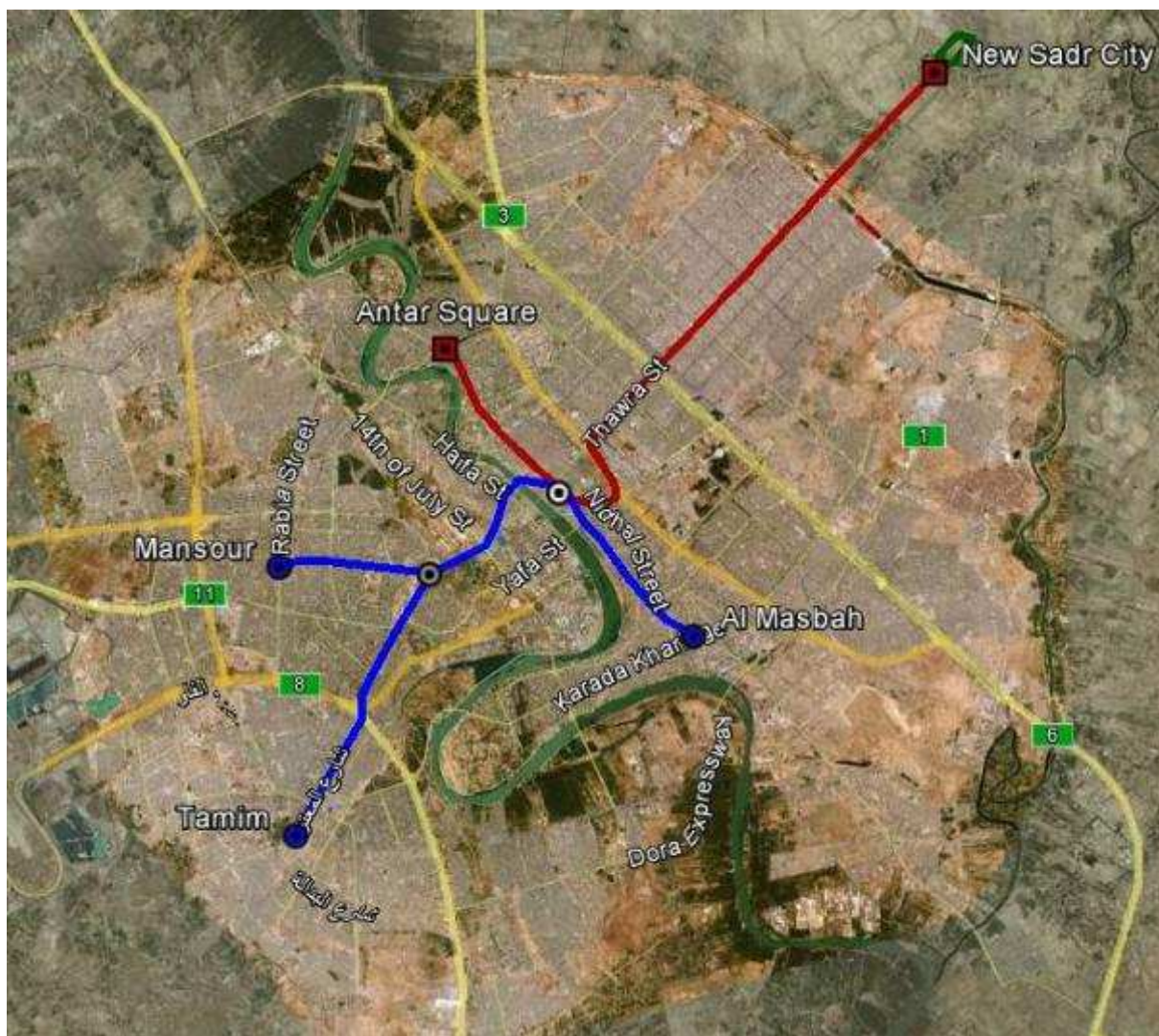




## BAGHDAD UNDERGROUND METRO





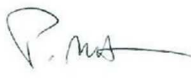

### PROJECT DESCRIPTION LINE 1 AND LINE 2

| Project | Stage | Phase | Type | Discipline | Subject | Location | Issuer | Number | Rev. |
|---------|-------|-------|------|------------|---------|----------|--------|--------|------|
| BUM     | A     | 2     | REP  | ALL        | ALL     | ALL      | SYSTRA | 3000   | 3    |



## BAGHDAD UNDERGROUND METRO

| Revision | Date       | Subject of Revision   |
|----------|------------|---|
| 0        | 27/12/2013 | First issue   |
| 1        | 26/02/2014 | Updated as per BM comments received on February 2014                      |
| 2        | 20/06/2014 | Updated as per BM comments received on 20 <sup>th</sup> June 2014 by mail |
| 3        | 23/06/2014 | Updated as per BM comments received on 23 <sup>rd</sup> June 2014 by mail |

|                    | Name                | Date       | Visa  |
|--------------------|---------------------|------------|---|
| <b>Written by:</b> | SYSTRA's team       | 23/06/2014 | P/O<br> |
| <b>Checked by</b>  | Faysal EL KHOUMISTI | 23/06/2014 |        |
|                    | Paolo MARCHETTI     | 23/06/2014 |        |
| <b>Approved by</b> | Mohammad KASHANI    | 23/06/2014 |        |

It is the responsibility of the addressee to destroy the previous edition or to indicate "Superseded".



# BAGHDAD UNDERGROUND METRO

## TABLE OF CONTENTS

|  |           |
|--|-----------|
| <b>1. GENERALITIES.....</b>  | <b>7</b>  |
| 1.1 AIM OF THE DOCUMENT .....  | 7         |
| 1.2 SCOPE OF WORK, INTERFACES & RESPONSIBILITY OF THE CONTRACTOR ..... | 7         |
| <b>2. TECHNICAL DESCRIPTION AND REQUIREMENTS .....</b>                 | <b>8</b>  |
| 2.1 GENERAL DESCRIPTION OF THE PROJECT .....                           | 8         |
| 2.2 MAIN PERFORMANCES.....   | 11        |
| 2.3 GEOMETRICAL PARAMETERS.....  | 11        |
| 2.4 TECHNICAL REQUIREMENTS .....                                       | 14        |
| 2.4.1 Surveys .....  | 14        |
| 2.4.2 Alignment and Right of Way.....                                  | 14        |
| 2.4.3 Phasing programme .....  | 14        |
| <b>3. PROJECT MANAGEMENT DOCUMENT .....</b>                            | <b>15</b> |
| 3.1 MANAGEMENT PLAN .....  | 15        |
| 3.2 SYSTEM DOCUMENTATION .....   | 15        |
| <b>4. ORGANIZATION REQUIREMENTS .....</b>                              | <b>17</b> |
| 4.1 ORGANIZATION PLANS .....   | 17        |
| 4.1.1 Project Management Organization Plan.....                        | 17        |
| 4.1.2 Design Organization Plan (DOP).....                              | 18        |
| 4.1.3 Procurement Plan .....   | 18        |
| 4.1.4 Construction Organization Plan .....                             | 18        |
| 4.1.5 Testing and Commissioning Organization Plan.....                 | 18        |
| 4.2 EXTERNAL ORGANIZATION REQUIREMENT .....                            | 18        |
| 4.2.1 Client's Representative .....                                    | 18        |
| 4.2.2 Independent Checking Engineer (ICE) .....                        | 18        |
| 4.2.3 Independent Safety Assessor (ISA).....                           | 19        |
| <b>5. PLANNING, PROGRAMME AND PROGRESS.....</b>                        | <b>20</b> |
| 5.1 PLANNING.....  | 20        |
| 5.2 PROGRAMMING GENERAL REQUIREMENTS.....                              | 20        |
| 5.3 PROGRESS MONITORING .....  | 20        |
| 5.4 DESIGN SUBMISSION PROGRAMME .....                                  | 20        |
| 5.5 PROCUREMENT AND MANUFACTURING PROGRAMME.....                       | 21        |
| 5.6 CONSTRUCTION/INSTALLATION PROGRAMME .....                          | 21        |



## BAGHDAD UNDERGROUND METRO

|           |  |           |
|-----------|--|-----------|
| 5.7       | TESTING AND COMMISSIONING PROGRAMME .....  | 22        |
| 5.8       | O&M TRAINING PROGRAMME .....   | 22        |
| 5.9       | THREE MONTH LOOK AHEAD PROGRAMME .....   | 22        |
| 5.10      | TIME CHAINAGE PROGRAMME (T/C) .....  | 23        |
| 5.11      | PROGRAMME REVIEW .....   | 23        |
| 5.12      | WORKS PROGRAMME REVISIONS .....  | 23        |
| 5.13      | MONTHLY PROGRESS REPORT .....  | 24        |
| 5.14      | KEY DATE AND MILESTONE REPORT .....  | 24        |
| 5.15      | PROGRESS MEETINGS .....  | 25        |
| 5.16      | STEERING COMMITTEE MEETINGS .....  | 25        |
| <b>6.</b> | <b>RISK MANAGEMENT .....</b>   | <b>26</b> |
| 6.1       | RISK MANAGEMENT PRINCIPLES .....   | 26        |
| 6.2       | MAIN STEPS OF RISK MANAGEMENT .....  | 26        |
| 6.2.1     | <i>Risk Identification</i> .....   | 26        |
| 6.2.2     | <i>Risk Analysis and Evaluation</i> .....  | 27        |
| 6.2.3     | <i>Risk Treatment</i> .....  | 27        |
| <b>7.</b> | <b>QUALITY ASSURANCE .....</b>   | <b>28</b> |
| 7.1       | OVERVIEW .....   | 28        |
| 7.2       | APPLICABLE STANDARDS & REGULATIONS .....   | 28        |
| 7.3       | AIM OF THE QUALITY ASSURANCE SYSTEM .....  | 29        |
| 7.4       | SPECIFIC QUALITY ASSURANCE STAFF .....   | 29        |
| 7.5       | PROCESS REVIEW .....   | 29        |
| 7.5.1     | <i>Review Principles</i> .....   | 29        |
| 7.5.2     | <i>Review Program</i> .....  | 33        |
| 7.6       | CONSTRUCTION SUPERVISION .....   | 33        |
| 7.6.1     | <i>Contractor's Quality Control of the Works on Site</i> .....                   | 33        |
| 7.6.2     | <i>Contractor's Quality Control of Off-Site Work The Contractor shall:</i> ..... | 34        |
| 7.7       | INTERNAL AUDIT .....   | 35        |
| 7.8       | QUALITY ASSURANCE MANAGEMENT PLAN .....  | 35        |
| 7.8.1     | <i>Background</i> .....  | 35        |
| 7.8.2     | <i>Content</i> .....   | 35        |
| 7.8.3     | <i>Quality Assurance Indicators</i> .....  | 35        |
| 7.9       | DEVELOPMENT SOFTWARE QUALITY SPECIFICATIONS .....                                | 36        |
| 7.9.1     | <i>Software Quality System</i> .....   | 36        |



