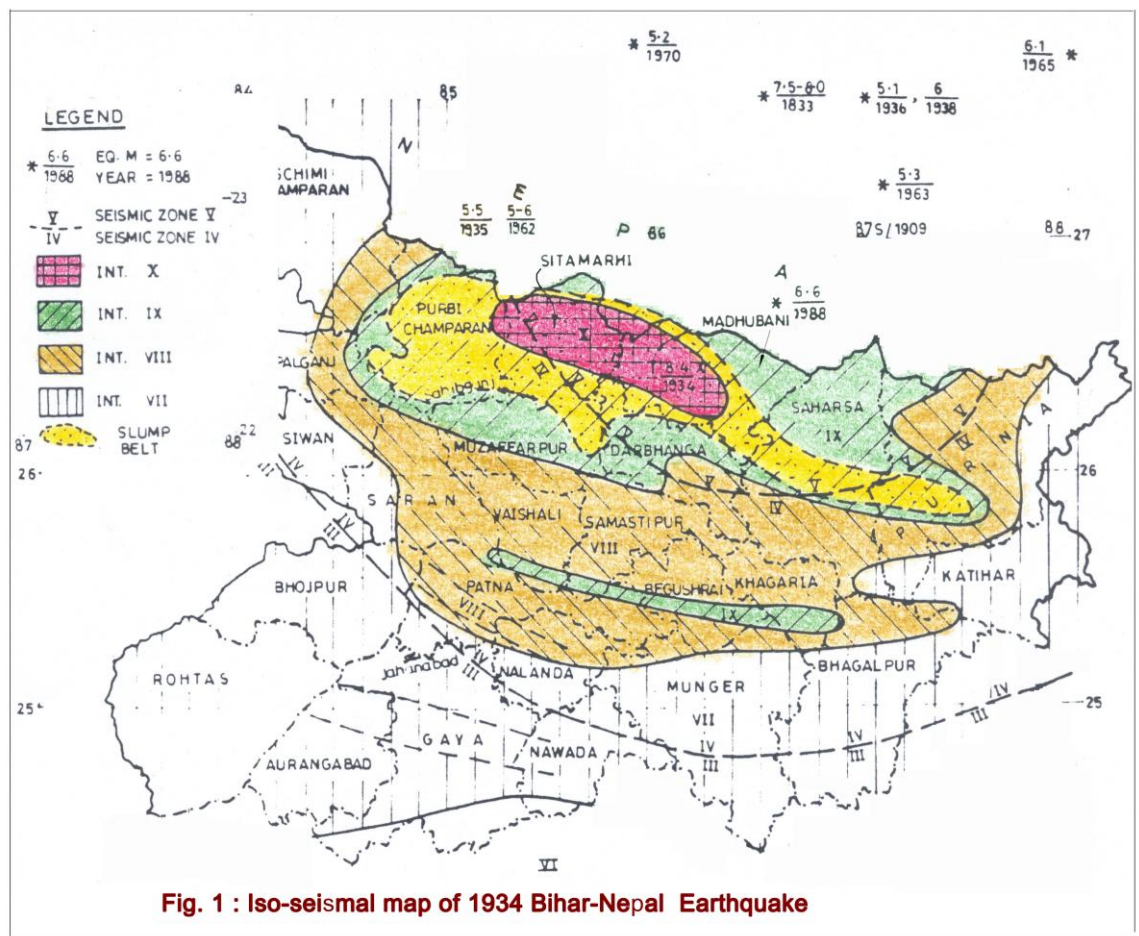
It is one of the few most violent earthquakes experienced in India and Nepal so far wherein 7153 lives were lost in India and about 8519 in Nepal. In this earthquake the towns of Monghyr in India and Bhatgaon in Nepal were completely in ruins, so were large parts of the cities of Motihari, Muzaffarpur and Darbhanga in India and, Patan and Kathmandu in Nepal, not mentioning the numerous villages razed to the ground in both countries. Large tracts in the districts of East Champaran, Sitamarhi, Madhubani, Saharsa and Purnia in a length of about 300 km and average width of about 50 km slumped due to liquefaction of sands and at many places sand fountains and sand-boils had occurred on a

large scale. In Sitamarhi, Madhubani and Purnia houses had greatly tilted and sank into the ground. In Purnia 95 percent houses became uninhabitable including 50 percent destroyed. Across the Ganga river also damage in towns of Patna, Barh and Jamalpur was severe including damage to roads.

The following is the district wise life loss reported in India (Bihar): Champaran 499, Muzaffarpur 2539, Darbhanga 2149, Monghyr 1497, Saran 193, Bhagalpur 174, Patna 142, Goya 34, Purnia 24, Santhal Parganas 2. (The old districts of Muzaffarpur and Darbhanga include the present districts of Sitamarhi, Madhubani and Saharsa).

The effects of this earthquake expressed in Modified Mercalli Scale and observed in terms of the slump belt are shown in Fig. 1 super imposed on the survey of India map of Bihar State published in 1974. See Fig.1. The epicenters of the earthquakes having Magnitudes more than 5.0 are also plotted.

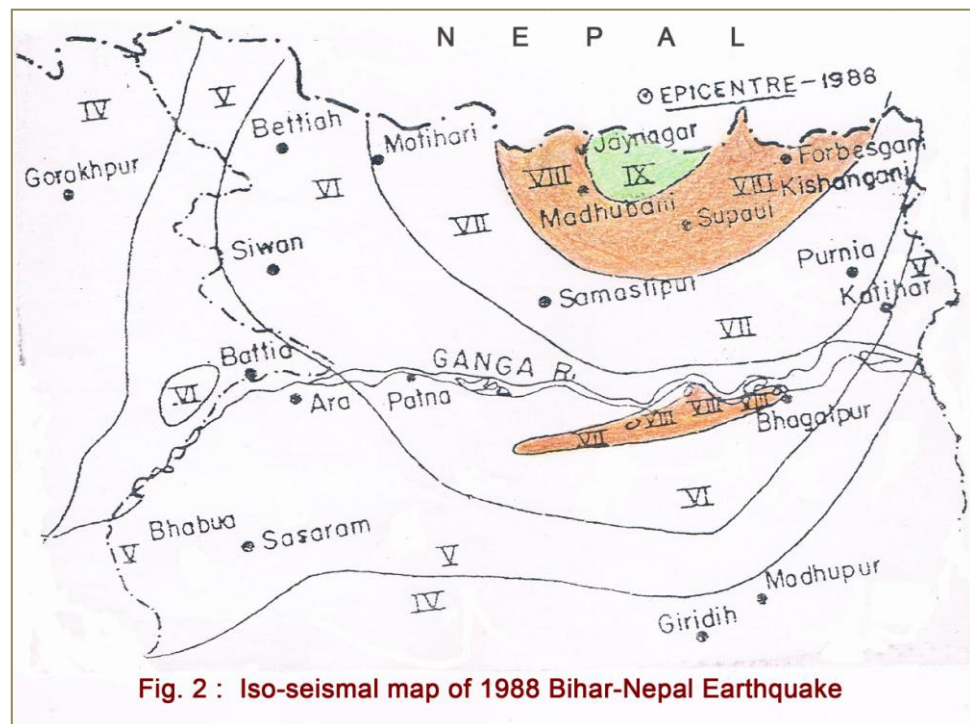
The seismic zones as per IS:1893-2002 are superimposed on this map to show the current thinking about probable maximum intensity on MSK scale since seismic zone V indicates roughly areas of 'MSK IX and more' and Zone IV areas of MSK VIII. Thus some of the factors that controlled the intensity distribution in this earthquake can be summarized as follows:



- i. Isoseismic X covered the epicentral region at the centre of the large slump belt and intensity dropped away from this area.
- ii. Damage was seen to be severe along river banks and low lying water logged areas near river banks (unconsolidated sandy beds). It was seen to be less on thick clay beds.
- iii. Damage in the slump belt was due to soil sinking effects. Outside this belt collapse of buildings occurred on account of direct shock, which was more pronounced in earthen or earthen-brick composite houses and less in fired-brick houses. Also huts made from bamboo with mud plaster suffered much less damage.
- iv. Munghyr town situated more than 120 km from the epicenter suffered much more severe damage as compared with many towns in between due to a peculiar geologic geotechnical set up. It is located on a thin shelf of alluvium abutting against Archaean quartzites. The discontinuity seems to play significant role in amplifying the ground motions greatly, due to which this town suffers damage from big as well as small earthquake motions arriving at it from any direction. This town was damaged again in the much smaller earthquake in Aug. 1988 described later and in the more distant earthquake of 1833 described here earlier.

It may be noted that iso-seismal IX in this earthquake that is presently in Zone V had enclosed an area of about 36000 km² (with a length of about 300km).

2.3 The 1988 Bihar-Nepal Earthquake



This earthquake of M 6.6 on Richter scale according to U.S. Geological Survey occurred in India-Nepal border region at Lat 26°45'18"N, Long. 86°36'57.6"E on Aug. 21, 1988 at 4h 39m 10.3s Indian Standard Time, that is, in the early morning hours of a day in the monsoon season when the areas in north Bihar were under floods. As a result 282 persons died and 3766 were injured in Bihar. The figures are surprisingly low in view of the fact that 149334 houses were damaged in Bihar, (Pucca private houses: collapsed 11335, major damage 19141, minor damage 34142; Kutcha houses: collapsed 13758, major damage 27258 and minor damage 43700). Most of the damaged houses were of Unburnt or burnt brick masonry in Bihar. The worst affected Districts in Bihar were again Darbhanga, Madhubani, and Saharsa close to the border and Munger town due its special geologic and geotechnical set-up. The iso-seismal map of 1988 Bihar-Nepal Earthquake is shown in Fig.2

As in the 1934 earthquake, large scale liquefaction of soil took place but to a much smaller extent than that in 1934. The overall damage costs in private housing and government buildings structures and services, estimated by the various Government Departments were Rupees 108.9 crores for houses and Rs. 79.9 crores for government buildings and facilities (Rupees of year 1988).

Note: It may be mentioned that the earthquake of Magnitude 8.4 in 1934 would be about 750 times of the energy release in 6.6 earthquake Magnitude in 1988. The repeat of 1934 in future will indeed be catastrophic in view the increased population and the vulnerable assets.

Whatever is built now must be earthquake resistant !

3. SEISMIC ZONING MAP OF BIHAR

Eight District of the State of Bihar lie in the Seismic Zone **V** of Seismic Zoning Map of India. These Districts are Sitamarhi, Madhubani, Darbhanga, Saharsa, Supan, Madhepura, Araria and Kishanganj. In Seismic Zone **V**, MSK Intensity '**IX** or higher' are considered probable. Twenty Four districts namely Poorvi Champaran, Paschim Champaran, Shivhar, Chapra, Siwan, Gopalganj, Muzaffarpur, Vaishali, Samastipur, Begusarai, Khagaria, Purnia, Katihar, Bhojpur, Patna, Jahanabad, Nalanda, Nawada, Shekhpura, Lakhisarai, Jamui, Munger, Bhagalpur and Banka are classified in seismic Zone **IV** with probable maximum earthquake intensity, MSK VIII. Only five districts at the South-West Corner of the State are placed in seismic zone III where maximum probable intensity MSK **VII** is postulated to occur. The seismic zoning map of Bihar is shown in Fig.3.

It will be instructive to note that during the 1934 Bihar-Nepal Earthquake an elliptic area of 120 km East-West & 30 km North-South was placed in the iso-seismal of Intensity MM **X** surrounded by an elliptic area of 300 km East-West by 120 km North-South which was placed in Iso-seismal of MM Intensity **IX** covering Nepal's Mountains area and the plain area in Bihar. The presently defined seismic Zone **V** area is wholly classified in the Iso-seismal of Intensity MM **IX** which also contains the Iso-seismal of Intensity **X**. A very large area covering most of the districts now placed in seismic Zone **IV** were actually subjected to MM Intensity **VIII**. Only the Southern part of some of the districts and whole of the

districts to the South-West of Bihar were subjected to MM Intensity VII which defines seismic Zone III. An iso-seismal map of 1934 earthquake is shown in Fig.1.

Thus, the present classification of seismic Zones in Bihar is in reality the outcome of the 1934 Bihar-Nepal Earthquake. Therefore, the repeat occurrence of similar intensities in a future large magnitude earthquake of the same size as in 1934 earthquake should be considered *probable* and the damage levels in various districts that could occur in the *present building types* can be worked out in a realistic manner.

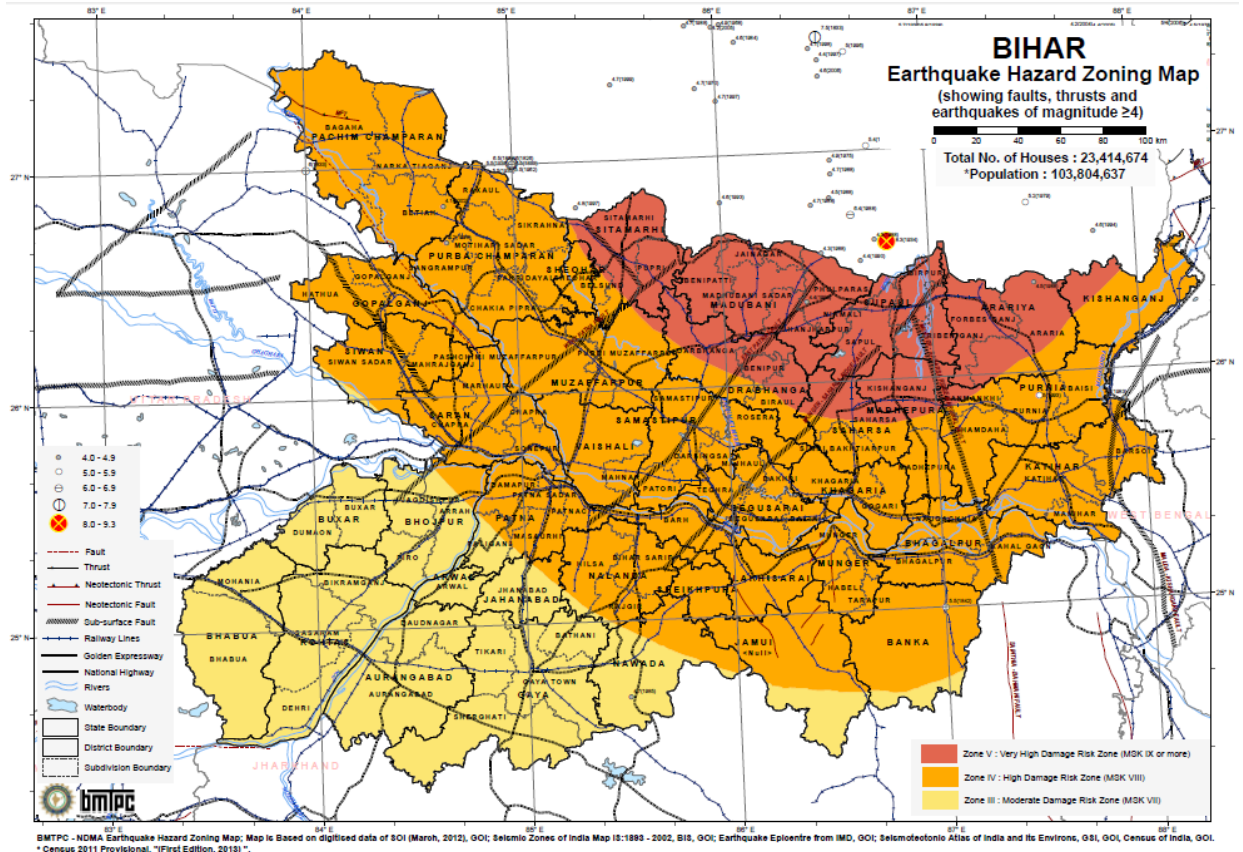


Fig.3 : Seismic Zoning map of Bihar

4. HOUSING DATA REQUIRED FOR WORKING OUT DAMAGE SCENARIOS

The best comprehensive data on types of housing units is being collected in the National Census exercise being conducted every 10 year in India. The author has looked at the data collected in 1971, 1981, 1991, 2001 & 2011. The type of Census housing is explained on **Annexure A**. The 1971 data also included sketches of various housing types which were common in those days in the Rural as well as urban areas of India. The data in 2011 Census classifies the various building types based on wall material and roof material which are considered most important in the damaging impacts of earthquakes, floods and cyclonic winds. In this report the impact of earthquake Intensities has only been considered. The specified data in the Census of housing units specifies the following materials for walling and roofing:

a) Walling material

- i) Grass/ Thatch/ Bamboo etc.
- ii) Plastic/ Polythene
- iii) Mud/
- iv) Un-burnt brick
- v) Wood
- vi) Stone not packed with mortar
- vii) Stone packed with mortar
- viii) G.I./ Metal/ Asbestos sheets
- ix) Burnt brick
- x) Concrete
- xi) Any Other material

b) Roofing material

- i) Grass/ Thatch/ Bamboo/ Wood/Mud etc.
- ii) Plastic/ Polythene
- iii) Handmade Tiles
- iv) Machine made Tiles
- v) Burnt Brick
- vi) Stone/Slate
- vii) G.I./Metal/ Asbestos sheets
- viii) Concrete
- ix) Any other material

Information on number of housing units for all wall materials is given in the housing tables of the Census for each district and *sub-district* (called *block* in Bihar) for rural and urban areas separately as well as the total housing unit per district/block.

5. RELATIONSHIP OF HOUSE TYPES WITH EARTHQUAKE DAMAGING INTENSITIES

5.1 Walling Material Classification

The impact of various earthquake intensities on buildings is indicated in the description given in MSK intensity scales. The building types for specifying the damage are classified as **A, B** and **C** types which are defined as follows (Refer IS 1893 (Part 1) : 2002, Annex D) :-

Type -A: Buildings in field-stone, rural structures, Un-burnt brick houses, clay houses.

