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Compliance with the building byelaws and earthquake safety in urban areas of Bihar: progress, constraints and challenges

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ABSTRACT

The adoption and enforcement of building codes is considered the most effective tool in safeguarding lives and property against earthquakes. There would appear to be a vital regulatory role for government in the enforcement of building codes, but this is somewhat at odds with the neoliberal agenda of 'rolling back the state'. This paper explores constraints to the implementation of building codes in the context of changing roles and responsibilities of local authorities in Bihar in India. In-depth interviews were conducted with key stakeholders across major urban centres in north Bihar. Some factors, such as: code complexity; competition between the public and private sectors for qualified personnel; and low public risk perception were found to be less significant in Bihar than has been noted elsewhere, while other factors such as: the cost of earthquake-resistant measures; political interests; corrupt practices; and lack of government capacity were important. Additional factors were also revealed by the research, some of which are exacerbated by the neoliberal climate of urban governance. While the recent 2014 byelaws represent an improvement in the system and a degree of re-regulation, ambiguities create opportunities for failures arising from 'normalised irresponsibility'.

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1. Introduction

Poor compliance with building codes, combined with inadequate construction practices and low levels of preparedness, has exacerbated people's vulnerability to earthquakes to a considerable level (Ainuddin, Mukhtar, & Ainuddin, 2014). The adoption and enforcement of building codes is widely considered the most effective tool in safeguarding lives and property against major disasters such as earthquakes and the most important factor in reducing a community's risk (Ainuddin et al., 2014; UNESCO, 2009). Spence (2004) notes that where building codes have been well accepted and thoroughly implemented, they have been highly successful in limiting damage from extreme events. Given the importance of building code enforcement there would appear to be a vital regulatory role for

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government, but this is somewhat at odds with the neoliberal agenda of 'rolling back the state'. This is clearly pointed to by Krimgold (2011):

[O]ver the past approximately 30 years, international development has been powerfully influenced by emphasis on free market economic philosophy including privatization and deregulation. In this climate, very little attention has been focused on formal regulation of urban development, building standards or land-use management. During a period of rapid urbanization over the past 30–40 years, disaster risk has expanded dramatically due to unregulated growth of the built environment. (Krimgold, 2011, p. 55)

This paper explores the challenges that arise in the enforcement of building codes in Bihar in India by reviewing the significance of factors that have been cited in the literature as constraints to building code implementation. This is contextualised by giving attention to the changes and debates in urban governance which have an important bearing on the regulatory environment in which building code enforcement takes place.

1.1. Barriers to the effective implementation of building codes

Great strides have been made in building standards over the last 30 years and national and international building standards have been consistently revised and improved following major earthquake events as building safety often takes a higher profile (Krimgold, 2011; Mora, Chang, Beatson, & Morahan, 2015). However, in poorer or less well-governed contexts, it is the *enforcement* of building codes that tends to be considered the major challenge. Spence (2004), for example, argues that the widespread destruction of buildings in the earthquakes of Kocaeli, Turkey, in 1999 and Gujarat, India, in 2001 was not due to inadequate codes. Destruction occurred because codes were not generally adopted. He later notes that in any relatively poor country seeking to industrialise rapidly in a competitive global economy, legislated inspection and building control will always face difficulties.

While efforts to strengthen building code enforcement are being made in many places (e.g. Dixit, Yatabe, Dahal, & Bhandary, 2013 for Nepal), to date, empirical research on regulatory regimes for the implementation of building codes and factors influencing the success of building code implementation has focused on wealthier countries (e.g. van der Heijden & Meijer, 2007, 2010a, 2010b, 2010c; May, 2003, 2007; May & Wood, 2003). Chmutina and Bosher (2015) explore the factors influencing building code implementation in Barbados tentatively conclude, on the basis of 15 interviews, that include: lack of capacity, human resources and coordination at the national level and a lack of understanding among the general public that the compliance with the code would significantly improve the safety of the dwellings. Bilham (2013) suggests that broader societal factors are at play in his assertion that in developing nations three factors – poverty, corruption and ignorance – conspire to reduce the effective application of seismic resistant codes. Below these and other factors cited in the literature are explored in more depth.

1.1.1. Code complexity

Building codes may be 'too complex' due to multiple iterations and improvements (van der Heijden & Meijer, 2007) and replication from a developed world to a developing world context with lower technical capacities (Spence, 2004). This may compromise implementation and enforcement (Spence, 2004). More sophisticated codes might help make future construction safer but simpler rules are more likely to be adhered (Spence, 2004).

1.1.2. Expertise, capacity and sector competition

Inadequate expertise is often cited as a constraint to the proper enforcement of building regulations (van der Heijden 2010a, van der Heijden & Meijer, 2007). Krimgold (2011, p. 56) notes that 'there is a shortage of trained professionals in the building professions. In many disaster-prone developing countries, there are no adequate instructional programmes for engineers and architects or builders on seismic-, wind- or flood-resistant design'. A particular issue for seismic resilience is the 'invisible' difference between safe and unsafe reinforced concrete construction (Krimgold, 2011). The building regulatory process requires competent professionals to review plans and inspect sites and in most developing countries, state bodies are under-resourced and underfunded and technical resources in terms of trained personnel are limited (for India, see Williams & Mawdsley, 2006 regarding environmental agencies/regulation; Kathuria, 2007 for pollution; and Chandel, Sharma, & Marwaha, 2016 for energy efficiency in buildings). The private sector, in such cases, is more likely to be able to compete in terms of paying good salaries to competent professionals. Typically, local government salaries are not adequate to attract or hold qualified personnel, particularly in rural areas (Bilham, 2009; Krimgold, 2011).