## BAGHDAD UNDERGROUND METRO

|            |  |           |
|------------|--|-----------|
| 7.9.2      | Software Quality Plan (SQP) .....                      | 36        |
| 7.9.3      | Transfer .....   | 37        |
| 7.9.4      | Traceability .....                                     | 37        |
| 7.10       | MODIFICATION CONTROL .....                             | 37        |
| 7.10.1     | Modification Control Plan (MCP) .....                  | 37        |
| 7.10.2     | Non-Conformity .....                                   | 37        |
| 7.11       | QUALITY CONTROL .....                                  | 37        |
| 7.11.1     | Quality Control Plan (QCP) .....                       | 37        |
| 7.11.2     | Commissioning Control .....                            | 38        |
| <b>8.</b>  | <b>DOCUMENTATION &amp; CONFIGURATION CONTROL .....</b> | <b>39</b> |
| 8.1        | CONFIGURATION CONTROL .....                            | 39        |
| 8.2        | DOCUMENTATION CONTROL .....                            | 40        |
| 8.2.1      | Documentation Control Plan .....                       | 40        |
| 8.2.2      | Documentation Control System .....                     | 40        |
| 8.2.3      | Means & Logistics .....                                | 41        |
| 8.2.4      | Breakdown & Codification .....                         | 41        |
| 8.2.5      | Transmission Procedures .....                          | 41        |
| <b>9.</b>  | <b>DESIGN REQUIREMENTS .....</b>                       | <b>42</b> |
| 9.1        | DESIGN PROCESS .....                                   | 42        |
| 9.1.1      | Identification of relevant design packages .....       | 42        |
| 9.1.2      | Design production program .....                        | 42        |
| 9.1.3      | Design review .....                                    | 42        |
| 9.2        | GENERAL ARRANGEMENT DRAWINGS .....                     | 42        |
| 9.3        | SHOP DRAWINGS AND RELATED DOCUMENTATION .....          | 43        |
| 9.3.1      | Definitions of Types of Contractor's Drawings .....    | 43        |
| 9.4        | AS BUILT DRAWINGS AND RELATED DOCUMENTATION .....      | 48        |
| 9.4.1      | As Built Document Submittals .....                     | 48        |
| 9.4.2      | Operating and Maintenance Instructions .....           | 48        |
| 9.5        | VALUE ENGINEERING .....                                | 48        |
| <b>10.</b> | <b>TRAINING PLAN .....</b>                             | <b>50</b> |
| 10.1       | CONTENT .....  | 50        |
| 10.2       | PEDAGOGIC DOCUMENTATION .....                          | 50        |
| <b>11.</b> | <b>EXTERNAL INTERFACES .....</b>                       | <b>51</b> |
| 11.1       | DEFINITION .....                                       | 51        |



## BAGHDAD UNDERGROUND METRO

|            |   |           |
|------------|---|-----------|
| 11.2       | SPECIFICATIONS.....   | 51        |
| <b>12.</b> | <b>SITE LOGISTICS.....</b>  | <b>52</b> |
| 12.1       | USE OF LAND SITE WORKING SPACE .....  | 52        |
| 12.1.1     | Protection of natural resources.....  | 52        |
| 12.1.2     | Protection of existing highways and property.....                                     | 52        |
| 12.1.3     | Land resources .....  | 53        |
| 12.1.4     | Erosion and sediment control measures - Temporary protection of erosion of soils..... | 53        |
| 12.2       | STORAGE .....   | 53        |
| 12.3       | SITE SERVICES.....  | 54        |
| 12.3.1     | Site Offices .....  | 55        |
| 12.3.2     | Client/ Representative and Other Consultants Facilities .....                         | 56        |
| 12.4       | CONTRACTOR'S SITE ACCOMMODATION.....  | 57        |
| 12.5       | MATERIAL AND STORAGE GENERAL REQUIREMENTS .....                                       | 57        |
| 12.6       | RUBBISH REMOVAL .....   | 58        |
| 12.6.1     | Contractor's cleaning responsibility.....   | 58        |
| 12.6.2     | Rubbish disposal .....  | 58        |
| 12.6.3     | Site cleaning.....  | 58        |
| 12.6.4     | Salvaging materials.....  | 58        |
| 12.6.5     | Control and disposal of wastes .....  | 58        |
| 12.7       | CLEANING.....   | 59        |
| 12.8       | LIGHTING.....   | 60        |
| 12.9       | WIRING STANDARDS .....  | 60        |
| 12.10      | ENERGY COSTS .....  | 60        |
| <b>13.</b> | <b>TEST, COMMISSIONING AND SYSTEM INTEGRATION.....</b>                                | <b>61</b> |
| 13.1       | SYSTEM VALIDATION PLAN.....   | 61        |
| 13.2       | TESTING & COMMISSIONING (T&C) AND SYSTEM INTEGRATION PLAN .....                       | 61        |
| 13.3       | SPECIAL REQUIREMENTS .....  | 62        |
| <b>14.</b> | <b>SHIPMENT .....</b>   | <b>63</b> |
| <b>15.</b> | <b>DELIVERY.....</b>  | <b>64</b> |





## BAGHDAD UNDERGROUND METRO

### 1. GENERALITIES

#### 1.1 Aim of the document

The objective of the specifications detailed in this document is to define the works to be carried by the Contractor especially with respect to Project Management requirements. The Contractor shall comply with these requirements and develop all relevant procedures and management plans to adequately and thoroughly perform all services needed for a proper implementation of Baghdad Underground Metro Line 1 and Line 2.

This document also provides some technical requirements to be fulfilled by the Contractor, these requirements are to be considered in addition to those described in the Technical Specifications.

#### 1.2 Scope of work, interfaces & responsibility of the Contractor

The Contractor shall deliver an operating system for Baghdad Underground Metro, designed and built upon the performance specifications and requirements described in the associated Specification documents, within the set deadlines and the prescribed quality.

The Contractor shall also:

- Manage all internal and external interfaces as stated in the present document.
- Design all materials, subsystems, systems and O&M equipment at all level of details required for the Baghdad Underground Metro.
- Perform all Project Management, Quality Control, Health & Safety services, in compliance with the requirements of the present document.
- Manufacture, deliver and assemble on site all Metro Components.
- Perform verification and validation tests during the Testing & Commissioning Phase.
- Bring into service the Baghdad Underground Metro, and train relevant personnel as required.
- Hand over all facilities and documentation to both the Client and the O&M Entity (if different from the Contractor).



## BAGHDAD UNDERGROUND METRO

### 2. TECHNICAL DESCRIPTION AND REQUIREMENTS

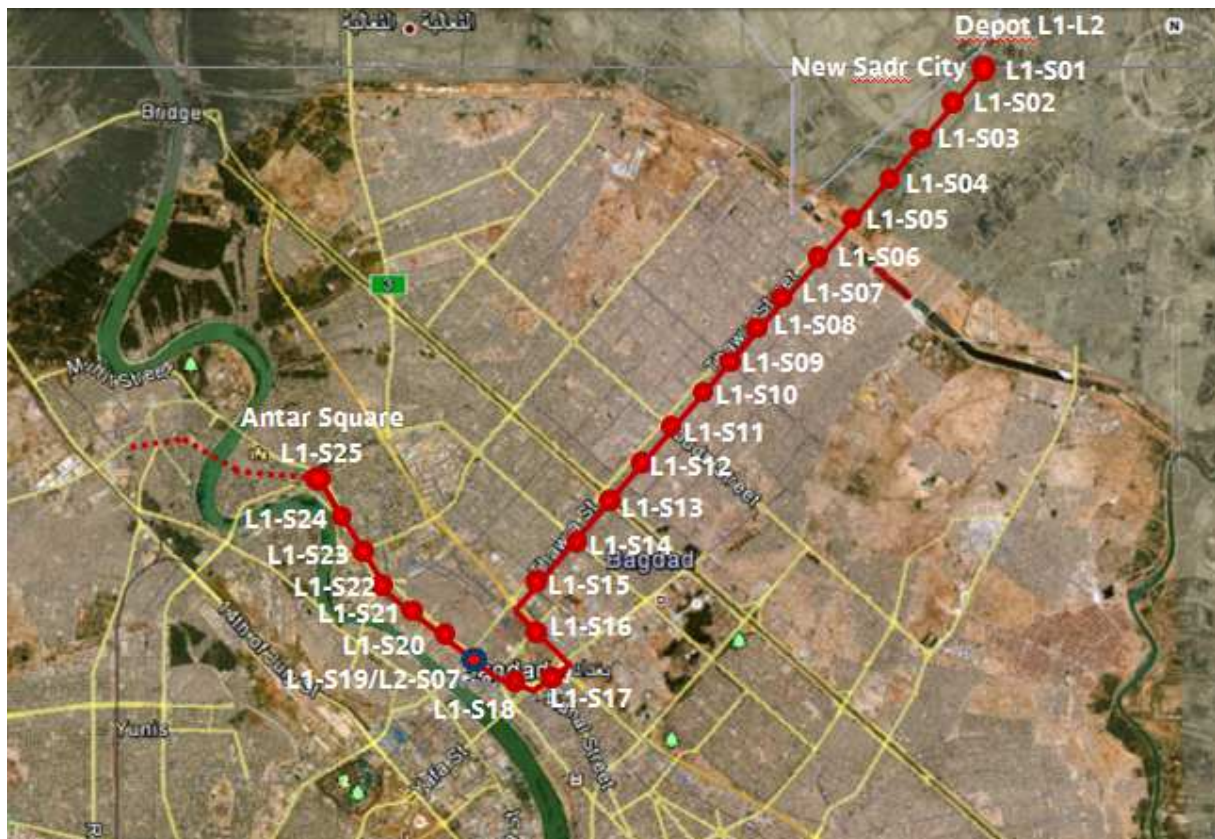
#### 2.1 General Description of the Project

Baghdad Underground Metro will consist in 2 fully underground metro lines. Line 1 will be about 23 km long with 25 stations. Line 2 will be about 23 km long with 22 stations. There is one interchange station between both lines located at Baghdad Municipality (L1-S19 & L2-S07). One tunnel connection between Line 1 and Line 2 is also to be implemented, it will link both lines between L1-S18 (Tayeran Square) and L2-S07 (Baghdad Municipality).

