The Horizon of Civil Engineering
Looking back at where we've been and forward to where we're going

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The expression "history repeats itself", or "the tide of history" are often mentioned. But history does not flow by itself. We have been making the "tide of history" as a result of our addressing the various issues such as hardships of life, foreign pressure, inner willingness, financial stringency, and so forth, with new ideas and actions each time. The success of the reforms did not depend on the moral adaptability or objective assessment then and there, but depended on the ideas and actions to solve the problems. At that time, people's life and actions were strongly influenced by nature as well as by precedents, the problems were solved only when there was no worry about their persistence, and that kind of situation was repeated.

At present, civil engineering, which makes it its responsibility to sustain people's living activities and their survival, is facing new environmental issues in addition to the unprecedented current situation, that is, divergence of public opinion and the argument over the unnecessity of public works, and cannot rest in complacence saying that history repeats itself. The following are my thoughts on the domestic and foreign issues necessary to address the new dimension.

Where we have been

There are a lot of supporters in Japan for Keynes' fiscal stimulus theory and Roosevelt's TVA, but later they abused them, and jeering at public works, which were the core of their theories, called them "behaviors to dig a hole and fill it up". They determined that they have lost their multiplier effect*, without regard to safety and environment. "Kamado nigiwau"*(There are a lot of furnaces") is well-known as the achievement of Emperor Nintoku(257-399)*, but it is not well known that it was achieved by a large-scale tax reduction and infrastructure building. Also, OHKUBO Toshimichi'*s long-term strategic nation planning[1)], which targeted prompt security measures by giving relief to the noble and warrier classes, has been forgotten. The Unemployment Relief Project★ that was abolished last year and the National Relief Project★ established at the time of the Showa Depression have been forgotten. "Civil Engineering" has not only a local power (a power to solve individual issues) like "mounding earth and assembling wood"[2)], which aims at sheltering us from rain, wind, heat and cold, but also a macro power to influence national management (a power to solve social issues). We cannot help **govern the society and relieve the people** if we forget this micro and global power, immediate and long term power.

The 17-Article Constitution* by **Prince Shotoku (574-622)** begins with the first article saying that "you should regard harmony as the most important and you should not rebel", the 6th Article saying that "punishing vice and encouraging virtue is an ancient law", and concludes simply with the article saying that "you should not decide a thing on your own but discuss it with the public". There we can

see a social order formulating process, which does not depend on the patronizing "harmony is important" dogma, and is a necessity of appropriate assessment, in other words, a proformas of establishing orderly "public relations in a modern democratic society". It seems that there are various theories as to its establishment process, but if you stick to details, you will sometimes miss the general picture. That's what academia and objective assessment can fall into.

UESUGI Yozan'*s plan for the district development lay in "disciplining the upper class and supporting the lower class". He can be evaluated for his taking up NINOMIYA Sontoku*, who was pushed back into the past due to a reaction against the excessive idol worship, out of outside government at a time when there still remained a rigid class system. Here is the basic point of talent scouting and evaluation. What is common with their nation planning is that it was after "cultivating human resources and building morals". That is the way true nation planning should be.

HIROI Isami*, FURUICHI Kimitake* TANABE Sakuro*, AOYAMA Akira, HATTA Yoichi, KUBOTA Yutaka were outstanding giants in the civil engineering world in terms of their long-term, multidisciplinary perspective, logicality, humanitarianism, bravery and daring. In addition, MUROHARA Tomoyuki[3)] at Hachinosu-jo★ should be re-evaluated. That's not because of his stubbornness but because there was the dedication to public works which went beyond individual interest in his beliefs. All of them had the same assertion that civil engineering, which cannot exist without academia, should assume publicness, and because of that, it should take in humanity without sticking to academia only, and carry out very modern issues.

