

**Ministry of Public Works and Transport
Kingdom of Cambodia**

**PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR FLOOD DISASTER
REHABILITATION AND MITIGATION
IN
KINGDOM OF CAMBODIA**

August 2012

**JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)**

KATAHIRA & ENGINEERS INTERNATIONAL

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Summary

1. Outline of the Country

Kingdom of Cambodia (Cambodia) is located at downstream region of Mekong River in Indochina Peninsula and is bordered by Thailand, Laos and Vietnam. The area of country is approximately 181,000 km², and it's population is approximately 13.4 million.

The annual growth rates of Gross Domestic Product (GDP) from 2005 to 2007 were over 10% each year. Although it suffered negative growth of GDP in 2009 due to the financial crisis in 2008, it's economy is smoothly recovering and the figure in 2010 turned positive.

The majority of the land is very low. Therefore, the rate of fatal risk for the both of life and economy by the flooding is around 13%, which is in the upper level in the world.

On the other hand, Cambodia has been enjoying fertile land. Cambodian granaries are located at flooding areas like Lake Tonle Sap and around Mekong River. Accordingly, ecosystem and human life in Cambodia has been adapted to the flood. As a result, the modern flood control facilities are available only in Phnom Penh City.

It is said that seasonal variation in water level of Mekong River has recently became large due to climate change, and drought and/or flood occurred almost every year.

2. Background of the Project

In the Kingdom of Cambodia (Cambodia), the worst flooding occurred in 2000, and 2 locations on the National Road No.1, which serves as the riverbank of Mekong River, were emergently cut to prevent flooding to the center of Phnom Penh. After the above flooding, the government of Japan has been supporting Cambodia in order to mitigate flood disasters in Phnom Penh through grant aid projects such as drainage system and pump station improvement, and improvement of National Road No.1 to strengthen the function as the riverbank of Mekong River and to install the openings to Colmatage by construction of bridges and culverts.

During the rainy season in 2011, the water level of Mekong River reached almost the same level as that of the serious flooding occurred in 2000 due to unusual rainfall at the upstream of the Mekong River. Although there was no serious flood disaster in Phnom Penh, there was widespread damage from the flooding outside Phnom Penh, and it was reported that over 250 persons were sacrificed, 1.5 million people suffered flood and 17 percent of paddy fields in Cambodia were spoiled by the flooding. Under such condition, the Government of Cambodia requested urgent grant aid for the rehabilitation of the flood disasters mentioned below to the Government of Japan.

Kampong Chhnang City flood disaster

Kampong Chhnang City is located at the west bank of Tonle Sap River, and when the water level of Tonle

Sap River rises during rainy season, lowland area of the city is usually flooded, but the city center area and the roads on embankment have seldom been flooded. During the flood in 2011, most of the city, including National Road No.5 city center section, has been flooded for over a month. Since the pavement type is DBST (Double Bituminous Surface Treatment), the most pavement in the city center was seriously damaged. Although the repairing work has been carried out temporarily, it is necessary to rehabilitate the pavement repeatedly damaged by floods with asphalt concrete in order not to obstacle the smooth passage of vehicles. Furthermore, since the road was flooded for a long time due to lack of drainage facilities along the road, it is also necessary to provide such facilities.

National Road No.11 flood disaster

National Road No.11 is located at the east bank of Mekong River in the flood plain of Cambodia connecting three National Roads, namely No.1, No.7 and No.8. It is also a part of the route to connect Vietnam and Thailand without passing through Phnom Penh, whose route is very important for the logistics especially when flooding occurs on the other National Roads. On National Road No.11, there are 14 dilapidated temporary bridges with load restricted only one lane. As a result, such road section does not fulfill the function as a national road. Therefore, it is necessary to improve the bridges. Of the above 14 bridges, 6 bridges were committed to be improved by the Government of Cambodia budget and ADB loan, but the remaining 8 bridges are not planed to be improved. Since the abutment protections, riverbeds and approach roads of the bridges were also damaged by flooding in 2011, durable protections and proper openings of the bridges to discharge/release the floods are required.

Receiving the request from the Government of Cambodia, the Government of Japan decided to carry out the preparatory survey (outline design) relating to the grant aid for the rehabilitation and mitigation of the abovementioned disasters.

3. Outline design of the Study and Contents of Project

In response to the request from Cambodia, the Government of Japan decided to conduct the preparatory survey on "the Project for Flood Disaster Rehabilitation and Mitigation in Kingdom of Cambodia".

JICA dispatched a survey team to the site between the period of 23rd January 2012 and 1st February 2012 in order to confirm the project area and components. Furthermore, the survey team was dispatched to the site again between the period of 13th February 2012 and 13th March 2012 to study the components in details. The survey team held a series of discussions with the concerned officials of Cambodia, and conducted field investigations.

Based on the results of the above Surveys, Outline Design was developed and summarized into Draft Final Report. Between 23rd and 30th July 2012, the survey team was dispatched again to discuss the Outline Design Report and it was agreed after the consultations with MPWT.

Overall goal and the Project objective of the project are described as below:

Overall Goal: Mitigation against flood disasters and activation of local economic activities by improving the road and drainage in Kampong Chhnang City and bridges along National Road No.11 which were damaged by the flooding in 2011.

Project Objective: Improvement of road and drainage in Kampong Chhnang City and bridges along

National Road No.11 which were damaged by the flooding.

The project aims to rehabilitate and improve the selected roads and drainages in Kampong Chhnang City and bridges along National Road No.11 under Japanese grant aid in order to accomplish the above overall goal. The improvement of roads in Kampong Chhnang City includes improvement of pavement, drainages and sidewalks of National Road No.5 city center section (2.2km), and related major streets (2.4km) and installation of drainage way (2.6km) to be extended to the proper outlet at the river. The improvement of bridges along National Road No.11 includes replacement of existing temporary 6 bridges and restoring of insufficiently opened 2 culverts by 2-lane permanent bridges (totally 8 bridges). The 6 bridges other than the above 8 bridges along National Road No.11 will be improved by the own fund of Government of Cambodia and ADB loan as the joint co-operation projects by ADB and JICA.

The contents of facilities under outline design are summarized in Table1-1-1

Table 1-1-1 Contents of Facilities under outline design

Facilities Name	Specification
Roads and drainages facilities in Kampong Chhnang City	<u>National Road No.5 in Kampong Chhnang City</u> Total Length : 2.2km Earthworks : Excavation (Removal of existing pavement) Road Pavement : Asphalt Concrete Surface Course (50mm thick) Asphalt Concrete Binder Course (50mm thick) Road Base : Bituminous Treatment Base Course (80mm thick) Mechanical Stabilized Base Course (200mm thick) Stabilized Base Course (200mm thick) Crusher-Run Sub-Base Course (300mm thick) Sidewalk Pavement : Tile Drainage : Concrete Pipe (300mm Internal Diameter) 、 In-situ side ditch (400x600mm) Catchpits、 Manholes Concrete Kerb : Sidewalk Separation Block (200 (w) x300 & 200 (h) mm) Ancillary Facilities : Roadmarking, Gabion
	<u>Main Streets and Drainage Ways in Kampong Chhnang City</u> Main Streets total length : 2.4km Drainage Ways total length : 2.6km Earthworks : Excavation, Embankment Road Pavement : Asphalt Concrete Surface Course (50mm thick) Aggregate Pavement (200mm thick) Road Base : Bituminous Treatment Base Course (50mm thick) Crusher-Run Sub-Base Course (200mm thick) Public market pavement : Inter-locking Blocks Drainage : Concrete Pipes(300~1,750mm internal diameter) 、 Catchpits、 Manholes In-situ side ditch (400x600mm、 1,000x1,000mm) Concrete Kerb : Sidewalk Separation Block (200 (w) x300 & 200 (h) mm) Ancillary Facilities : Roadmarking

Facilities Name	Specification			
Bridges along National Road No.11	Bridge No	Bridge Name	Bridge Length (m)	No of Span (no)
	BR-4	Kbal Boeung	33.0	3
	BR-5	Snate	40.0	4
	BR-7	Sam Puthor II	44.0	4
	BR-8	Mebon	50.0	5
	BR-9	Tkov I	44.0	4
	Clv-1	Tkov II	20.0	2
	BR-11	Ek Ream	33.0	3
	Clv-2	Rom Lech	44.0	4
	Total			308.0
<p>Road Width : 10.0 m</p> <p>Superstructure type : RC slab (Integral Type)</p> <p>Foundation type : Precast pile (400 mm x 400 mm)</p> <p>Road Pavement : Asphalt Concrete Surface Course (50 mm thick) Asphalt Concrete Binder Course (50mm thick)</p> <p>Road Base : Bituminous Treatment Base Course (80mm thick) Crusher-Run Sub-Base Course (180, 150, 130mm thick) Aggregate Sub-Base Course (Aggregate 250 mm thick)</p> <p>Subgrade : Cement stabilized Subgrade (400 mm thick)</p> <p>Slope Protection : Sodding、 Grouted Riprap、 Riverbed Protection</p> <p>Abutment Protection : Riverbed Protection、 Grouted Riprap、 Gabion</p> <p>Ancillary facilities : Guide Posts、 Guard rail、 Roadmarking</p>				

4. Implementation Schedule and Initial Cost Estimation

To implement the Project under the Japanese Grant Aid system, it is scheduled that the detailed design period to be 4 months and the construction period to be 24months.

The cost borne by Cambodian side to implement the Project is estimated at US\$ 39 thousand.

5. Project Evaluation

(1) Relevance

Improvement of roads and drainage facilities in Kampong Chhnang City

- ① Beneficiary of the Project reaches throughout Kampong Chhnang Province whose population is 540 thousand people and it is numerous.
- ② The National Road No.5 is located on the Asian Highway No.1 which connects Phnom Penh and Bangkok and it is very important route.
- ③ Although provisional emergency repair work was carried out for the damaged surface.it is a temporary measure and there is a need of full-scale rehabilitation with durable pavement. .
- ④ Improvement of Roads and Drainage Facilities in central area of Kampong Chhnang City may reduce road damages caused by inundation.
- ⑤ With regard to the management and maintenance of roads, Cambodia can operate and maintain the project facilities by itself and special techniques are not required.

- ⑥ This project meets the policy of “Further restoration and construction transport infrastructure” stated in National Strategic Development Plan Update 2009-2013.

Improvement of Bridges along National Road No.11

- ① Beneficiary of the Project reaches throughout Prey Veng Province whose population is 1,060 thousand people and it is numerous.
- ② The National Road No.11 connects three National Roads, namely N.R.No.1, N.R.No.7 and N.R.No.8 and constitutes very important national route from Thailand to Vietnam without passing through Phnom Penh Capital.
- ③ Although there was no overflowing of bridges during rainy season in 2011, the water level reached to almost bridge slab levels. Accordingly, urgent reconstruction of bridges is required taking into account that the bridges are very old.
- ④ Five wooden bridges along National Road No.11 will be reconstructed under ADB loan. Accordingly, it will be very effective to reconstruct the remaining bridges as a cooperation project with ADB in flood disaster mitigation
- ⑤ With regard to the management and maintenance of the road, Cambodia can operate and maintain the project facilities by itself and special techniques are not required.
- ⑥ This project meets the policy of “Further restoration and construction transport infrastructure” stated in National Strategic Development Plan Update 2009-2013.

(2) Effectiveness

- ① Quantitative Impact

Improvement of roads and drainage facilities in Kampong Chhnang City

Quantitative Impact Items	Before Implementation (2012)	After Implementation (2017)
① Maintenance Cost of Road & Drainage Facilities in Kampong Chhnang DPWT (US\$/year)	Approximately 20,000	Approximately 7,000
② Period of stagnant water at road sides (Day/Year)	Approximately 50	Approximately 0

Improvement of Bridges along National Road No.11

Quantitative Impact Items	Before Implementation (2012)	After Implementation (2017)
① Maintenance Cost of Bridges in Prey Veng DPWT (US\$/year)	Approximately 8,000	Approximately 3,500
② Travelling Time due to Improvement of Traveling Performance (through National Road No.11) (minutes)	Approximately 120	Approximately 80

② Qualitative Impact

Improvement of roads and drainage facilities in Kampong Chhnang City

- Comfort of travelling will be improved due to improvement of road pavement and drainage facilities.
- Safety and Comfort of pedestrian will be improved due to improvement of sidewalk.
- Living environment will be improved due to improvement of drainage system.

Improvement of Bridges along National Road No.11

- The function as National Road will be strengthened due to reconstruction of temporary bridges with permanent bridges
- Number and period of overflowing at two spillways on National Road No.11 will be reduced (Approximately 20 cm depth overflow occurred on the National Road No.11 for totally 30 days during the flood in 2000 and 2011, but it will be almost solved due to this project)

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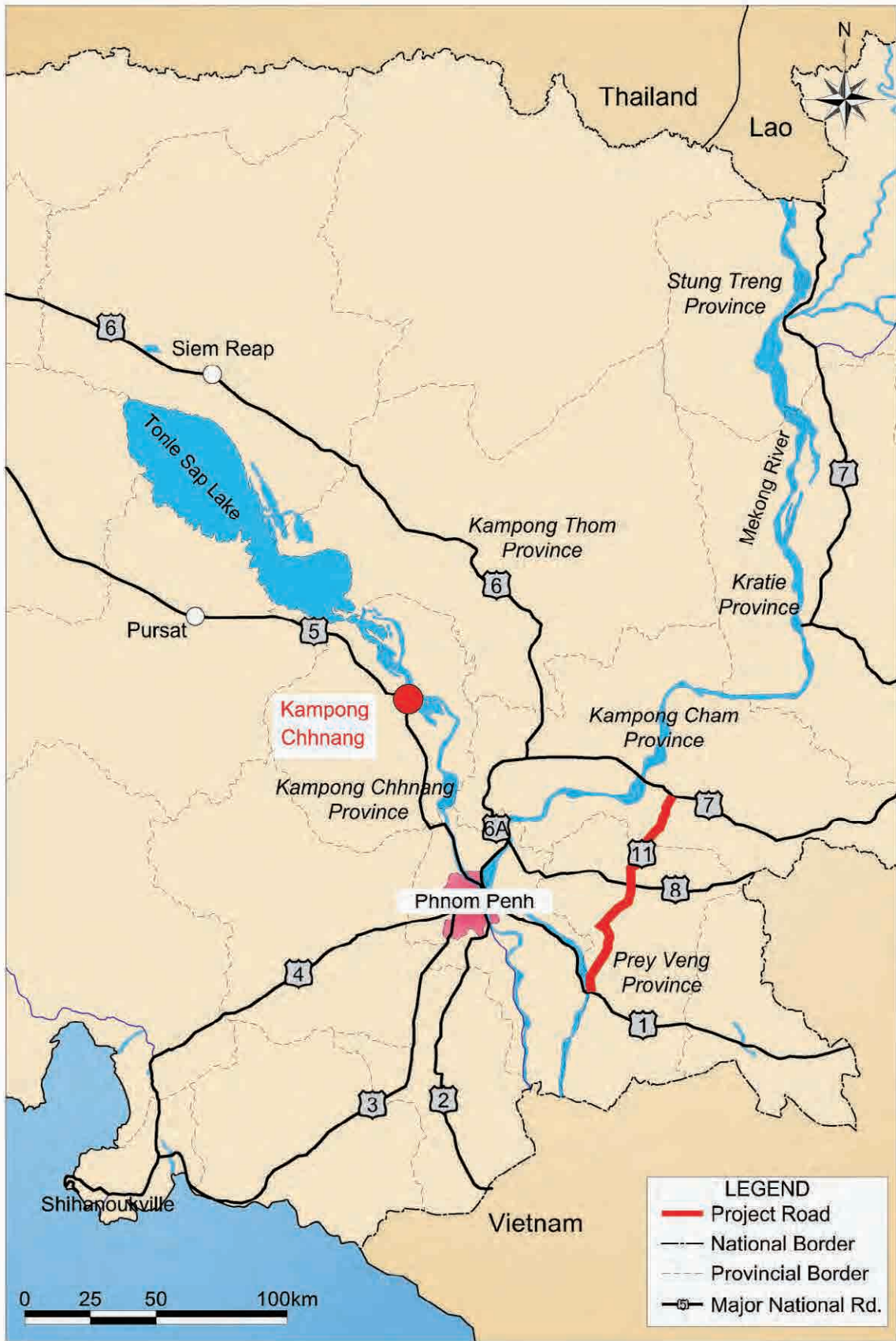
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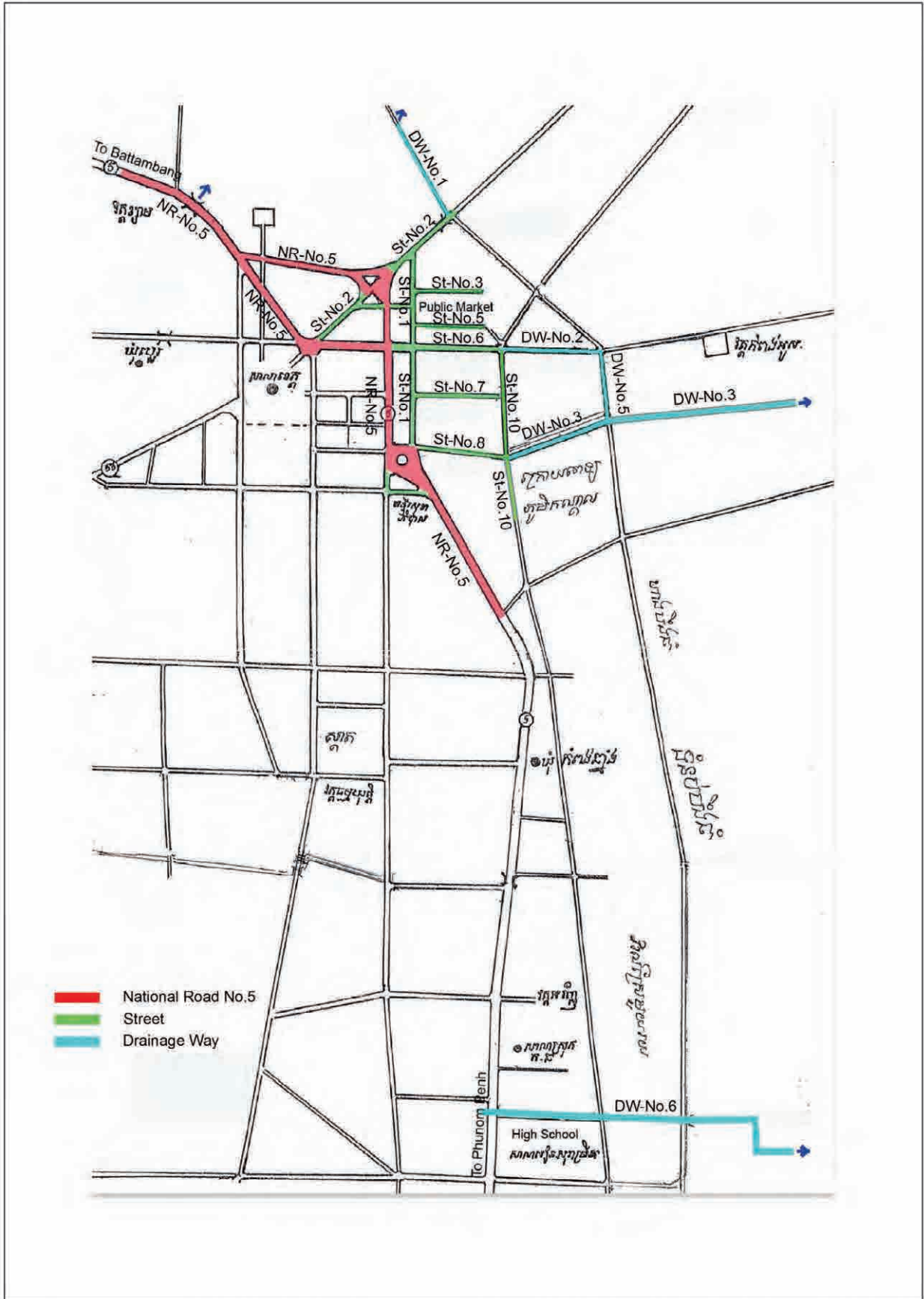
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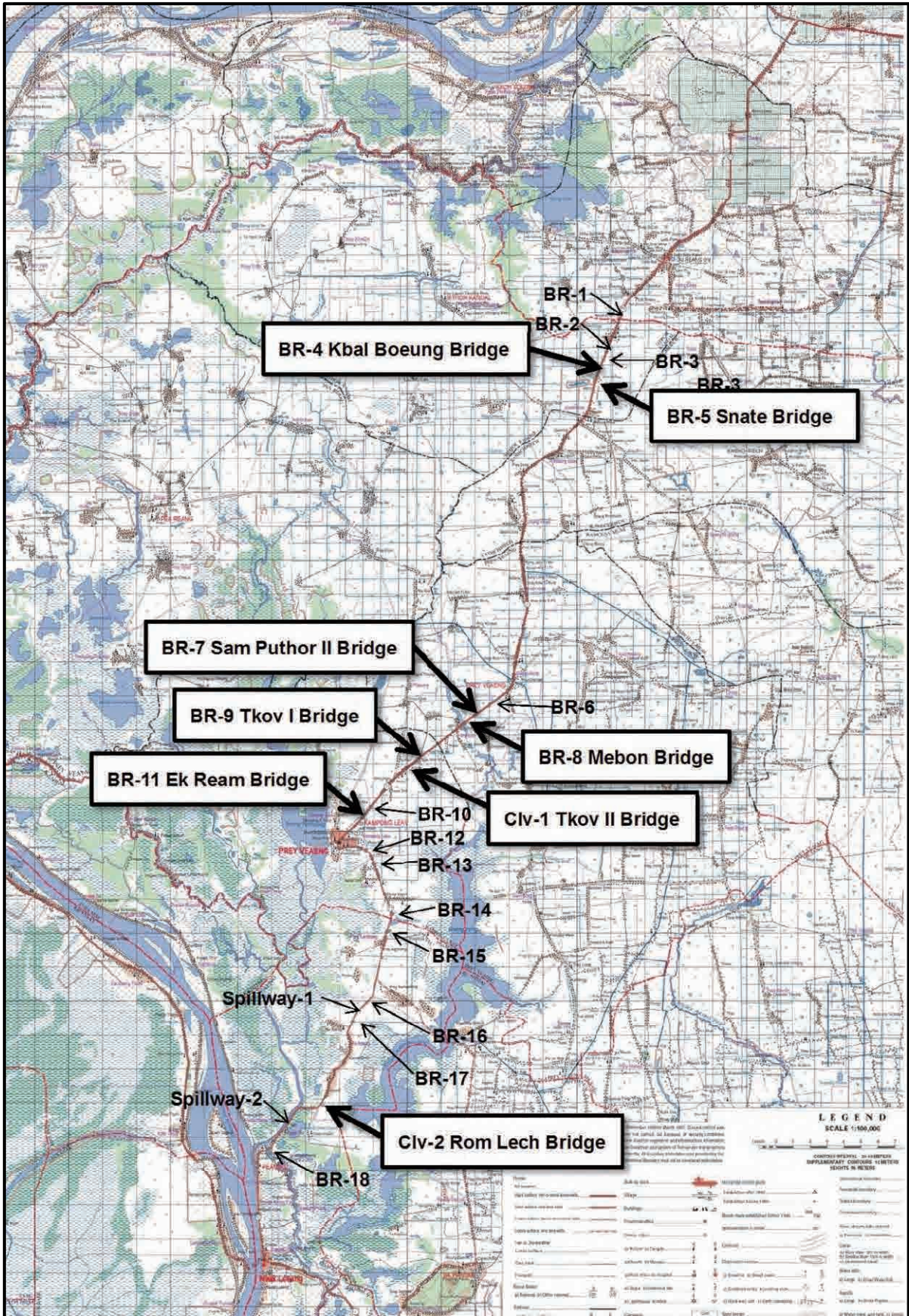
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Location Map



Location of Components / Roads and drainage facilities in Kampong Chhnang City



Location of Components / Bridges along National Road No.11



PERSPECTIVE (National Road No.11 Clv-2 Rom Lech Bridge)

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Abbreviation

AASHTO	:	American Association of State Highway and Transportation Officials
ADB	:	Asian Development Bank
AH	:	Asian Highway
AH	:	Affected Household
BCU	:	Bridge Construction Unit
DMS	:	Detailed Measurement Survey
DPWT	:	Department of Public Works and Transport
EDC	:	Electricite du Camboge
E/N	:	Exchange of Note
G/A	:	Grant Agreement
GDP	:	Gross Domestic Product
IRC	:	Inter-Ministerial Resettlement Committee
KC	:	Kampong Chhnang
M/D	:	Minutes of Discussions
MEF	:	Ministry of Economy and Finance
MPP	:	Municipality of Phnom Penh
MPWT	:	Ministry of Public Works and Transport
PAPs	:	Project Affected Persons
PPWSA	:	Phnom Penh Water Supply Authority
PRW	:	Provisional Road Width
PV	:	Prey Veng
RAP	:	Resettlement Action Plan
RCC	:	Road Construction Center
RCS	:	Replacement Cost Survey
RGC	:	Royal Government of Cambodia
RID	:	Road and Infrastructure Department
ROW	:	Right of Way
TC	:	Telecom Cambodia
T/N	:	Tender Notice
V/C	:	Verification of Contract

CHAPTER1 BACKGROUND OF THE PROJECT

1-1 BACKGROUND OF THE PROJECT

In the Kingdom of Cambodia (Cambodia), the worst flooding occurred in 2000, and 2 locations on the National Road No.1, which serves as the riverbank of Mekong River, were emergently cut to prevent flooding to the center of Phnom Penh. After the above flooding, the government of Japan has been supporting Cambodia in order to mitigate flood disasters in Phnom Penh through grant aid projects such as drainage system and pump station improvement, and improvement of National Road No.1 to strengthen the function as the riverbank of Mekong River and to install the openings to Colmatage by construction of bridges and culverts.

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durable protections and proper openings of the bridges to discharge/release the floods are required. Receiving the request from the Government of Cambodia, the Government of Japan decided to carry out the preparatory survey (outline design) relating to the grant aid for the rehabilitation and mitigation of the abovementioned disasters.

1-2 NATURAL CONDITIONS

Cambodia's climate is dominated by the monsoon, which is known as tropical wet and dry climate because of the distinctly marked seasonal differences. In summer moisture-laden air of the southwest monsoon is drawn landward from the Indian Ocean and the Gulf of Thailand. Southwest monsoon brings the rainy season from mid-May to mid-September or beginning of October, and Northeast monsoon and cold dry air blows from early November until March. Then hotter air prevails in April and early May.

The average annual temperature in 2006 was about 28°C, and the temperature has a slight variation throughout the year, and is nearly as nationwide.

It is almost no raining during dry season, but it rains almost every day during rainy season in both of Kampon Chhnang and Prey Veng. The large volume of water flow of Mekong River in rainy season causes backwater phenomenon, so large portion of the project area is submerged. The rainy season starts from April and the peak of the rain will come in September for Kampong Chhnang and October for Prey Veng. In November, the rainy season is ending and there is almost no raining in December in the both areas.

The geographical feature of Cambodia is classified into the following three areas.

- ① Coastal areas of southwest : Cardamom and Elephant mountain range of 1,000 ~ 1,800 m above sea level
- ② The central plain of the low flat ground consisting mainly of the Mekong River and Tonle Sap Lake: The water level rises and intuition Wed of each year in the Mekong River about 10m above sea level.
- ③ Low hilly eastern plateau : Elevation is about 100~300m

Kampong Chhnang City and National Road No.11 in Prey Veng is classified in ②.