1.1.3. Accountability

Corruption is often cited as a particular problem for safe construction (e.g. Bilham, 2013). Building owners and developers may find it less expensive to bribe a regulatory official than to conform to relevant building standards (Krimgold, 2011). Corruption can lead to illegal permits and unauthorised inspection certificates being issued. A lack of culpability and punishment for law breaking compounds the problem. A particular form of corruption may prevail because of the relationship between the building industry and local politicians. As noted by Krimgold (2011), local government is often dominated by building owners and developers who are not predisposed to limiting the prerogative of investors and builders, which may weaken the capacity for regulatory enforcement. For example in India, Abdulraheem (2009) explains that '[M]any state funded construction activities ... such as road-building are dominated by the construction mafia, which are groupings of corrupt public work officials, materials suppliers, politicians and construction contractors'. Also in India, Weinstein (2008) illustrates, through a detailed case study of Mumbai, how powerful organisations (organised crime gangs) with deep connections to political parties were able to overcome regulatory barriers in the construction industry, where, he suggests limited opportunities exist to develop property through purely legal means. Furthermore, the political will to combat this behaviour is often lacking. As Bilham (2009) notes, the term of most democratically elected officials rarely exceeds 1% of the return time of most plate boundary earthquakes. As a result few politicians are motivated to push the enforcement of earthquake-resistant codes ahead of other pressing issues for which they may be responsible.

1.1.4. Demand

Spence (2004, p. 391) notes that 'the success of any government action depends equally on the development in society of a "safety culture" in which citizens both understand the risks they face and are prepared to participate in the management of them'. A public that is well-informed regarding the level of risk is more likely to support and abide by seismic

codes and be willing to pay higher prices for safer construction. According to Krimgold (2011) the cost of safe construction is estimated to be between 5% and 10% of construction cost and the regulatory process itself can add around 1% of construction costs. However, these relatively small increments are readily balanced by the reduction of future disaster loss of life and property, and the benefit–cost ratio is high (Krimgold, 2011; Spence, 2004).

1.2. Regulatory capitalism: the role of the state in building code enforcement

Krimgold (2011) argues that assurance of safe construction requires a functioning regulatory process. Most writers on disaster mitigation suggest that there is a need for government action in terms of legislation and enforcement (Spence, 2004), but more market-oriented systems have also evolved. This section briefly situates the regulatory practice of building code enforcement within the wider context of the changing ‘role of government’ in urban governance.

In the post-war period, as part of the ideology of the Keynesian welfare state (in developed countries in particular), there had been a vast expansion of state intervention in the regulation of urban development and redevelopment, including building codes and other planning regulations (Sorensen, 2011) referred to as the ‘command and control approach’. While the command and control approach tended to have clear-cut lines of responsibility and thus accountability (May, 2007), its alleged weakness includes the prescriptive rules that impose needless costs; and generate adversarial relations between regulators and limit innovation (Levi-Faur, 2011; May, 2003). As the Keynesian idea of state-run subsidised services came into question in the late 1970s, it was replaced by ‘neoliberalism’ which can be understood as an ideology that glorifies market-based mechanisms rather than state intervention and as such entails minimising regulations (Furlong, 2012; Horowitz, 2015).

However, according to Levi-Faur and Jordana (2005), while conventional wisdom holds that we live in a neoliberal era, the current order is anything but free of regulation. While at the ideological level neoliberalism preaches and promotes deregulation, at the practical level, paradoxically, it has tended to extend regulation (Levi-Faur, 2005; Levi-Faur & Jordana, 2005). Peck and Tickell (2002) frame a similar observation in terms of two distinct phases of neoliberalism: the first phase of ‘roll-back’ and the second phase of ‘roll-out’ neoliberalism. *Roll-back* neoliberalism involved deregulation at higher scales of government and a reduction of service delivery at the local scale (Furlong, 2012). Largely in response to the failures and crises resulting from the policies of deregulation and marketisation of roll-back neoliberalism (Peck & Tickell, 2002, p. 390), *roll-out* neoliberalism focused on the purposeful construction and consolidation of neoliberalised modes of governance and regulatory relations (re-regulation) to consolidate state power and establish the rules for market-led management (Furlong, 2012; Peck & Tickell, 2002; Sangameswaran, 2009).¹ Levi-Faur (2005) suggests that this new global order may well be most aptly characterised as ‘regulatory capitalism’. Under regulatory capitalism, the state retains responsibility for steering, while business increasingly takes over the functions of service provision and technological innovation (Levi-Faur, 2005 citing Ayres & Braithwaite, 1992). Responsibilities of the state are delegated to third-party regulatory agencies, new regulatory instruments emerge and the capacity for self-regulation by individuals and corporations is harnessed (Levi-Faur, 2005), generating an individualisation of responsibility that places

more blame on civil-society actors in the case of failure (Sletto & Nygren, 2016 citing Lemke, 2001, p. 202).