The main depot will be located along line 1 (close to New Sadr City) it will house the heavy maintenance facilities for both lines and light repair workshop as well as stabling building for Line 1 rolling stock fleet. It will also house the administrative building, the back-up OCC of Line 1, training centre.

A light depot will be located at the end of the southern branch of Line 2 near the terminal station L2-S21. It will house mainly the light repair workshop, the stabling building for Line 2 rolling stock fleet as well as the back-up OCC of Line 2.

Figure 1: Line 1 Alignment Overview







## BAGHDAD UNDERGROUND METRO

Figure 2: Line 2 Alignment Overview



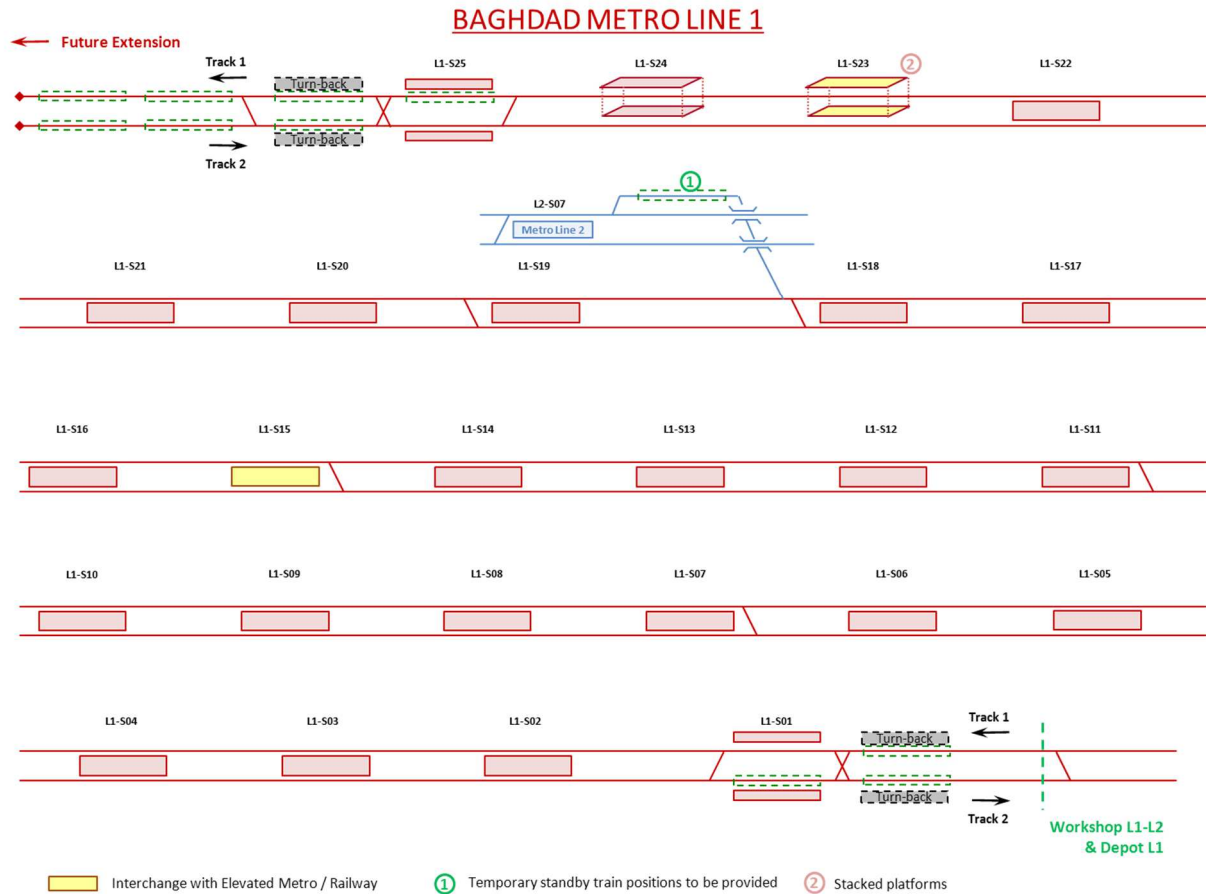
The 2 lines will be operated from two separate Operation Control Centre room (OCC) located within Baghdad Municipality Station. Main Security Centre for the two lines will be also located in Baghdad Municipality Station. There will be one Back-Up OCC for each line, Back-Up OCC for Line 1 will be located in Depot Line 1 and Back-Up OCC for Line 2 will be located in Depot Line 2.

The below figures shows the track layout for Line 1 and Line 2:



## BAGHDAD UNDERGROUND METRO

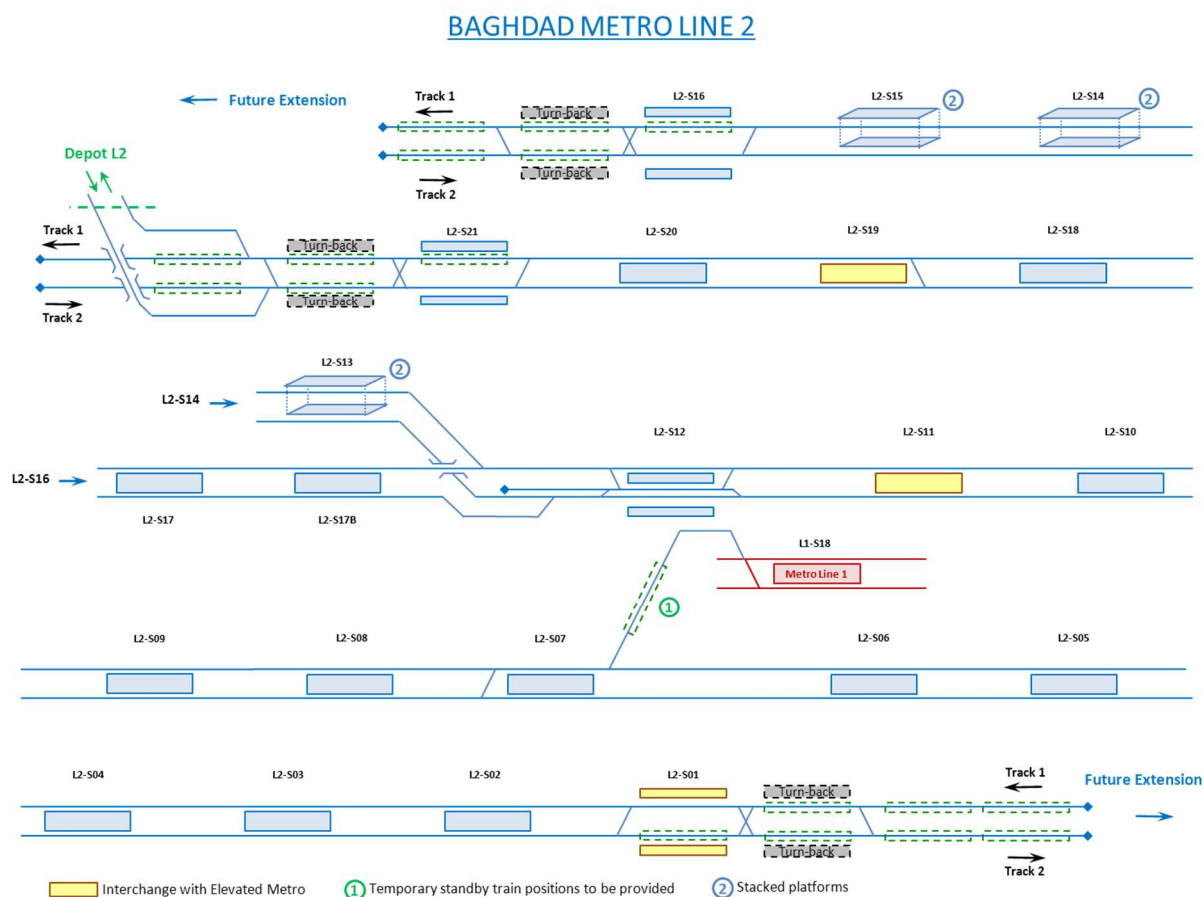
Figure 3: Line 1 Track Layout





## BAGHDAD UNDERGROUND METRO

Figure 4: Line 2 Track Layout



### 2.2 Main Performances

Baghdad Underground Metro Line 1 and Line 2 shall be designed, sized and built in order to carry at its ultimate capacity a passenger flow of 45,000 PPHPD at comfort of 5 pass/m<sup>2</sup> with 2 minutes headway. The train capacity shall be 1,500 passengers at 5 pass/m<sup>2</sup> over a maximum length of 150m.

The maximum operating speed for both lines is 80km/h.