1-3 ENVIRONMENT AND SOCIAL CONSIDERATION

1-3-1 Necessity of Land Acquisition and Resettlement

1-3-1-1 Kampong Chhnang

In total 19 independent shops are affected by the construction of new drainage facilities. Some simple wooden huts shop on the right of way need to be temporarily setbacked during construction. According to fact-finding on the spot, these huts belong to the owners of adjoining land along the street and rental fee for the hut is free. The sellers differ day by day. They are barber, repair shop for motorbike, retail shop and so on.

Land acquisition will be approximately 7,100 m² for the private land in order to discharge rain fall water to Tonle Sap River without any influence to the agricultural land.

As public institution has not acquired any information of land ownership, its knowledge has been known little. The project committee will be established and headed by a representative from the Ministry of Economy and Finance (MEF), and other representatives from concerned ministry/institutions.

Affected households having land title will be validated by the project committee during the detailed measurement survey (DMS).

1-3-1-2 Bridges along National Road No.11

Some small wooden houses located in the detour construction areas are necessary to be setback from the area. No land acquisition is necessary since all of the project structures including the detours are planned within the road right of way (ROW = 25m for each side).

1-3-2 Scale of Land Acquisition and Resettlement

1-3-2-1 Kampong Chhnang City

Table 1-3-1 shows number of affected structures necessary to be removed by the project.

Table 1-3-1 Number of Affected Structures Necessary to be Removed

Location	Structure Type	Number	Use
Street St-No.6	Wooden hut	13	Shop
Street St-No.8	Wooden hut	5	Shop
Drainageway DW-No.6	Wooden hut	1	Shop

Table 1-3-2 Land Acquisition Area

Station	Present Land Use	Estimated Area
Drainageway DW-No.3	Meadow/Rice field	Width:10.4m、 Length: 530m
Drainageway DW-No.6	Meadow	Width: 5m、 Length: 200m

1-3-2-2 Bridges along National Road No.11

Affected structures which are necessary to be setback during the construction are shown in Table 1-3-3.

Table 1-3-3 Affected Structures to be Setback

Location	Structure Type	Use
Culvert No.2	Wooden wall straw roof house	Residence
Bridge No.11	Wooden wall tin roof house	Residence
Bridge No.4 (1)	Wooden wall straw roof house	Residence
Bridge No.4 (2)	Wooden house	Residence

1-3-3 Compensation and Support

1-3-3-1 Kampong Chhnang City

For the loss of the private land, cash compensation will be made to the land owners who are clarified as the land owner. The land acquisition affects no serious negative impact for land owners' livelihood because the most portions of the lands are meadow and rice field. The land owners may accept installation of the drainage pipes as it requires no land acquisition. For the removal of the wooden huts located within the ROW, cash compensation should be requested to pay directly to the hut owners.

1-3-3-2 Bridges along National Road No.11

Under the current Cambodian land law, those who occupies land within ROW are not eligible for the compensation for it, but they are entitled to request the cost for setbackting their houses.

1-3-4 Grievance Redress Mechanism and Implementation System

According to MPWT, the project committee will be established and headed by a representative from the Ministry of Economic and Finance, and other representatives from concerned ministry/institutions. The project committee will carry out stakeholder meetings and detailed measurement survey of assets. Establishment of a grievance redress committee is stipulated in Article 14 of the law. A grievance redress committee shall be established and led by a representative from the Ministry of Land Management, Urban Planning and Construction, and composed of representatives from relevant ministries/institutions. However, provincial level organizations practically handle the grievance redress. The members of the provincial organization are provincial governor, deputy provincial governor, director/deputy director of provincial departments, chief/deputy chief of state property office of MEF, chief/deputy chief of light criminal office of the provincial commissariat, chief/deputy chief of military police headquarter, district governor commune chief and village chief, etc.

In case any grievance claimed by project affected persons (PAPs) cannot be settled within 15 days after the claim, it will be forwarded to district office. If it cannot be settled within 15 days after the forwarding date, it will be redressed at provincial committee. If it cannot be redressed at provincial committee, it will be forwarded to the provincial court for final decision.

1-3-5 Implementation Schedule

Implementation schedule of the land acquisition and resettlement is shown in Table 1-3-4.

Table 1-3-4 Implementation Schedule of Land Acquisition and Resettlement

Year Month	2012												
	3	4	5	6	7	8	9	10	11	12			
Provincial Resettlement Sub-Committee Working Group													
Stakeholder's meeting etc.													
Others													

1-3-6 Monitoring Plan

1-3-6-1 Land Acquisition and Resettlement Monitoring Plan

Monitoring on land acquisition and resettlement will be conducted by the project committee organized by MEF, MPWT and other relevant organizations. The project committee will explain and consult with the project affected persons. Monitoring forms for land acquisition and resettlement are shown in ANNEX 5 of Minutes of Discussion dated on 27th July, 2012. MPWT is requested to record and report to JICA monthly the outcome of the explanation and consultation with the project affected persons in accordance with the resettlement monitoring plan, which is shown in Table 1-3-5.

Table 1-3-5 Proposed Resettlement Monitoring Plan

Item	Contents	Frequency
Stakeholders Meeting	Items to be recorded: <ul style="list-style-type: none"> • Date of meeting • Attendees • Meeting venue • Comments from attendees and answers, others 	Every Meeting
Resettlement Action Plan (RAP)	Items to be recorded: <ul style="list-style-type: none"> • Confirmation of situation regarding land acquisition, compensation, supports, and resettlement • Evaluation • Points to be improved 	At any time
Grievance Redress	Items to be recorded: <ul style="list-style-type: none"> • Contents of grievance • Recipient of grievance • Countermeasures • Problems to be solved 	At any time

1-3-6-2 Environmental Monitoring Plan

There is a possibility of occurring temporary air pollution, water pollution and noise during the construction period. However, they may be within limited levels. The mitigation measures against the said pollutions should be stated in the construction plan. The environmental monitoring as shown in Table 1-3-6 will be recorded by the Consultant and reported to MPWT and JICA using Monitoring form shown in ANNEX 4 of Minutes of Discussion dated on 27th July, 2012 during the construction period.

Table 1-3-6 Proposed Environmental Monitoring Plan

Item	Proposed Mitigation Measure	Confirmation by	Frequency	Budget
During Construction				
Dust due to passing vehicles at construction area	Spreading water on the roads. To limit driving speed	Resident Engineer (Consultant)	Monthly report	Included in the Project Cost
Water pollution due to outflow of excavated soil	Cleaning it using settlement pond	-ditto-	-ditto-	-ditto-
Noise due to construction machinery	Fixing working hours. Explanation to the residence before commencement of the work	-ditto-	-ditto-	-ditto-

1-3-7 Environmental Checklist

The environmental checklist is shown in Annex 3 of Minutes of Discussion dated on 27th July, 2012.

CHAPTER2 CONTENTS OF THE PROJECT

2-1 BASIC CONCEPT OF THE PROJECT

2-1-1 Overall goal and project objective

Overall Goal: Mitigation against flood disasters and activation of local economic activities by improving the road and drainage in Kampong Chhnang City and bridges along National Road No.11 which were damaged by the flooding in 2011.

Project Objective: Improvement of road and drainage in Kampong Chhnang City and bridges along National Road No.11 which were damaged by the flooding.

2-1-2 Basic Concept of the Project

The project aims to rehabilitate and improve the selected roads and drainages in Kampong Chhnang City and bridges along National Road No.11 under Japanese grant aid in order to accomplish the above overall goal. The improvement of roads in Kampong Chhnang City includes improvement of pavement, drainages and sidewalks of National Road No.5 city center section (2.2km), and related major streets (2.4km) and installation of drainage way (2.6km) to be extended to the proper outlet at the river. The improvement of bridges along National Road No.11 includes replacement of existing temporary 6 bridges and restoring of insufficiently opened 2 culverts by 2-lane permanent bridges (totally 8 bridges). The 6 bridges other than the above 8 bridges along National Road No.11 will be improved by the own fund of Government of Cambodia and ADB loan as the joint co-operation projects by ADB and JICA.

2-2 OUTLINE DESIGN OF THE JAPANESE ASSISTANCE

2-2-1 Design Policy

2-2-1-1 Project Scope

(1) Improvement of Roads and Drainage Facilities in Kampong Chhnang City

Kampong Chhnang City center section of National Road No. 5 and its related major streets damaged by the flood are improved with the durable type pavement under the project. Road drainage facilities and sidewalks which are necessary to be furnished to the project roads are installed. The drainage ways which are necessary to discharge rainwater from the project road to the proper places at the river are installed. The project roads and drainageways are shown in the location map at the beginning of this report.

(2) Improvement of Bridges along National Road No.11

Eight (8) bridges along National Road No.11, the dilapidated temporary bridges and inadequate capacity box culverts which are having high priority to be reconstructed and are not committed to be reconstructed by other donors, are replaced by 2-lane permanent bridges under the project. The location of the project bridges are shown in the location map at the beginning of this report.

2-2-1-2 Design Policy

(1) Basic Policy

The basic policy of the outline design of the project roads and bridges is as follows:

(2) Policy for Natural Environmental Conditions

The project facilities are designed to reach adequate level from the points of durability, safety and function against the natural site conditions such as meteorology, hydrology and geology. Regarding to the project roads in Kampong Chhnang City, smooth and immediate draining from the roads is required. Regarding to the project bridges along National Road No.11, constructing the bridges with sufficient durability against floods and the floods level lower than the present is required.

(3) Policy for Socio-Economic Conditions

The project facilities are designed to satisfy the needs in the traffic and socioeconomic activities in the sites. Accessibility between the roadside facilities and the project roads and usability and conformability to road users will be considered.

(4) Policy for Construction & Procurement Conditions

Construction materials are specified in consideration of quality, cost and procurement condition. The common soils at the sites tend to be unsuitable for the embankment due to its derisiveness. Therefore, procurement of suitable soil for the embankment is planned. Since the ceramic industry is active in Kampong Chhnang Province, the local products of ceramic tiles are utilized for the sidewalk pavement.

(5) Policy for Utilization of Local Contractor & Consultant

Local contractors with sufficient equipment and technical capabilities are utilized in construction planning. Construction methods commonly used in Cambodia are adopted considering their capacity.

(6) Policy for Operation and Maintenance

The project facilities are designed taking account of minimal or free of maintenance. Sand sinks and trash separators are installed to prevent clog of the drainage facilities. See-through openable grating covers with hinge are installed to the drainage basins. The project bridges are designed without expansion joints which require frequent maintenance.

(7) Grade Setting Policy for Facilities

The proper specification and standards are established to be economical and to satisfy the required functions under the given conditions. The geometric standards of the project roads in Kampong Chhnang are to follow the existing ones since the major works of the project are rehabilitation/improvement of the pavement. The design specifications of the project bridges along National Road No. 11 are to be coordinated with other donor's bridges along the road.

(8) Policy for Construction/Procurement Method & Construction Schedule

Given above-mentioned policies, design, construction and procurement method are proposed. Further, rainy season should be considered in construction schedule, and minimum influence on residents in project sites as well as present traffic flow during construction works should be in construction methods.

2-2-2 Basic Plan

2-2-2-1 The Basic Plan of Roads and Drainage Facilities in Kampong Chhnang City

(1) Road Design Standards

The Cambodia Road Design Standard prepared by Ministry of Public Works and Transport is basically applied. Specifications of AASHTO (for pavement design) and Japan Road Association (for road design and drainage detail) are also applied supplementary.

Road Geometry

- The Cambodia Road Design Standard – Part 1 (Geometry) 1999, MPWT
- A Policy on Geometric Design of Highway and Streets 2001, AASHTO
- Road Structure Ordinance 2004, Japan Road Association

Pavement Structural Design

- The Cambodia Road Design Standard – Part 2 (Pavement) 1999, MPWT
- Guide for Design of Pavement Structure 1993, AASHTO
- Pavement Design Handbook 2006, Japan Road Association

Drainage Design

- The Cambodia Road Design Standard – Part 3 (Drainage) 1999, MPWT
- Engineering Guidelines Earthwork Road Drainage 1987, Japan Road Association

2-2-2-2 Plan of National Road No.5 Kampong Chhnang City Section

(1) Road Geometric Standard

National Road No.5 in Kampong Chhnang city center section is almost straight. The existing road geometries satisfy the geometric standards of design speed 60km/hr. Therefore, the proposed project road alignment follows the existing road. The proposed road width is the same as the existing road. The present traffic operation (the parts of the section is separated by direction) is remained in the proposed project road. The lane/carriageway width is 3.5m. The number of lanes is determined to accommodate as many lanes as possible as to the section, which are 2-lane (1-lane for each direction) or 4-lane (2-lane for each direction). The remaining road widths are used for road shoulders and sidewalks. The sidewalk widths vary from 1.5 to 3.0m, which depend on pedestrian volume and availability of width. Where sidewalk exists, it remains as it is.

(2) Typical Cross Section

In accordance with the above standard, the cross-sectional configuration of the National Road No.5 was planned. Location of Components / Roads of National Road No.5 in Kampong Chhnang City is shown in Figure 2-2-1, and typical cross sections are as shown in Figure 2-2-2.

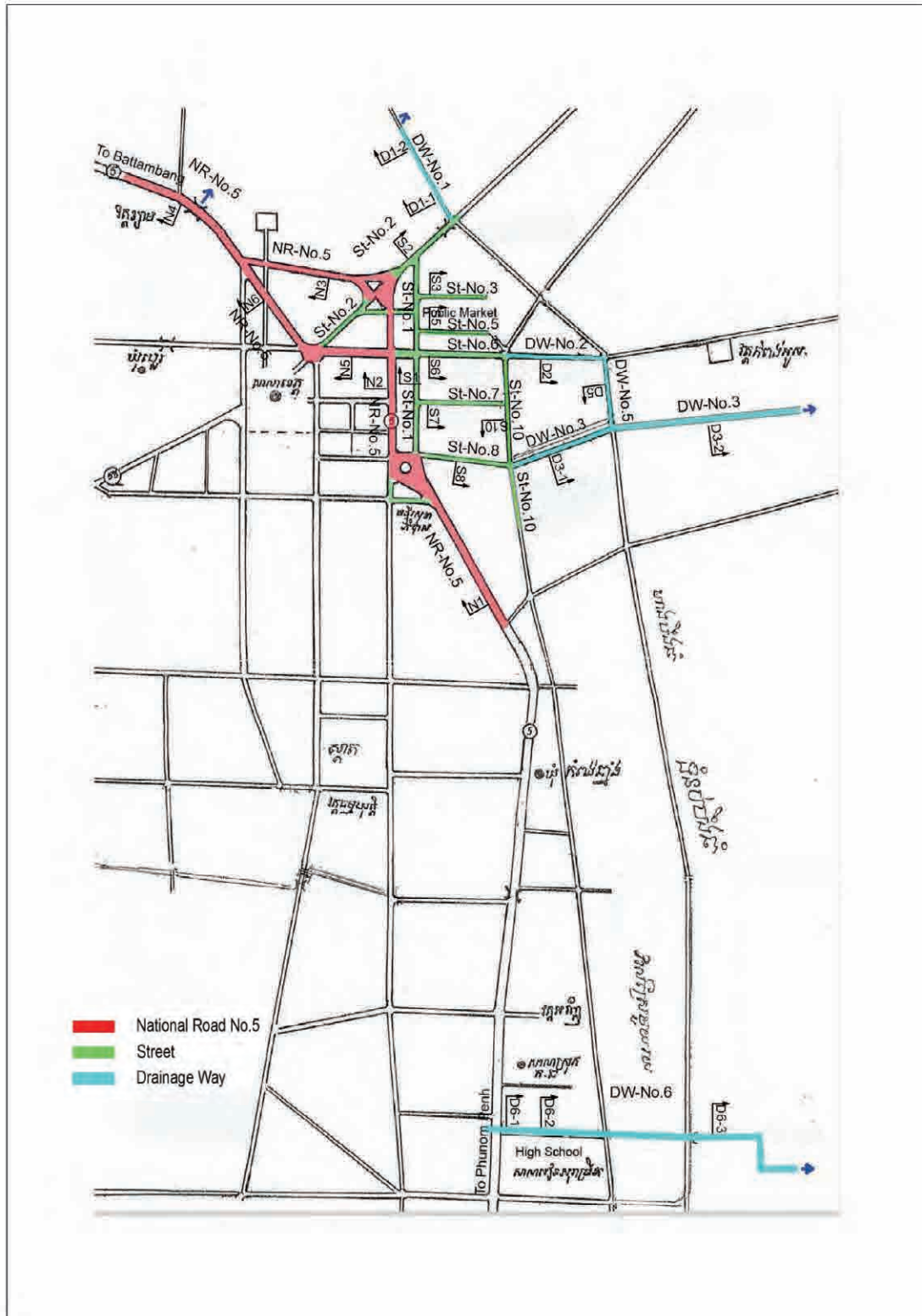


Figure 2-2-1 Location of Components / Roads and drainage facilities in Kampong Chhnang City

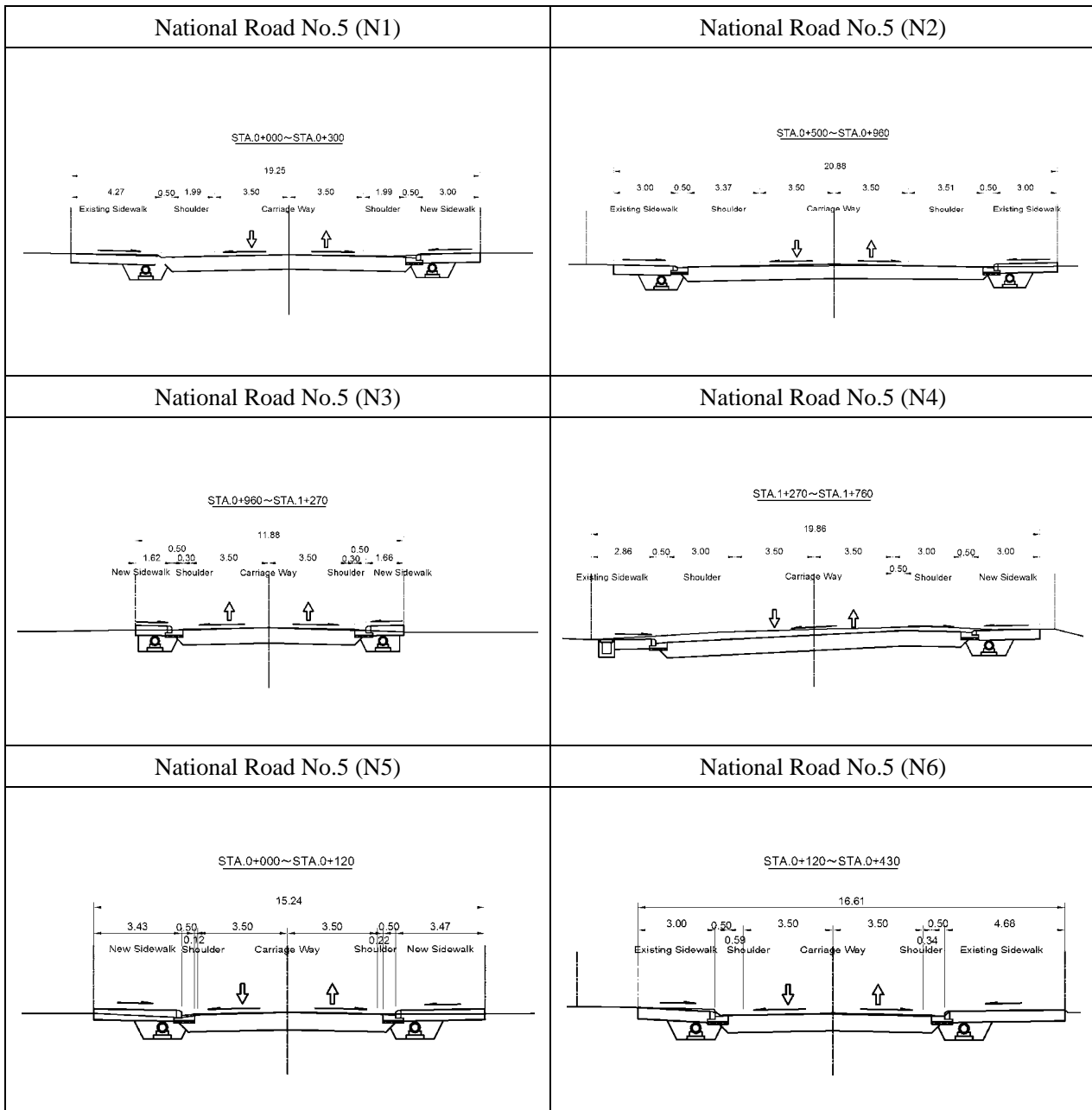


Figure 2-2-2 Typical Cross Sections / National Road No.5 in Kampong Chhnang City

2-2-2-3 Plan of Streets in Kampong Chhnang City

(1) Road Geometric Standard

The project streets in Kampong Chhnang City are straight. The existing streets satisfy the road geometries of design speed 40km/hr. The proposed streets widths are the same as existing streets. The proposed streets are composed of 2-lane with 3.5m wide carriageway (1-lane for each direction) and road shoulders. Where spaces are available, 1.5 to 2.0m wide sidewalks are proposed.

(2) Typical Cross Section

Location of Streets in Kampong Chhnang City is as shown in Figure 2-2-1, and typical cross sections are as shown in Figure 2-2-3.

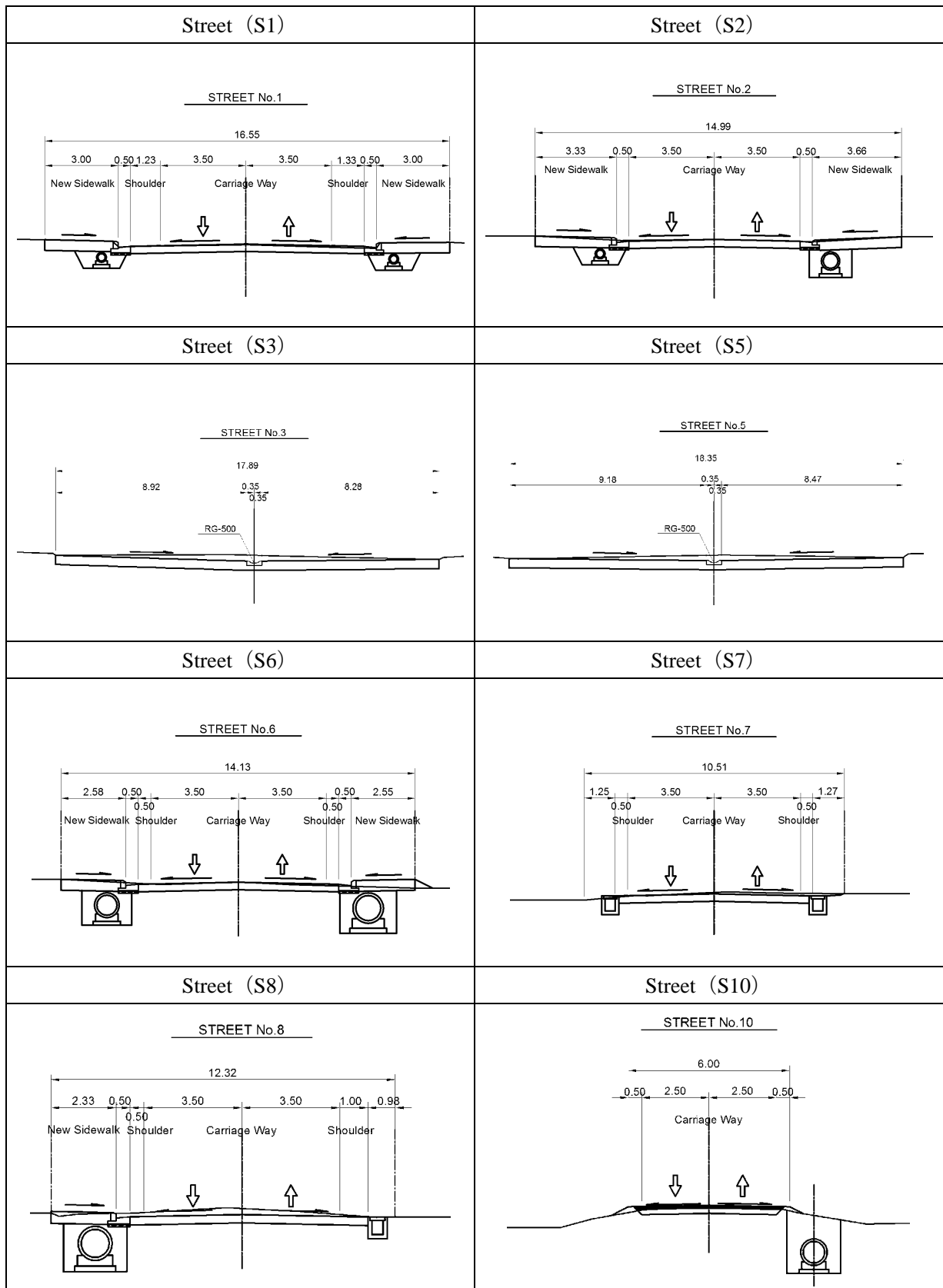


Figure 2-2-3 Typical Cross Sections / Streets in Kampong Chhnang City

2-2-2-4 Plan of Drainage Facilities

(1) Drain Area

The extent of drain water is as follows:

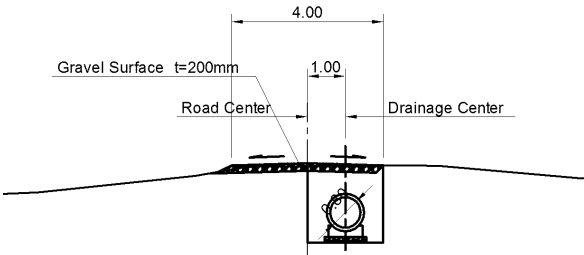
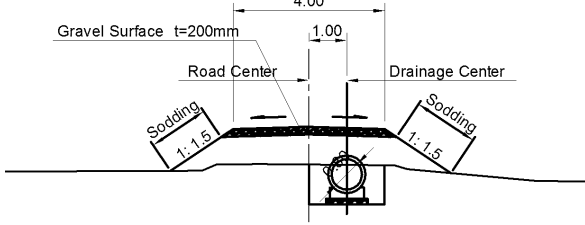
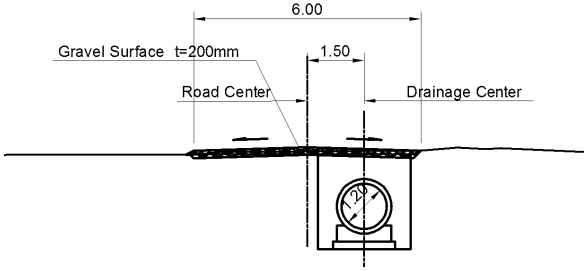
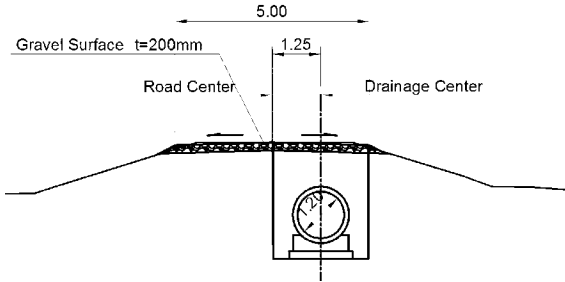
- Rainwater in the roads and roadside
- Rainwater of surrounding houses and parks which flow into the project drainage facility

Drainage facilities design is as shown in ANNEX 7-A DESIGN OF DRAINAGE FACILITIES .