Under the new order of regulatory capitalism, Levi-Faur and Jordana (2005) argue that it is important to make sense of the impacts of this multifaceted transformation of public policies. It has resulted in a diversity of regulatory arrangements and the results are often contradictory and unintended (Freestone, 2011; Levi-Faur, 2005) and involve 'trial-and-error' (Freestone, 2011, p. 177), as neoliberal projects collide with inherited regulatory landscapes (Sorensen, 2011). So, while neoliberalism 'remains an ideological force and shaper of governance frameworks of irresistible momentum', it is important to acknowledge that it gives rise to diverse and hybrid local forms (Horowitz, 2015; Sletto & Nygren, 2016).

The regulation of buildings standards is one clear arena in which there has been an increase in private sector involvement since the 1990s (van der Heijden, 2009) in many developed countries such as Australia and Canada (van der Heijden, 2010a, 2010b, 2010c), Holland (van der Heijden & Meijer, 2007) and Japan (Sorensen, 2011). These contexts indeed reveal diverse and hybrid forms of regulatory arrangements. Attempts have been made to categorise these new regimes. May (2003, 2007), for example, refers to the traditional 'command and control' regime as 'prescriptive regulation' and identifies two alternative forms of regulation as 'system-based regulation' (where processes are the focus of monitoring) and 'performance-based systems' (where results or outcomes are the focus of monitoring and the means of achieving them are not prescribed). He found that the substitution of professional accountability under system- and performance-regimes, for bureaucratic accountability under the command and control approach led to a relaxation of controls. In New Zealand specifically, he found that there was a blurring of responsibility between the public and private sectors and inadequately trained certifiers in the new regime. van der Heijden (2010a) also categorises the spectrum of regulatory reforms, but in terms of the division of responsibilities between private and state institutions. He also suggests that the reforms have led to 'accountability shortfalls'. He compared four regimes in two countries (Canada and Australia) and found that while the private sector could provide a cheaper or faster process, it may become subject to conflicts of interest giving rise to a situation in which the regulators serve commercial interests rather than society at large. He concluded that such privatised or third-party systems required strong regulatory oversight to both monitor and discipline, as well as to consider the content of permits and on-site controls, not just processes (van der Heijden 2010b). Also for Japan, Sorensen (2011) notes that allowing private firms to examine and approve applications for building permits increased the possibility of corruption and increased local conflicts over development. As Bilham and Gaur (2013) keenly point out, where seismic risk is high such failings could be assumed to result in higher death tolls in the event of an earthquake.

In the field of risk, disaster or emergency management then, neoliberal policies have particular implications. As Raikes and McBean (2016) explain, privatising aspects of emergency management that have shown to be related to inefficient government administration enables government to avoid legal responsibility. The privatisation of responsibility and re-regulation in support of market mechanisms has the potential to generate what Prudham (2004; cited by O'Reilly & Dhanju, 2012) refers to as 'normal accidents of neoliberalism', whereby risks are produced systemically in what he calls 'organised' (and

to which could be added 'normalised') 'irresponsibility'. Having considered, at least in theoretical terms, the possibility that shifts towards neoliberal governance may *produce* risk, we turn now to the specific context of India's disaster risk and governance to set the scene for the empirical research that forms the foundation of the paper.

2. Bihar: building codes, governance and seismic risk

Bilham (2009, 2013) notes that the global building boom of the last four decades has resulted in an increase in building stock without consideration to earthquake resistance and, in developing nations, inferior materials and incorrect assembly methods have been adopted. van der Heijden (2016) explains that India faces unprecedented urbanisation while simultaneously aligning with a 'new urban governance' that is characterised by a shift away from government as the sole authority in governing urban issues and an increase in self-organisation and market solutions as substitutes for or complements to the traditional command and control style of regulation. However, this new approach to urban governance is being introduced in a climate of weak and poorly organised government agencies responsible for urban affairs; poor law enforcement and corruption in the construction and property sectors and a culture of non-compliance with building codes (van der Heijden, 2016). Bihar is one of the poorest states in India and for decades was considered a lawless state rife with caste violence and corruption (Mathew & Moore, 2011). In the 1980s Bihar experienced: irregular elections; the suppression of local democracy by the state; inadequate finances; and insufficient staff and self-seeking leadership (Mitra, 2001, citing Khanna, 1994). While the situation has improved considerably since Nitish Kumar came into power in 2005 (Singh & Stern, 2014), it remains an interesting case study with which to explore how the problems of new urban governance in the global North may be amplified when adopted where weak institutional capital exists (cf. van der Heijden, 2016).