There was a description in **Nihon-shoki** about the occurrence of what seemed to be a red tide and prohibition of cutting trees and grass upstream of rivers[4)]. There was a record of the fact that peoplr ate human meat in the time of famine[5)], and a way of eating earth as a means of survival. From the fact that a head of a local meteorological station, who forecasted a big eruption of Sakura-jima an hour before, was criticized by victims and scholars, the eruption monument was despised as a monument of distrust in science[6)]. There was a fact that a report which figured out that the sea surface rise, reason unknown, was the result of the Chile-Offshore Earthquake* by paying attention to a clan's diary which kept the records. The clue was missed and the tsunami could not be foreseen[7)]. These facts show that there are disasters which happen due to mistakes and negligence different from disasters which could have been prevented even though the reasons were not clear, and as well, there are disasters whose cause was clear but inevitable. Actually, we now have issues like red tide, flood, cold summers and shortage of water and rice, even though the reasons are clear. The characteristic of Japan has been unchanged from ancient times. The whole picture has not yet been clarified. Public opinion rises endlessly as human desires rise. Now we are facing environmental problems. Now is the time to develop dramatically the possibility of civil engineering which has a sense of both the effects and the limitation of science.

Looking back

Civil engineering has been sustaining people by improving the living environment and accelerating economic growth, even though it might have caused a number of problems. I can well understand the distressed feeling about the harsh criticism. The civil engineering world has been such an easy order-taker and always awaiting the next instructions, because it has been pushed and pulled by the desire to escape from poverty from various sectors and had not had the necessity to work out something new by itself.

But look now. Although the "Yasukawa Report", which resulted from the Japan-U.S. Structural Discussions, helped greatly to dissolve a deficit in American finance and trade, it accelerated overseas transfers of Japanese factories and overseas production development since 1990, which caused personnel cuts in Japan, deflation and bad debts, and put civil engineering to blame for everything. Eventually civil engineering became the victim. Thus the undertaker of public works has been criticized as the bad guy to blame for the "lost 10 years", which is being said irresponsibly, although it is more acceptable if it is called the "10 years we lost" with a sense of self-reflection.

Various systems and a lot of money have been set aside for work-sharing, employment promotion and transfer support, which are all off the bottom line, saying "if public demand is decreased, private demand will be promoted and employment will also grow." and "shifting from public projects to welfare projects will increase employment". However, only dishonest money receiving cases increase whereas employment does not increase. Stable employment is essential to cultivating human resources and formulating social morals, whereas money handouts cannot replace stable employment. Public works which produce employment are completely different from just money handouts in effect.

What is needed for civil engineering that is responsible for the national land planning and national management is no longer its image improvement. It's action to seek its own way to go forward as a think tank with new ideas. We cannot only be proud that civil engineering has been working for the nation and land. We have to propose a new way for nation planning that is suitable for Japan, utilizing the civil engineering power for the regeneration of off-course Japan. It is surely possible if the whole civil engineering world has its own independence. We have to re-evaluate comprehensively the intentions that required civil engineering to solve the natural and social issues, the wish and zeal of the persons of interested parties for the realization of their dreams, the effects given to the society such as the change of social framework and living standards, the various issues that were caused in exchange, the influence by unsolved issues which will be handed down to the next generation and so on.

We now have "cycle" and "sustainment" as newly added important issues. These cannot be solved in a conventional way. To stick to the past is just nostalgia for the good old days. Now is the time that the knowledge of a short time ago, let alone convention, does not function. The conventional make-up and system of civil engineering has done nothing but stir up public opinion that public works are unneccessary. The driving force to look forward to where we are going lies only in a change in our way of thinking. There are a lot of subject matters for it, such as reconfirmation of civil engineering, inner willingness to reform ourselves and external pressure for reform, discussions with the people outside the field and opinion statements to them, and so on.

Looking forward to where we are going

Expressing opinions about the Constitution

It was in an article related to the Special Lecture of the 2000 JSCE National Convention written by Dr. HIGUCHI Yoichiro[8], a constitutional scholar, that the JSCE Journal took up the issue of the modern Japanese Constitution for the first time. He said that the Constitution laid down the national structure, with the two essential elements of guarantee of rights and separation of powers, defining "public" as an alignment of individuals and "citizens" as those responsible for the "public" and opined that the Japanese had not yet had "public" in a true sense

because they never asserted themselves. However, the Constitution, due to excessive reflection over the Imperial Constitution, guaranteed rights larger than obligations on the presupposition that the individuals are in a vulnerable position while the nation has powers. However, rights and freedom without restrictions is far from independence. It makes people more dependent and selfish. When an individual is granted universal rights, obligations to the same degree should be also imposed on him. Otherwise everyone is asserting himself without regard to others, and it results in no sense of social solidarity and eventually he fails to have a public sense. The balance between rights and obligations between individuals is totally different from the relationship between the nation and individuals.