The Rainfall Intensity in Kampong Chhnang was taken from 10-minutes consecutive rainfall intensity of 2-year return period which was proposed by “F/S on Flood Prevention and Drainage Improvement Project in Phnom Penh” is applied. Eventually, $I=2555.07 / (10+25.48)^{-0.93}=71.1(\text{mm/hr.})$

Catchment Areas are determined using topographic survey map and clarified with the field survey.

Location of Drainage Ways in Kampong Chhnang City is as shown in Figure 2-2-1, and typical cross sections are as shown in Figure 2-2-4.

<p style="text-align: center;">Drainage Way (D1-1)</p>	<p style="text-align: center;">Drainage Way (D1-2)</p>
<p style="text-align: center;">Drainage Way No.1 STA.0+000 - STA.0+280</p> 	<p style="text-align: center;">Drainage Way No.1 STA.0+280 - STA.0+360</p> 
<p style="text-align: center;">Drainage Way (D2)</p>	<p style="text-align: center;">Drainage Way (D3-1)</p>
<p style="text-align: center;">Drainage Way No.2</p> 	<p style="text-align: center;">Drainage Way No.5</p> 
<p style="text-align: center;">Drainage Way (D3-2)</p>	<p style="text-align: center;">Drainage Way (D5)</p>

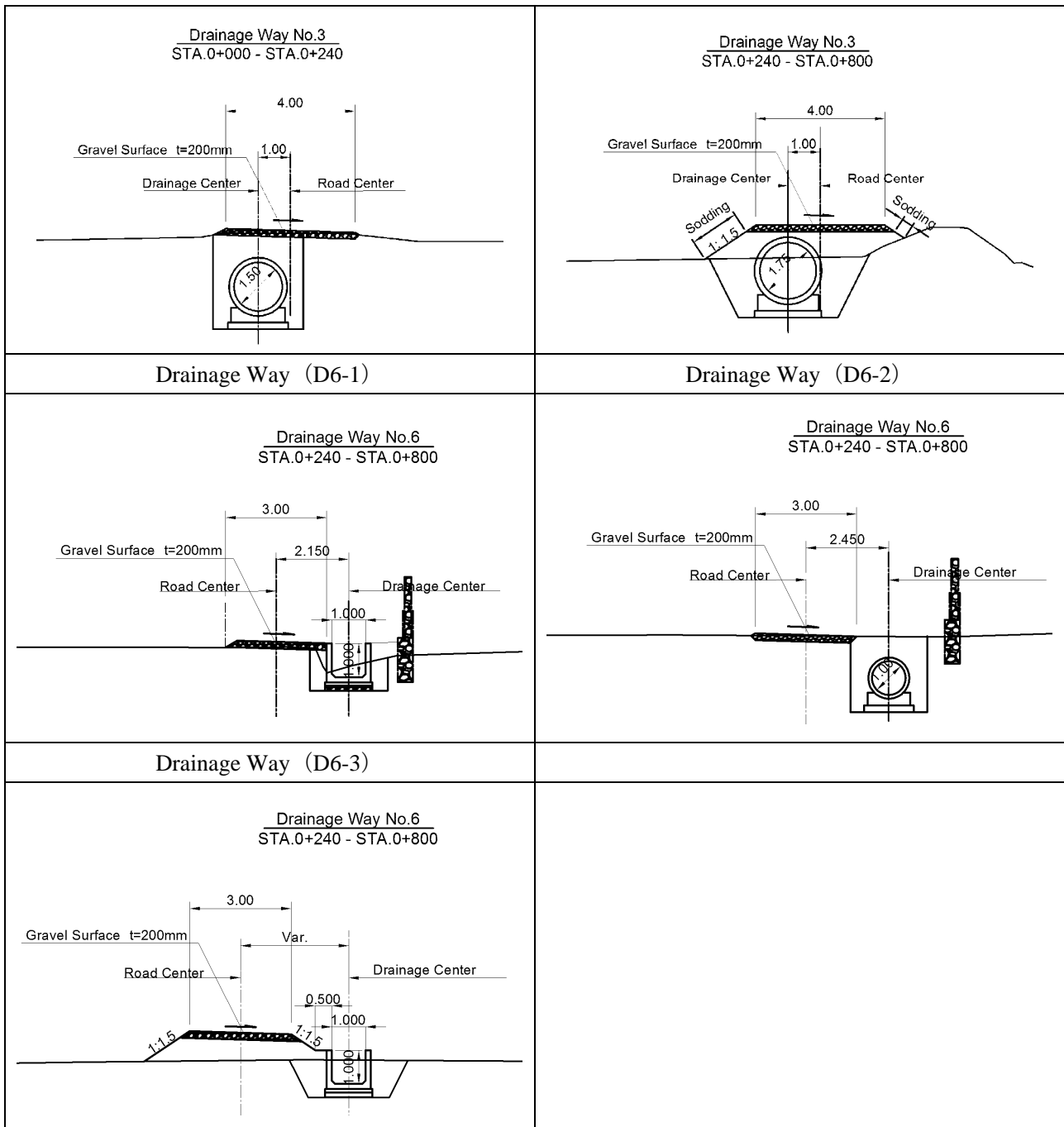


Figure 2-2-4 Typical Cross Sections / Drainage Ways in Kampong Chhnang City

(2) Typical Structures of Drainage Facilities

Typical structures of the drainage facilities are shown in Figure 2-2-5. Pipes are proposed rather than ditches since it is easy to secure the drainage gradient, durable and good in appearance. Hinged grating cover that is durable and easy for maintenance is proposed to be attached on the catch basins.

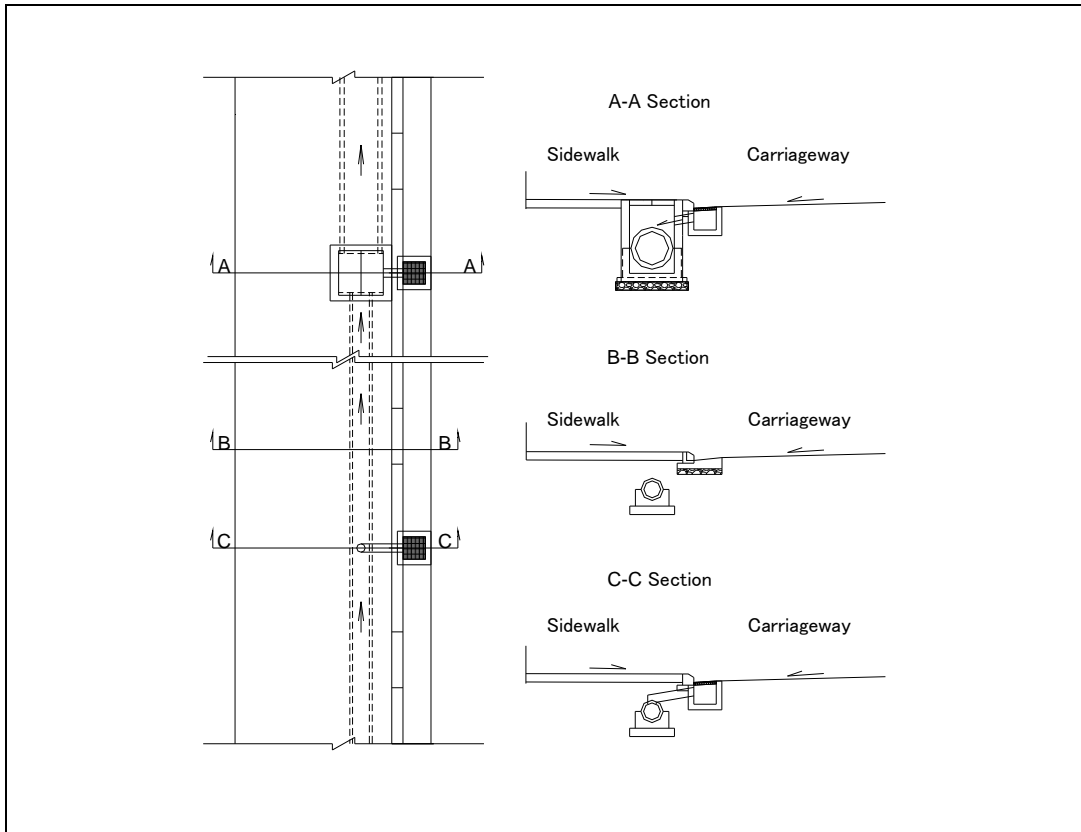


Figure 2-2-5 Typical Structures of Drainage Facilities

2-2-2-5 Plan of Road Facilities

The following road markings are proposed:

- Centerline and outline
- Stop line
- Zebra mark and allow mark of direction
- Crosswalk

2-2-2-6 Plan of Pavement Structure

(1) Design Condition of the Pavement Structure

The following are considered in the pavement design:

- Structural design is made based on AASHTO Guide of Pavement Structures 1993.
- Design period is 10 years (2015 to 2025).

(2) Pavement Structural Design Section

Pavement structures are designed for the 2 sections as shown in Table 2-2-1.

Table 2-2-1 Pavement Structural Design Section

No.	Section
1	National Road No.5
2	Streets

(3) Pavement Structure by Section

The structural calculation of the pavement by section is shown in Annex 3-B. The result of the calculation is shown in Figure 2-2-6.

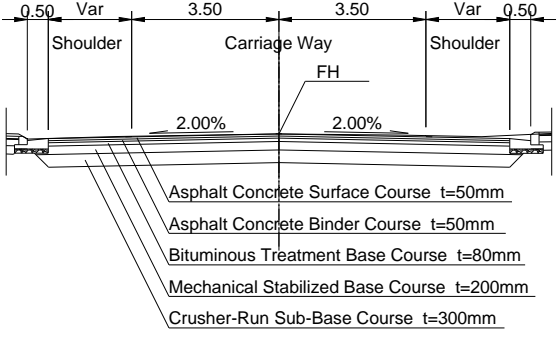
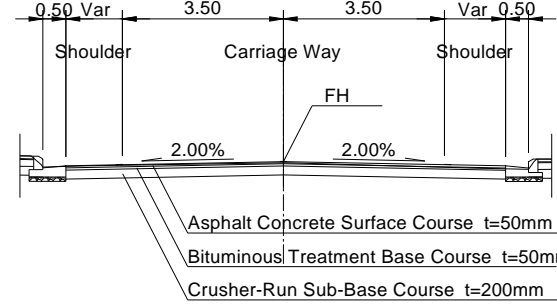
No.	Section	Pavement Structure
1	National Road No.5	
2	Streets in Kampong Chhnang City	

Figure 2-2-6 Proposed Pavement Structure by Section

2-2-2-7 Plan of Pavement Structure in the Public Market

Interlocking block pavement as shown in Figure 2-2-7 is proposed for the public market with the following consideration:

- The pavement work can be executed parts by parts, therefore, the market is not necessary to close.
- This type is easy to be repaired.

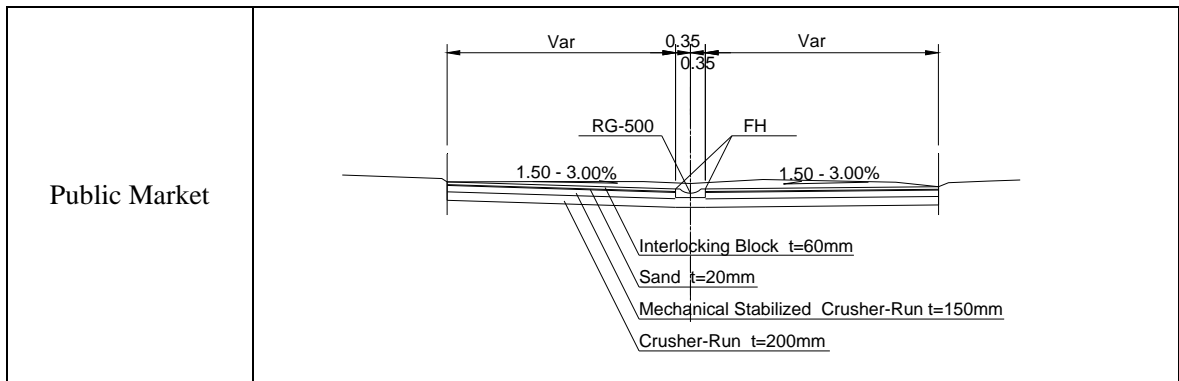


Figure 2-2-7 Pavement Structure of Interlocking Block

2-2-2-8 Plan of Sidewalk Pavement Structure

Most of the existing sidewalks in Kampong Chhnang are paved with ceramic tiles as shown in the photographs below. Since there has observed no serious problem so far, it is proposed that all of the project sidewalks will be paved with ceramic tiles. The sidewalk pavement structure is shown in Figure 2-2-8.



Photo 1 Existing Sidewalk Pavement in Kampong Chhnang

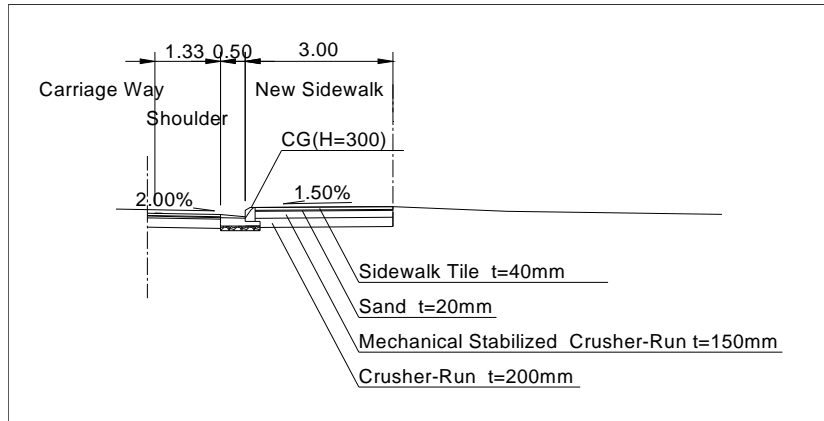


Figure 2-2-8 Sidewalk Pavement Structure

2-2-3 Basic Plan of Bridges along National Road No.11

2-2-3-1 Design Specifications

AASHTO Standard Specifications for Highway Bridges 2002 are adopted as they are commonly used even in other donor's projects in Cambodia. Live load 25% heavier than AASHTO's is adopted like other projects. Japanese bridge design specification (JRA) is adopted supplementary.

2-2-3-2 Bridge Width Component

The proposed bridge width component is as shown in Figure 2-2-9, which is same as the bridges recently constructed under ADB assisted project along National Road No. 11. However, the Project bridges located near to schools and urban areas are planned to furnish sidewalks as shown in the figure.

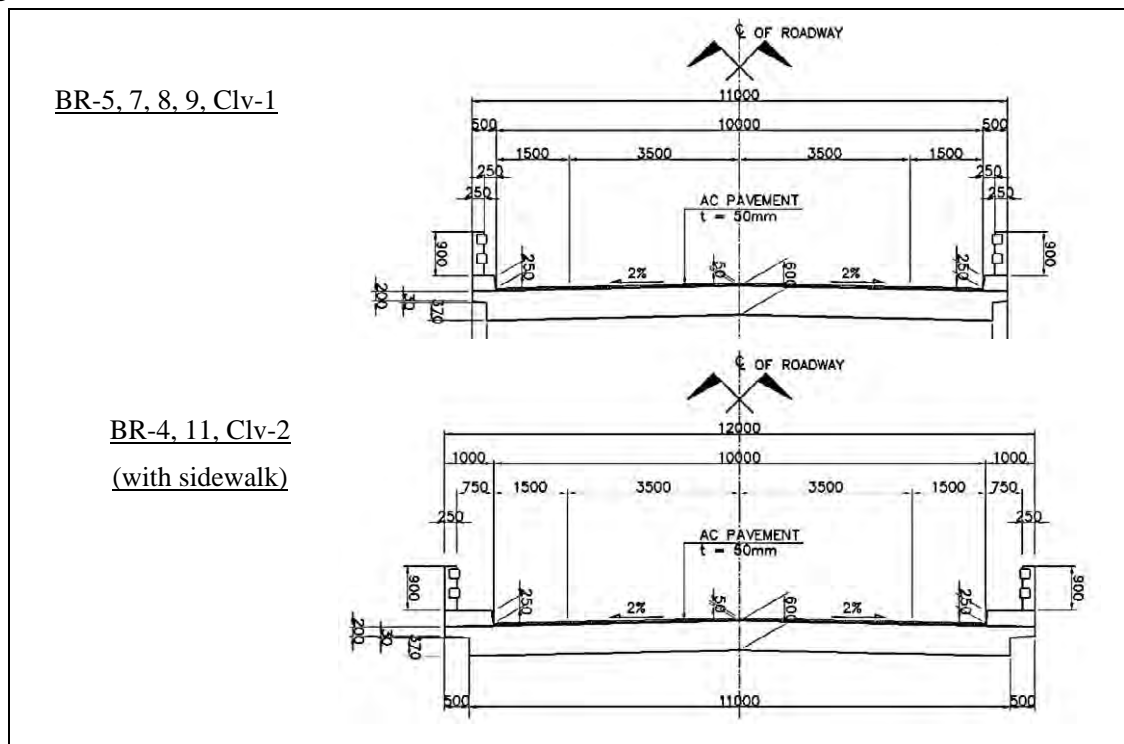


Figure 2-2-9 Proposed Bridge Width Component

2-2-3-3 Design Standards

Loads

Live Loads : 25% increase of AASHTO HS20-44

Temperature Change : $\pm 17^{\circ}\text{C}$ (8 - 42°C)

Design Seismic Coefficient : 0.05

Freeboard : 0.6m

Concrete Specification (Design Strength)

- Superstructure : 32 Mpa
- Substructure : 32 Mpa
- Lean Concrete : 18 Mpa
- RC Precast Pile : 32 Mpa

Reinforcing Bars

Deformed Bar : Grade 400 (Yield point 400 Mpa or higher)

Geometric Standards of the Bridge Approach Roads

The geometric standards are as shown in Table 2-2-2.

Table 2-2-2 Geometric Standards of Bridge Approach Road

Item	Standard
Carriageway Width (m)	3.5 x 2
Road Shoulder Width (m)	1.5 x 2
Design Speed (km/hr.)	80
Min. Horizontal Curve Radius(m)	300
Max. Slope (%)	4.0
Min. Vertical Curve Radius (m)	3000
Min. Vertical Curve Length (m)	50

2-2-3-4 Location of Proposed Bridge

The locations of all of the proposed bridges are same as the existing bridges since all of them are located along the long straight road sections.

2-2-3-5 Bridge Length

The proposed bridge lengths are shown in Table 2-2-3. The following ideas are considered in the planning of the bridge length. A comparison of bridge openings between the existing bridges and the proposed bridges are shown in Figure 2-2-9.

- To reduce velocity of floods is necessary to prevent erosion on bridge abutments, slopes of bridge approach roads and riverbed. The proposal that increasing the existing bridge lengths by 50 % is effective to reduce flood velocity is reported in “Mekong River Committee Flood Management and Mitigation Program, Road and Floods Project Report 2009” referring to a program of replacement of bridges along National Road No.11.
- The proposed total bridge lengths were determined through the observation of the level of the site erosion.
- The proposed bridge lengths are adjusted with the river widths. (where there are rivers at up and/or downstream) .
- The bridge lengths proposed by the officials of DPWT Prey Veng Province are referred.

Table 2-2-3 Proposed Bridge Length

Bridge No.	Bridge Name	Location	Existing Bridge (m)	Proposed Bridge (m)
BR-4	Kbal Boeung	64+300	19.0	33.0
BR-5	Snate	63+650	27.0	40.0
BR-7	Sam Puthor II	40+950	42.0	44.0
BR-8	Mebon	40+350	29.5	50.0
BR-9	Tkov I	38+450	42.0	44.0
Clv-1	Tkov II	37+900	5.8	20.0
BR-11	Ek Ream	32+100	18.5	33.0
Clv-2	Rom Lech	14+745	10.0	44.0
Total			193.8	308.0

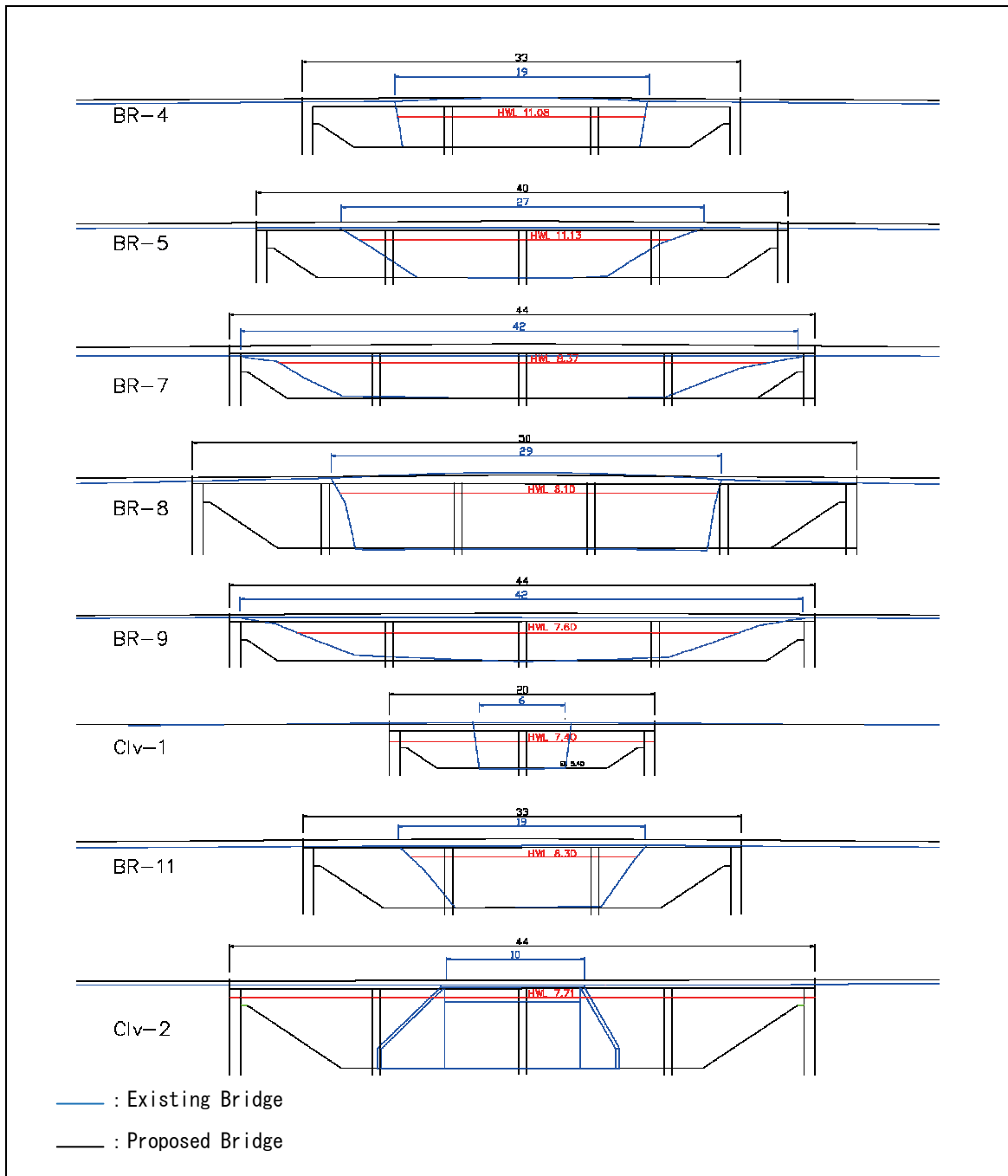


Figure 2-2-10 Comparison of Bridge Opening between Existing and Proposed bridges

2-2-3-6 Bridge Structure

Superstructure Type

RC flat slab type (Integral type) is proposed for all bridges. A comparison between RC-T girder type and PC hollow slab type is shown in Table 2-2-4. RC flat slab type (Integral type) is superior to the other types in the following aspects. The construction of the foundations, substructures and superstructures of RC flat slab type is easy since the most sites are dry in the dry seasons.

- Since RC flat slab is the minimum height, the raise of the vertical alignment at the proposed bridges are minimal ; therefore, the driving through the bridge section is safe and comfortable

although vehicles can drive very fast in the long straight road sections.

- Integral type requires less numbers of piles and sizes of the structures, therefore, the construction cost is the smallest and the required maintenance is minimal since there is no expansion joint and bearing.

Table 2-2-4 Comparison of Superstructure Types

	RC Flat Slab (Integral Type)	RC-T Girder (Integral Type)	PC Hollow Slab
Adoptable Span Length	5~12m	10~20m	15~25m
Girder Height	0.4~0.6m : ◎	1.0~1.5m : Δ	0.7~1.0m : ○
Cost	◎	○	Δ
Construction Duration	◎	○	Δ
Constructability	◎	○	Δ
Maintenance Needs	◎	◎	Δ
Overall Evaluation	◎	○	Δ

Note: ◎ : Superior, ○ : Medium, Δ : Inferior

Foundation Type

RC precast piles (400mm x400mm) are proposed for all of the bridge foundations. Since the geological conditions of all of the bridge sites are sandy-clay (N-value 10 to 20), the piles with the length of 12m to 15m are adequate to obtain the required bearing capacity.

Railing Type

Concrete type railing, which is common in Cambodia, is proposed as shown in Figure 2-2-11.

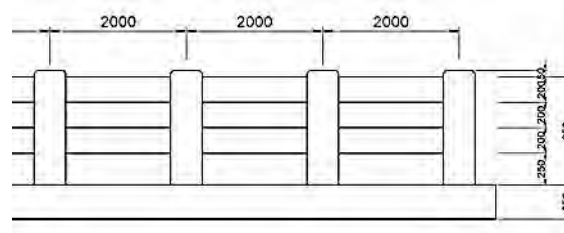


Figure 2-2-11 RC Type Railing

Approach Slab

Approach slabs with a length of 5m under the carriageway are proposed to be installed for all abutments.

2-2-3-7 Bridge Approach Road

Vertical Alignment

To secure 0.6m of the freeboard between the maximum flood level and the soffit of the proposed bridge, the proposed vertical alignment at the bridges are necessary to be raised 0.5m to 0.9m from the

proposed bridge approach roads. The vertical alignment was planned to satisfy the geometric specifications as shown in Figure 2-2-12.

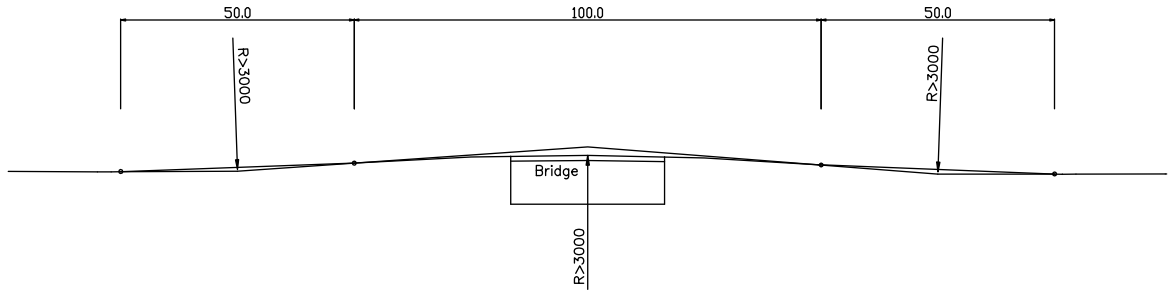


Figure 2-2-12 Vertical Alignment Specification

Plan Layout of Bridge Approach Roads

The pavement widths at the bridge decks are 11m while at approach roads are 7m. The gap is tapered in 45m long approach section (Taper =1: 30). 16m long guardrails are installed in back and forth of the bridges. Guideposts (4m interval) are installed in the 40 m sections of back and forth of the guardrail as shown in Figure 2-2-13.

