TOPOGRAPHIC SURVEY REPORT

Consultant:

Loya associates
Consulting Engineers and Project Planners

In association with:

REC Republic Engineering Corporation (Pvt) Ltd.
Consulting Engineers, Planners & Architects

TOPOGRAPHIC SURVEY REPORT

1. INTRODUCTION:

The Works & Services Department (WSD), Government of Sindh (GoS), is taking steps to improve traffic flow in major Port City of Karachi, Sindh.

These steps include providing internal grid works access control City highways, Underpasses Over-pass Double Tier Interchanges and Elevated Mass Transit corridors.

For increasing Traffic volume to and from Port City of Karachi, National Highway Authority is widening present 4 lane dual carriage way from Karachi to Hyderabad Superhighway M9 in to 6 lane Motorway and to ease to flow the traffic at Port Qasim, Steel Mills, Industrial areas of Landhi, and Gulshan-e-Hadeed on Karachi Hyderabad Highway, N5 NHA is continuously carrying out improvement and widening of N5.

It was recognized by GoS that linking Karachi Thatta Highway N5 near Port Qasim to in South to M9 Motorway undeniable advantages will be attained for easing the traffic by detour and serving the future Planned Education and Medical City on the East of Malir River and future DHA City near M9. And enabling north bound N5 traffic to use M9 and vice versa.

Therefore, proposed all-weather 4 lanes Link Road has been planned and the Task of preparation of Technical Feasibility of the proposed Link Road has been entrusted to Consultant **Loya Associates, GoS & United Bank**, its being PP Project.

Loya Associates has completed the Inception Report in October 2016 and has carried out Reconnaissance survey and preferred Alignment Route. This was explained in **Inception Report** submitted to W&S Department-GOS and presented in the Meetings.

Final Route Alignment OPTION 3 on the Inception Report had been accepted as preferred and Feasible Alignment by in the Meeting of W&S D in the Meetings, by Honorable Chief Minister GoS, Syed Murad Ali Shah for the Proposed Link Road. (This has been included in 'Alignment Report' Figure- 1 & Figure-2, OPTION 3) in the body of the Main Feasibility Report.

However due to land acquisition issues, new alignment is adopted as per OPTION 4C, as approved by Stakeholders. This OPTION 4C is further modified due to newly constructed DHA City Karachi Interchange over M9, and realign towards left side as discussed in Alignment Study Report.

Loya Associates assigned the responsibility of conducting the Detail Topographic on the field and provide the digitized Topographic Survey drawings reputable to Survey Specialized Firm of M/s **Survey Engineer**-Karachi. And assigned it to provide required Survey information for the Design of Road Geometrics, Pavement Design, Cross Drainage Structure: Bridges and Culvert Design. **M/s. Survey Engineers,** was asked to conduct topographical survey identified the centerline coordinates from Google map and marked on ground with instructions to follow the duly selected route as closely as practically. **Inception Report of October 2016** submitted to Survey Engineers to alternate alignments and for further identification the Feasible Option for Preferred Selected Alignment Route approved by the W &S Dept, GoS.

2. STUDY OF SELECTED ALIGNMENT BY SATELLITE SURVEY PLAN AND ON FIELD VISITS AND OBSERVATIONS:

Coordinates were selected from Google Map for the preliminary traverse lines. And on field observation survey marking were made of the Coordinates by Hand Held GPS to follow Selected Alignment as closely as possible**.**

It was observed that Selected Alignment is about 21.4 km and additional 6 loops connecting National Highway (N-5) and interchange on Motorway (M-9) are 4km Main Alignment passes through barren, undulated and hilly area in the east direction of existing link road and at **M-9 end.** In the opinion of the Surveyor the selected project would save the time and fuel of heavy traffics by avoiding the Education City and Medical Cities. At the same time, it would improve the economy of the country and reduce the cost of transportation and serve the future development and ease to a significant extent the traffic flow **from N5** Steel Town End.

