



## Keywords

Engineering,  
Ethics,  
Society,  
Education

Received: November 8, 2017

Accepted: November 22, 2017

Published: January 11, 2018

# Engineering Ethics and Social Responsibilities Education in Civil Engineering

Won Sun King<sup>1</sup>, Lian Duan<sup>2</sup>

<sup>1</sup>Department of Construction Engineering, Chaoyang University of Technology, Taichung, Taiwan

<sup>2</sup>Department of Transportation, Sacramento, California, USA

## Email address

wsking@cyut.edu.tw (W. S. King)

## Citation

Won Sun King, Lian Duan. Engineering Ethics and Social Responsibilities Education in Civil Engineering. *International Journal of Civil Engineering and Construction Science*. Vol. 4, No. 6, 2017, pp. 67-78.

## Abstract

The importance of an education that includes the study of engineering ethics and social responsibilities was investigated. As part of the educational program on engineering ethics and social responsibilities, case studies which examined the corruption of judges and prosecutors, and examples of illegal judgment were reviewed. The document analysis method and questionnaire inquiry method were used. It was found that social responsibility education was much more important than engineering ethics education and that societal corruption cannot be eliminated by engineering ethics education alone.

## 1. Introduction

### 1.1. Education of Engineering Ethics

Engineering ethics is the field of applied ethics and a system of moral principles that apply to the practice of engineering. The field examines and sets the obligations by engineers to society, to their clients, colleagues, bosses, governments, environment, and to the profession. As a scholarly discipline, it is closely related to subjects such as the philosophy of science, the philosophy of engineering, and the ethics of technology.

As engineering rose as a distinct profession during the 19th century, engineers saw themselves as either independent professional practitioners or technical employees of large enterprises. There was considerable tension between the two sides as large industrial employers fought to maintain control of their employees.

In the United States growing professionalism gave rise to the development of four major engineering societies: The American Society of Civil Engineers (ASCE) (1851), the American Institute of Electrical Engineers (AIEE) (1884), the American Society of Mechanical Engineers (ASME) (1880), and the American Institute of Mining Engineers (AIME) (1871). ASCE and AIEE were more closely identified with the engineers as learned professionals, while ASME, to an extent, and AIME almost entirely, were identified with the view that engineers are technical employees. Even so, at that time ethics was viewed as a personal rather than a broad professional concern.

When the 19th century drew to a close and the 20th century began, there had been a series of significant structural failures. These had a profound effect on engineers and forced the profession to confront shortcomings in technical and construction practice, as well as ethical standards. One response was the development of formal codes of ethics by three of the four major engineering societies. AIEE adopted theirs in 1912. ASCE and ASME did so in 1914.

Concerns for professional practice and protecting the public highlighted by these structural failures provided an impetus for another movement that had been underway for some time: to require formal credentials (Professional licensure in the US.) as a requirement to practice. This involves meeting some combination of educational, experience, and test requirements.

The US model has generally been only to require those practicing engineers (i.e. consulting engineers) to be licensed independently, while engineers working in industry, education, and sometimes government need not be licensed. This has perpetuated the split between professional engineers and those in industry. Professional societies have adopted generally uniform codes of ethics. On the other hand technical societies have generally not adopted these, but instead sometimes offer ethics education and resources to members similar to those of the professional societies. This is not uniform, and the question of who is to be held in the highest regard: the public or the employers, is still an open one in industry, and sometimes in professional practice [1].

Baccalaureate degree programs in civil engineering must demonstrate that graduates, in addition to their competencies, are capable of applying principles of construction law and ethics in the program criteria for construction engineering technology, and similarly named programs led by the American Society of Civil Engineers. Courses of engineering ethics taught at universities are not common in Taiwan. There are about ten colleges at universities which teach the course of engineering ethics. Although the Ministry of Education in Taiwan has encouraged universities to teach engineering ethics, colleges have not acted in response to this encouragement. The key points within Chinese culture are morality and ethics. This is a strange phenomenon for Chinese with five thousand years of recorded history.

The engineering ethics of engineers in Taiwan are questioned by the public. Some parts of investments were devoted to disgusting enterprises. The quality of infrastructure is very poor. Government does not pay attention to the problem of engineering quality. In 2009, Taiwan's Public Construction Commission suggested that the Ministry of Examination include the subject of engineering ethics into the license examination for professional engineers. However, nothing was done in response to this request for the past six years. In Taiwan, examinations guide the direction of education. Students do not want to learn engineering ethics because they can get the license for professional engineering practice without taking an examination for engineering ethics. Although the Public Construction Commission asks engineers who wish to renew their professional engineering license to take some credits that may include engineering ethics courses, engineers can take other courses to accumulate credits for renewing their licenses.

## **1.2. Education of Corporate Social Responsibility**

Corporate social responsibility (CSR) is a form of corporate self-regulation integrated into a business model. CSR policy

functions as a self-regulatory mechanism, whereby a business monitors and ensures its active compliance with the spirit of the law, ethical standards and international norms. A business needs a healthy and educated workforce, sustainable resources and adept government to compete effectively. The rise of ethics training inside corporations, some of it required by government regulation, has helped CSR to spread. An effective CSR program can persuade governments and the public that a company takes health and safety, diversity and the environment seriously, reducing the likelihood that company practices will be closely monitored. Better governmental regulation and enforcement, rather than voluntary measures, are an alternative to CSR that moves decision-making and resource allocation from public to private bodies. In the 1800s, the US government could take away a firm's license if it acted irresponsibly. However, government is also a huge enterprise which should also operate with a sense of CSR. Hence, government, corporations and individuals should have responsibility to society. Responsibility can have positive and negative directions. The positive direction of responsibility should be sought while the negative direction of responsibility should be avoided [2].

The development of character through education has been discussed by the public in Taiwan. There have been many cases of social irresponsibility in Taiwan. Corruption within the Taiwan Government is a very serious problem. Some people thought that teachers in schools should have the responsibility to correct and educate students as a means of reducing cases of social irresponsibility. It was also thought that the development of character through education had failed because students who move into professional practice are affected by social maladies and engage in corrupt behavior. For example, there are many cases where corruption within engineering practice has happened in Taiwan society within academia, private industry and government. Students observe and learn this bad behavior from society.

There is a course about Citizenship and Morality in Taiwan's elementary and high schools. The course teaches students about the responsibilities of citizenship within societies, autonomy, ethics, democratic disciplines, laws, government, culture and life. The Ministry of Education in Taiwan enforces the requirement that elementary and high schools teach the course of Citizenship and Morality because the government thought the course of Citizen and Morality was helpful to introduce the concepts of corporate social responsibility and appropriate individual behavior within society.

