

# Soil and Water Conservation Management and Design for the Development and Construction Projects of China

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## 1. Abstract

This paper introduced that since the water and soil conservation designing was brought into practice in the development and construction projects of China, the country has legislated and perfected a series of laws and statutes about the water and soil conservation of the development and construction projects. The water and soil conservation design of large projects given an official by the Ministry of Water Resources summed to 1060, including 142 commission items. And that given an official by each province (municipality, municipality directly under the Central Government) of China summed to eighty thousands. The paper also introduced the supervising, checking and implementing situation in the process of water and soil conservation designing of the projects, and the benefit from the process of water and soil conservation designing.

**Key words:** development and construction; projects design; water and soil conservation

On August the 1st 1993, «the Implemental Regulations of Soil and Water Conservation Law of the People's Republic of China» (№.120 of State Council Command) published and implemented, definitely ordaining that the water and soil conservation designing must be actualized in the development and construction projects of mountainous area, hill area, windy desert area. So the water and soil conservation designing system began to be implemented, and the construction of law system, executing system, technique service system for Chinese water and soil conservation supervising management developed comprehensively. On March the 1st 1996, the Ministry of Water Resources examined and approved the first soil and water conservation designing of China, that is <The Soil and Water Conservation Designing for Antaibao hypaethral coal mine of Pingshuo colliery industry company>, the examining and approving work of the soil and water conservation designing for construction projects walked up the right path. Up to the present, the soil and water conservation designing for construction projects experienced ten years. Until to the end of 2005, there have been eighty thousands items implemented soil and water conservation designing, the cost for soil and water conservation which the construction units carried out summed to six hundred billion, which increased the soil and water conservation cost intensity of China greatly. The concept of building zoology projects, green projects and sight projects was accepted widely by construction units. The actualizing of soil and water conservation designing effectively controlled the man-made water and soil loss in the process of constructing. The projects which have been actualized soil and water conservation designing seriously, their residue holding proportion is beyond 95%, the vegetation recovery coefficient and disturbed ground controlling rate were both more than 90%, which effectively controlled the soil and water loss, lightened the river way silt and ensured the flood preventing safety.

## 2. The establishment and recension of law and statute related to construction projects

Soil and water loss is one of the most serious environmental problems in China, in order to control the man-made water and soil loss caused by construction radically, our nation constituted and consummated a series of laws and statutes.

On June the 29th 1991, NO.20 conference of the 7th Standing Committee of the Chinese People's Congress discussed and over past <Soil and Water Conservation Law of People's Republic of China>, the soil and water conservation work entered into a new phase of preventing and controlling legally. On August the 1st 1993, <the Actualizing Ordinance of Soil and Water Conservation Law of People's Republic of China> (NO.120 of State Council Command) promulgated and put in force, impelling the law system, executing system, technique service system for Chinese water and soil conservation supervising management to develop widely.

After that, each provincial local people's congress of China came on provincial actualizing ordinance of soil and water conservation law of People's Republic of China in succession, and made it better step by step; in November of 1993, the Ministry of Water Resources started the first passel of Chinese soil and water conservation intendance and execution experimental work, so it entered into experimental actualizing phase from preparing phase. In January of 1994, in order to strengthen the soil and water conservation, the Ministry of Water Resources established the Department of Soil and Water Conservation, definitude its function of working for organizing Chinese soil and water conservation; On November 22nd, 1994, the Ministry of Water Resources, State Planning Commission, and State Environmental Protection Administration jointly published <Management Method of Soil and Water Conservation Design on Construction Engineering> (NO.513 soil and water conservation [1994]), the system of soil and water conservation design became an important program and content for the establishment of construction engineering in China and had an important role in preventing the manmade soil and water loss. On May 30th, 1995, the Ministry of Water Resources published <Regulations on