3. CORRIDOR WIDTH ON ALIGNMENT FOR TOPOGRAPHIC SURVEY:

For the design of new link road centerline, the topographical survey was limited to approx. 60 meters wide corridor along the length of Selected Alignment Route. This corridor width was sufficient to show all the manmade and natural features e.g. huts, buildings, villages, private farms orchard nallahs., rivers, rivulets roads, high and low electric lines etc.,

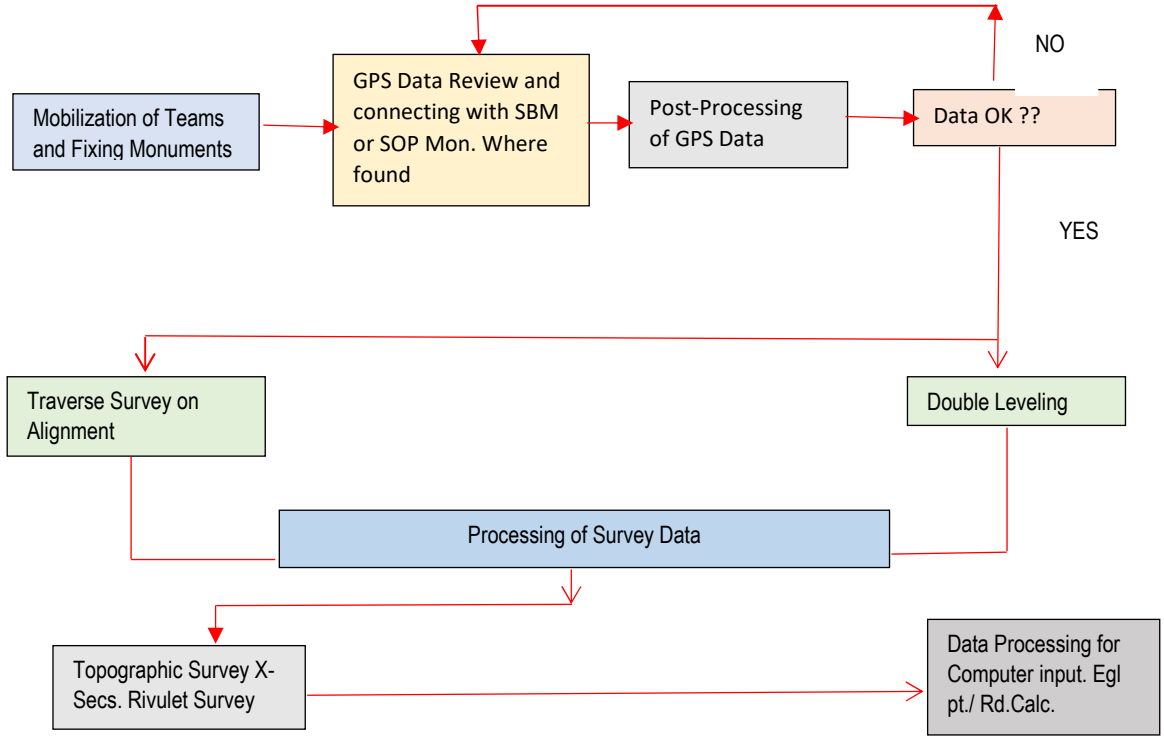
Longitudinal Profile and Cross Sections of proposed route, spot heights at the intervals of 25m c/c along length covering 60m wide corridor and at shorter intervals if sudden change of surface profile was observed.

4. APPROACH:

The Topographic Survey of 25.39 Km long Selected Alignment Route was conducted in comparatively sparsely populated a passing through some privately-owned lands. Because of arid environment way from the residential area of Malir City environment, the Survey was carried out under the sun light time. To achieve the target as soon as possible, four experienced survey parties were deployed on the project as hereunder:

The survey team was headed by **Syed Abid Hussain Shah** – Project Survey Manager

5. MOBILIZATION: TASK FLOW CHART FOR TOPOGRAPHIC SURVEY WORK:



6. SURVEY TEAMS:

After reviewing project requirements and Selected Alignment by on-site visits, following field teams were mobilized with their equipment:

(i) Monument Fixing Team
(ii) GPS Survey Team
(iii) Traverse Survey Team
(iv) Control Leveling Team (v) Topographic & X-Sec Survey Teams

Survey Party No. 1

- Mr. Faizan Kamil — Senior Survey Engineer
- Mr. Mohammed Sikandar — Asst Survey Engineer
- Mr. Mohammed Zaman — Survey Helper
- Mr. Mohammed Hasan — Survey Helper
- Mr. Muhammed Sharif — Survey Helper
- Mr. Ghulam Mustafa — Survey Helper

Survey Party No. 2

- Mr. Khalid Naeem — Senior Survey Engineer
- Mr. Mohammed Usama — Asst Survey Engineer
- Mr. Mohammed Ishaq — Survey Helper
- Mr. Rajab Ali — Survey Helper
- Mr. Mola Bux — Survey Helper
- Mr. Akber Khan — Survey Helper

Survey Party No. 3

- Mr. Muhammed Sajid — Senior Survey Engineer
- Mr. Mohammed Farooque — Asst. Survey Engineer
- Mr. Akhtar Ahmed — Survey Helper
- Mr. Hakim — Survey Helper
- Mr. Akram — Survey Helper
- Mr. Mohammed Muqeem — Survey Helper

Survey Party No. 4

- Mr. Taha Sheikh — Senior Survey Engineer
- Mr. Mohammed Sultan — Asst Survey Engineer
- Mr. Mohammed Bilal — Survey Helper
- Mr. Dhani Bux — Survey Helper
- Mr. Bux Ali — Survey Helper
- Mr. Muhammed Rizwan — Survey Helper

It was the result of combined efforts of all the above-mentioned personnel and the teamwork spirit that the fieldwork could be completed according to the schedule.

7. SCOPE OF WORK TOPOGRAPHIC SURVEY

- Provide Unit Measurements in Metric System
- Establish Horizontal and Vertical Survey Control
- Carry out Detail Topographical Survey
- Produce Computer Aided Drawing

8. SURVEY METHODOLOGY

To meet the requirement of the client, the survey work was sub-divided into various activities as described below:

8.1 Datum Reference
8.2 Reconnaissance of Project route and Pegging
8.3 Control Work
8.4 Detail Topographical Survey with Total Station
8.5 Establishment of Benchmarks

The above activities were conducted in the following manner:

8.1 Datum Reference

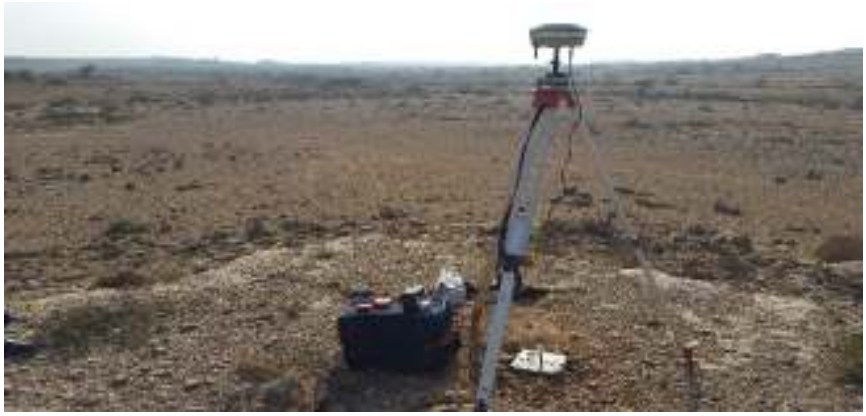
All coordinates and levels reference to WGS84 datum and UTM projection zone 42 observed using Sokkia GPS GSR 2700IS dual frequency at datum stations MDA14 & N1. The values of these stations are as under:

MDA14 E = 338386.255m N= 2750652.768m Z= 46.999m

Latitude (N) 24° 51' 44.41234"deg Longitude (E) 67° 24 '01.21976"deg

N1 E = 338358.832m N= 2750387.313m Z=46.190m

Latitude (N) 24 °51' 35.77531"deg Longitude (E) 67 °24 '00.35401"degree



8.2 Reconnaissance of Project route and Pegging

All the four survey parties mentioned in para-5 above were technically and administratively independent of each other but, they used the same methods and followed identical instructions. Hence the describing of method adopted by one party will cover all the parties. and followed identical instructions. Hence the describing of method adopted by one party will

cover all the parties. One survey team out of each party and headed by the Senior Survey Engineer of the party was entrusted with the responsibility of carrying out the reconnaissance and pegging of the selected project route. First of all, control stations / benchmarks at suitable interval and in commanding positions on the project route were fixed at approx. 200 / 300 meters interval on visible stretches of the project route and closer intervals on for stretches showing closer topographic details

8.3 Control work

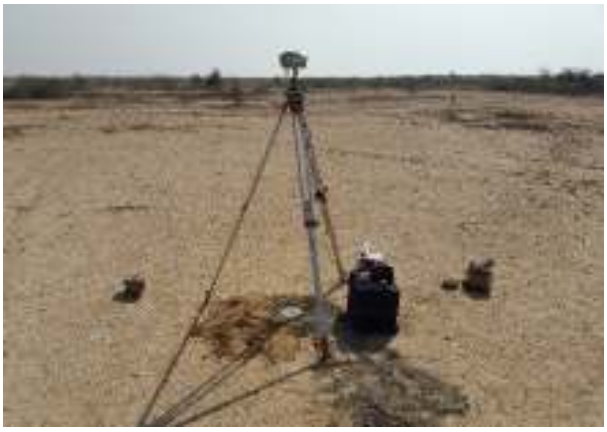
One of the first major tasks for surveying of long routes is the establishment of accurate survey control over the project route. In the technical survey sense, control framework of survey stations and benchmarks to which all other subsequent survey, design and construction operations are spatially related.

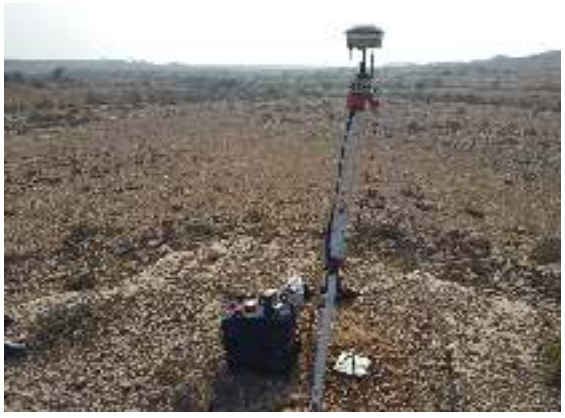
The control should conform to the time honored basic survey principle of “always working from the whole to the part”. If the survey is allowed to build up bit-by-bit, growing outwards as the project is extended, errors and tolerance will tend to accumulate beyond acceptable engineering limits. Every measurement is subject to some tolerance, thus the measurements, larger the overall error. A primary control framework on the project route can contain the tolerance within reasonable limits and therefore, it cannot and should not be overstressed or bypassed. The survey control is established as horizontal and vertical control.

8.3.1 Horizontal & Vertical Control by Global Positioning System (GPS)

8.3.1.1 Static GPS Survey

Two Sokkia GSR 2700IS Dual Frequency GPS receivers were used to establish the control stations / benchmarks. One receiver is set up over the datum station, whose coordinates are known and the second is positioned over other station whose coordinates are unknown. Both GPS receivers must receive signals from the same four (or more) satellites for a period of time that can range from a few minutes to several hours, depending on the conditions of observation and precision required. Station occupation time is dependent on baseline length, number of satellites observed, and the GPS equipment used. In general, 30 min to 6hr is a good approximation for baseline occupation time for shorter baselines of (1-30 kilometers) and we have observed minimum 1hr for each station, the maximum baseline distance is 551m on this project





8.3.1.2 Data Post-processing

After the observation session, has been completed, the received GPS signals from both receivers are then processed by Spectrum Survey Software to calculate the 3D coordinate X, Y and Z values based on the WGS84 - UTM coordinate system.