Type -B: Ordinary brick buildings, Building of the large block and prefabricated type, half timbered structures, building in natural hewn stone.

Type-C: Concrete building, Well built wooden structures.

It is seen that in the rural and urban areas of India, many houses are constructed by biomass type wall material such as Grass/ Thatch/ Bamboo etc., Plastic/ Polythene, G.I./ Metal/ Asbestos sheets and 'any other materials'. These materials do not fall under the categories **A, B** and **C**. The author therefore classified such materials under type **X**. To be able to correlate the buildings types in India stipulated in 2011 Census with the building types defined under MSK intensities, the house type tabulation was reworked as given below:

Type-A:	Mud/Un-burnt Brick, Stone not packed with Mortar, Stone Packed with Mortar.
Type-B:	Burnt Brick
Type-C1:	Wood
Type-C2:	Concrete
Type-X:	Grass/ Plastic/ Bamboo etc, Plastic/ Polythene, G.I./ Metal/ Asbestos sheets and 'any other material'.

For computation of the numbers of Census housing units under various damageability grades, the type **C1** and **C2** has been summed up and named as **Type C**. Type **X**, having low vulnerability, has not been considered for computation of damageability.

5.2 Roofing Material

The roofing material stated under 4 b) above were also classified under three roof types as follows:

- Category **R1**: Light weight pitched roofs consisting of grass, thatch, bamboo, wood, plastic, polythene, GI Metal, Asbestos Sheets, Other similar light materials.
- Category **R2**: Pitched roofs with heavy weight covering such as earthen tiles, slates.
- Category **R3**: Heavy flat roofs consisting of wooding joists carrying bricks and earth fill, stone slabs, RB or RC roof slabs.

6. THE DAMAGING EARTHQUAKE INTENSITIES

6.1 Damage grades

These are defined in MSK Intensity Scale as follows:-

(Refer IS 1893 (Part 2) : 2002, Annex D) - Classification of Damage to Buildings

- G5** : Grade 5 - *Total damage*
Total collapse of the buildings
- G4** : Grade 4 - *Destruction*
Gaps in walls; parts of buildings may collapse; separate parts of the buildings lose their cohesion; and inner walls collapse.
- G3** : Grade 3 - *Heavy damage*
Large and deep cracks in walls and plaster; fall of chimneys
- G2** : Grade 2 - *Moderate damage*
Small cracks in walls and plaster; Fall of fairly large pieces of plaster; Pantiles slip off; Cracks in chimneys; Parts of chimney fall down
- G1** : Grade 1 - *Slight damage*
Fine cracks in plaster; fall of small pieces of plaster

6.2 Probable Damages Stated in MSK Intensities VI to IX

(Refer IS 1893 (Part 2) : 2002, Annex D) - Intensity Scales

Intensity Scale VI: *Frightening*

Damage of **Grade 1** is sustained in single buildings of Type **B** and in **many** of Type **A**. Damage in **few** buildings of Type **A** is of **Grade 2**.

Intensity Scale VII: *Damage of buildings*

In **many** buildings of Type **C** damage of **Grade 1** is caused: in **many** buildings of Type **B** damage is of **Grade 2**. **Most** buildings of Type **A** suffer damage of **Grade 3**, **few** of **Grade 4**. In single instances, landslides of roadway on steep slopes: crack inroads; seams of pipelines damaged; cracks in stone walls.

Intensity Scale VIII: *Destruction of buildings*

Most buildings of Type **C** suffer damage of **Grade 2**, and **few** of **Grade 3**, **Most** buildings of Type **B** suffer damage of **Grade 3**. **Most** buildings of Type **A** suffer damage of **Grade 4**. Occasional breaking of pipe seams. Memorials and monuments move and twist. Tombstones overturn. Stone walls collapse.

Intensity Scale IX: *General Damage of buildings*

Many buildings of Type **C** suffer damage of **Grade 3**, and a few of **Grade 4**. **Many** buildings of Type **B** show damage of **Grade 4** and a few of **Grade 5**. **Many** buildings of Type **A** suffer damage of **Grade 5**. Monuments and columns fall. Considerable damage to reservoirs; underground pipes partly broken; In individual cases, railway lines are bent and roadway damaged.

6.3 Definition of terms **Most**, **Many** and a **Few**

European committee describing MSK Scale have tried to express range of numbers for the terms **Most**, **Many** and a **Few**. Since the number given in the MSK Intensity Scale 1964 are averages, the author has considered that the definition of '**Most**' can be taken up in the range of 60% to 90%, '**Many**' in the range of 40% to 60% and '**Few**' in the range of 5% to 15%.

6.4 Relationship of Building damages with building types and seismic intensity

Numerical values have been assigned to different damage grades for computation through a computer based on definition of **Most**, **Many** and a **Few**.

Table – 1: Number of Housing having various Damage Grades in different Seismic Zones

Type of building	Zone III Intensity : MSK VII	Zone IV Intensity : MSK VIII	Zone V Intensity : MSK IX or More
A	10% : G4 75% : G3 Rest : G2 or, (G1)	10% : G5 75% : G4 Rest : G3 or, G2	50% : G5 Rest : G4 or, G3
B	10% : G3 50% : G2 Rest : G1	10% : G4 75% : G3 Rest : G2	10% : G5 50% : G4 Rest : G3
C	10% : G2 50% : G1 Rest : No damage	10% : G3 75% : G2 Rest : G1	10% : G4 50% : G3 Rest : G2
D	10% : G1 Rest : No damage	10% : G2 Rest : G1 or, No damage	10% : G3 50% : G2 Rest : G1

Notes:

- (i) % shown in the table above denotes the average percentage of number of buildings of a particular type in the area under consideration.
- (ii) 10% shown above may range from 5% to 15%; 50% may range from 40% to 60% and 75% may range from 60% to 90%.
- (iii) Variation in % are due to age of the building, mortar used in masonry, workmanship of construction, maintenance of the building, number of storeys, storey height, type of roof (pitched roof, flat flexible, flat rigid), etc.

7. COMPUTATION OF PROBABLE BUILDING DAMAGE IN A GIVEN AREA

7.1 Number of Housing of different Types

Let,

nA_V, nB_V and nC_V = number of housing of type **A, B** and **C** respectively in zone **V**.

nA_IV, nB_IV and nC_IV = number of housing of type **A, B** and **C** respectively in zone **IV**.

nA_III, nB_III and nC_III = number of housing of type **A, B** and **C** respectively in zone **III**.

As explained in para 5, the number of housing of types **A, B, C** and **X**, related to the different districts and their blocks have been tabulated in Report-1. For Darbhanga district and it's Blocks, housing types is illustrated in Table-2 below. The earthquake zone of different blocks is also shown in the Table-2.

Table-2: Number of Census Houses of different Types in Present Darbhanga District

Block of Darbhanga District	Seismic Zone	nA	nB	nC
Jale	V	8,323	38,816	1077
Singhwara	V	10,453	41,359	1279
Keotiranway	V	6,947	41,746	784
Darbhanga	V	18,085	94,614	2170
Manigachhi	V	7,386	33,773	551
Tardih	V	2,398	15,858	349
Alinagar	V	5,292	18,087	240
Benipur	V	8,366	38,220	839
Bahadurpur	V	9,930	35,748	870
Hanumannagar	IV	4,083	19,294	568
Hayaghat	IV	4,370	20,418	457
Baheri	IV	11,685	46,622	674
Biraul	IV	11,696	41,566	722
Ghanshyampur	V	3,576	18,253	357
Kiratpur	V	617	4,771	107
Gora Bauram	V	5,807	15,837	615
Kusheshwar Asthan	IV	6,027	17,008	539
Kusheshwar Asthan Purbi	IV	2,342	5,509	392
Total for Darbhanga District	V & IV	127,383	547,499	12590

7.2 Number of housing under different damage grades

Following are the equations for number of housing under damage grade of **G5**, **G4**, **G3** and **G2**, for different seismic zones, generated with the help of Table-1.

a) For a region in Zone **V**

The number of housing under damage grade of **G5** in zone **V**,

$$\mathbf{NG5_V = 0.50 * nA_V + 0.10 * nB_V} \quad \dots \quad \mathbf{(V.5)}$$

The number of housing under damage grade of **G4** in zone **V**,

$$\mathbf{NG4_V = 0.25 * nA_V + 0.50 * nB_V + 0.10 * nC_V} \quad \dots \quad \mathbf{(V.4)}$$

The number of housing under damage grade of **G3** in zone **V**,

$$\mathbf{NG3_V = 0.25 * nA_V + 0.40 * nB_V + 0.50 * nC_V} \quad \dots \quad \mathbf{(V.3)}$$

The number of housing under damage grade of **G2** in zone **V**,

$$\mathbf{NG2_V = 0.40 * nC_V} \quad \dots \quad \mathbf{(V.2)}$$

b) For a region in Zone **IV**

The number of housing under damage grade of **G5** in zone **IV**,

$$\mathbf{NG5_IV = 0.10 * nA_IV} \quad \dots \quad \mathbf{(IV.4)}$$

The number of housing under damage grade of **G4** in zone **IV**,

$$\mathbf{NG4_IV = 0.75 * nA_IV + 0.10 * nB_IV} \dots \mathbf{(IV.5)}$$

The number of housing under damage grade of **G3** in zone **IV**,
 $NG3_IV = 0.075 * nA_IV + 0.75 * nB_IV + 0.10 * nC_IV$ (IV.3)

The number of housing under damage grade of **G2** in zone **IV**,
 $NG2_IV = 0.075 * nA_IV + 0.15 * nB_IV + 0.75 * nC_IV$ (IV.2)

c) For a region in Zone III

The number of housing under damage grade of **G5** in zone **III**,
 $NG5_III = Nil$ (III.5)

The number of housing under damage grade of **G4** in zone **III**,
 $NG4_III = 0.10 * nA_III$ (III.4)

The number of housing under damage grade of **G3** in zone **III**,
 $NG3_III = 0.75 * nA_III + 0.10 * nB_III$ (III.3)

The number of housing under damage grade of **G2** in zone **III**,
 $NG2_III = 0.075 * nA_III + 0.50 * nB_III + 0.10 * nC_III$ (III.2)

Probable number of housing under different damage grades, as per seismic zone of different blocks of Bihar are tabulated in Report-1. Probable number of housing under different damage grades, as per seismic zone of different blocks of Darbhanga district are illustrated in Table-3. The number of housing under different damage grades for different blocks has been sum up to obtain the total number of housing under different damage grades for the whole Darbhanga district.

**Table-3 : Probable Number of Housing Under Different Damage Grades
in Present Darbhanga District**

Blocks of Darbhanga District	Seismic Zone	Number of damageable cesus houses			Number of Houses under various Damage Grades			
		nA	nB	nC	NG5	NG4	NG3	NG2
Jale	V	8323	38816	1077	8043	21596	18146	431
Singhwara	V	10453	41359	1279	9362	23421	19796	512
Keotiranway	V	6947	41746	784	7648	22688	18827	314
Darbhanga	V	18085	94614	2170	18504	52045	43452	868
Manigachhi	V	7386	33773	551	7070	18788	15631	220
Tardih	V	2398	15858	349	2785	8563	7117	140
Alinagar	V	5292	18087	240	4455	10391	8678	96
Benipur	V	8366	38220	839	8005	21285	17799	336
Bahadurpur	V	9930	35748	870	8540	20444	17217	348
Ghanshyampur	V	3576	18253	357	3613	10056	8374	143
Kiratpur	V	617	4771	107	786	2550	2116	43
Gora Bauram	V	5807	15837	615	4487	9432	8094	246
Hanumannagar	IV	4083	19294	568	408	4992	14834	3626
Hayaghat	IV	4370	20418	457	437	5319	15687	3733
Baheri	IV	11685	46622	674	1169	13426	35910	8375
Biraul	IV	11696	41566	722	1170	12929	32124	7654
Kusheshwar Asthan	IV	6027	17008	539	603	6221	13262	3407
Kusheshwar Asthan Purbi	IV	2342	5509	392	234	2307	4347	1296
Total for Darbhanga District	V & IV				87319	266454	301410	31787

8. RISK OF LOSS OF HUMAN LIVES

As seen in many earthquakes in the world, there are many factors, which have given different numbers for loss of lives:-

(i) The time of occurrence of the earthquake

The time of occurrence of earthquake may be at any hour in the morning, daytime, evening or in the night and it may be during any day of any season of the year.

For example, 1934 Bihar – Nepal Earthquake occurred on the 15th January in the afternoon, on a sunny day. The casualties were very few, although the loss of buildings was huge both in urban and rural areas. During the winter season people were working out in the sun and only those who were still in houses, particularly women and old people lost their lives.

During 1980, in erstwhile Yugoslavia, at Skopje on the Adriatic coast, the earthquake destroyed all reinforced concrete 5 storied hotel buildings with practically no life loss. The hotels were to be occupied after a couple of days when the tourist season was to commence. The earthquake occurred a few days earlier before the opening. Had the earthquake occurred after a week, thousands of tourists would have been killed.

In North Yemen, Earthquake happened in 1982 at the noon time. Hundreds of Muslims were praying in the Mosque and the children were learning in the Madarsa attached to the Mosque. The earthquake killed more than 200 during collapse of the total structure.

In China, the Sichuan earthquake occurred at night, school and hostel buildings collapsed. School buildings were empty and no student was killed. But, thousands of students were killed in the hostel, sleeping at night.

(ii) Type of Construction

During Uttarkashi earthquake in 1991, 650 lives were lost, where, as per Government records, 14847 houses were termed fully damaged, i.e. one life was lost in 23 houses destroyed.

On the other hand, in the Killari earthquake of 1993 in Maharashtra, about 9000 lives lost and 28771 houses were destroyed, i.e., one life was lost in 3.2 houses destroyed.

As explained in the damage categories, houses damaged in G4 and G5 are clubbed under one heading by the revenue officers visiting a building site after an earthquake. If the destroyed (G4) and the collapsed (G5) be differentiated, the differences in life lost can be understood, since, life loss takes place mostly in the collapsed houses.

(iii) Type of Roof of the collapsed house

A big difference is seen in the loss of life, if a house has heavy flat roof (Type **R3**) consisting of wooden joist, brick laid over joist and lime or earth fill at the top. Other flat roof may be Reinforced concrete or Reinforced brick roof with or without roof covering. Collapse of such roof, with collapse of walls is sufficient to crush any life underneath. If the roof is sloping with light weight covering (Type **R1**), the injuries of the people underneath may be severe; but the life losses can be much less. Type **R2** will have more injurious effects than Type **R1** but much less than Type **R3**

(iv) Loss of Lives in 1934 Earthquake projected to the year 2011

Case 1. **Madhubani** district

Reported loss of life in old Darbhanga district, in 1934 Earthquake = 2,149

Old Darbhanga district in 1934 covered the three present districts Madhubani, Darbhanga and Samastipur.

As per 2011 Census Housing Data,

Madhubani District	1,068,295
Darbhanga District	993,103
Samastipur District	<u>1,028,897</u>

Total for **old** Darbhanga Distt. 3,090,295

Housing Fraction for Madhubani District, (with respect to **old** Darbhanga District)

$$= 1,068,295 / 3,090,295 = 0.35$$

Loss of Life in present Madhubani District, in 1934 Earthquake = $0.35 * 2,149 = 752$

As per 1931 Census, Population of Bihar in 1931 (Including Jharkhand) = 25,727,500

As per 2011 Census Population Data

Bihar	103,804,637
Jharkhand	<u>32,966,238</u>
Total for Combined Bihar	136,770,875

Ratio of increased population, 2011 to 1931 = $136,770,875 / 25,727,500 = 5.32$

Loss of Life in present Madhubani District, If 1934 Earthquake projected to 2011,

$$= 752 * 5.32 = \mathbf{4,001}$$
 numbers

Case 2. **DARBHANGA** DISTRICT

Reported loss of life in old Darbhanga district, in 1934 Earthquake = 2,149

Similarly, working out for the present Darbhanga district (as in Case.1),

Housing Fraction for Darbhanga District, (with respect to **old** Darbhanga District)

$$= 993,103 / 3,090,295 = 0.32$$

Loss of Life in present Darbhanga District, in 1934 Earthquake = $0.32 * 2,149 = 688$

Similarly, working out 1931 and 2011 Census Population Data (as in Case.1),

for Bihar and Jharkhand, Ratio of increased population, 2011 to 1931 = 5.32

Loss of Life in present Darbhanga District, If 1934 Earthquake projected to 2011,

$$= 688 * 5.32 = \mathbf{3660}$$
 numbers

Case 3. **MUZAFFARPUR DISTRICT**

Reported loss of life in old Muzaffarpur district, in 1934 Earthquake = 2,539

Old Muzaffarpur district in 1934 covered the four present districts Sheohar, Sitamarhi, Muzaffarpur, and Samastipur.

As per 2011 Census Housing Data,

Sheohar District	166,000
Sitamarhi District	856,964
Muzaffarpur District	1,119,394
Vaishali District	<u>750,811</u>

Total for **old** Muzaffarpur Distt. 2,893,169

Housing Fraction for Muzaffarpur District, (with respect to **old** Muzaffarpur District)
= $1,119,394 / 2,893,169 = 0.39$

Loss of Life in present Muzaffarpur District, in 1934 Earthquake = $0.39 * 2,539 = 990$

Similarly, working out 1931 and 2011 Census Population Data (as in Case.1),
for Bihar and Jharkhand, Ratio of increased population, 2011 to 1931 = 5.32

Loss of Life in present Muzaffarpur District, If 1934 Earthquake projected to 2011,
= $990 * 5.32 = 5267$ numbers

9. ESTIMATION FOR LOSS OF LIVES

➡ From Census data, total population and total no of housing is known for each district. Let **R** be the average population per house for a district. **R** for various districts of Bihar is computed in Report-2 and the values of **R** are used in Report-1.

