Ministry of Transport

Project Management Unit Thang Long

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Consulting Services for Package 3
Technical Design, Cost Estimation and Tender Assistance
for
Hanoi City Ring Road No.3 Construction Project
Mai Dich – South Thang Long Section

Work Plan for Topographical Survey and Existing Pavement Survey

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The Joint Venture of

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NIPPON ENGINEERING CONSULTANTS CO.,LTD.

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1 GENERAL INFORMATION

1.1 Introduction

The Project road is a part of HRR3 (Western Section) and is planned as viaduct on the median of existing Pham Van Dong Street (primary urban road). The Project road starts at the north side of existing Mai Dich Flyover (KM0+130) and ends at the south side of existing Thang Long Bridge (KM5+493.7).

The Project site is located in Cau Giay and Tu Liem districts at west of urban area in Hanoi city.

1.2 Legal basis

- Construction Low No.50/2014/QH13 dated June 18th 2014 instead of Construction Low No.16/2003/QH11 dated November 26th 2003;
- Highway Transportation Law No.23/2008/QH12 dated November 13th 2008
- Land Law No.45/2013/QH11 dated November 29th 2013
- Environmental Protection Law No.55/2014/QH13 dated June 23th 2014
- Degree No.12/2009/NĐ-CP dated February 12th 2009, issued by Government for management of construction and investment project. And Degree No.83/2009/NĐ-CP dated November 15th 2009 for supplementation and modification some provisions of Degree No. 12/2009/NĐ-CP;
- Degree No.15/2013/NĐ-CP, dated February 6th 2013, issued by Government for quality management of construction work;
- Terms of Reference (TOR) for consulting services of technical design for Hanoi Ring Road No.3 construction project, Mai Dich – South Thang Long section;
- Contract for consulting services of technical design, cost estimation and tender assistance for Hanoi Ring Road No.3 construction project, Mai Dich – South Thang Long section, Contact No 1725/HD-PMUTL, dated June 19th 2015;
- Work Plan of control network approved by the Client;
- Data on control network grade IV (GPS) and secondary control point formulated for technical design.

1.3 Definition

Words and expressions in this work plan shall be referred to the followings:

- ”Client” means PMUTL,
- ”Consultant” means NK-NE-NKV JV
- ”Sub-Consultant” means Service Trading Technology and Construction Joint Stock Company (T&C)
- ”Project” means stage 1 of Ring Road No. 3 Construction Project, Mai Dich – South Thanh Long Section,
- ”Survey” or ”Work” means topographic survey / existing road survey in the Project,
- ”Consulting Service” means package 3: consulting services of Technical Design, Cost Estimation and Tender Assistance for the Project.

1.4 Location of the Work

- Beginning point is at the North of Mai Dich flyover (Mai Dich flyover on the Ring Road 3 overpass Xuan Thuy street).
- Ending point is at approach of the Thang Long bridge in front of Ciputra residental area
- Length: 5,5 km along the Project road
- Project road alignment: Start from Mai Dich flyover and run along the median of Pham Van Dong street, overpass Hoang Quoc Viet intersection, continuously run straight and cross with the NH69 intersection, go to the North and cross with planned interchnage of West Lake – Ba Vi axis road (at the area of Hoa Binh park) and end at the approach of the Thang Long bridge.

1.5 Technical Features of the Project

The technical features of the project are shown in the table below:

Main Technical Features of the Project

No.	Item	Main Features	
		Stage 1: Initial Stage (The Project)	Stage 2: Ultimate Stage
1	Beginning Point (BP)	KM0+130, North side of the existing Mai Dich Flyover	
2	Ending Point (EP)	KM5+493.7, South side of the existing Thang Long Bridge	
3	Road Length	5.364km	
4	Road Classification	Expressway Class A, Grade 100	
5	Design Speed	100km/hr	
6	Nos. of Lane	4 lanes	
7	Road Width	24.0m	
8	Cross Section Elements	0.5m+2.5m+2@3.75m+0.75m+1.5m+0.75m+2@3.75m+2.5m+0.5m - Carriageway : 4@3.75m=15.0m - Outer Safe Line : 2@2.50m=5.0m - Median : 1@1.50m=1.5m - Inner Safe Line : 2@0.75m=1.5m - Concrete Barrier : 2@0.50m=1.0m	
9	Interchange (IC)	1 Interchange South Thang Long IC - IC Type: Half-diamond - Rampway: 1 lane (Width: 7.0m (0.5m+0.5m+3.5m +2.0m+0.5m))	2 ICs (Half-diamond) - Hoang Quoc Viet IC - Co Nhue IC
10	Viaduct	Total Length: 4.803km Superstructure - Typical Type: PC Super T Girder (Span Length: 30-40m) - At Hoang Quoc Viet/Co Khue Intersections: Steel Box Girder (Fewness Type, Span Arrangement: 63m+78m+63m) Substructure - All Sections: One Column RC Pier Foundation - Standard Section : RC Bored Pile - Narrow Section : Rotation Steel Pile	
11	Pavement Structure	Ultra-thin Bonded Wearing Course, t=2cm (Urban Road: Porous Course, t=4cm)	
12	Auxiliary Works	Retaining wall, drainage system, lighting system, plants, ditch, noise barrier and preparation works for future installation of ITS equipment. Urban Road: Improvement of existing pavement after construction, restoration of existing drainage system and road lighting.	

2 TOPOGRAPHIC SURVEY AND EXISTING ROAD SURVEY PLAN

2.1 General requirements

- The topographic survey and the existing road survey shall be controlled by the captioned system, survey teams shall strictly follow the work plan;
- Format of data output meets the general requirements for the unit design requirements and fit with the whole project.
- The type of data and records clearly and fully facilitate the inspection of the KCS and the Client.

2.2 Quality management

- The management of quality of works carried out in accordance with decree issued by the Vietnamese government.
- Team leader of Sub-consultant must fully examine the information on the work diary: date of delivery, the work of each person assigned, schedule completed, to enable effective inspection and control.
- All survey work must proceed from the overall sequence to details, follows the survey process.
- Survey data must be fully recorded, tidy and free from erasing and follow the prescribed form.
- Personnel of Consultant are responsible for checking the measurements, calculated daily when the job ends.
- Upon completion of documentation, team leaders and technicians must re-examine, compare the scene, additional shortcomings.
- Supervisor of the Client and Consultant will have to comply with the requirements and contents of the Decree No.15/2013/CP dated 6/2/2013 of the Government, supervisor of the investor to make frequent monitoring survey job from start to finish the job.

2.3 Reference Standard

No.	Code	Description	Issuer
A. Topographic Survey			
1	22TCN 263 - 2000	Specification for highway survey	MOT
2	TCVN 9401-2012	Specification for measuring and analyzing GPS data	MOC
3	96TCN 43 - 90	Specification for measuring and drawing topography	Department of survey and mapping
4	QCVN 11:2008 BTNMT	National Technical Regulation on Establishment of Leveling Network	MONRE
B. Existing Road Survey			
5	TCVN 8819 – 2011	Design mix for asphalt concrete.	MOC
6	TCVN 8867-2011	Identification of general module of the structure by Benkelman deflection	MOC

2.4 Equipment and Tools

No.	Equipment name	Manufacturer	Maker	Manufacturing year	Quantity
A. Topographic Survey					
1	Level B21	Japanese	Sokia	2009	01
2	Total station GTS235	Japanese	Topcon	2009	01
B. Existing Road Survey					
1	Standard vehicle (real axis bearing of 10 ton) attaching with plate "checking road".				01
2	Hydraulic jack of 30 ton				01
3	Benkelman rod				01
4	Thermometer				01
5	Timer				01
6	Other tools (signal plate, etc.)				