### 2.3 Geometrical Parameters

The following synoptic tables summarize the main functional and geometrical features of Baghdad Underground Metro Line 1 and Line 2. The various figures (chainage, depth, rail level, track axis distance, etc...) could be adjusted according to the Contractor's final design.



## BAGHDAD UNDERGROUND METRO

Table 1: Line 1 Geometrical Parameters

| Line   | Station Code | Platform type                       | Undergr. structure levels | Tracks axis distance | Rail level depth   | Shaft Code | Intermediate shaft type | Chainage | Interstation distance | Egress distances |
|--------|--------------|-------------------------------------|---------------------------|----------------------|--------------------|------------|-------------------------|----------|-----------------------|------------------|
| LINE 1 | DEPOT        |                                     |                           |                      |                    |            |                         | 22792,79 |                       |                  |
|        | S01          | LATERAL                             | 2                         | 4,40                 | -14,90             |            |                         | 21751,74 | 1191                  | 561              |
|        |              |                                     |                           |                      |                    | Sh01       | E                       | 21113,36 |                       | 475              |
|        | S02          | CENTRAL                             | 2                         | 18,50                | -15,10             |            |                         | 20560,48 | 911                   | 756              |
|        |              |                                     |                           |                      |                    | Sh02       | D                       | 20106,96 |                       |                  |
|        | S03          | CENTRAL                             | 2                         | 18,50                | -15,10             |            |                         | 19649,45 | 544                   | 389              |
|        |              |                                     |                           |                      |                    | Sh03       | D                       | 19377,55 |                       |                  |
|        | S04          | CENTRAL                             | 2                         | 18,50                | -15,10             |            |                         | 19105,64 | 995                   | 420              |
|        |              |                                     |                           |                      |                    | Sh04       | E                       | 18608,36 |                       | 420              |
|        | S05          | CENTRAL                             | 2                         | 18,50                | -15,10             |            |                         | 18110,43 | 761                   | 606              |
|        |              |                                     |                           |                      |                    | Sh05       | D                       | 17696,70 |                       |                  |
|        | S06          | CENTRAL                             | 2                         | 18,50                | -15,10             |            |                         | 17349,00 | 820                   | 665              |
|        |              |                                     |                           |                      |                    | Sh06       | D                       | 16999,96 |                       |                  |
|        | S07          | CENTRAL                             | 2                         | 18,50                | -15,10             |            |                         | 16529,26 | 819                   | 664              |
|        |              |                                     |                           |                      |                    | Sh07       | D                       | 16119,38 |                       |                  |
|        | S08          | CENTRAL                             | 2                         | 18,50                | -15,10             |            |                         | 15710,17 | 837                   | 682              |
|        |              |                                     |                           |                      |                    | Sh08       | D                       | 15262,13 |                       |                  |
|        | S09          | CENTRAL                             | 2                         | 18,50                | -15,10             |            |                         | 14873,59 | 848                   | 693              |
|        |              |                                     |                           |                      |                    | Sh09       | D                       | 14513,63 |                       |                  |
|        | S10          | CENTRAL                             | 2                         | 18,50                | -15,10             |            |                         | 14025,24 | 1192                  | 493              |
|        |              |                                     |                           |                      |                    | Sh10       | E                       | 13454,77 |                       | 544              |
|        | S11          | CENTRAL                             | 2                         | 18,50                | -15,10             |            |                         | 12833,04 | 886                   | 731              |
|        |              |                                     |                           |                      |                    | Sh11       | D                       | 12387,69 |                       |                  |
|        | S12          | CENTRAL                             | 2                         | 18,50                | -15,10             |            |                         | 11946,91 | 1307                  | 732              |
|        |              |                                     |                           |                      |                    | Sh12       | E                       | 11137,11 |                       | 420              |
|        | S13          | CENTRAL                             | 3                         | 18,50                | -20,55             |            |                         | 10640,00 | 718                   | 563              |
|        | S14          | CENTRAL                             | 2                         | 18,50                | -15,10             |            |                         | 9922,31  |                       |                  |
|        |              |                                     |                           |                      |                    | Sh13       | D                       | 9687,14  | 615                   | 460              |
|        | S15          | CENTRAL                             | 2                         | 18,50                | -15,10             |            |                         | 9307,32  |                       |                  |
|        |              |                                     |                           |                      |                    | Sh14       | D                       | 8737,13  | 910                   | 755              |
|        | S16          | CENTRAL                             | 2                         | 18,50                | -15,10             |            |                         | 8397,08  |                       |                  |
|        |              |                                     |                           |                      |                    | Sh15       | E                       | 7647,14  | 1314                  | 672              |
|        | S17          | CENTRAL                             | 3                         | 18,50                | -20,55             |            |                         | 7083,38  |                       | 486              |
|        |              |                                     |                           |                      |                    | Sh16       | D                       | 6828,79  | 489                   | 334              |
|        |              |                                     |                           |                      |                    | Sh17       | D                       | 6828,79  |                       |                  |
|        | S18          | CENTRAL                             | 3                         | 18,50                | -20,55             |            |                         | 6594,57  | 859                   | 704              |
|        |              |                                     |                           |                      |                    | Sh18       | D (right axis)          | 6257,54  |                       |                  |
|        | S19          | SPECIAL LAYOUT: INTERCHANGE STATION |                           | 24,50                | -14,90<br>(-24,60) |            |                         | 5735,96  | 742                   | 587              |
|        | S20          | CENTRAL                             | 3                         | 18,50                | -20,55             |            |                         | 4994,11  |                       |                  |
|        |              |                                     |                           |                      |                    | Sh19       | D                       | 4662,40  | 659                   | 504              |
|        | S21          | CENTRAL                             | 3                         | 18,50                | -20,55             |            |                         | 4335,16  |                       |                  |
|        |              |                                     |                           |                      |                    | Sh20       | D                       | 4037,15  | 590                   | 435              |
|        | S22          | CENTRAL                             | 3                         | 18,50                | -20,55             |            |                         | 3745,53  |                       |                  |
|        |              |                                     |                           |                      |                    | Sh21       | E                       | 3180,00  | 1274                  | 488              |
|        | S23          | STACKED                             | 3                         |                      | -15,20<br>-24,90   |            |                         | 2471,34  |                       | 631              |
|        |              |                                     |                           |                      |                    | Sh22       | D                       | 2145,07  | 700                   | 545              |
|        | S24          | STACKED                             | 3                         |                      | -15,20<br>-24,90   |            |                         | 1770,88  |                       |                  |
|        |              |                                     |                           |                      |                    | Sh23       | E                       | 1352,36  | 1074                  | 341              |
|        | S25          | LATERAL                             | 2                         | 4,40                 | -14,90             |            |                         | 696,65   |                       | 578              |
|        |              |                                     |                           |                      |                    | TS1        | T                       | 0,00     | 697                   | 619              |



