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Concepts of Disaster Prevention Design for Safety in the Future Society

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ABSTRACT

In this paper, we propose a pioneering concept of DPD(Disaster Prevention Design) to realize a securable society in the future. Features of danger in the future society are expected to be diverse, abrupt occurring, large scale, and complicated ways. Due to increment of dangers with their features of uncertainty, interactivity, complexity, and accumulation, human-oriented design concept naturally participates in activities to prevent our society against disasters effectively. We presented DPD is an essential design activity in order to cope with dangers expected in the future societies as well as realize securable environments. DPD is also an integrated design aids including preemptive protections, rapid preparing, recovery, and interactive cooperation. We also expect these activities of DPD is effective for generation of new values in the market, satisfaction of social needs, expansion of design industry, and a novel chance for development in the future society. Throughout this paper, we submit various aspects of DPD concepts including definition, classification, scope, necessity, strategy, influencing elements, process, and its principle. We expect these concepts will be the seed and/or basement of DPD research for the future works. For the direction of study for DPD in the future, we emphasize alarm system for preemptive protection rather than recovery strategy for the damage occurred. We also need to research about progressive prevention techniques and convergence with other areas of design. In order to transfer the concept of product design from facility-oriented mechanism to human-oriented one, we should develop new kinds of city basis facilities, public-sense design concepts referred to social weak-party, e-Learning content design preparing disasters, and virtual simulation design etc. On the other hand, we have to establish laws and regulations to force central and/or provincial governments to have these DPD strategies applying their regional properties. Modern design activities are expanding to UI(user interface) content design area overcoming the conventional design concept of product and/or service. In addition, designers are recognized as art directors or life stylists who will change the human life and create the social value. DPD can be divided into prevention design, preparedness design, response design, and recovery design. Five strategies for successful DPD are Precaution-oriented, Human-oriented, Sense-oriented, Legislation, and Environment Friendly Strategies.

***Key words**: DPD(Disaster Prevention Design), secure, industry, damage, product design, UI(user interface), precaution.*

1. INTRODUCTION

1.1 Problem Submission

In recent years, there have been a lot of natural disasters such as earthquakes, tsunamis, typhoons and hurricanes etc. In addition, we have also suffered from artificial human disasters such as terrorisms and wars in the whole world.

According to the result of Social Investigation conducted in 2012 by the Bureau of Statistical Affairs, only 13.7% of Korean people answered our society being safe, and 37.3% of them felt like so risky for disaster [1]. The report of disaster statistics in 2010 announced by Disaster Research Center located in Brussels, Belgium says that there have been totally 385 natural disasters in the world so that about 297,000 human beings died and incurred 123.9 billion USDs (about 133 trillion WONs) economic loss. The earthquake of 9.0 degrees intensity occurred in Northeastern part of Japan on Mar. 11, 2011 has

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registered 300 billion USDs (about 325 trillion WONs) economic damage which is the biggest one in successive generations [2]. Moreover the tsunami hit the nuclear power plants in Fukushima so that secondary damages and injuries are to be continued. Inevitable For the sake of these inevitable natural disasters and unexpected terrorisms or others, so to speak 'Disaster Management Business' is rapidly leaping into prominence as a novel blue-ocean [3].

Fig.1 shows the 'World Energy Scenario' from 2000 to 2050 announced by ISEO(international sustainable energy organization) [4]. Three curves in the graph indicate 'Demand of World Energy', 'Demand of Renewable Energy', and 'Finite Energy' retained in the earth. As shown in the figure, renewable energy cannot keep trace of the demand of energy, and on the other hand, as the energy retained decreases, the gap between 'Demand' and 'Energy Supply' will be dramatically wider and wider.