➡ Human lives are lost under damage grades of Collapse and Destruction (**G5** and **G4**). It is assumed that loss of lives may be 6 % in a house under damage grade **G5** and 2 % under damage grade **G4**. Loss of lives in damage grades **G3** and **G2** is assumed nil.

➡ It is assumed that the life loss Reduction Factor for a district, based on Light roof R1 housing and R2 housing; $L = (10 \% \text{ of } R1 + 30\% \text{ of } R2 + R3) / \text{Total Housing}$.

The values of **L** are computed in Report-3 and are used in Report-1

➡ Occurrence of Earthquake at a favorable time

It is assumed that the life loss Reduction Factor for a district, during clear weather and daytime, $F = (0.3 * \text{Rural housing} + 0.5 * \text{Urban Housing}) / \text{Total Housing}$

The values of **F** are computed in Report-2 and are used in Report-1

Then,

a) Estimated Loss of Human Lives, in a region in Zone V

For unfavorable time occurrence = $L * R * (0.06 * NG5_V + 0.02 * NG4_V)$

For favorable time occurrence = $F * L * R * (0.06 * NG5_V + 0.02 * NG4_V)$

b) Estimated Loss of Human Lives, in a region in Zone IV

For unfavorable time occurrence = $L * R * (0.06 * NG5_IV + 0.02 * NG4_IV)$

For favorable time occurrence = $F * L * R * (0.06 * NG5_IV + 0.02 * NG4_IV)$

c) Estimated Loss of Human Lives, in a region in Zone III

For unfavorable time occurrence = $L * R * (0.06 * NG5_III + 0.02 * NG4_III)$

For favorable time occurrence = $F * L * R * (0.06 * NG5_IIIV + 0.02 * NG4_IV)$

Probable losses of lives for different blocks of Bihar are tabulated in Report-1. Probable loss of life for each Block of Madhubani, Darbhanga and Muzaffarpur districts is illustrated in Table-4, Table-5 and Table-6 respectively. Probable Loss of Lives is based on:

- ✓ the average population per house, **R** for a district,
- ✓ probable number of housing of the blocks under damage grade of **G5** and **G4**
- ✓ the life loss Reduction Factor for a district, based on Light roof housing type R1 and R2
- ✓ life loss Reduction Factor for a district, during clear weather and daytime,

Probable losses of lives during favorable time, computed on Table-4, Table-5 and Table-6 has been compared with the projected loss of lives in 1934 Earthquake (favorable time) as below:

Districts	Table Vales	Projected Values
Madhubani	4973	4001
Darbhang	5025	3660
Muzaffarpur	<u>2633</u>	<u>5267</u>
Total Values	12631	12928

Total values show close resemblance of table values with projected values, if large area is considered.

Blocks of Madhubani District	Seismic Zone	District Factors	Number of Houses under various Damage Grades		Loss of Human Lives	
			NG5	NG4	Unfavourable	Favourable
Madhwapur	V		3529	8864	528	164
Harlakhi	V		4370	11086	656	203
Basopatti	V	R = 4.11	2861	8622	467	145
Jainagar	V	L = 0.33	3319	11382	579	179
Ladania	V	F = 0.31	5312	9401	687	213
Laukaha	V		5205	11292	730	226
Laukahi	V		7536	9230	864	268
Phulparas	V		4342	8120	574	178
Babubarhi	V		6671	13799	917	284
Khajauli	V		2460	8043	418	130
Kaluahi	V		2659	7339	415	129
Benipatti	V		7484	21947	1204	373
Bisfi	V		7536	21354	1192	370
Madhubani	V		7568	22887	1237	383
Pandaul	V		8712	20219	1257	390
Rajnagar	V		6496	17289	998	309
Andhratharhi	V		5079	12235	745	231
Jhanjharpur	V		5617	12691	801	248
Ghoghardiha	V		3905	8508	549	170
Lakhnaur	V		4164	10874	634	196
Madhepur	V		3555	11030	589	182
Total for Madhubani Distt.	V		108382	266210	16041	4973

Blocks of Darbhanga District	Seismic Zone	District Factors	Number of Houses under various Damage Grades		Loss of Human Lives	
			NG5	NG4	Unfavourable	Favourable
Jale	V		8043	21596	1359	435
Singhwara	V		9362	23421	1531	490
Keotiranway	V	R = 3.91	7648	22688	1356	434
Darbhanga	V	L = 0.38	18504	52045	3196	1023
Manigachhi	V	F = 0.32	7070	18788	1189	380
Tardih	V		2785	8563	503	161
Alinagar	V		4455	10391	706	226
Benipur	V		8005	21285	1346	431
Bahadurpur	V		8540	20444	1369	438
Hanumannagar	IV		408	4992	185	59
Hayaghat	IV		437	5319	197	63
Baheri	IV		1169	13426	503	161
Biraul	IV		1170	12929	488	156
Ghanshyampur	V		3613	10056	621	199
Kiratpur	V		786	2550	146	47
Gora Bauram	V		4487	9432	680	218
Kusheshwar Asthan	IV		603	6221	239	76
Kusheshwar Asthan Purbi	IV		234	2307	89	29
Total for Darbhanga District	V & IV		87319	266454	15702	5025

Table-6 : Probable loss of life in Blocks of Muzaffarpur district						
Blocks of Muzaffarpur District	Seismic Zone	District Factors	Number of Houses under various Damage Grades		Loss of Human Lives	
			NG5	NG4	Unfavourable	Favourable
Sahebganj	IV		561	6463	271	87
Baruraj (Motipur)	IV		1043	11927	501	160
Paroo	IV		698	8192	343	110
Saraiya	IV	R = 4.27	777	9146	382	122
Marwan	IV	L = 0.39	413	4968	207	66
Kanti	IV	F = 0.32	701	8503	353	113
Minapur	IV		910	10092	427	137
Bochaha	IV		445	5677	233	75
Aurai	V		7732	17805	1366	437
Katra	V		7440	17628	1331	426
Gaighat	IV		721	8381	351	112
Bandra	IV		391	4209	179	57
Dholi (Moraul)	IV		418	4267	184	59
Musahri	IV		1461	21934	877	280
Kurhani	IV		1439	15702	667	213
Sakra	IV		1193	13176	558	179
Total for Muzaffarpur Distt.	V & IV		26341	168069	8230	2633

10. ESTIMATION OF RECONSTRUCTION & REPAIRING

The housing under damage grade G5 and G4 shall have to be reconstructed and the housing under damage grade G3 and G2 shall have to be repaired, hence,

- For a region in Zone V
 Estimated Reconstruction = NG5_V + NG4_V
 Estimated Repairing = NG3_V + NG2_V
- For a region in Zone IV
 Estimated Reconstruction = NG5_IV + NG4_IV
 Estimated Repairing = NG3_IV + NG2_IV
- For a region in Zone III
 Estimated Reconstruction = NG5_III + NG4_III
 Estimated Repairing = NG3_III + NG2_III

Based on probable number of housing under various damage grades, probable number of housing of each Block of Darbhanga district, which will require reconstruction and repair, is illustrated in Table-7. The probable number of housing of each Block requiring reconstruction and repair has been summed up to obtain the total number housing requiring reconstruction and repair for whole Darbhanga district. Probable reconstruction and repair for different blocks of Bihar are tabulated in Report-1.

Table-7 : Number of Census Houses requiring Re-construction and Repair in Blocks of Darbhanga district							
Blocks of Darbhanga district	Seismic Zone	Number of Houses under damage Types				Number of Houses needing	
		NG5	NG4	NG3	NG2	Re-construction	Repairing
Jale	V	8,043	21,596	18,146	431	29,640	18,576
Singhwara	V	9,362	23,421	19,796	512	32,783	20,308
Keotiranway	V	7,648	22,688	18,827	314	30,336	19,141
Darbhangha	V	18,504	52,045	43,452	868	70,549	44,320
Manigachhi	V	7,070	18,788	15,631	220	25,858	15,852
Tardih	V	2,785	8,563	7,117	140	11,348	7,257
Alinagar	V	4,455	10,391	8,678	96	14,845	8,774
Benipur	V	8,005	21,285	17,799	336	29,290	18,135
Bahadurpur	V	8,540	20,444	17,217	348	28,983	17,565
Hanumannagar	IV	408	4,992	14,834	3,626	5,400	18,460
Hayaghat	IV	437	5,319	15,687	3,733	5,756	19,420
Baheri	IV	1,169	13,426	35,910	8,375	14,594	44,285
Biraul	IV	1,170	12,929	32,124	7,654	14,098	39,778
Ghanshyampur	V	3,613	10,056	8,374	143	13,670	8,517
Kiratpur	V	786	2,550	2,116	43	3,336	2,159
Gora Bauram	V	4,487	9,432	8,094	246	13,919	8,340
Kusheshwar Asthan	IV	603	6,221	13,262	3,407	6,824	16,669
Kusheshwar Asthan Purbi	IV	234	2,307	4,347	1,296	2,542	5,643
Total for Darbhanga District	V & IV	87,319	2,66,454	3,01,410	31,787	3,53,772	3,33,197

11. CONCLUSION

The damage scenario under hypothetical occurrences of postulated earthquake intensities in all districts and blocks in Bihar has been analyzed and computations are shown in Report-1.

In view of the huge number of probable Loss of Human Lives during postulated earthquake and a large number of Re-construction and Repair of Houses required at the probable post earthquake situation, the following measures are suggested that should be taken up urgently :-

- (i) All new construction of housing should be earthquake resistant as per BIS codes of India.
- (ii) The housing constructed without sufficient earthquake resisting elements, should be surveyed and retrofitted if required.
- (iii) A special legislation along with special team of private-public organization may be entrusted to accomplish the above tasks.

Understanding Census Housing

We may consider Housing Sector comprising of *all* buildings as per Census 2001- the Housing Series, where buildings are classified in there different ways “**rural and urban**”, based on “**functional uses**”, and as “**permanent semi-permanent or temporary**”. These are defined below:

a) Rural-Urban Areas

The unit of classification is ‘town’ for urban areas and ‘village’ for rural areas. The definition of urban area adopted is as follows:

- i) All places with a municipality, corporation, cantonment board or notified town area, etc.
- ii) A place satisfying the following three criteria simultaneously:
 - a minimum population of 5,000;
 - at least 75 per cent of male working population engaged in non-agricultural pursuits; and
 - a density of population of at least 400 per sq. km.

For identification of places, that would qualify to be classified as ‘urban’ all villages, which, as per the 1991 Census, satisfied the above criteria were so chosen.

Apart from these, the outgrowths (OGs) of cities and towns have also been treated as urban under ‘Urban Agglomerations’: Examples of out-growths are railway colonies, university campuses, port areas, military camps, etc. that may have come up near a statutory town or city but within the revenue limits of a villages or villages contiguous to the town or city. Thus, the town level data, wherever presented, also includes the data for outgrowths of such towns.

Towns with population of 1,00,000 and above are called cities

b) Uses of Census Houses

The different uses of census houses were standardized and grouped into ten categories, as shown below

Residence: This category includes houses that were used exclusively for residential purpose.

Residence-cum-other use: such as residence-cum- grocery shop, residence-cum workshop (book binding), residence-cum-boarding house, etc.,

Shop / Office: Census houses exclusively used as shops, and offices were covered under this category.

School / College, etc.: All types of educational institutions and training centers *without* lodging facilities or any residential use.

Hotel/ lodge /guest house, etc.: Used exclusively for temporary stay or stay in transit and where no person living for a period of three months or more.

Hospital/Dispensary, etc.: Used as hospitals, dispensaries, nursing homes and such other health or medical institutes.

Factory / workshop / work shed, etc.: Exclusively used for running a factory or a workshop of manufacturing, production, processing, repairing or services, etc.

Place of worship: Such as temples, gurudwaras, mosques, churches, prayer halls, etc.

Other non-residential use: Used as places of entertainment and community gathering and all other non-residential miscellaneous uses not covered under any of the above categories; used as cattle-shed, godown, garage, petrol pump, power station, pump house, tube well room, cinema house, museum, stadium, etc.

Vacant: Found vacant, under construction or not being used for any other non-residential purpose.

c) **Type of Census Houses**

These have been classified according to the types of material used in the construction of wall and roof of the house. The basis of their classification is described hereunder:

Permanent Houses: Houses, the walls and roof of which are made of permanent materials. The material of walls can be any one from the following, namely, galvanized iron sheets or other metal sheets, asbestos sheets, burnt bricks, stones or concrete. Roof may be made of from any one of the following materials, namely, tiles, slate, galvanized iron sheets, metal sheets, asbestos sheets, bricks, stones or concrete.

Temporary Houses: Houses in which both walls and roof are made of materials, which have to be replaced frequently. Walls may be made from any one of the following temporary materials, namely, grass, thatch, bamboo, plastic, polythene, mud, unburnt bricks or wood. Roof may be made from any one of the following temporary materials, namely, grass, thatch, bamboo, wood, mud, plastic or polythene.

Semi-permanent houses: Houses in which either the wall or the roof is made of permanent material.

Serviceable temporary houses: Temporary houses in which wall is made of mud, un-burnt bricks or wood.

Non-serviceable temporary houses: Temporary houses in which wall is made of grass, thatch, bamboo, etc., plastic or polythene.

Report - 1

Damage Senario under hypothetical Earthquake in Bihar, based on

H-3B: CENSUS HOUSES BY PREDOMINANT MATERIAL OF WALL IN BIHAR (Excluding Locked / Vacant Houses) (Cencus 2011)

District	Block	Seismic Zone	District Factors	Number of cesus houses of different Types and their Vulnerability						Number of Houses under various Damage Grades				Estimated Damages			
				nA (H)	nB (M)	nC1 (L)	nC2 (L)	Type X (VL)	Total	NG5	NG4	NG3	NG2	Loss of Human Lives		Re-construction	Repairing
														Unfavourable	Favourable		
Total for Bihar			V, IV, III	4,528,393	10,812,874	99,857	177,883	7,164,060	22,783,067	662,653	3,868,106	7,788,551	2,445,353	222,337	72,766	4,530,759	10,233,904
Pashchim Champaran		IV	R = 4.19	65,321	346,270	4,441	3,211	497,677	916,920	6,532	83,618	265,367	62,579	2,854	913	90,150	327,945
	Sidhaw	IV	L = 0.33	4,858	19,367	631	119	44,331	69,306	486	5,580	14,965	3,832	195	62	6,066	18,797
	Ramnagar	IV	F = 0.32	4,797	22,672	469	185	29,455	57,578	480	5,865	17,429	4,251	202	65	6,345	21,680
	Gaunaha	IV		2,791	13,422	109	110	35,086	51,518	279	3,435	10,298	2,387	118	38	3,715	12,685
	Mainatanr	IV		3,715	15,595	204	172	28,033	47,719	372	4,346	12,012	2,900	151	48	4,717	14,912
	Narkatiaganj	IV		9,920	43,469	134	271	39,077	92,871	992	11,787	33,386	7,568	408	131	12,779	40,954
	Lauriya	IV		5,845	22,892	200	246	20,567	49,750	585	6,673	17,652	4,207	233	75	7,257	21,859
	Bagaha	IV		5,942	33,038	432	158	47,173	86,743	594	7,760	25,283	5,844	264	84	8,355	31,127
	Piprasi	IV		85	1,043	14	11	7,172	8,325	9	168	791	182	5	2	177	973
	Madhubani	IV		216	3,270	182	45	17,230	20,943	22	489	2,491	677	15	5	511	3,168
	Bhitaha	IV		160	1,846	64	32	10,370	12,472	16	305	1,406	361	10	3	321	1,767
	Thakrahan	IV		278	2,038	88	22	9,444	11,870	28	412	1,560	409	14	4	440	1,969
	Jogapatti	IV		2,652	13,747	167	252	38,756	55,574	265	3,364	10,551	2,575	115	37	3,629	13,126
	Chanpatia	IV		5,626	33,102	292	198	32,789	72,007	563	7,530	25,297	5,755	255	82	8,092	31,052
	Sikta	IV		4,201	16,117	140	481	28,088	49,027	420	4,762	12,465	3,198	167	53	5,183	15,663
	Majhaulia	IV		5,124	30,226	503	193	39,449	75,495	512	6,866	23,123	5,440	232	74	7,378	28,564
	Bettiah	IV		4,943	36,209	319	429	9,617	51,517	494	7,328	27,602	6,363	244	78	7,822	33,965
	Bairia	IV		1,628	15,291	91	101	30,610	47,721	163	2,750	11,610	2,560	90	29	2,913	14,169
	Nautan	IV		2,540	22,926	402	186	30,430	56,484	254	4,198	17,444	4,070	137	44	4,452	21,514
Purba Champaran		IV	R = 4.09	120,560	555,452	5,105	5,402	539,200	1,225,719	12,056	145,965	426,682	100,240	5,512	1,764	158,021	526,922
	Raxaul	IV	L = 0.37	4,174	24,327	420	317	26,865	56,103	417	5,563	18,632	4,515	206	66	5,981	23,147
	Adapur	IV	F = 0.32	7,644	22,157	309	192	22,608	52,910	764	7,949	17,241	4,273	310	99	8,713	21,514
	Ramgarhwa	IV		4,090	18,262	202	105	26,578	49,237	409	4,894	14,034	3,276	185	59	5,303	17,310
	Sugauli	IV		4,923	23,954	82	216	25,674	54,849	492	6,088	18,365	4,186	229	73	6,580	22,550
	Banjaria	IV		4,690	17,521	55	117	16,587	38,970	469	5,270	13,510	3,109	202	65	5,739	16,619
	Narkatia	IV		9,010	21,295	143	99	12,997	43,544	901	8,887	16,671	4,052	351	112	9,788	20,723
	Bankatwa	IV		5,698	12,574	79	122	7,415	25,888	570	5,531	9,878	2,464	219	70	6,101	12,342
	Ghorasahan	IV		6,450	23,285	329	254	10,880	41,198	645	7,166	18,006	4,414	275	88	7,811	22,420
	Dhaka	IV		10,712	44,224	287	264	22,462	77,949	1,071	12,456	34,027	7,850	474	152	13,528	41,877
	Chiraia	IV		8,422	37,129	383	266	21,622	67,822	842	10,029	28,543	6,688	380	122	10,872	35,231
	Motihari	IV		7,427	46,704	551	948	34,425	90,055	743	10,241	35,735	8,687	377	121	10,983	44,422
	Turkaulia	IV		2,593	16,533	245	137	23,858	43,366	259	3,598	12,632	2,961	132	42	3,857	15,593
	Harsidhi	IV		1,901	18,798	118	180	28,125	49,122	190	3,306	14,271	3,186	117	38	3,496	17,457
	Paharpur	IV		1,464	18,876	145	71	21,301	41,857	146	2,986	14,288	3,103	104	33	3,132	17,392
	Areraj	IV		2,023	18,311	120	195	16,014	36,663	202	3,348	13,916	3,135	120	38	3,551	17,051
	Sangrampur	IV		1,406	12,002	126	142	13,604	27,280	141	2,255	9,134	2,107	81	26	2,395	11,241