Approval and Management of Soil and Water Conservation Design for Construction Engineering> (NO.5 of the Ministry of Water Resources Command), the approval work was further programmed and standardized. On February 5th, 1998, the Ministry of Water Resources approved and published <Technical Standard of Soil and Water Conservation Design for Construction Engineering> (SL204-98), the program design work of soil and water conservation get overall specification. On October 20th, 1998, the Ministry of Water Resources and State Power Corporation took the lead in printing and distributing <Temporary Provisions for Soil and Water Conservation Work of Electric Power Construction Engineering> (NO.423 of Soil and Water Conservation[1998]), enhancing the cooperation among departments and propelling the soil and water conservation design implement. After that, the Ministry of Water Resources successively combined and distributed regulations on strengthening soil and water conservation work with Ministry of Railway, Ministry of Communication, State Coal Industry Bureau, State Nonferrous Metal Industry Bureau, Three Gorges Project Office of State Council and so on. In June 1999, Ministry of Water Resources developed management standardizing work of soil and water conservation in 60 cities and counties, which further standardized the law enforcement, strengthened the ability of the supervision and management system, and improved the law enforcement efficiency. On June 15th, 2002, Ministry of Water Resource, State Development Plan Committee, National Economy and Trade Committee, National Environment Protection Master Office, Ministry of Railway, etc six ministries combined and distributed <Notice of Combining to Develop the Activity of Soil and Water Conservation Law Enforcement and Checking> [s and w conservation[2002]258], which pushed the work to develop in depth, and promoted further implement of the "three simultaneousness" system of soil and water conservation design. On October 14th, 2002, Ministry of Water Resources published <Acceptance and Management Method of Soil and Water Conservation Facilities for Construction Engineering>(NO.16 of Ministry of Water Resources Command), and the facilities acceptance work of soil and water conservation for construction engineering developed generally. In order to satisfy the demand of soil and water conservation work under the new situation, on July 8th, 2005, Ministry of Water Resources published NO.24 command, which revised the Regulations on Approval and Management of Soil and Water Conservation Design for Construction Engineering> (NO.5 of the Ministry of Water Resources Command) and <Acceptance and Management Method of Soil and Water Conservation Facilities for Construction Engineering> (NO.16 of Ministry of Water Resources Command, making the approval and management of soil and water conservation design for construction engineering and the acceptance and management method of soil and water conservation facilities for construction engineering more perfect.

**3. Water and soil conservation designing and examining**

**3.1 The ratio of water and soil conservation designing**

According to the characteristics of soil and water loss caused by different construction projects, compartmentalize the projects into line project and point project, the former includes road projects, railway projects, conduit project, channel project, transmitting and changing electricity project and so on; the latter includes electric power project, well mining project, open-air mining project, water conservancy and hydropower project, town building project, farming and forest exploration project, metallurgy chemical project. The statistic data of each province show that in 12 types of construction projects, the ratio of water and soil conservation designing of railway project, electric power project and water conservancy and hydropower project are higher, which are 65%, 63% and 62% separately; the detailed actualizing circs are shown as figure 1.



**Figure 1 Situation of soil and water conservation design ratio of each industry's construction projects**

### 3.2 The situation of water and soil conservation design reply

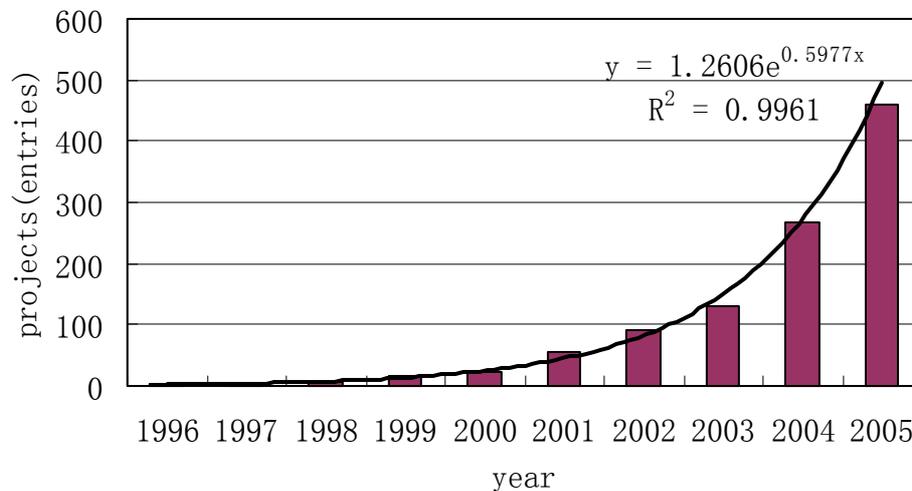
Until to the end of 2005, the Ministry of Water Resources have examined 1060 soil and water conservation designs for large construction projects, including 142 items which were examined by consigning provincial water resources administration charge department, the cost summed to more than 5000 billion, avoiding soil and water loss of more than 1000 kilometers area, reducing 500 million tons of soil erosion, and the detailed circs are as form Table 2.