## BAGHDAD UNDERGROUND METRO

Table 2: Line 2 Geometrical Parameters

| Line          | Station Code                             | Platform type                          | Undergr. structure levels | Tracks axis distance | Rail level depth   | Shaft Code | Intermediate shaft type | Chainage | Interstation distance | Egress distances |
|---------------|--|--|---------------------------|----------------------|--------------------|------------|-------------------------|----------|-----------------------|------------------|
| LINE 2 (main) |  |  |                           |                      |                    | TS1        | T                       | 18793,72 | 1053                  |                  |
|               | S01                                      | LATERAL                                | 2                         | 4,40                 | -14,90             |            |                         | 17741,19 |                       |                  |
|               | S02                                      | CENTRAL                                | 3                         | 18,50                | -20,55             |            |                         | 17094,92 | 646                   | 491              |
|               |  |  |                           |                      |                    | Sh01       | D                       | 16779,18 | 632                   | 477              |
|               | S03                                      | CENTRAL                                | 3                         | 18,50                | -20,55             |            |                         | 16462,92 |                       |                  |
|               |  |  |                           |                      |                    | Sh02       | D                       | 16102,96 | 748                   | 593              |
|               | S04                                      | CENTRAL                                | 3                         | 18,50                | -20,55             |            |                         | 15715,08 |                       |                  |
|               |  |  |                           |                      |                    | Sh03       | E                       | 15274,32 | 994                   | 363              |
|               | S05                                      | CENTRAL                                | 3                         | 18,50                | -20,55             |            |                         | 14721,21 |                       | 476              |
|               |  |  |                           |                      |                    | Sh04       | D                       | 14298,18 | 837                   | 682              |
|               | S06                                      | SPECIAL LAYOUT: DEEP CONCOURSE STATION |                           | 18,50                | -26,75             |            |                         | 13884,64 |                       |                  |
|               |  |  |                           |                      |                    | Sh05       | D                       | 13485,95 | 821                   | 666              |
|               | S07                                      | SPECIAL LAYOUT: INTERCHANGE STATION    |                           | 24,50                | (-14,90)<br>-24,60 |            |                         | 13063,93 |                       |                  |
|               |  |  |                           |                      |                    | Sh06       | D                       | 12576,92 | 776                   | 621              |
|               | S08                                      | CENTRAL                                | 3                         | 18,50                | -20,55             |            |                         | 12287,68 |                       |                  |
|               |  |  |                           |                      |                    | Sh07       | E                       | 11651,21 | 1006                  | 559              |
| LINE 2 (W)    | S09                                      | SPECIAL LAYOUT: MINED STATION          |                           | 22,40                | -25,50             |            |                         | 11281,20 |                       | 293              |
|               |  |  |                           |                      |                    | Sh08       | D                       | 10930,27 | 788                   | 633              |
|               | S10                                      | CENTRAL                                | 3                         | 18,50                | -20,55             |            |                         | 10492,90 |                       |                  |
|               |  |  |                           |                      |                    | Sh09       | D                       | 10240,07 | 513                   | 358              |
|               | S11                                      | CENTRAL                                | 3                         | 18,50                | -20,55             |            |                         | 9980,20  |                       |                  |
|               | Emergency staircase                      |  |                           |                      |                    |            |                         | 9235,00  | 944                   | 668              |
|               | S12                                      | SPECIAL LAYOUT: BRANCHING STATION      |                           | 18,90                | -14,90             |            |                         | 9036,02  |                       | 121              |
|               | Emergency staircase / tunnel ventilation |  |                           |                      |                    |            |                         | 8715,00  | to W / S branches     | 244              |
|               | Emergency staircase / tunnel ventilation |  |                           |                      |                    |            |                         |          |                       |                  |
|               |  |  |                           |                      |                    | Sh10       | E                       | 4339,40  | 1567                  | 438              |
|               | S13                                      | STACKED                                | 3                         |                      | -15,20<br>-24,90   |            |                         | 3531,69  |                       | 730              |
|               |  |  |                           |                      |                    | Sh12       | E                       | 3068,03  | 924                   | 386              |
|               | S14                                      | STACKED                                | 3                         |                      | -15,20<br>-24,90   |            |                         | 2607,49  |                       | 383              |
|               |  |  |                           |                      |                    | Sh13       | D                       | 2284,08  | 620                   | 465              |
|               | S15                                      | STACKED                                | 3                         |                      | -15,20<br>-24,90   |            |                         | 1987,34  |                       | 580              |
|               |  |  |                           |                      |                    | Sh14       | E                       | 1329,42  | 1404                  | 669              |
| LINE 2 (S)    |  |  |                           |                      |                    | TS2        |                         | 0,00     | 583                   |                  |
|               | Emergency staircase / tunnel ventilation |  |                           |                      |                    |            |                         |          |                       |                  |
|               |  |  |                           |                      |                    | Sh15       | D                       | 8208,07  |                       | 745              |
|               | Emergency staircase                      |  |                           |                      |                    |            |                         | 7970,00  | 1179                  | 36               |
|               | S17-B                                    | CENTRAL                                | 2                         | 18,50                | -15,10             |            |                         | 7856,60  |                       | 629              |
|               |  |  |                           |                      |                    | Sh16       | E                       | 7150,03  | 1416                  | 632              |
|               | S17                                      | CENTRAL                                | 3                         | 18,50                | -20,55             |            |                         | 6440,52  |                       | 728              |
|               | Emergency staircase                      |  |                           |                      |                    |            |                         | 5635,00  | 922                   | 39               |
|               | S18                                      | CENTRAL                                | 2                         | 18,50                | -15,10             |            |                         | 5518,28  |                       | 643              |
|               |  |  |                           |                      |                    | Sh17       | V                       | 4797,34  |                       | 758              |
|               |  |  |                           |                      |                    | Sh18       | E (no drain.)           | 4039,77  | 1867                  | 311              |
|               | S19                                      | CENTRAL                                | 2                         | 18,50                | -15,10             |            |                         | 3651,55  |                       | 606              |
|               |  |  |                           |                      |                    | Sh19       | E                       | 2967,76  | 1152                  | 391              |
|               | S20                                      | CENTRAL                                | 2                         | 18,50                | -15,10             |            |                         | 2499,53  |                       | 42               |
|               | Emergency staircase                      |  |                           |                      |                    |            |                         | 2380,00  | 1713                  | 660              |
|               |  |  |                           |                      |                    | Sh20       | V                       | 1719,80  |                       | 856              |
|               | S21                                      | LATERAL                                | 2                         | 4,40                 | -14,90             |            |                         | 786,56   |                       |                  |
|               | DEPOT                                    |  |                           |                      |                    |            |                         | 0,00     |                       |                  |





## BAGHDAD UNDERGROUND METRO

### 2.4 Technical Requirements

The Contractor shall perform all related detailed design including surveys, calculations, drawings, etc. for Baghdad Underground Metro Line 1 and Line 2. The Contractor shall improve, adjust, optimize the proposed design submitted in the tender documentation while keeping at least the same functional performances. All components and parts specified shall be of the same quality used in metro systems that have been operating during at least 5 years of commercial operation.

Among the overall technical requirements set out in the various specifications, specific attention shall be paid to the following:

#### 2.4.1 Surveys

The Contractor has to check all underground utilities at all construction sites (stations, shafts, etc) and to be responsible to change all when needed with the accordance of the authorized systems.

The Contractor, after accurate soil investigation and detailed definition of the structure on the stations and the lining should perform Noise and Vibration Analysis, and take necessary measurement to meet with international applied standards to avoid nuisance to the passengers or to the neighbouring.

Noise and vibration impact has also to be studied and controlled for historical buildings could potentially be affected by the construction or by the Operation of the lines.

#### 2.4.2 Alignment and Right of Way

The Contractor has to perform at the early beginning of the Project a detailed alignment study including Right Of Way based on the provided drawings. The Contractor shall improve, adjust and optimize the existing preliminary design and submit to Client for approval. Especially, the Contractor shall avoid use of small radius and sharp slope as much as practically possible.

#### 2.4.3 Phasing programme

If the Client decides to implement Baghdad Underground Metro through various successive operational phases, the Contractor has to take all necessary mitigation measures for not disturbing the operation of the already built and operated phase(s) while performing works on the adjacent phase(s).



## BAGHDAD UNDERGROUND METRO

### 3. PROJECT MANAGEMENT DOCUMENT

#### 3.1 Management Plan

At the beginning of the Contract, the Contractor shall supply the Client and/or his Representative with a set of Management Plans, which scope shall answer all requirements stipulated in this document. Those Management Plans may be supplemented by other Contractor's own reference documents. The latter should be available for the Client's review purposes.

Answers and measures within the Management Plans shall be sufficiently explicit, and potential discrepancies between requirements and measures shall be justified. The Client should be able to reject such discrepancies.

Updates of the Management Plans are permitted in so far as they comply with the present contractual requirements, and shall be formally handed over to the Client.

The Management Plans shall include, but shall not be limited to the following:

- Overall Organization Plan
- Design Management Plan
- Procurement Management
- Stakeholder Management Plan
- Fabrication Management Plan
- Construction Management Plan
- Test and Commissioning Plan
- Project Schedule Control Plan
- Risk Management plan
- Configuration Control Plan
- Requirements Management Plan
- Documentation Control Plan Quality Assurance Plan
- Site Health & Safety Plan
- Security Plan
- Environmental Management Plan
- Management Plan deliverable documents list

The Contractor shall establish and update the Management Plan Document List (MPDL).

As a minimum, the MPDL shall include the above listed documents.

#### 3.2 System Documentation

Aside from the Management Plan, the Contractor shall issue a set of system documentation:

- General Arrangement Drawings
- Reliability Availability and Maintainability (RAM) Plan
- System Safety Plan
- System Validation Plan (including Performance Verification Matrix)
- As Built Drawings & related documentation
- Testing & Commissioning plan



## BAGHDAD UNDERGROUND METRO

### ➤ Technical Operating and Maintenance documentation

The Contractor shall establish no later than one month after the Commencement Date and keep updated the System Documentation List (SDL). As a minimum, the SDL shall include the documents listed here-above.



## BAGHDAD UNDERGROUND METRO

### 4. ORGANIZATION REQUIREMENTS

#### 4.1 Organization Plans

The Contractor shall prepare and submit the following for Client's approval:

- Project Management organization plan for the transversal part of the Contract
- Design organization plan for the "Design" part of the Contract, including interfaces coordination within sub-systems, Civil Works and external agencies.
- Construction organisation plan for the "Build" part of the Contract (including procurement)
- Testing & Commissioning and System Integration Organization Plan

Each of the organization plans shall address at least the following items:

- Description of the organization breakdown structure the Contractor intends to set up to execute the specified part of the Contract. If necessary, this organization can be different for each period of the specified part of the Contract.
- List of the key management personnel to be employed, with their names, qualifications and experience clearly specified.
- Description of the staffing the Contractor intends to set up to execute the specified part of the Contract. This shall include for each position of the organization:
  - Number of staff members for the position.
  - Job profiles, including:
    - Title of the position.
    - Number of people to be hired for the position.
    - Required level of education and certificates.
    - Required experience: field of activity and duration.
    - Position objectives in the Contractor's organization.
    - Main activities related to the position.
    - Specific requirements for the position, such as night work, on-call duty, travel time from home to the site...
- List, quantities and description of the different resources the Contractor intends to set up to execute the specified part of the Contract.
- Description of the different contracts the Contractor intends to sublet to execute the specified Part of the Contract, with the name of the main possible subContractors.

##### 4.1.1 Project Management Organization Plan

In the Project Management Organization plan, the Contractor shall detail his transversal overall organization and how general management requirements stipulated in this document are transferred to internal suppliers or sub-Contractors. Rules and responsibilities shall be defined and submitted to the Client as part of the Management Plan.

Beyond the above requirements applicable to each Organization Plan, the additional requirements of the following chapters apply to each related plan.



## BAGHDAD UNDERGROUND METRO

### **4.1.2 Design Organization Plan (DOP)**

The Design Organization Plan shall include comprehensive description of the Design team organization breakdown; design processes flow charts, and the overall methodology for developing and achieving a high quality design throughout the corresponding phase. The DOP will detail the review and validation processes with all parties concerned as well as the envisaged time windows required for the different phases.

### **4.1.3 Procurement Plan**

The Procurement Plan shall include a comprehensive description of the organization the Contractor intends to use to control purchasing activities, manufacturing of equipment, testing in factory and acceptance before transportation and delivery to site.

### **4.1.4 Construction Organization Plan**

The Construction Organization Plan shall include a comprehensive description of Construction Works Organization Breakdown with a definition of the roles and responsibilities of the site staff and management personnel.

It will indicate in particular the location of the main site establishments and the communication links between themselves and the other Contractor's entities.

### **4.1.5 Testing and Commissioning Organization Plan**

The Testing and Commissioning Organization plans shall include a comprehensive description of the Testing and Commissioning team organization breakdown, testing and commissioning processes flow charts, the interface with the Design and Construction teams, the involvement of the Operator and Maintenance Entity and the overall methodology and certification phasing for the corresponding activities.