- All captioned equipment is in good condition and calibrated (attached with calibration record)
- Measurement equipment is followed specification on maintenance, transportation and usage.

2.5 Work Procedure

2.5.1 Review Existing Information

- The road alignment shall be provided by (highway design team of) Consultant upon the Client's approval;
- The control network grade IV and secondary control point;
- The previous plan scaled 1/500.

2.5.2 Topographic Survey

(1) Coordinates

- According to the Decision dated 12/07/2000 on the use 83/2000/QĐ-TTg reference system and coordinates of Vietnam (VN2000 coordinates).
- The reference ellipsoid: WGS-84 global dimensions as follows:
- Semi-major axis: a = 6.378.137m.
- The flat: f = 1/298,257223563.
- Selection of the project area in compliance with the Cadastral Directorate's requirements, i.e:
- Hanoi city: center meridian 1050 00'.

(2) Elevation

- Vertical datum: National elevation system (Hon Dau Island).

(3) Survey procedure

Topographic survey shall be carried out based on the following procedure;

- Collecting data of feasibility study;
- Comparing collected documents;

- Mobilizing manpower and equipment;
- Confirmation of center line of the Project road with the highway design team (staking);
- Carrying out level and cross sectional survey;
- Preparing and submission of survey report.

2.5.3 Existing Road Survey

Existing road survey shall be carried out in accordance with TCVN 8867 – 2011 and following work method;

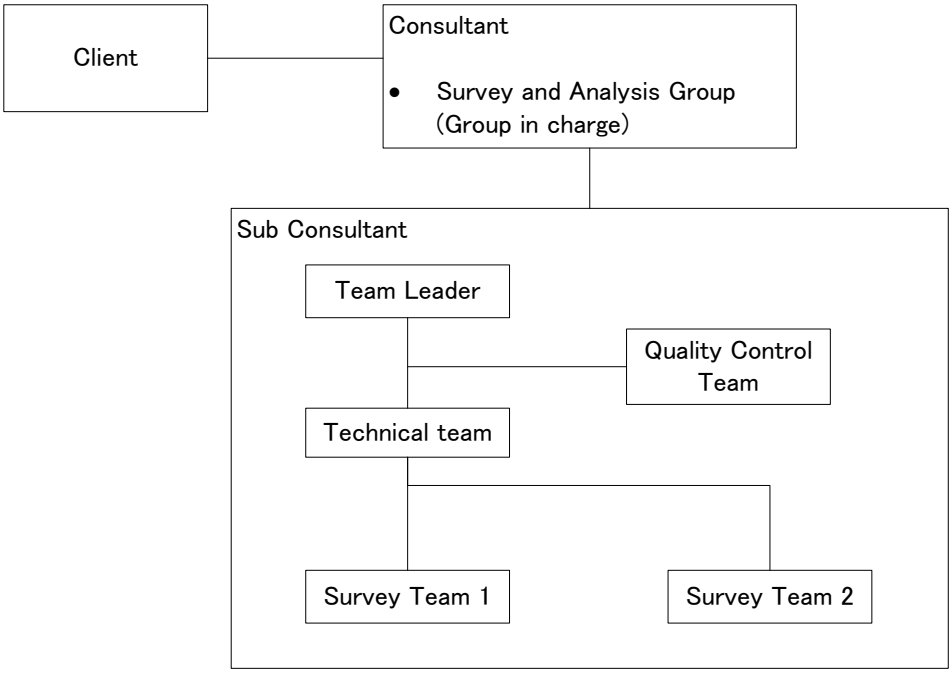
(1) Testing preparation

- To decide survey sections;
- Marking the measurement points (20 points in total). Measurement points shall be at outer lane (0.6 – 1.2m from the pavement edge) which is normally more deflective than the inner lane.
- Loading vehicle: having single axis and double tires, Q= 10000 daN; D=33cm ; P= 6daN/cm2, symmetric loading and fixed.
- To measure deflection of rod, scale vehicle, area of lane and its pressure to the pavement. To have printing paper for recording the results.

(2) Testing process

- Arrange loading vehicle in the position and measure the pavement temperature;
- Read the initial figure when the meter is at L_0
- Forward the vehicle at least 5m far from the measuring point
- Read the figure when the meter is at L_1
- Calculation the result
- Prepare the report

2.6 Work Organization



2.7 Key personnel

No.	Position	Name	Tasks	Remark
A	**Consultant**			
1	Team Leader	Ichizuru Ishimoto	Management and Guidance	Accountability for the Service
2	Deputy Team Leader	Do Hoang Anh	Management and Guidance	
3	Material Engineer	Toru Fujino	In charge	Responsibility for the Team
4	Topographical Engineer		In charge	
B	**Sub Consultant**			
1	Team Leader	Tran Van Quan	In change	Responsibility for the survey work
2	Quality Control Manager	Pham Nhan Duc	In change	Responsibility for the survey work
3	Survey Team 1	1 Licensed Survey Engineer, 2 workers, 1 flagman	Topographic and Existing Road Survey	
4	Survey Team 2	1 Licensed Survey Engineer, 2 workers, 1 flagman	Topographic Survey	

- Full name of the personnel shall be informed in details upon actual deployment.
- Compliance with Decree No. 12/2009/ND-CP on management of works construction investment and technical requirements of the Project

3 Details of the Works

3.1 Topographic Survey

3.1.1 Identification of actual road center

- Basing on the approved alignment and the secondary control point to make the site alignment including identification of the top, measurement of angles and staking.
- The staking is not exceeded to 20m/stake and positioned within a curve geometry (TS, ST, SC, CS, MP), bridge and culvert stakes, H stake, Km stake, cross section stake to power line and topographic stakes that ensure accuracy and efficiency the topography along the alignment and both sides following the project requirements.
- The staking for alignment center is by polar coordinates, using the total station and mirror to locate at DCC2 and GPS points made along the alignment for positioning the stakes at the to, the main stakes of the curve geometry (TS, ST, SC, CS, MP), Km stake, H stake and other stakes.
- The top stake of the curve line shall be concreted in triangle at 12cm and the stake length is 40cm.
- The stakes on the existing road shall be used iron nails at Φ1.5cm and 10cm long. Outside the existing road shall be wooden pile at square shape of 5cm wide and 40cm long.
- The coordinates of stakes for alignment center shall be provided by the Consultant to the survey company before implementation.
- The stakes position is made according to the coordinates, station and elevation and mentioned in the survey report.

3.1.2 Longitudinal Survey (level at center)

- Level and leveling staff shall be used for detailed points on the alignment center and led to DCC2 leveling points or GPS. The level of the captioned points shall be referred to calculate detailed points.
- Level measurement which is led to DCC2 and GPS, allowable tolerance is $\mathrm{fh} \leq \pm 50\sqrt{\mathrm{L}}$ (mm) (L+ Km)
- Length measurement for identification of space between detailed stakes. To measure in detail one time to match with H stake. Allowable tolerance is fl / l < 1 / 500 (fl: allowable tolerance).
- Basing on data on length and level measurements, vertical section, level scale of 1/50 and length at 1/500 at all stakes, the vertical section shall mention exactly natural terrain, location of bridge and culvert, cross section, power line and telecommunicaiton line.

3.1.3 Cross sectional Survey

- Measurement of cross section scaled 1/200 for identified stakes.
- Measurement scope from alignment center to each side of 30m.

(1) Option 1

From survey stakes to put device at the alignment center orienting to next alignment center at

retanglar angle to the alignment, mark the measuring point, use level to measure points from alignment center to the both sides till the end of the required scope for horizontal measurement.

Measurement data shall be recorded by 2 methods (site note or on device memory).