## **1.3. Education Includes Engineering Ethics and Social Responsibility**

It is aimed to understand whether an education of engineering ethics or social responsibility as learned through exposure to the behavior of society is more important. Teachers can offer the course of engineering ethics in schools. But, school cannot control the lessons in social responsibility

students receive through exposure to the behavior of others within their workplaces, exposure to the media, and their lives. Can the educational effect of engineering ethics contend and balance the educational effect by life lessons of social responsibility which are learned by overserving the behavior of others? Is it helpful for the education of engineering ethics that social duty education is positive, righteous, and law-abiding? Is it unhelpful for the education of engineering ethics that social duty education is negative, evil and lawless? It is the purpose of this study to investigate that the influence of engineering ethics and social responsibility educations on students' understanding.

## 2. Literature Review

### 2.1. Education of Engineering Ethics

A textbook of engineering ethics, based on a research project on engineering ethics [3] supported by Taiwan's National Science Commission, was published in 2009 [4]. There are six chapters including many cases, exercises, and 178 construction illustrations. The pictures are helpful to professional engineers as they illustrate the nature of construction problems. This text can guide students to learn engineering ethics and professional morals systematically and can be used not only by engineers but also their employers and the public. The textbook includes many engineering problems which have occurred frequently in Taiwan society. The domestic and foreign curricula and teaching methods were adopted to arrange the course of engineering ethics at Chaoyang University of Technology. This textbook has been adopted by several other universities. Construction engineering is of critical importance to the public. Construction engineering can result in huge financial overruns for projects in Taiwan and as a result, building developers raise the price of houses/apartments. However, the quality of building is very poor. Hence, the engineering ethics of construction is introduced in chapter five of the textbook. The related laws and judiciary cases are introduced in chapter six to illustrate the serious consequences to the finished construction project of a violation of engineering ethics.

There was a very serious earthquake in Taiwan September 22, 1999. Damage caused by the earthquake included 2,415 deaths, 29 missing, 11,305 severely wounded, with 51,711 buildings completely destroyed, 53,768 buildings severely damaged, and a total of New Taiwan Dollars (NT\$) 300 billion (US\$10 billion) worth of damage. It was the second-deadliest quake in recorded history in Taiwan, after the 1935 Hsinchu-Taichung earthquake. The epicenter was at 23.77° N latitude, 120.98° E longitude, 9.2 km southwest of Sun Moon Lake, near the town of Jiji, Nantou. The tremor measured 7.6 on the Moment magnitude scale, 7.3 on the Richter scale, and the focal depth was 8.0 km. Taiwan's Central Weather Bureau recorded a total of 12,911 aftershocks in the month following the main tremor.

The public did not understand why buildings collapsed. Peoples did not know that building developers had hidden

many mysteries and enigmas in the planning, design, construction and maintenance of structures. There was not a clear understanding of why the government provided permits to building developers as well as establishment and usage licenses for structures which performed so poorly in service [5].

Within the textbook there are several problems in construction engineering illustrating lawless behavior or poor design, resulting in the destruction of nearby buildings, spoiling infrastructure which serves a building and other nearby buildings and environmental harm. The aim of the text was to provide the education of engineering ethics focused on civil and construction engineering and the moral course was arranged to improve the quality of buildings [6].

A paper addressing improvement of quality of construction education in Taiwan was published in the *Journal of Professional Issues in Engineering Education and Practice* [7]. *Although those engineering problems occurred in Taiwan, that research was accepted and published by ASCE.* The text and papers described demonstrate that a technical education which includes engineering ethics is very important and helpful to students.

### 2.2. Education of Social Responsibilities

A thorough education of engineering ethics is the first line of defense to guide people toward doing what's right. Laws, standards and judgments are the last line of defense to punish people in doing what's wrong. The effects of judges and prosecutors' conduct and adjudications on the education of social responsibility are considerable. Hence, judges and prosecutors' conduct and adjudications are used here to explain the importance of their behavior on social responsibility education for engineers.

There is a proverb that there are millions of clauses of laws, but a strip of gold is more valuable than the millions of clauses of laws in Taiwan. A distinguished lawyer Ji-Ming Chang, who has been deemed "The Asia Lawyer" [8], helped the Matra Company in France accuse the Taipei City Government for problems encountered with the development of a mass rapid transit system. He turned defeat to victory and secured hundreds of millions NT\$ for the Matra Company's compensation. There were three times in his career when he found it necessary to protest judges who had already decided cases before their adjudication. He won those three lawsuits and wrote down what based upon his experience is the truth about Taiwan judiciary. His writings reveal the behind the scenes actions of a sinister judiciary. He said the truth is that some judges took bribes and that prosecutors were too weak. There were so many strange phenomena which occurred within the courts he became disillusioned and did not want to be a lawyer any longer and retired after 25 years of attorney service in 2011.

According to the 2015 crime victims' governance satisfaction survey executed by Crime Research Center, National Chung Cheng University in Taiwan [9], there were 84.6% people across the country who did not believe that judgments by judges are fair and impartial, and there were

76.5% people who did not believe that prosecutors are righteous.

### 2.2.1. Corruption of Judges

Mr. Jing-Bin Hu, a judge in the Taichung Branch Court, Taiwan High Court, liked to drink wine, party with girls, and take bribes. He has three wives simultaneously and six children. His wives and children do not work. But, his families have property valued at three hundred million NT\$. The prosecutor had collected evidences of bribes for three years. His third wife hid the most property and was the broker who received and saved money. His third wife had a deposit of NT\$ one million, investments of ten million, real estate, NT\$ ten million cash in house, and an automobile valued at NT\$ one million. The total assets for the third wife were one hundred seventy-one million eight hundred twenty thousand NT\$. The second wife was sick and needed nursing. She needed two hundred thousand NT dollars every month for her cost of living. The second wife and her children's total assets were sixty-three million, one hundred thousand NT\$. The first wife and her children have deposits of NT\$ ten million, real estate in Taipei City and Taichung City, and nineteen pieces of gold bullion. The total assets are ninety-eight million, six hundred fifty thousand NT\$. It is impossible that Judge Hu's income could support his huge amount of properties and luxury expenses [10].

### 2.2.2. Corruption of Prosecutors

Mrs. Yu-Zhen Chen, a prosecutor in the Taiwan High Prosecutors' Office, has taken bribes since 1999. She had been a head prosecutor in Yilan county and Banqiao county before she was promoted to the Taiwan High Prosecutors' Office. She took bribes 81 times for twenty-three million, two hundred fifty thousand NT\$ in six years and eight months continuously. She asked casino companies to pay her travel, food and entertainment. She used the loophole of investigation to keep secret information illegally. She advised criminals how to avoid investigations by the police and other prosecutors. Criminals who were arrested and sent to court, she chose not to prosecute. The criminals paid her bribes of one hundred thousand NT\$ every month. Prosecutor Chen to date is the government official who has been proven to have engaged in corrupt activities for the longest period of time and who has taken the most money. Her corrupt activities were found by the Special Investigation Unit of the Prosecutor. According to accounts in the media, people think that a female prosecutor who takes bribes means that the judiciary as a whole is very corrupt [11].

### 2.2.3. Example of Illegal Judgment

This example is provided by the first author and is based upon his personal experience as a plaintiff. He appealed an illegal usage license of a building to Taipei City Government which had issued the license rejected his appeal. It is a strange system in which the Urban Development Department in Taipei City Government approves illegal establishment and usage licenses, the plaintiff is then required to appeal this concern to that same Taipei City Government. It means that a player in

contest is also a referee and is a clear conflict of interest. Cases of this sort could be heard at no cost in the Administrative Court level in Taiwan; however, in order to reduce the amount of cases, the Administrative Court has asked the plaintiff to pay judgment fees, making the pursuit of an appeal against improper usage permits an expensive proposition. After the appeal was rejected at the Administrative Court level the plaintiff appealed to Taipei High Administrative Court. Taipei High Administrative Court rejected his appeal too. Then, the plaintiff hired a lawyer and appealed to the Supreme Administrative Court. However, the Supreme Administrative Court rejected his appeal too. The plaintiff did not satisfy the Supreme Administrative Court's judgment. He appealed to the Supreme Administrative Court for a retrial. But the Supreme Administrative Court rejected his retrial. The reason is that judges have the right to adopt or not to adopt evidence for a retrial. In other words, judges only adopted defendants' evidence but did not adopt the plaintiff's evidence. There is no justice of nature in Taiwan. It means that judges are suspected of taking bribes when judges adjudicate illegally. The illegal evidences are listed below [12].

#### (1) Spacing between Two Buildings to Prevent Collision due to Earthquake

Taiwan's Building Technical Specification published January 1, 2006 by the Construction and Planning Agency requires that two adjacent buildings must be kept at a specified spacing to prevent collision due to an earthquake. The design standard has been enforced since 2006 because 2,415 people died due to complete collapse of 51,711 buildings and 53,768 buildings which were damaged in the 1999 Jiji Earthquake.

Two buildings, A and B are shown in Figure 1. The left building A is the plaintiff's old house, a two story building built more than 80 years ago. The right building B is an illegal ten-story building built in 2012. According to the building-resisting earthquake design standard, the right building B should have a setback distance of 11.18 cm calculated by the professional civil engineer from the border of land. A distance of 100 cm as designed by the architect from the left side of building B to the border of land is shown in the design diagram approved by City Government. The planned distance of 100 cm is greater than the calculated 11.18 cm. Hence, the two buildings will not impact each other during an earthquake. Building A is not allowed to be rebuilt because the land is too small according to the law. So Building A cannot be moved from the border of land. The distance between Buildings A and B should be two times 11.18 cm in case of collision between the two buildings. The planned spacing of 100 cm is greater than 22.36 cm. However, the current distance from border of land to the left side of Building B is only 4 cm. The 4 cm interval was measured by the Land Administration Office ordered by a prosecutor. But judgment said that Building A is 8 cm from the border, that adding 4 cm is 12 cm. 12 cm is greater than 11.18 cm. Hence, the new building is illegal.

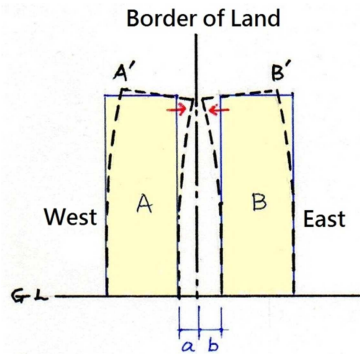


Figure 1. Buildings A and B.

As shown in Figure 1, in the spacing of 11.18 cm, “b” is equal to “a”. Two buildings will move in opposite directions. Building A may move to the right direction of the distance A' and Building B may move to the left direction of the distance B'. Hence, the spacing between the two buildings should be 22.36 cm. The 80-year old, two-story building is like an egg. The new ten-story building is like a stone. An egg will break when a stone impacts an egg. Then, plaintiff's old house will be destroyed and the inhabitants may die. The judges did not care about people's safety. The judgment is not legal, fair and just. So every new building can follow the illegal building with a spacing of only 4 cm. That means judges are more powerful than laws. Laws can be destroyed by judges. The plaintiff applied for an explanation of the definition of the spacing to the Construction and Planning Agency and the National Applied Research Laboratories. They explained that the spacing should be measured from the property border and should not be calculated by adding “a” and “b” in Figure 1. The spacing should be kept by the building itself. But the judge in the Supreme Administrative Court said the explanation is too late. The explanation should be proposed in the beginning at the Taipei High Administrative Court. However, the law is the law, and the explanation of the law is not the private evidence. If a judge does not know the meaning of a law, he should ask an expert to explain it. Some architects were punished by the Ministry of the Interior because they did not keep the spacing of 15 cm between buildings designed in 2010. Those punishments should be canceled if the interval of 4 cm is legal.

#### (2) Fake Certification for Fireproof Glass Bricks

There is a 105 cm height reinforced concrete wall under the glass-brick wall in the original approved design plans to support the glass-brick wall as shown in Figure 2. The outside wall should be fireproof at least for a period of one hour according to the Taiwan's Building Technical Specification published by the Construction and Planning Agency. The original reinforced concrete wall can resist the forces of an earthquake. But the glass-brick walls cannot resist earthquake forces. The building developer did not follow the original approved plan to construct Building B. The glass-brick walls were expanded taking the place of the reinforced concrete walls shown in Figure 2, which were previously intended to be placed above and below them as shown in Figure 3. Once earthquake and/or fire happen, Building B could cause a

public disaster. The glass-brick walls are part of fire-fighting equipment and should be checked before acceptance. But the officers in the Taipei City Government accepted the illegal glass-brick walls and issued the usage license for this building.

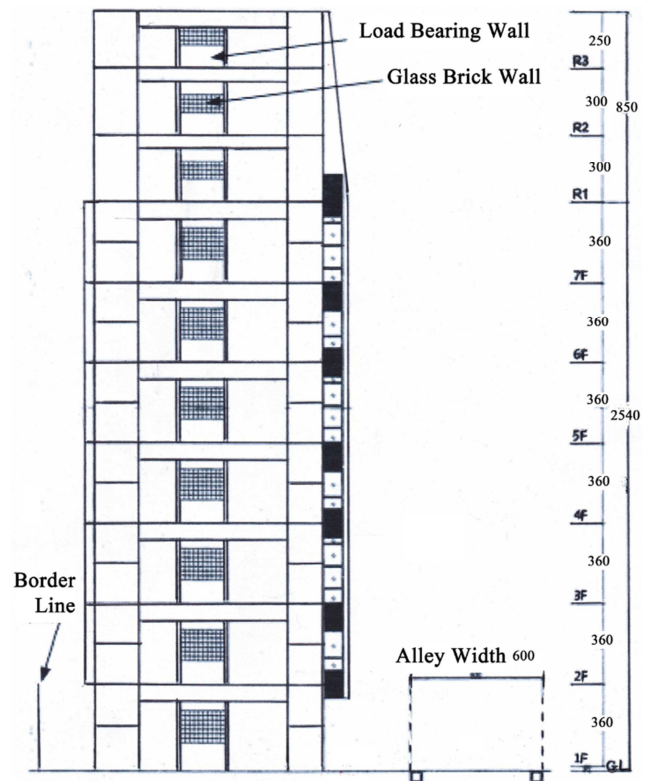


Figure 2. The Approved Plan of the West Side of Building B (Unit: cm).



Figure 3. The Current View of Glass-Brick Wall.



This is evidence to prove this is an illegal building. But judges chose to ignore the evidence and stated the evidence could not be adopted unless the prosecutor appeals to a criminal court and another judge adjudicates the evidence is illegal. It is shown that the plaintiff has to pay much more money for judgment fees and hiring lawyers and spends much more time when attempting to secure a judgement against illegal or poor building practices.

### (3) The East Side of Building Occupying the Road



*Figure 4. East Side of Building B Occupying the Ditch.*

The plaintiff finally was approved to copy all those design drawings of Building B on January 2013. The plaintiff hired the Taichung City Civil Technician Association to survey and investigate the problem of the east side of the building occupying the road. The Civil Technician Association compared the design drawings and proved that the east side of building should be located 40 cm from the allowable construction line. The allowable construction line is beside the public ditch. The public ditch is beside the road which is six meters in width. But the east side of Building B extends beyond the allowable construction line 22.5 cm and over the space originally allocated for the public ditch as shown in Figure 4. Hence the east side of Building B expands 62.5 cm. Building B developer attempted to increase the floor areas to make more profits. The defendant and the developer fabricated official documents to state the east side of the building did not occupy the road. The public ditch is used to drain floods. The construction of Building B also destroyed the original public ditch and a narrower ditch was rebuilt. The east-side walls are very near the covers of drainage inlets and a potential flood disaster could occur in a heavy rain. The cover of the original ditch could be opened. The new cover built by the developer is fixed and cannot be opened. When debris causes an obstruction of the covers on the relocated public ditch, engineers will not be able to open the cover to complete repairs. The public ditches belong to the public. But the judge stated that the plaintiff does not have the right to appeal this issue because the plaintiff's house is on the west side of Building B and this concern is not related to the concern raised by the plaintiff about the east side of the building. According

to the theory of fluid mechanics, once the ditch beside the east side of Building B is stuck, the flood will flow to the plaintiff's house. The judge could not state that the public ditch beside the east side of Building B is not related to the plaintiff's house. Another reason is that roads beside the east side and the south side of Building B are one-way from north to south and from east to west, respectively. Fire fighting vehicles must go through the road beside the east side and the south side of Building B to arrive at the plaintiff's house. Fire fighting vehicles are big and their turning movements may be prevented by the east extension of Building B. This is a serious concern for fire fighters. The judge should not state the extension on the east side of Building B is not related to the plaintiff's house.

### (4) The Plaintiff's Kitchen Wall Cracked due to the Developer Demolishing the North Wall



*Figure 5. Cracks on the Plaintiff's Kitchen outside Wall.*



*Figure 6. Leakage on the Plaintiff's Kitchen Floor.*

The Building B developer demolished the north old wall without permission and built another new wall at the same place. The old north wall belongs to the Ministry of the Interior's dormitory. The length of enclosures permitted by Taipei City Government is 23 meters. The original plan does not have the new north wall. The developer has to apply for a dismantling license before demolishing any old building. The old wall is the one of the sundries including in building according to Architecture Laws. The defendant did not show the dismantling license but let the developer demolish the old north wall and build a new wall. The evidence is that the length of the total new enclosing wall is 35.96 meters written on the usage license. 35.96 meters minus 23 meters equals to 12.96 meters. The length of the old north wall is 12.96 meters. The judge of the Taipei High Administrative Court stated that the north old wall does not belong to the plaintiff and demolition of the wall is not related to the usage license, so the plaintiff cannot appeal this issue. The plaintiff's kitchen walls were cracked due to strong vibrations created by the demolition of the north walls. The prosecutor stated that walls which were demolished are not a part of the house and the developers are not responsible for the wall cracks within the plaintiffs' kitchen. The judge of the Taipei District Court stated that the developer does not have to provide compensation and repair the cracked kitchen walls. Rain leaks through the cracks into the plaintiff's kitchen and accumulates on the floor as shown in Figures 5 and 6.

#### (5) Gas Steel Pipe Setting Illegally

The developer placed open-air steel gas pipes on the top of the new north wall and turned south beside the plaintiff's kitchen as shown in Figure 7. According to the Taiwan's Building Technical Specification published on June 30, 2011, steel gas pipes in building base which are outside the building, should be laid hidden in the earth at least 30 cm underground. Steel gas pipes going to a kitchen in a building should be laid hidden in hollow walls. Those open-air steel gas pipes are exposed to the sun and rain and battered by the wind and the acid rain. Those open-air steel gas pipes because of their exposure will be more subject to corrosion. Those open-air steel gas pipes on the top of a wall are vulnerable and more subject to damage in an earthquake and to have the potential to cause fires. If the gas leaks out from the steel pipe or explodes, it will cause danger to the public and the houses near Building B. The steel gas pipe is one of facilities which are important for fire control and which are considered the main equipment of the building. Main equipment should conform to laws for public safety and be approved in order to obtain a usage license for a building. When considering the case of Buildings A and B, the judge made an error in stating that even if the steel gas pipes were set up illegally, it was not related to the appeal of the request to cancel the usage license or permit for the building.



*Figure 7. Open-Air Gas Steel Pipes on the Top of the New North Wall.*

#### (6) Basement Enlarging Excavation Illegally

The original design plan of the basement for Building B is shown in Figure 8. The land on the north-east corner should not be excavated according to the original plans. The as-built plan which illustrates the dimensions of the basement after completion of construction is as shown in Figure 9. It is obvious that there must have been a construction change order for the basement during construction that allowed the additional excavation and change in the basement's dimensions. However, there is no record of the construction change order in the Building Management Engineering Department of Taipei City Government. The building officer Zheng returned a document on December 5, 2012 which stated that Building B did not have any design changes. So the as-built plan of the basement indicates that unapproved changes which occurred were illegal. The basement should have been constructed in accordance with the original design plan. This evidence can show that the judgment is not the truth and violates laws. The developer enlarged the excavation of basement in order to enlarge the floor areas because the prices of land and apartments are very expensive. The developer was motivated by the possibility of greater profits if the floor areas were expanded. The weights of structures such as slabs, columns, beams, foundations and roofs were increased because of the changes that have been made. Once the soils under or adjacent to Building B are disturbed during an earthquake or flood, it will cause uneven settlement of the building. But the judges decided and stated that surveying each floor's area to prove the changes in dimensions shown on the as-built plans was not necessary even though the plaintiff asked to do that. Inasmuch as judges did not believe the Technician Accreditation Report obtained by the plaintiff which provided a survey of the building and property lines, judges should order a third independent party to measure each floor's area. Otherwise, it would appear that the judges did the plaintiff an injustice on purpose. The judges stated in their verdict that Building B was checked by the contractor and his full-time engineers, and then rechecked by their supervisor (the original design architect), so the defendant thought that the basement was constructed based on the original design plan. The judges stated that the usage license of building is lawful. The plaintiff disagrees and feels that the contractor and his full-time engineers, and the original design architect are not being honest.



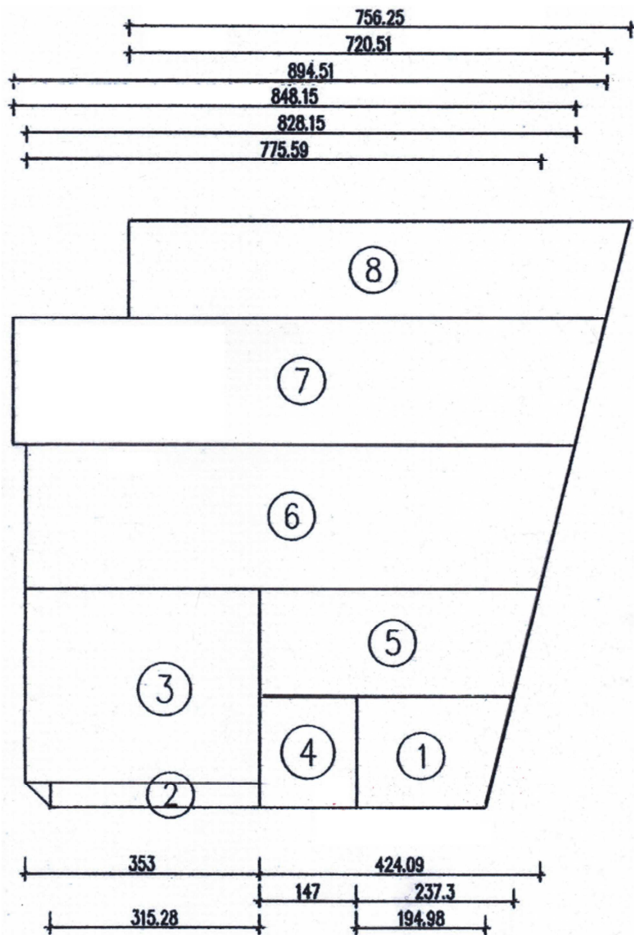


Figure 8. Original Design Plan of the Basement (Unit: cm).

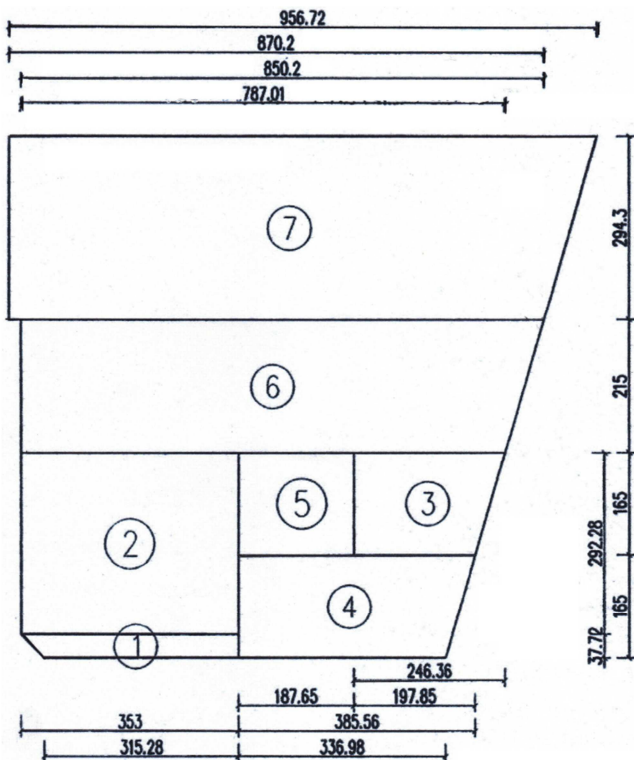


Figure 9. As-Built Plan of the Basement (Unit: cm).

#### (7) Violation of the Limiting Height Ratio

The limitation of height ratio for new buildings is 1.5 to 1 in residential areas of Taipei City. It means that the height of a building beside a road may be at most one and one-half of the road's width. The tallest height of a building is the sum of an adjacent road's width and the depth of building multiplied by one point five (1.5). For example, Building B is nine meters in height because the width of the adjacent road is six meters as shown in Figure 10.

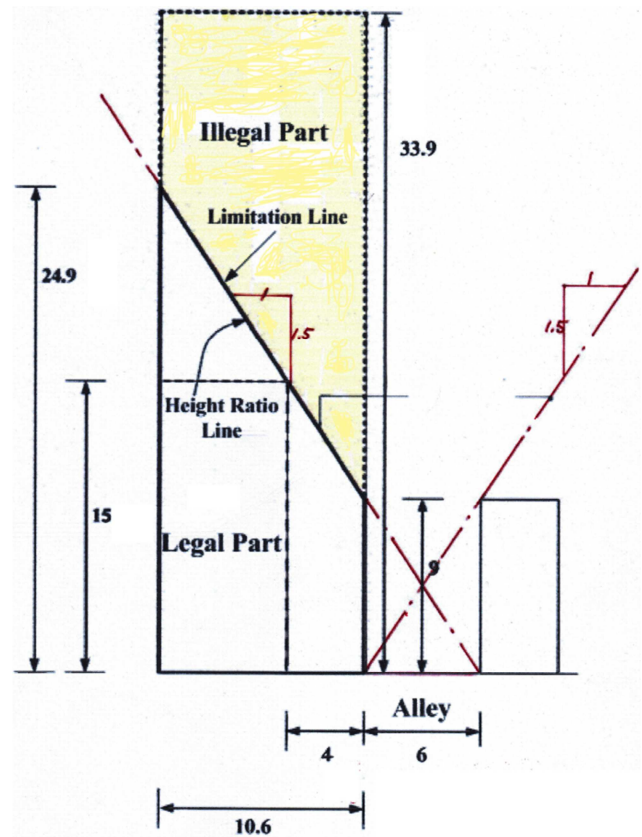


Figure 10. Limiting Height to Width Ratio 1.5 to 1 of Building from South View (Unit: meter).

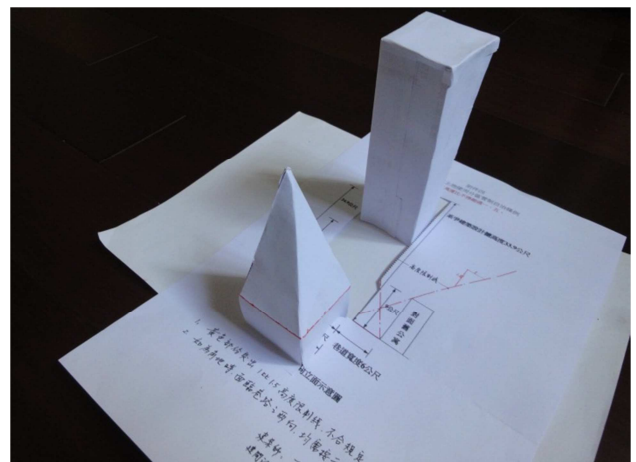


Figure 11. Models of Building B in Cutting Height.

The depth of the building is 10.6 meters. So the tallest height of building should be 24.9 meters. But the tallest height



of the Building B is 33.9 meters. The cutting height should be done from east to west and from south to north twice because the land on the corner of two roads' intersection such as a part of the pyramid as shown in Figure 11. So the new building can be built legally under the limitation line. But Building B with ten-story was built. The height of Building B violates the Land Using District Restraining Self-Rule Regulation of Taipei City Government.

In response to the plaintiff's concern about the height of Building B, the defendant referred to the second article of the Land Using District Restraining Self-Rule Regulation: if a building on an irregular plot of land has an area less than 1000 square meters, withdraws four meters from the front and the rear base lines, the building cannot be limited by the limitation of height ratio. According to the fourth article of the same Building Act, the "buildings" mentioned in this Code refer to the structures or miscellaneous works fixed on the ground or

under the ground surface, having top covers, beams, columns, or walls, and used for individuals or the public. Building B expanded the floor areas to south and north directions. In the eight-meter withdrawn front and rear areas, there are enclosing walls, building outside walls, entrance of basement and basement, beams, columns, and slabs. There is a triangular area in the west-north corner between the 4-meter withdrawing line and the Y2-Y2 line (Figure 12). The automobile parking lot number 1 is in the south of the building on the first floor. So the building on the first floor does not have outside walls in the south direction. Once the building is without outside walls, the 4-meter withdrawing south line should be replaced by the substituting column center line Y1-Y1 (Figure 12). But the line Y1-Y1 is less than four meters from the front base line. Hence, Building B violates the limiting height ratio in the eleventh Article of the Land Using District Restraining Self-Rule Regulation.

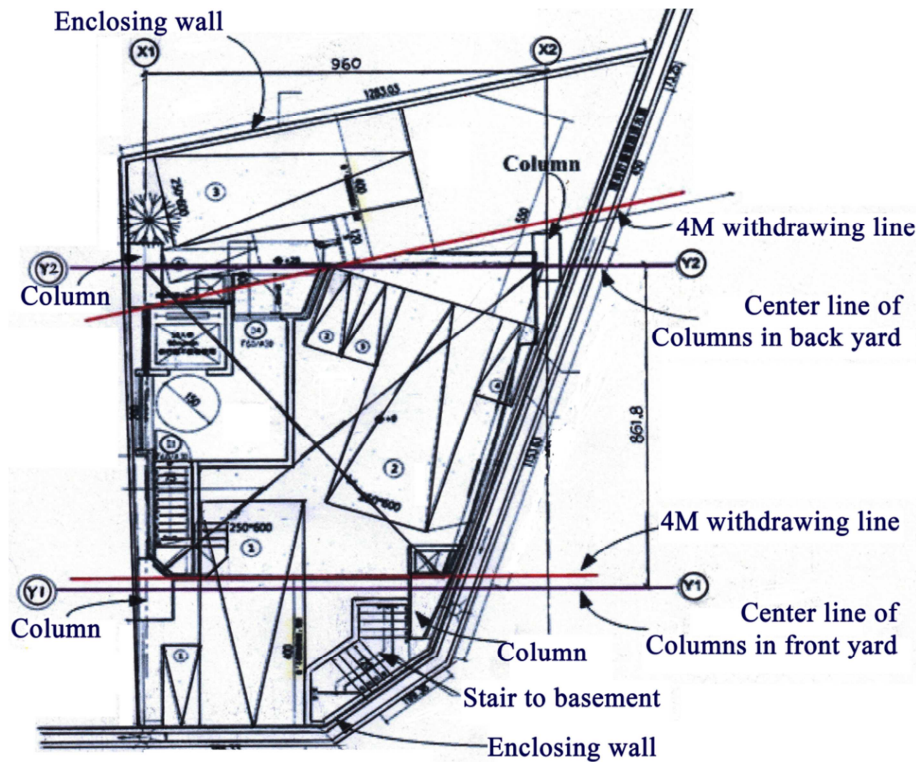


Figure 12. Design Plan on the First Floor of Building (Unit: cm).

#### (8) Illegal Erection License

According to the judgment of the Taipei High Administrative Court in 2009 (Accusation Number 2467), a case that caused a great sensation is related to a controversial issue about the Won-Lin-Yuan event in Taiwan society, the same chief justice decided that the plaintiff Mr. Wang lost a lawsuit. It means that Mr. Wang has to join the project of building renewing. Mr. Wang's house was torn down enforcedly by Taipei City Mayor Lung-pin Hau. But Mr. Wang did not want to join the project of building renewing.

The reason for the judgment is according to Taipei City Renewing Autonomy Regulation Article 14, the approved renewing area cannot occur beside adjacent land that will not be renewed. Mr. Wang's land cannot renew itself. Hence, Mr.

Wang should join the renewing project beside his land. So, the decision to have by the Taipei City Government to have Mr. Wang's old house torn down is legal. The judgment was decided on May 26, 2010. The erection license of the new building beside the plaintiff's land was approved by the Taipei City Government on February 15, 2011. Officers in the Taipei City Government and the Taipei High Administrative Court knew the above Autonomy Regulation Article 14 very well. The defendant (Taipei City Government) violated the above Autonomy Regulation Article 14 and issued the illegal erection license to the building developer. The same chief justice stated that the usage license of the new building beside the plaintiff's land was legal. However, the plaintiff's land cannot be the site for the erection of a new building because

the size of the lot of land is too small. But Mr. Wang's land was also too small and had to join the renewing project beside his land. The same chief justice made two contradicting judgments. He decided that Mr. Wang's land had to be renewed together with the new renewing project beside his land. It is doubtful that officers in the Taipei City Government and the Taipei High Administrative Court took bribes.

#### (9) Questionable Original Design Data

Building Act Article 1 states that this Act is enacted to implement building management to maintain the public safety, health, and mobility, and to improve the appearance of cities. For any affairs other than prescribed hereinto, other laws apply. Every building developer has to obey the Building Act and Building Technical Regulations. Officers in City Government examine if the new building project complies with the Building Act and then approve the projects. But, the original design data calculated by structural analysis computer program were kept confidential and were not provided for examination. The erection license was given first, then City Government expressed that the erection license had not matched the building codes. The reverse administrative procedure is incorrect. The original design has to be changed to meet the requirement specified in the Building Act. However, the developer constructed continuously and violated the Building Act without the approval of design changes.

#### (10) Disregarding of the Technician Association's Accreditation Report by the Judge

The Taichung City Civil Technician Association found that the as-built Building B plan is different from the original design plan. The Technician Accreditation Report is evidence and can assist judges in making decisions. The technicians are qualified by the Government and authorized by the law to investigate. Hence their accreditation report has statutory effect. Judges should adopt the Technician Accreditation Report. In this case judges chose not to accept the accreditation report and instead asked a third authorized party to investigate again. The judges chose to disregard the Technician Accreditation Report completely; as a result the only adopted evidence was given by the defendants. The judges chose not to consider and not to adopt evidence given by the plaintiff stating they have the right to accept or not to accept any evidence. According to the Administrative Procedure Law, judges should ask the other authorized party to investigate again. Judges cannot decide just based on their own proof. According to Taiwan's Law on Judges, judges should make their decisions based upon the constitution and laws and should try cases ethically, morally, independently, and justly.

It is shown that judgments can violate laws. No one can control judges in Taiwan. Even, the President of the Republic of China answered the plaintiff that he could not interfere in judicature or the actions of judging. Judicature is the last defense of ethics and morals. Judges and prosecutors are the guardians of laws. In this instance judges and prosecutors said that illegal is legal, wrong is correct, and developers are not guilty. However, teachers teach students to be ethical and law-abiding. The education provided negative social events as

described in this case can destroy the positive education in schools.

## 3. Research Method

The following methods adapted in this study are explained below.

### 3.1. Literature Review Method

A literature review is a text of scholarly papers, which includes the current knowledge including substantive findings, as well as theoretical and methodological contributions to a particular topic. Most often associated with academic-oriented literature, such as theses, dissertations or peer-reviewed journal articles, a literature review usually precedes the methodology and results section, although this is not always the case. Literature reviews are also common in a research proposal. Its main goals are to situate the current study within the body of literature and to provide context for the particular readers. Literature reviews are a basis for research in nearly every academic field. The literatures include social news and reports published by these verdicts of judgment cases. Those documents are analyzed, compared, and become the basis of the study.

### 3.2. Questionnaire Method

A questionnaire is a research instrument consisting of a series of questions and other prompts for the purpose of gathering information from respondents. Although they are often designed for statistical analysis of the responses, this is not always the case. The questionnaire was invented by the Statistical Society of London in 1838. Questionnaires have advantages over some other types of surveys because they are cost effective, do not require as much effort from the questioner as verbal or telephone surveys, and often have standardized answers that make it simple to compile data. However, such standardized answers may frustrate users. Questionnaires are also sharply limited by the fact that respondents must be able to read the questions and respond to them.

## 4. Results and Discussion

### 4.1. Positive Education of Engineering Ethics

The first author offered the course of engineering ethics at Chaoyang University of Technology in 2010 from February to May. A textbook written by the first author was adapted in that course. Two questionnaires before and after the course were taken to understand the education effects. The mean values (Mean), standard deviations (SD), T-test value (t), and asymptotic significant values (P) were calculated by the SPSS computer program. Likert five scoring point ranking was used. One-point is strongly disagreeing. Two-point is disagreeing. Three-point is neither disagreeing, nor agreeing. Four-point is agreeing. Five-point is strongly agreeing. When the P value is less than 0.005, it means that students' opinions are consistent

and significant, and then education effects either positive or negative can be determined.

The analysis results are shown in Table 1. The agreement mean value after the course increased significantly. There were 36 students that joined this survey. The mean data values are calculated before and after the course. It can be seen that

all data of mean value after the course are greater than that before the course except numbers 13, 14, 15 and 17. The results of numbers 13, 14, 15 and 17 showed that students did not agree on those question items. They thought this course should be required, three hours, and three credits in a semester. Item numbers 6, 7 and 10 did not have significant differences.

**Table 1.** Positive Education Results of Engineering Ethics by Questionnaire Method.

No.	Item	Before		After		t	P
		Mean	SD	Mean	SD		
1	I know why I have to select this course	4.00	0.76	4.36	0.59	-2.60	0.01
2	I know what engineering ethics is	3.86	0.80	4.44	0.61	-4.16	0.00
3	I know what professional morals are	4.17	0.74	4.47	0.51	-2.23	0.03
4	I know of real cases which violated engineering ethics	3.64	0.87	4.39	0.60	-5.35	0.00
5	This course is helpful to me as a student of professional technology	4.00	0.72	4.36	0.59	-2.50	0.02
6	This course can assist me after I get a job	4.36	0.68	4.39	0.69	-0.20	0.84
7	To obey professional morals is more important than to pursue benefit	4.47	0.61	4.44	0.65	0.22	0.83
8	It is the basic duty of engineers to obey ethics and morals	4.47	0.61	4.67	0.59	-1.42	0.16
9	The content of this course is meaningful	4.19	0.62	4.36	0.68	-1.14	0.26
10	The teaching methods are satisfactory	4.28	0.61	4.25	0.65	0.22	0.83
11	The evaluation method for a grade is suitable	4.44	0.61	4.53	0.70	-0.57	0.57
12	This course should be three hours, three credits in a semester	3.61	1.32	3.72	1.09	-0.44	0.66
13	This course should be two hours, two credits in a semester	3.78	1.22	3.58	1.38	0.77	0.44
14	This course should be two hours, one credit in a semester	2.42	1.02	2.03	0.88	1.94	0.06
15	This course should be one hour, one credit in a semester	3.28	1.32	2.58	1.18	2.49	0.02
16	This course should be required	3.81	1.14	4.28	0.81	-2.40	0.02
17	This course should be selected.	3.25	1.02	3.03	1.21	0.83	0.41
18	This course should be offered for engineers in society	4.22	0.72	4.58	0.50	-3.17	0.00

## 4.2. Negative Education of Social Responsibilities

An example of an illegal building adjudicated to be legal construction by judges and a questionnaire as shown in Table 2 were given to 99 students in April 2014. Twenty-nine students selected the Engineering Ethics course. Seventy students selected the Construction and Environment course. Likert five scoring point ranking was used. One-point is strongly disagreeing. Two-point is disagreeing. Three-point is

neither disagreeing, nor agreeing. Four-point is agreeing. Five-point is strongly agreeing.

Students thought the positive education of social responsibilities is helpful to the education of engineering ethics. Education of social responsibilities is more important than that of engineering ethics. The education of ethics and morals and law governing should be enforced on common people in society and officers in government. Engineers, administrative officers, and judiciary officials who violated laws should be assessed and punished.

**Table 2.** Results of Questionnaire about Education of Social Responsibilities and Engineering Ethics.

No.	Item	Number	Mean	SD
1	Education of social duty is more important than that of engineering ethics	99	4.0808	1.00688
2	Engineering ethics education in school can contend with negative education of social duty	99	3.1818	1.09137
3	I think that engineering ethics education is of no use because of the negative education of social duty	99	2.8182	1.07251
4	The positive education of social duty is helpful to the education of engineering ethics	99	4.3131	0.72346
5	I think that engineering ethics education is of no use because of the news of corruption by officers in government	99	2.9293	1.23926
6	I think that engineering ethics education is of no use because of the last defense of ethics destroyed by judges, prosecutors, and police due to bribery	99	3.2626	1.32161
7	I think that engineering ethics education is of no use when I see the statistical results in Figure 8	99	3.0202	1.07836
8	I think that engineering ethics education is of no use when I see the example of an illegal building adjudicated as legal construction by judges	99	3.1818	1.26462
9	The education of ethics and morals and law governing should be enforced on common people in society and officers in government	99	4.7374	0.54559
10	Engineers, administrative officers, and judiciary officials who violated laws should be assessed and punished	99	4.8182	0.45989

## 4.3. Discussion

After some students saw the above example of illegal building, they said that selection of the department of construction engineering to study was wrong. They said that they should select the department of law, and pass the

examination to be a judge or prosecutor playfully. Students thought that judge or prosecutor can make a lot of money. Positive education can solve the problem of corruption. For example, students should be arranged by normal placement in each class in primary school. However, some schools arranged students in different classes by scoring placement. The scoring is based on course test, and not on the behavior of morality.



Some parents want their children to be arranged in the best learning class in primary schools. So their children have the chance to pass the entrance examination and enter the best higher school. Some parents bribed teachers or principals to let their children have the chance to get into the best learning class. Children saw their parents or other students' parents sending gifts to teachers and getting a better position in class. If they study hard and pass the examination of officer even judge when they grow up, they follow their parents' behavior to give or receive gifts illegally. Because parents and teachers taught them how to bribe and bribery became a social custom.

## 5. Conclusions

In the first part of paper, the school education between engineering ethics and social responsibilities were compared, and case studies which examined the corruption of judges and prosecutors, and actual examples of illegal judgment were reviewed and discussed. Then, the document analysis method and questionnaire inquiry method were used to study importance of educations of engineering ethics and social responsibility in school. An example of judiciary judgment was used.

It was found that the education effect of engineering ethics was good and positive in schools. It was found that social responsibilities education is more important than engineering ethics education. Corruption of some unworthy officers causes wrong to become right, negative to become positive, illegal to become legal, and disorder in Taiwan society. The presence of corruption is the negative educational influence in Taiwan society. Corruption reduces the educational effect of engineering ethics.

It is recommended that (1) educations of engineering ethics and social responsibilities should be encouraged, cooperated and strengthened in school, (2) education of ethics and morals should be taken by the people in society and officials in government. It is believed that social fashions can be improved by checking out and punishing those bad officials including judges, prosecutors, police, investigators, and tax inspectors, etc.

## Acknowledgements

Authors appreciate the students at Chaoyang University of Technology who answered the questionnaire. Authors express thanks for the one-year research project (NSC 89-2516-S-324-003) supported by the Department of Science Education, National Science Council, Taiwan. The authors

would like to give special thanks to Mr. Craig Copelan, Consulting Transportation Engineer, and Ms. Janet Barnett, Associate Governmental Program Analyst, California Department of Transportation, for their valuable comments about writing structure and English corrections.

## References

- [1] Wikimedia, Engineering Ethics, ([https://en.wikipedia.org/wiki/Engineering\\_ethics](https://en.wikipedia.org/wiki/Engineering_ethics)), 2017.
- [2] Wikimedia, Corporate social responsibility, ([https://en.wikipedia.org/wiki/Corporate\\_Social\\_Responsibility](https://en.wikipedia.org/wiki/Corporate_Social_Responsibility)), 2017.
- [3] King, W. S. Study on the Engineering Ethics and Professional Morals of Construction Engineering, Research Report, supported by National Science Council in Taiwan's Executive Branch (No. NSC89-2516-S-324-003), 2000.
- [4] King, W. S., and Jiang, C. S. Engineering Ethics, 1<sup>st</sup> ed. Taipei: Wu Nan Publisher, 2009.
- [5] Wang, C. L. and King, W. S., A Study of Construction Ethics from Structural Collapse Patterns in Earthquake, Conference of Concerning 921 Earthquake Disaster, Institute of Building Technology, Taichung, Taiwan, 2000.
- [6] King, W. S., Pan, C. L. and Jiang, C. S. Curriculum Planning on the Professional Morals of Construction Engineering, Journal of General Education, 2001, 8 (1): 61-78.
- [7] King, W. S., Duan, L., Chen, W. F., and Pan, C. L. Education Improvement in Construction Ethics, *Journal of Professional Issues in Engineering Education & Practice*, 2008, 134 (1): 12-19.
- [8] Lin, H. D. Explosion Inside Story by a Lawyer: A Gold Bar is More Valuable Than Law Articles, Business Weekly, 2011.
- [9] Crime Research Center, National Chung Cheng University, 2015 people across the country crime victims' governance satisfaction survey, A News Release on Feb. 23, 2016, (<http://depterc.ccu.edu.tw/news/showNews/149.htm>), 2016.
- [10] Lin, S. S., Hsu, M. K., and Chen, J. H. Judge Jing-Bin Hu Received Bribes Three Hundred Millions, The Third Wife Suspected to be White Glove, News by Formosa TV, (<https://www.youtube.com/watch?v=GkKdIWdhAcQ>), 2013.
- [11] Apple Daily, The Most Greedy Female Prosecutor, Apply for Life Sentence, Cover up Gambling Computer Games, Bribery 23.25 million New Taiwan Dollars, (<http://www.appledaily.com.tw/appledaily/article/headline/20130309/34876292>), 2013.
- [12] The Judiciary, Sentence by Supreme Administrative Court (102 Year Judge No. 799), Legal Information Retrieval System, (<http://jirs.judicial.gov.tw/FJUD/>), 2013.