

Proven Practices in Improving Contractor Safety and Management: An Indian Perspective

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Introduction

Organizations involved in managing construction contractors in Asian countries often face various degrees of challenges to attain and maintain a high level of safety performance. Few contractors have well-established safety programs, whereas a large section, mostly engaged in small or medium scale projects, do not demonstrating a satisfactory level of safety awareness and systems.

With the steep rise in industrialization and economy in Asia, the demand for construction contractors also saw a rapid increase in all construction sectors. Projects ranging from a few thousand dollars to mega ones, with price tags of a couple billion dollars, became reality.

Contractors with inadequate experience, lack of profound safety systems and commitment, and an unqualified workforce, along with other coexisting factors, result in unsafe construction sites, a large number of crippling accidents, and irreparable losses.

The objective of this paper is to identify strategies that customer or project management organizations managing construction projects may adopt for effective contractor management and safe execution.

Contractors willing to work with clients with international repute may find these information useful to understand Global benchmarks for safety in construction project sites.

Challenges

Organizations keen to have their construction sites run with high safety standards, often face a few common challenges. Available contractors in the small and medium segment (typically construction cost up to 10 million USD) projects exhibits identical problems.

Large scale contractors, with established systems and profound experience, do not bid for small and medium sized projects.

Demand for the rest of the players is always high in market. More orders in hand than their existing capacity.

Many existing customers' demand for Safety is not meeting global benchmark. Hence, the necessity of the contractors to improve upon their Safety standards remains low.

Cost & schedule tops the priority chart of many customers. Hence, construction Safety takes a back seat.

Many Asian Countries still lacks stringent statutory safety compliance requirement in construction industry. For example, something similar to OSHA as in the United States.

Non-availability of safety statistics and historic performance data for construction contractors:

- Incident Rates,
- Records of Serious / Fatal Accidents,
- EMR (Experience Modification Rate)
- TRIR (Total Recordable Incident Rate)

Hence, the selection process is largely dependent on 'judgment call'.

Laid down statutory rules for construction, even though they exist, are not seriously followed by contractors in field.

Tough and reprimanding action as a result of safety non-compliance or accidents is not a common phenomenon in construction industry yet. Thus accountability for safety has not reached a decent level within contractors.

Safety awareness and commitment of majority of construction personnel do not measure up to global expectation. This is primarily because of gaps in their structured safety training and positive reinforcement of Safety as part of their education or professional curriculum

Seasonal and frequently changing workforce is yet another challenge in construction sites.

Absence or low level of education, lack of Safety Awareness and a general fatalistic mindset among workers makes situation even more critical.

Outcome

Those Project management companies or clients trying to establish uniform, global safety standards in all their projects, keep facing the challenges listed in the earlier section.

Continuous violations may result in accidents and injuries.

Most client companies generally have a dedicated project management team who are entrusted to manage local contractors deployed in the job sites. Gaps in contractor's safety management systems, at-risk-behaviors and unsafe conditions often lead to stoppage of work and penalty.

Client-contractor relationship deteriorates with these situations coming up repeatedly.

Financial penalties and enforcement works in many instances and the contractor makes up plans to meet safety requirements. However in many cases, such attempts are made with inadequate planning and preparation and just to meet the sudden 'crisis'.

Such approach is generally short living and results in exposing the gaps once again.

With repeated ongoing misalignment between client and contractor are at times considered 'incompatible' and may even ends up in cancelation of contract or reduction in execution scope. Neither, are encouraging situation for a project.

On the other hand, resilience or getting used to the prevailing situation may ends up in unfortunate accidents or damaging incidents.

Contractor Selection

Here, a few effective contractor management approach are listed which may help client organizations and project management companies.

Contractor Identification

Planning and methodical approach are keys to successful contracting. An initial survey is required to identify prospective contractors in the specified range (e.g. Project construction cost).

Too small contractors may be willing, but possibly deficient in many of the expected criteria. Large contractors may not be keen to undertake projects costing below their minimum cost criteria. So pursuing both these groups may not yield good results.

Some of the contractor identification keys may be:

- Meeting 'project value' criteria
- Identical Sector. E.g. Chemical, Metal, Infrastructure etc.
- Work with Safety Conscious clients
- Multinational client exposure
- Worked with a competing / similar business customer
- Specific expertise areas. E.g. Equipment Erection, Tank Construction, heavy fabrication

Pre-bidding Orientation

Prospective and willing contractors are required to undergo a detailed orientation on Safety. Each specific safety requirement shall be stated in details. Anticipated concerns explained with respect to the organization specific expectation.

This orientation should be attended by the contractor's top management representative, essentially Project Manager and Head of Construction.

Practical field examples. E.g. pictures of common unsafe practices vis-à-vis safe examples of similar areas helps immensely.

Available safety guidelines and manuals may be shared.

