Modernization of Uzbekistan Building Code (UBC) System

# Construction Technology Development in Korea

# - Case Study -


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# Contents

# Ⅰ. Introduction



**What keywords come to mind when you think of “Korea”?**

K-Pop K-Content

Samsung LG Hyundai

New Village Movement

IT

Ppalli-Ppalli(quickly & quickly)

BTS Black Pink

Parasite


Mobile Home Appliances Car

ITS BIS

Transportation Card System

BIM, Free Wi-Fi

Wide Tunnel Long Bridge

Smart City

Small Reactor Technology

Ultra-high-rise Building

Korean War

Divided Country

Starvation

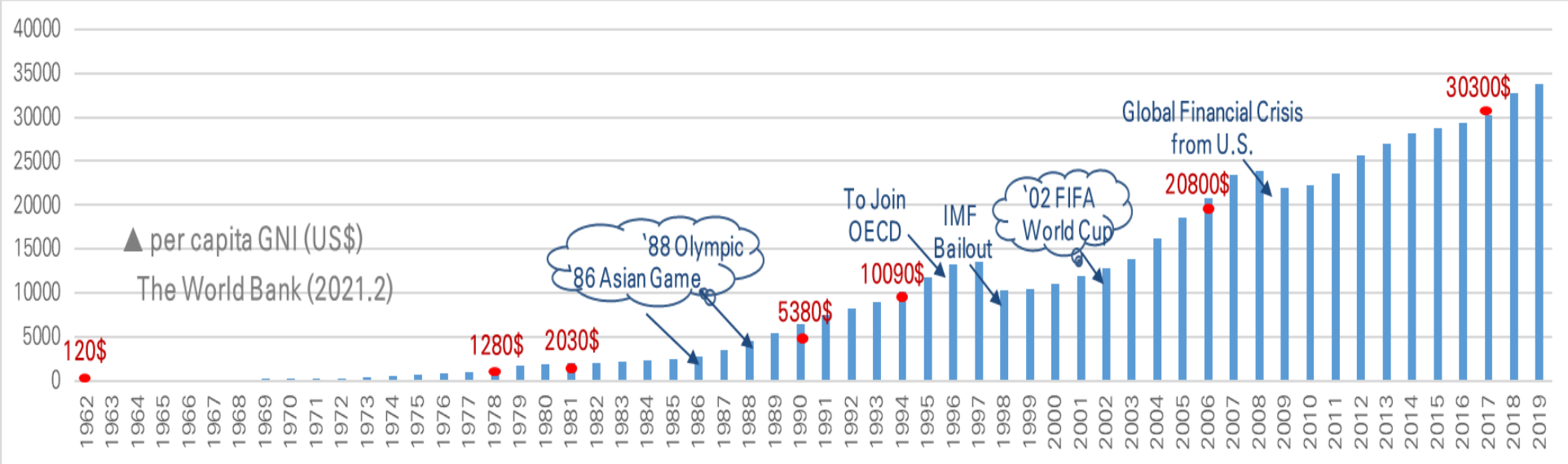
Least Developed Countries

# Ⅰ. Introduction

## Construction Industry and Economic Development in Korea

- **Korea, One of the World`s Least Developed Countries (LDC) about 70 years ago**
  - Became a new sovereign state in 1945 but divided into South and North
    - The Korean War(1950.06~1953.07): All industries were ruined and depended on foreign aid
    - About 60 years ago, in Korea, per capita GNI was less than USD 100$, and many people were suffering from hunger
  - Rapid Industrialization since the 1960s
    - The industrialization has begun since 1961, characterized by the “Ppalli Ppalli (quickly & quickly)" and the "New Village Movement"
    - Driving Force: People (education and diligence) + Technocrat (passion and leadership)
    - It took about 35 years to be a member of OECD (1996)