The limits of this article prevent me from stating my opinions any further. The Constitution is the supreme rule that ordains the nation's foundation and social justice and underlies the very basis which the civil engineering field should depend on. I would just like to point out that there are only provisions for international disputes and security but not the rights and obligation provisions concerning public works, and that there are no environmental provisions related to Japanese people's survival and activity, which are suitable issues to be discussed by the civil engineering world

Seeking the essence of economy

The industrial structure is said to move from a low place to a higher place in the course of modernization. But it should be changed gradually as the living standard improves as, if it were changed drastically on purpose, it would cause some distortions in every place in society. The responsibility of having changed Japan's industrial structure to an extremely high place is quite large. The present social tendency is shifted from a "material" economy to a "money" economy, and money is misleading people. The civil engineering world, which is responsible for governing the society and saving the people, cannot overlook it.

If we regard civil engineering as a means of national management, we will not be able to resist the efficiency-best economy and the world-standard-following economy. That's because we miss the need for civil engineering to be indigenous. Though I may sound a bit biased, I believe the civil engineering world should not stick to technological theories but try to make proposals so as to convey various ideas to citizens.

It is impossible to acquire profit accrued by moving "materials" in foreign countries without any actual experiences of handling virtual money, an IT heart, any blatant compliments or lawsuit strategies, as we cannot insist on our rights to the "materials" in foreign countries because we do not have an armed force. A money economy is not suitable to the Japanese. A region or a country has its own roles decided by its natural and social environment. There are no cases of success in imitating a foreign country without thinking of one's own characteristics. As well, although bad finance has been a motive for reform, there has been no success in weathering a crisis by simply cutting a certain portion of expenditures. There are no measures for curbing production sectors going out of Japan and it is no use stopping it. The government says it cut the public work budget saying that there is no longer a multiplier effect, and stopped the production infrastructure development. Yet, they say they will keep up employment and rebuilding the economy will improve welfare. It has been covered by the savings in the past, but in order to meet the growing money demand such as for pensions, the only measures left are to raise taxes and borrow money, which will not last long.

A purchasing appetite is high for "material" which is for a sophisticated taste and easy to use, long lasting and not cloying, with maintenance guaranteed and assured for recycle. A "material" which is abundant, fresh, delicious and safe, is worth more than some cost increases. Moreover, the material economy cuts resource usage and energy consumption, improves the living environment more comfortably in accordance with the regional characteristics, cuts the distribution costs in order to strengthen competitiveness, secures the punctuality and increases options. The "material" economy sounds oily and muddy, but it's more suitable to the Japanese than the "gambling" economy which ignores the national profit and decreases the international dependence and accrues a continuous and secure tax income. If the steep rise of personnel cost is the only motive for the Japanese companies' overseas exodus, it will be averaged in due course and only a hollowing-out will remain and the scramble for foreign "materials" will become a violent vicious circle and go to ruin eventually. Preference for margin has no stability and looses the long-term perspective.

Economic activity is the whole relationship of man, materials and money from resource acquisition to production, distribution and consumption. Although resources are limited whereas disposal, discharge and excretion are limitless, the limit to obtain energy and collect resources will come sooner or later regardless of disposal. An economy that does not incorporate material recycling in it will fall apart at some time or other. From that viewpoint, sustainable development,★ of which efficiency and cost accounting come first, is nothing but an illusion. We should establish economics based on cyclicity and sustainability.

Confronting the environmental issues

Nowadays people have a lot of desires for nature, but it does not create an ideal environment. It will rather produce destruction of nature like increment of abandoned things or leftovers and expand the disaster scale. National management in accordance with the national characteristics is essential. A forest fire in Los Angeles is not a fire on the other side of the river.