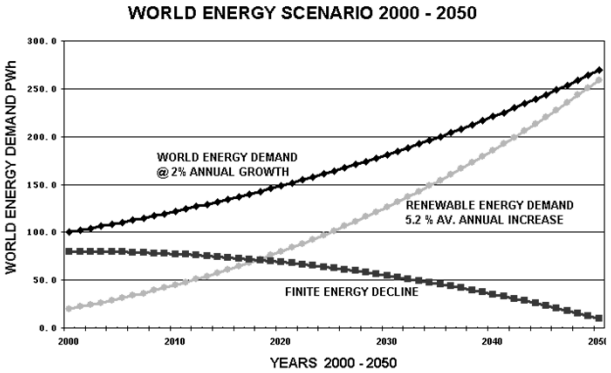

Fig. 1. Energy Problems (ISEO)

Therefore exhaustion of main energy resources such as oil and water is being realized, and we can easily expect that there will be a serious resource war in the world.

We can see another background of these future trends in Fig.2. During a few years in recent, there happened to be 'prepper' as they call themselves which means a new kind of survivalist in this dangerous society expected [3]. The importance of personal disaster management becomes bigger and bigger as they expected.

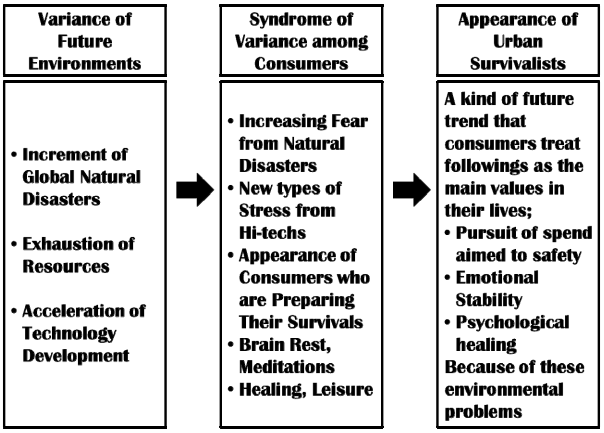

Fig. 2. Procedure of Urban Survivalists Appearance

The distinct characteristics of 'prepper' are that he/she usually has proper job and takes the role of a member of the society. They are willing to prepare against real crises rather than some absurd fears. Like we are all feeling for this world, there have been a lot of environmental changes, and we can expect much more serious changes in the near future. Increment of global natural disasters, exhausting resources, and excessive development of technology are all the causes of human uneasiness. Because of these environmental variances, a kind of syndrome naturally occurred among consumers whose characteristics are realizing fear seriously, new stress from hi-tech, preparing for survival, meditations, and healings to be cured out of such damages. Therefore, appearance of urban survivalists will be a somewhat natural phenomenon. They are commonly pursuing safety, stability, and healing against this dangerous society.

1.2 Background

Entering the 21st century, convergences of various industrial areas are generating new demands with requiring a total change in Design Industry. We need a totally novel concept of Design which can reduce the usage of natural resources and energy in order to be friendly with environment we are faced with. In addition we need a pioneering proposal of the new concept of Design which solves the problems on aging society, big urbanization, and severe separation between both poles.

Table 1 shows some important macroscopic environments which influence on Design Industry [5]. It presents influencing elements corresponding to areas such as society, technology, economy, environment, and politics.

Table 1. Macroscopic Environment Influencing on Design Industry

Areas	Influencing Elements
Society	•Variation of Population : Aging Higher •Family Type : TIF(triple income family) & Single Home •Public Preservation : Health Care
Technology	•Convergence:IT/BT/NT/Recognition Science •Environment Friendly : Materials
Economy	•Globalization & Localization •Income : Severe Gap between Both Poles •Inflation : Cost Increasing
Environment	•Weather Variation & Earth Warming •Management of Water Resource •Surface Soil & Agricultural System •Quality of Atmosphere
Politics	•Regulations & Control of Government •New Laws & Regulations

From these considerations, we figure out the main factors of danger for the future society are as follows; rapid aging society, severe income differences, increment of safety weak-party, big urbanization and its resulting into huge disasters, increment of natural disasters caused by extreme climate changes, terrorism, and variations of international situation.