**Table 2 Collecting table of soil and water conservation design given official by Ministry of Water Resources**

Time (a)	Nation examine projects(item)	Nation commission projects(item)	Total (item)	Water and soil conservation investment (100 million RMB)	Area of avoiding soil and water loss (km <sup>2</sup> )	Quantity of avoiding soil and water loss (100 million t)
1996	2	-	2			
1997	4	-	4	0.07		
1998	8	-	8	0.14		
1999	15	-	15	3.20		
2000	24	-	24	5.89		
2001	57	-	57	34.3	866.8	0.4
2002	90	-	90	44.9	3069.6	0.5
2003	111	20	131	80.3	1075.1	0.8
2004	215	53	268	195.6	2835.7	2.0
2005	392	69	461	162.2	2871.2	1.5
□□	918	142	1060	526.6	10718.4	5.2

Remark: Information come from Water Resources Department of Soil and Water Conservation.

From form 1, it can be seen that during the “fifteenth” period, the quantity and invests of Chinese construction are both growing by exponential form, the preventing area of responsibility and decrement of soil and water loss are on the same tendency. In which, the growing situation of the construction projects quantity can be seen from chart 2 directly.



**Figure 2 The increasing trend of large exploitation and construction engineering given official by Ministry of Water Resources**

From chart 2, it can be seen during “the ninth five-years plan ” and” the tenth five-years plan”, the amount of large construction projects which are examined by the Ministry of Water Resources increases by exponential form, and the formula is  $y = 1.2606e^{0.5977x}$ , curve coefficient is 0.9961, close to 1, and the relevance is very good.

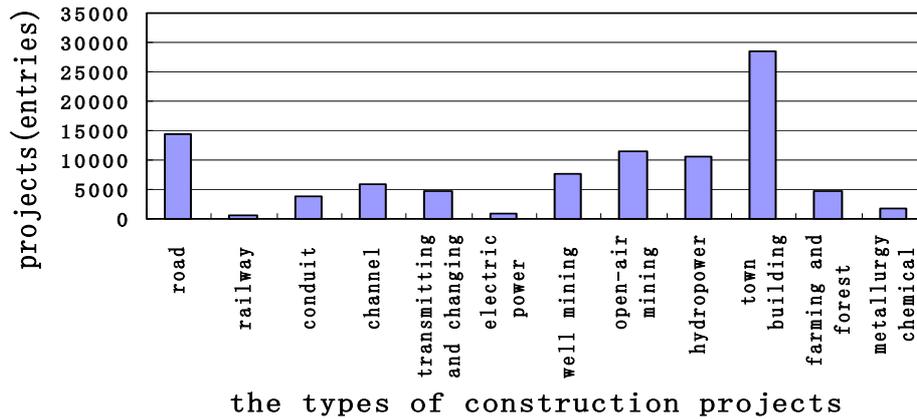
### 3.3 The contribution of region and industry

According to the statistic data of Chinese 32 provinces, the construction projects are mainly contributed on the west, the east, the middle, and the northeast of China, the detailed circs are shown as table 3.

**Table 3 Industry distribution situation of different regions**

Area	Projects (entries)	Rare (%)
West	32306	41
Middle part	19060	24
East	24977	32
East-North	1809	2
Total	78152	100

Figure 3 shows the industry distribution situation of exploitation and construction engineering in China.



**Figure 3 Industry distribution situation of exploitation and construction engineering in China**

Figure 3 shows that in each type of projects in China, the number of projects in town much higher than other types of construction items, the second is road construction, the third is water conservancy and hydropower projects and open air mining projects.