This effort may help screening and shortlist willing contractors who would be ready to work with the given requirement

Evaluation Process

Contractor evaluation should include the following as a minimum:

- Visit to two ongoing construction site of the contractor
- Interaction with key personnel e.g. Site Construction Manager, Safety Manager, Quality Head etc.
- Verification of key safety programs like:
 - Visitor's Safety orientation
 - Personal Safety program administration
 - Job Hazard Analysis,
 - Work Permitting process,
 - Employees and workers training
 - Safety Inspection program
 - Internal Safety Audits
 - Incident reporting
 - Incident Investigation
 - Knowledge Management
 - Competent Personnel selection for specific hazardous job
 - Emergency planning
 - Security
 - Occupational Health
 - Environment management plan
 - Statutory compliance

Some client organizations follow a rating process in each of the areas listed above to understand adequacy of these safety management systems.

Minimum criteria are specified for selection in the evaluation method.

Existing Customer Feedback

This is yet another proactive measure. It may be useful to interact with a couple of key representatives of an existing client and collect feedback about the prospective contractor's performance in Safety and other areas.

Cost: Safety Doesn't Come Free

It is important for a responsible customer to understand that, only specifying stringent requirement will not yield desired result, 100 %.

It may require helping a prospective contractor to work out cost implication for specific improvement program and assure support.

This initially requires some hand holding. At the same time, it will be essential to check during execution that the support is duly honored and suitably used by the contractors.

Post-Selection—Pre-start up

As part of this program, a number of well-planned steps are required to be followed after selecting a contractor. The effort may not succeed if the selected contractor is sent directly to the field to execute per given requirements without any structured 'coaching'. This may sound unrealistic, but it works. Especially in long term, the client organization actually invests in developing contractors to their needs. These efforts will go a long way to make many future projects safe and successful.

Site Orientation

A selected contractor may be taken to an existing construction site of the client to show them practically how safety requirements are implemented. This help build up confidence and trust.

Selection of Key Personnel

Many clients insist on selecting contractor's key site personnel through an evaluation process. Manager of construction, Safety Manager / Engineer, Lead field engineers etc. This must be a part of the contractual agreement with the contractor.

Training Support

Guide contractor and provide necessary support to have personnel get trained in requisite Safety Requirements as required by the customer.

Site Mobilization Checklist

Safety Requirements for all construction Equipment, materials, formwork / scaffold, temporary structures, electrical set up etc. shall be provided well in advance. Clearly state, basis for rejection and acceptable standards.

Site Start up – Review / Kick-off meeting

Client project team lead shall convene this meeting with key contractor personnel shall review and ensure that all stated requirement for startup have been met. This effort shall also require the participating team members to field verify each of the items listed.

With satisfactory conformance and action plan for identified gaps, the client Project Manager / Construction Manager shall allow construction activities to start.

Execution Phase Verification

Once the process has started well, it is imperative to steer it to success. Some of the measures are mentioned below, which may be adopted aligning with the organizations laid down procedures. These are methods, if adopted, by the client will help monitor contractors' safety performance through the construction phase:

- Construction Site Safety Inspections
- Equipment on-arrival safety inspection
- Internal audits and reviews
- Corporate level safety audits
- Safety Observation program
- Job hazard analysis and Hazardous work Permit reviews
- Safety Meetings
- Incident investigation and Root cause analysis

Accountability and Recognition

As we develop and help a new contractor grow, it calls for attention towards both non-conformances and also their contribution to the project..

Departures from Contract

Unsafe work practices, at-risk-behaviors and unacceptable condition needs to be handled immediately and seriously. The on-site project team is responsible to address all such situations as per the stated rules and bring to the corporate management notice.

Repeated violations may lead to penalties or suspension of work, depending on the severity of the violations.

Improvement

Positive improvement efforts, innovation, and implementation of safety rules deserve appreciation in the best suitable way.

Provide due encouragement to concerned individual and team.

Post-execution Evaluation

Decision to continue with a contractor in future projects depends on their performance. Client organization generally evaluates contractors on a number of parameters. Safety needs to be a high priority one in this list.

In some evaluations, a contractor's incident statistics are considered as the primary criteria for safety. That may not be an ideal approach. Safety Statistics along with results of ongoing evaluation, participation in the safety initiatives, should be weighed together while rating safety performance.

Conclusion

A right approach in contracting will not only help in bonding between right partners (contractor and Client Company) with an overall improved outlook about safety, but also set examples for others to upgrade their safety programs and systems to compete in a globally emerging market.

Let us all look forward to building project safely, reduce loss and develop high level of safety awareness in the construction industry.

An Overview of Worker Safety and Property Protection In South Korea

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Introduction

The remarkable economic evolution of South Korea (Korea) over the past fifty years cannot be overstated. Korea was one of the poorest countries in the world after the devastation suffered from the Korean War and subsequent armistice agreement (technically North Korea and South Korea are still at war). In the 1960's, Korea's Gross National Product (GNP) was comparable to the poorest African nations.¹ Over the past twenty-five years, the dynamic Korean economy (GDP) has grown 11 fold, from \$984 million in 1987 to \$11.1 trillion in 2011.²

Today, Korea is a highly industrialized, leading global fiscal power whose economy ranks 15th (GDP) in the world.³ It is the number one producer of over 60 global products, including: smart phones, TV's, ocean vessels, memory chips, rolled and plate steel, synthetic rubbers and resins, and sea water desalinization technology. Korea is also a member of the G-20 (group of 20 major global economies that account for 80% of gross world product {GWP}), as well as the Organisation for Economic Co-operation and Development (OECD).