In general, we classify societies according to their degrees of age distribution as i) Aging Society, ii) Aged Society, and iii) Super-Aged Society. When the rate of aged population over 65 is 7~13%, we classify it as 'Aging Society'. When the rate is 14~19%, 'Aged Society', and for more than 20%, we call 'Super-Aged Society'. Many countries including France and America are supposed to be into 'Super-Aged Society' after 2020. Moreover it is expected that Korea will enter 'Super-Aged Society' from 2018 [6]. This rapid aging phenomenon makes the income gap to be severe and the number of weak-party for safety increased. So we can easily expect that there will be a lot of casualties when disaster occurs.

Urbanization is rapidly proceeding in newly industrialized nations such as China and India etc., which can be main reasons of these gigantic disasters. We expect new and larger cities are variously increased over the world because of these economic growths and urbanizations. According to the investigation of PRB(population reference bureau), 48% of world population lives in cities 2006, which will increase up to 60% until 2030. Moreover, there were only 8 mega-cities having population more than 5 million in 1950, but there will be 59 mega-cities in 2015 and 48 mega-cities are from under-developed countries [7]. The rates of urbanization in Korea are 79.7% in 2000 and 82.1% in 2010 according to 'Population and Housing Census' performed by Korea Bureau of Statistics [8].

1.3 Purpose and Scope of the Research

As shown in the above survey, natural disasters such as tsunamis, typhoons and earthquakes, artificial human disasters such as terrorisms and wars are continuously occurring and getting bigger and bigger in their economic losses all over the world. Therefore current strategy of safety management leaded by the Government reveals its short limitation. We need a mutual cooperation between individual persons, enterprises, and the nation in order to prevent these future dangers effectively.

In this paper, we propose pioneering concepts of Disaster Prevention Design as a novel area of design in order to cope with dangers expected for future societies and effectively realize securable environments in the future. This research includes definition and scope of the new area of design, successful process for performing design, and submission of design strategy for disaster prevention. We expect they will be effective in the processes of preemptive protections, rapid preparing, recovery, and interactive cooperation in order to construct a safe society in the future.

The organization of the rest of this paper is as follows; In Section II, we present a theoretical consideration about disaster and design. In Section III, we discuss various aspects of Disaster Prevention Design concepts including definition, classification, scope, necessity, strategy, influencing elements, process, and principle etc. Finally in Section 4, we arrange the results of this study and offer some tips for the future works.

2. THEORETICAL CONSIDERATION

2.1 Description of Disasters

Disasters can be classified into natural disasters and artificial (or social) disasters. Natural disaster is a kind of disaster occurred by natural phenomena, which includes flood, heavy rain, earthquake, heavy waves, typhoon, hurricane, heavy snowfall, drought, thunderbolt, yellow sand, red tide, and tidal wave etc [9]. On the other hand, artificial (or social) disaster is another kind of disaster happened from human mess or intention, which includes fire, collapse, explosion, traffic accident, chemical/biological/radiological, environmental pollution and others. We arranged these descriptions of disasters in Table 2 [10].

We can divide artificial disasters into 2 parts like 'humane disasters' and 'social disasters'. In that case, we put accidents caused by intention into 'social disasters' such as energy exhaustion, terrorism, war, financial trouble, and crime etc.