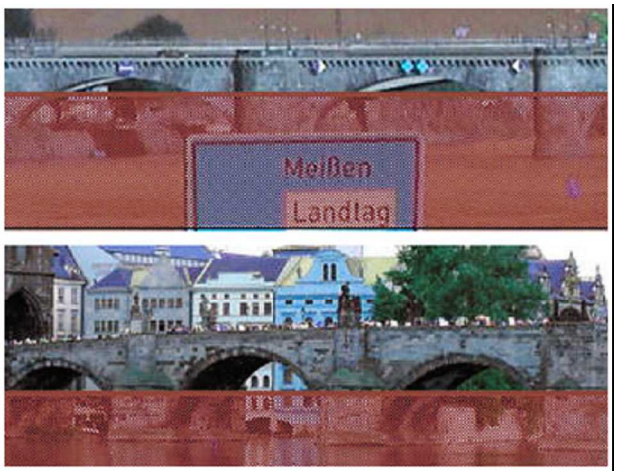

Photo-1 The shadowy part of the photo shows the highest water level at the time of the great flood in Europe in 2002. (Extracted from an on-site photo) Dresden and Prague which are located upstream on the Elbe, were flooded at this stage.

There are some voices that stated the cause of this flood should be attributed to global warming, but there were floods of the same scale 100 years ago or even 500 years ago in Dresden. A campaign for preventing global warming is necessary, but it is more important to know the feature of the regional nature.

Also, a lot of arch stone bridges were washed away by floods, yet the above two cities did not lose the bridges as they dared not raise the embankments higher.
Since floods of this scale only rarely take place, it is reasonable to think that it is easier to rebuild the town rather than rebuild the bridges, accepting small disasters. There were methodologies like this to control disasters in Japan too. I don't think that today's Japan can do to the same degree, yet it is true that we always have to assume the ultimate situation in handling environmental issues.

Civil engineering puts some burden on the environment during the construction work and when in service, but we must not cower at being criticized as being destructive of nature. Recently the civil engineering world has started addressing natural regeneration, and we can see a secret intention for impossible redemption. Prevention is more desirable than remedy and a measure is expected to be taken to minimize the burden on the environment covering the whole course from resource to disposal. Partial natural regeneration can implant the wrong view of

nature. For example, though recent large scale disasters tend to be attributed to global warming, there are the facts explained in Photo-1. It will help to foster a sense of crisis about environmental problems, but nature which can be regenerated is limited and reports of crisis push away the reality of the natural world. It is quite sinful to create an idea of sweet nature and to put aside disaster prevention from our mind. Rather, it is more important to pursue and practice nation planning (city regeneration, Japan regeneration) that is suitable to the environmental problems.

The conservation of nature does not mean to preserve every species. It is often concluded that the ecology can be maintained if artificiality is eliminated, but extinction of a species can happen in the natural world. Rather, conservation should be differentiated to exterminate mosquitoes, flies, rats etc. which convey infectious diseases which directly lead to the mass grave. I can hear the predecessors' ardent wishes and victims' cries through various new types of viruses. If we try to conserve everything which is called "natural" such as unthinned forests and wilderness, we will be sorry to see an unexpected retribution.

Though we can reduce garbage, we cannot reduce human wastes. The technology for the reduction and recycling disposed wastes has made progress, but we still have a problem of a huge amount of residue which cannot be gotten rid of. We must not approve of burial as the final disposal option. Buried material does not change its nature during a period of over a few generations, and it is more possible that poison will leak out from the disposal place, which is supposed to be appropriately managed and blocked off, in a period of one generation or so. Because of that worry, inhabitants hate to have a dump nearby and we have no more places acquired for that purpose. Useful natural resources are not widely available but the need for disposal/waste goes along with human beings. Energy issues can be dealt with to a respectable degree by carrying out various cost reduction measures and alternate solutions, but resource issues can be solved only by establishing a recycle system of disposed waste materials. It is a national issue beyond the framework of government ministries and agencies not to leave a dangerous heritage but to preserve resources for the next generations, which is where the civil engineering world should take a lead. Here we can see a dream and the origin of creativity.

Waste material is overflowing, final disposal site constructions are becoming rare, the segregation of waste materials is troublesome and charging for garbage collection is causing friction in local districts and the holding-off of buying new products is sapping the economic dynamism. On the other hand, natural resources, especially sand, are running dry. The author is promoting an "e-Eco Project" (Projects for environmental economics) and advocating the construction of structures using waste residue and natural leftovers[9]. To begin with, I organized an "Eco-arch" study group[10].

No other field faces nature more rationally and bravely than civil engineering whether it is good or bad. We should draw up the "Environmental Constitution", which is realistic and useful for citizens' consensus building toward the nation planning that is suitable to the morality of the Japanese society and the characteristics of the land of Japan, and we should have it tested by the world. This would be the origin of civil engineering's pride.