Bihar is also an appropriate case study for seismic building code enforcement due to its high seismic risk. The largest of India's earthquakes occur on the northern boundary of the Indian plate and according to Bilham (2004) and Bilham and Ambraseys (2005) with a convergence rate of 1.8 m/century earthquakes at this plate boundary have apparently released less than a third of their geodetic convergence, suggesting that either four great ($M > 8$) earthquakes are missing from the historical record or they will occur in the next few hundred years. Bihar is located in the high seismic zone that falls on the boundary of the tectonic plate joining the Himalayan tectonic plate near the Bihar–Nepal border and has six sub-surface fault lines moving towards the Gangetic plains in four directions (BSDMA, 2016). As such it 'is vulnerable to the worst kind of disaster caused by earthquake of near maximum intensity' (NDMA, 2016). Of the 38 districts of Bihar, 8 districts (in the northernmost part of the state) fall in the highest risk area which is seismic zone V; 24 districts fall in seismic zone IV; and 6 districts in seismic zone III (BSDMA, 2016). In all 15.2% of the total area of Bihar is in Zone V (NDMA, 2016). A map of the seismic zones can be found on the BSDMA's website (www.ndma.gov.in/en/bihar-sdma-office).

Bihar has suffered 10 earthquakes in a span of 247 years ranging from 5.5 to 8.3 on the Richter scale (NDMA, 2016). The worst of these recorded was the 1934 which resulted in heavy fatalities (10,000 according to the BSDMA and 25,000 according to the NDMA websites). Munger was 'completely ruined' while a large part of Patna 'and Motihari, Muzaffarpur and Darbhanga in Bihar were also destroyed along with innumerable villages in

between' (NDMA, 2016). The BSDMA website mentions the 1988 earthquake in eastern Nepal but notes no damage. The 2011 Sikkim earthquake caused extensive damage to buildings and infrastructure in Northeast India and 10 deaths in Bihar (NDMA, 2016). The 2015 Nepal-Gorkha earthquake led to a total of 60 fatalities in Bihar and hundreds of injuries (BSDMA, 2015).²

The Bihar State Disaster Management Authority (BSDMA) has the remit for promoting capacity-building, long-term mitigation and awareness raising and training for disaster risk reduction (e.g. architects, engineers, builders and masons in earthquake-resistant construction). The BSDMA has several esteemed engineers who in 2012 adapted the National Building Code of India (NBCI), which has been mandatory in all areas of highest seismic risk since the Bhuj earthquake in 2001, into user friendly guides called Earthquake Safety Guidelines for Bihar State. In 2013, they were released by the Chief Secretary of Bihar as a Government Circular (i.e. they became legally binding) and they were also included as an annex in the Bihar Building Byelaws (2014). The Urban Development and Housing Department has responsibility for urban development policies, finances and planning and developing the building bye laws (UDHD, 2014) while the municipalities are tasked with public health, public safety and public works and executing the byelaws.

2.1. The Bihar Building Byelaws 2014

The building byelaws detail the requirements and responsibilities for building construction in Bihar. They address not only structural safety but also stipulate parking, fire safety and environmental provisions. There have not been any changes in the building code since 2005, but the 2014 byelaws are more stringent in terms of setbacks and plot-to-building ratios. The focus below is upon structural safety.

Before 2009, municipal commissioners were solely responsible for approving building applications. This was replaced in 2009 by a system in which empanelled architects approved plans/applications³ and there were no requirements for supervision of building projects. In 2014, under the new byelaws empanelled persons are also required to supervise certain building projects and the authorities were brought back into the process to sign off approved plans. The account below, taken from the 'Bihar Building Byelaws' (2014) provides a little more detail.

The building byelaws are 'enforceable' in all municipal areas (including Municipal Corporations, Municipal Councils, Nagar (town) Panchayats and Gram (village) Panchayats falling within Planning Areas). This means that they apply, but are not enforceable in Gram Panchayats that are not covered by a Planning Area (which applies to much of rural Bihar). Approximately 89% of Bihar's total population of about 100 million reside in rural areas (Census, 2011; UNDP, 2011).

Applications for building permits should include a 'sectional drawing' but there is no requirement for any features of earthquake-resistant construction to be identified. However, the application should include a 'certificate from a registered engineer that the building plan and the design complies with earthquake safety requirements as stipulated in the (government circular)' and for buildings above G + 2 (three storey) to a maximum of 10 m, the registered engineer should also sign a form to say that they have supervised the construction to ensure compliance. Buildings above 15 m also require a structural stability certificate signed by the engineer/structural engineer and the owner. It is noted that the

approval of the plan (by the Authority) shall not mean (validation of) structural stability, workmanship or soundness of materials used in the construction and the approval shall not bind or render the Authority liable in any way. Thus, although the municipal bodies sign off the plans, they carry no responsibility for structural safety – this rests with the owner and empanelled persons approving the plans and supervising the construction.

If work is not carried out according to plans, municipal bodies may issue a notice to halt further construction. At this point the authorities have fulfilled their duties and any appeals made become a judicial matter. The implications of these points are returned to in the discussion.