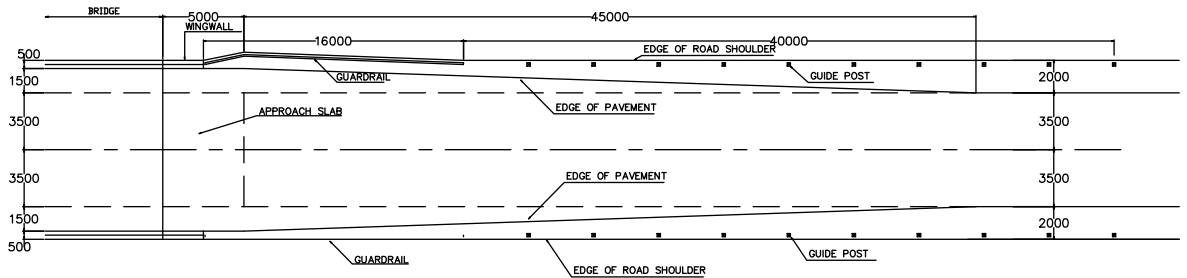


Figure 2-2-13 Plan Layout of Bridge Approach Road

Pavement Structure of Bridge Approach Road

The proposed pavement structure of the bridge approach roads is shown in Figure 2-2-14. Since the CBR of the subgrade of the bridge approaches are very small, cement mix stabilization of the upper subgrade is proposed as it was adopted in the Project for Improvement of National Road No. 1.

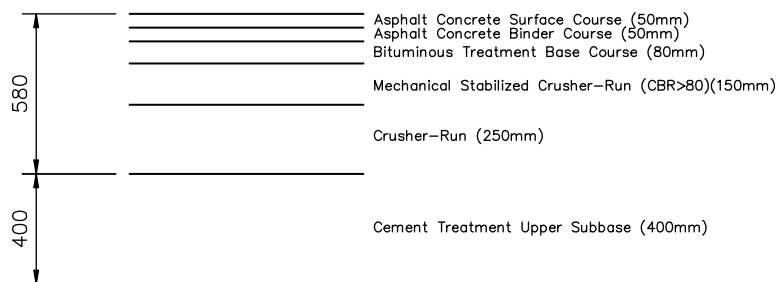


Figure 2-2-14 Proposed Pavement Structure for Bridge Approach Roads

Typical Cross Section of Bridge Approach Roads

The typical cross section of the bridge approach roads are shown in Figure 2-2-15. To raise the bridge approach roads, embankment and widening of the roads is necessary. The procurement of suitable soil from the proper quarry is proposed since the excavated soil is not suitable for the embankment.

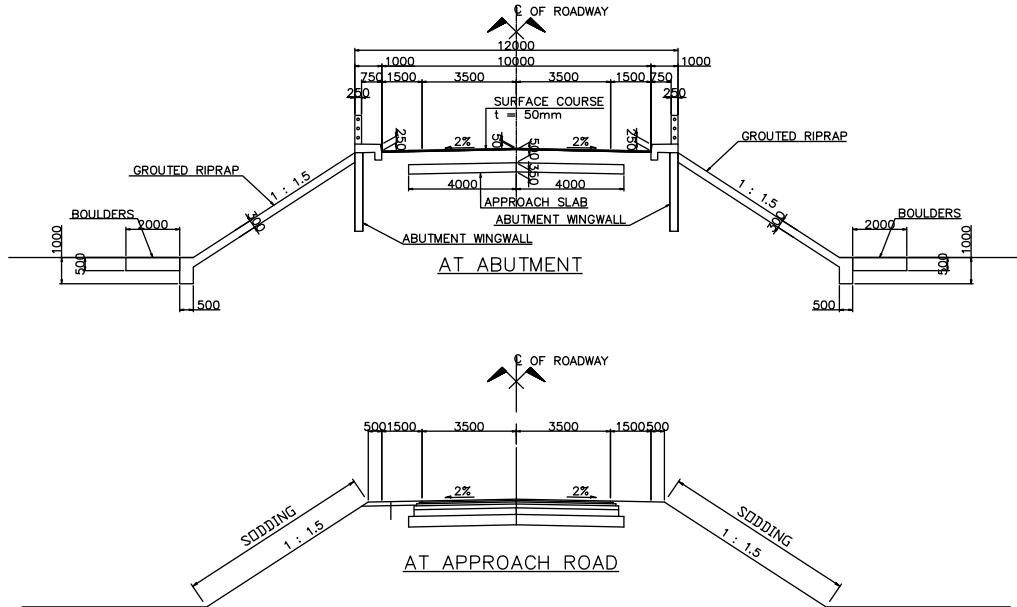


Figure 2-2-15 Typical Cross Section of Bridge Approach Road

2-2-3-8 Erosion Protections

Slope Protection

Grouted riprap (thickness 30cm) is proposed to be installed around the abutments and slopes of the bridge approach roads within 16m from the edge of the wing walls. Sodding is proposed for the slopes beyond the 16m from the wing walls.

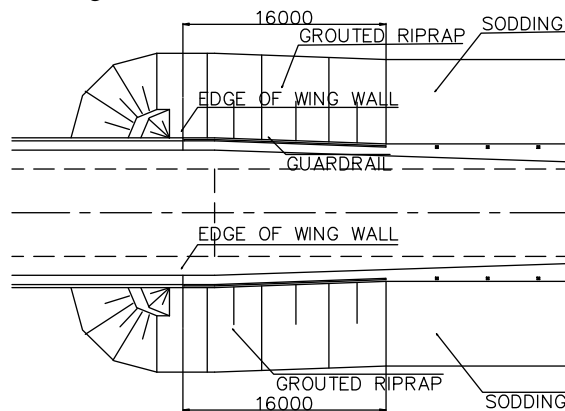


Figure 2-2-16 Erosion Protection for Abutment and Approach Road Slope

Riverbed Protection

The riverbed protection is proposed to be installed in the area shown in Figure 2-2-17 to protect pier foundations and abutment protection foundations from flood erosion. As for the riverbed protection,

boulders larger than 20cm with a thickness of 50cm is proposed since the boulders larger than 20cm have been remained in the existing bridge sites without being washed out by floods.

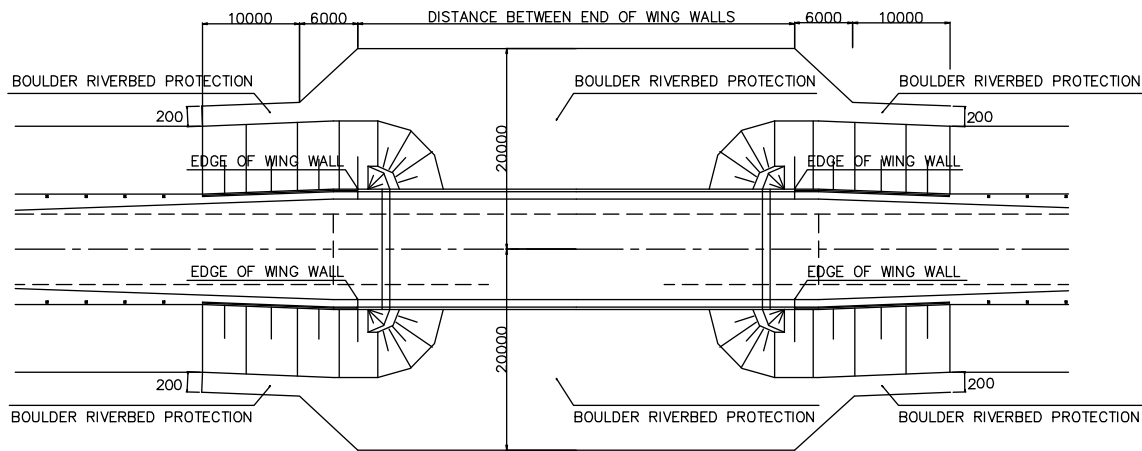


Figure 2-2-17 Area of Riverbed Protection

2-2-4 CONTENTS OF FACILITIES

The contents of facilities under outline design are summarized in Table 2-2-7

Table 2-2-5 Contents of Facilities under outline design

Facilities Name	Specification
Roads and drainages facilities in Kampong Chhnang City	<u>National Road No.5 in Kampong Chhnang City</u> Total Length : 2.2km Earthworks : Excavation (Removal of existing pavement) Road Pavement : Asphalt Concrete Surface Course (50mm thick) Asphalt Concrete Binder Course (50mm thick) Road Base : Bituminous Treatment Base Course (80mm thick) Mechanical Stabilized Base Course (200mm thick) Stabilized Base Course (200mm thick) Crusher-Run Sub-Base Course (300mm thick) Sidewalk Pavement : Tile Drainage : Concrete Pipe (300mm Internal Diameter) 、 In-situ side ditch (400x600mm) Catchpits、 Manholes Concrete Kerb : Sidewalk Separation Block (200 (w) x300 & 200 (h) mm) Ancillary Facilities : Roadmarking, Gabion
	<u>Main Streets and Drainage Ways in Kampong Chhnang City</u> Main Streets total length : 2.4km Drainage Ways total length : 2.6km Earthworks : Excavation, Embankment Road Pavement : Asphalt Concrete Surface Course (50mm thick) Aggregate Pavement (200mm thick) Road Base : Bituminous Treatment Base Course (50mm thick) Crusher-Run Sub-Base Course (200mm thick) Public market pavement : Inter-locking Blocks Drainage : Concrete Pipes(300~1,750mm internal diameter) 、 Catchpits、 Manholes In-situ side ditch (400x600mm、 1,000x1,000mm) Concrete Kerb : Sidewalk Separation Block (200 (w) x300 & 200 (h) mm) Ancillary Facilities : Roadmarking

Facilities Name	Specification			
Bridges along National Road No.11	Bridge No	Bridge Name	Bridge Length (m)	No of Span (no)
	BR-4	Kbal Boeung	33.0	3
	BR-5	Snate	40.0	4
	BR-7	Sam Puthor II	44.0	4
	BR-8	Mebon	50.0	5
	BR-9	Tkov I	44.0	4
	Clv-1	Tkov II	20.0	2
	BR-11	Ek Ream	33.0	3
	Clv-2	Rom Lech	44.0	4
	Total		308.0	29
	<p>Road Width : 10.0 m</p> <p>Superstructure type : RC slab (Integral Type)</p> <p>Foundation type : Precast pile (400 mm x 400 mm)</p> <p>Road Pavement : Asphalt Concrete Surface Course (50 mm thick) Asphalt Concrete Binder Course (50mm thick)</p> <p>Road Base : Bituminous Treatment Base Course (80mm thick) Crusher-Run Sub-Base Course (180, 150, 130mm thick) Aggregate Sub-Base Course (Aggregate 250 mm thick)</p> <p>Subgrade : Cement stabilized Subgrade (400 mm thick)</p> <p>Slope Protection : Sodding, Grouted Riprap, Riverbed Protection</p> <p>Abutment Protection : Riverbed Protection, Grouted Riprap, Gabion</p> <p>Ancillary facilities : Guide Posts, Guard rail, Roadmarking</p>			

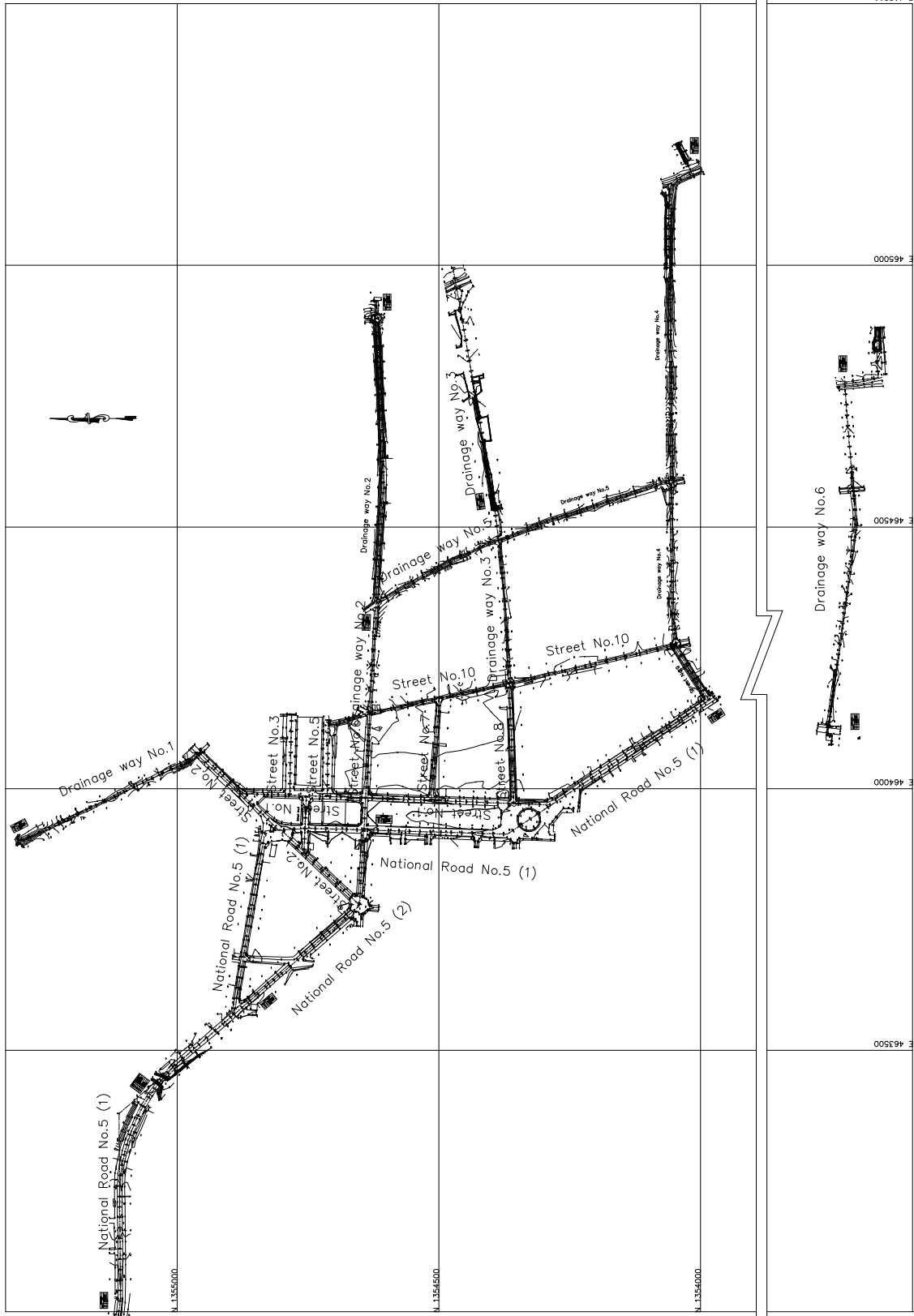
2-2-5 OUTLINE DESIGN DRAWING

Outline design drawings are as shown from the next page.

ABBREVIATION LIST

CLASSIFICATION	ABBREVIATION	DESCRIPTION	DRAWING NO.	CLASSIFICATION	ABBREVIATION	DESCRIPTION	DRAWING NO.
CURB STONE	CG-H 200	For boundary between carriage way and side walk. Allow car crossing	KS-01	CATCH BASIN	CB(G)400x400x500	Concrete catch basin with grating cover	DR-04
	CG-H 300	For boundary between carriage way and side walk			CB(C)-600x600x1000	Concrete catch basin with concrete cover for CP-D300, 400	
DRAINAGE	UD(C)-400x600	Concrete ditch with concrete cover	DR-01	DRAINAGE	CB(C)-800x600x1200	Concrete catch basin with concrete cover for CP-D500, 600	DR-05
	RG-500x100	Concrete ditch of rolled gutter type			CB(G)-1000x1000x1400	Concrete catch basin with concrete cover for CP-D800	
	Ww-U(R)1000x1000	Reinforced concrete water way			CB(C)-1400x750x1200	Concrete catch basin with concrete cover for CP-D1000, Ww-U(R)1000x1000	
	CP-D 300(90)	Concrete pipe with 90 degree concrete base. Diameter=300mm			CB-1400x1400x1200	Concrete catch basin for Ww-U(R)1000x1000	
	CP-D 400(90)	Concrete pipe with 90 degree concrete base. Diameter=400mm			MH(C)-1300x1300x1900	Concrete manhole with steel cover for CP-D1000	
	CP-D 500(90)	Concrete pipe with 90 degree concrete base. Diameter=500mm			MH(C)-1600x1600x2200	Concrete manhole with steel cover for CP-D1200	
	CP-D 1750(90)	Concrete pipe with 90 degree concrete base. Diameter=1750mm			MH(C)-2000x2000x2600	Concrete manhole with steel cover for CP-D1500	
	CP-D 300(90)S	Concrete pipe with 90 degree concrete base. Diameter=300mm, Excavation with sheet pile			MH(C)-2300x2300x2900	Concrete manhole with steel cover for CP-D1750	
	CP-D 400(90)S	Concrete pipe with 90 degree concrete base. Diameter=400mm, Excavation with sheet pile			SM350(H3.50)	Grouted riprap masonry t=350mm, H=3.50m	
	CP-D 500(90)S	Concrete pipe with 90 degree concrete base. Diameter=500mm, Excavation with sheet pile			SM200(H6.00)	Grouted riprap masonry t=200mm, H=6.00m	
	CP-D 600(90)S	Concrete pipe with 90 degree concrete base. Diameter=600mm, Excavation with sheet pile			SW(W a)	Interlocking block surfacing side walk, a=width(m)	
	CP-D 800(90)S	Concrete pipe with 90 degree concrete base. Diameter=800mm, Excavation with sheet pile			Rd(G) a	Gravel surface road, a= width (m)	
CP-D 1000(90)S	Concrete pipe with 90 degree concrete base. Diameter=1000mm, Excavation with sheet pile	Rd(As) a	Asphalt surface road, a= width (m)				
CP-D 1200(90)S	Concrete pipe with 90 degree concrete base. Diameter=1200mm, Excavation with sheet pile	Gabion (D45) 5.00	Steel gabion, diameter=45cm, length=5.00m				
CP-D 1500(90)S	Concrete pipe with 90 degree concrete base. Diameter=1500mm, Excavation with sheet pile	Gabion (D45) 4.00	Steel gabion, diameter=45cm, length=4.00m				
CP-D 400(360)	Concrete pipe with 360 degree concrete base. Diameter=400mm						
CP-D 500(360)	Concrete pipe with 360 degree concrete base. Diameter=500mm						
CP-D 600(360)S	Concrete pipe with 360 degree concrete base. Diameter=600mm, Excavation with sheet pile						
CP-D 800(360)S	Concrete pipe with 360 degree concrete base. Diameter=800mm, Excavation with sheet pile						
CP-D 1000(360)S	Concrete pipe with 360 degree concrete base. Diameter=1000mm, Excavation with sheet pile						

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				NON SCALE		Sheet No.	



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KATAHIRA & ENGINEERS INTERNATIONAL

TITLE :
KEY PLAN OF
KOMPONG CHHNANG CITY

SCALE

Drawing No.

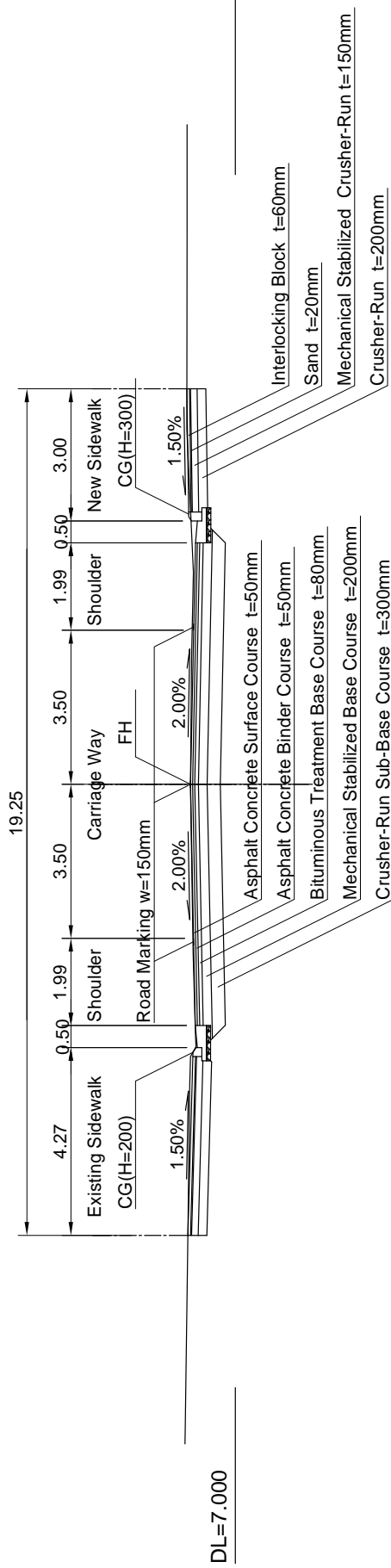
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Sheet No.