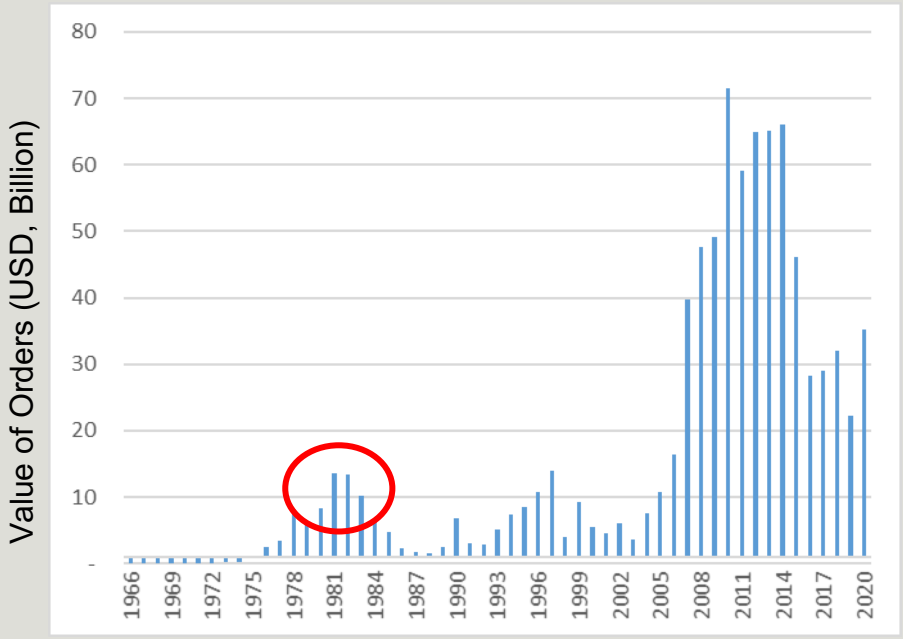
■ Changes in per capita GNI (Gross National Income) after Korea’s industrialization



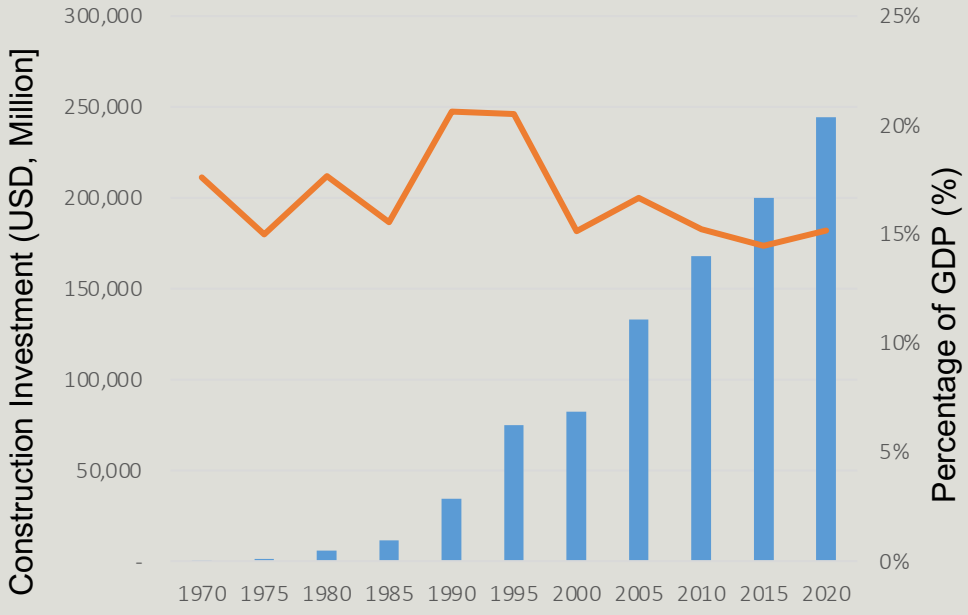
# Ⅰ. Introduction

## Construction Industry and Economic Development in Korea

- **Construction Industry as a Key Contributor to Korean Industrialization**
  - Korea had invested extensively in various infrastructure with the start of industrialization
    - Roads, railways, airports, ports, electricity, steel, etc.
    - Gyeong-Bu Expressway (`68.2.1 ~ `70.7.7): Seoul-Busan 416.05km, by Korean own technology
  - Construction has been a key sector for national economy during industrialization
    - In 70s-80s, construction industry grew rapidly with expansion of the Middle-East market,
    - Construction industry's contribution to national economy reached to 21% of GNP in `90s