3. Methodology

A total of 36 in-depth semi-structured interviews were conducted ranging from relatively short interviews of 15–20 minutes which were a result of impromptu visits to over an hour and a half (with pre-scheduled interviews held in offices). The aim was to interview all relevant stakeholders. These included Municipal Commissioners/Executive Officers (2); private homeowners and small scale builders (4); large-scale apartment block builders (2); on-site contractors for government buildings (2); administrative/clerks processing building applications (1); empanelled engineers (5); empanelled architects (3); government engineers (9 in total but in two cases as a focus group discussion with 3 government staff); government surveyor (1); cement and rebar vendor (1); civil engineer overseeing the construction of a large apartment block (1); estate agent (1); government engineers (policy-makers) involved in the drafting of the byelaws (2); a representative engineer from the Department of Urban Development (1) and a representative of the Builders Association (1).⁴ Interviews were recorded where interviewees willingly agreed, and transcribed. Anonymity was guaranteed (hence no locations are specified relating to comments made by stakeholders interviewed, only their position is disclosed in the discussion). Interviews were conducted in municipal areas in seismic zones 4 and 5, within three municipal corporations, two municipal councils and one nagar panchayat in central and north Bihar (see Table 1 highlighting the key characteristics of the case study locations). The 36 interviews were conducted in March and April 2016 but the research also draws upon some earlier research on disaster risk reduction.⁵

4. Results and discussion: factors affecting building byelaw implementation

This section first reflects on the significance of factors that emerged in the literature review above, mirroring the same structure. It then considers factors which are less noted in the literature but were found to be of significance on Bihar.

4.1. Code complexity

As noted earlier, the 2012 user-friendly Earthquake Safety Guidelines developed by the BSDMA and based on the NBCI are annexed in the Building Byelaws. They contain diagrams and are written in Hindi. As all government and empanelled engineers were familiar with and had access to the byelaws they would also be aware of these guidelines. When asked what

Table 1. Background information on the case study areas.

Place	Distance and direction from Patna	Seismic zone	Admin. unit	Population 2011	Pop. growth p.a. average (1991–2011)	Engineers employed	Empanelled persons ^a	Number of building applic.	Number of building applic. passed	Description/ notable characteristics
Munger	177 km E	IV	Municipal corporation	213,303	2.2%	2JE, 1AE, T, R, 1S	15	156	156	Least vibrant and developing urban area, few consumer goods, run down colonial buildings, heavy police presence, weak transport links
Jamalpur	180 km E	IV	Municipal Council	105,430	1.1%	–	6	350	350	15 km from Munger with a rail link (not present in Munger)
Dharbanga	131 km NE	V	Municipal Corporation	296,039	1.77%	3JE, 1AE, 1ME	50	131	–	Vibrant growing city, high levels of construction outside the periphery of the MC. Height restricted to 5 m due to the proximity of a military airport – above this permission is needed from the airport authority
Muzzaffarpur	73 km N	IV	Municipal Corporation	354,462	2.3%	2JE, 2AE	101	606	426	Vibrant and growing city with good access to Patna
Danupur	11 km W	IV	Municipal Council	182,429	5.2%	1AE, 1JE, 1S	220	111	29	Extremely high rate of urbanisation as Patna's growth is constrained by the Ganges – this corridor has good road and rail links. Many multistorey apartments for the growing middle class of Bihar – often rented out as investments; over eight storeys
Naubatpur	22 km SW	IV	Nagar Panchayat	25,011		0	Yes R	22	22	Most of the agricultural land has been purchased by speculative builders; still predominantly rural but with some RRC 3 and four storey buildings; relatively poor area with mostly mud and brick single storey dwellings

Notes: T, temporary; R, retired; JE, junior engineer; AE, assistant engineer; ME, municipal engineer; S, surveyor.

^aThese included architects, civil engineers, structural engineers and diploma holder engineers.

could be done to increase earthquake-resistant construction in Bihar, not a single interviewee suggested that the building codes were too complex, needed simplifying or were incongruent with local conditions, suggesting code complexity is not an issue in Bihar.

4.2. Expertise, capacity and sector competition

The numbers of government engineers employed to review building applications is woefully inadequate. It was estimated by staff in some of the corporations and councils that four or five times the number of staff would be needed to engage in the process properly. While most municipal staff suggested that they were able to check sites at the application stage, few of the sites had been revisited. None of the municipal bodies had as yet issued completion certificates.⁶ One empanelled architect suggested that 'Earthquake laws are good enough if they are followed'. When asked why the law is not being enforced, he said 'The municipal bodies are not equipped to do it. They don't have enough people'. Staff shortages in the government departments were consistently explained in terms of the recruitment policies from the Department of Urban Development (favouring the temporary appointment of 'retired' government officials). Competition with the private sector was not cited as a cause of staffing shortages in government. While empanelled engineers undoubtedly have the potential to earn much more than government employees with equivalent qualifications, government jobs were still deemed to be more attractive as they are secure, permanent and come with pensions. However, it was evident that government engineers also concurrently work in the private sector. As government employees cannot be empanelled engineers, the legal system of using empanelled engineers to supervise projects and approve plans does not amplify this practice.

In terms of expertise, more than one government engineer noted they did not have the training or expertise necessary to check the structural integrity of buildings. Architects, while noting they had structural training as part of their course, explained that they would always prefer to work with a structural engineer to design buildings. Many engineers said they had taken a module or undergone some seismic training during their engineering course but in some of the more provincial areas, heavy reliance was placed on retired engineers who admitted during interviews, having little knowledge of earthquake-resistant construction techniques. Engineering qualifications varied considerably, as may be expected, from highly reputable Indian Institutes (e.g. IIT) to more local colleges teaching B.Tech courses. The latter tended to be less well informed in terms of seismic safety in building design. Approximately 25–30% of the engineers interviewed had attended one or more BSDMA training course but one government engineer who had undertaken the BSDMA training could only name 'bands' as a feature of earthquake-resistant design and another suggested that out of say 10 earthquake safe design features that they had learned on the course 'two may be completely followed, eight I'm not sure about'.