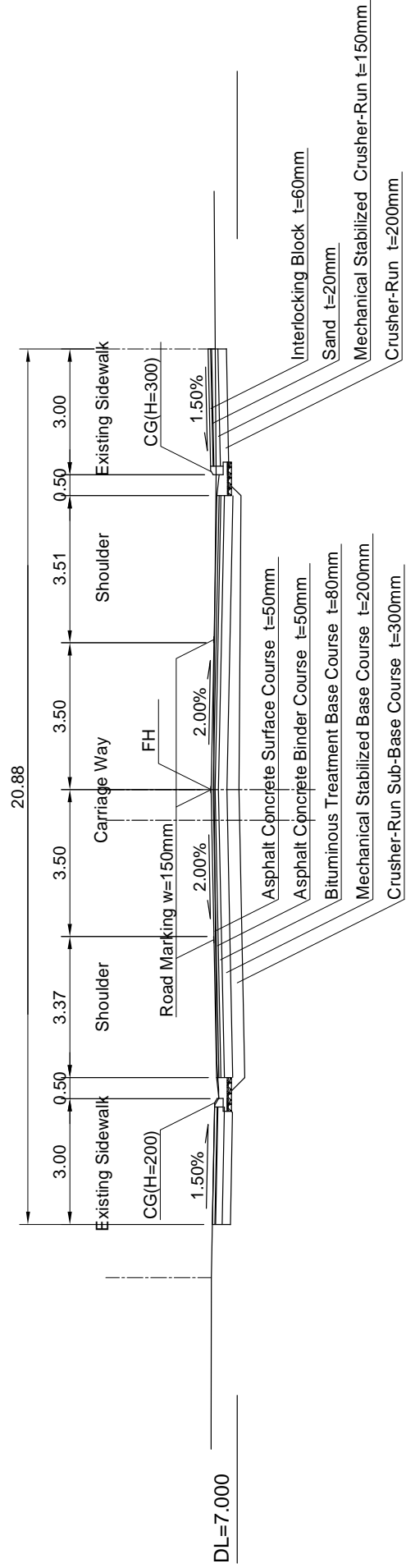
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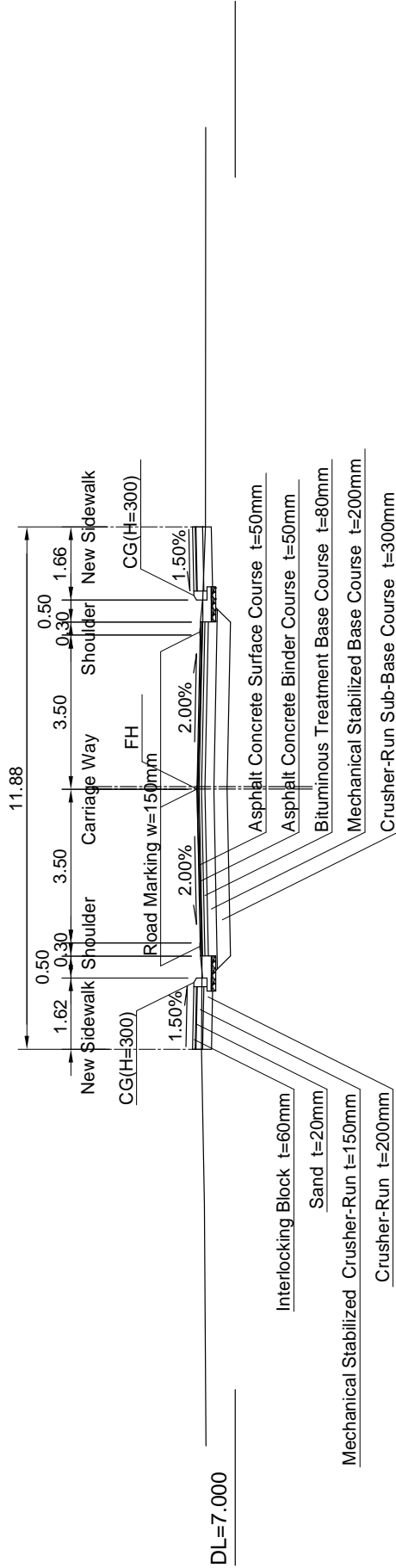
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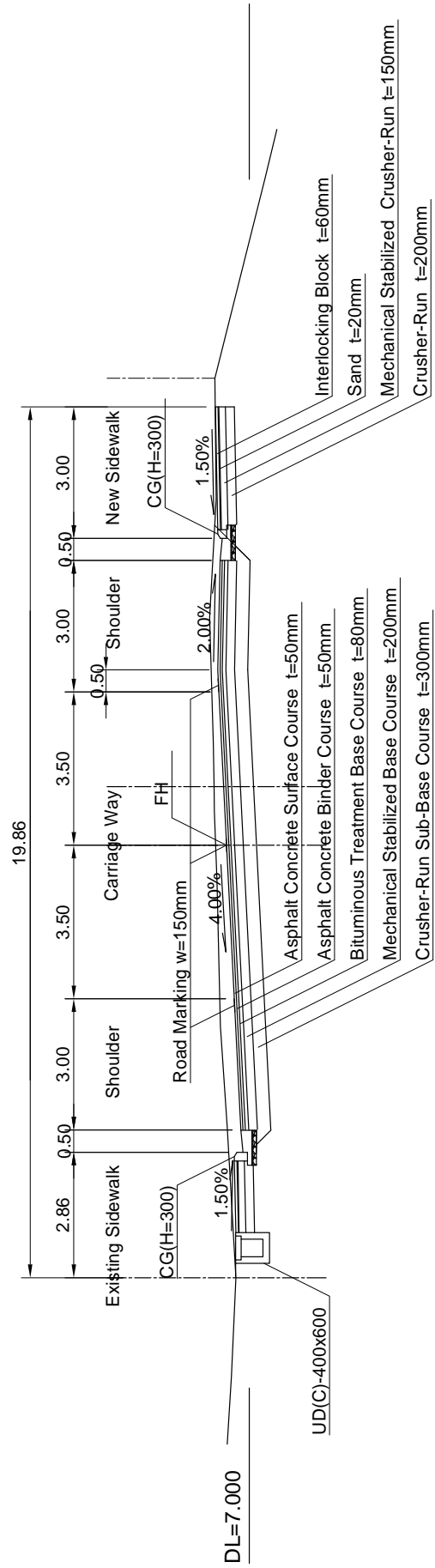
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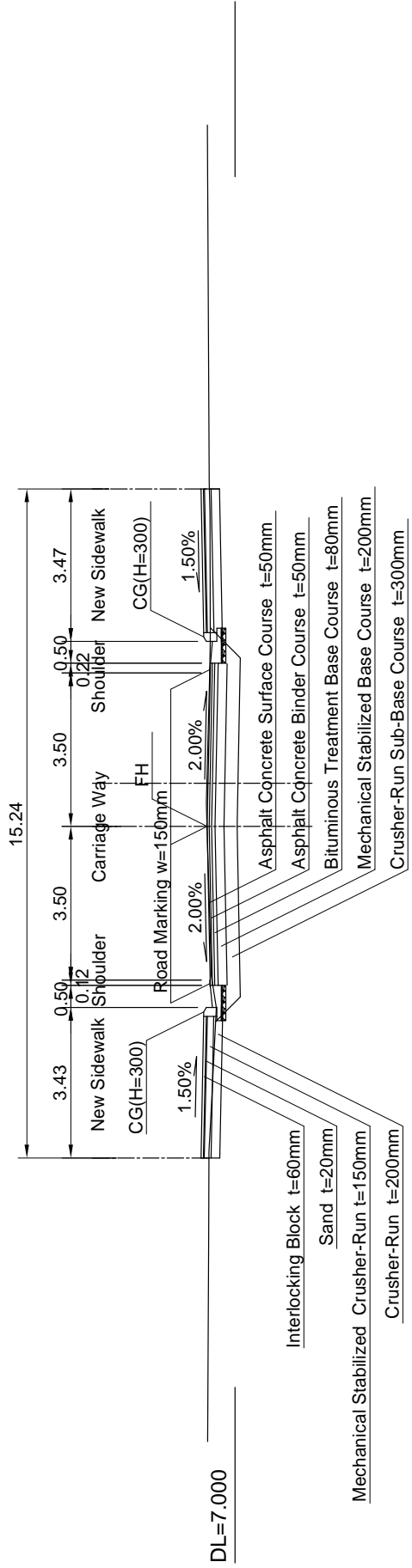
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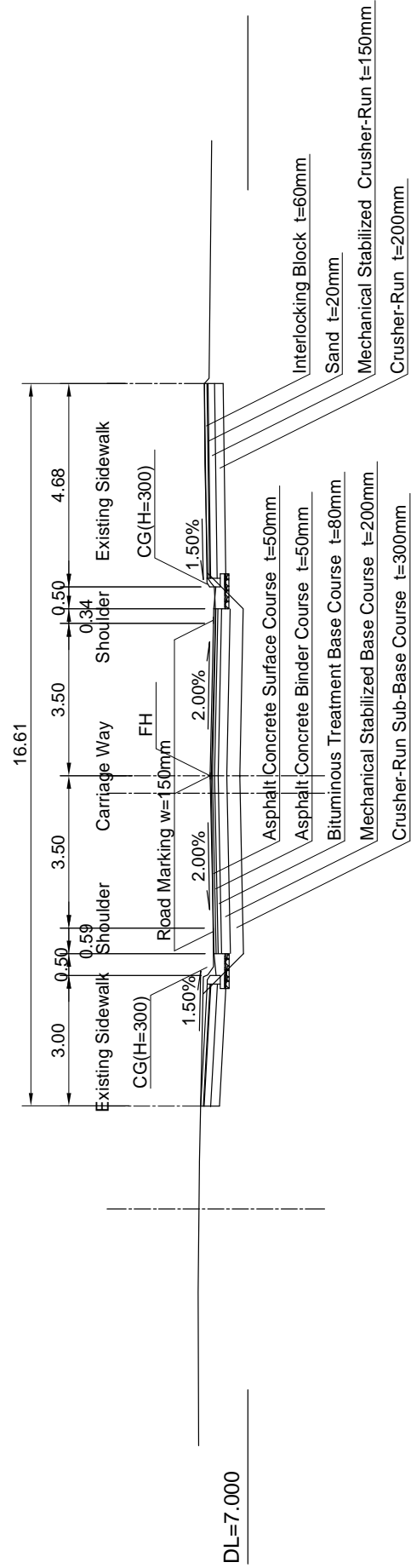
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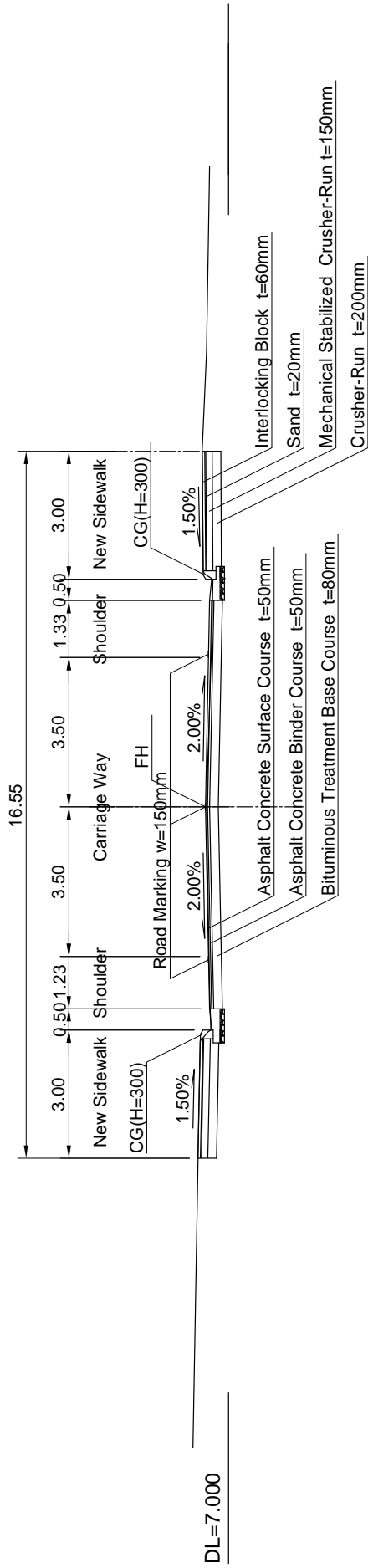
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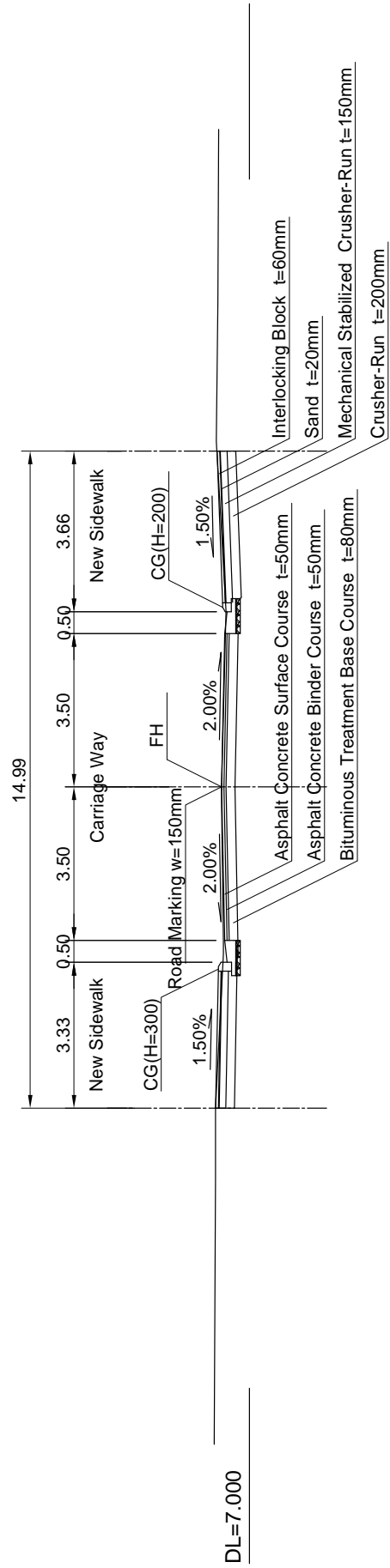
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KAMPONG CHHUNAG CITY ROAD

STREET No.1



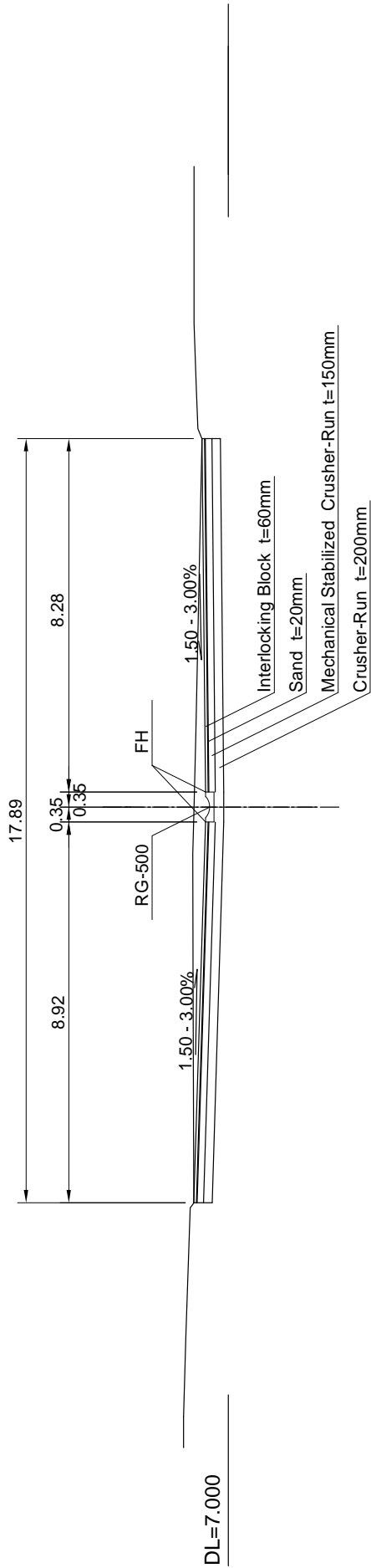
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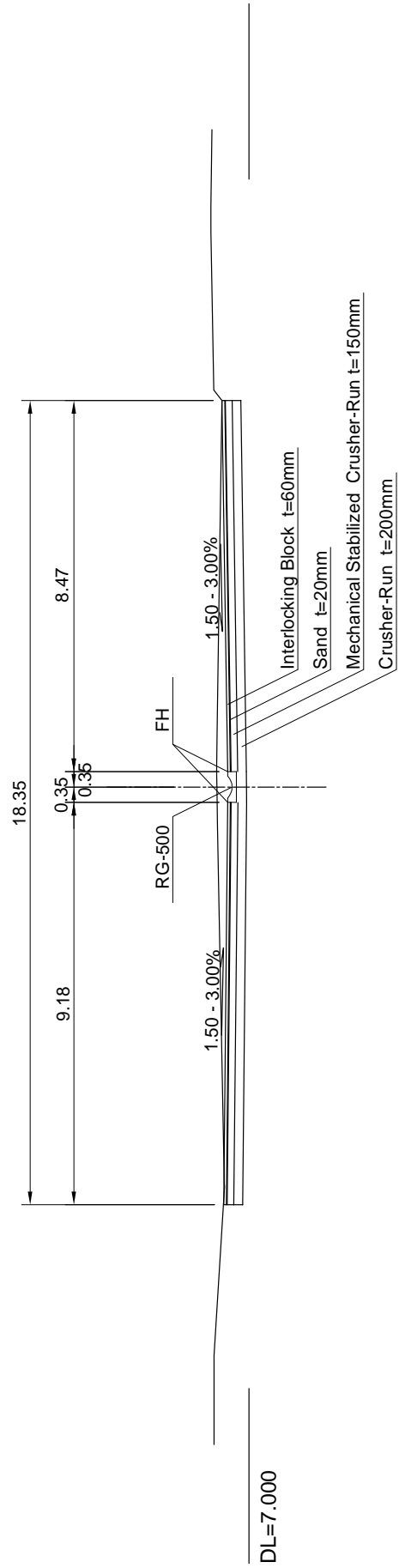
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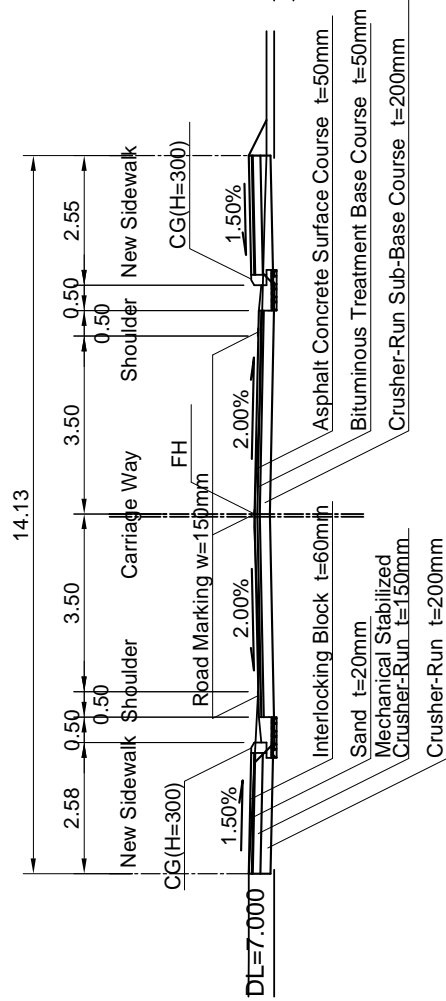
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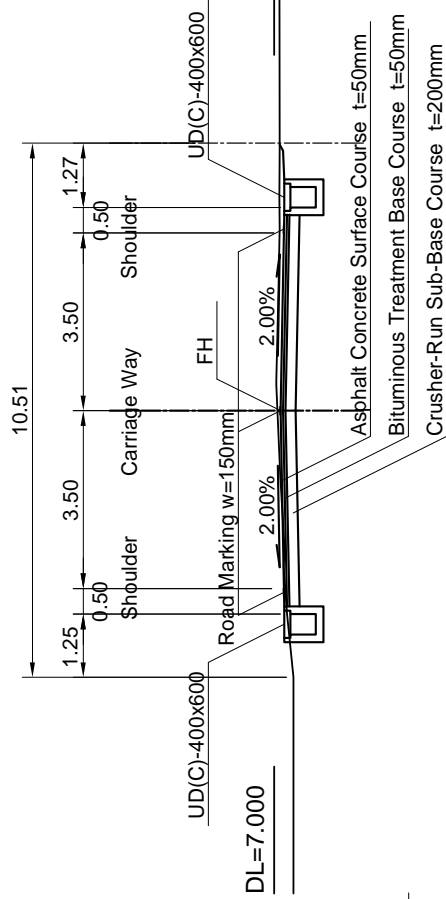
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KAMPONG CHHUNAG CITY ROAD

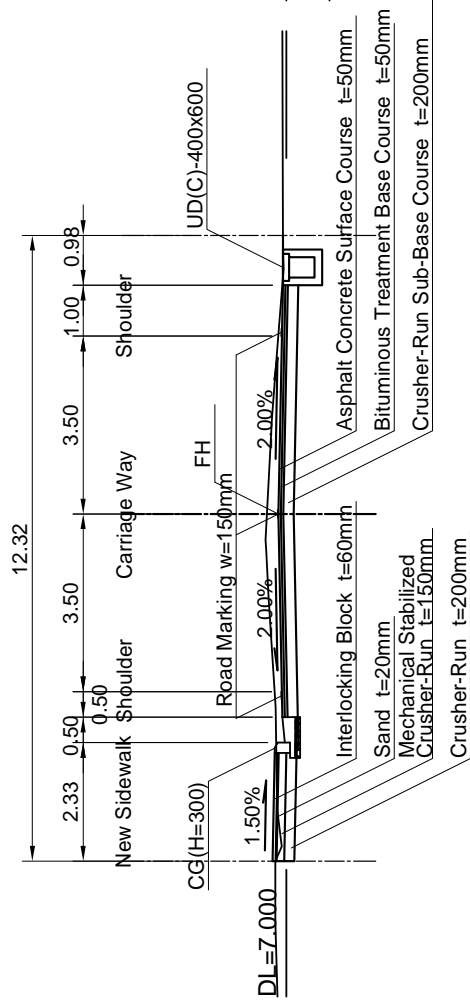
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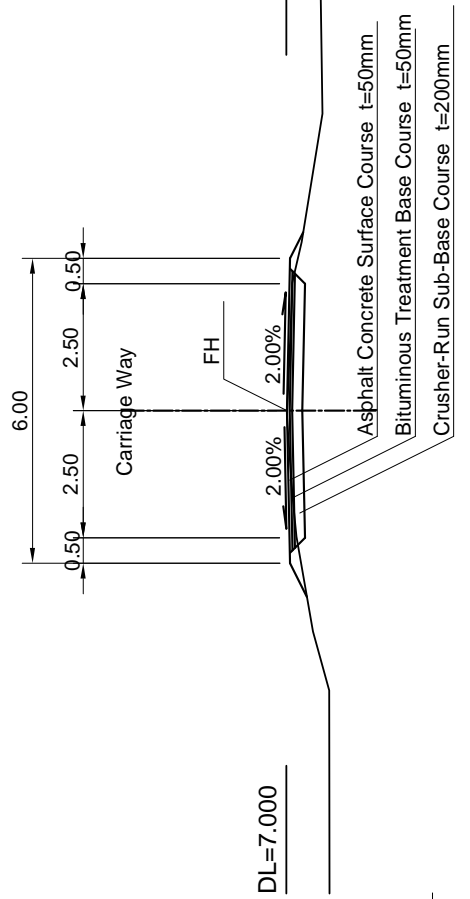
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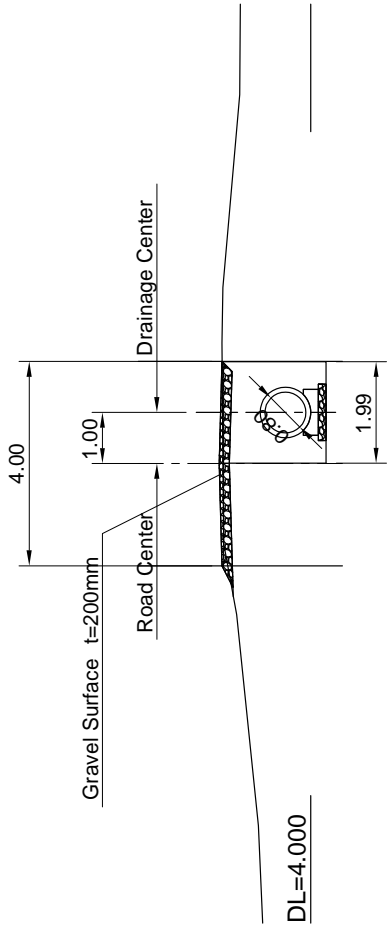
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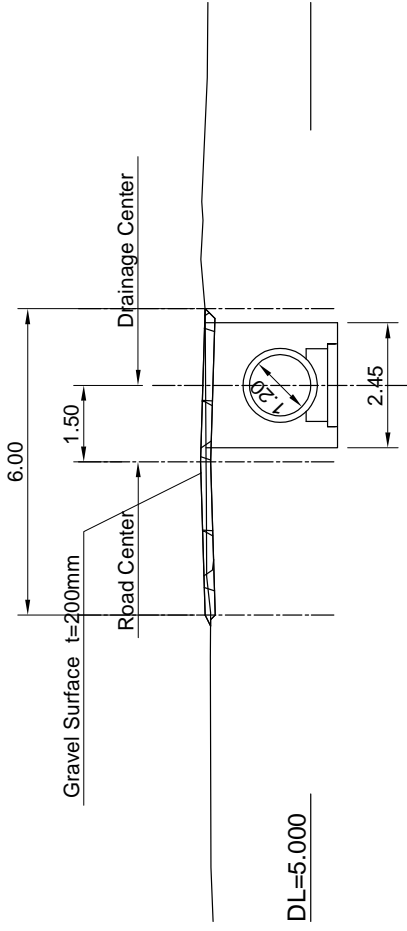
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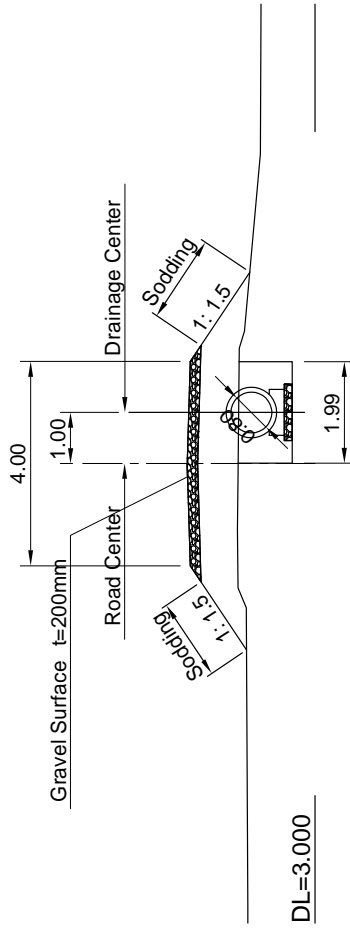
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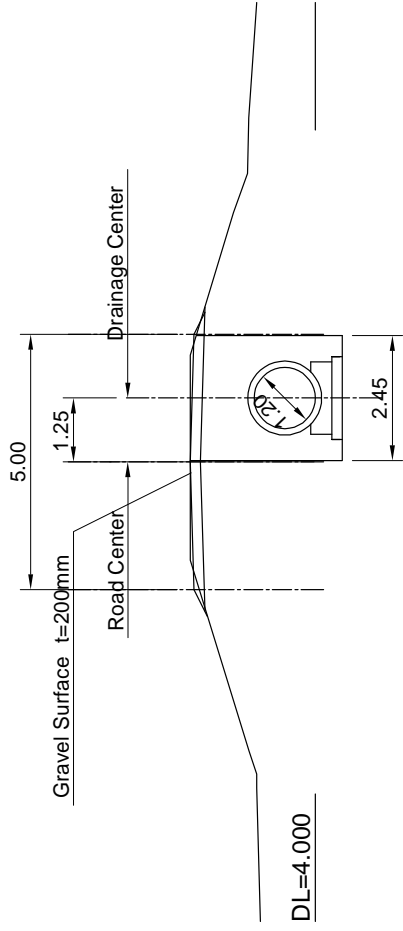
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Drainage Way No.1
STA.0+280 - STA.0+360



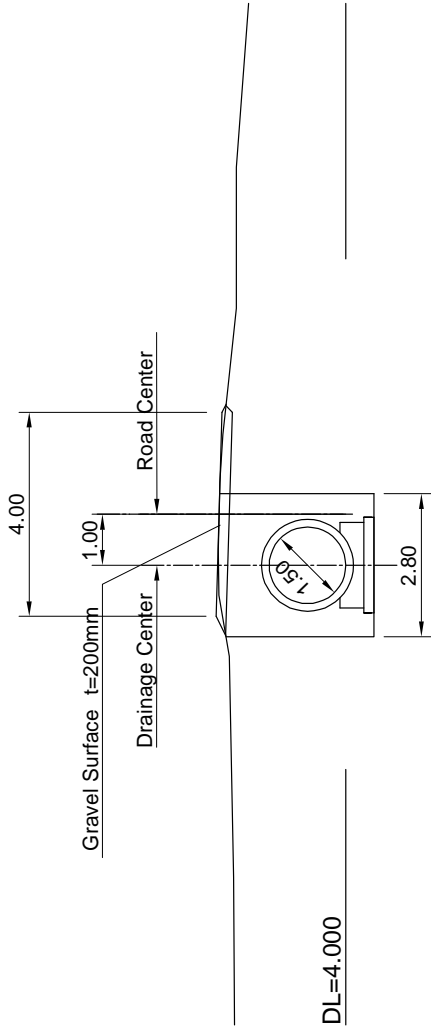
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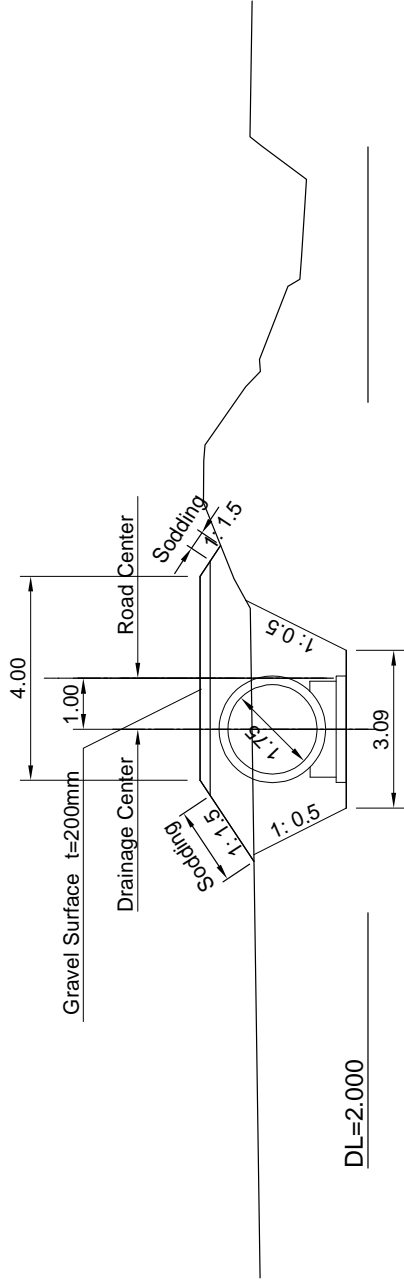
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DRAINAGE WAY

Drainage Way No.3
STA.0+000 - STA.0+240



Drainage Way No.3
STA.0+240 - STA.0+800



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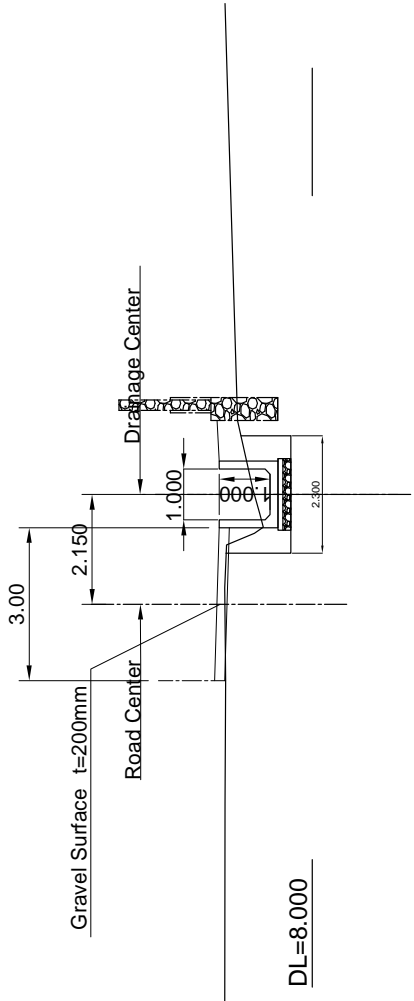
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TC-8

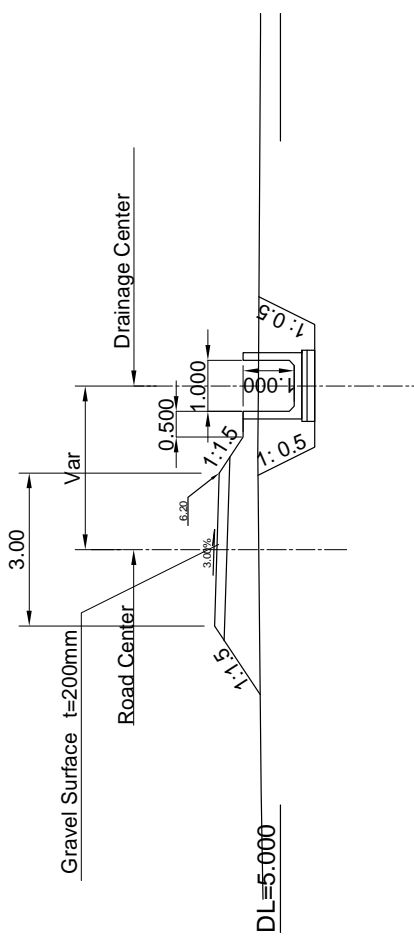
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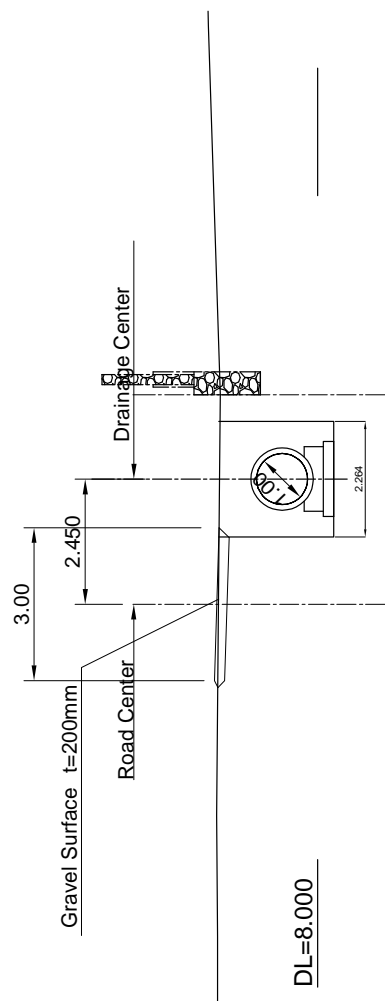
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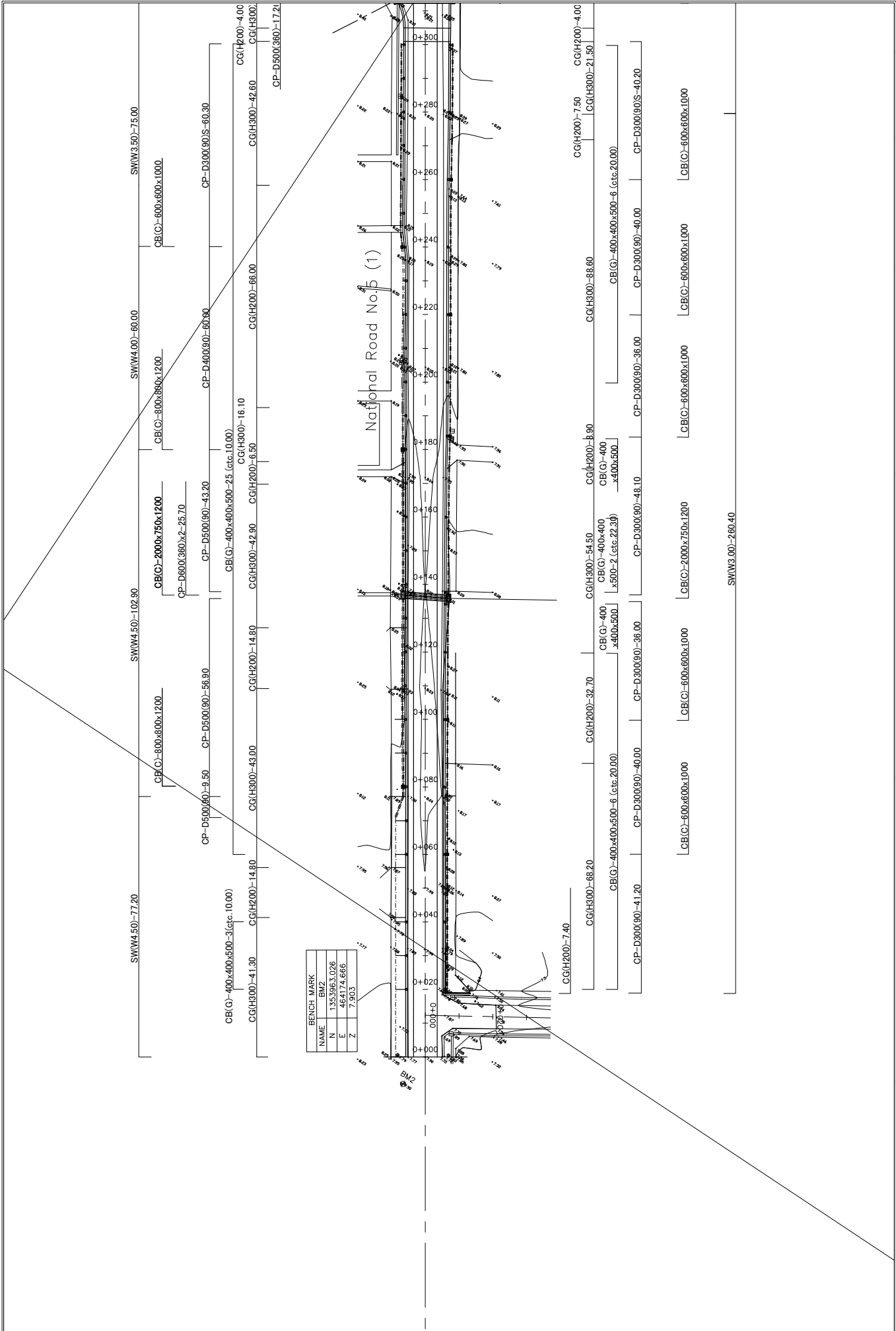
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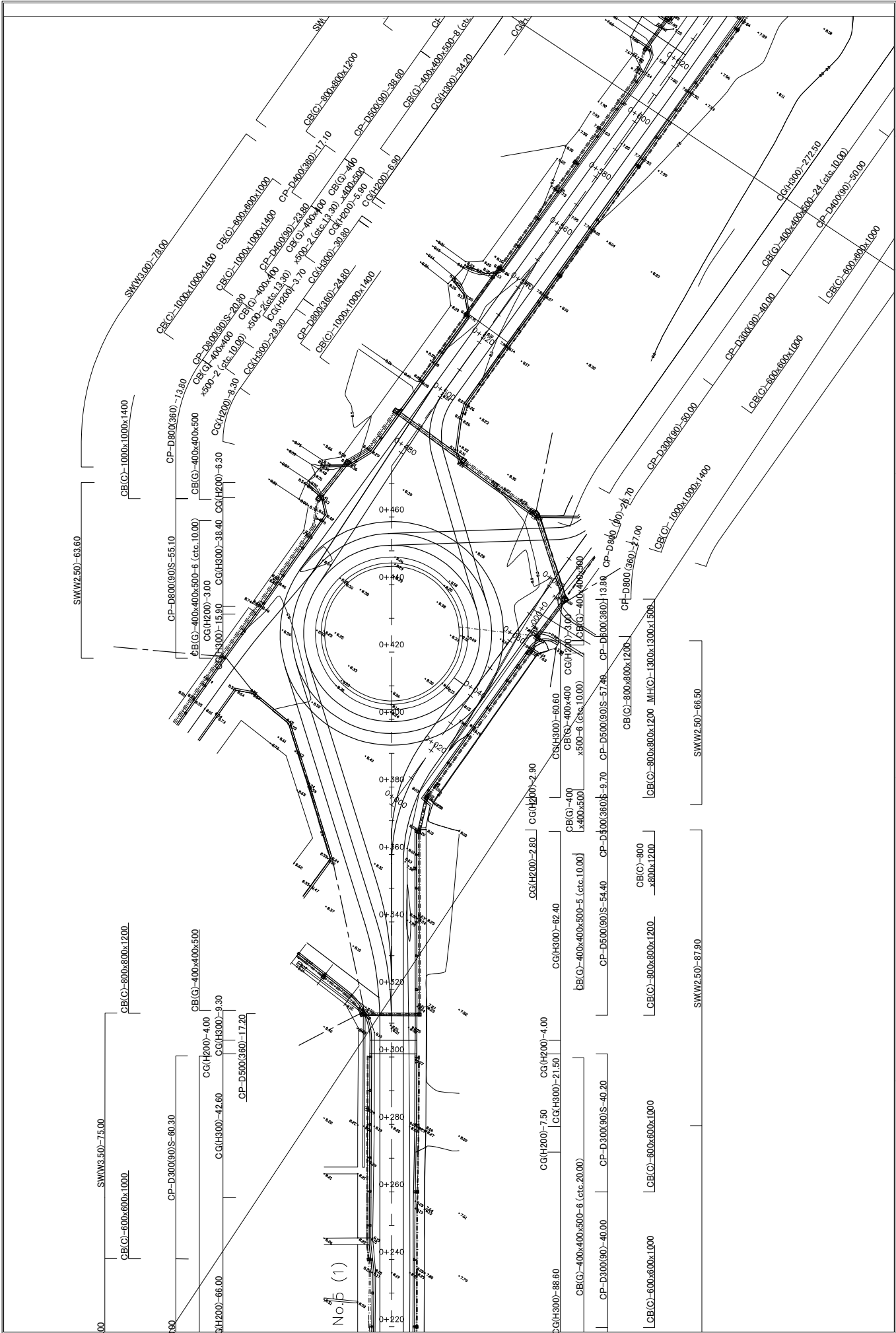
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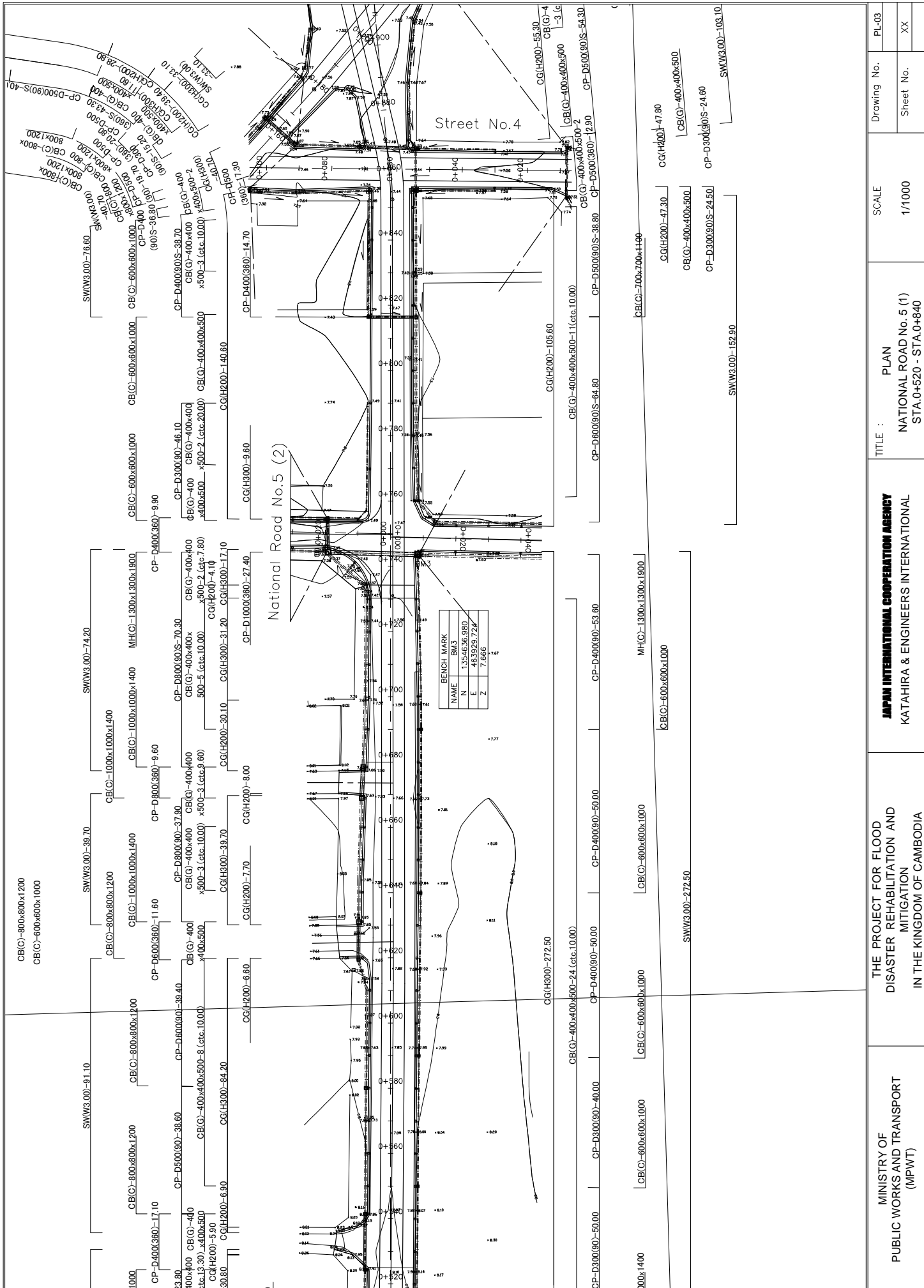
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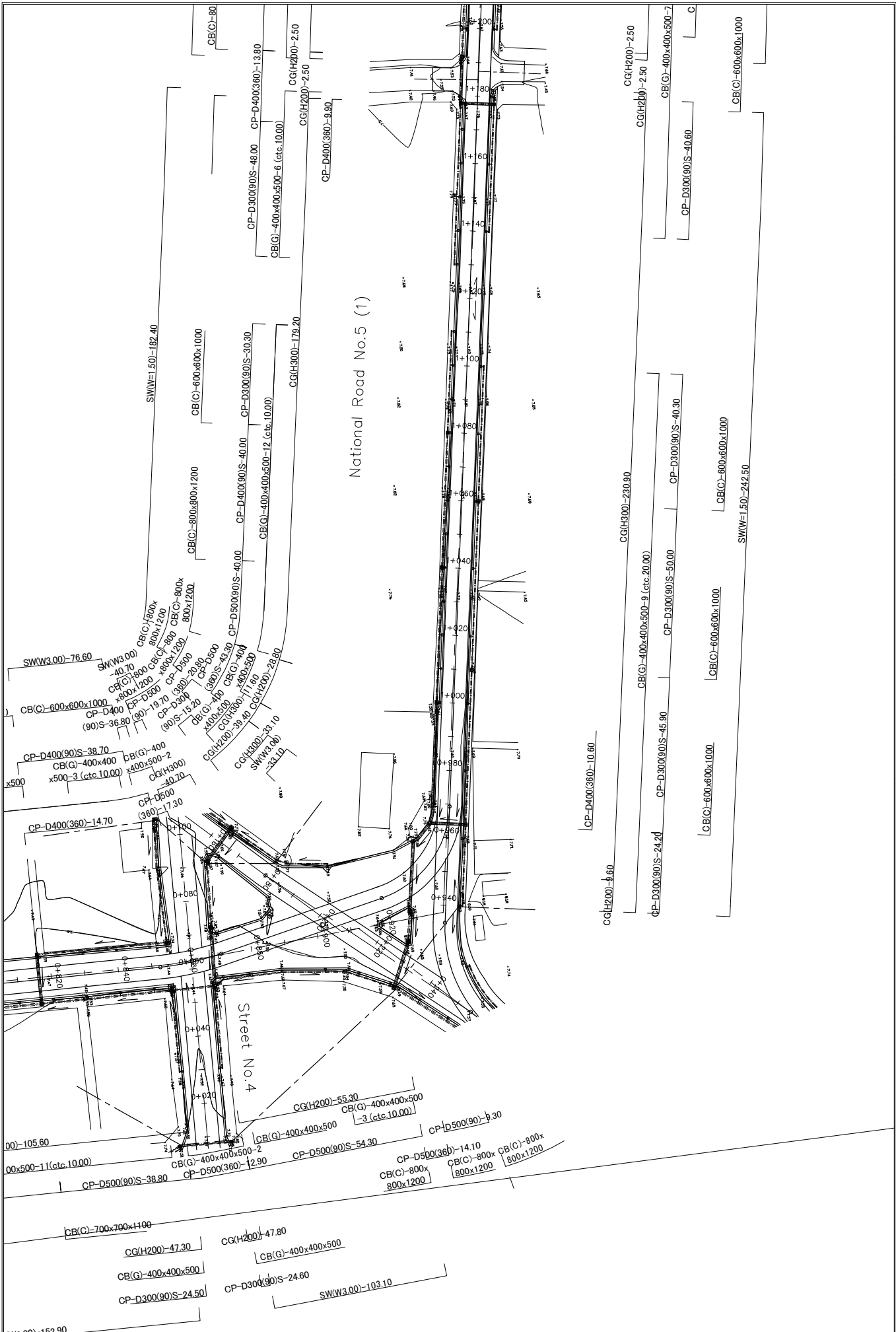
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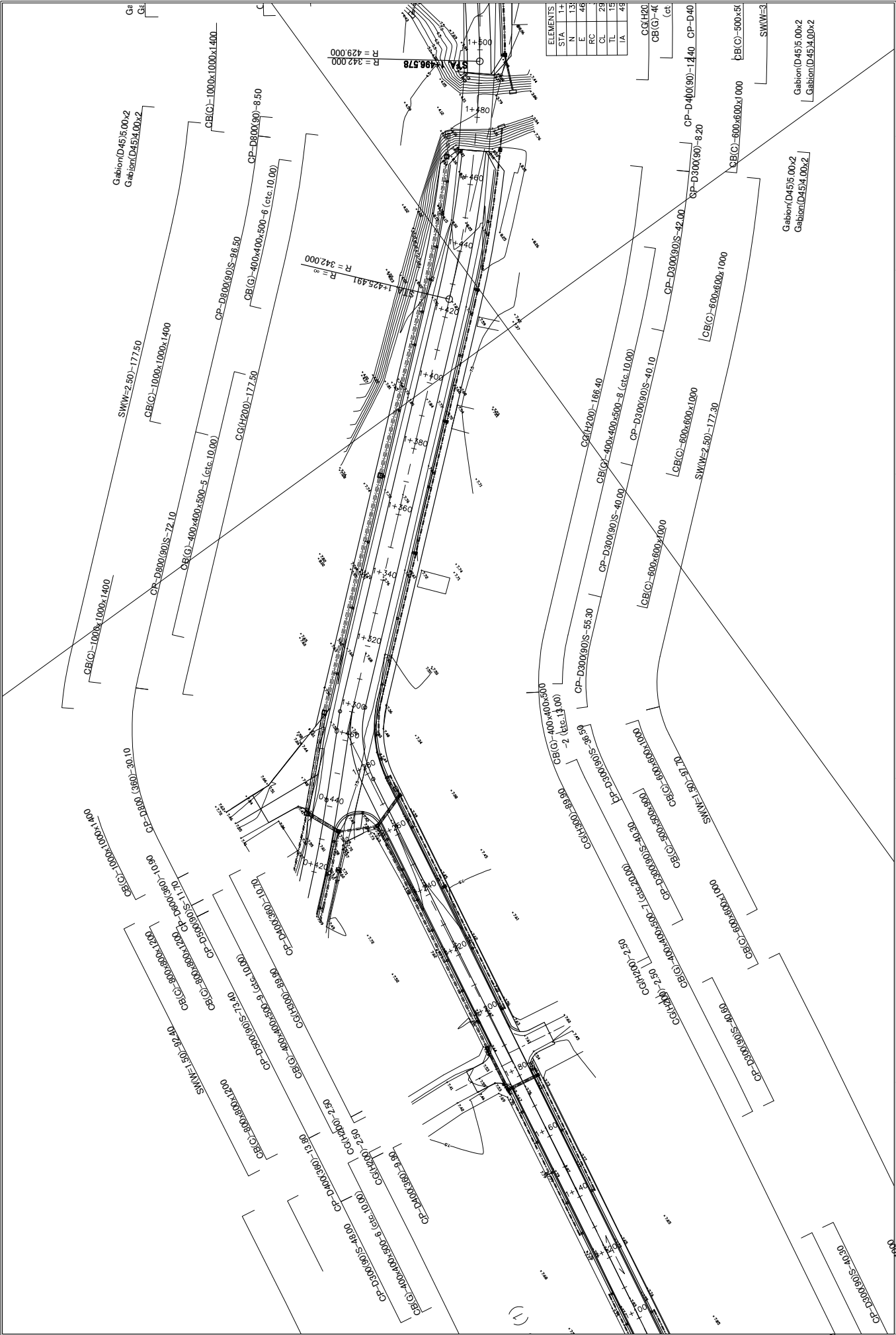
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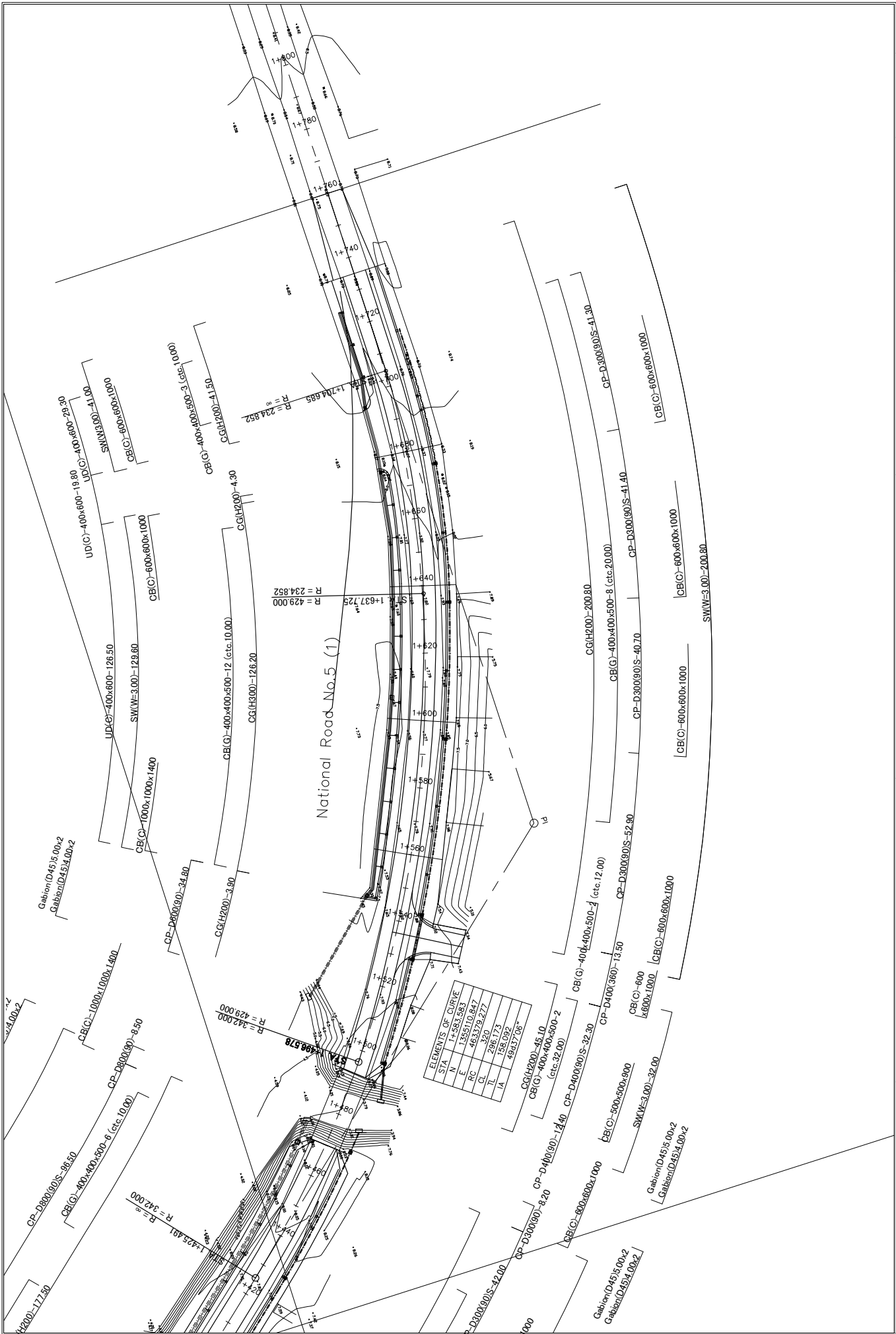
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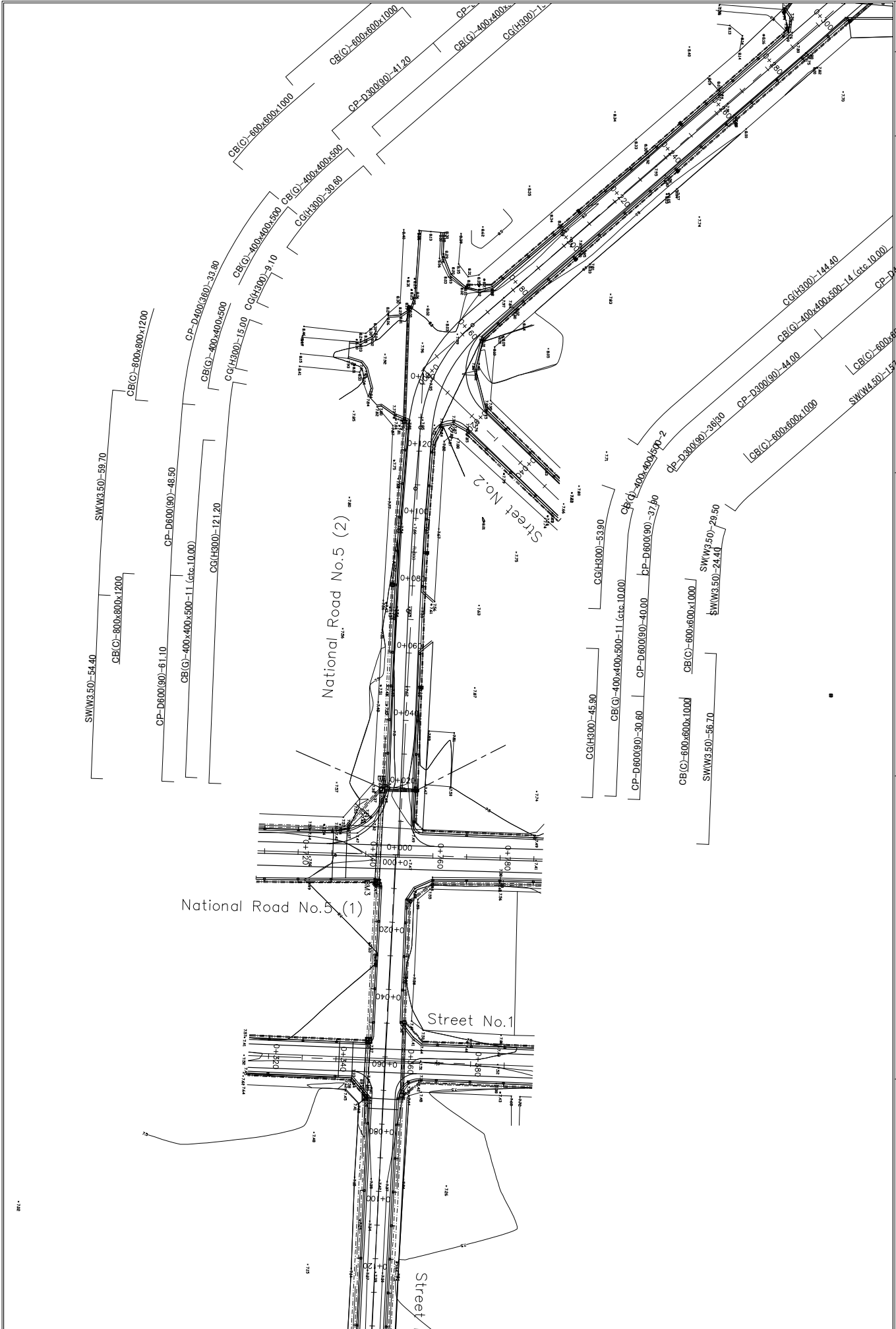
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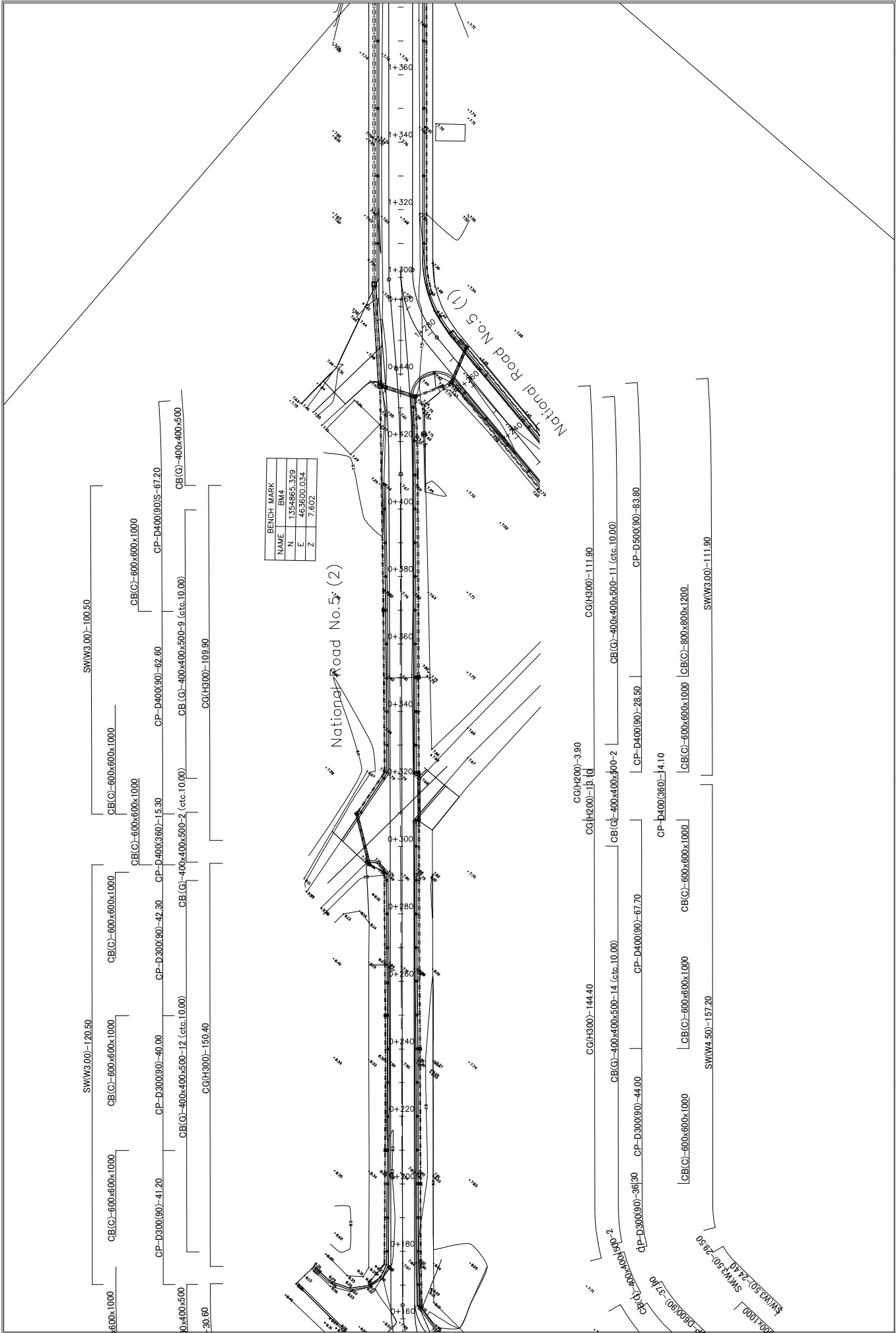
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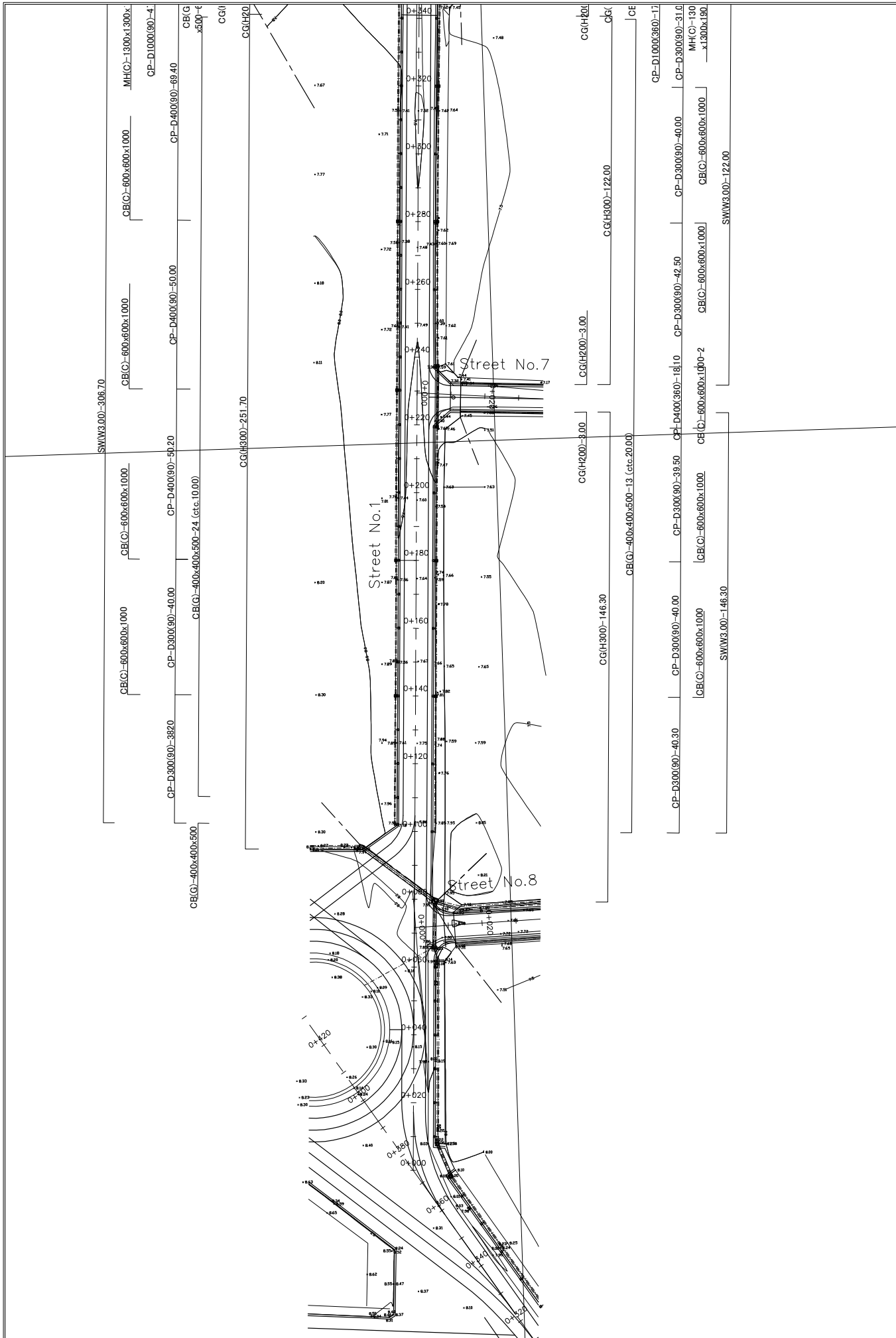