Speaking out to the society and listening to its voice

If civil engineering keeps silent when the society is in a confused state with conflicts over the convenience and safety of the nation's land and districts, and worries and concerns for environmental pollution, it cannot be said to be a technological group

with a social conscience that can activate its knowledge that has been accumulated as expertise as to the information on the national land, economy, and environment.

If we keep silent toward the No Dam Proclamation, it can be misunderstood that the civil engineering world admitted that dams are a waste. Every advantage and disadvantage concerning dams, including the mistakes of the no dam proclamation, countermeasures and alternate solutions, should be disclosed. As well, silence toward the road issue can be understood that even the civil engineering world recognizes roads as just roads, not as economic capital. It's no longer time to have discussions in comparison with other developed countries, and we should explain every advantage and disadvantage of how roads (including railways, vessels and airlines) affect life, the economy and the environment. Also we should explain that in Japan the separation of roles between the center and the districts is essential and should not be regulated by profitability.

The civil engineering world, which consists of citizens who live in every part of Japan and also who are experts from industry-government-academia, with different positions whether it is academia or business, needs independence and does not need uniformity like a trading association. We should announce our view that clearly distinguishes each position's responsibility rather than the faceless view that is well coordinated inside. If the assertion is true, citizens will accept it even if it is rejected by clients for violating the confidentiality agreement, and trust toward civil engineering will increase.

Even if the final decision concerning civil engineering is left to citizens, to accommodate the wishes of the public is not the only way civil engineering should go from now on. The bottom line is to seek the independence of citizens, and for that purpose, we should provide the information concerning the environment and safety, discuss and prepare the system to take it up. We cannot fulfill our accountability only by giving a one-side explanation or just disclosing the information.

The civil engineering world, which commands high technology, does not hesitate to acknowledge itself as a backseat player of the society, but it is regarded as a group who acts behind the scenes by outsiders. In order for a "doboku-ya"(an undisciplined engineer without integrity**) to become a "doboku-ka"(an engineer with high self-esteem and integrity**) and step out of the shadow into the limelight, as FURUICHI Kimitake advocated, we should step out of our narrow specialty into a more comprehensive and long-term generality, and have discussions inside and outside to listen to wide opinions.

Knowing the limit of science and testing the possibility of civil engineering

We usually derive a general law from the cases in the past by scientific method and regard it as being adaptable universally anywhere for many years to come. There would be no doubt about the rule if it were the result derived from an examination of every case, or if it were verified by all the possible cases to happen. If a natural phenomenon happens constantly, not regionally but universally, even a conclusion derived from a few cases is rational enough. From the result of observation of a phenomenon, which has been continuously changing for thousands or millions of years seeking stability on the earth, at a particular point after observing only for a period of a hundred years or so, there is no foreseeing correctly for a hundred years to come, and what we can get is only a matter of probability. Here is the limit of science. We must not emphasize safety too much for promotion of civil engineering projects. Our knowledge and wisdom, as experts, will be

questioned.

We cannot exceed the science limit only by preparation. Therefore we must not forget preparation in building civil engineering structures. As TERADA Torahiko remarked, "as civilization makes progress, disasters increase in its intensity. (summary)", even if scientific technology makes progress, large scale disasters often take place. Although there is an aspect in people's minds of trying to avoid disasters and social changes make disasters larger, civil engineering has been solving problems which have not been clarified skillfully, making use of natural characteristics by flexible ideas. As shown in Photo-l, civil engineering that dares to accept a disaster in order to overcome it is a form of civilization.

Civil engineering sometimes has to assume a situation where people must leave the land where they have lived in order to evade destruction. Today, when clarification has been considerably progressed, we can cope with large-scale disasters, accepting light disasters and damages, far more appropriately than before, and propose a technology with higher disaster evasion ability with a smaller budget. As one of the proposals, the author and his group are putting forward the idea of constructing a facility at low cost based on the premise of early evacuation as shown in Photo-2[11]. At the same time, there are a lot of buildings that are more than one thousand years old in Europe, whereas in Japan there are structures that become too old and must be dismantled when they are twenty years old or so. We should have a sense of crisis over the resource issue. While development of a high strength material is a technology, it is also a technology to fully utilize lower grade materials and make them last longer. The author is proposing long-lasting structures by recycling disposed wastes and recycled residues as shown in Photo-3.

