What role should risk-based inspections play in construction?

- Inspections during the construction of buildings are crucial, but assessing the potential risks of a building—such as its environmental impact—is even more important.
- Risk-based inspections, which focus on what to inspect and when, have become more popular in the past decade. They are conducted to ensure a building's structural safety, fire safety, worker safety and public safety.
- In Australia risk management for construction emerged in 1999 but not all aspects of the system were incorporated immediately. The 2005 Building Professionals Act introduced the accreditation and regulation of private inspectors, creating competition between the public and private sectors.
- France strengthened its liability regimes and introduced a risk-based inspections system based on building classifications that already existed in the law but were never implemented.
- Economies seeking to adopt risk-based inspections should consider that successful implementation requires strong legislation for construction, strong enforcement institutions, conflict resolution mechanisms, adequate resources and a liability and insurance regime.

Construction accounts for a large share of GDP in most economies. In 2005, during a period of high growth, it was the source of at least 7% of GDP in Bangladesh, India and the United Arab Emirates. Governments often use construction to stimulate economic activity because of its benefits for people across socioeconomic strata.[1] From New York to Shanghai, economies are competing to build the tallest, biggest, most beautiful buildings.

Ensuring safety in construction is not easy. A single structural failure can cause an entire building to collapse, often leading to injuries and deaths. The collapse of the Kihonge high-rise in Kenya in 2006, a multistory Melcom department store in Ghana in 2012 and the Rana Plaza Building—a multiuse building including a garment factory—in Bangladesh in 2013 show that strong regulation for building construction and equally strong enforcement of the law are essential for worker and public safety. Furthermore, the monetary costs incurred by governments or private sector to replace the buildings or fix the damages can be substantial.

These incidents do not imply that these countries do not officially require inspections. Ghana's Building Inspectorate is legally required to inspect buildings at 4 stages before the official final inspection. Similarly, Bangladesh's City Development Authority is supposed to conduct excavation and foundation inspections before conducting a final inspection. But such inspection requirements do not do enough to guarantee worker and public safety.

Inspections during the construction of buildings are crucial—but assessing potential risks might be even more important. For example, several factors must be taken into account when building a power plant, such as the pollution it is expected to emit, which will affect how thoroughly it needs to be inspected. Accordingly, there has been growing consensus in the construction industry on the need for supervisory bodies to consider the potential risks imposed by a building, rather than applying the same inspections standards to all buildings. Many economies are adopting innovative approaches to construction controls, with the focus shifting from random, systematic and untargeted inspections to more targeted, selective and risk-based inspections.

Both developed and developing economies have implemented risk-based inspections, which take into account the varying risks for different types of buildings. Since 2005, 18 economies have incorporated elements of risk-based inspection systems.[2] For example, Germany adopted a system similar to Australia's that makes private inspectors responsible for ensuring buildings' safety and thus responsible for conducting the required inspections based on the type of building.

Over the past three decades other governments have also worked with the private sector to develop risk-based inspections, resulting in new laws and regulations that make safety a central focus of the construction industry while maintaining efficiency. Risk-based inspections, as opposed to random, untargeted inspections, allow governments to allocate resources where they are most needed without compromising worker and public safety. But their effectiveness depends on several factors, including strong oversight, proper enforcement of legislation, sufficient resources and technical expertise.

Economies require inspectors to inspect buildings to ensure that builders comply

with legal requirements for worker safety (construction inspections), structural integrity (building inspections) and fire safety. There can be too few inspections or too many; neither approach benefits the construction industry or the public interest.

In some economies obtaining a construction permit requires dozens of procedures. It can take more than a year to comply with these, and they can cost several times annual income per capita. Moreover, the process is often little more than a way to extract rents and so is associated with corruption. In contrast, countries such as France, New Zealand and the United Kingdom have created permit procedures that strike a much better balance, ensuring high levels of public safety while not burdening the private sector with excessive red tape. Builders in such economies are creating simpler structures that are generally subject to less requirements and inspections due to their lower risks.