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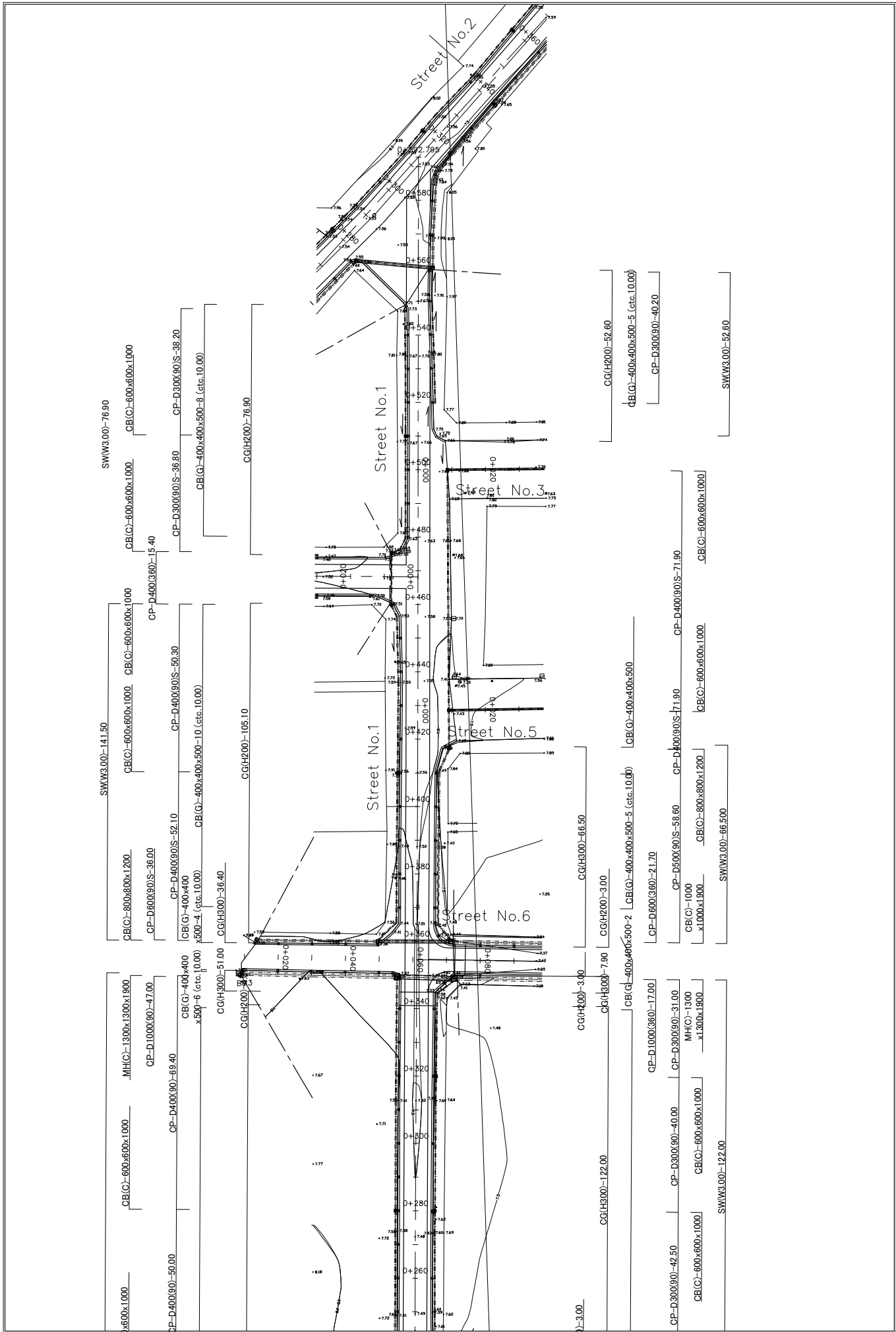


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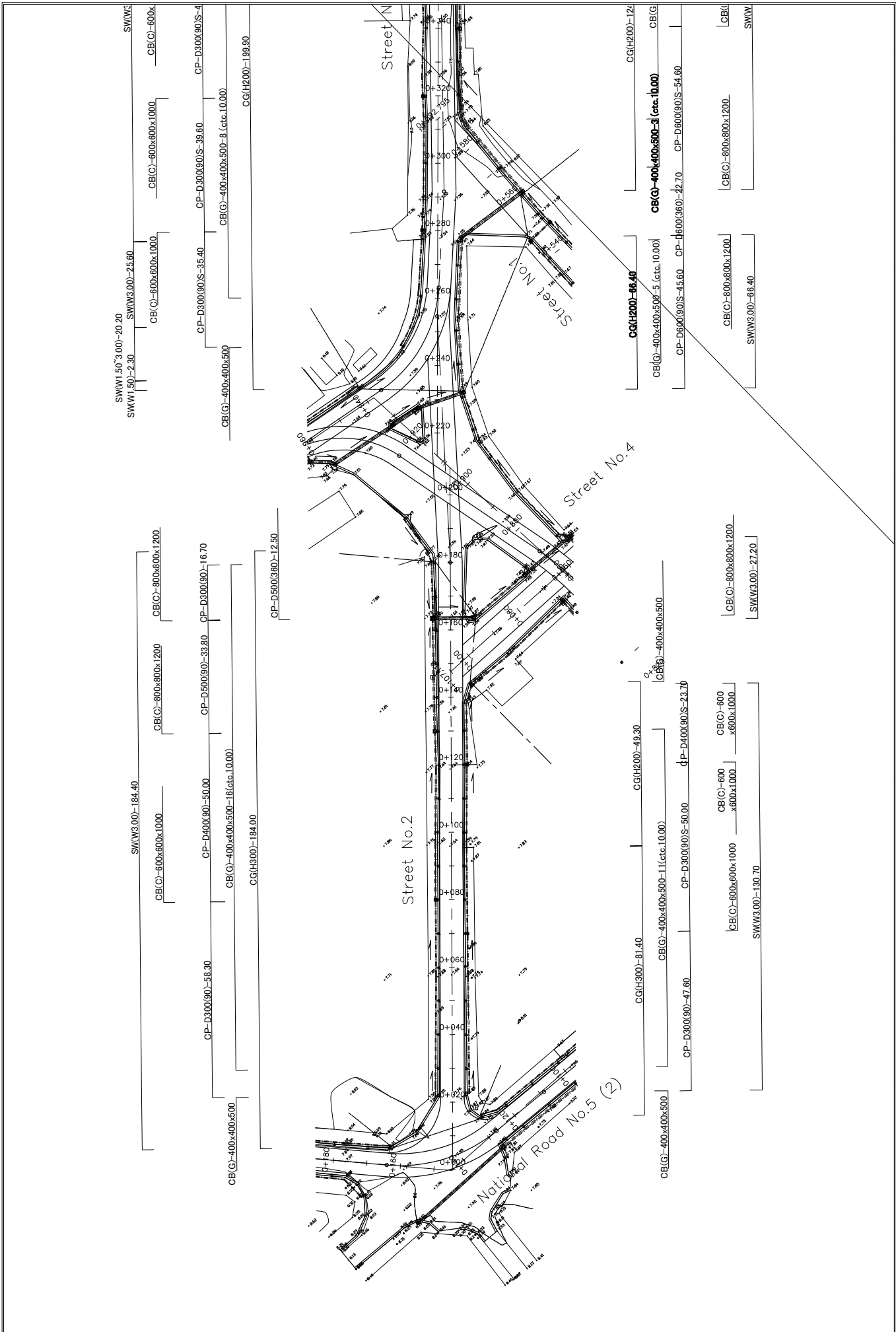




