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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 Restoration Work for Primary Control Network Grade IV (GPS) and Secondary Control Points

June ...., 2015

The Joint Venture of

NIPPON KOEI CO.,LTD.

NIPPON ENGINEERING CONSULTANTS CO.,LTD.

NIPPON KOEI VIETNAM INTERNATIONAL CO., LTD.

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CONSULTING SERVICE FOR TECHNICAL DESIGN FOR HANOI RING ROAD NO.3 CONSTRUCTION PROJECT
MAI DICH – SOUTH THANG LONG SECTION

SURVEY WORK PLAN FOR PRIMARY CONTROL NETWORK GRADE IV (GPS) AND SECONDARY CONTROL POINTS

Detailed Design Stage

1. GENERAL

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 Bases

- Construction Low No.50/2014/QH13 dated June 18th 2014 instead of Construction Low No.16/2003/QH11 dated November 26th 2003;
- Highway Transportation Low No.23/2008/QH12 dated November 13th 2008
- Land Low No.45/2013/QH11 dated November 29th 2013
- Environmental Protection Low 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;

- Minutes of handing over for primary control network grade IV (GPS) and secondary control points of F/S stage, date 26th June 2015

1.3 Phạm vi dự án

- Begin point is at the North of Mai Dich flyover (Mai Dich flyover on the Ring Road 3 overpass Xuan Thuy street).

- End point is at approach of Thang Long bridge in the front of the Ciputra residental area Project length: 5,5 km.

- Project 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 NH69 intersection, go to the North and cross with planned interchnage of Tay Lake – Ba Vi axis road (at the area of Hoa Binh park) and end at the approach of Thang Long bridge.

1.4 Technical Features of the Project

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

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.	

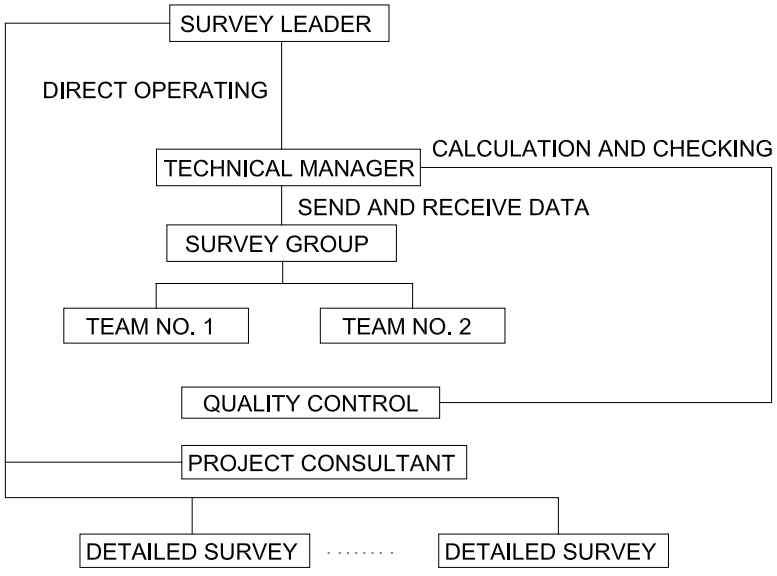
Source: Decision No. 2660/QD-BGTVT dated 3rd September, 2013, MOT

2. SURVEY WORK PLAN

2.1 Work Method

- Data collection phase of the previously surveyed;
- Plan the implementation of the existing control system and establishment of new systems;
- Site inspection, check and compare the data has been collected;
- Mobilization of manpower and equipment to the scene (the group split implementation);
- Establishing a new system for the control network;
- Measuring and calculating the field for the new establishment;
- Measuring for the inspection was made additional updates in step (compare and evaluate);
- Calculate the total overall project;
- Provide results to the Consultant of the project and the units detailed survey participants.
- Preparation of report

2.2 Work organization



2.3 Key personnel

No.	Name	Title	Work	Remarks
1	Survey Eng. 1	Chief of survey	Leader survey	

No.	Name	Title	Work	Remarks
2	Survey Eng. 2	General technical assistance	Chief technical	
3	Survey group	Site survey	Team No.1 and No.2	and 04 workers

(Full name of staff will be informed when the actual implementation)

2.4 Equipments for survey

No.	Description	Producer	Maker or Type	Year Made	Quantity
1	**Primary control networks**				
1.1	HyperGa Topcon (GPS)	USA	Trimple	2009	01
1.2	Leveling machine B21	Japan	Sokia	2006	01
2	**Secondary Control Points**				
2.1	Leveling machine B21	Japan	Sokia	2009	01
2.2	Total Station GTS235	Japan	Topcon	2009	01

2.5 Implementation process of the work

- Collect data of National control network, utilize the data of National control network which was collected in the F/S stage;
- Built for GPS point in the field - new section;
- Measuring coordinates and elevation for the new establishment;
- Connected to the National control network with the project;
- Measure the new network with the network was established in the feasibility study stage;
- Connected to the measuring point was established in the feasibility study stage;
- Measuring and testing was established in the feasibility study stage (see appendix);
- Calculate for primary control network - grade IV;
- Provide results for the traverse control network to consulting of projects
- Provides detailed survey units data traverse control network;
- Prepare reports for primary control network.

3. STANDARD OF SURVEY AND SPECIFICATIONS

3.1 Standard of Survey

Code	Title	Issued year

Code	Title	Issued year
22TCN 263 - 2000	Specification for highway survey	MOT
TCVN 9401-2012	Specification for measuring and analyzing GPS data	MOC
96TCN 43 - 90	Specification for measuring and drawing topography	Department of survey and mapping
QCVN 11:2008 BTNMT	National Technical Regulation on Establishment of Leveling Network	MONRE

- Refer to the project by the Consultant in accordance with specific requirements for projects.

3.2 Survey work specifications

- In accordance with Decree No.12/2009/NĐ-CP of the Government on management of construction, investment and the technical requirements of the project, the capacity of consultants surveyed as follows:

3.2.1 Personnel mobilization

- Based on the quantities and technical requirements of the project, conducted the survey contractor to mobilize manpower as follows:

- Survey Engineers: 02 engineers
- Workers: 04 workers

Note: (Chief of survey shall has Certificate in engineering survey)

3.2.2 Segmentation Survey

- The survey work is divided into the following groups:
- Group 1: 2 persons conduct reconstruction for the landmarks which were missing and destructive points
- Group 2: 4 persons conduct the establishment of control network and measurement.

4. TECHNICAL SPECIFICATIONS

4.1 General requirements

- The topographical survey will be conducted about precision by a system of rules above.
- The uniform forms for the whole project should strictly comply with the survey plan was launched.
- 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 later investors.

4.2 The quality management

- The management of quality of works carried out in accordance with ISO9001 quality management process: 2008
- Team leader 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, clean and free from erasing and follow the prescribed form.
- The leader of the engineers in charge is 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.
- The supervisor of the investor and consultant of the project 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.

5. COLLECTION AND CHECK EXISTING DATA FOR THE PROJECT AND SELECTION OF REFERENCE SYSTEM

5.1 Collection and check existing data for project

- The alignment of the project road shall be provided by project consultant
- The survey report of Primary Control Network grade IV (GPS) and Secondary Control Points in the F/S stage
- The data of National control network is referred from the data of the F/S consultant which was bought at Department of Surveying and Mapping (Coordinate of the National control point: “104491, 104548”) in the region are distributed along the route to ensure compliance with procedures and norms.
- Map of project area ratio 1/500 established in the F/S stage for reference markers arranged to control the project.

5.2 Selection of reference system of the project

5.2.1 Coordinates

- According to the Decision dated 12/07/2000 on the use 83/2000/QĐ-TTg reference system and coordinates of Vietnam (VN2000 coordinates).

- Hanoi City: center meridian 105^0 00 '

- For the projects: VN2000 coordinate system, center meridian 105^o 00 ', projection zone 3^o, distortional factor of length K = 0,9999.

- The system of reference and coordinates national VN2000 whose parameters are as follows:

The reference ellipsoid: WGS-84 global dimensions as follows:

+ Semi-major axis: a = 6378.137m

+ The flat: f = 1/298.257223563

5.2.2 Elevation

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

6. THE MAIN CONTENT OF WORK

6.1 Restoration and checking for control network - grade IV (GPS)

6.1.1 Horizontal control network – grade IV

- On the basis of survey report of primary control point grade IV in the F/S stage, the project road has three (3) GPS points are: GPS10, GPS11 and GPS12. Through the site checking and handing over, PMUTL and Consultant have confirmed the current condition of the existing landmarks, the result are as follows:

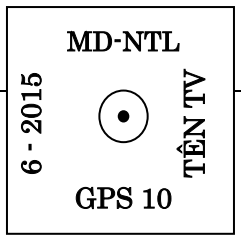
  - GPS 11, GPS12: good condition
  - GPS 10: missing

- The selection of location for additional GPS point will be conducted as follows:

  - Arrangement shall be located at the beginning alignment.
  - Request to select the location marker on the field to ensure the distribution and structure diagram, long-term stability, good range communication direction, combining online and works to ensure that lower-level road construction pass level 2 and higher levels are favorable.
  - The grade IV will built along the route and distance away from the centerline 100 - 150m.

- Form and size of landmark *(in compliance with requirements of survey standard)*:

+ Face of landmark: 50cm x 50cm



+ Bottom of landmark: 60cm x 60cm

+ Depth of landmark: 45cm

+ The material of landmark: Concrete C20

+ Center of landmark: Porcelain

- On the marker names, symbols and numbers of mold along with the date, month and year built.

- Using a 4-frequency receiver and measurement control network coordinates Grade IV

- Using the data of coordinate and elevation of National Control Point which was collected in the F/S stage, in order to minimize the error.

- The minimum measurement time of 1 point of all is: from 60 'to 90' *(Based on the stability of the satellite appears and distance between points) - Refer to table below*

Length of edge (km)	**Interval of a shift (minute)**
0 -:- 1	20’ -:- 30’
1 -:- 5	30’ -:- 60’
5 -:- 10	60’ -:- 90’
10 -:- 20	90’ -:- 120’

- Measurements are fully recorded content at the site include:

+ Date, shift measurement, weather, height receiver, signal acquisition time..

+ The measured data of each day will be put into the computer end of each day, measured in each (section) in order to expedite the process of reading in each case which, on measurement

+ The calculation and processing is done on the software Trimble Business Center, editorial boards 7 according to TCVN 9401:2012 standard.

D / n	0,10 km	0,15 km	0,20 km	0,50 km	1,00 km	2,00 km	3,00 km	4,00 km
3	1:8160	1:12200	1:16300	1:40600	1:80000	1:151600	1:210000	1:255000
4	1:9430	1:14100	1:18800	1:46900	1:92400	1:175000	1:242500	1:294500
5	1:10500	1:15800	1:21000	1:52400	1:103400	1:195700	1:271200	1:329200
6	1:11500	1:17300	1:23000	1:57400	1:113200	1:214400	1:297000	1:360700

6.1.2 Leveling control network - grade IV

- This leveling shall be done by the Grade IV, which has been regulated in QCVN 11:2008/BTNMT standard

Terrain	**Order**				**Remarks**
	I	**II**	**III**	**IV**	
Flat	$\pm 2\sqrt{L}$	$\pm 4\sqrt{L}$	$\pm 10\sqrt{L}$	$\pm 20\sqrt{L}$	where L = km
Hills	$\pm 3\sqrt{L}$	$\pm 5\sqrt{L}$	$\pm 12\sqrt{L}$	$\pm 25\sqrt{L}$	where L = km

- Use leveling machine with high accuracy and leveling staff 4m for measuring the control network - grade IV.

- Limit of closing error shall be applied by: $F_h \leq \pm 20\sqrt{L}$ (where L = km)

- Leveling control network adjustment is closely on specialized software, a full assessment of the impact parameters and *(is shown in detail in grade IV reports).*

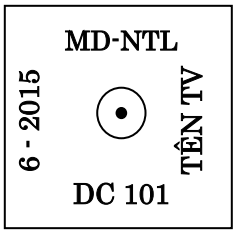
6.2 Restoration and checking the secondary control network and technical leveling control network

6.2.1 Secondary control network

- On the basis of survey report of secondary control network in the F/S stage, the project road has twenty six (26) secondary control points are: from DC101 to DC126. Through the site checking and handing over, PMUTL and Consultant have confirmed the current condition of the existing landmarks, the result are as follows:
  - Good condition: 16 landmarks
  - Missing and broken: 10 landmarks
- The selection of location for additional secondary control point will be conducted as follows:
  - The secondary control points shall be located at the stable location on the ground to facilitate for connection measurement with GPS points and remainning secondary control points and for survey work of topographic plan, setting out and locate the construction work of the project.
  - The secondary control point will be located based on the principle of visible double points in order to carry out the setting out and other survey works.
  - Intervals of control points shall be approx. 150 - 200 m along the route.

- The secondary control points will be constructed at the site, in conformity with the following regulations: *(paticular reguration for the project in the urban area refer to the standars 96TCN43-90 and 22TCN263-2000 on the dimension of the banchmark).*

  + Top of landmark: 20cm x 20cm
  + Bottom of landmark: 30cm x 30cm
  + The material of landmark: Concrete C20
  + Center of landmark: Porcelain



  + On the marker names, symbols and numbers of mold along with the date, month and year built.

  + Depth of landmark is 40cm *(in the special case, the bottom of landmark can be placed on the concrete foundation if any)*

  + The name of landmark is marked (as shown in the drawing) and numbering from DC-101, DC-102,….DC-n.

- Secondary control network (SCP) was measured by the Total Station with accuracy as follows:

No	Network parameter	Regulation
1	Maximum single length	3km
2	Length - Maximum - Minimum - Average	 0,35km 0,08km 0,20km
3	Maximum number of edge	15
4	Relative error of edge measurement shall be less than	1 / 5 000
5	The error of angle measurement is not exceed of	± 10”
6	The error of close angle	$20”\sqrt{n}$
7	Relative error of the horizontal control network	$\sqrt{f_x^2 + f_y^2} : [S] \le 1:5000$

f_x: Incremental coordinate error of X axis

f_y: Incremental coordinate error of Y axis

S: Length between two GPS points.

6.2.2 Technical levelling control network

- Technical leveling control network shall be linked to control network grade IV.

- Lưới độ cao kỹ thuật được thực hiện bằng phương pháp đo cao hình học, độ cao gốc là các điểm hạng IV của dự án được phân bố rải dọc tuyến khảo sát, sai số đo đạc khép giữa các mốc hạng cao dẫn qua các điểm GPS được tính bằng:

- Technical levelling network is carried out by levelling-geometry measurement, primary levelling are grade IV control points which ware located along the project route, measurement error is calculated by:

- Close levelling error fh $\leq \pm 30\sqrt{L}$ mm (In there: L levelling length km).

- Technical levelling network is adjusted closely by specialized software with consideration of the affecting factors and shown in report of secondary control point network.

6.2.3 Specified number of the landmarks

- In the feasibility study stage numbered for secondary control point: DC101 ...DC126, in order to avoid the duplication the name of the landmark of the stages, the additional points for the losing position markers will be marked with same name and add B (for example, DC101-DC101B)

7. SURVEY SCHEDULE

(see appendix)

8. SUPERVISION IN THE FIELD

- Prior to implementing the field survey contractor will provide design consultant of the project plan of survey techniques.

- After the plan is approved survey contractors shall provide written notice to implement the project investor, consultant of the project design, supervision consultant of the project to facilitate the monitoring of the and field testing after the end of the project.

9. QUANTITY FOR CONTROL NETWORK

- Based on the result of site handing over for primary control network grade IV (GPS) and secondary control point network which was done on June 26th 2015. The result confirmed that the losing or broken landmarks are 11 points, the detail is shown in the hand over minute as attached in the Appendix:

+ Losing landmarks : GPS 10, DC100, DC107, DC110, DC118, DC119, DC120

+ Broken landmarks: DC103, DC105, DC116, DC117.

Reconstruct the losing and broken GPS point and secondary control points, reuse the remaining landmarks which were installed in the F/S stage. Carry out the measurement and adjustment for whole network. Quantity is shown in the below table:

Work item	Unit	Quantity	Remark
I. Data collection			
Collecting the data of control network established in the previous stage.	TB	TB	
Collecting the topographic plan established in 2012	TB	TB	
II. Survey of control network			
Supplementing the horizontal control network grade IV	Point	1	New construction
Checking the horizontal control network grade IV	Point	2	Reuse
Checking the levelling control network grade IV	Km	16.05	
Supplementing the secondary control point network	Point	10	New construction
Checking the secondary control point network	Point	17	Reuse
Technical levelling network	Km	6.05	

10. SAFETY WORK

- The project road has high traffic volume, therefore, during the survey at site, survey engineers, workers shall wear uniform with reflecting. Other protective equipment shall be provided as regulations.

11. SUBMISSION DOCUMENT

- The collecting and investigation document.
- Testing certificate of the measurement instruments.
- The original survey document shall be checked at site before submission to the design team (including electric data).
- Expected volumes of topographic survey:

No	Document	Remark
I	**Volume I: Topographic survey report**	

1	Volume I.1: General report of the topographic survey.	
2	**Volume I.2: Horizontal and levelling control point network.**	**x**
3	Volume I.3: Plan, Profile and Cross Section survey.	
4	Tập I.4: Existing utilities survey.	

12. APPENDIX

- Schedule of impplement manpower;
- List of survey instruments and testing certificate;
- Survey work schedule;
- Site handing over minute;
- Photos of the F/S landmarks at the time of handover.

Appendix

TIẾN ĐỘ KHẢO SÁT DỰ KIẾN ĐỐI VỚI CÔNG TÁC KIỂM TRA KHÔI PHỤC HỆ THỐNG MỐC GPS VÀ ĐƯỜNG CHUYỀN CẤP 2
SCHEDULE OF SURVEY WORK FOR RESTORATION OF GPS AND SECONDARY CONTROL POINT NETWORK

Bước thiết kế kỹ thuật/Detailed Design Stage

TT No.	Hạng mục công việc/Items	2015																										Ghi chú Remark
		Thang 6/ June							Thang 7/ July																			
		Tuần 1/week 1							Tuần 2/week 2							Tuần 3/week 3												
		24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14						
1	**Kiểm tra hệ thống lưới khống chế bước dự án** **Checking and handover the F/S control point network**																											
1.1	Kiểm tra hệ thống lưới GPS và DDCC2 ngoài hiện trường, số mốc còn và số mốc mất Checking and confirmation at the site for current condition of the GPS and Secondary Control																											
2	**Lập phương án kỹ thuật** **Preparation of Work Plan**																											
2.1	Lập và trình duyệt phương án kỹ thuật cho công tác kiểm tra khôi phục lưới không chế Prepare and submit the work plan for restoartion work																											
3	**Kiểm tra và bổ sung lưới tọa độ và cao độ hạng IV** **Checking and restoration for primary control network grade IV**																											
3.1	Lựa chọn và chôn mốc tại hiện trường - Điểm bổ sung(điểm mất) Selection and installation at the site for the losing points																											
3.2	Đo kiểm tra và bổ sung(điểm bị mất) lưới tọa độ hạng IV Measurement and checking the horizontal control network grade IV																											
3.3	Đo kiểm tra và bổ sung(điểm bị mất) lưới độ cao hạng IV Measurement and checking the leveling control network grade IV																											
4	**Kiểm tra và bổ sung lưới ĐCC2 và độ cao kỹ thuật** **Checking and restoration for secondary control point network**																											
4.1	Lựa chọn và chôn mốc tại hiện trường - Điểm bổ sung(điểm mất) Selection and installation at the site for the losing points																											
4.2	Đo lưới tọa độ đường chuyền cấp 2 Measurement of horizontal control network class 2																											
4.3	Đo lưới độ cao - thủy chuẩn kỹ thuật Measurement for technical leveling network																											
5	**Lập hồ sơ lưới khống chế hạng IV và ĐCC2** **Prepare the report of GPS and secondary control point network**																											

- Thời gian huy động được bắt đầu sau khi Phương án khảo sát được chấp thuận 1 ngày
- The mobilization time will be started after the work plan is approved 1 day


GPS-10 (Bị mất/Losed)

GPS-11 (Còn/Exist)


GPS-12 (Còn/Exist)


DC-100 (Bị mất/Losed)


DC-101 (Còn/Exist)

DC-102 (Còn/Exist)

DC-103 (Hỏng núm sứ/Damaged)

DC-104 (Còn/Exist)

 DC-105 (Hỏng núm sứ/Damaged)	 DC-106 (Còn/Exist)
 DC-107 (Mất/Losed)	 DC-108 (Còn/Exist)
 DC-109 (Còn/Exist)	 DC-110 (Mất/Losed)
 DC-111 (Còn/Exist)	 DC-112 (Còn/Exist)

DC-113 (Còn/Exist)

DC-114 (Còn/Exist)

DC-115 (Còn/Exist)

DC-116 (Hỏng núm sứ/Damaged)

DC-117 (Hỏng núm sứ/Damaged)

DC-118 (Mất/Losed)

DC-119 (Mất/Losed)

DC120 (Mất/Losed)

DC-121 (Còn/Exist)

DC-122 (Còn/Exist)

DC-123 (Còn/Exist)

DC-124 (Còn/Exist)


DC-125 (Còn/Exist)


DC-126 (Còn/Exist)