Table 2. Classification of Disasters

Class	Description	Contents
Natural Disasters	Flood	River Overflow, Submersion, Landslide, Collapse, Numbness of Traffic&Comm.
	Typhoon	Collapse, Tidal Wave, Stone Falling, Numbness of Traffic&Comm.
	Snowfall	Landslide, Collapse
	Earthquake	Fire, Collapse, Explosion, Numbness of Traffic&Comm.
Artificial (or Social) Disasters	Fire	Electricity, Gas, Oil, Comm., Subway, Railroad, Building, Flight, Ship etc.
	Collapse	Building, Bridge, Tunnel, Water Gate, Bank, Dam, Buried Cable & Pipe etc.
	Explosion	Electricity, Gas, Oil, Atomic Power, Subway, Railroad, Flight, Ship etc.
	Traffic Accident	Road Facilities, Subway, Railroad etc.
	Chemical/ Biological/ Radiological	Poison Gas, Bacteria, Toxic Chemicals, Biologicals Radioactive Materials etc.
	Environment Pollution	Water Quality, Atmospherics, Wastes, Noise and Vibration
	Others	Shipwrecks, Oil Tanker Accident

2.2 Characteristics of Disasters

In general natural disasters are to be prepared or prevented by well-known methods of trial and error with our experiences and responses throughout the history of mankind.

But some artificial (or social) disasters cannot be expected in terms of their proper causes and fulfilling processes, because they maybe new types of danger that we have not experienced before. The characteristics of these kinds of disasters are uncertainty, interoperability, complexity, and accumulation etc. Moreover they can be enormous tragic accidents and become not only astronomical loss of expenses but secondary damages when disasters occur in a big city with dense population.

Table 3 lists examples of 'Black Swan' happened in the last decade. So to speak 'Black Swan' means happening or accident that seems like to be impossible. It became generally used after the book entitled 'Black Swan' written by Nicolas a famous specialist of investment [3]. He predicted a serious situation of sub-prime loan throughout the book.

Table 3. Black Swan Examples in the Past Decade

Year	Contents of Black Swan
2001 9.11	Terrorism 911 against the World Trade Center and Pentagon
2002	78% Decreasing in Stock Price of NASDAQ
2003	High Temperature in Europe (40,000 people died)
2004	Tsunami in Indonesia (230,000 people died)
2005	Earthquake in Pakistan (80,000 people died)
2005	Hurricane Katrina in New Orleans
2008	Earthquake in Burma (140,000 people died)
2008	Earthquake in Tsuchan China (68,000 people died)
2008	World Financial Crisis
2008	30% Decreasing in House Price in USA
2010	Earthquake Port-au-Prince in Haiti (220,000 people died)
2010	High Temperature in Russia (56,000 people died)
2010	Oil Spill in the Gulf of Mexico
2010	1,000 Points Decreasing in Dow Jones Industrial Avg.
2011	Unstable Politics in the Mideast and North Africa
2011	Earthquake at Northeastern Part of Japan (24,000 people died)

2.3 Design Concept for Disaster Prevention

The definition of Disaster Prevention is keeping off disasters such as flood, typhoon, earthquake, and/or fire etc. [3]. In addition, scientific definition says artificial efforts to minimize the damage of human or property from any kind of disaster and to prevent its expansion to other areas. On the other hand, Design is the most basic and human oriented science which initiates the problems of food, clothing, and shelter that we are supposed to contact from the point when we were born. It satisfies our fundamental requirements for the bottom of human.

Recently, the focus of Disaster Prevention is moving from facilities to people so that we can concentrate on precaution rather than recovering, not only for physical cures but psychological healings. Therefore we should get over these limited and passive strategies that the Government has taken the initiative in so far. For the sake of effective prevention of disasters, we have to make the system of cooperation which induces participations of individuals, enterprises, and the nation.

We depict the novel concept of Disaster Prevention Design as integrated management of safety in Fig.3.

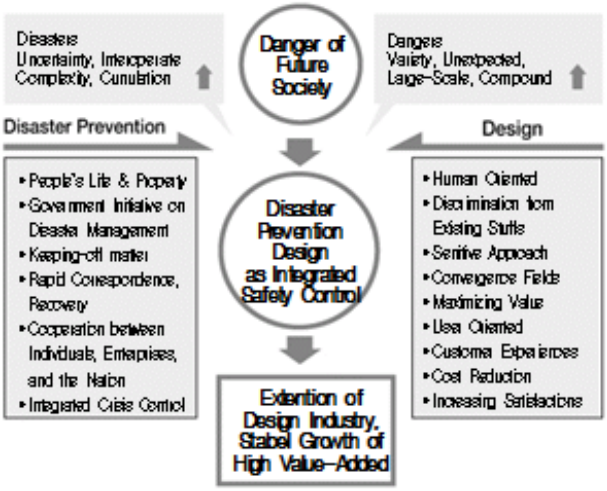

Fig. 3. Concept of Disaster Prevention Design as an Integrated Safety Management

We propose that we can extend the concept of conventional design industry into considering disaster prevention to accomplish a stable growth of high value-added promotion throughout 'Disaster Prevention Design' as an integrated safety control. Modern or future society must have its characteristics like uncertainty, interoperability, complexity, and cumulative damages. In addition, we will suffer from various kinds of dangers caused by variety, unexpected events, large-scale, and compound disasters. Design concepts deeply participate in the process of disaster prevention strategy for their characteristics such as human-orientation, discrimination, cost reduction, and satisfaction etc. show in Fig.3. Therefore 'Disaster Prevention Design' is a kind of pioneering concept from which design has been combined with conventional concept of disaster prevention. We present the definition, classification, scope, necessity, strategy, influencing elements, performing processes, and principles of 'Disaster Prevention Design' in the rest of this article.

3. DISASTER PREVENTION DESIGN FOR FUTURE SAFE SOCIETY

3.1 Definition of Disaster Prevention Design

Design behaviors of human have been started with the history of mankind fabricating instruments or housings for their survival. But nowadays design exerts a great influence even on the essence of human. Design is originally a communication activity that gives shape to the thought and/or image of designer to deliver into the conclusion throughout some real modeling. So design is usually willing to generate aesthetical styles as well as fitting the usage of that objects [11].

Therefore, we can define 'Disaster Prevention Design' as follows; DPD is a kind of design activity that protects life and property of human beings, minimizes damages, and makes the recovering process rapid and easy, against any kind of disasters.

3.2 Classification of DPD

According to their principal subjects, we can classify DPD into 1)Private DPD, 2)Enterprise DPD, and 3)National DPD.

3.2.1 Private Disaster Prevention Design

Private Disaster Prevention Design is a kind of design on the level of person which protects life and property from various causes of disasters. We can submit a lot of personal causes such as disease, medication misuse, falling, crash, electric shock, drowning, thunderbolt, fire, explosion, traffic accident, personal information drain, voice fishing, violence, and self- suicide etc. Additionally, there are also lots of outer causes such as theft, robbery, collapse, terrorism, pollution, contagious disease, cold wave, typhoon, flood, mountain fire, earthquake, heavy rain, heavy wave, and spill of radioactivity etc.

3.2.2 Enterprise Disaster Prevention Design

Enterprise Disaster Prevention Design is a kind of design which minimizes the loss and continues its business recovering the original function when the company is suffering from crisis and/or disaster. We can submit various kinds of internal causes such as stock price decline, defect in product, rumor, technology spill, employee's disease, walkout, and injustice etc. On the other hand, we can define a lot of kinds outer crisis like stopping business, spilling pollution material or oil caused from fire, flood, and earthquake etc.

3.2.3 National Disaster Prevention Design

National Disaster Prevention Design is a kind of design performed on the level of national or provincial government for protections of life and property of the people. We can list various kinds of large scale disasters which even threat fundamentals of nation. Natural disasters are like flood, heavy rain, earthquake, typhoon, heavy wave, heavy snow, drought, thunderbolt, yellow sands, red tide, tidal wave, and climate variations etc. In addition we can mention national disasters on the level of government like fire, collapse, explosion, traffic accidents, environmental pollution, various large scale accidents in the area of pavement, bridge, tunnel, railroad, ship, and airplane. Contagious disease, medical disasters, energy disaster caused by atomic, water, fire generations of electricity, war, and terrorism are also included in this category.

3.3 Scope of DPD

According to their methods of confrontations, we can extend the scope of DPD like 1)Mitigation or Prevention Design, 2)Preparedness Design, 3)Response Design, and 4)Recovery Design.

In Table 4, we arrange the scope and content of design activities for disaster prevention.

3.3.1 Prevention Design

It is a kind of design activity that protects or suppresses the occurrence of disaster by elimination or decreasing causes of disaster analyzing existing weak points.

3.3.2 Preparedness Design

It is a kind of design activity that strengthens capability and status against disasters throughout planning, preparation, and their education and advertisement before actual disaster occurs. We need repetitive exercising and modification assuming real disaster perspective.

3.3.3 Response Design

It is a kind of design activity that minimizes the damage and reduces the possibility of secondary disaster by rapid coping with it using existing resources and capabilities when actual disaster occurs.

3.3.4 Recovery Design

It is a kind of design activity that recovers the situation as before the disaster, which includes recoveries lost functions and situations. We can also consider recurrence prevention or taking complementary measures throughout evaluation during this kind of activities.

Table 4. Scope and Content of Design Activities for DPD

Scope	Contents
Mitigation/ Prevention Design	City Foundations (signpost, danger mark, and information designs), Disaster Area Notice, Disaster Map(GIS), Safety Facilities, Investigation Equipment of Safety Degree, Content of Disaster Management, Design for Prevention of Crime, Universal Design, Barrier-Free Design, Echo Design, Durable Design etc.
Preparedness Design	Evacuation Facilities, Refugee Camp, Urgent Rescue Facilities, Equipment for Emergency Escape, Education for Disaster, Enlightening Poster, Safety Campaign, e-Learning Content for Disaster Prevention, Disaster Simulations, Safety Management System, Relief Equipment for Weak Hierarchy, Emergency Alarm System, Damage Investigation System etc.
Response Design	Emergency Guide Facilities, Disaster Relief Equipment, Relief Supplies, Life Relief Supplies, Relief Equipment, Emergency Communication Equipment, Urgent Evacuation Shelter, Emergency Medical Supplies, Clothing for Disaster Prevention, Disaster Prevention Supplies, Emergency Electric Equipment, Rescue Robot Design, Rescue Equipment, Weapons etc.
Recovery Design	Refugee Camp, Shelters, Equipment & Supplies for Epidemics Prevention, Life Rescue Supplies, Physical & Psychological Healing Program, Recovery Equipment, Pollution Prevention, Pollution Control, Urgent Recovery Facilities, Emergency Recovery Equipment etc.

3.4 Necessity of DPD

We present necessity of Disaster Prevention Design as in Table 5, which divided into its classification and contents. The increment of uncertainty, interoperability, complexity, and

cumulative characteristics in the future society make the necessity of DPD more serious.

Table 5. Necessity of DPD, Division & Contents

Division	Contents
Increment of Weak-Party for Safety	Increasing gap between the rich and the poor Increasing female's social activities Entering an aging or super aging society Increasing disabled persons because of various accidents
Increment of Dangerous Entries	Increasing natural disasters(climate changes) Increasing artificial disasters Increasing accidents in big cities Diametrical separation in fortune
Increment of Consumer's Requirements	Increasing requirements for safety Increasing personal requirements for services Increasing high quality & variety Increasing urban survivalists Expectation of increment in the market of personal disaster prevention
Social Variations	From recovery to precaution orientation From facilities to human orientation From physical to psychological recovery Increasing requirements for convergence of response, prevention, and recovery

Not only for artificial disasters' causes including social variation and increasing gap between the rich and the poor, but for aging or super aging of our future society, we need to change our design concepts into DPD mentioned above. Naturally, the focus of DPD is moving from facility-oriented to human-oriented, from recovery-oriented to precaution-oriented, from physical rescue to psychological healing etc.

3.5 Strategy of DPD

When we plan a DPD strategy, we should refer to the purpose and characteristics of the selected region and need to make sophisticated assigning priority and weight on elementary performing so that we can apply them more effectively. We can think of 5 strategies of DPD as show in Table 6, which are 1)Precaution-oriented Strategy, 2)Human-oriented Strategy, 3)Sense-oriented Strategy, 4)Legislation Strategy, 5)Environment Friendly Strategy.

Table 6. Design Areas According to Their Strategies for Disaster Prevention

Strategies	Related Design Areas
Precaution-oriented Strategy	Design for precaution of crime Construction of safe village Design for city safety Design of Information etc.
Human-oriented Strategy	Universal design, Life style design Service design, Interface design Inclusive design, Barrier-free design CMF(color material finishing) design etc.
Sense-oriented Strategy	Sensitivity design Psychological healing design etc.
Legislation Strategy	CPTED design Certification mark design Standardization & Formalization etc.
Environment Friendly Strategy	Eco design Design for durability

3.5.1 Precaution-oriented Strategy

Disaster Prevention Design should be performed as a precaution for any kind of disaster rather than a recovery orientation in order to minimize the damage from that disaster.

3.5.2 Human-oriented Strategy

It is required that we have to perform our design activity in order to prevent life of human from the disaster rather than facilities or properties. Therefore scenario and plan for disaster prevention design should be based on the principles of user-oriented and customer's experience.

3.5.3 Sense-oriented Strategy

Although rescue of physical damage from disaster ought to be important, emotional stability and psychological healing are a lot more important for the victims from that disaster. Therefore sense-oriented design should be performed for any kind of disaster prevention in order to minimize secondary or subordinate incidents.

3.5.4 Legislation Strategy

In order that we can effectively perform Disaster Prevention Design and activate its fulfillment, central and provincial governments should be able to force its performance through their laws or regulations.

3.5.5 Environment Friendly Strategy

We continuously need the strategy of Eco design as the danger of energy and resource exhaustions. Because we can contribute for more environmental world by performing like decreasing material usage, optimizing fabrication process, effective logistics, reuse, and recycle.

3.6 Influencing Elements on DPD

Designer has to refer to elements influencing on the process of development when he/she performs Disaster Prevention Design. First of all, we should consider the differences of regional character, academic career, body physicals, and culture. Second, we analyze dangerous elements and their corresponding strategies by considering geographical conditions such as regional environment, traffic and weather matters. Finally, we consider legal elements such as laws, regulations, authentications, and provincial regulations when we are performing DPD.

3.7 Performing Processes of DPD

The process of Disaster Prevention Design is closely similar to general design process. But there are a little difference between the two because DPD always consider precaution, damage minimizing, and recovery against possible disasters. Table 7 shows these performing processes of Disaster Prevention Design.

Table 7. Performing Processes of DPD

Stages	Contents
Planning	Organized data, Design research, Investigations of laws and regulations
Draft	Making Scenario, Concept setting up, Design guideline, Visual structure
Manufacturing	Fabrication of prototype, Investigation of materials for safe/harm Resource reduction plan
Production	Approval of formality, Authentication, and Evaluation, Test for usage, Purpose product
Maintenance & Repair	Continuous management by personnel Evaluation tool Environmental consideration Decreasing maintenance cost

Disaster Prevention Design should keep the principal rules such as precaution-oriented, human-oriented, sense-oriented, legislation, and environment friendly strategies in the process of its production, which can be started after product planning and design guideline set-up.

3.8 Principles of DPD

There are 5 principles of Disaster Prevention Design in order to perform successfully as follows;

First, DPD should be fast and simultaneous in responding to the disaster. Transferring and responding speed must be fast. It must also be used by a lot of people in a short time.

