

Potential Opportunities for Cross Laminated Timber in South Korean Residential Building Market

Dominic Yun

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Abstract

Cross laminated timber (CLT) is one of the fastest growing engineered wood products in Europe. It is considered to be one of the most reliable wood building materials in the current market. It provides great strength while reducing construction time and carbon emission, which can be marketed competitively with steel and concrete as a primary building material. These advantages allow CLT to be considered the most popular timber product in multi-home complex construction as well as mid-rise commercial building constructions in Europe.

Current Korean building permits and regulation system are highly favourable to steel and concrete construction. In order for CLT and other wood products to penetrate into this monopolized construction market, Korean government needs to make changes to promote sustainable building code. However, it is highly unlikely that CLT construction will be able to generate any significant revenue at this point due to lack of marketing and knowledge of the product in South Korea. This report will discuss in detail on what ways CLT products can be introduced initially in South Korea to create similar interest and demand CLT gained in Europe and North America.

The public awareness on environment is growing rapidly in South Korea, and construction companies consistently look for greener marketing strategies to satisfy the interest and concern of the general public. CLT can be the ideal material to break through the heavily favoured construction material market in South Korea. Potential opportunities of CLT products are discussed extensively in this report.

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1.0 Introduction

South Korea has been one of the fastest growing countries in the world economically in recent decades. A historical GDP growth of 6.90 percent in March of 1988 along with current \$1 trillion US dollars of GDP in 2012 indicate the rising economic strength of South Korea (Google, 2012). The living conditions in the urban areas have drastically improved as the economy boosted. As the population began to cluster in the major cities in South Korea, countless buildings including high rise apartments and mid to low rise commercial buildings have been constructed to meet the need for sudden increase in urban population. However, wood products have yet to break through the monopoly market in construction materials in South Korea. The most commonly used wood product in South Korea is pulp. South Korea demands pulp chips the most out of all British Columbian wood products, pulp chips accounts for over 40% of imported wood products in 2005 (Marshall Consulting, 2006, p. 12). Meanwhile, plywood, OSB and particleboards account for the remainder demands, which are used mostly for interior purposes. This clearly shows the limited demand of wood in construction sector in South Korea.

Despite the low demand in recent decades, the trend of building construction with wood has somewhat taken a step forward over the last 5 years in Korea from 2005 to 2010, jumping from 2,326 wood building constructions to 10,922 permits given, slightly over 5% of the entire building permits given in 2010 (Lee, 2011). This was largely influenced by the revised 4th Comprehensive Territorial Plan which encourages “decentralization” of major cities and the development of smaller cities in the hopes of spreading out the population from concentrated regions (Graham, 2006). However, wood is still considered as the fourth option in building material after steel, concrete and brick. There are multiple reasons for wood’s struggle to

establish a strong market: cost, perception and regulations. Each obstacle will be discussed further in detail later in this report. Nevertheless, it is clear that without solving these issues, demand for wood as structural material will remain a minor commodity in South Korean market.

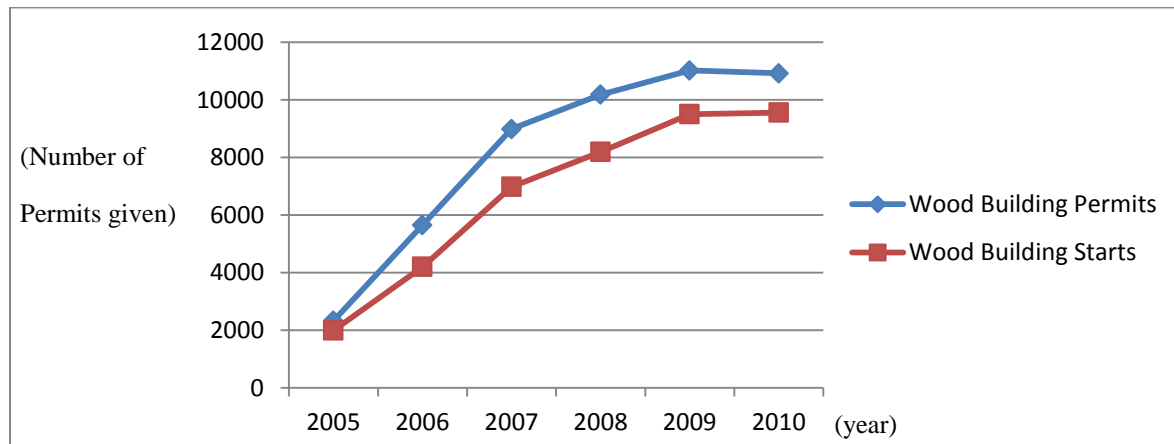


Figure 1- Wood Building Permits Given in Korea from 2005-2010 (Source: Lee, 2011)

As mentioned, the revised 4th Comprehensive Territorial Plan provides opportunities for any construction material in the market by encouraging the expansion of minor cities. Recent growth of interest in environmental issues in South Korea will be beneficial for wood products (Marshall Consulting, 2006, p. 10). Such demand from the general public can force the industry to use more wood products in their projects in coming future.

CLT can be an ideal product for South Korean market because of its flexibility in design and physical properties of strength and stiffness, which outperforms the current 2x4 stick frame timber construction method mostly used in South Korean wood buildings. CLT is a multi-layered panel made out of lumber. Each layer is glued “cross-wise to the adjacent layers for increased rigidity and stability” (GagnonSylvain, 2011). It is suitable for both floor diaphragms and walls that can be a great substitute for steel and concrete. Moreover, it is prefabricated to provide

significantly reduced construction time compared to masonry and ferroconcrete construction method. Recent increased awareness on environment is a positive factor for CLT since it reduces waste and carbon emission compared to steel and concrete construction used mainly in South Korea today. In order to break the conservative construction method barrier, CLT products must have an effective marketing strategy. Such marketing strategies, solutions and opportunities are analyzed extensively in this report.

2.0 Trend in Korean residential construction

South Korea is known for its expertise in construction. The country is “the seventh biggest contractor in the world;” it is responsible for 15.4% of construction projects in the Middle East (ConstructionWeekOnline, 2010). It produces the majority of its building materials domestically including most of steel, reinforced concrete and cement bricks. On the demographic side, South Korea has almost 50 million citizens with an annual 0.26% population growth rate. As a result of the growing population, more housing and public facilities are needed. Approximately 380,000 residential buildings underwent construction in 2009 and it is projected to increase even more each year (MLTM, 2009).

2.1 Market share of wood in construction material

Steel and concrete have been dominating the South Korean building construction material market in the past several decades. These two highly favourable materials have accounted for 85% of the market share in primary structural material (Graham *et al.*, 2004, p. 40). There are several key reasons for this monopoly market to exist. First of all, South Korea’s forest land mass only accounts for 6.44 million hectares compared to 55 million hectares in British Columbia, Canada (Graham *et al.*, 2004, p. 44). British Columbia uses this abundant source to generate top revenue amongst all other industrial sectors in the province (The Working Roundtable on Forestry, 2009). The lack of natural resource of wood in South Korea has led to minimum forestry related investment from the government in the past (Graham, 2006). Instead, South Korean government made the decision to invest in steel and concrete which now became one of the largest industries in South Korea (KOSA, 2010). From Figure 2, it is clear that steel and concrete building permits outnumber wood constructions by an unmatched margin.

Reinforced concrete and heavy steel account for more than 85% of the building permits, in contrast to a mere 3% of wood share in the market. Well-developed steel and concrete domestic industry has a clear edge against wood as of today.

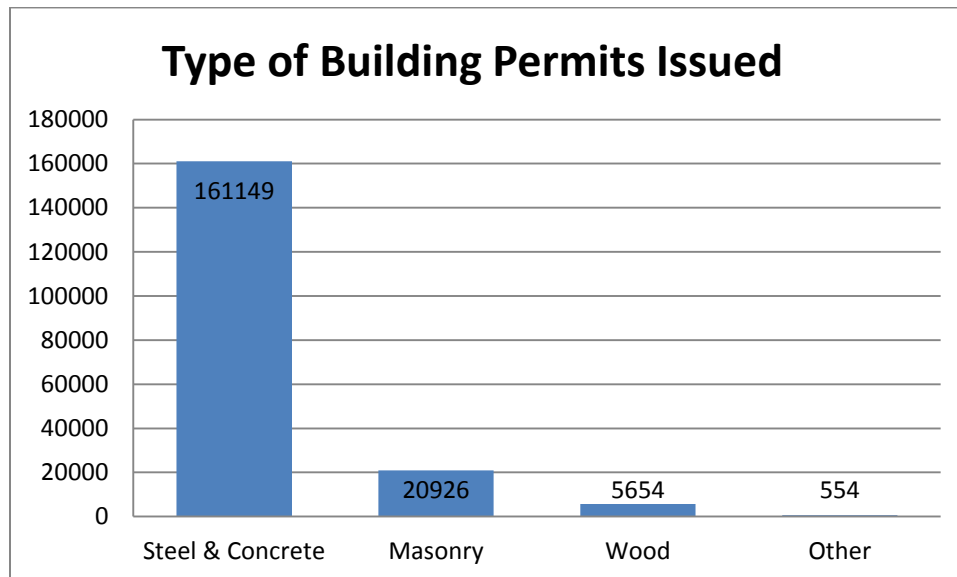


Figure 2- Type of Building Permits Issued by Material Used in Korea, 2006 (Source: KOSIS, 2008)

2.2 Different uses of wood in construction market

This section discusses where wood is used as a primary structural material in South Korean construction market. From the data collected, it is evident that residential sector has the most demand for wood as primary structural material, accounting for over half the market share followed by commercial buildings at 29%. However, most of wood constructions in residential sector are made out of logs. Cabins and lodges are the most common residential buildings constructed out of wood in South Korea. Moreover, residential construction with wood accounts for only 0.33% of the total construction in the capital city, Seoul (Graham *et al.*, 2004, p. 40).

This suggests that the demand for wood in residential construction is mostly from the rural regions of the country.

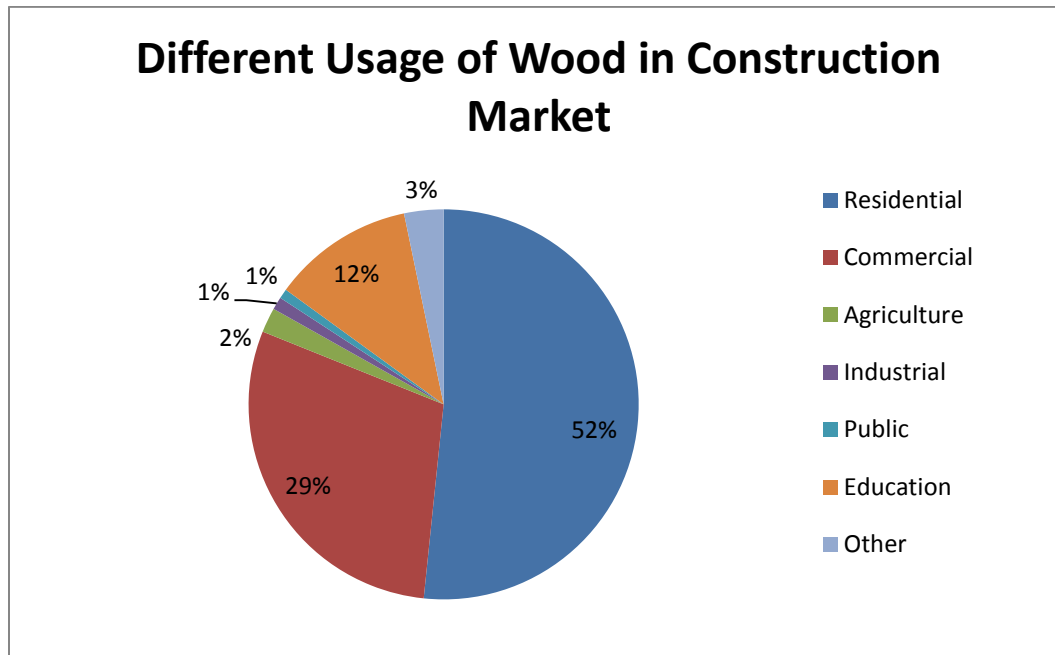


Figure 3- Percentage of Wood Material Used in Building Types (Source: Graham *et al.*, 2004)

All in all, in order for wood products to generate market value and attract public attention, marketers must focus on construction in major cities. Urban construction accounts for 85% of entire residential construction in 2009 compared to 15% for rural areas; 320,000 residential buildings underwent construction in the major provinces in South Korea in 2009 compared to 60,000 residential constructions from the rest of the regions in the country (MLTM, 2009). Therefore wood products need to target the bigger market to achieve better results. Further discussion on how wood products such as CLT can penetrate into urban construction business will be made in a later chapter of this report.

3.0 Obstacles for Cross-Laminated Timber to penetrate into construction market

South Korean construction industry has adapted to the building method of ferroconcrete and masonry for decades. Ever since the economy started to pick up in the 1940's with the introduction of steel and concrete construction, government support has driven the steel and concrete industry to take over the construction sector (KOSA, 2010). Despite the recent awareness of global warming and environmental issues, steel and concrete construction has kept its stand atop of every competition. This chapter discusses the reason why wood is still struggling to take a significant remark in South Korean construction market in detail.

3.1 Perception of wood as a structural material

Regulation issues aside, both the general and professional perception of using wood as a main building material are negative. This is the very opposite perception from that of the North American view at wooden buildings. A research paper conducted by Forest Innovation Investment (FII) has surveyed “the major specifiers and decision makers on [building] material” who consisted of architects, developers, structural engineers and construction companies. The results collected from this research paper indicate what exactly these decision makers think and worry about wood as a primary building material (FII, 2008, p. 9).

3.1.1 Experience with wood construction

Most of the wood building stereotypes such as wood's durability and susceptibility to fire are caused by the lack of experience in wood constructions. From the 2008 FII surveys, out of the 120 respondents, of “decision makers” in building construction materials in South Korea, 2/3 of them had “no experience of using wood in structural applications” (FII, 2008, p. 9).

Furthermore, these respondents were “unable to identify the species, size or country of origin for the type of wood they had specified” (FII, 2008, p. 9). These statistics explain one of the reasons for the current unsuccessful market for wood as construction material in South Korea. However, on the bright note, almost 2/3 of the respondents had experience with hybrid building construction. Hybrid building, which is referred in this survey, is a building constructed out of wood in conjunction with steel and concrete. Unfortunately, the hybrid construction method is still a minority in building method. Figure 3 indicates only 20% of the respondents have worked with “90% and over” in hybrid construction; whereas almost half of the respondents had “20% and less” experience in hybrid construction.