▲ Value of Overseas Construction Contracts




▲ Construction Investment & Percentage of GDP

# Ⅱ. Overview of Construction Industry Development in Korea



## Definition of Construction Technology

- **It shall contribute to the promotion of public welfare and the development of the national economy by carrying out the proper implementation of construction works, and ensuring the quality and safety of construction works**
- **Classification of construction technology to secure the appropriateness of construction work (construction cost, construction period, formativeness, environmental characteristics, etc.)**
  - Construction project management technology: construction market research and discovery, finance, purchasing and procurement, bidding, etc.
  - Construction engineering technology: planning, survey, design, testing, evaluation, supervision, natural disaster prevention, formative security and environmental protection technology, etc.
  - Construction work technology: planning, manufacturing, transportation, installation, on-site construction technology, etc.
  - Operation and maintenance technology: operation, safety inspection, maintenance, etc.

※ Definition of construction technology based on Korea's Construction Technology Promotion Act

# Ⅱ. Overview of Construction Industry Development in Korea



## Development (Chasing) Stage of Construction Technology

### ▪ Development (chasing) stage of general technology

- Technological development in developing countries generally follows the path of developed countries

**Step A → Step B → Step C → Step D**

**Technology Introduction → Technology Chase → Post-Technology Chase → Technology Leading**

- Frog jumping phenomenon of technology occurs according to industry characteristics
  - The phenomenon of going from stage A to stage C or D without going through stage B
  - This phenomenon occurs most frequently in the ICT field
  - As the most representative case enters the wireless communication stage without going through the wired communication stage, various frog jumping phenomena occur
  - China's mobile payment technology is a representative example of the frog jumping phenomenon and is the world's best: Alipay, etc.

# Ⅱ. Overview of Construction Industry Development in Korea



## Development (Chasing) Stage of Construction Technology

### ▪ Characteristics of construction technology

- Frog jumping phenomenon rarely occurs in construction technology
  - It means that certain fields of construction technology in which the phenomenon of frog jumping occurs are subordinated to foreign technology
  - Therefore, in the case of construction technology, it generally follows the path of developed countries
- Construction technology should achieve mutual development with related industries
  - Development of materials, products, and equipment industries related to construction
  - Plant industry (cement, steel, glass, waste, etc.) power generation
- Construction technology must ensure the quality and safety of construction work
  - It must meet the requirements of construction-related laws and system set forth in this
  - After the collapse of Seongsu Bridge in 1994, the construction technology management system in various fields was established focusing on construction technology

# Ⅱ. Overview of Construction Industry Development in Korea

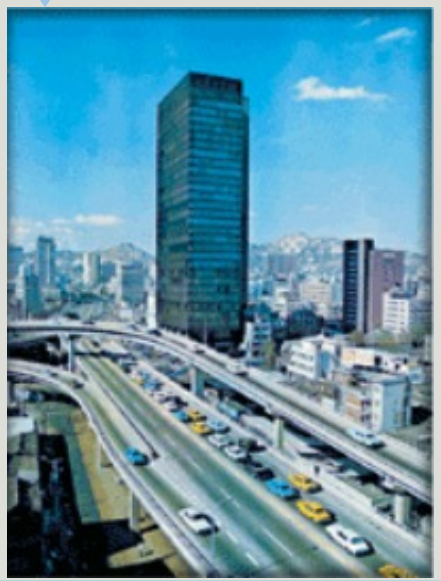


## Cheonggyecheon Stream Change Process

- **Representative examples of the transition process of the construction industry and construction technology in Korea**

Cheonggyecheon in 1960's

Cover up stream with concrete (1958~1977)



Elevated highway (1967~1971)


Restoration (2003~2005)

Cheonggyecheon in 2021

# Ⅲ. Construction Technology Introduction Stage



## Construction Technology Introduction Stage (1962~1982)

The development stage of construction technology in Korea can be classified differently according to scholars, and the development stage defined here was based on my opinion and experience

- **The period when per capita GNI went from $120 to $2,000**
  - The construction industry plays a leading role in national economic development by expanding various construction infrastructure.
- **Construction technology introduction and learning stage (1962~1971)**
  - Ministry of Construction (MOC) established government organization in 1962
    - Introduction and learning of construction technology from foreign engineers in the process of supporting the five-year economic development plan
  - 1st Five-Year Economic Development Plan (1962-1966)
    - Full-scale construction of infrastructures such as roads, railroads, electric power plant, etc.
    - Learning while observing the detailed design and specification of infrastructure facilities by foreign engineers
    - Completion of Yanghwa Bridge, Seomjin River multi-purpose dam, etc.