8.3.1.3 Accuracy of Static Surveys

Accuracy of GPS static survey is the most accurate and can be used for any order of survey

8.4 Detail Topographical Survey with Total Station

The invention of total station has resulted into revolutionary changes in surveying technology; it has capability of developing topo drawings on any desired scale, three dimensional outputs of every feature points along with on-screen plotting of them. The use of total station has not only accelerated the pace of site work but has also increased the speed of drafting since the data entered in the total station at site and can be directly downloaded to the computer and thereafter transferred to AutoCAD system through DXF File. The quality drawing has also improved. The benefits of the system are discussed as under:

The automated technique of survey is very expedient and offering the benefits because it reduces the possibility of human errors and increases the probability of accurate analysis, most optimal design and automatic production of presentable drawings in short time. Survey Teams are capable to utilize all State- of- the- art computer aided techniques with latest instruments for survey. Detail topographical survey has been conducted by our automated survey team equipped with most sophisticated total station of Sokkia, is very dedicated and updated with rapidly advancing technology of Optics wave-laser-ultra sound required for fast and accurate topographic Survey works.

8.4.1 Computerized Data Processing:

The result of computer-aided survey is X, Y, Z information of ground features with unique labels of them and these results are processed for further analysis. At the end of each working day, the data is transferred to a computer through communication applications from total station. The data is then processed using SDR map & design software, which enables the surveyor to plot the whole work, conducted during the day on computer monitor or on paper. So, by comparing the ground sketch with the plotted map, errors, if any, are automatically detected which can then be corrected either in the field, if it is an observational error, or in the office, if it is coding error.

After removal of errors a unique model of detail and traverse is developed for further analysis from SDR map software and DXF (Data Exchange Format) file is produced for enhancement, labeling and further analysis on AutoCAD software in order to produce the map.

8.4.2 Computer Aided Drawing

The processing and analyzing of data as received from site have been described in sub-Para's, together with the advantages of total station survey. The DXF files are then transferred into AutoCAD, very sophisticated software where drawings are edited with the help of field sketches which generally consists of features detail, writing names, destinations and other

8.5 Establishment of Benchmarks

Benchmarks have been established on concrete marker at safe and sound locations, described as LBM1 to LBM8 in List of benchmarks of this Survey Report.

9. COORDINATES OF SURVEY CONTROL STATIONS

M9 - N5 LINK ROAD			
COORDINATES OF AUXILIARY SURVEY CONTROL STATIONS			
STN	**EASTING**	**NORTHING**	**LEVEL**
T81	338387.201	2750859.425	47.206
T82	338374.944	2751042.188	47.479
T83	338360.340	2751342.537	48.436
T84	338336.598	2751803.214	50.960
T85	338319.568	2752220.972	53.842
T86	338300.656	2752528.050	55.927
T87	338277.738	2753003.907	59.432
T88	338239.742	2753550.864	63.161
T89	338228.298	2753776.688	65.235
T90	338200.826	2754309.328	70.320
T91	338180.206	2754706.603	73.273
T92	338104.006	2755100.854	75.906
T93	338030.982	2755477.688	78.704
T94	337971.627	2755778.577	81.732
T95	337900.615	2756144.142	85.863
T96	337798.400	2756613.586	91.340
S105	337747.432	2756930.635	95.976
S104	337704.965	2757147.869	97.436
S103	337638.435	2757485.867	100.937
S102	337583.565	2757765.779	104.004
S101	337522.676	2758073.268	107.308
S100	337454.715	2758422.121	112.932
S99	337436.879	2758516.705	111.826
S98	337402.403	2758683.432	107.108
R1	337476.289	2758499.605	113.804
R2	337521.340	2758654.719	110.421
R3	337536.972	2758865.786	107.529
R4	337607.693	2758971.930	106.860