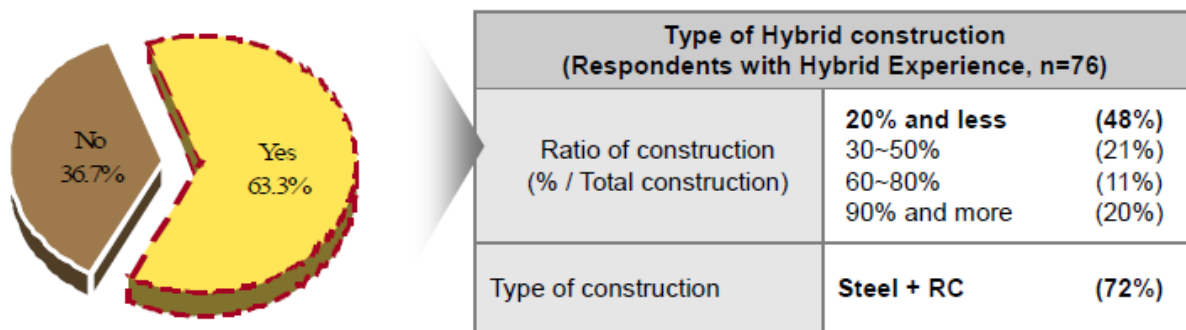


Figure 4- Experience with Hybrid Construction (FII, 2008)

These overall results indicate the much needed effort to promote the use of wood as a building material in South Korea, so the “decision makers” would choose wood over other materials. It is safe to conclude that most South Korean decision makers have zero to no experience in wood construction, and improvements must be made to properly market wood as building material in South Korea.

3.1.2 Concerns about Using Wood as a Structural Material

Wood is a great fuel source for burning. Ever since mankind existed, wood had its numerous functions as tools and structural element, but burning for fuel and heat was its major purpose (Oosthoek, 2005). In recent decades, the introduction of engineered wood products has provided mechanical properties such as strength and stiffness that solid sawn wood products never achieved before. However, the general perception of wood as a building material is still very conservative and poorly developed in South Korea. This assumption is supported by the growing demand for wood pellets as a source of energy in the past years. As Figure 4 reveals, wood's susceptibility to fire is by far the most concerning factor when using wood as a primary structural material for South Korean "decision makers." Poor durability comes second by getting approximately 16% of the first votes (FII, 2008, p. 17).

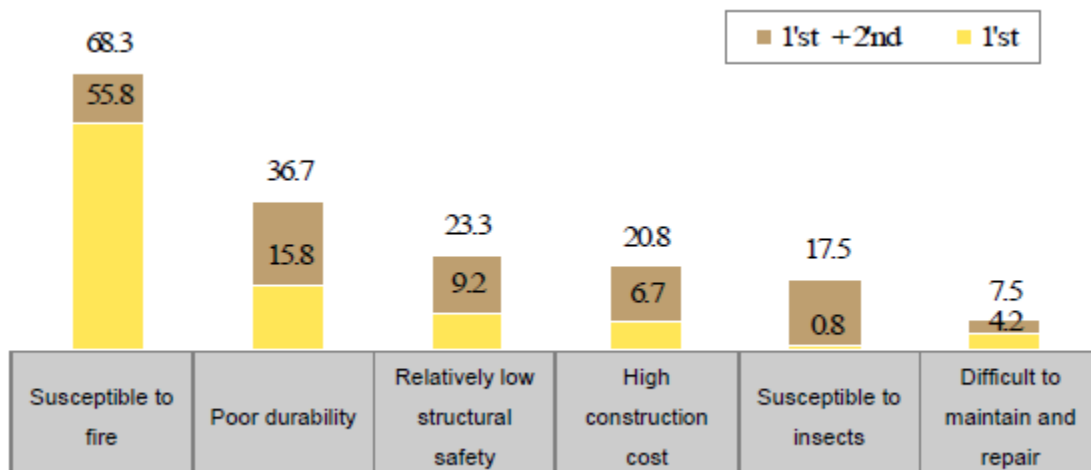


Figure 5- Factors that Concern 'Decision Makers' in Building Material in South Korea (Source: FII, 2008)