(2) Option 2:

Based on design road center and detailed points of vertical survey to calculate coordinates of two ends and road center then put into the total station, from the position of cross sectional survey to measure following polar coordinates method that the device is not in the road center. The mirror holder shall start from road center to the both sides of cross sectional survey till the end of the scope and mark the measuring points then to use level following the geometry level method (data shall be recorded as mentioned above) and processed via software of VNRoad.

- The detailed point density on the horizonal survey shall reflect the most typical features of the pavement and both sides (to ensure the future calculation) as well as <4m to the asphalt face and <5m to soil foundation or even smaller in case of changes of the pavement.
- On the horizontal section shall reflect terrant and special works if any. To measure cross section equivalent to positions of electric pole, communication pole, etc., and put on the cross section.

Note:

- Detailed measuring points on cross sectional survey: due to the old pavement layer, the detailed level measurement on asphalt pavement shall ensure the accuracy.
- The cross section on the asphalt pavement shall be measured via geometry level (trigonometric method shall completely not be applied to avoid tolerance for leveling course of asphalt) for the pavement reinforcement section, therefore the horizontal survey shall impact to future calculation of volume.
- For road section in damage or in settlement by vehicle which moves asphalt to the both sides, beside horizontal survey to increase the depth following the terrain, the area shall be limited with clear note of the status (or to be mentioned under the flat plan) for design treatment.

3.1.4 Plan survey

Utilize the plan with scale 1/500 which was conducted in F/S stage. The control points network and urban infrastructure works shall be updated and shown in the alignment plan.

3.1.5 Survey for other works

Survey to be conducted to cross section with railway, HV and LV lines and tele-communication, lighting, post cable and substructure crossing the alignment with the following contents:

- Survey of planning level of cross line if any;
- Survey of level and align (via coordinates) for lines of 220KV, 110KV, 10KV and 0,4KV. Intersection angle between the lines and the alignment, distance between the centerline to poles, pole's height and clearance of the lowest wire to natural ground.
- Type of pole, power, cable, pipeline, electricity and voltage.
- Management agencies

- Kind of documentation.

4 SURVEY SCHEDULE

See Attachment 1.

5 WORK QUANTITIES

Work quantitiesof surveys are as follows:

Item	Unit	Expected volume	Remark
I. Topographic survey			
Center line survey (vertical profile)	Km	5.5	
Cross sectional survey	Km	16.5	
II. Existing road survey			
Elastic modulus test of existing road pavement	Point	20	

6 SAFETY

Work area is on the road having busy traffic so reflective jacket is required to surveyors and other labor protection equipment. All permissions shall be obtained from related local authorities prior to the work.

7 DOCUMENTATION AND SUBMISSION

- Collected data on survey
- Machine and equipment calibration certificates
- Documentation prior to submission shall be checked on site and handed with original before printing and transmitting to design section (including soft data)
- Categorizing the document as follows:

No	Description	Remark
I	**Volume I: Topo document**	
1	Vol I.1: General description on topographic survey	
2	Vol I.2: Document on control network and level	
3	Vol I.3: Alignment layout, profile and cross sectional survey	x
4	Vol I.4: Survey document on existing utilities survey	
5	Vol I.5: Document on existing road survey	x

EXPECTED PROGRESS OF TOPOGRAPHICAL SURVEY AND EXISTTING PAVEMENT SURVEY

No.	Items of work	2015																														Remark
		July										August																				
		22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
1	**Preparation of Work Plan**																																	
1	Prepare and submit the work plan of topographical survey and exiting pavement survey																																	
2	**Approval of horizontal alignment**																																	
2	Submission and approval of horizontal alignment, provide the alignment coordinate to the survey team																																	
3	**Setting out and survey the profile and cross section**																																	
3	Setiing out for approved alignment																																	
3	Profile survey																																	
3	Cross section survey																																	
4	**Reporting**																																	
4	Calculation and preparation of the survey report																																	
5	**Existing pavement survey**																																	
5	Elastic Modun measurement for existing pavement																																	
5	Preparation of the report																																	

- The mobilization time will be started right after the work plan is approved