In order to confront new environmental problems, daring and creative ideas and the system to evaluate them are necessary. Toward the intellectual property that is the offspring of a creative idea, if we do not admit its exclusive right saying it's a public project, innovative technologies will never come out. Respecting and utilizing intellectual property actively would be a clue to realize "a nation based on the creativity of science and technology" upon the recycling-based "material" economy.

Photo-2 The left top is a flow bridge, the bottom is a submerged bridge. The girders of these bridges are drifted or submerged when the water rises, they come back easily when the water level lowers. These are typical of early evacuation models.

The place is the beach on Koshiki Island, Kagoshima Prefecture. Here an innovative small factory with a big dream was built. (TSUKADA Masahide, Civil Engineering Journal, Vol.88, No.9, 2003.9). When I explained that since the low atmospheric pressure of typhoons and that the weather in winter could be correctly forecast, if they adopted the early evacuation type, they would be able to lay intake pipes of the deep ocean water at one hundredth the cost of the conventional type, the local people, who had been considering the business by a governmental subsidy, said they could manage by themselves and started it promptly. Eventually it did not turn to be an early evacuation type, but it was completed considerably more inexpensively than the conventional type.

The project of a flow bridge method is effective for the district development by grass roots, independent of the government. A delegation from Korea praised, when they saw it, that this system very highly saying that this was very encouraging for small and weak autonomous bodies.

Actually I am sure that this very easy system of intake pipes of the flow bridge type can be a way to alleviate world famine.

Working out a new design

A "material" aiming at practicable sustainment of the environment and a "material" which gives little burden on the environment are

prerequisites of a new design. Consultants, contractors and of course governmental offices also are agents who have a basic responsibility for meeting clients' (citizens') trust. The agents who are involved in the nation and the national land should propose a design which they will be able to approve as the party-interested with mettle for problem solutions managing to come up with the labor and wages on their own.

A job that anyone can compute does not need creativity. That civil engineering fulfills a function means to fulfill dynamics and fulfill the users' sensitiveness. Sensitivity has been hidden by dynamics in terms of cost and taste, which has distorted citizens' feelings. I would like to think that what does not fulfill people's sensitivities does not fulfill a function. Now is the time when we can easily use the dynamics that sensibility can draw thanks to the development of computing technology. Why don't we acquire basics, think and polish our sensibility?

I think we should learn the spirit embodied in the quote "we work hard faithfully for construction not to be a sinner in history" from a monument in the subway in Korea[12]. There the names of the persons who worked for the project are engraved. In Japan only the names of the persons who died on duty are recorded. Under such circumstances eager human resources will not be cultivated and a good "material" will not be made. Because it is a public project, honoring individuals is necessary.

Referendum should be utilized more actively. If we simply raise a question about a construction issue and ask yes or no by vote, as opaqueness of business dealings before the project establishment and inefficient handling of reconciliation of interests tend to be highlighted, it can be evaded and denied. We should put it to a vote showing profound power of civil engineering by giving various proposals that clarify advantages and disadvantages of approving or disapproving a construction as well as burdens on the environment.

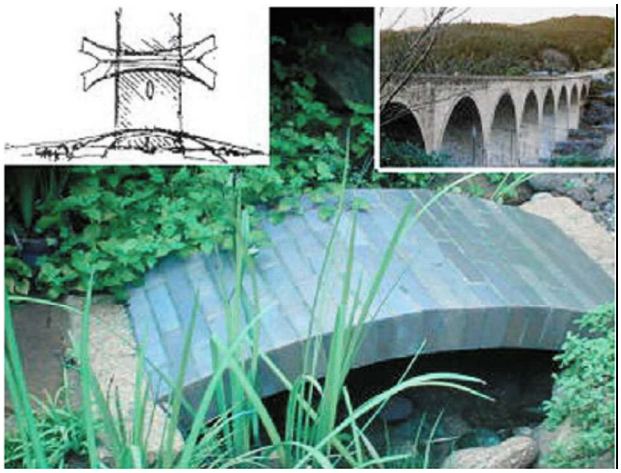

Photo-3 Many of the mechanisms worked out by Leonardo da Vinci have been realized today, but the huge arch stone bridge he drew (shown left top) has not been realized yet.