# Ⅲ. Construction Technology Introduction Stage



## Construction Technology Introduction Stage (1962~1982)

- **Construction technology introduction and learning stage (1962~1971)**
  - The 2nd Five-Year Economic Development Plan (1967~1971)
    - Expansion of transportation infrastructure such as highways and ports, reinforcement of water resource management, etc.
    - Completion of Gyeongin Expressway, Gyeongbu Expressway, Namgang Multipurpose Dam, etc.
    - Started construction of Pohang Steel (POSCO), Ulsan Petrochemical Complex, Soyang River Dam, etc.
- **Construction technology introduction and imitation stage (1972~1982)**
  - The 1st 10-Year Comprehensive National Land Development Plan (1972~1981)
    - Same as the 3rd and 4th Five-Year Economic Development Plan period
  - The emergence of engineering companies following the creation of large-scale industrial complexes
    - Established the foundation for company establishment with the enactment of the Technical Service Promotion Act in 1973
    - Construction technology development started with the emergence of construction engineering companies

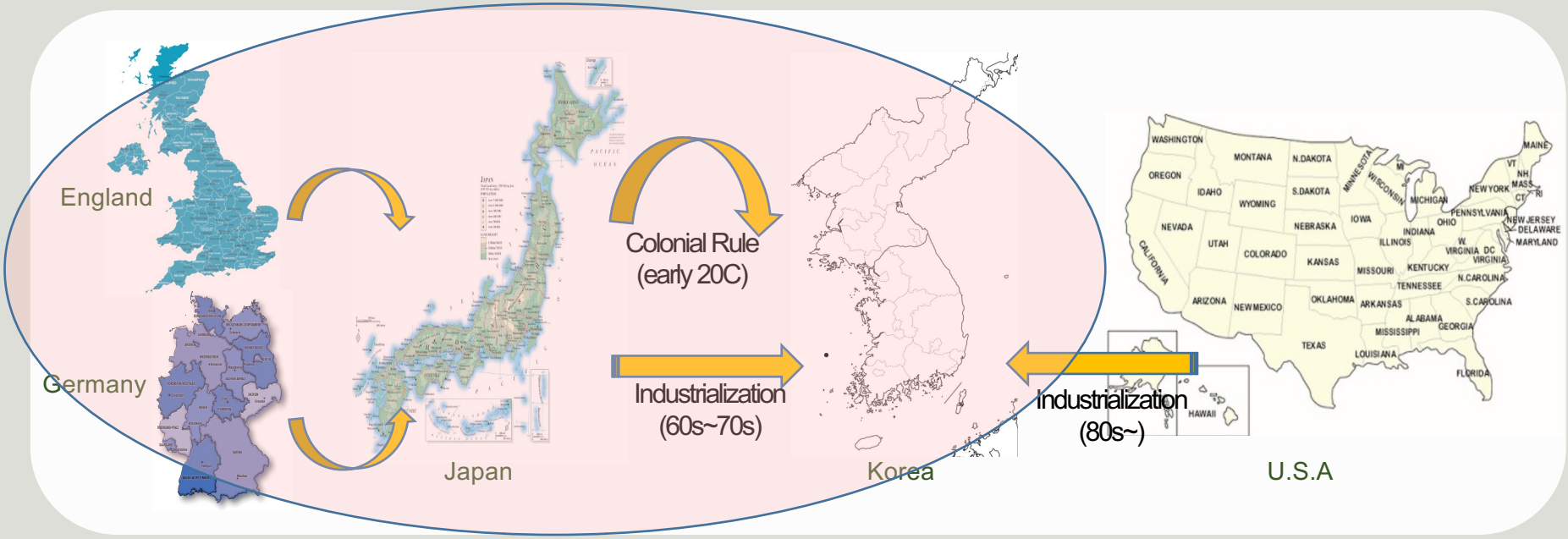
# Ⅲ. Construction Technology Introduction Stage