District	Block	Seismic Zone	District Factors	Number of cesus houses of different Types and their Vulnerability						Number of Houses under various Damage Grades				Estimated Damages			
				nA (H)	nB (M)	nC1 (L)	nC2 (L)	Type X (VL)	Total	NG5	NG4	NG3	NG2	Loss of Human Lives		Re-construction	Repairing
														Unfavourable	Favourable		

	Kesaria	IV		4,057	17,119	148	162	22,445	43,931	406	4,755	13,175	3,105	181	58	5,160	16,279
	Kalyanpur	IV		6,097	27,574	119	288	32,535	66,613	610	7,330	21,178	4,899	277	89	7,940	26,077
	Kotwa	IV		3,265	14,905	190	71	24,371	42,802	327	3,939	11,450	2,676	149	48	4,266	14,126
	Piprakothi	IV		1,127	7,872	8	83	9,940	19,030	113	1,632	5,998	1,334	60	19	1,745	7,331
	Chakia(Pipra)	IV		4,298	25,841	117	271	23,883	54,410	430	5,808	19,742	4,490	215	69	6,237	24,231
	Pakri Dayal	IV		2,946	17,345	76	156	18,295	38,818	295	3,944	13,253	2,997	146	47	4,239	16,250
	Patahi	IV		3,597	20,992	202	161	19,524	44,476	360	4,797	16,050	3,691	178	57	5,157	19,741
	Phenhara	IV		1,046	6,074	46	63	11,213	18,442	105	1,392	4,645	1,071	52	17	1,497	5,716
	Madhuban	IV		5,044	14,423	160	290	16,214	36,131	504	5,225	11,241	2,879	204	65	5,730	14,120
	Tetaria	IV		2,360	6,747	64	70	14,164	23,405	236	2,445	5,251	1,290	95	31	2,681	6,540
	Mehsi	IV		4,096	20,608	381	162	15,601	40,848	410	5,133	15,818	3,806	193	62	5,542	19,623

Sheohar		V & IV	R = 3.96	11,037	59,653	1,362	648	91,661	164,361	2,757	16,628	43,288	9,769	631	196	19,384	53,057
	Purnahiya	V	L = 0.32	2,026	8,424	191	92	13,581	24,314	1,855	4,747	4,018	113	261	81	6,602	4,131
	Piprahi	IV	F = 0.31	1,748	11,429	164	127	13,879	27,347	175	2,454	8,732	2,064	75	23	2,629	10,796
	Sheohar	IV		3,478	17,966	204	233	17,526	39,407	348	4,405	13,779	3,284	138	43	4,753	17,063
	Dumri Katsari	IV		1,453	7,819	298	93	13,813	23,476	145	1,872	6,012	1,575	58	18	2,017	7,587
	Tariani Chowk	IV		2,332	14,015	505	103	32,862	49,817	233	3,151	10,747	2,733	98	30	3,384	13,480

Sitamarhi		V & IV	R = 3.99	99,007	393,612	7,146	3,340	340,644	843,749	86,460	218,849	191,274	16,782	13,739	4,259	305,309	208,056
	Bairgania	V	L = 0.36	4,180	14,604	105	119	12,655	31,663	3,550	8,369	6,999	90	546	169	11,920	7,088
	Suppi	V	F = 0.31	3,031	13,998	237	42	16,575	33,883	2,915	7,785	6,496	112	475	147	10,700	6,608
	Majorganj	V		3,163	11,166	245	76	12,343	26,993	2,698	6,406	5,418	128	417	129	9,104	5,546
	Sonbarsa	V		6,302	27,376	940	202	27,247	62,067	5,889	15,378	13,097	457	949	294	21,266	13,554
	Parihar	V		7,085	32,145	1,179	306	38,370	79,085	6,757	17,992	15,372	594	1,099	341	24,749	15,966
	Sursand	V		5,930	21,623	601	260	21,906	50,320	5,127	12,380	10,562	344	798	247	17,507	10,907
	Bathnaha	V		7,513	28,578	430	231	30,215	66,967	6,614	16,233	13,640	264	1,036	321	22,848	13,904
	Riga	V		6,107	26,988	198	111	18,820	52,224	5,752	15,052	12,476	124	928	288	20,804	12,600
	Parsauni	V		2,867	10,653	168	51	9,044	22,783	2,499	6,065	5,087	88	390	121	8,564	5,175
	Belsand	IV		2,810	12,807	229	162	15,504	31,512	281	3,388	9,855	12,744	122	38	3,669	22,599
	Runisaidpur	V		8,036	39,135	779	295	43,675	91,920	7,932	21,684	18,200	430	1,307	405	29,615	18,630
	Dumra	V		13,053	62,266	812	837	27,707	104,675	12,753	34,561	28,994	660	2,092	649	47,314	29,654
	Bajpatti	V		6,633	21,346	493	175	22,596	51,243	5,451	12,398	10,531	267	826	256	17,849	10,798
	Charaut	V		4,005	9,666	137	69	7,027	20,904	2,969	5,855	4,971	82	424	131	8,824	5,053
	Pupri	V		5,364	22,267	302	132	16,590	44,655	4,909	12,518	10,465	174	783	243	17,427	10,638
	Nanpur	V		7,626	25,127	200	182	12,687	45,822	6,326	14,508	12,148	153	962	298	20,834	12,301
	Bokhara	V		5,302	13,867	91	90	7,683	27,033	4,038	8,277	6,963	72	586	182	12,315	7,035

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				nA (H)	nB (M)	nC1 (L)	nC2 (L)	Type X (VL)	Total	NG5	NG4	NG3	NG2	Loss of Human Lives		Re-construction	Repairing
														Unfavourable	Favourable		

Madhubani		V	R = 4.11	122,983	468,902	4,520	5,615	466,275	1,068,295	108,382	266,210	223,374	4,054	16,041	4,973	374,592	227,428
	Madhwapur	V	L = 0.33	3,919	15,699	176	176	13,211	33,181	3,529	8,864	7,435	141	528	164	12,394	7,576
	Harlakhi	V	F = 0.31	4,798	19,705	156	184	18,219	43,062	4,370	11,086	9,252	136	656	203	15,456	9,388
	Basopatti	V		2,554	15,844	280	331	19,206	38,215	2,861	8,622	7,282	244	467	145	11,483	7,526
	Jainagar	V		2,356	21,411	583	288	19,349	43,987	3,319	11,382	9,589	348	579	179	14,701	9,937
	Ladania	V		7,640	14,919	95	220	15,471	38,345	5,312	9,401	8,035	126	687	213	14,713	8,161
	Laukaha	V		6,569	19,209	250	201	19,661	45,890	5,205	11,292	9,551	180	730	226	16,497	9,732
	Laukahi	V		12,657	12,074	76	207	24,792	49,806	7,536	9,230	8,135	113	864	268	16,765	8,249
	Phulparas	V		6,048	13,179	77	105	20,005	39,414	4,342	8,120	6,875	73	574	178	12,462	6,947
	Babubarhi	V		8,708	23,170	128	245	18,126	50,377	6,671	13,799	11,632	149	917	284	20,470	11,781
	Khajauli	V		1,911	15,045	269	162	14,947	32,334	2,460	8,043	6,711	172	418	130	10,503	6,884
	Kaluahi	V		2,658	13,304	84	139	10,373	26,558	2,659	7,339	6,098	89	415	129	9,998	6,187
	Benipatti	V		6,923	40,224	570	477	36,031	84,225	7,484	21,947	18,344	419	1,204	373	29,431	18,763
	Bisfi	V		7,298	38,868	448	505	29,170	76,289	7,536	21,354	17,848	381	1,192	370	28,890	18,229
	Madhubani	V		6,673	42,317	275	324	25,012	74,601	7,568	22,887	18,895	240	1,237	383	30,455	19,134
	Pandaul	V		10,413	35,058	275	591	21,925	68,262	8,712	20,219	17,059	346	1,257	390	28,931	17,406
	Rajnagar	V		6,771	31,105	173	260	23,740	62,049	6,496	17,289	14,351	173	998	309	23,785	14,524
	Andhratharhi	V		5,867	21,459	155	233	18,575	46,289	5,079	12,235	10,244	155	745	231	17,314	10,400
	Jhanjharpur	V		6,859	21,873	82	311	21,930	51,055	5,617	12,691	10,660	157	801	248	18,307	10,818
	Ghoghardiha	V		4,908	14,511	45	210	28,277	47,951	3,905	8,508	7,159	102	549	170	12,413	7,261
	Lakhnaur	V		4,438	19,452	182	202	20,980	45,254	4,164	10,874	9,082	154	634	196	15,038	9,236
	Madhepur	V		3,015	20,476	141	244	47,275	71,151	3,555	11,030	9,137	154	589	182	14,585	9,291

Supaul		V	R = 3.71	22,614	125,254	1,879	1,713	440,365	591,825	23,832	68,640	57,551	1,437	1,976	612	92,472	58,988
	Nirmali	V	L = 0.19	546	5,458	21	21	18,939	24,985	819	2,870	2,341	17	75	23	3,689	2,358
	Basantpur	V	F = 0.31	906	10,265	332	60	40,689	52,252	1,480	5,398	4,529	157	139	43	6,878	4,685
	Chhatapur	V		1,271	8,806	223	143	62,266	72,709	1,516	4,757	4,023	146	131	41	6,273	4,170
	Pratapganj	V		877	6,295	58	45	22,369	29,644	1,068	3,377	2,789	41	93	29	4,445	2,830
	Raghopur	V		3,599	14,894	81	135	40,511	59,220	3,289	8,368	6,965	86	257	80	11,657	7,052
	Saraigarh Bhaptiyahi	V		641	4,345	83	151	30,875	36,095	755	2,356	2,015	94	65	20	3,111	2,109
	Kishanpur	V		923	7,974	239	84	39,982	49,202	1,259	4,250	3,582	129	113	35	5,509	3,711
	Marauna	V		380	3,771	104	85	36,661	41,001	567	1,999	1,698	76	52	16	2,567	1,774
	Supaul	V		5,933	30,871	383	711	58,250	96,148	6,054	17,028	14,379	438	496	154	23,082	14,816
	Pipra	V		3,752	15,505	143	154	29,281	48,835	3,427	8,720	7,289	119	268	83	12,147	7,407
	Tribeniganj	V		3,786	17,070	212	124	60,542	81,734	3,600	9,515	7,943	134	286	89	13,115	8,077

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														Unfavourable	Favourable		

Araria		V	R = 3.99	25,907	104,755	3,142	1,938	559,951	695,693	23,429	59,362	50,919	2,032	1,862	577	82,791	52,951
	Narpatganj	V	L = 0.18	1,908	12,627	258	154	76,644	91,591	2,217	6,832	5,734	165	194	60	9,048	5,899
	Forbesganj	V	F = 0.31	8,730	28,270	1,045	369	82,635	121,049	7,192	16,459	14,198	566	546	169	23,651	14,763
	Bhargama	V		979	5,412	99	68	49,368	55,926	1,031	2,967	2,493	67	87	27	3,998	2,560
	Raniganj	V		2,448	11,515	318	117	83,256	97,654	2,376	6,413	5,436	174	194	60	8,789	5,610
	Araria	V		4,096	19,145	939	289	87,205	111,674	3,963	10,719	9,296	491	325	101	14,682	9,787
	Kursakatta	V		1,080	3,648	99	242	30,953	36,022	905	2,128	1,900	136	70	22	3,033	2,036
	Sikti	V		1,531	4,287	120	100	31,603	37,641	1,194	2,548	2,208	88	88	27	3,742	2,296
	Palasi	V		2,438	9,142	88	232	50,950	62,850	2,133	5,213	4,426	128	167	52	7,346	4,554
	Jokihat	V		2,697	10,709	176	367	67,337	81,286	2,419	6,083	5,229	217	192	59	8,502	5,447

Kishanganj		V & IV	R = 3.80	23,138	125,181	1,500	1,473	286,775	438,067	5,885	35,287	90,204	19,512	845	270	41,171	109,717
	Terhagachh	V	L = 0.21	2,480	5,815	45	68	31,451	39,859	1,822	3,539	3,003	45	144	46	5,360	3,048
	Dighalbank	V	F = 0.32	1,756	12,948	64	102	41,785	56,655	2,173	6,930	5,701	66	215	69	9,102	5,768
	Thakurganj	IV		5,854	20,561	465	428	51,247	78,555	585	6,447	15,949	4,193	131	42	7,032	20,142
	Pothia	IV		3,015	18,685	296	211	43,790	65,997	302	4,130	14,291	3,409	80	26	4,431	17,700
	Bahadurganj	IV		2,438	19,539	136	82	43,212	65,407	244	3,782	14,859	3,277	72	23	4,026	18,136
	Kochadhamin	IV		2,690	20,596	197	127	49,610	73,220	269	4,077	15,681	3,534	78	25	4,346	19,215
	Kishanganj	IV		4,905	27,037	297	455	25,680	58,374	491	6,382	20,721	4,987	125	40	6,873	25,708

Purnia		V & IV	R = 4.10	34,667	167,777	2,042	2,503	578,958	785,947	5,761	47,653	124,306	28,658	1,118	358	53,414	152,963
	Banmankhi	V	L = 0.21	2,071	14,660	291	176	63,129	80,327	2,502	7,894	6,615	187	265	85	10,396	6,802
	Barhara	IV	F = 0.32	2,001	7,262	129	162	38,091	47,645	200	2,227	5,626	1,458	49	16	2,427	7,083
	Bhawanipur	IV		1,775	7,056	142	46	30,933	39,952	178	2,037	5,444	1,333	44	14	2,214	6,776
	Rupauli	IV		2,872	11,757	155	200	40,801	55,785	287	3,330	9,069	2,245	72	23	3,617	11,314
	Dhamdaha	IV		2,585	9,869	123	172	54,269	67,018	259	2,926	7,625	1,895	64	20	3,184	9,521
	Krityanand Nagar	IV		1,783	11,753	98	207	39,746	53,587	178	2,513	8,979	2,125	52	17	2,691	11,104
	Purnia East	IV		4,766	44,917	566	697	52,558	103,504	477	8,066	34,172	8,042	164	52	8,543	42,214
	Kasba	IV		1,268	11,142	124	381	34,041	46,956	127	2,065	8,502	2,145	42	13	2,192	10,647
	Srinagar	IV		665	3,499	41	24	21,924	26,153	67	849	2,681	623	18	6	915	3,304
	Jalalgarh	IV		738	7,063	25	63	22,161	30,050	74	1,260	5,361	1,181	26	8	1,334	6,542
	Amour	IV		3,152	9,919	100	163	59,338	72,672	315	3,356	7,702	1,922	74	24	3,671	9,623
	Baisa	IV		2,347	8,246	80	43	39,410	50,126	235	2,585	6,373	1,505	57	18	2,820	7,878
	Baisi	IV		5,941	10,413	96	71	39,623	56,144	594	5,497	8,272	2,133	125	40	6,091	10,405
	Dagarua	IV		2,703	10,221	72	98	42,934	56,028	270	3,049	7,885	1,863	66	21	3,320	9,749

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														Unfavourable	Favourable		

Katihar		IV	R = 4.16	68,738	196,467	2,673	2,739	455,170	725,787	6,874	71,200	153,047	38,684	2,139	685	78,074	191,731
	Falka	IV	L = 0.28	1,443	6,791	111	84	28,000	36,429	144	1,761	5,221	1,273	51	16	1,906	6,494
	Korha	IV	F = 0.32	4,591	14,612	387	197	44,207	63,994	459	4,904	11,362	2,974	146	47	5,364	14,336
	Hasanganj	IV		862	3,241	18	28	10,545	14,694	86	971	2,500	585	29	9	1,057	3,085
	Kadwa	IV		6,280	19,967	135	312	59,962	86,656	628	6,707	15,491	3,801	200	64	7,335	19,292
	Balrampur	IV		5,919	9,242	75	60	22,507	37,803	592	5,363	7,389	1,931	166	53	5,955	9,320
	Barsoi	IV		8,855	23,678	225	131	52,673	85,562	886	9,009	18,458	4,483	272	87	9,895	22,941
	Azamnagar	IV		10,689	19,861	63	197	48,110	78,920	1,069	10,003	15,723	3,976	308	98	11,072	19,699
	Pranpur	IV		3,805	8,370	243	89	22,671	35,178	381	3,691	6,596	1,790	113	36	4,071	8,386
	Dandkhora	IV		1,558	3,577	35	60	12,807	18,037	156	1,526	2,809	725	46	15	1,682	3,534
	Katihar	IV		5,977	42,169	671	1,135	25,724	75,676	598	8,700	32,256	8,128	244	78	9,297	40,384
	Mansahi	IV		1,584	4,355	42	29	12,590	18,600	158	1,624	3,392	825	49	16	1,782	4,217
	Barari	IV		6,014	12,129	260	113	43,226	61,742	601	5,723	9,585	2,550	175	56	6,325	12,135
	Sameli	IV		703	5,376	147	40	12,225	18,491	70	1,065	4,103	999	30	10	1,135	5,103
	Kursela	IV		428	5,453	33	14	9,028	14,956	43	866	4,127	885	23	7	909	5,012
	Manihari	IV		5,661	9,916	77	185	27,889	43,728	566	5,237	7,888	2,108	162	52	5,803	9,996
	Amdabad	IV		4,369	7,730	151	65	23,006	35,321	437	4,050	6,147	1,649	125	40	4,487	7,796

Madhepura		V & IV	R = 3.91	32,993	140,256	1,427	1,390	327,417	503,483	21,056	61,172	82,971	10,667	2,431	754	82,227	93,638
	Gamharia	V	L = 0.25	3,940	10,350	41	52	5,865	20,248	3,005	6,169	5,172	37	297	92	9,174	5,209
	Singheshwar	V	F = 0.31	2,969	11,916	156	102	18,829	33,972	2,676	6,726	5,638	103	288	89	9,402	5,741
	Ghailarh	V		6,732	9,971	83	100	6,885	23,771	4,363	6,687	5,763	73	387	120	11,050	5,836
	Madhepura	V		5,498	23,711	184	225	35,633	65,251	5,120	13,271	11,063	164	560	174	18,391	11,227
	Shankarpur	V		969	5,906	45	17	22,358	29,295	1,075	3,201	2,636	25	126	39	4,277	2,660
	Kumarkhand	V		1,392	9,774	128	139	49,004	60,437	1,673	5,262	4,391	107	201	62	6,935	4,498
	Murliganj	V		1,725	13,037	103	102	40,358	55,325	2,166	6,970	5,749	82	263	82	9,136	5,831
	Gwalpara	IV		639	6,027	46	44	21,860	28,616	64	1,082	4,577	1,019	25	8	1,146	5,597
	Bihariganj	IV		1,276	7,674	121	148	25,258	34,477	128	1,724	5,878	1,449	41	13	1,852	7,327
	Uda Kishunganj	IV		2,080	11,964	240	132	34,113	48,529	208	2,756	9,166	2,230	66	20	2,964	11,396
	Puraini	IV		1,110	7,541	100	103	18,095	26,949	111	1,587	5,759	1,367	38	12	1,698	7,126
	Alamnagar	IV		2,166	11,400	50	48	28,323	41,987	217	2,765	8,722	1,946	67	21	2,981	10,668
	Chausa	IV		2,497	10,985	130	178	20,836	34,626	250	2,971	8,457	2,066	73	23	3,221	10,523

District	Block	Seismic Zone	District Factors	Number of cesus houses of different Types and their Vulnerability						Number of Houses under various Damage Grades				Estimated Damages			
				nA (H)	nB (M)	nC1 (L)	nC2 (L)	Type X (VL)	Total	NG5	NG4	NG3	NG2	Loss of Human Lives		Re-construction	Repairing
														Unfavourable	Favourable		
Saharsa		V & IV	R = 4.03	55,073	171,199	1,622	1,535	232,179	461,608	30,580	87,110	99,678	11,866	4,469	1,430	117,690	111,544
	Nauhatta	V	L = 0.31	1,264	8,768	135	100	33,747	44,014	1,509	4,724	3,941	94	231	74	6,232	4,035
	Satar Kataiya	V	F = 0.32	5,458	18,822	152	78	12,958	37,468	4,611	10,799	9,008	92	615	197	15,410	9,100
	Mahishi	V		2,139	9,746	70	68	36,505	48,528	2,044	5,422	4,502	55	289	92	7,466	4,557
	Kahara	V		14,508	44,107	250	454	11,584	70,903	11,665	25,751	21,622	282	1,518	486	37,416	21,903
	Saur Bazar	V		8,655	23,645	166	158	19,436	52,060	6,692	14,019	11,784	130	852	273	20,711	11,913
	Patarghat	V		2,162	8,894	80	148	23,001	34,285	1,970	5,010	4,212	91	273	87	6,981	4,303
	Sonbarsa	IV		1,406	15,406	105	112	38,546	55,575	141	2,595	11,682	2,579	75	24	2,736	14,261
	Simri Bakhtiarpur	IV		12,299	26,913	231	263	26,652	66,358	1,230	11,916	21,157	5,330	390	125	13,145	26,486
	Salkhua	IV		3,665	7,786	243	97	18,520	30,311	367	3,527	6,148	1,698	116	37	3,894	7,846
	Banma Itahari	IV		3,517	7,112	190	57	11,230	22,106	352	3,349	5,622	1,516	110	35	3,701	7,138
Darbhanga		V & IV	R = 3.91	127,383	547,499	4,954	7,636	285,631	973,103	87,319	266,454	301,410	31,787	15,702	5,025	353,772	333,197
	Jale	V	L = 0.38	8,323	38,816	247	830	14,452	62,668	8,043	21,596	18,146	431	1,359	435	29,640	18,576
	Singhwara	V	F = 0.32	10,453	41,359	398	881	14,978	68,069	9,362	23,421	19,796	512	1,531	490	32,783	20,308
	Keotiranway	V		6,947	41,746	168	616	16,999	66,476	7,648	22,688	18,827	314	1,356	434	30,336	19,141
	Darbhanga	V		18,085	94,614	668	1,502	21,097	135,966	18,504	52,045	43,452	868	3,196	1,023	70,549	44,320
	Manigachhi	V		7,386	33,773	219	332	14,455	56,165	7,070	18,788	15,631	220	1,189	380	25,858	15,852
	Tardih	V		2,398	15,858	228	121	14,125	32,730	2,785	8,563	7,117	140	503	161	11,348	7,257
	Alinagar	V		5,292	18,087	148	92	12,987	36,606	4,455	10,391	8,678	96	706	226	14,845	8,774
	Benipur	V		8,366	38,220	220	619	13,496	60,921	8,005	21,285	17,799	336	1,346	431	29,290	18,135
	Bahadurpur	V		9,930	35,748	462	408	17,388	63,936	8,540	20,444	17,217	348	1,369	438	28,983	17,565
	Hanumannagar	IV		4,083	19,294	252	316	15,526	39,471	408	4,992	14,834	3,626	185	59	5,400	18,460
	Hayaghat	IV		4,370	20,418	224	233	11,296	36,541	437	5,319	15,687	3,733	197	63	5,756	19,420
	Baheri	IV		11,685	46,622	280	394	17,347	76,328	1,169	13,426	35,910	8,375	503	161	14,594	44,285
	Biraul	IV		11,696	41,566	210	512	16,232	70,216	1,170	12,929	32,124	7,654	488	156	14,098	39,778
	Ghanshyampur	V		3,576	18,253	142	215	14,155	36,341	3,613	10,056	8,374	143	621	199	13,670	8,517
	Kiratpur	V		617	4,771	30	77	15,204	20,699	786	2,550	2,116	43	146	47	3,336	2,159
	Gora Bauram	V		5,807	15,837	508	107	16,369	38,628	4,487	9,432	8,094	246	680	218	13,919	8,340
	Kusheshwar Asthan	IV		6,027	17,008	281	258	17,236	40,810	603	6,221	13,262	3,407	239	76	6,824	16,669
	Kusheshwar Asthan Purbi	IV		2,342	5,509	269	123	22,289	30,532	234	2,307	4,347	1,296	89	29	2,542	5,643

District	Block	Seismic Zone	District Factors	Number of cesus houses of different Types and their Vulnerability						Number of Houses under various Damage Grades				Estimated Damages			
				nA (H)	nB (M)	nC1 (L)	nC2 (L)	Type X (VL)	Total	NG5	NG4	NG3	NG2	Loss of Human Lives		Re-construction	Repairing
														Unfavourable	Favourable		

Muzaffarpur		V & IV	R = 4.27	129,722	550,253	6,691	8,380	397,984	1,093,030	26,341	168,069	406,136	92,463	8,230	2,633	194,410	498,599
	Sahebganj	IV	L = 0.39	5,612	22,539	259	199	23,302	51,911	561	6,463	17,371	4,145	271	87	7,024	21,516
	Baruraj (Motipur)	IV	F = 0.32	10,426	41,074	493	380	40,398	92,771	1,043	11,927	31,675	7,598	501	160	12,970	39,273
	Paroo	IV		6,975	29,610	228	511	34,495	71,819	698	8,192	22,805	5,519	343	110	8,890	28,323
	Saraiya	IV		7,774	33,155	313	341	25,936	67,519	777	9,146	25,515	6,047	382	122	9,923	31,562
	Marwan	IV		4,129	18,715	267	130	13,878	37,119	413	4,968	14,386	3,415	207	66	5,381	17,800
	Kanti	IV		7,012	32,439	435	271	24,970	65,127	701	8,503	24,926	5,921	353	113	9,204	30,847
	Minapur	IV		9,102	32,658	419	555	36,927	79,661	910	10,092	25,274	6,312	427	137	11,003	31,585
	Bochaha	IV		4,445	23,429	412	315	30,333	58,934	445	5,677	17,978	4,393	233	75	6,121	22,371
	Aurai	V		9,303	30,802	298	485	31,768	72,656	7,732	17,805	15,038	313	1,366	437	25,537	15,351
	Katra	V		8,731	30,749	236	473	17,833	58,022	7,440	17,628	14,837	284	1,331	426	25,069	15,120
	Gaighat	IV		7,205	29,771	379	476	25,789	63,620	721	8,381	22,954	5,647	351	112	9,101	28,601
	Bandra	IV		3,905	12,800	137	197	15,971	33,010	391	4,209	9,926	2,463	179	57	4,599	12,390
	Dholi (Moraul)	IV		4,180	11,319	160	130	6,367	22,156	418	4,267	8,832	2,229	184	59	4,685	11,061
	Musahri	IV		14,612	109,745	1,571	2,606	29,502	158,036	1,461	21,934	83,822	20,690	877	280	23,395	104,513
	Kurhani	IV		14,385	49,134	474	605	23,737	88,335	1,439	15,702	38,037	9,258	667	213	17,141	47,296
	Sakra	IV		11,926	42,314	610	706	16,778	72,334	1,193	13,176	32,762	8,229	558	179	14,369	40,990

Gopalganj		IV	R = 4.62	41,374	362,280	3,296	2,718	130,428	540,096	4,137	67,259	275,414	61,956	4,270	1,324	71,396	337,370
	Katiya	IV	L = 0.58	2,554	19,794	116	168	7,369	30,001	255	3,895	15,065	3,374	250	77	4,150	18,439
	Bijaipur	IV	F = 0.31	3,013	18,866	50	218	5,484	27,631	301	4,146	14,402	3,257	271	84	4,448	17,659
	Bhorey	IV		2,622	25,399	202	151	9,495	37,869	262	4,506	19,281	4,271	284	88	4,769	23,552
	Pach Deuri	IV		872	12,366	72	119	8,735	22,164	87	1,891	9,359	2,064	115	36	1,978	11,423
	Kuchaikote	IV		4,638	46,643	517	409	20,443	72,650	464	8,143	35,423	8,039	511	158	8,607	43,462
	Phulwaria	IV		1,783	18,776	82	123	7,292	28,056	178	3,215	14,236	3,104	201	62	3,393	17,340
	Hathua	IV		3,250	35,175	266	365	7,954	47,010	325	5,955	26,688	5,993	371	115	6,280	32,681
	Uchkagaon	IV		2,378	28,850	142	198	4,673	36,241	238	4,669	21,850	4,761	288	89	4,906	26,611
	Thawe	IV		2,412	18,836	197	124	3,323	24,892	241	3,693	14,340	3,247	237	73	3,934	17,587
	Gopalganj	IV		2,587	32,949	233	158	11,749	47,676	259	5,235	24,945	5,430	322	100	5,494	30,375
	Manjha	IV		2,532	27,367	513	193	10,212	40,817	253	4,636	20,786	4,824	289	90	4,889	25,610
	Barauli	IV		5,324	34,984	385	225	13,087	54,005	532	7,491	26,698	6,104	487	151	8,024	32,803
	Sidhwalia	IV		2,453	14,768	273	72	7,843	25,409	245	3,317	11,294	2,658	217	67	3,562	13,952
	Baikunthpur	IV		4,956	27,507	248	195	12,769	45,675	496	6,468	21,046	4,830	426	132	6,963	25,876

District	Block	Seismic Zone	District Factors	Number of cesus houses of different Types and their Vulnerability						Number of Houses under various Damage Grades				Estimated Damages			
				nA (H)	nB (M)	nC1 (L)	nC2 (L)	Type X (VL)	Total	NG5	NG4	NG3	NG2	Loss of Human Lives		Re-construction	Repairing
														Unfavourable	Favourable		

Siwan		IV	R = 4.92	74,305	506,850	3,196	4,530	66,249	655,130	7,431	106,414	386,483	87,395	8,612	2,670	113,844	473,878
	Nautan	IV	L = 0.68	1,743	12,623	61	47	3,147	17,621	174	2,570	9,609	2,105	207	64	2,744	11,714
	Siwan	IV	F = 0.31	6,609	55,347	340	946	3,991	67,233	661	10,491	42,135	9,762	835	259	11,152	51,897
	Barharia	IV		5,771	50,084	244	199	6,434	62,732	577	9,337	38,040	8,278	741	230	9,914	46,318
	Goriakothi	IV		7,122	32,184	391	404	6,949	47,050	712	8,560	24,752	5,958	716	222	9,272	30,710
	Lakri Nabiganj	IV		3,452	18,039	227	132	3,969	25,819	345	4,393	13,824	3,234	363	113	4,738	17,058
	Basantpur	IV		1,986	16,076	259	51	2,851	21,223	199	3,097	12,237	2,793	247	77	3,296	15,030
	Bhagwanpur Hat	IV		4,462	30,732	291	230	5,256	40,971	446	6,420	23,436	5,335	519	161	6,866	28,771
	Maharajganj	IV		4,991	29,891	303	275	3,221	38,681	499	6,732	22,850	5,291	551	171	7,231	28,142
	Pachrukhi	IV		5,077	32,764	161	433	3,358	41,793	508	7,084	25,013	5,741	576	179	7,592	30,754
	Hussainganj	IV		4,450	27,415	78	418	1,821	34,182	445	6,079	20,945	4,818	496	154	6,524	25,763
	Ziradei	IV		2,771	25,089	110	102	2,425	30,497	277	4,587	19,046	4,130	363	112	4,864	23,176
	Mairwa	IV		1,643	18,034	113	66	3,083	22,939	164	3,036	13,667	2,963	236	73	3,200	16,629
	Guthani	IV		2,524	20,533	130	142	3,804	27,133	252	3,946	15,616	3,473	315	98	4,199	19,090
	Darauli	IV		3,733	25,020	104	209	3,909	32,975	373	5,302	19,076	4,268	430	133	5,675	23,344
	Andar	IV		2,168	17,710	36	143	2,001	22,058	217	3,397	13,463	2,953	271	84	3,614	16,416
	Raghunathpur	IV		3,706	24,109	85	198	3,333	31,431	371	5,190	18,388	4,107	422	131	5,561	22,495
	Hasanpura	IV		3,172	21,648	74	212	1,638	26,744	317	4,544	16,503	3,700	368	114	4,861	20,202
	Daraundha	IV		4,828	26,156	119	138	2,523	33,764	483	6,237	20,005	4,478	514	159	6,719	24,483
	Siswan	IV		4,097	23,396	70	185	2,536	30,284	410	5,412	17,880	4,008	444	138	5,822	21,888

Saran		IV	R = 5.07	146,493	496,689	5,829	6,054	97,255	752,320	14,649	159,539	384,692	94,403	11,967	3,830	174,188	479,095
	Mashrakh	IV	L = 0.58	5,630	24,832	541	279	7,154	38,436	563	6,706	19,128	4,762	494	158	7,269	23,890
	Panapur	IV	F = 0.32	4,533	14,125	79	206	6,586	25,529	453	4,812	10,962	2,672	363	116	5,266	13,635
	Taraiya	IV		5,573	15,788	255	94	7,047	28,757	557	5,759	12,294	3,048	437	140	6,316	15,342
	Ishupur	IV		4,148	16,993	306	126	3,890	25,463	415	4,810	13,099	3,184	356	114	5,225	16,283
	Baniapur	IV		6,486	32,617	629	324	6,512	46,568	649	8,126	25,045	6,094	592	190	8,775	31,138
	Lahladpur	IV		1,740	13,043	52	66	1,384	16,285	174	2,609	9,925	2,175	184	59	2,783	12,100
	Ekma	IV		6,624	32,201	203	363	2,903	42,294	662	8,188	24,704	5,751	598	191	8,851	30,456
	Manjhi	IV		8,217	40,421	332	279	4,312	53,561	822	10,205	30,993	7,138	745	238	11,027	38,131
	Jalalpur	IV		4,890	27,259	181	292	2,281	34,903	489	6,393	20,858	4,810	462	148	6,882	25,669
	Revelganj	IV		4,119	11,713	261	122	2,662	18,877	412	4,261	9,132	2,353	323	103	4,672	11,485
	Chapra	IV		14,652	60,642	631	1,001	7,154	84,080	1,465	17,053	46,744	11,419	1,261	404	18,518	58,163
	Nagra	IV		3,372	17,038	71	281	1,523	22,285	337	4,233	13,067	3,073	308	99	4,570	16,139
	Marhaura	IV		9,220	30,717	440	414	6,746	47,537	922	9,987	23,815	5,940	750	240	10,909	29,754
	Amnour	IV		10,342	22,582	389	277	6,734	40,324	1,034	10,015	17,779	4,662	771	247	11,049	22,441
	Maker	IV		3,112	11,636	12	113	3,432	18,305	311	3,498	8,973	2,073	261	83	3,809	11,045
	Parsa	IV		7,813	17,894	201	342	4,250	30,500	781	7,649	14,061	3,677	588	188	8,430	17,738
	Dariapur	IV		15,797	32,047	458	441	8,098	56,841	1,580	15,052	25,310	6,666	1,164	372	16,632	31,976
	Garkha	IV		11,300	30,800	330	263	5,505	48,198	1,130	11,555	24,007	5,912	879	281	12,685	29,919
	Dighwara	IV		6,984	14,962	301	228	2,800	25,275	698	6,734	11,798	3,165	519	166	7,433	14,963
	Sonepur	IV		11,941	29,379	157	543	6,282	48,302	1,194	11,894	23,000	5,827	910	291	13,088	28,827

District	Block	Seismic Zone	District Factors	Number of cesus houses of different Types and their Vulnerability						Number of Houses under various Damage Grades				Estimated Damages			
				nA (H)	nB (M)	nC1 (L)	nC2 (L)	Type X (VL)	Total	NG5	NG4	NG3	NG2	Loss of Human Lives		Re-construction	Repairing
														Unfavourable	Favourable		

Vaishali		IV	R = 4.66	147,007	374,114	3,094	7,104	201,414	732,733	14,701	147,667	292,631	74,791	7,507	2,327	162,367	367,422
	Vaishali	IV	L = 0.42	5,519	21,407	161	166	14,458	41,711	552	6,280	16,502	3,870	311	96	6,832	20,372
	Paterhi Belsar	IV	F = 0.31	2,811	9,601	130	168	8,993	21,703	281	3,068	7,441	1,874	153	47	3,349	9,316
	Lalganj	IV		10,370	27,769	246	475	18,008	56,868	1,037	10,554	21,677	5,484	535	166	11,591	27,160
	Bhagwanpur	IV		7,008	23,260	216	415	13,824	44,723	701	7,582	18,034	4,488	379	118	8,283	22,522
	Goraul	IV		5,325	20,214	152	205	12,124	38,020	533	6,015	15,596	3,699	298	92	6,548	19,295
	Chehra Kalan	IV		5,014	11,565	136	258	9,850	26,823	501	4,917	9,089	2,406	251	78	5,418	11,496
	Patepur	IV		18,090	40,395	262	758	24,469	83,974	1,809	17,607	31,755	8,181	902	280	19,416	39,936
	Mahua	IV		10,189	28,815	163	424	17,082	56,673	1,019	10,523	22,434	5,527	532	165	11,542	27,961
	Jandaha	IV		12,684	28,578	304	795	19,274	61,635	1,268	12,371	22,495	6,062	633	196	13,639	28,557
	Raja Pakar	IV		8,851	15,089	65	253	8,479	32,737	885	8,147	12,012	3,166	423	131	9,032	15,178
	Hajipur	IV		17,979	56,040	335	1,266	12,708	88,328	1,798	19,088	43,539	10,955	958	297	20,886	54,494
	Raghopur	IV		11,303	14,034	332	184	18,147	44,000	1,130	9,881	11,425	3,340	520	161	11,011	14,765
	Bidupur	IV		13,399	28,802	132	734	6,005	49,072	1,340	12,929	22,693	5,975	663	206	14,269	28,668
	Desri	IV		4,772	9,925	121	331	3,922	19,071	477	4,572	7,847	2,186	235	73	5,049	10,033
	Sahdai Buzurg	IV		6,068	15,950	141	169	6,286	28,614	607	6,146	12,449	3,080	312	97	6,753	15,529
	Mahnar	IV		7,625	22,670	198	503	7,785	38,781	763	7,986	17,644	4,498	402	125	8,748	22,143

Samastipur		IV	R = 4.03	170,612	510,891	8,890	6,801	331,703	1,028,897	17,061	179,048	397,533	101,198	7,237	2,244	196,109	498,731
	Kalyanpur	IV	L = 0.39	7,848	32,459	685	366	35,282	76,640	785	9,132	25,038	6,246	361	112	9,917	31,284
	Warisnagar	IV	F = 0.31	6,361	24,059	310	136	19,958	50,824	636	7,177	18,566	4,420	286	89	7,813	22,986
	Shivaji Nagar	IV		4,511	29,330	381	309	15,126	49,657	451	6,316	22,405	5,255	241	75	6,767	27,660
	Khanpur	IV		4,218	18,274	423	133	24,412	47,460	422	4,991	14,077	3,474	197	61	5,413	17,552
	Samastipur	IV		11,230	52,096	653	873	19,141	83,993	1,123	13,632	40,067	9,801	534	166	14,755	49,868
	Pusa	IV		5,935	19,241	276	108	8,556	34,116	594	6,375	14,914	3,619	256	79	6,969	18,534
	Tajpur	IV		8,411	20,525	293	193	7,459	36,881	841	8,361	16,073	4,074	342	106	9,202	20,147
	Morwa	IV		6,183	23,954	239	223	15,628	46,227	618	7,033	18,475	4,403	279	87	7,651	22,879
	Patori	IV		9,614	19,727	192	255	8,634	38,422	961	9,183	15,561	4,015	379	118	10,145	19,576
	Mohanpur	IV		6,604	10,217	194	142	7,183	24,340	660	5,975	8,192	2,280	250	78	6,635	10,472
	Mohiuddinagar	IV		9,145	19,895	306	470	12,529	42,345	915	8,848	15,685	4,252	364	113	9,763	19,937
	Sarairanjan	IV		8,626	34,783	384	513	18,521	62,827	863	9,948	26,824	6,537	394	122	10,810	33,361
	Vidyapati Nagar	IV		8,425	17,018	352	370	10,380	36,545	843	8,021	13,468	3,726	332	103	8,863	17,194
	Dalsinghsarai	IV		10,260	23,396	842	213	14,130	48,841	1,026	10,035	18,422	5,070	412	128	11,061	23,492
	Ujiarpur	IV		14,491	34,138	626	694	22,668	72,617	1,449	14,282	26,822	7,198	586	182	15,731	34,020
	Bibhutpur	IV		16,376	38,499	992	555	24,807	81,229	1,638	16,132	30,257	8,163	662	205	17,770	38,420
	Rosera	IV		6,569	28,822	445	392	15,691	51,919	657	7,809	22,193	5,444	307	95	8,466	27,637
	Singhia	IV		7,721	26,081	424	307	16,963	51,496	772	8,399	20,213	5,039	337	104	9,171	25,252
	Hasanpur	IV		11,490	25,327	460	413	18,535	56,225	1,149	11,150	19,944	5,316	459	142	12,299	25,260
	Bithan	IV		6,594	13,050	413	136	16,100	36,293	659	6,251	10,337	2,864	259	80	6,910	13,201

District	Block	Seismic Zone	District Factors	Number of cesus houses of different Types and their Vulnerability						Number of Houses under various Damage Grades				Estimated Damages			
				nA (H)	nB (M)	nC1 (L)	nC2 (L)	Type X (VL)	Total	NG5	NG4	NG3	NG2	Loss of Human Lives		Re-construction	Repairing
														Unfavourable	Favourable		

Begusarai		IV	R = 4.03	168,097	361,211	5,427	7,576	166,768	709,079	16,810	162,194	284,816	76,541	8,397	2,855	179,004	361,357
	Khudabandpur	IV	L = 0.49	5,662	11,286	198	221	5,805	23,172	566	5,375	8,931	2,432	279	95	5,941	11,363
	Chhorahi	IV	F = 0.34	7,024	15,463	125	198	9,614	32,424	702	6,814	12,156	3,089	352	120	7,517	15,245
	Garhpura	IV		5,476	14,400	212	205	9,096	29,389	548	5,547	11,252	2,883	284	97	6,095	14,136
	Cheria Bariarpur	IV		8,515	19,967	317	300	9,469	38,568	852	8,383	15,676	4,096	432	147	9,234	19,772
	Bhagwanpur	IV		12,338	19,924	422	314	9,983	42,981	1,234	11,246	15,942	4,466	590	201	12,480	20,408
	Mansurchak	IV		5,145	10,528	230	230	4,827	20,960	515	4,912	8,328	2,310	255	87	5,426	10,638
	Bachhwara	IV		10,682	17,141	259	479	18,163	46,724	1,068	9,726	13,731	3,926	511	174	10,794	17,657
	Teghra	IV		13,854	33,269	411	725	9,411	57,670	1,385	13,717	26,104	6,881	706	240	15,103	32,986
	Barauni	IV		16,213	35,572	449	683	8,084	61,001	1,621	15,717	28,008	7,401	813	276	17,338	35,409
	Birpur	IV		4,358	12,006	137	400	4,600	21,501	436	4,469	9,385	2,531	228	78	4,905	11,916
	Begusarai	IV		27,049	71,467	870	1,261	22,196	122,843	2,705	27,433	55,842	14,347	1,404	477	30,138	70,189
	Naokothi	IV		5,241	13,296	347	418	8,669	27,971	524	5,260	10,442	2,961	270	92	5,784	13,403
	Bakhri	IV		5,893	17,553	320	585	10,354	34,705	589	6,175	13,697	3,754	314	107	6,764	17,451
	Dandari	IV		4,982	7,635	125	225	6,977	19,944	498	4,500	6,135	1,781	237	80	4,998	7,916
	Sahebpur Kamal	IV		13,667	21,748	469	566	9,079	45,529	1,367	12,425	17,440	5,063	653	222	13,792	22,503
	Balia	IV		11,230	20,207	254	438	8,595	40,724	1,123	10,443	16,067	4,392	545	185	11,566	20,459
	Matihani	IV		9,633	16,294	247	287	9,138	35,599	963	8,854	12,996	3,567	464	158	9,817	16,563
	Shamho Akha Kurha	IV		1,135	3,455	35	41	2,708	7,374	114	1,197	2,684	660	61	21	1,310	3,344

Khagaria		IV	R = 4.20	73,632	162,803	2,293	3,443	143,238	385,409	7,363	71,504	128,198	34,245	3,223	999	78,868	162,443
	Alauli	IV	L = 0.41	12,063	22,395	313	221	34,376	69,368	1,206	11,287	17,754	4,664	513	159	12,493	22,419
	Khagaria	IV	F = 0.31	17,238	43,750	564	750	25,677	87,979	1,724	17,304	34,237	8,841	774	240	19,027	43,078
	Mansi	IV		4,463	10,793	62	107	4,573	19,998	446	4,427	8,446	2,080	199	62	4,873	10,527
	Chautham	IV		6,507	13,285	327	204	14,784	35,107	651	6,209	10,505	2,879	281	87	6,859	13,384
	Beldaur	IV		2,637	10,213	365	202	32,133	45,550	264	2,999	7,914	2,155	131	40	3,263	10,069
	Gogri	IV		16,574	34,950	465	732	17,842	70,563	1,657	15,926	27,575	7,383	720	223	17,583	34,959
	Parbatta	IV		14,150	27,417	197	1,227	13,853	56,844	1,415	13,354	21,766	6,242	606	188	14,769	28,008

Bhagalpur		IV	R = 4.64	174,014	322,647	2,744	7,662	127,392	634,459	17,401	162,775	256,077	69,253	10,175	3,459	180,177	325,330
	Narayanpur	IV	L = 0.51	4,991	9,216	36	232	7,118	21,593	499	4,665	7,313	1,958	292	99	5,164	9,271
	Bihpur	IV	F = 0.34	8,129	12,059	400	139	6,853	27,580	813	7,303	9,708	2,823	461	157	8,116	12,531
	Kharik	IV		6,674	10,892	138	274	11,593	29,571	667	6,095	8,711	2,443	383	130	6,762	11,154
	Naugachhia	IV		6,316	14,790	209	210	10,717	32,242	632	6,216	11,608	3,006	384	131	6,848	14,615
	Rangra Chowk	IV		2,781	8,331	49	136	8,149	19,446	278	2,919	6,475	1,597	178	60	3,197	8,072
	Gopalpur	IV		4,447	9,476	51	142	6,373	20,489	445	4,283	7,460	1,900	266	90	4,728	9,360
	Pirpanti	IV		13,508	20,874	259	386	22,680	57,707	1,351	12,218	16,733	4,628	770	262	13,569	21,361
	Colgong	IV		19,501	40,693	673	972	15,784	77,623	1,950	18,695	32,147	8,800	1,162	395	20,645	40,947
	Ismailpur	IV		1,067	2,302	48	13	5,912	9,342	107	1,030	1,813	471	64	22	1,137	2,284
	Sabour	IV		8,606	17,439	78	279	3,105	29,507	861	8,198	13,760	3,529	510	173	9,059	17,289
	Nathnagar	IV		10,039	14,610	76	453	4,012	29,190	1,004	8,990	11,763	3,341	568	193	9,994	15,105
	Sultanganj	IV		13,437	30,692	124	790	7,204	52,247	1,344	13,147	24,118	6,297	813	276	14,491	30,415

District	Block	Seismic Zone	District Factors	Number of cesus houses of different Types and their Vulnerability						Number of Houses under various Damage Grades				Estimated Damages			
				nA (H)	nB (M)	nC1 (L)	nC2 (L)	Type X (VL)	Total	NG5	NG4	NG3	NG2	Loss of Human Lives		Re-construction	Repairing
														Unfavourable	Favourable		
	Shahkund	IV		15,978	19,992	75	388	3,525	39,958	1,598	13,983	16,239	4,544	889	302	15,581	20,783
	Goradih	IV		14,597	12,728	99	298	3,054	30,776	1,460	12,221	10,680	3,302	786	267	13,680	13,982
	Jagdishpur	IV		28,552	78,849	291	2,484	6,487	116,663	2,855	29,299	61,556	16,050	1,792	609	32,154	77,606
	Sonhaula	IV		15,391	19,704	138	466	4,826	40,525	1,539	13,514	15,993	4,563	858	292	15,053	20,556
Banka		IV	R = 4.57	229,767	166,369	1,106	5,146	27,905	430,293	22,977	188,962	142,634	46,877	9,900	3,069	211,939	189,511
	Shambhuganj	IV	L = 0.42	15,531	18,663	44	540	3,443	38,221	1,553	13,515	15,220	4,402	698	216	15,068	19,623
	Amarpur	IV	F = 0.31	18,993	26,356	52	834	3,430	49,665	1,899	16,880	21,280	6,042	867	269	18,780	27,322
	Rajaun	IV		20,151	19,452	61	454	2,879	42,997	2,015	17,058	16,152	4,815	887	275	19,074	20,967
	Dhuraiya	IV		25,758	16,532	87	365	3,915	46,657	2,576	20,972	14,376	4,751	1,102	342	23,548	19,127
	Barahat	IV		15,903	15,187	65	426	1,669	33,250	1,590	13,446	12,632	3,839	699	217	15,036	16,471
	Banka	IV		23,565	20,705	290	515	2,711	47,786	2,357	19,744	17,377	5,477	1,029	319	22,101	22,854
	Phulidumar	IV		14,171	10,020	54	184	1,819	26,248	1,417	11,630	8,602	2,744	610	189	13,047	11,346
	Belhar	IV		18,913	13,502	132	743	2,513	35,803	1,891	15,535	11,632	4,100	814	252	17,426	15,733
	Chanan	IV		24,618	7,122	47	271	1,240	33,298	2,462	19,176	7,220	3,153	1,020	316	21,638	10,373
	Katoria	IV		27,645	6,490	130	202	2,006	36,473	2,765	21,383	6,974	3,296	1,139	353	24,147	10,270
	Bausi	IV		24,519	12,340	144	612	2,280	39,895	2,452	19,623	11,170	4,257	1,036	321	22,075	15,426
Munger		IV	R = 4.41	83,073	173,625	916	4,547	35,092	297,253	8,307	79,667	136,996	36,371	5,350	1,926	87,975	173,367
	Munger	IV	L = 0.58	14,937	44,287	138	1,508	10,863	71,733	1,494	15,631	34,500	8,998	1,029	370	17,125	43,498
	Bariarpur	IV	F = 0.36	4,785	12,144	149	205	5,829	23,112	479	4,803	9,502	2,446	319	115	5,282	11,948
	Jamalpur	IV		9,955	31,628	69	914	2,750	45,316	996	10,629	24,566	6,228	697	251	11,625	30,794
	Dharhara	IV		10,905	13,440	177	242	4,295	29,059	1,091	9,523	10,940	3,148	655	236	10,613	14,088
	Kharagpur	IV		16,778	24,562	271	649	5,928	48,188	1,678	15,040	19,772	5,633	1,027	370	16,718	25,405
	Asarganj	IV		5,870	9,927	36	77	893	16,803	587	5,395	7,897	2,014	366	132	5,982	9,911
	Tarapur	IV		6,734	15,723	32	454	1,476	24,419	673	6,623	12,346	3,228	442	159	7,296	15,574
	Tetiha Bambor	IV		5,945	9,461	22	228	1,539	17,195	595	5,405	7,567	2,053	368	132	5,999	9,619
	Sangrampur	IV		7,164	12,453	22	270	1,519	21,428	716	6,618	9,906	2,624	449	161	7,335	12,531
Lakhisarai		IV	R = 4.82	66,522	110,713	694	2,141	18,797	198,867	6,652	60,963	88,307	23,722	4,602	1,519	67,615	112,030
	Barahiya	IV	L = 0.59	7,816	12,904	65	345	2,755	23,885	782	7,152	10,305	2,829	540	178	7,934	13,135
	Pipariya	IV	F = 0.33	3,077	5,011	16	34	1,991	10,129	308	2,809	3,994	1,020	212	70	3,117	5,014
	Surajgarha	IV		17,687	34,156	248	935	5,360	58,386	1,769	16,681	27,062	7,337	1,251	413	18,450	34,399
	Lakhisarai	IV		12,076	29,647	221	348	3,478	45,770	1,208	12,022	23,198	5,780	890	294	13,229	28,977
	Chanan*	IV		9,756	8,988	62	234	2,132	21,172	976	8,216	7,502	2,302	634	209	9,191	9,804
	Ramgarh Chowk	IV		7,617	8,507	28	123	1,185	17,460	762	6,563	6,967	1,961	503	166	7,325	8,927
	Halsi	IV		8,493	11,500	54	122	1,896	22,065	849	7,520	9,280	2,494	573	189	8,369	11,774

District	Block	Seismic Zone	District Factors	Number of cesus houses of different Types and their Vulnerability						Number of Houses under various Damage Grades				Estimated Damages			
				nA (H)	nB (M)	nC1 (L)	nC2 (L)	Type X (VL)	Total	NG5	NG4	NG3	NG2	Loss of Human Lives		Re-construction	Repairing
														Unfavourable	Favourable		
Sheikhpura		IV	R = 4.79	44,333	71,367	292	1,143	9,007	126,142	4,433	40,386	56,994	15,106	3,086	1,049	44,820	72,100
	Barbiga	IV	L = 0.60	9,130	17,168	100	132	1,401	27,931	913	8,564	13,584	3,434	650	221	9,477	17,018
	Shekhopur Sarai	IV	F = 0.34	4,041	8,513	34	92	884	13,564	404	3,882	6,700	1,675	293	100	4,286	8,375
	Sheikhpura	IV		12,782	23,255	72	613	2,578	39,300	1,278	11,912	18,468	4,961	905	308	13,190	23,429
	Ghat Kusumbha	IV		2,287	5,840	22	64	852	9,065	229	2,299	4,560	1,112	172	58	2,528	5,672
	Chewara	IV		6,410	7,242	23	78	1,342	15,095	641	5,532	5,922	1,643	428	146	6,173	7,565
	Ariari	IV		9,683	9,349	41	164	1,950	21,187	968	8,197	7,758	2,282	638	217	9,165	10,041
Nalanda		IV	R = 4.66	183,471	358,994	1,378	7,112	33,339	584,294	18,347	173,503	283,855	73,977	14,058	4,639	191,850	357,832
	Karai Parsurai	IV	L = 0.66	7,530	6,513	19	85	780	14,927	753	6,299	5,460	1,620	526	174	7,052	7,080
	Nagar Nausa	IV	F = 0.33	7,146	11,275	37	158	1,335	19,951	715	6,487	9,012	2,373	531	175	7,202	11,385
	Harnaut	IV		11,399	20,705	53	199	2,540	34,896	1,140	10,620	16,409	4,150	864	285	11,760	20,559
	Chandi	IV		10,778	18,157	60	251	2,260	31,506	1,078	9,899	14,457	3,765	808	267	10,977	18,222
	Rahui	IV		9,266	18,715	178	148	1,962	30,269	927	8,821	14,764	3,747	714	235	9,748	18,511
	Bind	IV		5,459	7,908	37	120	988	14,512	546	4,885	6,356	1,713	401	132	5,431	8,070
	Sarmera	IV		7,423	11,618	156	95	1,921	21,213	742	6,729	9,295	2,488	551	182	7,471	11,783
	Asthawan	IV		8,091	20,102	65	635	1,452	30,345	809	8,078	15,753	4,147	646	213	8,888	19,900
	Bihar	IV		22,075	72,004	267	2,424	4,575	101,345	2,208	23,757	55,928	14,474	1,869	617	25,964	70,402
	Noorsarai	IV		11,586	21,076	40	326	1,784	34,812	1,159	10,797	16,713	4,305	878	290	11,956	21,017
	Tharthari	IV		5,494	7,719	37	77	848	14,175	549	4,892	6,213	1,655	402	133	5,442	7,868
	Parbalpur	IV		4,404	9,023	21	94	834	14,376	440	4,205	7,109	1,770	340	112	4,646	8,879
	Hilsa	IV		14,596	22,886	101	295	1,893	39,771	1,460	13,236	18,299	4,825	1,083	358	14,695	23,123
	Ekgarsarai	IV		9,523	22,604	45	301	2,011	34,484	952	9,403	17,702	4,364	754	249	10,355	22,066
	Islampur	IV		16,235	24,831	93	409	3,145	44,713	1,624	14,659	19,891	5,319	1,201	396	16,283	25,210
	Ben	IV		7,181	9,513	30	134	1,185	18,043	718	6,337	7,690	2,089	522	172	7,055	9,778
	Rajgir	IV		9,324	14,503	40	310	1,596	25,773	932	8,443	11,612	3,137	691	228	9,376	14,749
	Silao	IV		8,809	19,506	52	689	1,218	30,274	881	8,557	15,364	4,142	689	227	9,438	19,507
	Giriak	IV		4,795	13,450	30	245	547	19,067	480	4,941	10,475	2,583	392	130	5,421	13,058
	Katrisarai	IV		2,357	6,886	17	117	465	9,842	236	2,456	5,355	1,310	195	64	2,692	6,665

District	Block	Seismic Zone	District Factors	Number of cesus houses of different Types and their Vulnerability						Number of Houses under various Damage Grades				Estimated Damages			
				nA (H)	nB (M)	nC1 (L)	nC2 (L)	Type X (VL)	Total	NG5	NG4	NG3	NG2	Loss of Human Lives		Re-construction	Repairing
														Unfavourable	Favourable		
Patna		IV & III	R = 4.77	275,990	773,473	2,394	25,054	64,471	1,141,382	24,745	261,418	594,291	171,978	21,134	8,242	286,163	766,269
	Maner	IV	L = 0.66	12,709	29,287	66	453	3,853	46,368	1,271	12,460	22,970	5,735	1,025	400	13,731	28,706
	Dinapur-Cum-Khagaul	IV	F = 0.39	15,213	49,277	152	1,774	5,443	71,859	1,521	16,337	38,291	9,977	1,316	513	17,859	48,268
	Patna Rural	IV		43,961	293,248	949	14,570	12,982	365,710	4,396	62,296	224,785	58,924	4,753	1,854	66,692	283,709
	Sampatchak	IV		4,702	14,585	23	380	1,348	21,038	470	4,985	11,332	2,843	403	157	5,455	14,174
	Phulwari	IV		11,890	37,887	47	1,263	1,939	53,026	1,189	12,706	29,438	7,557	1,025	400	13,895	36,995
	Bihta	IV		14,426	31,938	82	824	2,645	49,915	1,443	14,013	25,126	6,552	1,155	450	15,456	31,678
	Naubatpur	IV		12,502	26,776	68	456	2,463	42,265	1,250	12,054	21,072	5,347	995	388	13,304	26,419
	Bikram	IV		10,395	20,856	97	501	1,615	33,464	1,040	9,882	16,481	4,357	819	319	10,921	20,838
	Dulhin Bazar	III		8,636	14,544	34	241	1,499	24,954		864	7,931	7,947	54	21	864	15,879
	Paliganj	III		19,901	29,184	61	638	3,022	52,806		1,990	17,844	16,154	125	49	1,990	33,999
	Masaurhi	IV		16,745	29,434	76	535	3,248	50,038	1,675	15,502	23,392	6,129	1,292	504	17,177	29,522
	Dhanarua	IV		14,812	22,537	41	211	2,346	39,947	1,481	13,363	18,039	4,680	1,121	437	14,844	22,719
	Punpun	IV		10,110	19,104	64	282	1,677	31,237	1,011	9,493	15,121	3,883	789	308	10,504	19,004
	Fatwah	IV		11,212	23,359	110	477	2,086	37,244	1,121	10,745	18,419	4,785	888	346	11,866	23,204
	Daniawan	IV		6,099	7,887	14	112	871	14,983	610	5,363	6,385	1,735	453	177	5,973	8,120
	Khusrupur	IV		8,725	9,971	40	250	1,416	20,402	873	7,541	8,162	2,368	640	249	8,413	10,529
	Bakhtiarpur	IV		10,787	23,506	93	413	4,679	39,478	1,079	10,441	18,489	4,714	861	336	11,520	23,204
	Athmalgola	IV		5,392	8,876	35	212	1,528	16,043	539	4,932	7,086	1,921	412	161	5,471	9,007
	Belchhi	IV		4,278	8,340	7	62	301	12,988	428	4,043	6,583	1,624	335	131	4,470	8,206
	Barh	IV		10,087	24,768	94	614	2,291	37,854	1,009	10,042	19,403	5,003	823	321	11,051	24,406
	Pandarak	IV		9,341	16,259	138	188	1,477	27,403	934	8,632	12,927	3,384	720	281	9,566	16,311
	Ghoswari	IV		5,919	6,681	15	153	1,121	13,889	592	5,107	5,471	1,572	433	169	5,699	7,044
	Mokameh	IV		8,148	25,169	88	445	4,621	38,471	815	8,628	19,541	4,786	697	272	9,443	24,327
Bhojpur		IV & III	R = 5.31	151,488	300,000	1,770	4,836	34,128	492,222	3,773	50,061	185,906	127,266	2,738	903	53,835	313,172
	Shahpur	III	L = 0.42	7,754	20,307	259	317	5,549	34,186		775	7,846	10,793	35	11	775	18,639
	Arrah	IV	F = 0.33	16,291	59,593	191	951	4,442	81,468	1,629	18,178	46,031	11,017	1,029	339	19,807	57,048
	Barhara	IV		10,513	20,682	254	404	6,652	38,505	1,051	9,953	16,366	4,384	585	193	11,004	20,750
	Koilwar	IV		10,928	23,592	122	535	3,210	38,387	1,093	10,555	18,579	4,851	617	204	11,648	23,430
	Sandesh	III		6,937	12,166	32	302	1,235	20,672		694	6,419	6,637	31	10	694	13,056
	Udwant Nagar	III		8,357	18,492	63	239	1,026	28,177		836	8,117	9,903	37	12	836	18,020
	Behea	III		9,852	19,280	170	476	2,238	32,016		985	9,317	10,444	44	15	985	19,761
	Jagdishpur	III		18,874	26,711	127	272	2,454	48,438		1,887	16,827	14,811	84	28	1,887	31,638
	Piro	III		16,342	28,439	71	231	1,878	46,961		1,634	15,100	15,475	73	24	1,634	30,576
	Charpokhari	III		7,086	12,022	16	82	964	20,170		709	6,517	6,552	32	10	709	13,069
	Garhani	III		7,726	10,695	64	177	722	19,384		773	6,864	5,951	34	11	773	12,815
	Agiaon	III		9,679	16,585	219	240	1,568	28,291		968	8,918	9,064	43	14	968	17,982
	Tarari	III		13,071	19,467	163	388	1,372	34,461		1,307	11,750	10,769	58	19	1,307	22,519
	Sahar	III		8,078	11,969	19	222	818	21,106		808	7,255	6,614	36	12	808	13,870

District	Block	Seismic Zone	District Factors	Number of cesus houses of different Types and their Vulnerability						Number of Houses under various Damage Grades				Estimated Damages			
				nA (H)	nB (M)	nC1 (L)	nC2 (L)	Type X (VL)	Total	NG5	NG4	NG3	NG2	Loss of Human Lives		Re-construction	Repairing
														Unfavourable	Favourable		

Buxar		III	R = 5.10	90,788	198,459	1,344	2,308	29,664	322,563		9,079	87,937	106,404	333	107	9,079	194,341
	Simri	III	L = 0.36	8,252	20,178	244	259	6,750	35,683		825	8,207	10,758	30	10	825	18,965
	Chakki	III	F = 0.32	1,399	3,641	8	31	1,371	6,450		140	1,413	1,929	5	2	140	3,343
	Barhampur	III		8,338	19,955	311	186	4,240	33,030		834	8,249	10,653	31	10	834	18,902
	Chaugain	III		2,870	6,342	14	33	466	9,725		287	2,787	3,391	11	3	287	6,178
	Kesath	III		2,192	4,490	6	26	510	7,224		219	2,093	2,413	8	3	219	4,506
	Dumraon	III		13,022	30,414	120	484	3,819	47,859		1,302	12,808	16,244	48	15	1,302	29,052
	Buxar	III		10,369	39,120	265	737	4,309	54,800		1,037	11,689	20,438	38	12	1,037	32,127
	Chausa	III		5,658	12,545	89	72	1,662	20,026		566	5,498	6,713	21	7	566	12,211
	Rajpur	III		17,142	21,780	108	128	2,857	42,015		1,714	15,035	12,199	63	20	1,714	27,234
	Itarhi	III		11,306	18,800	79	90	1,865	32,140		1,131	10,360	10,265	42	13	1,131	20,624
	Nawanagar	III		10,240	21,194	100	262	1,815	33,611		1,024	9,799	11,401	38	12	1,024	21,201

Kaimur (Bhabua)		III	R = 4.78	141,278	165,677	1,081	1,573	21,420	331,029		14,128	122,526	93,700	527	163	14,128	216,226
	Ramgarh	III	L = 0.39	7,851	16,630	179	86	3,356	28,102		785	7,551	8,930	29	9	785	16,482
	Nuaon	III	F = 0.31	6,108	11,369	48	100	2,333	19,958		611	5,718	6,157	23	7	611	11,875
	Kudra	III		11,329	19,323	34	181	1,249	32,116		1,133	10,429	10,533	42	13	1,133	20,962
	Mohania	III		13,548	26,741	132	265	3,344	44,030		1,355	12,835	14,426	51	16	1,355	27,261
	Durgawati	III		9,268	15,838	75	154	2,103	27,438		927	8,535	8,637	35	11	927	17,172
	Chand	III		13,155	10,685	51	74	1,556	25,521		1,316	10,935	6,342	49	15	1,316	17,276
	Chainpur	III		21,428	15,598	156	268	1,455	38,905		2,143	17,631	9,449	80	25	2,143	27,079
	Bhabua	III		23,523	35,315	107	278	3,902	63,125		2,352	21,174	19,460	88	27	2,352	40,634
	Rampur	III		11,957	6,225	13	97	846	19,138		1,196	9,590	4,020	45	14	1,196	13,611
	Bhagwanpur	III		11,235	7,511	54	51	910	19,761		1,124	9,177	4,609	42	13	1,124	13,786
	Adhaura	III		11,876	442	232	19	366	12,935		1,188	8,951	1,137	44	14	1,188	10,088

Rohtas		III	R = 4.87	220,283	334,230	1,433	5,327	22,944	584,217		22,028	198,635	184,312	987	326	22,028	382,947
	Kochas	III	L = 0.46	10,623	20,923	60	127	1,255	32,988		1,062	10,060	11,277	48	16	1,062	21,336
	Dinara	III	F = 0.33	15,812	23,432	147	290	2,780	42,461		1,581	14,202	12,946	71	23	1,581	27,148
	Dawath	III		7,564	12,057	62	167	1,312	21,162		756	6,879	6,619	34	11	756	13,497
	Suryapura	III		3,519	7,329	10	68	396	11,322		352	3,372	3,936	16	5	352	7,308
	Bikramganj	III		10,734	20,637	38	370	1,051	32,830		1,073	10,114	11,164	48	16	1,073	21,279
	Karakat	III		15,029	23,520	81	520	1,734	40,884		1,503	13,624	12,947	67	22	1,503	26,571
	Nasriganj	III		10,070	15,432	75	295	762	26,634		1,007	9,096	8,508	45	15	1,007	17,604
	Rajpur	III		5,760	8,854	6	127	396	15,143		576	5,205	4,872	26	9	576	10,078
	Sanjhauli	III		4,204	7,950	45	63	354	12,616		420	3,948	4,301	19	6	420	8,249
	Nokha	III		13,710	18,757	68	370	1,856	34,761		1,371	12,158	10,451	61	20	1,371	22,609
	Kargahar	III		15,914	23,874	69	194	2,145	42,196		1,591	14,323	13,157	71	24	1,591	27,480
	Chenari	III		14,189	13,772	51	133	580	28,725		1,419	12,019	7,969	64	21	1,419	19,988
	Nauhatta	III		13,843	2,281	77	88	545	16,834		1,384	10,610	2,195	62	20	1,384	12,806
	Sheosagar	III		15,826	17,315	47	194	1,060	34,442		1,583	13,601	9,869	71	23	1,583	23,470
	Sasaram	III		21,929	47,259	209	941	2,453	72,791		2,193	21,173	25,389	98	32	2,193	46,562

District	Block	Seismic Zone	District Factors	Number of cesus houses of different Types and their Vulnerability						Number of Houses under various Damage Grades				Estimated Damages			
				nA (H)	nB (M)	nC1 (L)	nC2 (L)	Type X (VL)	Total	NG5	NG4	NG3	NG2	Loss of Human Lives		Re-construction	Repairing
														Unfavourable	Favourable		
	Akorhi Gola	III		10,230	12,574	87	273	1,110	24,274		1,023	8,930	7,090	46	15	1,023	16,020
	Dehri	III		13,968	40,388	167	824	1,640	56,987		1,397	14,515	21,341	63	21	1,397	35,856
	Tilouthu	III		9,165	10,988	104	123	902	21,282		917	7,973	6,204	41	14	917	14,177
	Rohtas	III		8,194	6,888	30	160	613	15,885		819	6,834	4,078	37	12	819	10,912

Aurangabad		III	R = 5.26	217,676	216,371	1,055	4,848	23,230	463,180		21,768	184,894	125,102	1,145	366	21,768	309,996
	Daudnagar	III	L = 0.50	15,697	21,244	52	877	1,264	39,134		1,570	13,897	11,892	83	26	1,570	25,789
	Haspura	III	F = 0.32	13,553	16,306	49	301	1,350	31,559		1,355	11,795	9,204	71	23	1,355	21,000
	Goh	III		21,669	18,206	89	289	2,156	42,409		2,167	18,072	10,766	114	36	2,167	28,838
	Rafiganj	III		29,331	22,955	79	374	1,919	54,658		2,933	24,294	13,723	154	49	2,933	38,016
	Obra	III		19,550	21,320	70	338	2,015	43,293		1,955	16,795	12,167	103	33	1,955	28,962
	Aurangabad	III		18,150	30,232	147	934	1,722	51,185		1,815	16,636	16,585	95	31	1,815	33,221
	Barun	III		15,492	18,580	76	275	2,024	36,447		1,549	13,477	10,487	81	26	1,549	23,964
	Nabinagar	III		28,399	22,180	263	482	3,687	55,011		2,840	23,517	13,294	149	48	2,840	36,812
	Kutumba	III		19,496	18,812	67	331	2,801	41,507		1,950	16,503	10,908	103	33	1,950	27,411
	Deo	III		16,186	13,181	79	408	1,872	31,726		1,619	13,458	7,853	85	27	1,619	21,311
	Madanpur	III		20,153	13,355	84	239	2,420	36,251		2,015	16,450	8,221	106	34	2,015	24,672