The two most concerning areas of using wood as structural material are complete misunderstanding. Construction industry's lack of experience in wood construction as well as

proper research and training contribute to this surprising survey result. The fire resistance property of wood in general is nowhere near as critical as these respondents might think. North American fire-loss statistics “reveal that death and injury in building fires are usually caused by smoke inhalation, and occur long before structural failure” (Forintek Canada, 2002, p. 1). Moreover, most wooden structures do not collapse after they are burnt. It retains the structural shapes, and stands relatively strong because “a layer of char is created, which helps to maintain the strength and structural integrity of the wood inside, reducing the potential for complete collapse” (Girioux, 2012). Engineered wood product like CLT performs even better against fire than solid timber. This fact is directly opposite to the general perception of South Korean “decision makers,” hence this property of CLT must be emphasized when entering into the Korean market. Furthermore, CLT floors combined with gypsum boards significantly increase fire protection because gypsum boards shield structural wood members from the effect of heat. When gypsum board is exposed to fire, it absorbs “large amounts of heat as its water content are released” to prevent full heat exposure (Forintek Canada, 2002). Unfortunately this knowledge is not passed onto South Korean contractors as effectively and thoroughly yet. The conclusion is that the FII survey results suggest clearly that without proper marketing and transfer of information, the perception on wood buildings of the South Korean “decision makers” and the general public will never change.

3.2 Cost competitiveness

South Korean steel and iron industry is one of the nation’s prosperous sectors. It plays an important role in the economy by “providing materials to numerous industries in need for steel such as automobile, shipbuilding and construction” (KOSA, 2010). The revenue generated from steel industry has increased from 10 trillion KOR won in 2000 to 20 trillion in 2009; this is

equivalent to 17.66 billion CAD dollars (KOSA, 2010). Continuous demand for steel and iron domestically and internationally have drawn more investment than any other sectors in South Korea with the investment value exceeding 7.5 billion CAD dollars in 2009 (KOSA, 2010). This in turn allowed manufacturers to sell steel products at a reasonable price to contractors which stimulated further usage of steel in construction. Current market price of concrete in South Korean market is 55,000 KOR won per cubic meters on average which is about \$48.50 CAD (KPI, 2012). Whereas, regular steel is dealt at 850,000 KOR won per metric tonne on average which is about \$750.00 CAD (KPI, 2012). If this price is compared to steel prices in North America which is at \$870.00 CAD per metric tonne on average, North American steel is 14% more expensive than South Korean steel (Meps, 2012). Concrete on the other hand shows even bigger margin in price at \$75.00 CAD per cubic meters in North America, which is 35% more expensive than South Korean concrete price (ConcreteNetwork, 2012). As the price differences indicate, South Korean market for steel and concrete is well developed and financially affordable for all domestic contractors. Meanwhile, CLT is dealt at €400 Euros per cubic meter on average in European market currently which is equivalent to \$520.00 CAD and 590,000 KOR won (Kaufmann, 2012). The expected price is likely to be much higher than 590,000 won when taxes and tariffs are applied.

For cost evaluation purposes, a model used by Athena Impact Estimator, which compares the usage of structural material in a mid-rise residential building was analyzed. According to this software, 910 m³ of CLT is used for an alternative source of material to 950 m³ of concrete and 120 tonnes of steel (Berry *et al.*, 2011). A cost analysis excludes fasteners and added construction materials in order to compare cost of structural raw material specifically. The total cost in CLT raw material summed up to \$473,200 CAD, and steel-concrete raw material cost

calculated up to \$136,075 CAD. Steel-concrete construction is over 70% cheaper in structural raw material cost compared to CLT construction. Although other factors are not considered such as labour cost and machining cost, 70% cost differential is something that can definitely hold back most of contractors to choose CLT products in construction projects. In result, the cost analysis suggests that a “100%- CLT structural material” construction to be highly unfeasible in South Korean market in current price differentials.

		Concrete & Steel	
	CLT	Concrete	Steel
Material Usage	910 m3	950 m3	120 tonnes
Price	\$520.00 / m3	\$48.50 / m3	\$750.00 / tonne
Overall Material Cost	\$473,200.00	\$46,075.00	\$90,000.00
	\$473,200.00	\$136,075.00	

Table 1 – Material Cost Comparison between CLT and Steel-Concrete Construction in South Korea

3.3 Regulations and building codes

The Ministry of Construction and Transportation (MOCT) and the Korean Building Law (KBL) play key roles in determining construction regulations in South Korea. As stated in previous chapters, regulations are highly favourable to steel and concrete construction. Light Wood Frame buildings are restricted to 4 stories while sound insulation requirement is also unfavourable to wood construction at 58 dB (National Research Council Canada, 2008). According to MOCT and KBL guidelines, buildings totaling more than 13 meters in overall height with a floor area exceeding 3,000 m² are not permitted to be built in wood frame (FII, 2008). Hence in practice, light wood frame multi-family building constructions are not feasible given “the relevant fire resistance rules and regulations, and the KBL requirements with respect to number of households, storeys and fire resistance between floors” (FII, 2008). Furthermore,

high-rise apartments account for almost 90% of the residential construction in South Korea, where low-rise multi-family housings take up only 5% (FII, 2008). With the current regulation, structural wood products can only enter into low-rise building, which is at 5% of the entire residential construction market. This would not only reduce foreign investment on wood construction, but also less interest from domestic contractors to use more wood.