The bridge, shown in the center, has a span of 1.2 m and is made of bricks made from waste incineration ash. This brick has a greater strength than the usual concrete (700 kg/cm^2). A brick made from sewage sludge has even greater strength (4,000 kg/cm^2).

The photo at the top right is a concrete highway continuous elevated bridge.

Sand which is indispensable for concrete is running short. However, we have an inexhaustible supply of disposed wastes around human beings and animals. We should not bury them underground. Two bricks can be made from one person's waste for one year.

The Japanese made a lot of brick bridges and tunnels one hundred years ago. The brick at that time had only a 55 kg/cm^2 strength but they endured earthquakes and the shock of high speed high load. Now that we obtained a far stronger brick, still it is a dream to make it 1.2 m to 250 m. However, it is not a dream to make 1.2 m to 30 m and to connect some continuously. Then the amount of sand we can save, and the volume of the buried wastes we can reduce would be immense.

Factories have been transferred overseas, capable human resources have been lost by restructure inside Japan, and remaining people are put into anxiety. The influences are revealed in development failures, construction disasters or scandals that have been made by some leading-edge technology institutions or in various fields these several years. Even if we have leading-edge technologies, if we ignore people's mind and deprive them of dreams, we cannot produce a "material". We should develop favorable environments to return to the "material" economy as soon as possible. For that purpose, we should not stick to our narrow specialty field nor try to

gloss over by giving another name to civil engineering, but it is necessary to review the skill education as the basic of technology.

Before conclusion

In "Chubyu-shoki"[13], which was a record of KATSU Kaishu's dictation, there is a passage as follows: A guest saw a plan that was made up based on a famine in the Edo period and said laughing "Alas, you have become old.

How amateurish and irrelevant your plan is! Now there are a lot of wise men in the government and all of them have outstanding knowledge. In addition, as the government has a good amount of reserve funds for disasters, no one will get panicked by a small yawn. Who will pay attention to your plan." Civil engineers must not be like this guest or the wise men who reserve money and then rest assured. Even with a large amount of money and advanced technology, we must remember hundreds of thousands of lives were lost in foreseen disasters. Japan, which is now facing an environmental crisis, trying to be prepared even for a small yawn at the same time, should establish a regulated society which can cope with the recycling of disposed wastes and the feature of the natural world. We have to become wise men who can practice the micro and at the same time the macro power of civil engineering in order to confront the current unprecedented situation.

The horizon of civil engineering is under our feet and before our eyes. Let us take a step with a new perspective. There is no nation without civil engineering, no national land without civil engineering.

-List of references

* By Koji-en, etc.

★ By encyclopedia

1. SAWAMOTO Moriyuki, "100 Year History of Public Investment", Taisei Publishing
2. The word is shown in "Enanji", and said to be the origin of the word "doboku" (civil engineering)
3. The leader of the opposition movement of Matsubara, 下？ Dam, upstream of the River Chikugo.
4. There is a description of "red tide" in "Nihon-shoki", Vol.24 [19], and the "ban for cutting tress" in Vol. 29 [28]
5. "Nihon Kinsei Kiga-shi"(Famines in the modern Japan) compiled by ONO Takeo
6. Written on the guide board beside the monument standing in the playground of Higashi Sakurajima Elementary School, Kagoshima Pref.
7. YOSHIMURA Akira, "Sanriku Kaigan O-Tsunami", Bunshun Bunko
8. HIGUCHI Yoichi, "Civil Engineering", JSCE, Vol. 85, No.9, 2000.9
9. YOSHIHARA Susumu, "Aiming at realization of an Eco-Arch Bridge-as a Bridge leading to a Recycle-based Society", Doboku Cost Joho (Civil Engineering Cost Information), Construction Research Institute.

   Author's web:
   http://www.oce.kagoshima-u.ac.jp/users/susumu/
10. The Eco-Arch Study Group (The Environmental and Economical Construction Organization on Arched Structures), http://eco-arch.jp
11. The author's proposals are compliled in the collected papers by the Deep Ocean Water Utitilizing Study Group, No.6, No.7
12. YOSHIHARA Susumu, "Sustainable Japan – Road to Civil Engineering Philosophy", Giho-do Shuppan
13. Extra volume attached to "Tamasato Bunko", in the storage of Kagoshima University Library