R5	337757.695	2759112.026	114.017
R6	337943.781	2759300.908	129.034
R7	338248.071	2759416.410	131.594
R8	338337.245	2759447.110	134.676
R9	338627.831	2759573.467	146.112
R10	338769.117	2759654.838	147.734
R11	339214.174	2759821.944	139.490
R12	339622.523	2759972.147	139.732
R13	339888.227	2760134.132	134.281
R14	340231.313	2760259.738	128.296
R15	340392.005	2760351.978	125.221
R16	340814.277	2760639.426	129.217
R17	340929.846	2761067.368	111.070
R18	340902.719	2761387.341	108.562
R19	340928.783	2761565.140	111.654
R20	340951.123	2761765.160	109.883
R21	340867.426	2761832.397	108.909
R22	340884.129	2761929.209	108.191
R23	340895.965	2762100.300	108.695
R24	340969.580	2762135.951	108.145
R25	340956.964	2762188.777	107.818
R26	340984.041	2762273.894	107.872
R27	340899.532	2762618.475	108.039
R28	340918.686	2762780.754	108.414
R29	340936.037	2762920.615	108.497
R30	340926.651	2762997.171	107.180
R31	340989.461	2763036.494	108.320
R32	340950.667	2763076.708	108.778
R33	340972.928	2763318.559	106.885
R34	341032.425	2763659.535	112.634
R35	340984.118	2763836.945	107.042
R36	341001.083	2763951.619	107.737

R37	340937.518	2764038.706	107.702
R38	340977.865	2764130.352	108.501
R39	341013.428	2764217.571	109.293
R40	340937.373	2764254.656	108.242
R41	340982.649	2764329.311	108.809
R42	341023.412	2764368.929	109.343
R43	341034.886	2764600.563	114.602
R44	341010.192	2764815.809	115.310
R45	341149.983	2765471.328	120.399
R46	341166.228	2765525.451	121.405
R47	341090.412	2765707.674	120.266
R48	340996.670	2765833.484	120.560
R49	341018.006	2765956.855	120.278
R50	341027.925	2766047.486	119.339
LT33	340943.076	2766399.105	124.607
LT34	340967.079	2766589.545	125.520
LT35	340635.820	2766995.823	123.375
LT36	340281.147	2767154.379	114.955
LT37	340026.146	2767324.943	111.463
LT38	340008.327	2767785.358	113.058
LT39	340093.909	2767808.208	113.843
LT40	340114.596	2768113.550	115.343
LT41	340208.190	2768142.754	116.634
S27	339874.259	2768040.287	109.851
S28	339834.428	2767735.726	110.996
S29	339871.566	2767605.945	111.207
S30	340271.760	2768364.466	119.191
S31	340494.842	2768818.472	132.088
S32	340636.882	2769194.347	120.503
S33	340649.449	2769363.758	133.928
S34	340717.417	2769467.211	132.813
LT42	340963.932	2769658.527	138.860
LT43	341065.350	2769688.941	134.990

LT44	340996.275	2769843.205	136.889
LT45	340833.362	2769757.432	134.129

10. BENCHMARK COORDINATES

M9 – N5 LINK ROAD			
COORDINATES OF PERMANENT BENCHMARKS			
BM	**EASTING**	**NORTHING**	**LEVEL**
LBM1	338370.843	2750390.686	46.075
LBM2	338426.887	2750786.246	46.949
LBM3	338131.667	2755066.522	74.140
LBM4	338075.781	2755357.476	76.375
LBM5	337486.467	2758093.234	106.249
LBM6	337411.360	2758347.214	112.837
TBM1	337443.925	2758246.958	108.252
TBM2	337474.598	2758430.843	113.420
TBM3	338815.073	2759742.945	147.481
TBM4	339010.769	2759746.837	149.656
LBM7	340546.291	2760394.696	119.191
LBM8	340694.300	2760606.011	123.263
TBM5	340929.115	2762347.201	107.606
TBM6	340884.857	2762496.302	108.809
LBM9-N	341039.991	2763662.763	113.114
LBM10-N	341159.409	2763880.070	116.569
TBM7	341013.520	2766164.507	117.573
LBM7-O	340123.251	2768204.429	116.562
LBM8-O	340097.896	2768371.064	116.735

11. PROJECT PHOTOGRAPH: