



PROFESSOR TAE SANG WON'S CONTRIBUTIONS TO MODERN HYDRAULIC ENGINEERING IN KOREA

이 원고는 지난 2001년 9월에 중국 북경에서 열린 제29차 국제수리학회(당시명칭 임: IAHR) 대회에서 '아시아의 현대 수리학자'라는 기념 심포지엄에서 한국을 대표한 수리학자로서 '고 원태상 박사'에 대해 한양대학교 윤태훈 명예교수가 발표한 것이다.

고 원태상 박사는 1903년에 경기도 광주에서 태어나 1976년에 서거한 토목공학자, 수리학자로서 호는 정암(靜岩)이다. 그 당시 경성 고등공업학교 토목과를 졸업한 후 조선총독부 토목과와 만주국 교통부에 근무하면서 하천조사와 하천수문(河川水文) 자료의 정리·분석에 전념하였다. 광복 후에는 미 군정청 보건후생부 위생국장직에 잠시 있다가 서울대학교 토목과 교수에 임명되었다.

1952년에 서울대학교에〈배수곡선(背水曲線)의 신허리적 해법(新合理的 解法)을 제출하여 우리나라 최초의 이학박사가 되었고, 1955년에는 일본 동경대학에서〈극대홍수량도식(極大洪水量圖式)에 관한 연구〉로 공학박사 학위를 받았다.

그는 1950년대 중반 미국에 가서 미네소타대학교, 컬럼비아대학교, 뉴욕대학교에서 연구하였고, 하천공학, 위생공학, 수력발전공학, 하수도 및 하수처리 등 많은 저서와 논문을 발표하였으며, '원박사식 수리계산척(元博士式 水理計算尺)'을 고안하여 유명해졌다. 토목학계에 이바지한 공로로 1968년 한국토목학회 제1회 학술상을 받았고, 서울특별시문화상도 받았다.

고 원태상 교수 관련 기사로는 '원태상 박사 서거 추도문' (이원환, 대한토목학회 논문집, 1976)과 '원로 수공학자 정암 원태상박사의 삶' (이원환, 한국수자원학회지, 1993) 등이 있다. <이상 '한국역대

인물 종합정보시스템'에서 발췌하였음)

우리 학회는 국내 수자원 분야에서 탁월한 업적을 남기신 고 원태상 박사를 기념하기 위해 금년부터 학회 학술발표회의 초청 강연을 '원태상 기념강연'이라는 이름으로 하기로 하였다.

INTRODUCTION

When I was asked to recommend a person who is considered as a pioneer of modern hydraulic engineering in Korea for the Memorial Symposium at the 29th IAHR Congress in Beijing from Professor N. Tamai who was the organizer of the Special Memorial Symposium,

I recommended the late Professor Tae Sang Won who is regarded as the most adequate for the purpose. And I was searching for a person who had to write the manuscript and give a presentation at the Congress even though Professor Tamai asked me to do that job. There are no contemporaries who can carry out this sort of burden, and I had tried to find a willing author in vain and there was no other choice except that I myself had to do it. While the sources of his professional works and publications are known and accessible, very little is known about his personal cir-

cumstances, his friends, his character and likings. Fortunately, a good deal of information could be drawn from his family archives.

BOYHOOD AND EDUCATION

Prof. Tae Sang Won was born in Gwangjoo County in the central part of the Korean Peninsula on May 22, 1903. Since his father was fluent in Japanese and so was employed as an interpreter of Japanese at the railway construction site in Hamgyung Province, in the northeastern part of the Peninsula, and Prof. Tae Sang Won had an elementary education there. Upon the completion of his elementary school at age of 14, Prof. Won went to Seoul alone to take the entrance examination for Gyunggi High School which was in the first rank in the Korean Peninsula. Good students all over the nation gathered to take the entrance examination and, consequently, the competition was very high. Nevertheless, he passed the entrance examination.

He studied at the Seoul National Engineering College(which is now the College of Engineering at the Seoul National University) majoring in civil engineering from 1922 to 1927 and received his Bachelor of Science degree on March 1, 1927.