## **4.2 External Organization Requirement**

### **4.2.1 Client's Representative**

The Client may appoint a Client's Representative who shall carry out the duties assigned to him by the Client. He will be acting on behalf of the Client.

### **4.2.2 Independent Checking Engineer (ICE)**

As a complement to the Contractor's team, a dedicated entity, called the ICE (Independent Checking Engineer), in charge of external technical control shall be appointed and paid by the Contractor. The ICE's Scope of Work shall cover all the Contractual stages.

This dedicated entity shall report monthly to the Contractor, with a copy to the Client and/or his Representative, all discrepancies and non-compliances regarding:

- Design stage:
  - o Contractual requirements





## BAGHDAD UNDERGROUND METRO

- o State-of-the-art regulations
- o Thorough acknowledgement and inclusion of physical, special and functional interfaces
- Build stage:
  - o Design
  - o State-of-the-art buildings techniques and procedures
  - o Quality Control application

### ***4.2.3 Independent Safety Assessor (ISA)***

The Client shall appoint an ISA (Independent Safety Assessor).

The role of the ISA is to conduct the safety audits and to submit the safety reports to the Client so that the Authority in charge of authorising the commercial revenue service of the Baghdad Underground Metro is able to grant a Permit to Operate in due time. This will be performed in compliance with the System Safety Plan requirements and shall cover all safety equipment such as train control and protection, signalling system and associated equipment on board and along the track, and shall cover all safety related functions as well. Supplies and commissioning shall fully comply with the safety requirements as specified.

The ISA shall:

- Prepare Safety audit plan in cooperation with the Contractor and the Client.
- Conduct initial review of all relevant documents
- Review and audit Engineering application
- Assess on-site activities as per field reports.
- Write and submit to the Client the final Safety report, which shall include its own comments, the comments of the Client and the comments of the Client and/or his Representative.



## BAGHDAD UNDERGROUND METRO

### 5. PLANNING, PROGRAMME AND PROGRESS

#### 5.1 Planning

The Contractor shall develop in detail, a logical method of executing the Works taking into account their complex nature and different phases and shall provide programmes which reflect the detailed planning undertaken.

The programmes shall start with the Commencement Date of the Works as day one, are to be realistic, achievable and shall be accompanied by the detailed supporting Plans referred to in the following sections.

#### 5.2 Programming General Requirements

Programme activities shall be discrete items of work, which when combined, produce definable elements, components, Milestones, Stages and Sections of the Works and clearly identify the completion obligations of the Contractor. Design programmes shall be organised by Design Stages and Plans as described below.

Key Dates and Milestones shall be an integral part of all programmes and all activities, and sequencing and interrelationships required to achieve each completion obligation shall be shown. Milestones shall not impose constraints that in any way affect the programme logic and float or limit the achievement of Key Dates. Milestones shall not be introduced into any programme as constrained dates.

The critical path and the float shall be clearly identified in the programme and fully described in the accompanying programme narrative.

Activity descriptions shall clearly convey the nature and scope of the Works.

Programmes shall take into account the activities of precursor, concurrent, adjacent and follow on Project Contractors as well as utility service diversions, new utilities and connections and any other activity that may affect the progress of the Works.

The Contractor shall also incorporate the Client's requirements for additional activities, to further explain or subdivide complex or long duration tasks, without affecting completion dates.

#### 5.3 Progress Monitoring

The Contractor shall monitor his own and his subContractor's performance and against programmes to ensure its compliance with its obligations under the Contract. Monitoring of the Works shall include direct, daily monitoring of the progress of the Works and the preparation of written and computerised reports to be submitted to the Client. The reports shall include all necessary supporting data to apprise the Client of the status of the completion of the Works as described below.

#### 5.4 Design Submission Programme

The Contractor shall, within 30 days of the Commencement Date of the Works, submit a Design Submission Programme covering all proposed submissions to the Client. The Design Submission Programme shall be broken down into a submission programme for each of the Management Plans



## BAGHDAD UNDERGROUND METRO

defined below each of which shall define the dates for individual submissions and these shall conform to the baseline dates shown in the Works Programme.

The Submissions Programme shall include the requirements of the Design Submissions as described below, including the procurement activities of all sub-Contractors and suppliers.

The Submissions Programme shall include each submission for every item listed in the Specification as being required to be submitted.

The Submissions Programme shall ensure that all submissions are properly co-ordinated with the Contractor's overall Works Programme, particularly in respect of the following:

- (i) progress of design, manufacture, installation and testing Work
- (ii) co-ordination with other Contractors
- (iii) including due allowance for the Client's review process to be undertaken, including the time needed for any re-submissions.

The Design Submission Programme shall specifically include a milestone for the submission by the Contractor of the Final Design on completion of the Preliminary Design stage. The Final Design shall include at least but not limited to; detailed design drawings, shop drawings, phasing plans, details showing all the proposed equipment interconnections, physical layout, Installation locations and interfaces to other suppliers.

### 5.5 Procurement And Manufacturing Programme

Within 60 days of the Commencement Date of the Works, the Contractor shall submit for review by the Client a Procurement and Manufacturing Programme that shall be an integrated part of the overall Works Programme.

The Procurement and Manufacturing Programme shall show the interdependencies between Engineering disciplines as well as between the Contractor, his sub-Contractors and suppliers.

### 5.6 Construction/Installation Programme

The Construction/Installation Programme shall be submitted no later than 2 months before the start of the Works or as directed by the Client.

The Construction/Installation Programme shall include detailed activities describing all aspects of the construction and installation of the Works, to meet all Milestones and Key Dates given in the Contract. It shall be clearly linked to the Procurement, Manufacturing Programme, Inspection, Testing and Commissioning Programme to form an integrated part of the Works Programme.

The Construction/Installation Programme shall indicate the physical areas to which the Contractor requires access, access date, duration required and the required degree of completion for civil or architectural finishes prior to the access date.



## BAGHDAD UNDERGROUND METRO

### 5.7 Testing and Commissioning Programme

The Testing and Commissioning Programme shall be submitted no later than 2 months before the start of any testing activity or as directed by the Client and shall comply with the requirements stated above.

The Contractor shall submit the Testing and Commissioning Programme that shall fulfil all the on-Site testing and commissioning requirements below. The Testing and Commissioning Programme shall clearly demonstrate the logic and highlight the topics listed in the On-Site Testing and Commissioning Plan.

The Testing and Commissioning Programme shall be fully detailed, with activities individually identifying all tests for which a certificate will be issued, and shall include activities for preparation, submittal and review of the test procedures.

The Testing and Commissioning Programme shall demonstrate the logical dependencies between the individual tests of the Works, and shall also show the interfaces and dependencies with all of the Project Contractors' tests required to commission the Works and support the Commissioning Plan.

### 5.8 O&M Training Programme

As the Contractor will ensure the Operation and Maintenance activities for a duration of 2 years after the revenue service (this duration could be extended upon agreement with the Client), the Contractor shall, within 180 days of the Commencement Date of the Works, submit for review by the Client, a Training Programme covering all proposed formal training courses, delivery of training equipment and accesses by the Client's personnel for informal 'hands on' technology transfer. The Training Programme shall also detail specific transfer of technology features as required and proposed by the Contractor.

The Training Programme shall be developed to the Training Plan as required below.

The Training Programme shall be sufficiently detailed that the Client can ensure the availability of staff for all the courses required.

The Training Programme shall include the requirements as listed below, including the Training activities of all sub-Contractors and suppliers.

### 5.9 Three Month Look Ahead Programme

Within 30 days of the Commencement Date of the Works, the Contractor shall submit to the Client for review his initial Three Month Look Ahead Programme. The Initial submission shall show in detail all activities that have commenced or are due to start within the first three calendar months period to meet Key Dates and Milestones and any other dates set out in the Contract. Thereafter, the Contractor shall submit a new Three Month Look Ahead Programme every month as part of the Monthly Progress Report.

The Three Month Look Ahead Programme shall after the initial submittal:

- (1) provide details of all activities that are in progress, or are due to start, within the forthcoming two month period and the previous one month period shall also be shown
- (2) be updated every month and be submitted concurrent with the Monthly Progress Report



## BAGHDAD UNDERGROUND METRO

- (3) highlight all required dates for transmittal or receipt of information to or from the Client, sub-Contractors or Project Contractors
- (4) consist of a three month time window extracted from the Works Programme

### 5.10 Time Chainage Programme (T/C)

The Contractor shall submit a T/C Programme 14 days after the Commencement Date. The format and content of the T/C Programme shall be submitted for review by the Client prior to submission of the substantive T/C programme itself. The Tenderer shall submit in his proposal a tentative T/C programme.

The T/C Programme shall be compatible in all respects with the Works Programme and shall include, but not be limited to, details of the planning of the Works in a linear time/location manner. The T/C Programme shall demonstrate how linear tasks interrelate with time, access points, access/handover dates, planned production outputs, construction material call-off rates, etc.

The T/C Programme shall be updated and submitted to the Client on a monthly basis or when installation methods, production rates or interfaces deviate from that shown in the Works Programme.

### 5.11 Programme Review

The Client shall, within 28 days of receipt of the initial submission of any programme for review, either give a notice of no objection or provide specific details as to why a notice of no objection is not given. If the Contractor is advised that the programme is not given a notice of no objection, the Contractor shall amend the programme taking into account the Client's comments and/or requirements and resubmit the programme within 14 days.

In the case of further re-submittals, the resubmission time shall also be 14 days.

### 5.12 Works Programme Revisions

The Contractor shall immediately notify the Client in writing of the need for any change in the Works Programme, whether due to a change of intention or circumstances or for any other reason. Where such a proposed change affects the timely completion of the Works; the Contractor shall within 14 days of the date of notifying the Client submit for the Client's review his proposed revised Works Programme and accompanying programme analysis report. The proposed revised Works Programme shall show the sequence of operations of any and all work related to the change and the impact of changed work or changed conditions on the Works and Project Contractors and their works.