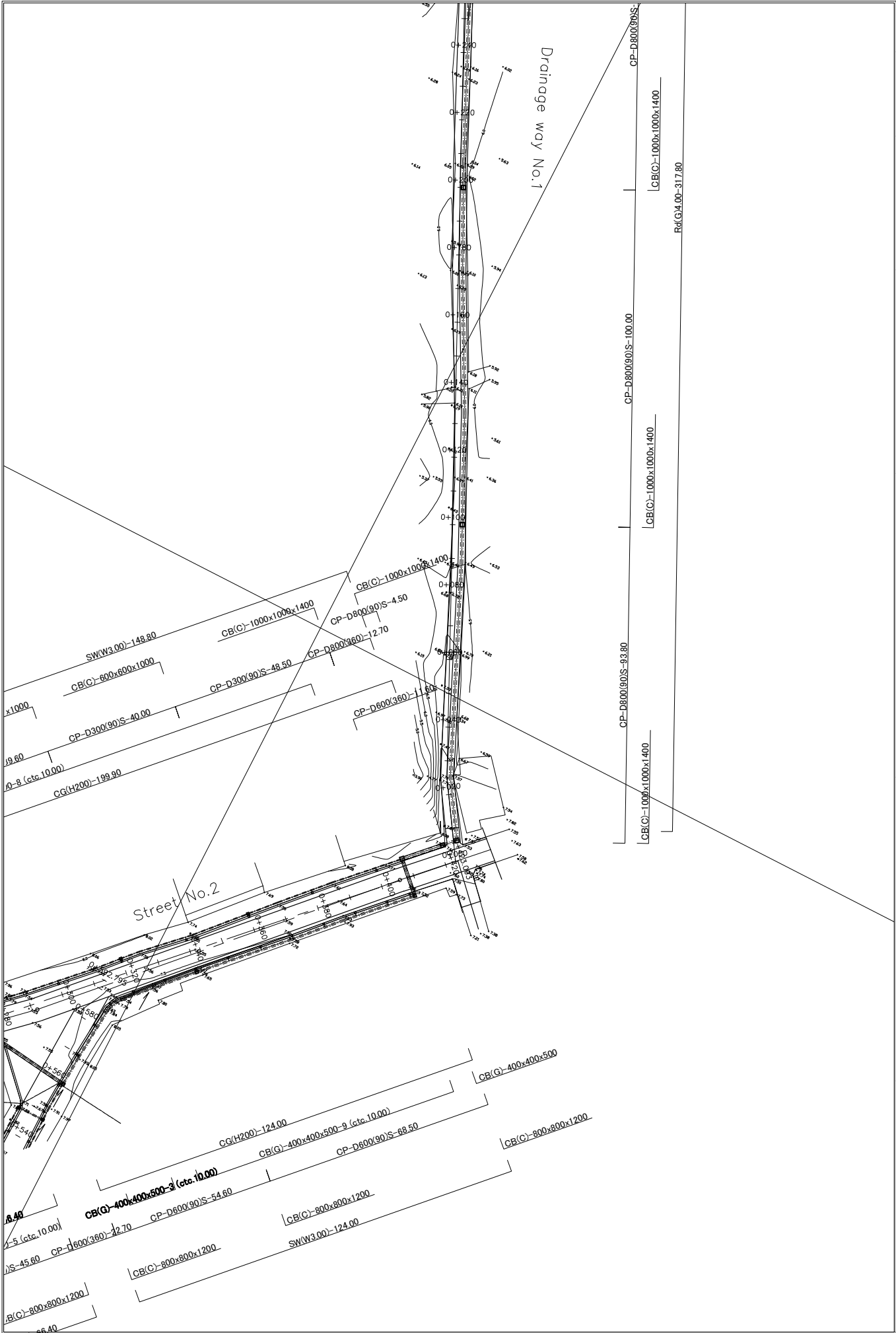
MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	THE PROJECT FOR FLOOD DISASTER REHABILITATION AND MITIGATION IN THE KINGDOM OF CAMBODIA JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE : PLAN STREET No. 1 STA. 0+000 - STA. 0+300	SCALE 1/1000	Drawing No. PL-09 Sheet No. XX
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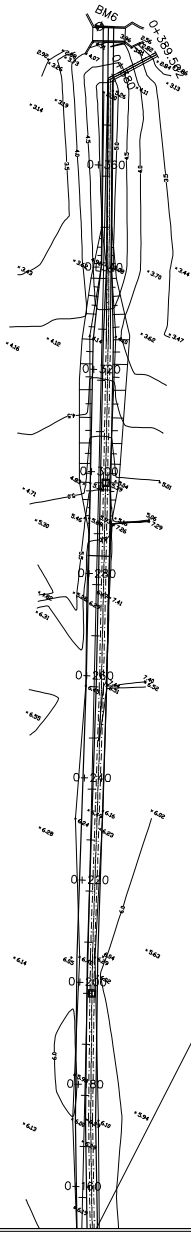
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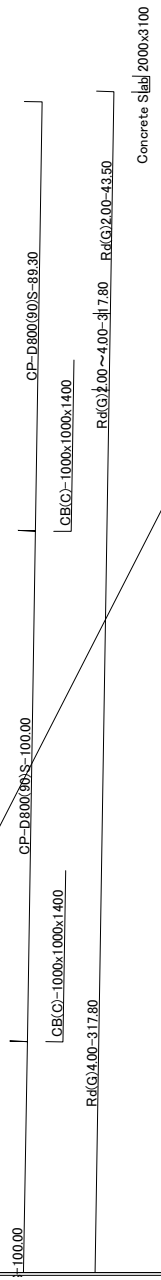
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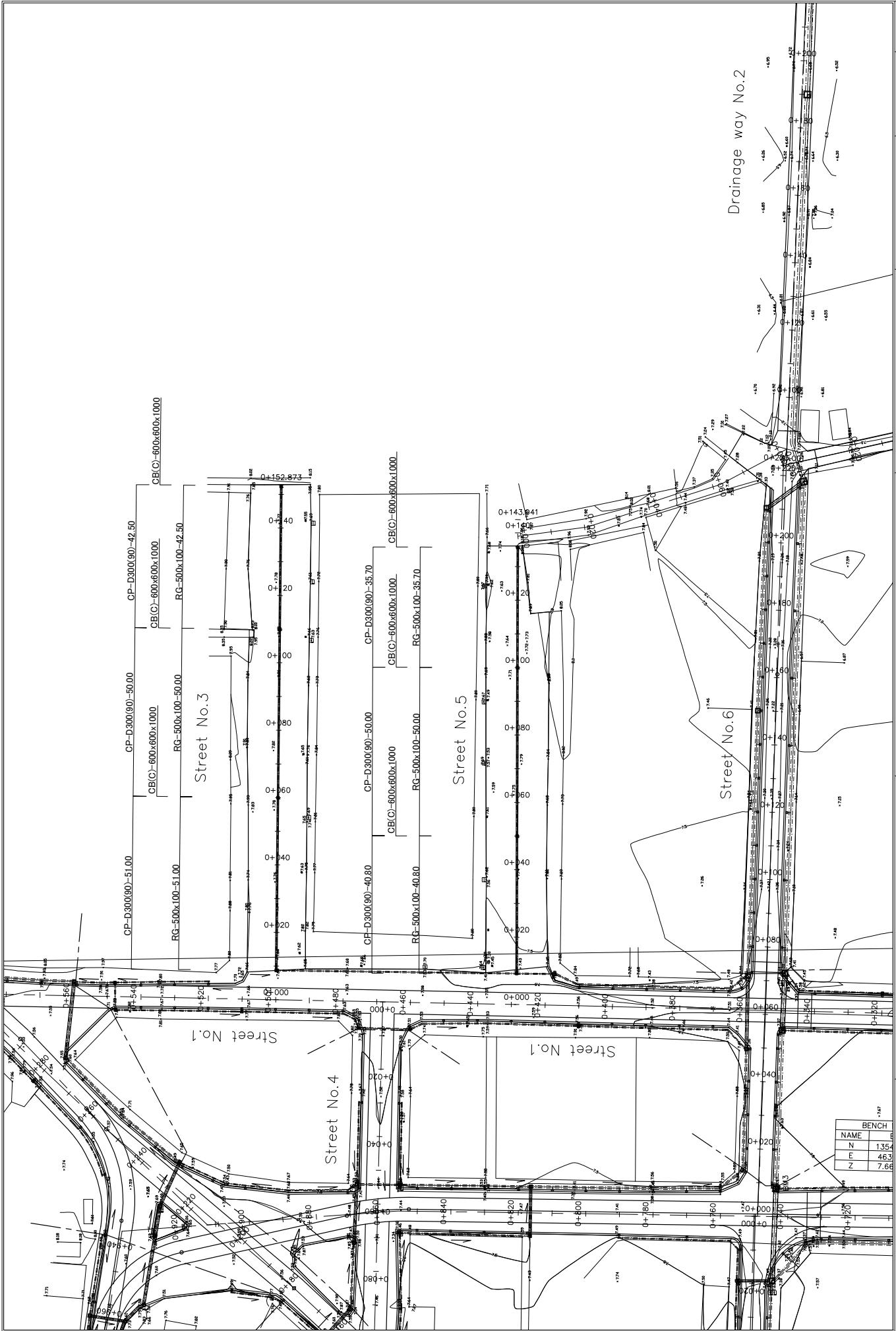
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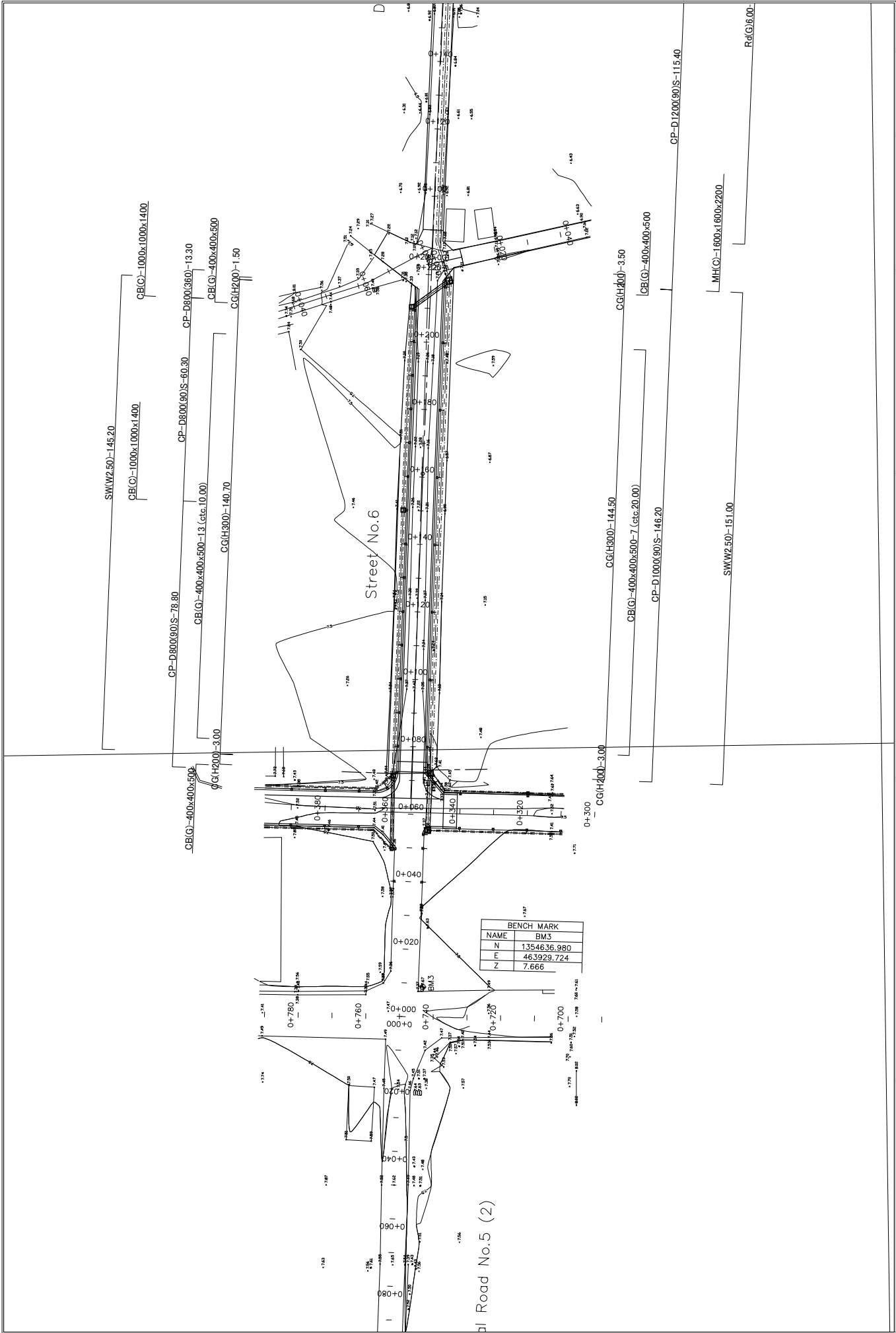
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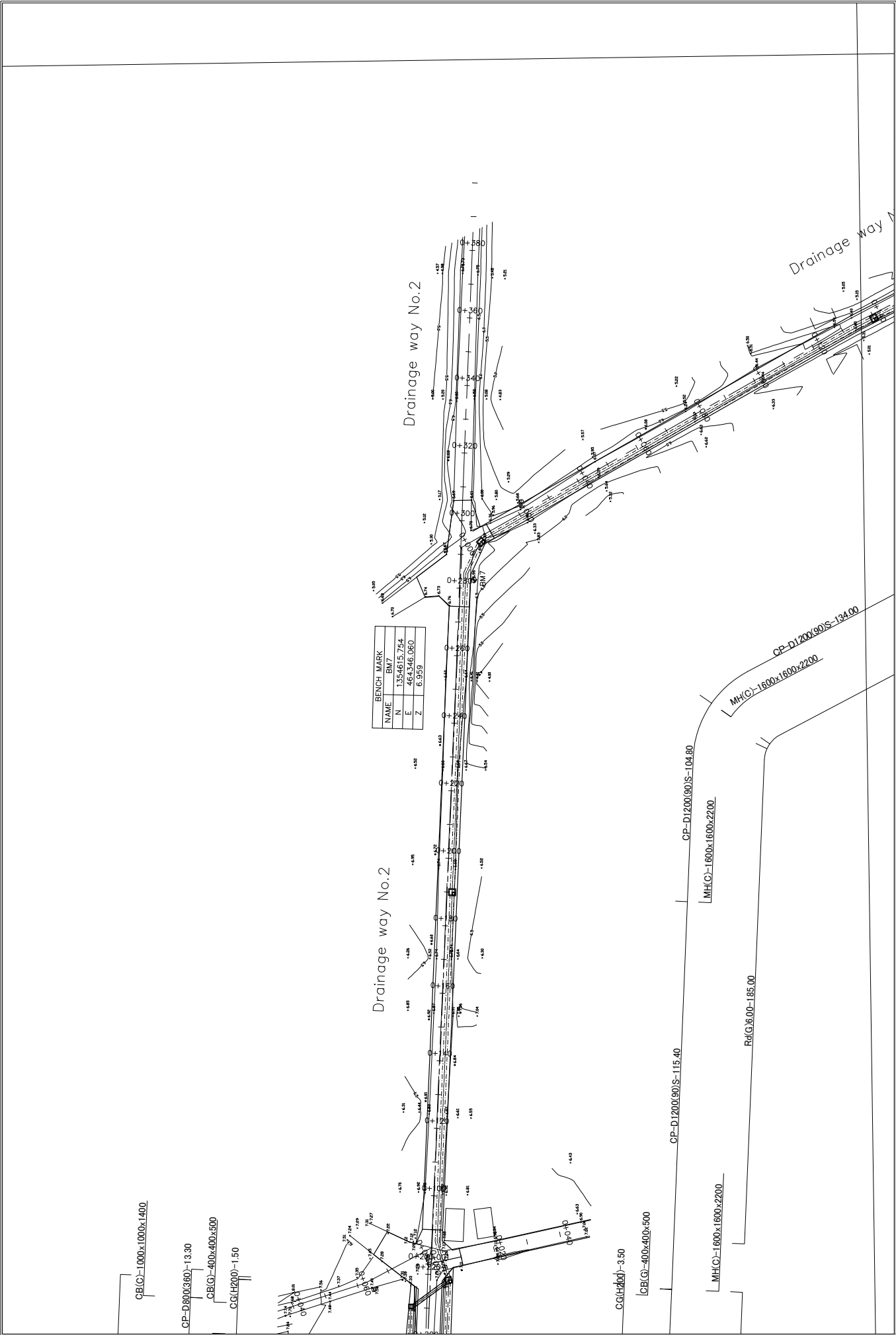
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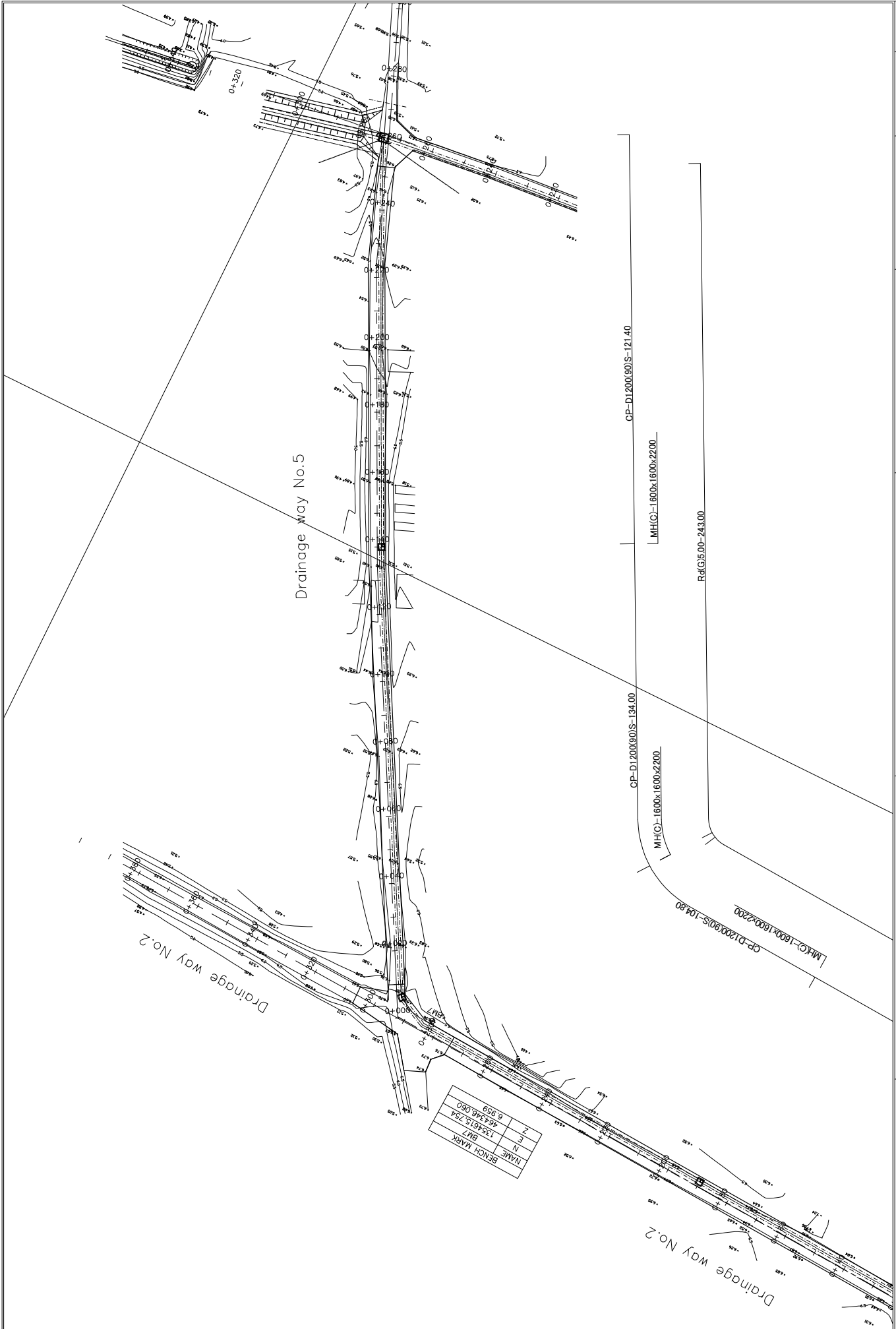
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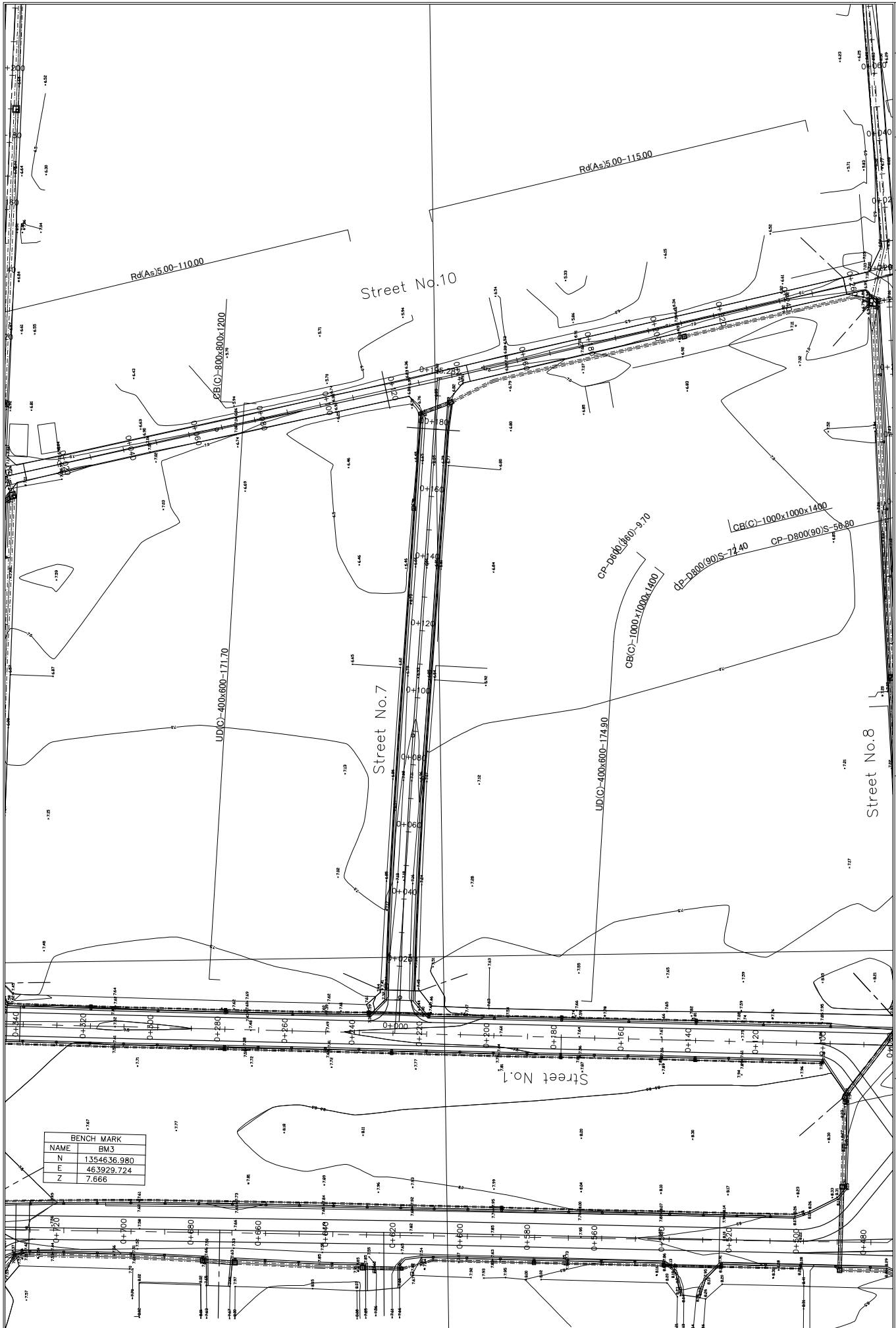
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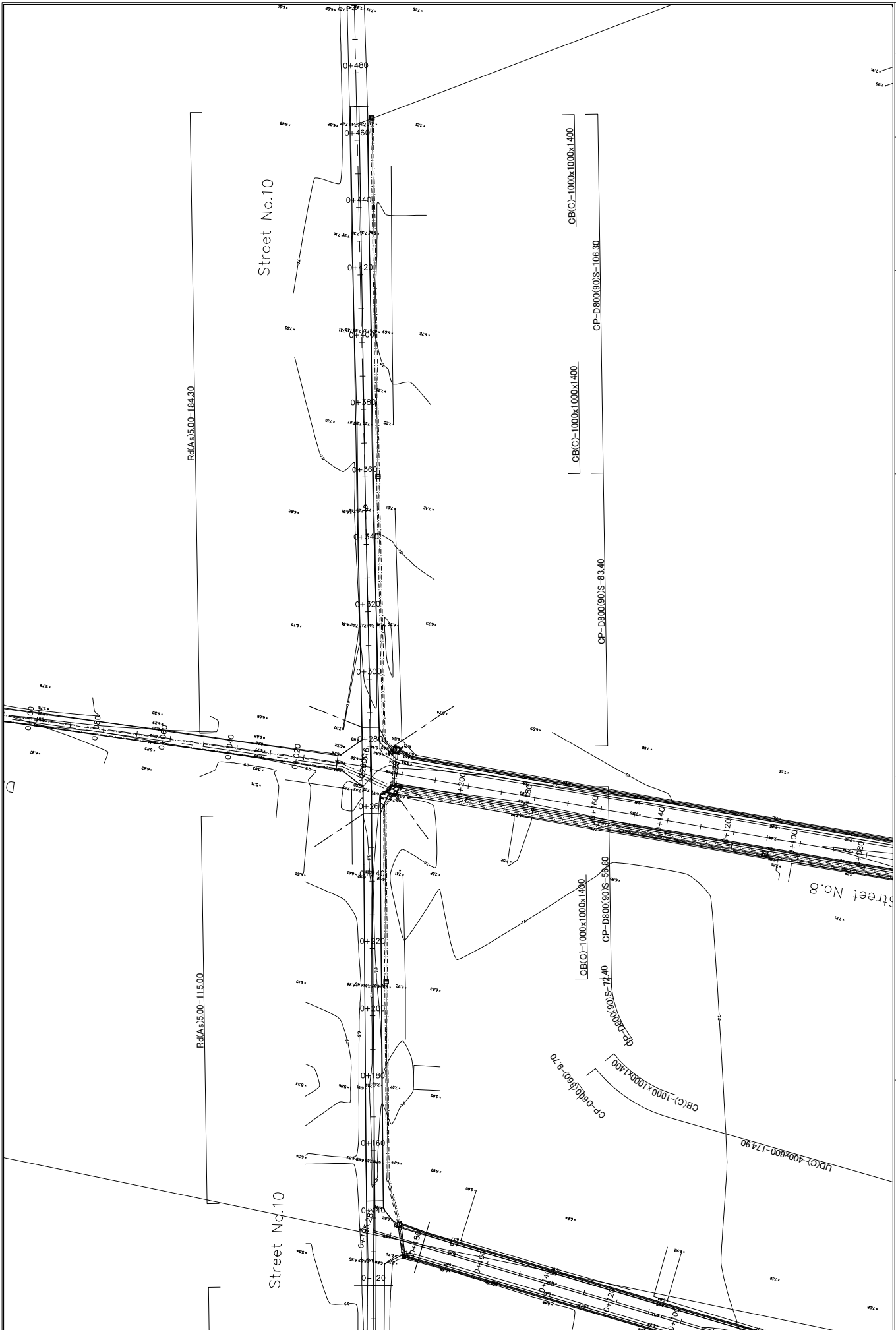
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JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	THE PROJECT FOR FLOOD DISASTER REHABILITATION AND MITIGATION IN THE KINGDOM OF CAMBODIA	MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	



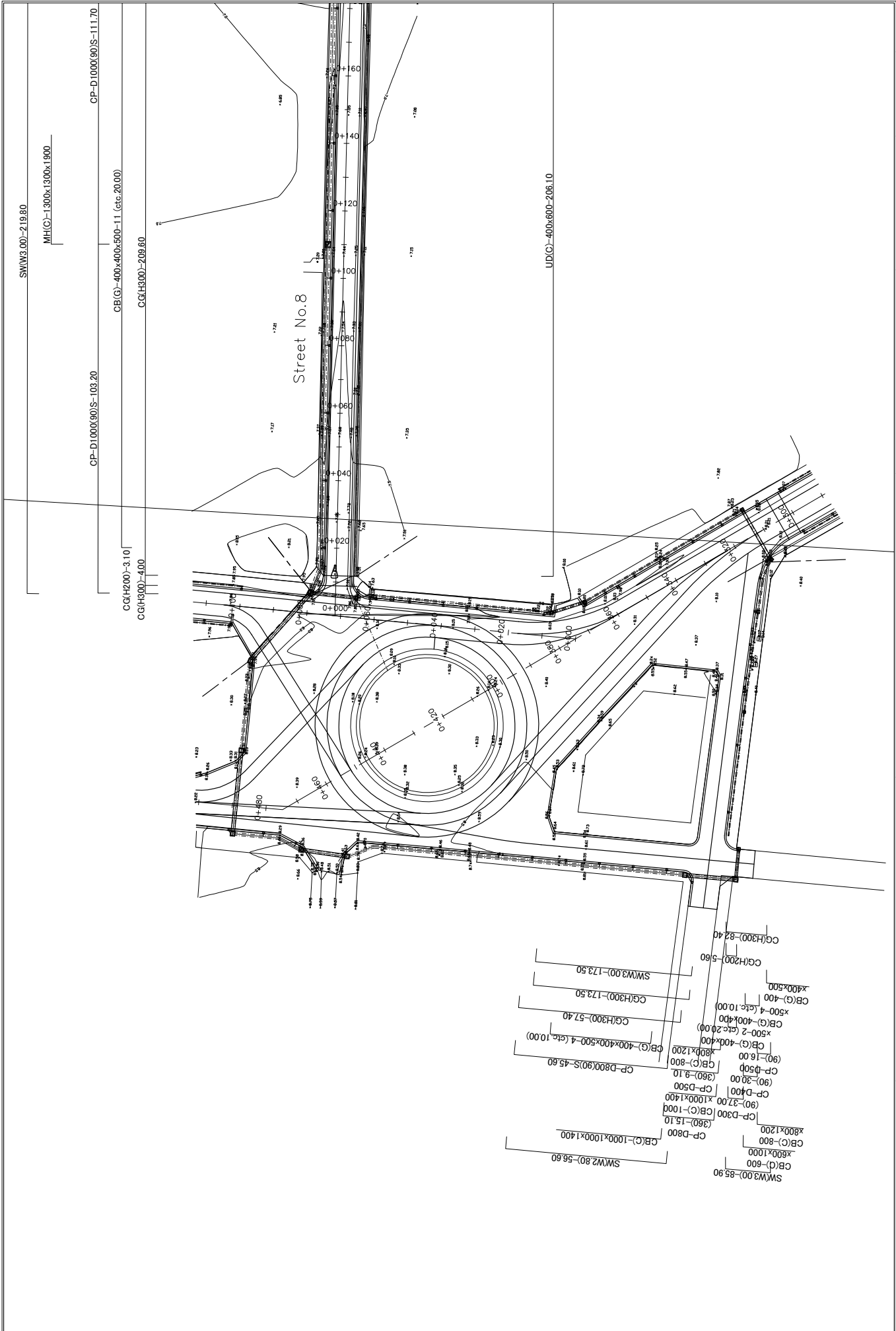
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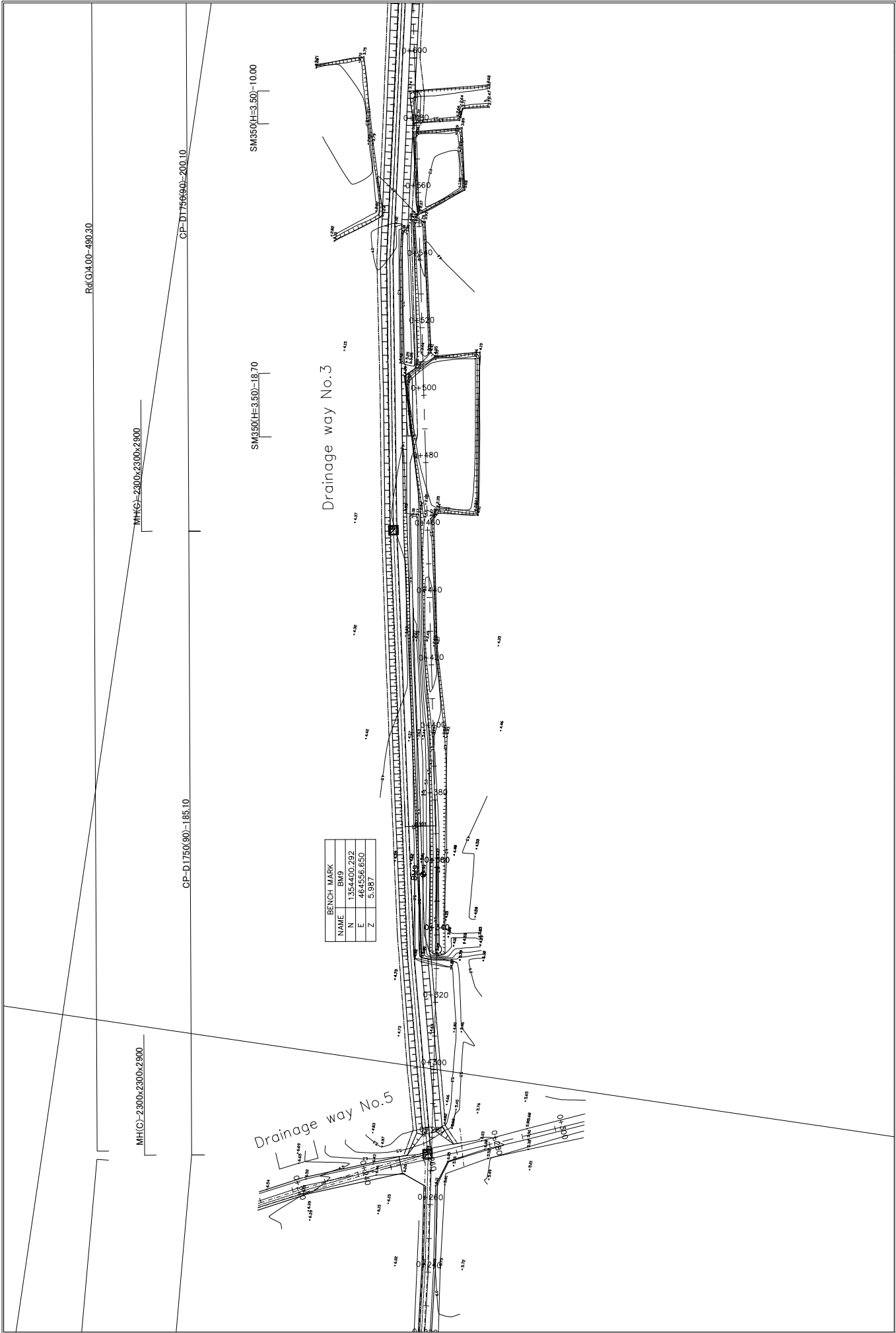
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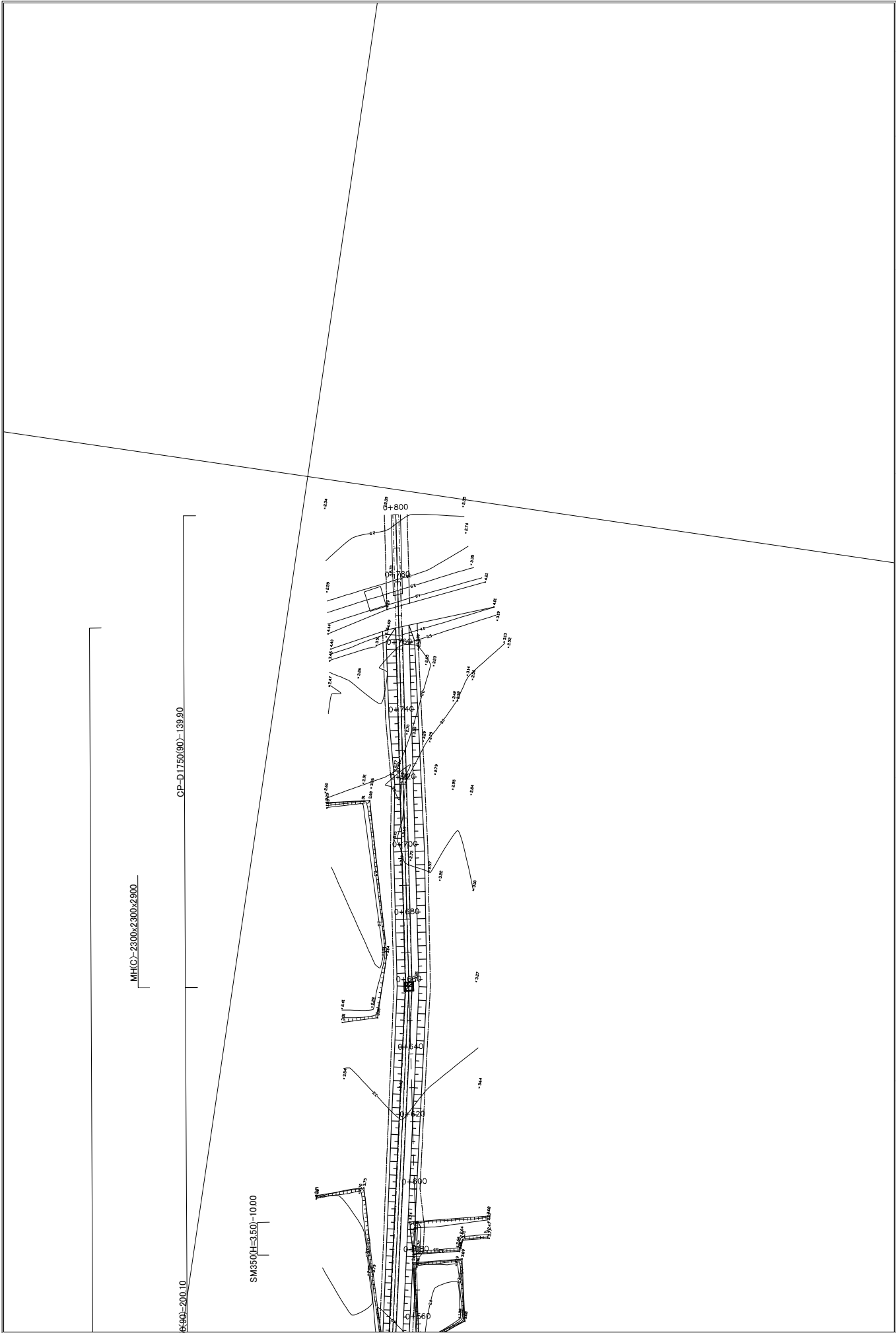
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MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	THE PROJECT FOR FLOOD DISASTER REHABILITATION AND MITIGATION IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE	Drawing No.	PL-20
			PLAN STREET No.8 - DRAINAGE WAY No.3 (1/4)	1/1000	Sheet No.	XX



MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	THE PROJECT FOR FLOOD DISASTER REHABILITATION AND MITIGATION IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE :	SCALE	Drawing No.
			PLAN STREET No.8 - DRAINAGE WAY No.3 (3/4)		
					Sheet No. XX



MINISTRY OF PUBLIC WORKS AND TRANSPORT (MPWT)	THE PROJECT FOR FLOOD DISASTER REHABILITATION AND MITIGATION IN THE KINGDOM OF CAMBODIA	JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	TITLE : PLAN STREET No.8 - DRAINAGE WAY No.3 (4/4)	SCALE 1/1000	Drawing No.	PL-23
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