WHAT TYPES OF INSPECTIONS ARE THERE?

Unannounced or unscheduled inspections are known as random inspections. They can occur at any time and any stage of a construction project. There can be as many inspections as the building inspector deems necessary. For a 30-week construction project—the model measured by *Doing Business*—several economies have 1 random inspection, while the Lao People's Democratic Republic and Liberia have 12 and Guinea has 15.[3]

Though random inspections can reveal more instances of noncompliance with building regulations than do phased inspections, they also create more opportunities for graft. And requiring a lot of inspections might not be necessary for smaller buildings that do not pose serious environmental or hazardous risks. Still, having no inspections is a safety risk.

Phased inspections occur during specific phases of construction. They occur regardless of a building's size, location or use. Economies such as Canada and the United Kingdom recommend conducting such inspections in 9 phases, but this number might differ for other economies based on factors such as geographical location.[4] Thus both countries have implemented hybrid systems that include both phased and risk-based inspections. On the other hand, Bhutan inspects all buildings at 7 phases of construction, without additional risk-based inspections. A phased inspection strategy demands that authorities have enough resources to inspect every building at each required phase. An insufficient number of inspectors can lead to missed, hurried or incomplete inspections.

Risk-based inspections have become more popular in the past decade, resolving some of the issues from random and phased inspections. Though many risk-based inspection systems include a minimum number of phased inspections for all buildings, they typically give priority to buildings with high risks—such as environmental ones—and optimize the process. For example, the United Kingdom has defined key stages of inspections for all buildings, plus additional inspections based on the building's risk level (table 5.1). Hence risk-based inspections focus on what to inspect and when. Risk-based inspections are conducted to ensure a building's structural safety, fire safety, worker safety and public safety but in a more efficient manner. Riskier buildings face more inspections. Having fewer inspections for less risky buildings lowers costs without compromising safety, increasing flexibility and enabling inspectors to move away from random and phased inspections.

In addition to defining the inspections that must take place for different types of buildings, risk-based inspections systems have involved a growing shift in risk, responsibility and liability from public bodies to private engineers and inspectors. Private practitioners tend to have the skills, expertise and experience to function without controls or with limited controls.[5] They are also held liable for the safety of buildings and subject to independent oversight.

TABLE 5.1 The United Kingdom requires a range of building inspections

Phased inspections required for all buildings	Inspections based on risk assessment
• Commencement of works • Excavation of foundation • Superstructure, structural frame or components • First fix (pre-plaster) • In-situ testing, such as for drains, sound, air pressure, electrical and fire alarms • Intermediate inspections when required • Pre-occupation issue of a completion certificate	In addition to key stage inspections, high-risk sites must undergo extra inspections. The assessment is adjusted accordingly during construction.

Source: http://www.teignbridge.gov.uk.

HOW ARE RISK-BASED INSPECTIONS IMPLEMENTED?

Efforts to develop risk-based inspections must consider several elements, including:

- *Classifying and assessing buildings.* Building classifications and assessments are important for determining the frequency and scope of inspections. Not all buildings face the same risks. Thus risk evaluation requires a holistic approach, and understanding the risks associated with different types of buildings is essential for successful risk-based inspections. Building classification is just as important when determining the necessary levels of review for the building plans prior to construction, for construction of the building itself and for assessment of the building after construction to ensure its compliance with safety standards.
- *Identifying who will conduct inspections.* Risk-based inspections rely on professional inspectors who are responsible for ensuring that buildings are constructed according to safety standards. If violations occur, inspectors must hold insurance to cover the loss of any structural damages. Accordingly, only experts certified by the state or a legal body should perform inspections.
- *Identifying the responsibilities of those authorities.* Inspectors' mandates must

be clearly defined. In addition, a formal enforcement mechanism must be in place to ensure compliance with regulations and administer penalties for violations, as well as a conflict resolution mechanism in cases of disagreement between inspectors and developers.