He married Boonnam Jung at the age of 27 in 1929 and the couple had four sons and two daughters. His wife studied music at the Ehwa Women's College in Seoul. In those days very few women had a college education in Korea. She must have come from a wealthy family with an enlightened view.



Fig. 1. Prof. Tae Sang Won(taken in 1971)

PRACTISING ENGINEER

On May 1, 1927 Prof. Tae Sang Won obtained a teacher's license in physics and mathematics from the Government General of Korea. From 1927 to 1928 Prof. Won taught physics and mathematics at the Ehwa Women's College in Seoul as an instructor and at the Young Saeng High School in Hamheung, northeastern city in Korea. During the following five years until 1933, he worked as a public service worker of the City Government of Seoul. The assignments were chiefly on the extension of projects of water supply systems in Seoul area and the maintenance of the systems.

In 1933 Prof. Won moved to the Public Works Department of the Ministry of Interior, the



Fig. 2. Prof. Won, Instructor at Ehwa Women's College

Government General of Korea and was employed until 1942. He was mainly involved in the whole gamut of fields in civil engineering such as field investigation, planning, design and construction of water supply, flood control, hydro-power, irrigation, river improvement works, highways, bridges and sewerages.

On April 1, 1943, Prof. Tae Sang Won accepted an offer as the chief engineer of the Division of Hydraulic Investigation from the Ministry of Transportation, Manchurian Government. Five months later he was assigned an additional duty of research engineer of the Imperial Science Research Institute of the Manchurian Government. He was engaged in investigation, planning, design and model tests on flood control, water supply, hydro-power, irrigation, river



Fig. 3. Prof. Tae Sang Won(center at back), student of Seoul National Engineering college(1926)

improvement works and hydrological surveys.

In April, 1945, Prof. Tae Sang Won returned to Seoul and briefly he was engaged in the planning and design of plants as a chief engineer at the Korea Airplane Manufacturing Company in Seoul until the liberation on August 15, 1945.

EDUCATOR AND RESEARCHER

During the period from the liberation in 1945 to the outbreak of the Korean War in 1950, the political situation as well as the economical and social circumstances in Korea were in the worst situation. Law and order were not established and it was in political turmoil. There were a large number of politi-

cal parties and a couple of them were communist or pro-communist which were closely connected with the North Korean Government under the strong influence of Russia. Even college students in that period were divided into two groups of the right wing and left wing and there were many politically oriented student activities. Consequently college education was carried out rather erratically. For instance, some classes were interrupted or cancelled, and some students were arrested.

In such a chaotic situation Prof. Tae Sang Won was appointed on October 1, 1945 as a professor and the head of the Department of Civil Engineering at the Seoul National Engineering College by the American Military Government in Korea. A year later, in 1946, he was appointed as a professor and the head of the same institution which was re-organized as the College of Engineering at the Seoul National University. He held the position of department head for 18 years until 1964. His teaching assignments included a variety of subjects such as river engineering, sanitary engineering, hydro-electric power, hydraulics and hydrology.

Even in this chaotic period, he started to write his doctoral thesis and came to give a presentation of the doctoral thesis "Rational Solution Method of Backwater Curves" in May, 1950. However, the submission of the thesis to the Graduate School of the Seoul National University was postponed due to the outbreak of the Korean War a month later on June 25, 1950.

At the outbreak of the Korean War on June 25, 1950, the Korean Army retreated all the way to the southeastern region of Korea, and the Korean Government and all the educational institutions moved to southeast most port city, Busan. Prof. Tae Sang Won also moved to Busan with the university and there classes were resumed. The classrooms were in the temporarily fabricated barracks which barely provided protection from the wind and rain. It had no heating, its floor was sand, and it was equipped simply with a blackboard and benches. Giving a lecture could be barely managed and doing research was unthinkable. The most difficult problem was lack of teaching materials. Especially since there were no textbooks, Prof. Tae Sang Won wrote textbooks which were hand written and mimeographed and even such mimeographed textbooks were not available to every student. During his stay in Busan, the degree of Doctor of Natural Science was conferred on him on April 26, 1952. Tae Sang Won was the first doctorate in the field of



Fig. 4. Prof. Tae Sang Won(center), after receiving the Academic Award of the National Academy of Science(1962)

civil engineering in Korea.

Upon the cease fire agreement of the Korea War in 1953, Prof. Tae Sang Won returned to Seoul from Busan and he was faced with bunch of work before resuming classes at the heavily damaged engineering campus due to frequent bombings. Nevertheless, he wrote another doctoral thesis "A Study on the Maximum Flood Discharge Formulas" and submitted it to the Faculty of Engineering of the Tokyo University and his second doctoral degree of a Doctor of Engineering was bestowed on December 5, 1955.

His major research interests were about runoffs, flow profiles and backwater curves, and flood discharges. In those subjects, he published a number of papers and suggested his own formulas including time of concentration, flood discharges and peak flood discharges called the "T. W. Formula", which were appeared in the book 'River Engineering' written by him in Korean.

In April, 1955 Prof. Tae Sang Won took a leave of absence to stay at the University of

Minnesota as an honorary fellow for five months and at the Columbia University as a visiting scholar for a half year. He also accepted a lectureship at the City College of New York for the later period.

During the period of 1946 to 1959, in addition to his university position, Prof. Tae Sang Won was very active in consulting for a number of government agencies. Especially, he served actively as an expert individual consultant for the 8th U.S. Army stationed in Korea since the World War II to provide advice on coping with water supply systems, housing and sewage projects for the U.S. Army in Korea. He also participated as an expert consultant to the Technological Training Division of the Economic Commission of America on technical training of man power for the development of economy, industry, science and technology in Korea.

Unlike the present circumstances that traveling abroad is easy, convenient and affordable, it was very inconvenient and very expensive, especially for professors to go abroad to



Fig. 5. Prof. Tae Sang Won at his 60th birthday with his wife(1963)

attend conferences in the 1950s and 1960s in Korea. Nevertheless, Prof. Tae Sang Won traveled quite a number of times to attend international conferences and research oriented meetings. During his overseas trips he was served well by his good command of foreign languages. He was able to communicate in as many as five different languages: his Japanese and English along with Korean were fluent and he could commu-

nicate in German and French, which he learned by himself.

It has been remembered by his former students that he was a man of dignified mien with imposing presence. Also remembered are that his way of speaking was also solemn. Whenever he came to his office he dressed up and wore a hat. These aspects of his appearances were considered to suit his characters very adequately.

INVENTOR

Prof. Tae Sang Won was interested in devising new tools and equipment in a wide variety of fields, probably he must had tried to invent a lot of items and finally he was successful in inventing a few items and to get patents. The invented items by him are four different types of hydraulic slide rules patented by the Korean and Japanese Governments, a route surveying and curve setting slide rule with a patent from the Japanese Government, a portable multiple stage water filter with a patent from the Korean Government and a floating breakwa-

ter and a floating platform patented by the Korean Government.

Hydraulic Slide Rule

Prof. Tae Sang Won invented a hydraulic slide rule, which was manufactured by Hemi Co. in Japan. Hemi Company can be remembered by most engineers and engineering students all over the world in the 1950s and 1960s who used a general purpose slide rule. The hydraulic slide rule is capable of calculating a myriad of calculations. They are the solution of the Manning formula in open channels (rectangular, triangular and trapezoidal channels) and pipelines for average velocity and discharge. In the solving of the Manning formula, any one of four variables such as mean velocity, roughness coefficient, slope and hydraulic radius can be found if the rest of four are given by just three steps of moving of the cursor and the sliding scale. An example of this kind of problem is given below.

Example: Find the average velocity of a river which has a width of 50m, a flow sectional area of 150m², a Manning coefficient of

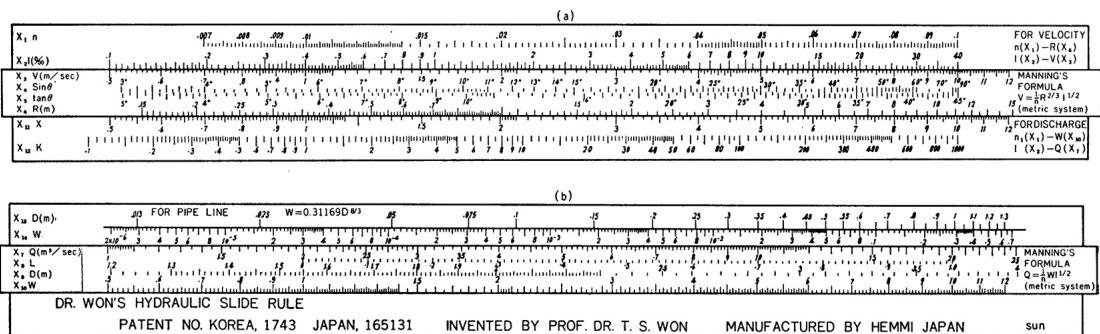


Fig. 6. Hydraulic Slide Rule invented by Prof. Tae Sang Won

$n=0.025$ and a slope of $S=1\%$.

Solution : The river is taken as a wide channel and then the hydraulic radius is $R=3$. The solution procedure is as follows :

- step 1. locate the cursor line at $n=0.025$ of the scale n .
- step 2. Set $R=3$ of the sliding scale R to coincide with the cursor line.
- step 3. move the cursor to locate the cursor line at $S=1$ of the scale S .
- step 4. then, the cursor line indicates the average velocity of $v=2.63\text{m/s}$.

The solution processes may be faster than getting the answer by using an electronic calculator used now. The slide rule can also be used to solve problems with serial pipelines and parallel pipeline systems with reservoirs. The slide rule is applicable to both the metric unit system and the English unit system. The

hydraulic slide rule can also be used as a general purpose slide rule for multiplication, division, square and square root, cube and cube root, $2/3$ and $3/2$ power, 4 and $1/4$ power, logarithms and triangular functions.

Floating Breakwaters and Floating Platforms

After retirement from the Seoul National University at the age of 65 in 1969, Prof. Tae Sang Won devoted most of his time in developing floating breakwaters and floating platforms for which works he initiated in the 1960s. The structure consisted of reinforced concrete caisson blocks made for the purpose of developing offshore ocean resources, especially which are deposited in the area of the continental shelves. They are also designed to be used for power generating plants, sewage treatment plants, living quarters and even for

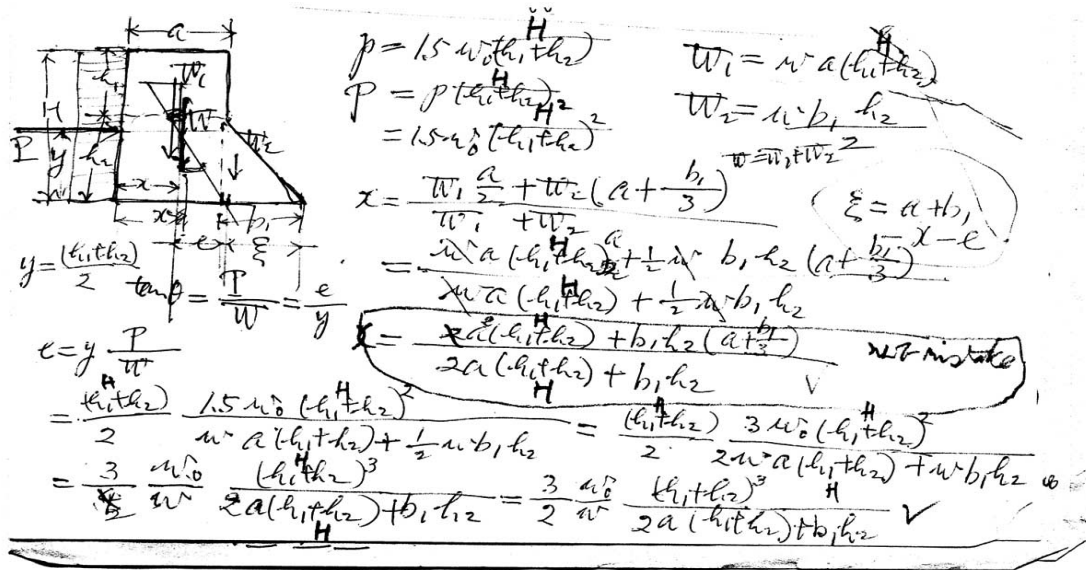


Fig. 7. A computation sheet for floating breakwater

military purposes, i.e., for a mobile naval or air base. The linkage systems connecting the block elements is specially designed to prevent the rolling and rocking of the caisson blocks. He did lots of paper work and calculations, and he was proud of the specially devised linkage system. However, the systems were not put to practical use probably due to the lack of large scale experimental verification.

AFTER RETIREMENT

In June, 1969 Prof. Tae Sang Won retired from the Seoul National University after serving for 24 years including the hard endeavors of putting education, research and personals in order during the early period of the state of disorder when the Seoul National University was first established and significant contributions which made possible what the present Department of Civil Engineering is, and he was honored as an emeritus professor.

Even after his retirement, his spirit remained as lively as ever. He could keep himself busy by lecturing, presentations and attending international conferences. He devoted most of his time in developing floating breakwaters and floating platforms. In order to put them in practical use he tried to get a research fund from the U.S. Government for fairly large size experiments but he was not successful in getting funds.

CONCLUDING REMARKS

With this writing of his biographical facts, it is hoped it will remind us of the significant contributions and endeavors that Prof. Tae Sang Won made through his textbooks, lectures and research, his engineering consulting works and his inventive achievements to our understanding and the development of river hydraulics. ☯

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3. Won, Tae Sang(1962), River Engineering, Moonwoon Dang Pub. Co., Seoul Korea.

ACKNOWLEDGEMENTS: The author would like to express his sincere appreciation to Professor Jongwoo Park, Seoul National University, a grandson-in law and Mr. Wonchan Lee, president of Namwon Construction Engineering Co. for providing valuable material and photos of Prof. Tae Sang Won from his private archives.



Appendix 1 : PROF. TAE SANG WON – PUBLICATIONS

Year of issue	Title	Publishers
..1931	Design of masonry dams Hydraulics of percolating wells	Jour. of Construction, Seoul
	Comparative studies of average velocity formulas	Jour. of Construction, Seoul
1932	Relation between roughness coefficients of Kutter and Manning formulas	Jour. of Construction, Seoul
1935	Flood forecasting formulas of Nakdong River	Flood of Southern Korea
	Economical design of a simple reinforced concrete rectangular beam	Jour. of Japan Society of Civil Engineers
	Economical design of a composed reinforced concrete rectangular beam	Jour. of Japan Society of Civil Engineers
1938	Economical design of a simple reinforced concrete T-type beam	Jour. of Japan Society of Civil Engineers
1939	A method for obtaining of economical cross-section in open channel	Jour. of construction, Seoul
	A study on economical channel width and levee height	Jour. of construction, Seoul
	Principle of a slide rule for open channel flow	Jour. of construction, Seoul
1941	Nomogram solution for a differential surge tank	Jour. of construction, Seoul
1943	General solution of non-uniform steady flow	Jour. of Manchurian Society of Civil Engineering
1945	The characteristics of demand variation of water use in Korea	Sanitary Engineering
1947	On the characteristics of rivers in Korea	Modern science
	New rational method of backwater curves	Separate volume
	Backwater formulas in horizontal channels	Separate volume
1948	Hydropower Engineering	Seoul National University Press
1950	The proprietorship of the Yalu River including Soopoong hydro-electric power plant	Dong A Daily
1952	Sanitary Engineering	Seoul National University Press
..1953	New method of estimating of time of concentration	Separate volume
	Estimation of Peak flood discharge	Jour. of Korea Society of Civil Engineers
	Sewage and Sewage Treatment	Seoul National University Press
1955	Geomorphological study of rivers in Korea	River Engineering
1958	A study of maximum flood discharge formula	Jour. of Seoul National University
1959	A new solution for varied flow in channels with uniform depth of water	Jour. of National Academy of Science
1960	A new rational method for calculation of maximum flood discharge by amount of rainfall in the catchment	Jour. of Science and Technology Seoul National University,
	A new solution for varied flow in channels with horizontal bottom	Jour. of National Academy of Science
	Feasibility study and Evaluation on Danyang pumped electric project	Jour. of Korea Society of Civil Engineers
1961	Characteristics of Korean rivers	Jour. of Korea Society of Civil Engineering
	A study on the phenomena of hydraulic jump for sloping channel in a stilling basin	Jour. of Korea Society of Civil Engineers
1963	The tidal power resources of the Incheon Bay, Korea	UN Conferences on the Application of Science and Technology, Geneva
1969	A study on construction of Floating backwater and floating platform	Ocean Engineering Conf. ASCE, Coral Gables, FL
1970	A new theoretical solution for backwater and drop down curves	Hydraulic Conf. ASCE, Minneapolis, MN
1972	Water pollution control and industrial management in Korea	6th Int. Conf. on Water Pollution Research, Jerusalem, Israel
1971	River Engineering	Moonwoon Dang Pub. Co., Korea
..1973	The effect of self-purification of flowing water	1st world Cong. on Water Resources, Chicago, USA
1974	A study on maximum flood discharge formula	ASCE National Meeting on Water Resources Engineering

Appendix 1 : PROF. TAE SANG WON – PUBLICATIONS (Continued)

Year of issue	Title	Publishers
1974	Some characteristic aspects of water law in Korea	1st Int. Conf. on Water Law and Administration, Mexico City
1975	Man's activities for changing hydrological conditions Environmental quality protection and resources management in Korea	IAHS Symposium Tokyo, Japan 13th Pacific Science Congress, Vancouver, Canada
	The tidal power resources and their power generation projects of the Western Coast of Korea	13th Pacific Science Congress, Vancouver, Canada
1976	Flood control and multi-purposes development on water resources as a means of economical and social development	2nd Int. Conf. on Water Law and Administration, Caracas, Venezuela
1976	Man's activities for erosion and silting in Korea	2nd Int. Conf. on Water Law and Administration, Caracas, Venezuela

Appendix 2 : PROF. TAE SANG WON – CHRONOLOGY

22. 05. 1903	Born in Gwangjoo, Korea
1911-1917	Elementary education in Hoeryung, Korea
1917-1921	Gyunggi High School in Seoul, Korea
1922-1927	College studies, Civil Engineering, Seoul National Engineering College
1927	Teacher's license in mathematics and physics granted Instructor at Ehwa Women's College
1927-1928	Teaching at Youngsaeng High School in Hamheung, Korea
1929	Married Boon Nam Jung
1928-1933	Sanitary Engineer, City Government of Seoul
1933-1942	Civil Engineer, Bureau of Public Works, Ministry of Interior, Government General of Korea
1935	Member, Japan Society of Civil Engineers
1943-1945	Chief Engineer, Department of Flood Control and Investigation, Research Engineer, Central National Science Research Institute, Ministry of Transportation, Manchurian Government
1945	Chief Civil Engineer, Korea Airplane Manufacturing Co, Korea
1945-1945	Professor and Head, Department of Civil Engineering Seoul National Engineering College and Acting Director, Bureau of Sanitation, Ministry of Health and Welfare, American Military Government in Korea
1946	Appointed as Professor and Head, Department of Civil Engineering, Seoul National University
1951	Vice-president, Korean Society of Civil Engineers Director, Federation of Korea Society of Engineers
1952	Doctorate degree at Seoul National University Elected as a Member of National Academy of Science
1947-1959	Engineer-Consultant, Technological Training Div, ECA , AMGK , Seoul Engineering Adviser, City Government of Busan Engineering Consultant, Office of Economic Coordination for Korea, UN Command in Korea Engineering Consultant, 8th U.S. Army, Korea
1953	Academic award, Korean Engineers Association
1955-1956	Honorary Fellow at University of Minnesota, visiting scholar at Columbia University, Lecturer at City University of New York
1955	Doctorate degree of Engineering at Tokyo University Academic award, Korean Society of Civil Engineers
1956	Member, American Society of Civil Engineers(ASCE) Member, International Association for Hydraulic Research(IAHR)
1959	Vice-President , Korean Committee of International Committee on Large Dams
1962	Academic Award, National Academy of Science
1963	Cultural Award by the President of the Republic of Korea
1966	Cultural Award by the Mayor of the City Government of Seoul
1969	Retired from Seoul National University
8, 12, 1970	Permanent resident of USA
18, 5, 1976	Passed away in Los Angeles, USA