If at any time the Client considers the actual or anticipated progress of the work reflects a significant deviation from the Works Programme, he may request the Contractor to submit a proposed revised Works Programme. Upon receipt of such a request the Contractor shall submit within 14 days a revised Works Programme, together with an accompanying programme analysis report and narrative statement that shall demonstrate the means by which the Contractor intends to eliminate the deviation.





## BAGHDAD UNDERGROUND METRO

### 5.13 Monthly Progress Report

The Contractor shall prepare Monthly Progress Reports covering all aspects of the execution of the Works. Such Monthly Progress Reports shall be in writing and shall be delivered to the Client by the 5th day of the month following the month of the Monthly Progress Report. The Monthly Progress Report shall take account of work performed up to and including the last day of the month to which the Monthly Progress Report relates.

The Monthly Progress Report shall include an executive summary and contain clear and concise statements in respect of every significant aspect of the Works including safety, quality and environmental issues. .

The Monthly Progress Report shall contain evidence that documents and supports the progress of the Works, as stated in the Interim Payment Certificates, to the satisfaction of the Client and/or his Representative.

The Monthly Progress Report shall describe the physical progress of the Works.

### 5.14 Key Date and Milestone Report

The Key Date and Milestone Report shall be prepared in a format reviewed by the Client and identify and state the status of:

- (1) all Key Dates and Milestones that were planned to be achieved in the reporting period or earlier but have not been achieved;
- (2) all Key Dates and Milestones that have been achieved in the reporting period;
- (3) all Key Dates and Milestones that are planned to be achieved in the next reporting period; and
- (4) any future Key Dates and Milestones that appear unlikely to be achieved on time.

The Key Date and Milestone Report shall identify, for all relevant Key Dates and Milestones, the planned dates, the actual dates achieved, and where the original planned dates are forecast to be unachieved, the revised dates identified in the Contract, as the same may be revised from time to time in accordance with the Contract.

The Key Date and Milestone Report shall also provide an explanation for any deviation from the planned dates. Measures taken or required to recover programme delays shall also be identified, as well as the impact on the float.

Transfer station (Baghdad Municipality) milestones:

In connection with the construction phasing of the transfer station and the timing for arrival, departure and crossing of the stations by the TBM's, the Contractor is required to develop a specific schedule indicating the main civil and tunnelling activities in order to determine the sequences and priorities between lines and Contractors in the transfer station. Vertical and horizontal movements in stations shall be specified as well.

This schedule will identify some major key dates and provide the right order to develop the works.

These key dates will be added to the list of the project milestones as a tool to monitor progress and interface between Contractors.



## BAGHDAD UNDERGROUND METRO

### 5.15 Progress Meetings

The Client will chair progress meetings every month with the Contractor.

These meetings will be held at dates and times to be advised by the Client. Progress meetings shall not be later than 10 days after the issue of the Contractor's Monthly Progress Report.

The Client may convene at his discretion, at any time upon reasonable notice to the Contractor, any meeting, either on or off the Site, to discuss and address any aspect of the Works or the Contract. The Contractor shall attend any such meetings convened by the Client.

All meetings shall be convened in Baghdad unless directed otherwise by the Client. Meetings shall be attended by senior personnel from the Contractor who shall arrive properly briefed for all aspects of the meeting and shall be empowered to make executive decisions in respect of the execution of the Works.

### 5.16 Steering Committee Meetings

The Client may convene Steering Committee Meetings in Baghdad at approximately three monthly intervals. The Client will notify the Contractor the date of such Meetings not less than 28 days before they are to be held.

Steering Committee Meetings shall be held in order to review the overall progress of the Works in the context of the Project as a whole and to address and resolve any issues relevant to the execution and progress of the Works. Such meetings will be chaired by the Senior Director of the Client or his delegate. The Contractor shall have in attendance one senior representative of Director Level from each of the companies comprising the Contractor (together with the Managing Director of the company acting as leader or sponsor of the Contractor if it is a joint venture, consortium or partnership whenever necessary and required by the Client).

The Contractor shall submit names of the persons whom the Contractor proposes to attend each Steering Committee Meeting to the Client for review not less than 7 days prior to each Meeting.



## BAGHDAD UNDERGROUND METRO

### 6. RISK MANAGEMENT

The Contractor is required to implement a Risk Management Plan. This plan will be submitted no later than 2 months after the Commencement Date.

It shall detail all applicable rules, regulations and procedures defined by the Contractor to manage all the risks identified on the project.

#### 6.1 Risk Management Principles

Risk Management must start at the very beginning of the project.

This section presents the main steps of risk management.

#### 6.2 Main Steps of Risk Management



##### 6.2.1 Risk Identification

This step seeks to identify the risks to be managed. Comprehensive identification using a well-structured systematic process is critical, because a potential risk not identified at this stage is excluded from further analysis. Identification should include all risks whether or not they are under the control of the Contractor.

The risks can be of different origins:



## BAGHDAD UNDERGROUND METRO

- External Environment (political decisions, opposition to the project...)
- Financial and legal (project funding, properties, claims ...)
- Project organisation (disputes between members, management problems)
- Technical / Cost / Time (Contractors delay, weather conditions, ...)

### 6.2.2 Risk Analysis and Evaluation

All the risks identified are classified according to their:

- Probability of occurrence.
- Consequences.

The goal of this analysis is to separate the minor acceptable risks from the major risks and to provide data to assist in the evaluation and treatment of those risks.

Risk evaluation will compare the level of risk found during the analysis process with previously established risk criteria.

### 6.2.3 Risk Treatment

Risk Analysis will document how the chosen options shall be implemented. There are three basic ways of treating risks:

- **Acceptance**, if the resulting risks fall into the low or acceptable risk categories,
- **Reduction** or cancellation. In some cases risks can be reduced or even cancelled by taking **some appropriate actions**.
- **Transfer**, risks can be transferred to others (Insurance, subContractors, third party...).

The treatment will identify responsibilities and plan the expected outcome of treatments, the budgeting, the performance measures and the review process to be set.



## BAGHDAD UNDERGROUND METRO

### 7. QUALITY ASSURANCE

#### 7.1 Overview

It is required that the Contractor shall fulfil all the Quality Assurance requirements detailed in the present chapter. These requirements shall be fulfilled by the Contractor through a Quality Assurance Program.

The Contractor's Quality Assurance System shall be detailed in a document titled "Quality Assurance Management Plan" (hereinafter referred to as QAMP) which will be presented by the Contractor to the Client for consent.

The minimum requirements for the QAMP documents are outlined below.

The Contractor shall manage the completion of the contract by implementing a Quality Assurance System as specified by the requirements of ISO 9001 as well as all related ISO standards for quality assurance. The Contractor's Quality Assurance System shall also be consistent with any quality assurance programs maintained by the Client and or in effect in Iraq for projects of similar nature. The Contractor may utilize a proven in-house Quality Assurance System so long as it meets the objectives outlined in the present chapter.

If during the course of the Works, the Client finds the accepted Quality Assurance Program to be insufficient, the Client may request that the QAMP has to be modified to ensure higher quality of the Works to be carried out. The Contractor shall comply with this request.

The Client has the right to reject any construction, production or installation, or part thereof, which has not been carried out, or documented as having been carried out, in accordance with the accepted QAMP. The Contractor shall make replacements, improvements or corrections at his own expense.

The Contractor shall be responsible for quality control to include, but not restricted to:

- Contractor's provision and maintenance of a quality control program in conjunction with his subContractors as approved by the Client. The program shall provide regular inspection and testing of products during fabrication and installation, since the Contractor may deem necessary to ensure that work is performed in compliance with the Contract. Such inspection and testing shall be performed at no additional expense to the Client
- Inspections and testing required by the orders, laws, ordinances, rules and regulations of utility and local authorities
- Employment of separate professional inspection and laboratory testing firms to provide inspection services and to supervise laboratory testing services as specified in the applicable sections of the Specifications and under the review of the Client. Perform inspection and testing by or under the supervision of approved testing and inspection firms only

#### 7.2 Applicable Standards & Regulations

The reference documentation is:

- ISO 9001





## BAGHDAD UNDERGROUND METRO

- ISO 14001

The Contractor shall be aware of the changes and evolution regarding this reference quality standards documentation.

Should these changes affect the Contractor's organization, the Client shall be informed accordingly.

### 7.3 Aim of the Quality Assurance System

The Contractor shall establish and maintain a Quality System as a mean of assuring that the products to be delivered are in accordance with the requirements of the contract and the applicable standards and regulations.

Organisation set up, procedures, verification plans, allocated Staff and Equipment resources for the completion of the contract must be both coherent and complementary with each other.

Particular emphasis shall be made by the Contractor on:

- Clear definition of responsibilities.
- Traceability of the development of the deliverables.
- Means for immediate detection of any deviation from plans and implementation of corrective measures.

### 7.4 Specific Quality Assurance Staff

The Contractor's Manager in charge of the Quality Assurance System shall be identified and shall approve all Quality Plan Submittals. His CV shall be submitted to the Client for approval prior the start of his duties. The Contractor QA Manager shall have the sole authority of assessing and approving quality assurance of all sub-Contractors' and Client and/or his Representatives' documentation, and shall carry out a comprehensive audit program of Contractor activities for the entire contract duration.

### 7.5 Process Review

#### 7.5.1 Review Principles

In addition to its own internal validation process, the Contractor shall involve an ISA, as required by the Contract, and the entity in charge of the ICE while performing its design.

Any approval or issuance of "Statement Of No Objection" by the Client and/or his Representative shall not in any way limit the Contractor's liability.

##### 7.5.1.1 General Principles

- A. Make submissions to the Client generally as required by the Contract Documents,
- B. Scope of Submittals includes but is not limited to:
  1. SubContractor List.