## Korea Building Code Introduction Stage (1962~1982)

### ▪ Initial introduction of Building Codes in Korea

- Establishment of Building Code system started in the 1960s, when industrialization began
  - 1962: MOC launched, Building Act enacted, Korea Construction Research Institute launched, Industrial Standardization Act, which is the basis of Korea Industrial Standards (KS), enforced
- This period is mainly a copy of Japanese Building Code
  - Reflecting some of the lessons learned in the detailed design and specification writing process of foreign engineers for infrastructure facilities
- Countries that influenced the establishment of Korea Building Code system



# IV. Construction Technology Chase Stage



## Construction Technology Chase Stage (1983~1994)

- **When per capita GNI enters the $10,000 range from the $2,000 range**
  - Transition from people-oriented construction to technology-oriented construction
- **Chasing construction technology and creating a foundation for technological independence**
  - The 2nd 10-Year Comprehensive National Land Development Plan (1982~1991)
    - Per capita GNI increased from $2,000 to $7,000
    - Hosting the 1986 Asian Games and the 1988 Olympic Games, improving the living environment of the people
    - Announcement and commencement of development of new towns such as Bundang, Ilsan, etc.
  - Entering the era of full-scale construction technology development with the establishment of the KICT (Korea Institute of Civil Engineering and Building Technology) (1983.06)
    - Time to overcome the foreign exchange crisis by entering the Middle East construction industry in the early 1980s
  - Enactment of Construction Technology Management Act entered into force (Jan. 1988)
    - The law was enacted in the wake of the fire incident at the Independence Hall in 1986.
    - Establishing a support system and expanding the budget for the government's R&D of construction technology

# IV. Construction Technology Chase Stage



## Construction Technology Chase Stage (1983~1994)

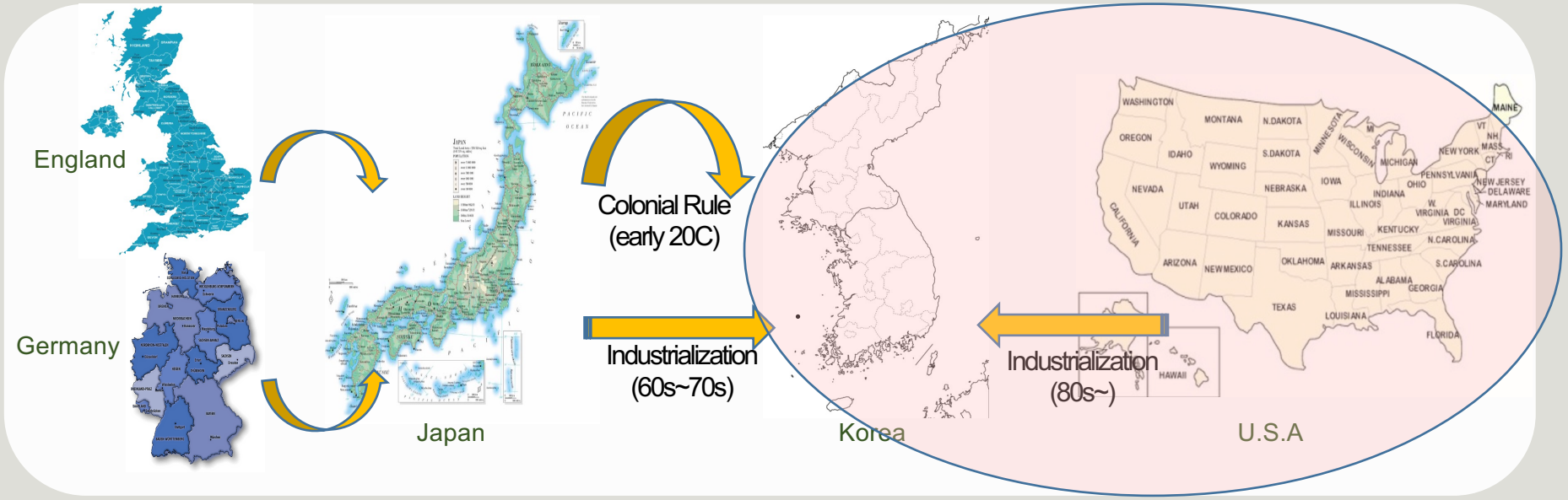
- **Moving from quantitative growth to qualitative growth**
  - Expansion of technology development investment by construction companies
    - 10-20% annual technology investment budget increase since 1985
    - Increase in establishment of research departments and technology research centers by company
    - Large construction companies prepare for the Uruguay round: Pursue EC (Engineering Construction) and promote competitiveness in plant construction
  - The government is interested in solving social problems such as maintenance of living environment facilities such as housing and water and sewerage in economic development centered on growth
    - Expansion of housing supply, formation of a wide-area water supply system
    - Expanded environmental impact assessments such as domestic sewage and industrial wastewater
    - The period of transition from development-oriented construction to construction that improves the quality of life such as environmental improvement
  - First application of cement pavement technology highway: 88 Olympic Expressway
  - Yeouido 63 Building (high-rise steel structure) completed: 1985