4.3. Accountability

Corruption is a difficult topic to research as people obviously would not admit to their own corrupt practices. However, some interviewees pointed to the corrupt practices of others. Corrupt practices vary considerably in terms of their potential impact on safe construction. Much corruption may be harmless (e.g. a clerk recommending an empanelled engineer

over others for a small fee, or builders paying to have their plans prioritised). Another form of corruption cited included bribes to approve plans (one government engineer suggested that up to 20% of applications came with a bribe). Additionally, one government engineer revealed that 20–30% of applications had ‘some political influence behind them’ (either the applicant would be accompanied by an influential person or a phone call would be received). It is likely that byelaws are breached more in terms of plot-to-building ratio and setback requirements rather than structural integrity but this is not possible to know for sure. Another practice of concern was the private purchase of certificates from empanelled engineers for 3000–5000 rupees (roughly 30–50 pounds). Homeowners take this risk upon themselves but with the enormous growth of large apartment blocks, particularly around Patna, perhaps the greatest risk of fraudulent certification is faced by apartment buyers/renters.

Bihar is no exception in terms of the strong connection between the building industry and politicians. Interviewees revealed that local politicians invest in construction projects. Construction companies and large builders also help fund election campaigns. The *Bihar Times* (2014) reports that the ‘builder-politician-bureaucrat nexus is largely responsible for the mushroom growth of high rise buildings’. Nitish Kumar is reported to have received considerable opposition to the 2014 Building Byelaw (as a result of the new requirements, for example, that 25% of space should be allocated to parking and the width of road determining the extent of setback). To his credit he went ahead despite this opposition. However, malpractice is endemic and institutionalised and is difficult to overturn with new regulations. One interviewee cited the case of the previous Patna Municipal Commissioner who made a demolition order for three illegal buildings. He explained that the demolition did not occur (although Jha, 2014 suggests that the buildings were demolished) and that the Commissioner was suspended for his tough stance following pressure from the ruling party (this is corroborated in the literature – Nezami, 2015; Tewary, 2015; Verma, 2015). This suggests that the system is extremely resistant to improving practices and supports Williams and Mawdsley’s (2006) point that in India honest government officers face a huge struggle trying to combat corruption.

4.4. Demand

Mostly the public were very aware of the earthquake risk. Some of the homebuilders interviewed commented that they were using their hard-earned income to build their house, why would they compromise on quality and risk the destruction of their house in an earthquake? Most had sought out reputable engineers and most potential buyers of apartments were reported to ask to see permissions and certifications. At the same time, it was frequently suggested by key informants that the public knew little about earthquake-resistant design and their awareness of earthquake risk was not matched by their understanding of earthquake-resistant construction. One empanelled architect, when asked about the public’s understanding of structural design for earthquake safety, noted that

I think the basic thing that has to be done is to make the public informative about this. Public is very ignorant on this part. Like still after the Nepal earthquake they don’t understand actually. The situation is better than it was before but not as good as it should be.

In the poorer areas visited (Munger and Naubatpur) a few respondents suggested that cost was a constraint to safer construction: 'poor people can't afford safe houses' and 'a safe house is not a priority when you don't have enough food to eat'. However, the poorest of the poor in Bihar tend to live in bamboo houses or makeshift tents. In the towns and cities, those people building their own homes (or are having their own homes built) 'will act according to their budget' and 'make their houses as safe as they can afford' (e.g. whether they follow engineers' plans, how frequently they use an engineer to supervise a site, whether they employ a structural engineer or not). Some of the empanelled engineers suggested that they had to persuade some homebuilders to engage in earthquake safe construction despite the additional cost. We say to clients 'if you pay 5–10% more you will be safe throughout your life'.

4.5. Additional factors constraining building byelaw implementation and earthquake-resistant construction in Bihar

4.5.1. Confusion about expertise

A number of empanelled members mentioned that the public do not have a very good understanding of who they should consult for structural advice. For example, one empanelled architect noted that 'Here there is a concept that every person doing the construction is an engineer.' People tended not to appreciate that architects are not trained in structural engineering. The empanelled architect was most concerned about masons. He commented that 'even the masons – when they have experience they think they know more than engineers'. An important point here is that not all of the empanelled persons who are officially authorised to validate the structural safety of buildings are structural engineers. In Munger, for example, out of the list of 15 empanelled people, 14 were architects and only 1 was an engineer, suggesting that most builders are likely to have their plans signed by someone who is not an expert in structural safety (see [Table 1](#)).

4.5.2. Scrutiny of the structural features of building plans

There is no system of regulatory oversight – in particular for checking the plans for structural integrity. Plans are primarily checked by government staff to ensure that they comply with other aspects of the building byelaws, such as setbacks, the building-to-plot ratio, and so on. One empanelled engineer confirmed: 'The authorities can just check according to the byelaws – size, setbacks and all that – technicality they can't check.' As noted above, there is insufficient information on the plans for them to be checked for structural integrity or earthquake safety features and the government authorities legally are not responsible for this. One empanelled architect suggested that 'what is submitted on the designs is faulty but there is no system to check it. But what is made on site is far more inferior than that'.

4.5.3. Areas outside the municipal limits

While areas outside of the municipal limits are still required to adhere to the building byelaws, permission to build is not required and yet some of these areas are rapidly urbanising and are indistinct from the areas required to follow the byelaws. One of the empanelled engineers interviewed expressed concern: 'Outside the municipal limits government has not provided any clear cut mandate ... rural areas, if you go there, new buildings are coming up but they are not following the building byelaws. There is

no authority or agency there.' Areas around rapidly growing municipalities need some provision for submitting and checking plans. Perhaps extending the limits of the municipalities would be one way to address this.

4.5.4. *Unauthorised construction*

Unauthorised construction could be considered the single biggest problem in Bihar in terms of building byelaw enforcement. For example, the level of unauthorised construction was estimated to be around 70–75% in Danapur,⁷ in Muzzaffarpur it was felt that more than half of the construction taking place in the municipality was unapproved and in Naubatpur the local authorities estimated that at least 90% of construction in the area was unauthorised. Very little action was taken against unauthorised construction. One government engineer, for example, noted: 'Here if we get information about unauthorised construction, we give them notices, so he may submit an application for approval, and then, even we have not done anything much.' Without specifically getting a complaint, illegal construction is ignored and few of the municipal councils had received complaints. Where notices were issued it was explained that a common process was to appeal – first to the local court, then to high court and finally to the supreme court in a process that may take many years, or be pending for many years. Eventually, the courts tended to give approval for the buildings and very few demolition orders were made. This was another arena in which corruption is likely to be playing out. One empanelled architect noted that 'Even if they are issued a notice, the guy who is making a house goes to a higher authority. He bribes them, or he does anything to get the notice cancelled.'

One government engineer astutely noted that the system is failing completely in India at large as no-one went to prison after Bhuj. Although the byelaw allocates responsibility clearly, there is 'no punishment system'. Another interviewee explained that this is 'a popular government' (meaning that the government did not want to become unpopular by enforcing unpopular rules). While Nitish Kumar was willing to pass legislation that was opposed by the building lobby, little change in practice occurs without it being fully enforced.

Apart for building construction taking place without permission, another unauthorised and potentially dangerous practice is the construction of additional storeys to a building. It was explained by an empanelled engineer that when a landowner dies the children would be eligible to have an equal share of the plot, but adhering setback requirements would often mean that the subdivided plots would be too small to build on, so additional storeys are added to a building. In terms of structural safety, the addition of storeys is problematic in terms of the foundation depth. This practice is most prevalent in the older core areas of the cities where land is scarce. One interviewee joked that 'you would have to demolish half of Bihar' if this issue of additional storeys were to be addressed.

5. Discussion and conclusion: building code enforcement, urban governance and the neoliberal agenda

It is virtually impossible to assess the extent of earthquake-resistant construction in Bihar.⁸ This research has aimed to interrogate the process of building code enforcement and identify factors inhibiting earthquake-resistant construction practice. This section refers back to the discussion on regulation and neoliberalism to contextualise the findings and reflect upon the changing processes for governing building safety.

The period prior to 2009, when municipal commissioners were solely responsible for approving building applications, marked a period of state-led regulation in urban governance. Between 2009 and 2014 the pendulum swung in the opposite direction towards privatisation and market-led practice whereby empanelled architects alone validated plans and there were no requirements to supervise projects. This was a period of deregulation and a reduced role for the state in building regulation (equating with Peck and Tickell's roll-back neoliberalism). Homeowners chose their engineer/architect/builder in a free market environment as well as choosing how frequently an engineer checked building works (most likely determined by their budget). It was suggested by one interviewee that this system had been much more vulnerable to corruption (there had been 'malpractice among architects') and builders were known to be buying structural safety certificates. As noted above, although this practice was suspected to continue today, it was generally agreed during key informant interviews that the current legislation, bringing the municipal bodies back into the picture was considerably better as there are 'more layers for checking'. This reflects a period of re-regulation or roll-out neoliberalism as the state 'governs at a distance'. Legally, municipal bodies are absolved of any duties with respect to structural safety – which is passed on to empanelled engineers/architects and home owners, but the government retains the authority to check other aspects of building regulations, such as building/plot ratios, clearances and permissions, facilities, etc., and the state regulates the price that can be charged by empanelled persons for their time (as such 'establishing the rules for market-led management').

Some interviewees felt that the state should play a stronger role, in terms of site checks and construction monitoring but mostly in terms of dealing with unauthorised construction. On the other hand, it was noted by some of the larger builders that the authorities do not have the access to the same level of equipment or technology to check the strength of the materials as the large construction companies, so they could not be so rigorous in quality control. It was also noted that giving government officials a stronger role in each stage of the construction process would merely present more opportunities for taking bribes.

This case study provides an example of a sub-state level form of 'hybrid neoliberalism' that has ensued as a result of 'trial-and-error' as neoliberal sensibilities are being superimposed onto existing forms of governance. In Bihar, the inherited regulatory landscape is characterised by weak governance and corruption from the pre-Nitish Kumar period which is highly resilient to improvement, not least because of its 'builders-politician-bureaucrat nexus'. Within India at large there is a poor record of the bureaucracy being punished for corruption and incompetency, as noted by Williams and Mawdsley (2006).

Spence (2004) describes a privatised/market-oriented system that was proposed for Turkey following the 1999 earthquake whereby private supervision firms take full responsibility for building safety, and where the private sector being covered by indemnity insurance for poor practice. Insurance does not exist in Bihar (Jain, 2015 suggests that current levels of insurance in India are about 1%). The absence of a penal system (noted by Krimgold, 2011 as an essential aspect of a regulatory process for safe construction) essentially provides an 'alternative form of insurance' for empanelled persons (that they will not be penalised for poor practice) but this does not provide the appropriate incentives for earthquake-resistant construction. A market-led system also requires a fully informed consumer base creating the demand for earthquake safety which equally is weak in Bihar (while this

research has shown that earthquake risk awareness is reasonably high, civil society's technical knowledge of good construction practice is weak). Furthermore, a more advanced market economy may create greater responsibility for banks/lenders in terms of mortgage requirements, but in Bihar only a partial process exists (plan approval) without any follow-up (completion certificates).

In Bihar, the system now renders homeowners and empanelled persons legally responsible for construction practice. This creates an 'individualization of responsibility that places more blame on civil-society actors in the case of failure' (Sletto & Nygren, 2016, citing Lemke, 2001, p. 202) rather than necessarily creating a safer system. Plans could include their specific earthquake-resistant features so they can be reviewed by an independent/government structural engineer (including structural safety calculations), in what van der Heijden terms 'regulatory oversight'.

As the following quotation illustrates, the system that prevails in Bihar currently fails to provide adequate conditions for citizen safety and may be creating 'normalised irresponsibility' as homebuilders have their plans signed by people they think are experts and apartment buyers think their properties have been supervised by suitably qualified people:

There are many builders building apartments. They don't have skilled engineers to supervise. Authorities need to check that they are there or not. Who will say? The plans get approved by us but then they are doing as per their will, because if they hire us they will have to pay us. They will cut the steel; they will cut the cement. If M25 is required they will go for M20. Who is going to check? They don't go for cube [materials] testing. It should be mandatory. (empanelled engineer)

This paper has evaluated the factors which have been identified as challenges to the implementation of building codes and earthquake-resistant construction in the context of Bihar. There are three key areas of failure in the system: those areas that lie outside of the regulatory process (rural areas and rapidly urban areas outside municipal limits); illegal/unauthorised construction which is not being addressed by the state; and failings in the regulatory system itself (whereby there is no 'regulatory oversight'). As roll-back and roll-out neoliberalism have collided with an inherited regulatory context of weak (poor) governance and a builder-bureaucrat-politician nexus, it has produced a localised form with neither the strengths of a state-regulated system nor a market-based system. This form of hybrid neoliberalism is producing normalised risks and irresponsibilities through the creation of an illusion of safety. The paper has contributed to the literature by scrutinising the impact of changes in urban governance on the process of building regulation enforcement in a developing world context. It has shown the failings of the hybrid neoliberalism for building code enforcement.

Notes

1. Although the distinction between these phases and forms of neoliberalism is made in the context of the north Atlantic zone, they are evident in other parts of the world as neoliberal global capitalist governance gained hegemony over the third world (Sangameswaran, 2009; Sheppard & Leitner, 2010).
2. Claims made to the BSDMA for building damage as a result of the Nepal earthquake in the District visited were: Patna 20; Munger 11; Muzzafarpur 22 and Darbhanga 109.
3. A registered engineer/architect is a member of a professional body, whereas an empanelled person is licenced under the 'Authority' (municipal body)

4. There was not a noticeable difference between the views in the different sectors (except perhaps the large builders who painted quite a glossy picture). Interviewees varied in the extent to which they were vocal and critical about the current system but government officials and empanelled persons did not present obviously different perspectives.
5. This was conducted in June 2014 in two districts in seismic zone 5 (Madhubani and Sapaul) and in January 2013 with key stakeholders based in Patna (particularly the Department of Urban Development, the Bihar State Disaster Management Authority and the Patna Municipal Corporation).
6. Some government engineers noted that the only reason building applications were made was for mortgage purposes. The banks did not require any further paperwork and so there was little reason to apply for a completion certificate.
7. This was considered to be a substantial underestimate by the second author of the paper who is familiar with the area and felt that more than 1000 buildings were currently under construction (suggesting 90% unauthorised construction is taking place).
8. In terms of current practices, one large builder in Patna guessed that about 80% of builders were following the National Building Code of India in terms of earthquake-resistant practices. Another large builder in Patna gave a similar estimate: that about 10% of buildings could be structurally unsafe in an earthquake, but the smaller private houses which are mostly designed by masons the figure could be more like 70%. Similar estimates were given elsewhere: '5–10% of buildings in Muzaffarpur are not being built earthquake safe. Some older buildings need retrofittings. 80% of buildings here are safe' (empanelled engineer). At the other end of the extreme, one of the government engineers gave a much lower estimate than this: 'I don't think more than 20% of the builders are making earthquake-resistant buildings. I cannot say for sure'.

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