4.0 Possible solutions

In this section, solutions to the obstacles mentioned in the previous chapter are discussed in ways that make most sense realistically. Furthermore, such solutions may be infeasible at the moment, but are likely to occur in near future. It is hopeful that with some of these issues resolved, CLT will find its way to penetrate into the market more effectively.

4.1 Solution to perception

As discussed in the previous chapter, the wrong perception on wood is largely influenced by the lack of experience with wood in construction. Therefore, providing more opportunities and incentives for contractors and architects to build with wood are critical. As wood building construction increases domestically, more experience and training will be available for people who are interested in greener and aesthetical construction. Moreover, conventions and seminars conducted by experts in CLT construction are much needed as well. This would directly affect the perception of “decision makers” on wood as a structural material by providing the correct information on their wrong information such as fire resistance and durability of CLT.

4.2 Solution to cost margin

In order to solve the large cost margin between steel and CLT, government assistance is the key factor. Wood products including CLT require the funding and support that steel and concrete industry received when they were first introduced in mass quantity in the early 1900's. President Park Chung-Hee at the time provided unconditional support financially and regulation-wise to boost the demand for steel and concrete (Khaled, 2007). This bold movement eventually made South Korea one of the most advanced steel producers in the world and self-sufficient in

construction materials (Khaled, 2007). If the same support is given to wood products, South Korean forestry sector could well develop into a self-sufficient engineered wood product manufacturer in the long run.

Moreover, contractors and companies must realize that significant labour cost can be saved by shifting over to CLT construction. CLT is an extremely efficient and fast building system since it requires only a small number of workers and inexpensive machinery (FPInnovations, 2011).

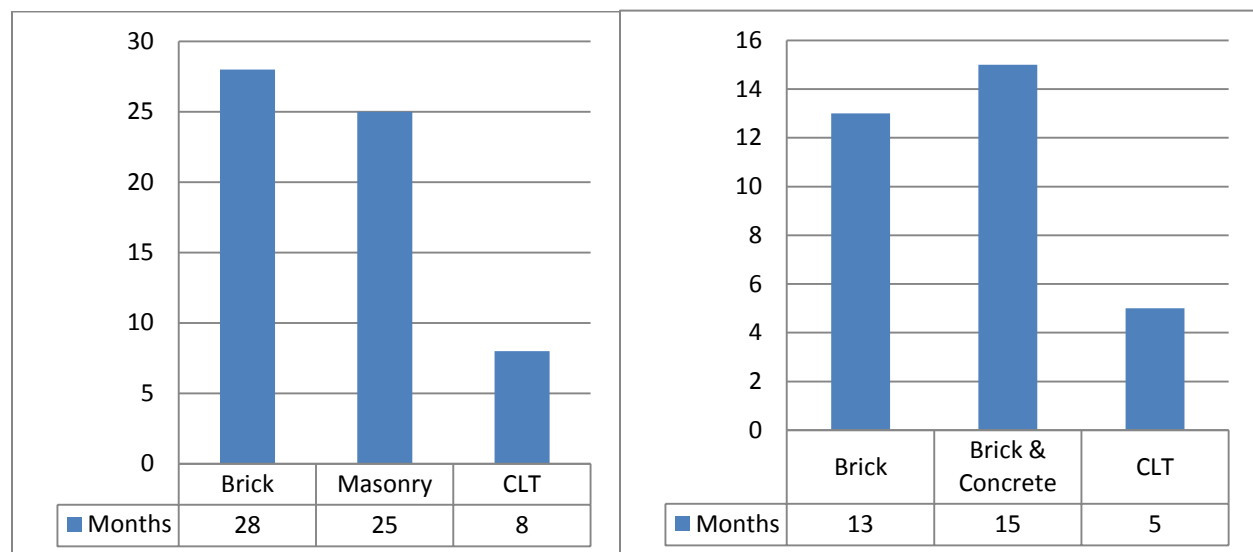


Figure 6- Construction Time Required for Mid-Rise Residential Building and 3-Storey Educational Building Respectively (Source: FPInnovations, 2011)

CLT construction saves 30% in construction time on average compared to other popular construction methods used today. This fact could be appealing to almost every contractor, and as labour cost increases over time, reducing construction time could be one of the most important factors that construction companies take in to consideration. CLT's advantage in construction

time can well be the decisive factor when companies select structural materials in near future as inflation and increase in labour cost are inevitable.

4.3 Solution to regulation

Regulation changes are one of the least likely events to occur among number of issues discussed in this report. The current regulation has been revised throughout the years to adequately administer the current building construction. Such things will not change in a short period of time. Nevertheless, CLT marketers must be patient with regulation changes, and instead be optimistic about the current environmental awareness rising in South Korea. The recently revised 4th Comprehensive Territorial Plan (4CTP), which runs from 2000 through 2020, lays out a positive outlook for wood products. The main purpose of the 4CTP is to promote decentralization and greener environment. The four cornerstones of the 4CTP are as follows:

1. Balanced regional development to try to stop the flow of people into the major cities
2. Green technologies and living in harmony with nature
3. Opening up to the global village
4. Creating a unified region for a unified nation

The second cornerstone definitely is in favour of wood products as well as the first cornerstone which will encourage more construction to start in minor cities. Furthermore, MOCT is “also providing significant tax incentives to owners of older apartments and buildings in central cities to renovate” to greener standards of 4CTP (Graham *et al.*, 2004). Although this transition period will take a great amount of time to show progress, such efforts from the government is an encouraging news for wood products in South Korea.

5.0 Opportunities for CLT products

With the environmental guidelines set according to the 4CTP, South Korean government must take further actions to promote greener building codes. As Figure 7 indicates, CLT construction saves energy and reduces carbon emission significantly compared to reinforced concrete construction.

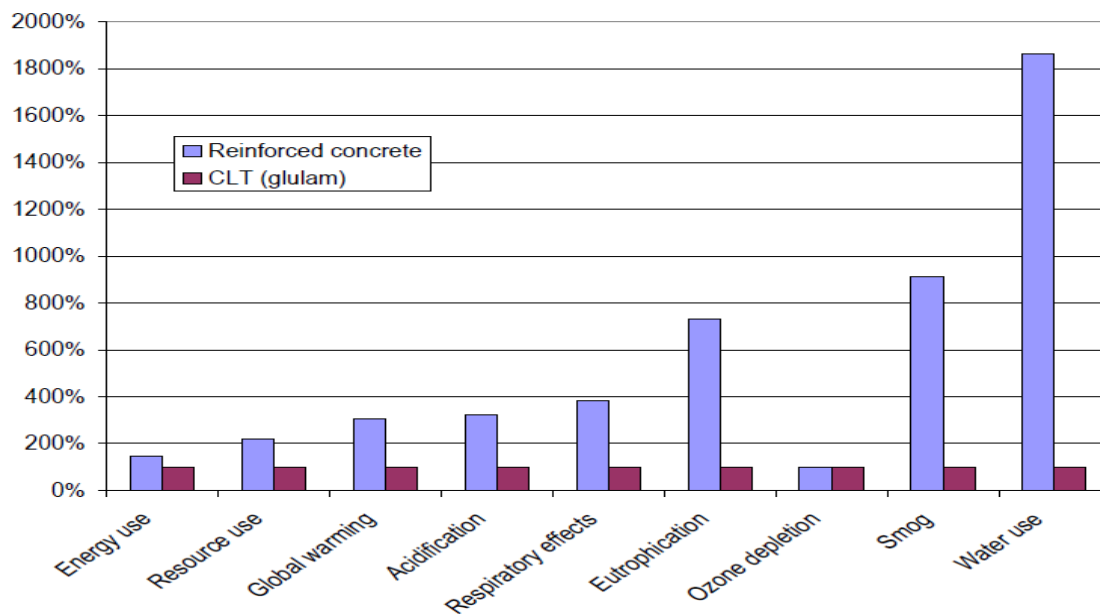


Figure 7- Mid-Rise Comparative Environmental Impact between CLT and RC (Source: Berry *et al.*, 2011)

Wood structures reduce carbon footprints because wood as a material stores carbon. In turn, this decreases the amount of carbon released into the atmosphere if wood is used for building materials instead of steel and concrete. Furthermore, using CLT that are shipped prefabricated to job sites can save consumption of fossil fuel usages on job site machineries compared to that of steel and concrete construction (WOODWORKS, 2009).

Regardless of the advantages of using wood for environmental purposes, for any product to enter a competitive market, it needs to have a smart strategic plan to be successful. Needless to say, if CLT is marketed as a full construction material replacing steel and concrete entirely, it will have no chance to attract buyers' interest in South Korea. Therefore, CLT promoters must use CLT's versatility to correctly enter the market one product at a time. This sequential strategy should start with a product that is most likely to penetrate into the market most effectively. Once the introductory products settle into the market and earn buyers' and consumers' trust, further steps can be taken gradually.

5.1 Floor diaphragm

CLT flooring has several properties that make it one of the most potent flooring products amongst its competitors like steel and concrete. It comes prefabricated to job sites for quick installation which saves time and labour cost. On the other hand, concrete floors, a flooring method mostly used in South Korea require at least 3 to 6 weeks drying time depending on thickness. This is one of the critical disadvantages of concrete floor, a bottleneck in construction. Therefore, it is essential to builders to minimize construction time as much as possible to maximize profit by saving labour cost. CLT flooring definitely costs more than concrete in terms of material cost in South Korean market for now, but it brings green construction image as well as significantly reduced construction time. Therefore, a hybrid construction method seems adequate where steel-concrete walls and posts remain unchanged, but CLT floor diaphragms replacing steel-concrete floors.

Flooring materials require both strength and good sound insulation. The figure below is maximum insulation capability of 5-ply CLT and 5-ply CLT with fibre glass insulation glass and gypsum board.


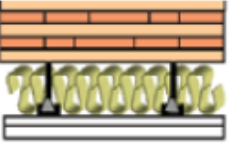
Floor Type	Floor Composition	Airborne (STC) dB	Impact (IIC) dB
	5-ply CLT 146 mm	38	26
	5-ply CLT + suspended ceiling + fibre glass insulation 200 mm+2 gypsum boards 2 x 15mm	63	62

Figure 8- CLT Acoustical Performance (Source: Crespell & Gagnon, 2010)

Korea's minimum impact sound insulation requirement is 58 dB according to the Korean Building Law (National Research Council Canada, 2008, p. 23). CLT with fibre glass and gypsum board installed together satisfies the sound insulation requirement in South Korea at 63 dB Airborne (STC) sound insulation and 62 dB Impact (IIC) sound insulation (Gagnon, 2011).

Furthermore, CLT floors can be up to 80% lighter than steel-concrete floors (Hu, 2011). Lighter building in weight leads to less cost in foundation platform as well as effective safety performance during earthquakes compared to steel-concrete buildings. Consequently, CLT floor diaphragm is a perfect product to introduce CLT into the South Korean market.

5.2 Prefabricated house

South Korea has a unique way of utilizing the rooftop of 3 to 5 storey residential and commercial buildings. A single unit house is constructed on rooftops to accommodate extra tenants who are looking for cheaper housing in the major cities, where apartment units are financially unaffordable to many people. This single unit is called “Ok-Tab Bang”. Since thousands of these Ok-Tab-Bangs are built and removed each month, there are no ways of



Figure 9- Single unit "Ok-Tab-Bang"

figuring out exactly how many of these houses exist in major cities of South Korea. However, it is for certain that this style of housing is high in demand to students and low income families who cannot afford expensive housing in the urban areas (Global Property Guide, 2012). This could be a great market for CLT prefabricated homes to enter. Ok-Tab Bangs are relatively

small in general as shown in Figure 9 (Chaoskcuf, 2006), thus they do not require much material to build. Furthermore, the construction time of CLT prefabricated houses can save significant amount of time compared to masonry and concrete building method commonly used to build Ok-Tab- Bangs in South Korea. As mentioned in the introduction of this chapter, starting from small and easily accessible market is the key to successfully promote CLT products. Aesthetic advantage of CLT prefabricated houses also has the edge over commonly seen brick houses, which in result can draw more attention from tenants as well.



Figure 10 – L21 CLT home designed by Architect M. Katz and J. Corne (Katz, 2010)

Figure 10 is a CLT home designed by Michael Katz and Janet Corne, which was showcased during the Vancouver Winter Olympics in 2010. It is a 220 sq ft home that costs only \$50,000 US (Katz, 2010). It ships prefabricated like all the other CLT products, and can be placed anywhere with minimal impact. A home like

this can definitely be marketable, and have a competitive edge over concrete Ok-Tab Bangs in South Korea with its beautiful design and eco-friendly image.



Figure 11- Shin-Lim, Seoul: Commonly Seen Ok-Tab-Bang Suburbs in South Korea (Chaoskcuf, 2006)

This suburb called Shin-Lim in Seoul, has one of the most populated Ok-Tab-Bang housing in the country. Suburbs like this exist almost in all 8 major cities in South Korea.

Residing in Ok-Tab-Bang is one of the top choices for younger tenants for decades due to low rent, and the demand will always be there as housing prices soar year after year (Global Property Guide, 2012). CLT Ok-Tab-Bang might as well be the catalyst to CLT growth in residential market in South Korea.

6.0 Conclusion

In a country where wood resource is scarce and costly, CLT products certainly face some difficult challenges to enter into South Korean construction market. Therefore, targeting a specific sector in construction business is the key to establish a solid market demand in coming future. As discussed, CLT floor diaphragm and CLT prefabricated Ok-Tab-Bang could well be suitable for introductory products to enter a very conservative market.

Over 50% of the South Korea's population live in Seoul, the Capital Region, and 77% of the total population reside in one of the country's eight major cities (Graham, 2006). Thus, the 4CTP is implementing a set guideline for decentralization that will provide opportunities for more construction business as populations start spreading out from major cities. Furthermore, there are almost 400,000 residential constructions starting each year in South Korea, increased number of construction is projected due to the implementation of 4CTP (KOSIS, 2012). CLT products must seize the opportunity with regulation-tested materials to increase demand for greener structural materials. Moreover, constant support from the government and foreign investment is essential for CLT products to succeed. Perception and incentives on wood construction must be improved as well. All in all, once CLT's true values are recognized by the South Korean "decision makers," CLT can definitely change the method of construction in South Korea in near future.

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