Different economies have taken different approaches to risk-based inspections. In the 1990s Austria introduced three classes of construction so not every building requires a building permit, as had been the case:

- *First class.* For small expansions or other small construction works exempt from building permits and planning and zoning reviews.
- *Second class.* For construction works up to 20 square meters that do not require building permits and technical reviews. But these projects are subject to planning reviews, and signatures must be obtained from neighbors to ensure they have no objections to the project.
- *Third class.* These projects require building permits with third-party review of all crucial elements. A subcategory in the third class known as the "light procedure" requires little or no independent review of building design and construction. In Vienna a structural review is the only requirement for this subcategory. Though notifications to the relevant agency are required once certain stages of construction are completed, inspections are the exception rather than the rule under the light procedure.[6]

Economies that have been using risk-based inspections the longest, such as Australia and France, have comprehensive classifications of building categories and risks based on size and use. Their systems have proved quite successful over the years. Thus the case study has focused on the experiences of these two countries.

AUSTRALIA AND FRANCE: TWO EXAMPLES OF GOOD PRACTICE

Australia: privatizing inspections

In Australia risk management for construction emerged in 1999 based on techniques developed by Standards Australia, an independent nonprofit considered the country's leading nongovernmental standard-setting body.[7] Buildings began being inspected by local councils, and risk assessments by those councils determined the number of inspections needed, with standards varying by council. But the 2005 Building Professionals Act allowed for accreditation and regulation of private inspectors.[8] By opening to the private sector, Australia introduced competition to a system that had primarily been the responsibility of local councils. Furthermore, in 2005 Australia amended its Building Code to introduce a risk-based categorization system for buildings that inspectors had to follow (see next section for more details on the categorization).

In addition, in 2010 changes were made to the Building Professionals Board, which had been the sole body authorized to accredit private inspectors, regulate the profession and enforce disciplinary and legal actions against private inspectors. Now principal certifying authorities can accredit professionals from various backgrounds—including engineers, planners and building and land surveyors—to serve as inspectors. In addition, the board became responsible for accrediting, regulating and enforcing actions against certified inspectors.[9]

As a result principal certifying authorities can retain both private and council inspectors, who report back during and after construction. By law, principal certifying authorities must be designated to conduct the mandatory inspections at the critical stages (stipulated in the Environmental Planning and Assessment Act), manage inspections and decide if additional inspections are needed based on a building's risk level. The principal certifying authority must also issue the certificate of construction (a mandatory certificate that must be obtained prior to the commencement of construction works) and certify the safety of the building upon completion of construction. The principal certifying authority is held liable if any issues arise related to the building construction.[10] However, inspectors must obtain an annual professional insurance up to a minimum of AUD 1,000,000 in order to be retained in their position.

France: establishing insurance-driven building control and mandating risk-based inspections

France's 1978 Spinetta Law provided a legal framework for creating technical control agencies and dramatically modifying liabilities in construction works.[11] Until then it was unclear who was responsible for inspecting buildings during construction. The government had limited involvement in the construction industry. Builders and architects were simply required to have 10-year warranty insurance for damages caused by a building collapse. Furthermore, while previous legislation had stipulated various categorizations of buildings, it had never stipulated what types of inspections should be conducted for each category.

Under the Spinetta Law only private, state-licensed technical control agencies can inspect construction sites.[12] Technical controllers cannot be directly involved in construction-related activities. They must be accredited for 5-year terms based on requirements defined by a state decree, including for technical competence and professional conduct.[13] Technical control agencies must verify buildings' strength, safety and compliance with building regulations, including standards for seismic construction and accessibility for the disabled. In addition, all parties involved in construction—such as contractors, builders, and technical control agencies—must obtain insurance covering defects in construction. Compliance with regulations has improved dramatically since the Spinetta Law was implemented.[14]

Building classifications in Australia and France

A building's risk level is based on its classification, use and height. Volume 1 of the 2005 Building Code of Australia considers all buildings low risk regardless of their class if they are less than 4 stories except class 9 (table 5.2).[15] Class 9 buildings are considered high risk due to their uses and regardless of their height. Moreover, some buildings are considered high risk because of their importance as class 3 or 4 buildings. Class 3 buildings house more than 250 guests, motels or guest

TABLE 5.2 What building classifications does Australia use?

Building class	Use	Risk level
1	Standalone residence	n.a.
2, 3, 4	Residential	Low for up to three stories Medium for more than three stories but less than 25 meters High for more than 25 meters
5, 6, 7	Office building for commercial purposes	Low for up to three stories Medium for more than three stories but less than 25 meters High for more than 25 meters
8	Laboratory	Low for up to three stories Medium for more than three stories but less than 25 meters High for more than 25 meters
9	Building of a public nature	High
10	Other domestic utilities	n.a.

Note: Buildings in any class with a risk level of 3 or 4 are considered high-risk buildings. n.a. = not applicable.
Source: 2005 Building Code of Australia.

houses. Class 4 is the residential part of buildings classified under classes 5, 6, 7, 8 or 9. For example, if an office building has one floor with residential apartments, that floor is classified as class 4.

Risk levels and building classes enable principal certifying authorities to develop inspections that protect public safety. For example, 2 buildings might be considered low risk because of their height. But depending on their uses, 1 might require more inspections because of the complexity of its construction. In addition to the risk-based inspections that principal certifying authorities deem necessary, several critical inspections are set by law for each building class, including standalone residences (class 1) and garages and parking lots (class 10). For classes 1 and 10, 7 inspections are required, compared with just 3 for class 7 warehouses.[16]

In France building classifications are mainly based on occupancy and use, though height also plays a role. Only nonresidential buildings that receive visitors—such as malls, office buildings or movie theaters (*établissement recevant du public*, or ERP) and residential buildings up to 50 meters tall are categorized. The 5 categories for these buildings are based on the number of people they can house (table 5.3). For categories 1 to 4 the threshold includes both employees and visitors, while only visitors are considered for category 5 (which has more lenient safety regulations).

TABLE 5.3 What building classifications does France use for ERP?

Classification	Number of people the building houses	Mandatory inspection required?
Category 1	More than 1,500	YES
Category 2	701–1,500	YES
Category 3	301–700	YES
Category 4	300	YES
Category 5[a]	300 or fewer[b]	NO

Note: In addition to ERP, residential buildings up to 50 meters high are also classified according to the 5 categories above.
a. Includes only visitors.
b. Refers to small construction works with or without sleeping quarters.
Source: 2009 Building and Housing Code of France.

Mandatory inspections are required for categories 1 to 4 and are classified into 2 main categories: L and S. Each category has sub-categories that relate to a specific part of the building such as framing, roofing or thermal performance.

- Category L (Legal aspects—excluding seismic risk level): This type of control focuses on the structural strength, the foundation, the framing, the roofing and the mandatory equipment to be used for each step.
- Category S (Safety): This category concerns the safety of the workers on the construction site.

Depending on a building's class and type, the safety control agency conducts either category L or S inspections. High-risk buildings have both types of inspections. A special category, category PS (Paraseismic), is applied to zones prone to seismic activity. In this case, all three categories of inspections are mandatory.

WHAT CHALLENGES HAVE BEEN FACED?

Economies seeking to adopt risk-based inspections can face several challenges. First, economies with weak legal institutions will find it nearly impossible to implement such a complex system. It requires passing legislation that, among other things, clearly stipulates categorization of buildings, identifies qualification and licensing requirements for private practitioners, calls for strong oversight mechanisms and calls for the establishment of agencies that are well-equipped and trained to ensure the safety standards of buildings. Having clear zoning and land regulations is also key. In some economies implementing risk-based inspections has been a challenge because authorities do not know if the building that will be constructed is in a high-risk zone (such as a zone prone to flooding or seismic activity, has natural reserves, is a historical heritage site, or the like).

Second, enforcement of the legal framework is essential to ensuring its successful implementation. The relevant agencies must be independent enough to enforce the law and exercise their right to conduct any needed oversight. For example, they must establish mechanisms whereby clients can submit complaints about their dissatisfaction with an inspector, then investigate the case and take disciplinary actions against the inspector if the case is confirmed.

Corruption can be reduced as well in these cases; without the proper enforcement mechanisms, it becomes easier to engage in paying bribes to the inspectors. Economies with successful risk-based inspections have strong legal institutions and solid enforcement mechanisms.

Consider Brazil, where the construction industry has expressed strong and growing demand for risk-based inspections. But because of a weak legal framework and poor dissemination of a risk assessment methodology, only São Paulo was able to implement risk-based inspections—and the system remains limited. Many practitioners lacked sufficient knowledge and were not well-trained to properly identify the various types of risk involved in the different types of buildings.[17]

Establishing a conflict resolution mechanism can also be challenging. It entails establishing a system where entities adversely affected by permitting authorities' decisions can appeal them. Like the enforcement mechanisms, conflict resolution mechanisms can only be successful if there is technical competence, procedural safeguards and transparent processes. For example, Canada's Building Code Commission members have the appropriate technical expertise and are appointed from both the regulatory and industry sectors. The commission's decisions are binding and hearings on technical issues almost never exceed 6 to 8 weeks.[18]

Another main challenge is securing adequate resources. Developing a sound risk management system to implement risk-based inspections requires investing time and money. Risk-based inspections involve identifying and assessing the risks of every building. Such efforts are time-consuming and require staff with technical expertise. Thus sufficient financial resources have to be allocated to training. And to allocate these resources wisely, agencies must be run by individuals who are technically competent and can act independently.

Still, economies can start with smaller steps that do not require extensive resources. In 2012 the municipality of Ciudad de Guatemala issued a new technical manual on construction permits that introduced a risk-based approach to inspections conducted during construction. Low-risk projects—buildings smaller than 3,000 square meters with 3 floors or fewer—were exempted from inspections during construction but remain subject to a final inspection. Before, random inspections for low-risk projects occurred about once a month.

Finally, economies implementing risk-based inspections must develop liability and insurance systems. Doing so helps hold building inspectors and enforcement agencies accountable and deters them from delaying the issuance of permits. Building inspectors in those economies, such as Australia, France and the United Kingdom, hold insurance regimes that guarantee compensation in case of defects. But in most developing economies implementing such a regime can be a challenge since insurance systems are not readily available.[19]

WHAT BENEFITS HAVE BEEN REALIZED?

Implementing risk-based inspections can present enormous challenges, but the benefits are greater. After France implemented its Spinetta Law, construction-related conflicts and litigation fell, protection improved for owners and contracting authorities, and building safety, quality and compliance with building standards increased. The reforms also lowered repair costs.[20]

Indicators of construction quality—as measured by the percentage of buildings for which insurance claims are filed and related repair costs relative to the cost of the building—have also improved. For instance, repair costs as a percentage of construction costs fell from more than 4% in the 1990s to 3.6% for buildings completed after 2001. That these figures are both low and declining reflects the system's effectiveness.[21]

In 1984 the United Kingdom began modernizing its building regulation. As in Australia, builders can now choose whether to have inspections conducted by licensed private inspectors or local public authorities. This has greatly benefited clients because if they choose a private inspector, they can involve the inspectors at an earlier stage of the process (meaning, before construction even begins). A public inspector is only involved during construction. In 2012, 60 or so private inspectors—including several large corporate inspection firms—handled 30% of building control work. Introducing a private alternative to public building control has made the process more efficient and expedited services.[22] Inspections in the United Kingdom are not free of charge, so by having clients choose private inspectors, local public authorities are losing revenue and thus have an incentive to compete with the private sector.

But much of the success of these economies has also been a result of strong implementation and oversight of the privatized systems. First, a robust system of qualification and licensing requirements exists for private inspectors. Inspectors in these economies have extensive technical expertise, which results in higher compliance with building codes.[23] And enforcement agencies operate with considerable independence and can hold private practitioners accountable for wrongdoing. Without these necessary safeguards, the effectiveness of a privatized system can remain limited.

For example, the former Yugoslav Republic of Macedonia privatized its design and construction reviews process. Many requirements and documentation were streamlined or eliminated. In just one year the time needed to obtain a construction permit was cut by 22 days and the number of procedures required by 10 as measured by *Doing Business*. For inspections, FYR Macedonia introduced two categories of buildings: those of national importance and those of local importance, such as commercial warehouses. The 5 phased inspections previously required by the State Inspectorate for Construction and Urban Planning for buildings of local importance were eliminated, and construction oversight can now be performed by independent professionals hired by investors. But licensing requirements for engineers are not yet robust and oversight of their work remains weak.

CONCLUSION

Introducing risk-based inspections is challenging. Among the many prerequisites are sound legislation, accurate categorization of buildings and effective agencies with sufficient resources, well-trained workers and legal mandates to conduct inspections. Economies that have successfully implemented such systems have seen more efficient inspections of their construction industries without compromising the safety of workers, the public or buildings.

Australia privatized its inspection system, while France strengthened and clarified its liability regime. Technical controllers must be licensed, and technical control agencies are held accountable for building safety. And while Australia categorizes buildings based on their uses, France categorizes its buildings based on their occupancy. Though the two countries took different approaches, both emerged with far more efficient construction inspection systems.

NOTES

This case study was written by Marie Lily Delion and Joyce Ibrahim.

1. World Bank, https://openknowledge.worldbank.org/bitstream/handle/10986/7671/416300PK.txt?sequence=2); http://siteresources.worldbank.org/SOUTHASIAEXT/Resources/Publications/448813-1202436185914/ch4PIIC.pdf.
2. World Bank Group 2013b. The economies are Australia, Austria, Republic of Congo, Czech Republic, Denmark, Finland, Germany, Iceland, Ireland, Kenya, Mali, Mauritius, the Netherlands, New Zealand, Portugal, Slovak Republic, Spain and the United Kingdom.
3. *Doing Business* database.
4. http://www.rbwm.gov.uk/web/bc_nine_stages_of_work.htm.; http://ottawa.ca/en/residents/laws-licenses-and-permits/building-and-renovating/building-inspections
5. World Bank Group 2013b.
6. World Bank Group 2013b.
7. Baccarini 2000.
8. Independent Commission Against Corruption Act, Section 3, 1988.
9. Building Professionals Board, http://www.bpb.nsw.gov.au.
10. Environmental Planning and Assessment Act (EPAA) 1979. These classes are 1 (standalone houses) and 10 (other domestic utilities such as garages).
11. While technical control agencies are primarily responsible for the inspection of buildings, they also play a role at the outset with the design and plans of the building.
12. Building and Housing Code of France (Code de la construction et de l'habitation), Articles L111-23 to L111-26, 2009.
13. Law on Liability and Insurance System (Loi sur l'assurance-construction), Article 10, 1978.
14. World Bank Group 2013b.
15. Building Code of Australia, Volume 1, 2005.
16. Clause 162A of the Environmental Planning and Assessment Act 1979 addresses the critical inspections required for each category.
17. Martins and others 2011.
18. World Bank Group 2013b.
19. World Bank Group 2013b.
20. World Bank Group 2013b.
21. World Bank Group 2013b.
22. World Bank Group 2013b.
23. World Bank Group 2013b.