# IV. Construction Technology Chase Stage



## The Full Introduction of US Building Code

- **Reflecting the influence and introduction of US Building Code**
  - Start of transition from Japan-centered Building Code to US-centered Building Code
    - Entering the era of construction technology development and expanding the return of Korean students studying in the USA to their home countries
  - Start of Local Adaptation to the Building Code suitable for the situation in Korea
    - Start of the revised work on Korean Building Code in preparation for the WTO
  - Countries that influenced the establishment of Korea Building Code system



# V. Post-Technical Chase and Leading Technology Stage



## Post-Technical Chase Stage in the Construction Field (1995~2005)

- **Between $10,000 and $18,000 per capita GNI**
  - 1995 WTO launched, Joining the OECD and IMF bailout period
- **Reorganization of related laws and systems due to continuous construction accidents**
  - Continuous accidents such as the collapse of Seongsu Bridge
    - Collapse of Sinhaengju Bridge under construction (1992), Collapse of Seongsu Bridge (1994)
    - Gupo train overturned accident (1993), Collapse of Sampoong Department Store (1995)
  - Reinforcement of Facility Inspection and O&M
    - Enactment of the Special Act on Safety Control and O&M of Facilities
    - Establishment of KISTEC (Korea Infrastructure Safety & Technology Corporation)
    - Development of Safety Diagnosis and Maintenance Manual for 13 types of facilities
- **Time to overcome difficulties caused by the launch of the WTO and the IMF**
  - With the launch of the WTO, construction technology entered a free competition system
  - Reorganization of the Korean construction industry due to the subsequent IMF
  - Korea, which focuses on construction work technology, has experienced a period of decline in the overseas construction market

# Ⅴ. Post-Technical Chase and Leading Technology Stage



## Post-Technical Chase Stage in the Construction Field (1995~2005)

- **Comprehensive construction technology development stage**
  - Equipped with a comprehensive technology development system such as ‘construction project management technology’, ‘operation and maintenance technology’, and ‘construction engineering technology’ in a technology development system centered on ‘construction work technology’
    - Establishment and implementation of relevant government policies and systems
- **Advancement of construction technology through large-scale construction**
  - 2002 Korea・Japan World Cup: Design and construction technology for large space structures
  - Development of related complex technologies through the activation of high-rise buildings: materials and materials, facility environment and information communication, construction and maintenance, structure・safety・disaster prevention, etc.
  - Technology related to airports, high-speed rail, and Korean nuclear power plants
  - Globalization of long bridge and tunnel technology
  - Through this, the level of Korean construction technology was upgraded

# V. Post-Technical Chase and Leading Technology Stage



## Post-Technical Chase Stage and Leading Technology Stage (2006~Present)

- **When per capita GNI exceeds $20,000 to $30,000**
  - Korea is the only country in the world that became a developed country from a low-income country
  - The gap between the level of construction technology with advanced countries has narrowed significantly, and Korea has begun to lead the global construction technology in certain construction technology fields.
- **Entering the era of infinite competition**
  - Fierce competition in the overseas construction market due to the end of Korea's development era
    - Still, some technical fields such as ‘construction project management technology’ and ‘construction engineering technology’ are inferior to advanced countries
    - Overcoming inferior technological fields and strengthening the technological fields stronger
    - It is necessary to share Korea's experience and know-how with developing countries, and to establish a win-win-based strategy for mutually beneficial cooperation and mutual growth
  - Expanding the concept of construction engineering by winning the PMO project
    - Ordered PMO project for Chinchero New Airport project in Peru (2019.10)
    - Peru Chinchero New Airport Terminal Project Order (2021.07)