One of the factors responsible for Korea's economic growth has been its ability to succeed in many different industries. This includes construction, shipbuilding, industrial and specialty gas manufacturing, electronics and other high tech markets. Being a leader in such a variety of markets presents unique management and operational challenges. These manufacturing processes require highly skilled and experienced employees. Such operations also require specialized machinery and equipment, which is often housed in facilities that are constructed to suit the specific operation. As the country has grown, both in an economic and

industrial sense, the South Korean government has recognized the need to protect companies' most valuable assets: employees, equipment and facilities.

When the Republic of Korea was founded in 1948, the Ministry of Home Affairs developed and enforced the Fire Investigation Ordinance. This ordinance was then replaced on March 11, 1958 with Law No. 485, the Korean Fire Service Law. This law outlined the requirements to prevent, guard against and control fires in order to protect people and property.

In 1973, the national government passed a special law that resulted in the development of the Korea Fire Protection Association (KFPA). The KFPA was instituted as a means to assist in the development of fire regulations, provide research to corporations and promote education to citizens and companies in Korea. In 1987, the government developed the Korea Occupational Safety and Health Agency (KOSHA). KOSHA has developed regulations regarding worker safety and performed research on many different occupational exposures. Both of these entities have continued to progress and mature as viable safety organizations keeping pace with the rapidly growing Korean economy.

Safety and Loss Control professionals understand that one key to successful companies is a strong, results oriented, loss prevention and safety program. Prosperous businesses generally have excellent financial results complemented by low worker accident rates. This truism, we believe, can also be applied to a country. This paper will present a loss control perspective of how Korea's commitment to safety, including worker safety and health and fire protection, was a major dynamic in this country's phenomenal growth and climb to become an industrial world leader.

“Low Cost” Business Model

One common economic strategy for poor or developing nations is to develop a “Low Cost” business model.⁴ Typically, unsophisticated everyday consumer goods are manufactured, including products such as textiles, paper goods, plastic ware, pens and pencils, general disposable items, etc. The “Low Cost” model can be very profitable initially because minimal money is invested into the business infrastructure. Buildings are generally of minimal construction. Production machinery in use would not be “high tech” and could in fact be second hand equipment. Maintenance of the facilities and equipment will most likely be ignored or given low priority in order to save on cost. Another over-riding factor is also that cheap, unskilled labor is plentiful so that workers may be seen as expendable. This abundance of workforce allows production costs to be kept to a minimum.

Certainly, this type of business model seldom provides for an investment in industrial safety. Fire safety in particular takes a back seat to production. Buildings are constructed as cheaply as possible, without automatic protection and detection systems. Means of egress may be inadequate in size and number. There may be no installation of portable extinguishers or standpipes/hose reels. Flammable liquids and other hazardous chemicals are most likely kept in ordinary containers, which are not stored in approved cabinets or cutoff rooms. Electrical systems are inadequate, increasing the possibility of fire. Warehouse storage space is at a premium, leading to large fire loads in all areas.

Additionally, there is little to no investment in employee safety training or life safety. Machine guards may be eliminated as a way of increasing production. Personal protective equipment (PPE) will not be used, as this is an extra expense that may take away from purchase of raw materials and supplies used in production. Employees are not trained in proper housekeeping and storage techniques. There may be no discussion of emergency

response and evacuation from a facility in the event of a fire. More importantly, means of egress may be intentionally obstructed or secured in a misguided attempt to prevent a drop in production rates. Recently, this can be illustrated from the incident that occurred on November 24, 2012, in which 117 Bangladeshi workers died during a garment factory fire because of locked exits, blocked means of egress and inadequate fire protection systems. This tragic event occurred despite the worldwide publicity in 2011 marking the 100th anniversary of the Triangle Shirtwaist Factory fire in New York City, where 146 workers perished (See Exhibit 1).