Gaya		III	R = 5.42	395,816	348,334	1,037	8,748	29,193	783,128		39,582	331,695	204,832	2,060	680	39,582	536,527
	Konch	III	L = 0.48	19,842	11,748	57	331	1,631	33,609		1,984	16,056	7,401	103	34	1,984	23,457
	Tikari	III	F = 0.33	19,217	25,375	103	522	2,531	47,748		1,922	16,950	14,191	100	33	1,922	31,142
	Belaganj	III		16,179	19,762	47	431	1,606	38,025		1,618	14,110	11,142	84	28	1,618	25,253
	Khizirsarai	III		16,596	16,097	16	366	1,406	34,481		1,660	14,057	9,331	86	28	1,660	23,388
	Neem Chak Bathani	III		9,529	6,384	6	49	1,101	17,069		953	7,785	3,912	50	16	953	11,697
	Muhra	III		10,791	5,912	9	129	776	17,617		1,079	8,684	3,779	56	19	1,079	12,464
	Atri	III		8,487	4,356	9	72	669	13,593		849	6,801	2,823	44	15	849	9,623
	Manpur	III		11,016	15,205	38	347	711	27,317		1,102	9,783	8,467	57	19	1,102	18,250
	Gaya Town C.D.Block	III		25,468	83,841	255	3,237	2,894	115,695		2,547	27,485	44,180	133	44	2,547	71,665
	Paraiya	III		9,940	8,047	25	119	852	18,983		994	8,260	4,783	52	17	994	13,043
	Guraru	III		13,617	9,126	9	244	1,052	24,048		1,362	11,125	5,610	71	23	1,362	16,735
	Gurua	III		20,714	11,650	29	160	1,432	33,985		2,071	16,701	7,397	108	36	2,071	24,098
	Amas	III		9,914	8,265	11	88	682	18,960		991	8,262	4,886	52	17	991	13,148
	Banke Bazar	III		15,515	7,747	26	218	563	24,069		1,552	12,411	5,062	81	27	1,552	17,472
	Imamganj	III		22,579	10,395	34	199	1,308	34,515		2,258	17,974	6,914	117	39	2,258	24,888
	Dumaria	III		16,542	5,612	36	212	1,006	23,408		1,654	12,968	4,071	86	28	1,654	17,039
	Sherghati	III		15,121	11,493	13	157	818	27,602		1,512	12,490	6,898	79	26	1,512	19,388
	Dobhi	III		17,190	8,528	31	143	957	26,849		1,719	13,745	5,571	89	30	1,719	19,316
	Bodh Gaya	III		24,183	18,351	15	271	1,026	43,846		2,418	19,972	11,018	126	42	2,418	30,990
	Tan Kuppa	III		14,043	6,604	11	65	812	21,535		1,404	11,193	4,363	73	24	1,404	15,555
	Wazirganj	III		20,624	17,966	70	449	2,502	41,611		2,062	17,265	10,582	107	35	2,062	27,846
	Fatehpur	III		23,697	14,848	124	196	1,130	39,995		2,370	19,258	9,233	123	41	2,370	28,491
	Mohanpur	III		22,087	10,183	44	245	994	33,553		2,209	17,584	6,777	115	38	2,209	24,360
	Barachatti	III		12,925	10,839	19	498	734	25,015		1,293	10,778	6,441	67	22	1,293	17,218

District	Block	Seismic Zone	District Factors	Number of cesus houses of different Types and their Vulnerability						Number of Houses under various Damage Grades				Estimated Damages			
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														Unfavourable	Favourable		
Nawada		IV & III	R = 5.22	178,109	207,795	835	4,257	18,959	409,955	7,710	79,694	179,072	78,121	5,797	1,855	87,404	257,193
	Nardiganj	III	L = 0.54	9,907	11,654	133	110	1,135	22,939		991	8,596	6,594	56	18	991	15,190
	Nawada	IV	F = 0.32	16,521	41,823	64	928	2,201	61,537	1,652	16,573	32,706	8,257	1,214	388	18,225	40,962
	Warisaliganj	IV		14,055	21,288	132	462	2,056	37,993	1,406	12,670	17,080	4,693	952	305	14,076	21,772
	Kashi Chak	IV		4,736	7,782	26	104	837	13,485	474	4,330	6,205	1,620	324	104	4,804	7,825
	Pakribarawan	IV		13,439	17,785	46	201	1,921	33,392	1,344	11,858	14,371	3,861	896	287	13,202	18,232
	Kauwakol	IV		13,780	15,039	28	198	1,151	30,196	1,378	11,839	12,335	3,459	900	288	13,217	15,794
	Roh	IV		14,565	13,993	42	160	1,049	29,809	1,457	12,323	11,607	3,343	941	301	13,780	14,950
	Gobindpur	III		8,865	7,923	16	553	387	17,744		887	7,441	4,683	50	16	887	12,124
	Akbarpur	III		18,841	18,196	24	501	1,750	39,312		1,884	15,950	10,564	106	34	1,884	26,514
	Hisua	III		11,870	14,312	18	228	1,227	27,655		1,187	10,334	8,071	67	21	1,187	18,405
	Narhat	III		8,748	8,742	31	116	1,393	19,030		875	7,435	5,042	49	16	875	12,477
	Meskaur	III		11,335	6,894	36	149	1,185	19,599		1,134	9,191	4,316	64	20	1,134	13,506
	Sirdala	III		17,636	10,759	40	258	1,127	29,820		1,764	14,303	6,732	99	32	1,764	21,035
	Rajauli	III		13,811	11,605	199	289	1,540	27,444		1,381	11,519	6,887	78	25	1,381	18,406

Jamui		IV & III	R = 4.92	187,473	135,447	730	4,060	17,786	345,496	15,208	130,168	133,607	41,073	8,476	2,712	145,376	174,679
	Islamnagar Aliganj	IV	L = 0.49	10,522	15,054	68	448	1,364	27,456	1,052	9,397	12,131	3,434	605	194	10,449	15,566
	Sikandra	IV	F = 0.32	12,568	14,222	111	346	2,532	29,779	1,257	10,848	11,655	3,419	705	226	12,105	15,073
	Jamui	IV		18,621	23,617	83	786	2,692	45,799	1,862	16,327	19,196	5,591	1,057	338	18,190	24,787
	Barhat	IV		9,134	7,975	52	189	1,450	18,800	913	7,648	6,690	2,062	501	160	8,561	8,752
	Lakshmipur	IV		14,415	8,745	47	178	1,985	25,370	1,442	11,686	7,662	2,562	772	247	13,127	10,224
	Jhajha	IV		28,311	20,413	155	406	2,199	51,484	2,831	23,275	17,489	5,606	1,532	490	26,106	23,095
	Gidhaur	IV		5,997	7,106	31	328	696	14,158	600	5,208	5,815	1,785	338	108	5,808	7,600
	Khaira	IV		25,739	15,404	69	483	2,228	43,923	2,574	20,845	13,539	4,655	1,377	441	23,419	18,194
	Sono	IV		26,776	13,131	39	478	1,268	41,692	2,678	21,395	11,908	4,366	1,419	454	24,073	16,274
	Chakai	III		35,390	9,780	75	418	1,372	47,035		3,539	27,521	7,594	171	55	3,539	35,114

Jehanabad		IV & III	R = 5.23	70,548	125,485	258	2,214	9,270	207,775	3,684	38,373	88,674	43,519	2,947	972	42,056	132,193
	Ratni Faridpur	III	L = 0.57	9,661	14,667	32	201	1,082	25,643		966	8,712	8,081	58	19	966	16,794
	Jehanabad	IV	F = 0.33	13,773	33,455	69	762	1,646	49,705	1,377	13,675	26,207	6,674	1,062	350	15,053	32,882
	Kako	IV		10,947	18,831	29	223	1,278	31,308	1,095	10,093	14,969	3,835	798	263	11,188	18,804
	Modanganj	IV		5,158	9,335	17	141	527	15,178	516	4,802	7,404	1,906	379	125	5,318	9,310
	Ghoshi	IV		6,961	12,103	21	340	837	20,262	696	6,431	9,635	2,608	508	168	7,127	12,244
	Makhdumpur	III		18,191	27,865	55	416	2,118	48,645		1,819	16,430	15,344	108	36	1,819	31,774
	Hulasganj	III		5,857	9,229	35	131	1,782	17,034		586	5,316	5,070	35	12	586	10,386
Arwal		III	R = 4.85	57,101	76,520	261	1,158	4,521	139,561		5,710	50,478	42,684	260	81	5,710	93,162
	Arwal	III	L = 0.47	11,171	19,214	35	262	884	31,566		1,117	10,300	10,475	51	16	1,117	20,774
	Kaler	III	F = 0.31	11,328	15,827	99	291	1,077	28,622		1,133	10,079	8,802	52	16	1,133	18,881
	Karpi	III		16,882	21,464	77	284	1,334	40,041		1,688	14,808	12,034	77	24	1,688	26,842
	Sonbhadra Banshi Suryapur	III		8,392	7,467	24	72	624	16,579		839	7,041	4,373	38	12	839	11,413
	Kurtha	III		9,328	12,548	26	249	602	22,753		933	8,251	7,001	43	13	933	15,252

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Computation of R and F for each district of Bihar,

R = Total Population / Total Census Houses

Favourable Condition factor, F = { 0.3 * Rural housing + 0.5 * Urban Housing } Total Housing

S. No.	Districts / State	Census Houses			Population			R	F
		Total	Rural	Urban	Total	Rural	Urban	Total	
1	Pashchim Champaran	936,134	839,514	96,620	3,922,780	3,528,781	393,999	4.19	0.32
2	Purba Champaran	1,243,825	1,142,260	101,565	5,082,868	4,683,820	399,048	4.09	0.32
3	Sheohar	166,000	158,484	7,516	656,916	628,821	28,095	3.96	0.31
4	Sitamarhi	856,964	807,294	49,670	3,419,622	3,228,904	190,718	3.99	0.31
5	Madhubani	1,088,786	1,047,552	41,234	4,476,044	4,311,466	164,578	4.11	0.31
6	Supaul	600,102	572,287	27,815	2,228,397	2,122,869	105,528	3.71	0.31
7	Araria	703,274	659,061	44,213	2,806,200	2,637,656	168,544	3.99	0.31
8	Kishanganj	445,150	401,793	43,357	1,690,948	1,527,249	163,699	3.80	0.32
9	Purnia	798,596	712,847	85,749	3,273,127	2,932,527	340,600	4.10	0.32
10	Katihar	738,070	668,232	69,838	3,068,149	2,794,765	273,384	4.16	0.32
11	Madhepura	510,278	486,278	24,000	1,994,618	1,906,448	88,170	3.91	0.31
12	Saharsa	470,697	432,651	38,046	1,897,102	1,741,927	155,175	4.03	0.32
13	Darbhanga	1,002,713	907,174	95,539	3,921,971	3,541,846	380,125	3.91	0.32
14	Muzaffarpur	1,119,394	998,694	120,700	4,778,610	4,308,714	469,896	4.27	0.32
15	Gopalganj	554,058	515,925	38,133	2,558,037	2,396,270	161,767	4.62	0.31
16	Siwan	674,372	632,514	41,858	3,318,176	3,135,865	182,311	4.92	0.31
17	Saran	777,622	701,323	76,299	3,943,098	3,591,053	352,045	5.07	0.32
18	Vaishali	750,811	699,317	51,494	3,495,249	3,262,715	232,534	4.66	0.31
19	Samastipur	1,056,465	1,012,979	43,486	4,254,782	4,107,725	147,057	4.03	0.31
20	Begusarai	733,625	594,377	139,248	2,954,367	2,387,311	567,056	4.03	0.34
21	Khagaria	394,703	373,696	21,007	1,657,599	1,570,470	87,129	4.20	0.31
22	Bhagalpur	653,161	522,527	130,634	3,032,226	2,432,126	600,100	4.64	0.34
23	Banka	444,096	425,604	18,492	2,029,339	1,957,988	71,351	4.57	0.31
24	Munger	308,063	222,281	85,782	1,359,054	974,425	384,629	4.41	0.36
25	Lakhisarai	207,645	175,882	31,763	1,000,717	857,751	142,966	4.82	0.33
26	Sheikhpura	132,638	108,293	24,345	634,927	526,132	108,795	4.79	0.34
27	Nalanda	616,663	514,141	102,522	2,872,523	2,415,034	457,489	4.66	0.33
28	Patna	1,210,094	657,991	552,103	5,772,804	3,262,711	2,510,093	4.77	0.39
29	Bhojpur	511,927	434,559	77,368	2,720,155	2,331,450	388,705	5.31	0.33
30	Buxar	334,657	299,252	35,405	1,707,643	1,543,476	164,167	5.10	0.32
31	Kaimur (Bhabua)	340,442	325,143	15,299	1,626,900	1,561,538	65,362	4.78	0.31
32	Rohtas	608,061	512,383	95,678	2,962,593	2,535,085	427,508	4.87	0.33
33	Aurangabad	477,297	428,291	49,006	2,511,243	2,275,761	235,482	5.26	0.32
34	Gaya	807,571	696,289	111,282	4,379,383	3,803,888	575,495	5.42	0.33
35	Nawada	424,874	379,551	45,323	2,216,653	2,001,120	215,533	5.22	0.32
36	Jamui	356,760	325,909	30,851	1,756,078	1,611,431	144,647	4.92	0.32
37	Jehanabad	214,792	186,660	28,132	1,124,176	989,816	134,360	5.23	0.33
38	Arwal	144,294	134,334	9,960	699,563	648,094	51,469	4.85	0.31
Bihar State		23,414,674	20,713,342	2,701,332	103,804,637	92,075,028	11,729,609	4.43	

Computation for Light Roof Reduction factor, L

$$L = (10 \% \text{ of } R1 + 30\% \text{ of } R2 + R3) / \text{Total Housing}$$

Census Houses by predominant material of Roof for Bihar Districts

Sr. No.	Area Name	Roof Type R1 Grass Thatch, Plastic, GI Metals, Any Other Material	Roof Type R2 Handmade Tiles, Machine Made Tiles, Stone/State	Roof Type R3 Burnt Brick and Concrete	Total number of census houses	Light Roof factor, L
	STATE - BIHAR	10,454,348	5,478,944	6,849,775	22,783,067	
1	Dist. - Pashchim Champaran	514,916	212,480	189,524	916,920	0.33
2	Dist. - Purba Champaran	638,613	286,963	300,143	1,225,719	0.37
3	Dist. - Sheohar	99,042	32,874	32,445	164,361	0.32
4	Dist. - Sitamarhi	358,220	305,990	179,539	843,749	0.36
5	Dist. - Madhubani	676,347	157,357	234,591	1,068,295	0.33
6	Dist. - Supaul	503,174	38,439	50,212	591,825	0.19
7	Dist. - Araria	614,577	24,633	56,483	695,693	0.18
8	Dist. - Kishanganj	373,165	15,332	49,570	438,067	0.21
9	Dist. - Purnia	658,466	36,037	91,444	785,947	0.21
10	Dist. - Katihar	439,886	179,292	106,609	725,787	0.28
11	Dist. - Madhepura	362,224	75,824	65,435	503,483	0.25
12	Dist. - Saharsa	265,403	116,228	79,977	461,608	0.31
13	Dist. - Darbhanga	416,064	320,356	236,683	973,103	0.38
14	Dist. - Muzaffarpur	571,545	219,363	302,122	1,093,030	0.39
15	Dist. - Gopalganj	225,621	34,551	279,924	540,096	0.58
16	Dist. - Siwan	195,864	48,141	411,125	655,130	0.68
17	Dist. - Saran	259,286	122,180	370,854	752,320	0.58
18	Dist. - Vaishali	352,164	150,782	229,787	732,733	0.42
19	Dist. - Samastipur	436,181	338,153	254,563	1,028,897	0.39
20	Dist. - Begusarai	225,282	230,767	253,030	709,079	0.49
21	Dist. - Khagaria	171,148	105,911	108,350	385,409	0.41
22	Dist. Bhagalpur	219,669	163,488	251,302	634,459	0.51
23	Dist. - Banka	203,162	97,298	129,833	430,293	0.42
24	Dist. - Munger	91,516	61,865	143,872	297,253	0.58
25	Dist. - Lakhisarai	51,630	50,412	96,825	198,867	0.59
26	Dist. - Sheikhpura	35,093	26,890	64,159	126,142	0.60
27	Dist. - Nalanda	153,097	87,835	343,362	584,294	0.66
28	Dist. - Patna	271,754	199,224	670,404	1,141,382	0.66
29	Dist. - Bhojpur	119,167	257,086	115,969	492,222	0.42
30	Dist. - Buxar	82,246	190,398	49,919	322,563	0.36
31	Dist. - Kaimur (Bhabua)	84,507	181,808	64,714	331,029	0.39
32	Dist. - Rohtas	124,770	294,032	165,415	584,217	0.46
33	Dist. - Aurangabad	137,075	155,531	170,574	463,180	0.50
34	Dist. - Gaya	240,895	273,506	268,727	783,128	0.48
35	Dist. - Nawada	102,199	136,060	171,696	409,955	0.54
36	Dist. - Jamui	75,672	154,502	115,322	345,496	0.49
37	Dist. - Jehanabad	58,630	50,950	98,195	207,775	0.57
38	Dist. - Arwal	46,078	46,406	47,077	139,561	0.47