# V. Post-Technical Chase and Leading Technology Stage



## Post-Technical Chase Stage and Leading Technology Stage (2006~Present)

- **Entering the era of infinite competition**
  - World-class construction technology construction work
    - Various bridges in Korea and Canakkale Bridge project in Turkey
    - Opened various wide tunnels in Korea and Eurasia tunnel in Turkey
    - Jamsil Lotte World Tower (123th floor building) in Korea and Burj Khalifa (163th floor building) in Dubai
    - In addition, leading specific technology fields such as smart city, small reactor technology, etc.
  - Promote R&D intensive investment in the field of future construction technology that can lead the world
    - Technology to cope with climate change: buildings, transportation, energy, etc.
    - Mobility technology: Self-driving, drone, etc.
    - Digital management technology: Digital twin, BIM, etc.
    - Smart City Technology: Convergence of various technologies
  - Establishing a roadmap for MOLIT ODA projects and strengthening cooperation with developing countries
    - Linked with Korea-supported Grant Aid projects, PPP projects, EPC projects, etc.

# V. Post-Technical Chase and Leading Technology Stage



## Development and Operation of Korea Building Code (1995~Present)

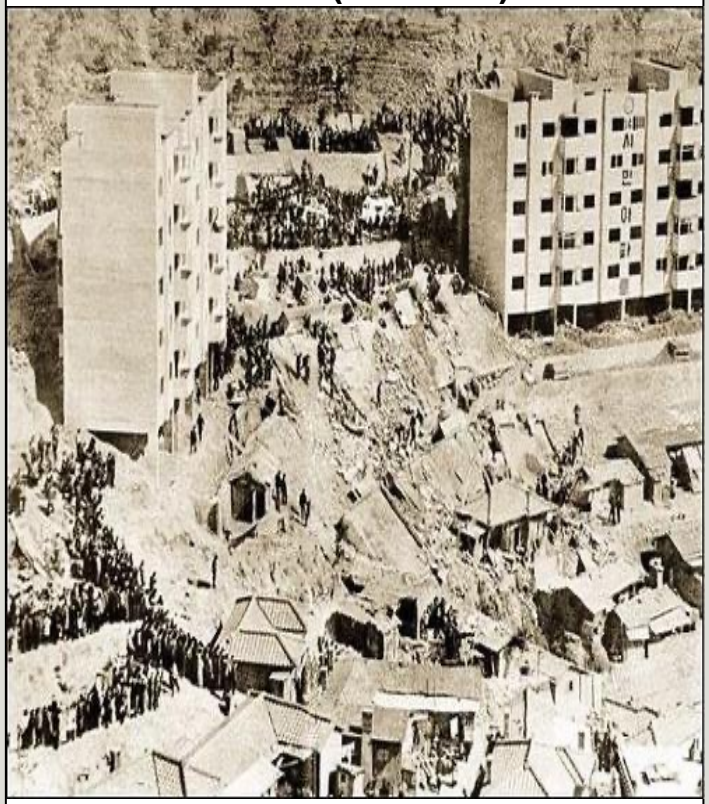
- **Full-scale development of Korea Building Code**
  - Response to the launch of the WTO and the collapse of various facilities in the 1990s
    - Thorough local adaptation to Building Code introduced and adopted in foreign countries
    - Compensation and new enactment for insufficient Building Code
  - Establishment of the Construction Standards Maintenance Council under the MOLIT
    - The vice president of KICT is the chairman, and KICT oversees the revision of Korea Building Code
- **2013 KCSC (Korea Construction Standards Center) launched**
  - Need for Reorganizing Separate Construction Standards Management System
    - Confusion in the construction field due to different terms and standards
    - Need to reflect the results of various empirical tests to prevent poor construction quality
    - Need to improve the performance, save costs, and reflect newest technology
  - Establishment of Korea Building Code: Integrate and unify detailed technical regulations described for each facility, and convert to a Building Code Platform form that uses detailed technical regulations for each facility

# VI. What about Other Countries?



## Large-Scale Facility Collapse Accidents in Korea in the Past

### WOW Apartment Collapse/ Seoul (1970.4.8)



Details : Collapse of the 5F Apartment
Damage of Life : 33 deaths, 39 injuries

### Seongsu Bridge Collapse/ Seoul (1994.10.21)

Details :
48M Fall on the Center of the Bridge, 6 of bus/car crashed
Damage of Life :
32 deaths, 17 injuries