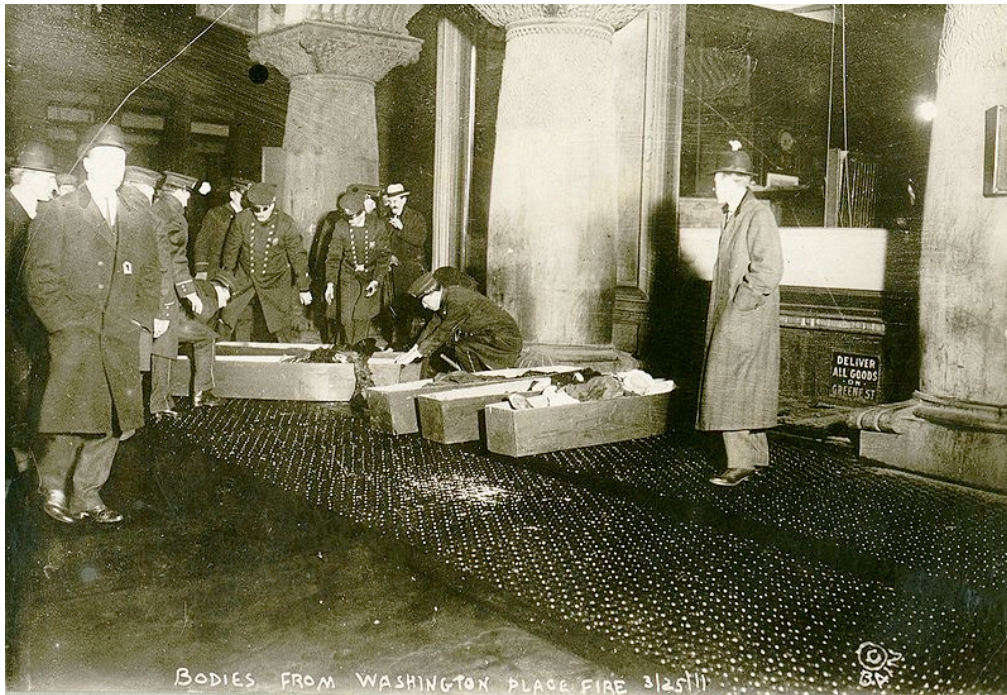


Exhibit 1. This photo shows the aftermath of the Triangle Shirtwaist Co. fire, March 1911. Photo from Library of Congress

These countries and companies have also placed a low priority on occupational health hazards faced by their workers. An April 28, 2012 article by CNN correspondent Hilary Whiteman, “Asia facing ‘Epidemic’ of Worker Deaths, Report Warns,” provides disheartening insight to this issue. Occupational disease data in most of Asia is almost nonexistent because these events are rarely reported. In its latest (2008) report, The International Labor Organization estimated that over 1.1 million people in Asia are dying annually due to occupational diseases. Global labor experts feel this number is very conservative because of gross under reporting of these incidents.⁵

The “Low Cost” business model is not a sustainable long-term strategy for economic growth. Eventually, other emerging countries or startup companies with a cheaper labor pool can easily adopt the same model and compete. This model is also dependent on increasing worker productivity in order to improve competitiveness; however, this model only erodes competitiveness because of poor worker treatment, low wages, poor/hazardous work conditions and low morale. In addition, global corporations are putting pressure on their subcontractors in developing countries to improve working conditions and treatment of workers in light of recent tragic worker deaths. This outside pressure to raise business practices to globally acceptable standards, high worker turnover, and unskilled labor pool will drive up production costs.

Korea Emerges from the War

Korea adopted a similar “Low Cost” model immediately following the Korean War. The country produced and exported food goods, textiles, basic chemicals and cheap appliances. This model worked very well as a means for developing an economy in the wake of the damage from the war. But as other developing countries began to compete with even cheaper labor costs, the Korean government and businesses realized that they must work together to change their business model in order to continue their economic growth.

Korea changed itself from a “Low Cost” business model to an “Industry and Technology Leader” model. Instead of making cheap consumer goods they began building ships, constructing power plants, producing semiconductors and high tech consumer products such as smart phones. Some of the actions that have helped raise Korea to the next tier of advanced industrial nations included:

- develop energy industries (such as coal production and electric power)
- invest in heavy industries and the economic infrastructure
- increase employment/reduce turnover
- promote education and training programs (workers are an investment)
- focus on national science and technology programs
- encourage corporate research and development
- change in management styles
- modernize production processes

Korea’s Commitment to Safety

“To make Korea a truly advanced nation, the culture of our society should value not only the level of economic development but the importance of human lives. Only when these values are given proper attention, will we be able to realize a safe society.”
- Hun Ki Baek, KOSHA President.⁶

Worker/Employee Safety in Korea

Prior to 1987, devastating worker accidents were common and an acceptable business risk. The 1970’s was called “the period of economic growth.” As the economy grew rapidly, so did the number of industrial accidents. In 1978 - 139,242 accidents were reported and the accident frequency rate was 4.48%. In the 1980’s the industrial infrastructure was changing rapidly as Korea was evolving into a more modern economy. However, the workplace conditions and practices did not change as quickly, and in 1984 a record 154,000 accidents occurred. The Korean government knew that to compete globally at the highest levels, industry as a whole needed to change this unacceptable trend. It took action and KOSHA was founded in 1987.

KOSHA’s role in Korea is similar to OSHA’s role in the United States. Each entity sets the worker safety standards for its respective country, conducts safety and occupational health research, works with industry to reduce accidents and has significant enforcement powers. Each country’s government also realizes the importance of these agencies and provides sizeable budgets and support. Many developing countries also have government safety and health agencies but they tend to be ineffective because they are generally under budgeted, have limited enforcement authority and support, and are inadequately staffed. Their

governments do not provide genuine support because they do not want to impede their country's economic growth. The governments will show great support to these agencies usually after tragic accidents and use them to identify scapegoats. KOSHA, on the other hand, has played an important role in helping Korea become an economic success.

KOSHA has grown and matured as a viable worker safety organization and kept pace with the rapidly growing Korean economy. After the establishment of KOSHA, the accident frequency rate dropped dramatically and in 1995 the rate fell below the organization's stated goal of 1%. Since then, the accident frequency rate has been maintained around 0.7% (See Exhibit 2). While KOSHA has been doing an excellent job working with industry to reduce worker accidents, they were not as successful in reducing serious worker injuries and deaths until recently. Korea's accident severity rate hovered between 2.0% and 3.0% from 1987 to 2006. In order to continue to strive for a safer work environment, KOSHA and the Korean government has re-examined its priorities and set a national goal of a 0.5% accident frequency rate by 2014. One of KOSHA's stated goals is as follows:

“We will raise Korea's prestige around the world by reducing the nation's occupational accident rate to the level of advanced countries.”
- Hun Ki Baek, KOSHA President.

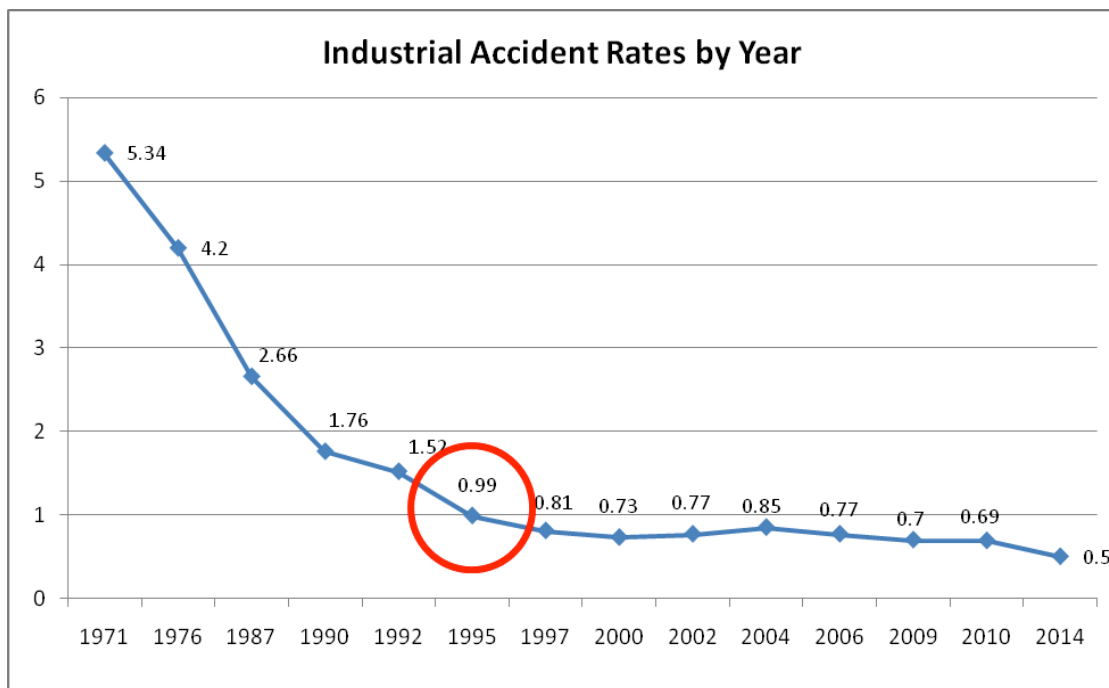


Exhibit 2. This graph represents the KOSHA Accident Frequency Rate.

Beginning in 2006, KOSHA conducted a more detailed accident analysis of their data and discovered that 80% of all worker accidents were incurred by small and medium size businesses. Conversely, the big businesses in Korea, known as chaebols (conglomerates), showed a significant decrease in severe worker accidents. The findings of this accident analysis support the “Low Cost” model premise. The chaebols are successful global businesses. All of the chaebols that were informally interviewed have fully staffed and funded safety departments. They and their subsidiaries are also 100% KOSHA 18001 certified. In addition, they seek to comply with voluntary government compliance programs outside of

Korea. For example, the USA operations of these chaebols are 100% OSHAS 18001 certified. The chart below compares the accident frequency rates of KOSHA certified companies (chaebols) versus non-KOSHA certified companies (small businesses). The small business accident frequency rate is about four (4) times higher than the chaebols (See Exhibit 3).



Exhibit 3. This graph shows a comparison of accident rates for small/medium businesses vs. chaebols.

The small businesses tend to follow the “Low Cost” model where safety is only an afterthought. KOSHA has been focusing its attention on addressing the safety and health issues of small businesses and has been successful. Since 2007 the accident severity rate has dropped below 2.0% and the “No. of Deaths per 10,000 people” has declined from 1.92 to 1.47, according to the most recent 2011 statistics.

Fire Safety in Korea

As Korea’s economy transitioned and grew, new challenges from a fire safety perspective appeared. The government understood the need to protect its economic engine, including both the manufacturing facilities and the employees who worked there. As part of this economic revitalization, Korean companies focused on production of primary products and heavy industries. Exports of mineral products were vital to the economy, as were industries such as shipbuilding, plate and rolled steel and industrial gas manufacturing.