Second, DPD can be used with ease and convenience. It should be conveniently recognized and used according to their culture. At the same time, users' capability of language or information understanding should not be a serious problem when they are willing to approach the design objective. And DPD can sufficiently deliver the necessary information using synesthesia.

Third, DPD should have a complete stability under the given environment. It can prove stabilities in its material or structure. In addition, it should have capability to minimize secondary damage after using the design.

Fourth, DPD should have flexibility and expandability. We should be able to select a usage because of its flexibility in variety of methods. It can also have its various features.

Finally, DPD should be easily used for a long time and have its continuity. It should be kept in custody or used frequently for a long time. Moreover maintenance and repair cost should be cheap.

4. CONCLUDING REMARKS

Characteristics of Danger in the future society are expected to be diversity, abrupt occurring, large scale, and complexity. So the human-oriented design concept naturally participates in activities to prevent our society against these disasters effectively.

In this paper, we have proposed pioneering concepts of DPD(Disaster Prevention Design) as a novel area of design. We presented DPD is an essential design activity in order to cope with dangers expected for future societies and effectively realize securable environments in the future. DPD is also an integrated design aids including preemptive protections, rapid preparing, recovery, and interactive cooperation. We must expect these activities of DPD would be effective for generation of new values in the market, satisfaction of social needs, expansion of design industry, and a novel chance for development in the future society. Throughout this paper, we have submitted a theoretical consideration about disaster and design, various aspects of DPD concepts including definition, classification, scope, necessity, strategy, influencing elements, process, and principle etc. We expect these concepts would be the seed and/or basement of DPD research for the future works.

For the direction of study for DPD in the future, we emphasize alarm system for preemptive protection rather than recovery strategy for the damage occurred. We also need to research about progressive prevention techniques and convergence with other areas of design. Urban survivalists are presenting the needs of personal disaster prevention products and their service market converged with high level technology. In order to transfer the concept of product design from facility-oriented mechanism to human-oriented one, we should develop new kinds of city basis facilities, public-sense design concepts referred to social weak-party, e-Learning content design preparing disasters, and virtual simulation design etc. On the other hand, we have to establish laws and regulations to force central and/or provincial governments to have these DPD strategies applying their regional properties.

These days, modern design activities are expanding to UI(user interface) content design area overcoming the conventional design concept of product and/or service. In addition designers are recognized as art directors or life stylists who would change the human life and create the social value. Therefore we expect design activity would be a very important leadership which changes the life of human beings as well as the conventional role of beauty requirements of mankind throughout this Disaster Prevention Design.

REFERENCES

[1] Korea Bureau of Statistical Affairs, 2012 Report of Social Investigation, http://www.kosis.kr

[2] Yeol Chung, "A Big Earthquake Occurred in Northeastern Part of Japan, the Secondary Damages are Expanding so Japan Shows a Structural Problem," Yon-Hap News Report, Mar. 21, 2011.

[3] Hye-Ryun Kim et al., *Design Strategy 2020 Report*, KIDP 2011, pp.70-71, p.19.

[4] International Sustainable Energy Organization, "World Energy Scenario from 2000 to 2050," ISEO, http://www.uniseo.org/background.html

[5] Eric Garland, *Future Inc*., Korea Economics Newspaper, 2008.

[6] Population Reference Bureau, "2004 World Population Data Sheet", PRB report http://www.prb.org/pdf04/04worlddatasheet_eng.pdf

[7] U.S. Census Bureau, "International Database," USCB report, http://www.census.gov/population/international

[8] Korea Bureau of Statistical Affairs, 2010 Population and Housing Census, http://www.kosis.kr
[9] Min-Ho Baek, *Planning of Disaster Prevention,* National Institute of Disaster Prevention, 2009.
[10] Korea Disaster Prevention Association, *Disaster Prevention*, Kumi-Seokwan, 2012, p.9, p. 496.
[11] Kyung-Won Chung, *Design Business Administration*, Ahn Graphics, 1999.

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