### Sampoong Department Store Collapse/ Seoul (1995.6.29)

Details :
complete collapse of the department both complex
Damage of Life :
502 deaths, 937 injuries

# VI. What about Other Countries?



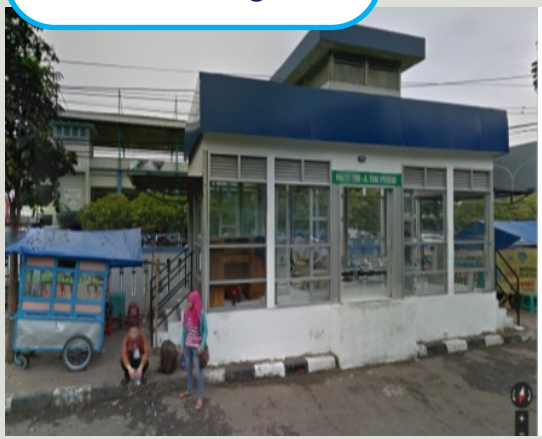
## Example of Building Code that Failed to Locally Adaptation

### ▪ Example of BRT in Indonesia

Jakarta

- Jakarta City installed and operated BRT by introducing foreign building code
  - Contributing to relieving traffic congestion through normal operation

Bandung



- Bandung city applies foreign building code without considering poor road conditions
  - Advice on the possibility of problems arising from the Korean supervisory company was not accepted
  - It loses its function as a BRT and causes a lot of inconvenience to citizens using the bus

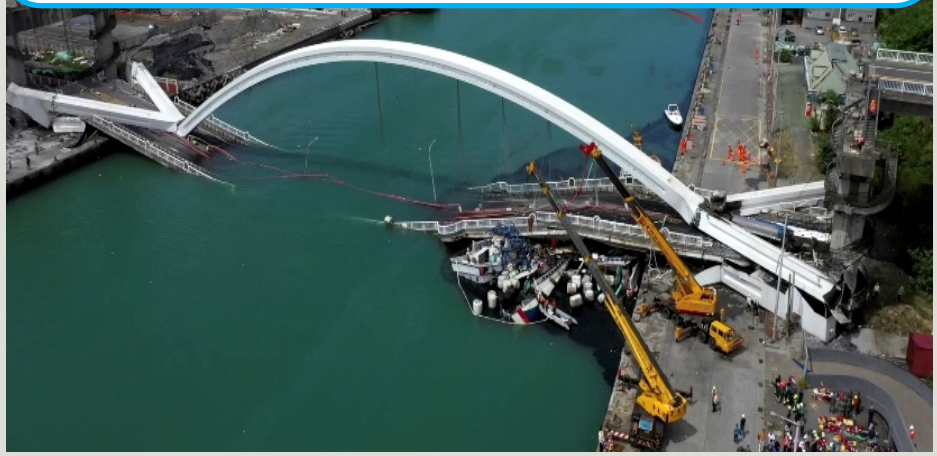
# VI. What about Other Countries?



## The collapse continues today

Brumadinho dam disaster, Brazil (Jan 25, 2019)


Bridge Collapse in Taiwan (Oct 1, 2019)



Building Collapse in Shanghai, China (May 16, 2019)

21-Story Building Collapses in Lagos, Nigeria (Nov 1, 2021)

# VI. What about Other Countries?



## The collapse continues today

- **Apartment Building Collapses in Florida, USA (June 24, 2021)**


- Even the United States, the world's richest and most technologically advanced country, cannot avoid construction accidents
  - Excessive cost expected due to obsolescence of facilities
  - ASCE expects to spend USD 4.59 trillion to improve all construction infrastructure in the U.S. according to U.S. Building Code (2016-2025, as of 10 years)
- Building code for facilities are important, but O&M of built facilities are also important

# Ⅶ. Concluding Remarks



## Concluding Remarks

- **We are faced with the challenge of which Building Code to choose**
- **Which Building Code is the best case or the optimized case?**
- **Through this thinking, Uzbekistan should find a way to modernize UBC**
  - Korea's case will be helpful to find the way

Modernization of Uzbekistan Building Code (UBC) System

# Thank you

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