As can be expected, the challenges associated with an expanding economy and new types of manufacturing were numerous. The trials associated with fire and life safety were difficult, and significant. On March 2, 1960 a fire occurred at the Kukje Rubber Plant #2 in Busan, South Korea. This disaster resulted in the death of 68 employees and civilians, with another 44 injured. Following the Kukje fire, the Taeyunkak Hotel fire in Seoul, which occurred on Christmas Day in 1971, was another event that spurred renewed concentration on fire safety. And in 1976, there was a fire at a large electronics manufacturer that resulted in a total loss of the building and contents. As a result of these widely publicized losses, the Korean government refocused its efforts regarding fire safety. As stated previously, the Korea Fire Protection Association was formed by special law in 1973.

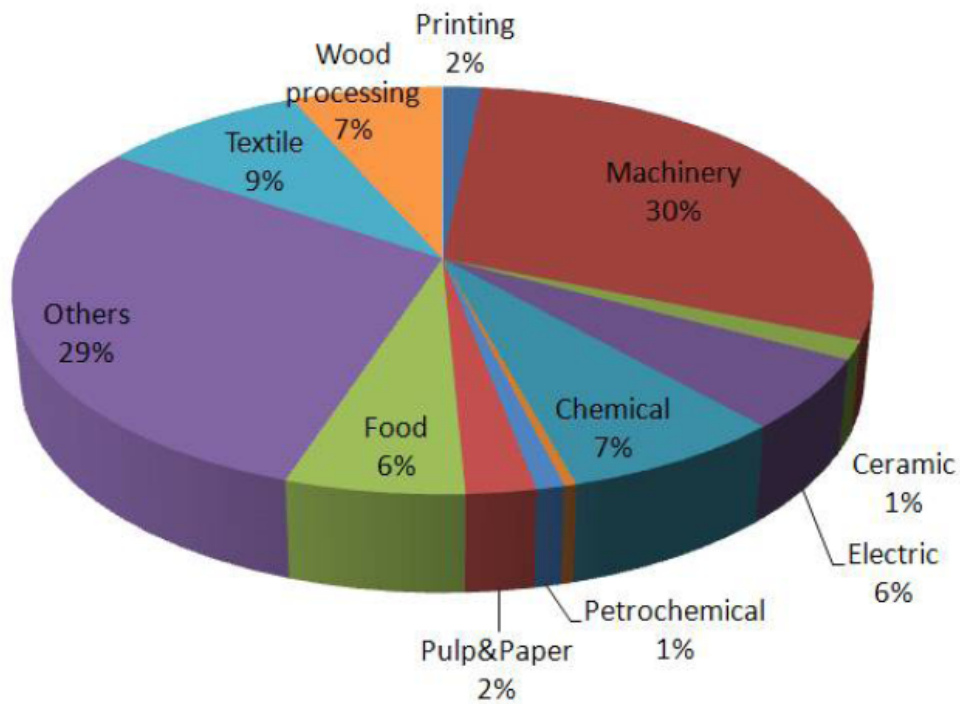
The next step in the evolution of the economy was a movement towards the electronics and semiconductor industries, which continues to this day. Certainly, many of the Korea’s largest chaebols are involved in manufacturing high-end consumer electronics, as well as all

phases of semiconductor production. This push began in earnest in the 1980s, which was a time of great economic prosperity in Korea. Companies were investing billions, sometimes trillions, of Won in new facilities, including high tech semiconductor and clean room operations. These entities began to realize the need for these production operations to be properly protected, including installation of automatic detection and protection systems.

The large chaebols are truly global companies, with operations located throughout the world. As a result, they have developed global guidelines that should be followed by all locations to ensure uniform protection practices at all locations. Most companies are choosing to follow global standards, such as National Fire Protection Association or Factory Mutual, for fire detection and protection. Electronics manufacturers are using NFPA 13, *Standard for Installation of Sprinkler Systems*, as the basis for protection in their facilities. NFPA 72, *National Fire Alarm and Signaling Code*, is used for installation of smoke and fire detection systems. NFPA 318, *Standard for the Protection of Semiconductor Fabrication Facilities*, or Factory Mutual Data Sheet 7-7, *Semiconductor Fabrication Facilities*, acts as the basis for protection of semiconductor facilities in Korea. NFPA 101, *Life Safety Code*, is being used by all entities for means of egress and life safety.