The circles above of area and industry contribution of soil and water conservation design for construction projects is totally consistent with the contribution of Chinese natural resources and the China's Regional Development Strategy during "the ninth five-years plan" and "the tenth five-years plan". The advantage of China's natural resources is "vast territory and abundant resources", among 150 types of mineral resources utilizable by human beings in the world, China has 137 types of them proved reserves preliminarily, but the contribution is unbalance. The coal resources are mainly contributed in the North and the Northwest of China, in which the reserves of Shanxi, Nei Monggol, Shanxi, Guizhou, Xinjiang, Ningxia, Anhui these 7 provinces account for 84% of the total reserves in China; the petroleum and natural gas are mainly distributed in northeast, west and east; the mineral resources of Fe, Mn, Cu and so on are mainly distributed in west, middle and east; the possible exploitation rate of China's hydropower resources is 32%, which is mainly distributed in Changjiang River Basin, Yarlungzangbo River and other rivers of Tibet, international rivers in the southeast; all the phenomena above explain that the distribution of China's natural resources is very unbalanced, the coal should be transported from North to South, the gas should transmit from West to East, the electric power should synchronize and close. So, the construction presents regional unbalance situation.

#### 4. The control and management on the conservation design of soil and water

Since 2000, especially in the year of 2002, after Ministry of Water Resources, Ministry of Communications and other six ministries and commissions combine to advocate a notification "the notification about the expansion of examine the law of water and soil conservation" (Water and Soil Conservation[2002] NO.258), all levels of institutions that superintended water and soil conservation increase the power of intendance and management to explore and construct projects on water and soil conservation work, according to the law, develop a series of intendance and management work and have good effects. At present, nearly more than 200 regions (town) and 2400 countries (city, section) are conformed to establish water and soil conservation institutions of intendance and management with definitely function and definite the main body of execute the law, in order to make water and soil keep "the three authorities", now the institution have 74,000 tipstuffs, including 18,000 fulltime personnel and 56,000 pluralities, moreover nearly 10,000 tipstuffs are prepared in villages. Institutions of drainage basin and intendance and management system are already formed basically. By far, China promulgate nearly 1698 regional codes, regulations, criterions, conduct 37073 examinations, examine 33821 projects, deal with 6327 irregularity cases.

## 5. The effects obtained

Explore and conduct project through take engineering measures, plant measures and temporary measures and so on, to prevent and cure the erosion of debris from construction and excavation, because of construction cause the excavation face unsteadily ,leading geological hazard such as landslide, debris flow and landslip etc, controlling the newly increase of soil erosion efficiently ,adding area of the forests and vegetation, enhancing the ground coverage ratio, improving environment, insuring constructions and operation run regularly, avoiding to influence the construction of the main body of the project , avoiding to influence the water circumstance nearby, limit the current of environment exasperated, accelerating Sustainable development of society and economy.

According to investigation and statistics, the engineering such as electric power, electric transmission, gas pipeline, speedway, railway and coal mine, as chart 4 shown, the number of soil erosion per unit capacity increased gradually. For the increase of soil erosion per unit capacity in engineering as mentioned, the fund devoted to water and soil conservation increased correspondingly, whereas, Owing to the localization of industry productive character, benefits gained were different. Chart 5 shows the investment in water and soil erosion per unit engineering quantity, chart 6 shows the decrease of soil erosion by the investment.

**Table 4 Water and soil conservation benefit of a unit project**

title	road	electric power	mining	Transmitting and changing electricity	conduit
New increase water and soil erosion quantity(t)	1535.92	27.06	7450.38	42.94	354.96
Decrease water and soil erosion quantity(t)	28.54	29.66	33.23	7.06	24.13
Water and conservation investment(10000 RMB)	77.46	4.65	380.21	7.49	15.16

As Table 4 show, can clearly get the number of soil erosion caused by different types of projects and the fun invested and the effects obtained.

Furthermore, according to statistical data that every province (Municipalities) offered, up to 2004, comprehensive treatment soil erosion area were add up to 79,0500stere, comprehensive treatment implemented reduce soil erosion 2,725,000,000 tons, increasing rainfall efficiency utilization 32,026,000,000, increasing economy earning 28,428,000,000 Yuan, increasing commissariat product 8,757,000,000kg, increasing area of the forests and vegetation 14,505,800 hectares; beneficiary up to 64,469,700, make 12,508,200 break away from poverty, solving the problem of drinking .so explore engineering through implement soil conservation project, gain remarkable effects.