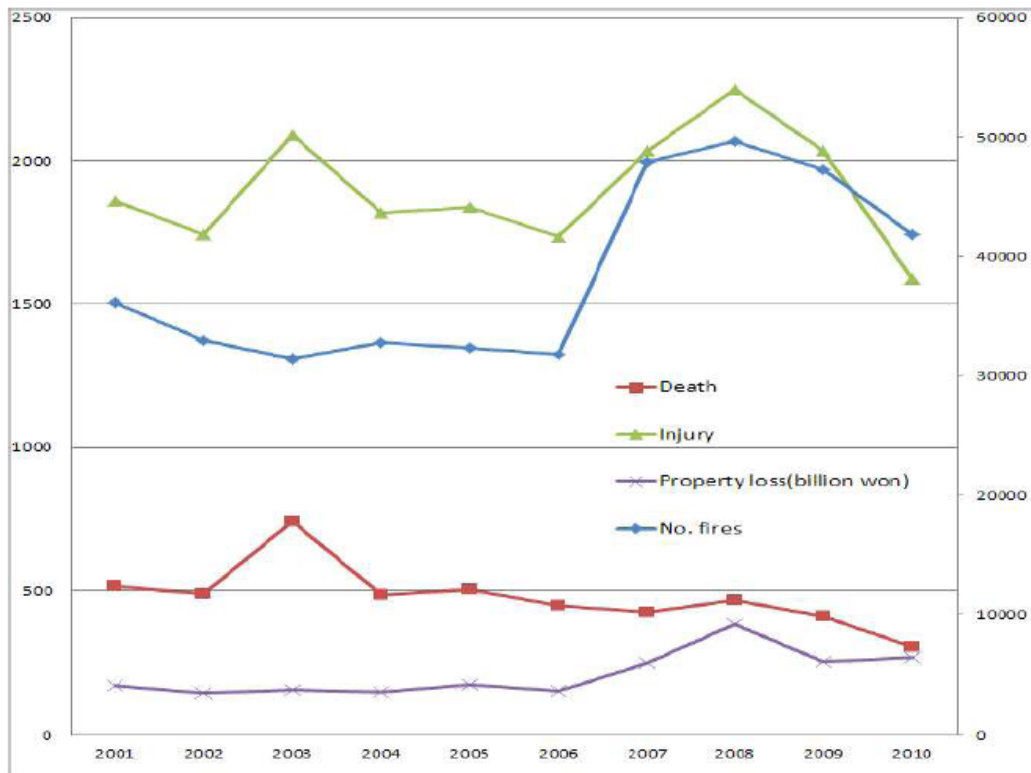
KFPA, with assistance from the National Fire Protection Association, began keeping records regarding fire incidents in Korea starting in 1997. In order to gain a more comprehensive understanding of causes and other relevant information, the method of data collection was revised beginning in 2007. In that year, the Korea National Fire Incident Classification System was brought online. This system allowed for collection of more relevant data and lead to additional classifications for fires being used. This accounts for the upward spike from 2006 to 2007. In addition, this allowed KFPA to provide a breakdown of the industries which had fires occur during this time. As can be seen from the chart, 30% of fires occurred in the machinery industry (See Exhibit 4).⁷

The efforts put forth by all entities, including the Korean government, KFPA and individual corporations show that efforts are having a positive effect. The following charts illustrate decreasing trends since 2007 in number of fires, as well as number of deaths and injuries from the fires (See Exhibit 5). Efforts will continue throughout the coming years to maintain this trend.



Industry	No	Fire	Injury	Property loss (thosand won)	loss/a fire
Total	10,363	54	663	257,413,716	24,839.70
Printing	177	0	14	3,560,506	20,115.90
Machinery	3,068	12	163	34,863,769	11,363.70
Ceramic	154	0	5	1,988,834	12,914.50
Electric	580	2	66	20,133,197	34,712.40
Chemical	756	4	90	39,925,107	52,811.00
Mining	41	0	3	355,782	8,677.60
Petrochemical	95	2	33	6,058,342	63,772.00
Pulp&Paper	235	0	7	8,632,576	36,734.40
Food	603	7	26	14,514,184	24,070.00
Others	3,037	21	212	88,574,929	29,165.30
Textile	930	5	24	25,646,724	27,577.10
Wood processing	687	1	20	13,159,766	19,155.40

Exhibit 4. This graph and chart illustrate a breakdown of fire incidents by industry in Korea, 2007-2010.



Year	No. fires	Death	Injury	Property loss (billion won)
2001	36,169	516	1,860	169.8
2002	32,966	491	1,744	143.4
2003*	31,372	744	2,089	151.6
2004	32,737	484	1,820	146.6
2005	32,340	505	1,837	171.4
2006	31,778	446	1,734	150.8
2007**	47,882	424	2,035	248.4
2008	49,631	468	2,248	383.1
2009	47,318	409	2,035	251.9
2010	41,863	304	1,588	266.8

*2003 includes Daegu subway arson fire, which resulted in 192 deaths

**2007 sees an increase in number of fires based on change in reporting methods. Fires resulting in no property damage are now included in the total count.

Exhibit 5. This graph and chart show the number of fires, deaths, injuries and property loss from fires, 2001-2010.

One of the current challenges being undertaken by the Korean government is the protection of national cultural treasures around the country. This has become an issue of great importance as a result of the arson fire that occurred on February 11, 2008 which destroyed the Namdaemun gate. This structure was considered the Number One cultural artifact in the country. The gate is being rebuilt and is nearing completion and the new structure will be

fitted out with automatic fire detection and sprinkler protection systems. This incident resulted in amendments to fire laws, including enactment of The Culture Properties Protection Law, Article 5, in 2009. This law requires appointed wooden structures to be protected by a water mist system or other types of automatic protection, and yard hydrants. In addition, wooden structures must be equipped with portable extinguishers, an automatic fire department paging system and managed by a fire warden. The government is currently exploring the best course of action to retrofit and protect many of the other national landmarks throughout the country.

Korea is a dynamic country, which is seeing a remarkable construction boom despite the sluggish world economy. The lack of physical space requires the building of larger high rise and ultra high rise buildings. As a result, continued focus is being placed on fire and life safety for future tenants within these buildings. A recent article outlined some of the different options that are currently being implemented, or are being researched for use in these facilities (See Exhibit 6).⁸

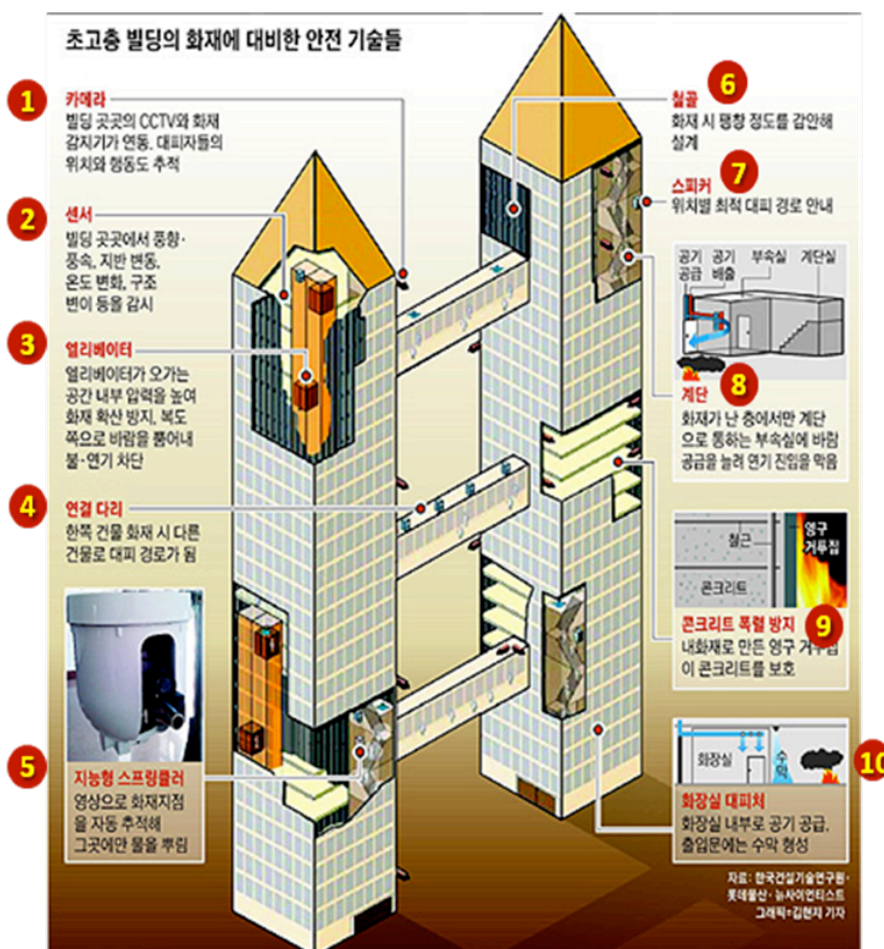


Exhibit 6. This diagram shows multiple tools that are being used or in development in order to improve safety in high rise buildings.

1. CCTV. Cameras are interlocked with smoke detection so that they may more easily locate the area where a fire may be occurring. CCTV can also be used to assist employees/visitors with evacuation.
2. Internal/external sensors. These sensors may be used to monitor wind direction and speed, ground fluctuation, temperature changes, and structural changes.

3. Elevators. Pressurized elevator shafts can reduce spread of flame and smoke into the shaft. Allows for use of elevators as a means of egress, per NFPA 101.
4. Connecting bridges. Employees/visitors can use the bridges for horizontal evacuation to adjacent buildings.
5. Intelligent sprinkler systems. Nozzles equipped with an infrared or CCTV lens, which may allow an operator to view the fire origin and discharge water directly on the fire.
6. Analysis of steel structure. Strength of steel to be used can be analyzed by first comparing to expected fires through fire modeling.
7. Use of speakers. Increasing the number of speakers within the building to guide evacuees to areas of refuge or other safe locations.
8. Stairwells. The vestibule of the enclosed staircase on the fire floor is pressurized to reduce the possibility of smoke entering the stairwell.
9. Concrete casting. During construction, a fire rated cast is applied to reduce the possibility of spalling during a fire.
10. Restrooms. Restrooms may be used as an area of refuge by installing a water curtain in front of the restroom door and supplying fresh air into the room.

Conclusion

Korea has made what can only be considered an unprecedented turnaround from the devastation incurred as a result of The Korean War. It has risen from essentially nothing to be one of the world's strongest economies and a world leader in the production of consumer electronics, semiconductors and a number of other products. Throughout this turnaround, the central government and business leaders realized the need to properly protect the employees and the facilities that led to this successful turnaround. The development of organizations such as KOSHA and KFPA has helped drive the focus on employee safety and facility protection.

Studies have clearly shown that an efficient and integrated management of occupational safety and health is closely related to business excellence and profitability. Companies with strong safety records are generally better managed, more efficient and more competitive within their respective industry. As we all recognize, a healthy workforce leads to less employee turnover, thus reducing production costs and interruption of the production process. The country of Korea, through the cooperative relationship between business and central government, is an excellent example.

Endnotes

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