## BAGHDAD UNDERGROUND METRO

2. Material and Assembly Submittals (as required under the sections of the specification) including:
    - a. Submittal schedule.
    - b. Samples.
    - c. Manufacturer's Literature.
    - d. Shop Drawings and Coordination Drawings.
    - e. As Built Drawings and Operations & Maintenance Instructions.
    - f. Mock-ups.
    - g. Manufacturing Details/Samples
    - h. Calculations, specifications and the like relating to submittals, if required by the Client.
    - i. Details of temporary works, if required by the Client.
  3. Project Record Documents including purchase orders, letters of credit and other documents relating to the procurement of materials, goods and services and progressing the works.
  4. Warranties and Guarantees.
  5. Schedules.
  6. Project Close-out Report.
- C. Identification and Certification of Submittals:
1. All submittals shall be referenced and titled
  2. Identify each submittal with contract identification, the corporate names of the Contractor, and the SubContractor, supplier or manufacturer as may be applicable, and the date of submittal.
  3. Provide on each shop drawing and sample a clear space for the review stamp and comments of reviewer and Contractor. Where a clear space cannot be provided, secure a tag to the submittal.
  4. Submittals shall bear the Contractor's stamp and written certification that they have been coordinated, checked for compliance with the Contract, and approved by the Contractor.
- D. Payment for Transmittal of Submittals:
- The Contractor shall be responsible for payment of the costs for transmittal of submittals to the Client.

### 7.5.1.2 Procedures for Transmittal of Submittals

- A. Accompany submissions by a transmittal form provided by the Contractor in A4 size and in a format and with text suitable for the project, all as approved by the Client.



## BAGHDAD UNDERGROUND METRO

B. Provide the following printed or typed information on each transmittal form:

- Client's Contract Identification and number.
- Name of Contractor,
- Transmittal number, which shall be consecutive throughout the works.
- Date of submission.
- Number each new submission item consecutively. Add a suffix (alphabetical or numerical but of consistent type throughout the work) to submission number for each resubmission. Suffixes shall be consecutive.
- Number of submitted items and a description of the item.
- The Specification Section number relevant to the submittal, with further reference to the paragraph number of the section if required for precise identification. Do not make submission of items from more than one Specifications Section on the same transmittal form.
- Drawing number, title and date of each shop drawing transmitted.
- Parts, areas, etc of the Works to which samples pertain and sample products are scheduled for incorporation in the Works.
- When submission of an element consists of many individual parts/submissions – submit an overall schedule indicating all elements with each submission together with the status of each submitted part so that an overview of the already submitted, approved and outstanding element can be monitored pertaining to this specific element.
- Contractor's remarks pertinent to the submittal including exceptions to or deviations from the Contract and the reasons therefore.
- Definitions of actions to be taken by the reviewer as under:
  - A – Approved
  - B – Approved as noted
  - C – Approved as noted and Resubmittal required
  - E – Disapproved
  - F – No action taken

Provide spaces on the transmittal forms for information to be inserted as follows:

1. Date submittal was received by designated recipient.
2. Date submittal is returned by designated recipient to Contractor.
3. Number of submitted items and a description of the item.
4. Action taken.
5. Reviewer's remarks including major deviations from the Contract or reasons for "C" Action if there are no notes on the submission itself.



## BAGHDAD UNDERGROUND METRO

Submittals, which in the reviewer's opinion are incomplete, contain errors, or have not been checked or have been only checked superficially will be returned for resubmission without detailed review.

Distribute finally reviewed shop drawings and samples to the installers and provide additional submittals to the Client and reviewer as directed.

### 7.5.1.3 Submittal Review and Procedures for Subsequent Action

- A. Failure of the Contractor to process submittals for review or find alternatives in case of rejections shall not relieve the Contractor of his responsibilities under the Contract.
- B. Notwithstanding the provisions of the Special Conditions of Contract, until the submittal has been verified by the Contractor, reviewed by the Client and marked with the appropriate action, the Contractor proceeds at his own risk in ordering any material to be used in the Works. Making good work that has proceeded in error because of non-compliance with the requirements of the drawings, specifications and Contract Documents shall be at the Contractor's expense. Review of submittals shall not relieve the Contractor of his responsibility for execution of the Works in accordance with Contract Documents.
- C. The Contractor shall not be relieved of responsibility for deviations from the Contract, or errors of any kind in the submittals, or from the necessity of furnishing work required by the Contract which may have been omitted from the submittals marked with the appropriate Action. The review of individual items in submittals shall not be construed as a review of the complete assembly in which it functions.
- D. No authorisation of an increase in Contract Price or time shall be implied by comments marked on submittals or submittal transmittals by the Client.
- E. Review of submittals shall not absolve the Contractor from the responsibility of correctly locating all items in the Works. The Contractor shall pay all costs for revisions to work caused by improper location in the Works.
- F. No approval by the Client of a submittal shall be deemed to imply agreement to deviate from the requirements of the contract drawings and contract documents, unless specifically stated in writing.
- G. Approval of Substitutions, Alternatives and Deviations:  
Whenever and wherever the Contractor proposes to make substitutions to the specified construction method or process, or proposes the use of non-listed manufacturers or products, or to deviate from the materials specified, the Contractor must make a full submission as required in the Contract Documents, including written guarantees. The Contractor shall evaluate such proposal as provided for in this Section and forward his recommendation to the Client for his consideration. Only the Client has the authority to approve or reject the proposed substitutions, alternatives and/or deviations.
- H. The Contractor shall be responsible for costs for alterations to the Works caused by discrepancies, errors or omissions in submissions, irrespective of whether the submissions have been reviewed or not.



## BAGHDAD UNDERGROUND METRO

### 7.5.1.4 *Remarks and Observations Treatment*

The Contractor's Safety responsible shall be in charge of collecting all relevant remarks and observations from the ICE and the ISA.

After thorough scrutiny, consensus and consistency shall be sought and achieved to modify design features as required.

### 7.5.2 *Review Program*

Design Reviews shall take place periodically, as shown in the master schedule, and all along the Design process. The entity in charge of these reviews shall be the Client and/or his Representative.

The Contractor shall submit to the Client and/or his Representative all relevant specification, drawings and calculation note sorted by sub-system.

These reviews will enable the Client to assess overall Design quality and consistency with the required level of performance.

Upon review of the Contractor's Design, the Client and/or his Representative shall issue a set of observations to the Contractor, specifying "Objection" if necessary.

"Objection" will be stated where the Client and/or his Representative has detected a specific feature of the Contractor's Design which does not comply with the specifications detailed within the present document.

Upon statement of this Objection, the Contractor shall propose a remedial action or an alternative design solution to achieve the correct Design requirement.

The final delivery of the Shop Drawings and its related documentation shall be deemed accepted with no objection if no observation has been made within one month after its issue. The Contractor shall then be authorized to continue the execution of its services under the Contract.

## 7.6 *Construction Supervision*

The Contractor shall take appropriate measures to be able to answer questions arising from the Client and/or his Representative during Construction Works.

The Client and/or his Representative will check and supervise the following:

- System tests in factory or at designated locations
- System installation on site
- System Acceptance Tests on site

### 7.6.1 *Contractor's Quality Control of the Works on Site*

The Contractor shall:

- Provide a control system in order to ensure quality control by phased inspections as follows:
  1. Preparatory Phase Inspection:



## BAGHDAD UNDERGROUND METRO

Perform inspections prior to commencement of each part of the works, which shall include a review of requirements with the supervisors directly responsible for that part of the works. Such reviews shall be in the form of written statements of the processes to be followed, and critical characteristics, tests and similar evaluations which will be a part of inspection procedures. Verify that all applicable technical documentation are available and valid for construction, that products incorporated with that part of the works have been approved and tested and applicable submissions have been made for control testing. Verify that preceding work has been completed, and that work conforms to submission data and contract requirements and that necessary materials and equipment are readily available.

### 2. Continuing Inspections:

Perform inspections on a continuing basis as each part of the works commences and on a regular basis following to ensure constant compliance with contract requirements.

Provide samples of materials to be tested in required quantities at locations where testing is performed.

- Provide labour, instruments, testing devices, facilities, and required shelter at the site:
  1. To determine ambient and material temperature by thermometers with Celsius scale.
  2. To determine relative humidity of air and moisture content of materials.
  3. To facilitate inspections and tests.
  4. to obtain and handle samples at site and plant.

Upon receipt of items at the job site, the Contractor's quality control representative at the site shall be responsible for noting any damage suffered by the items during shipment, and for directing that they will be replaced. The Contractor's Representative shall also ensure that approval is obtained for any material delivered to site, or is in accordance with previously obtained approval thereof.

- Be responsible for protecting and maintaining items on the site free from damage during storage, erection, installation and maintenance.
- When it is discovered on inspection that work is proceeding with incorrect materials or methods, ensure that corrective actions are immediately implemented and that improper completed work is replaced.

### 7.6.2 Contractor's Quality Control of Off-Site Work The Contractor shall:

- Impose quality control methods at the location of manufacture, fabrication and assembly of items to be incorporated in the works to ensure that they conform to requirements of the Contract Documents. This quality control may not apply to proprietary products except as may be deemed necessary by the Contractor or as directed by the Client.

The Contractor's quality control representative off-site shall be responsible for the release of items before shipment to the job site.

- Notify Client in writing at least 3 weeks in advance of packing of every batch of product components or assemblies so that the Client may have the opportunity, if he so desires, to inspect any such product components or assemblies prior to shipment.





## BAGHDAD UNDERGROUND METRO

Acceptance of product components or assemblies prior to shipment shall not imply final acceptance under the Contract.

### 7.7 Internal Audit

At any moment, the Client can perform an internal audit for the design and/or the construction phase in order to check the correct contract execution by the Contractor.

After this internal audit, the Client shall inform the Contractor about any relevant non conformity. The Contractor shall take all measures required to correct those non-conformities and dully inform the Client about the progress and closing date of these non-conformities.

### 7.8 Quality Assurance Management Plan

#### 7.8.1 Background

The Contractor shall ensure that all relevant resources are mobilized to bear the load of the Quality obligations during the Project, and that they are fully in possession of all means necessary to meet the requirements specified hereafter.

#### 7.8.2 Content

The Quality Assurance Management Plan shall include the following but shall not be limited to:

- Applicable standards and regulations
- Quality indicators
- Documentation control procedures
- Modification Control procedures
- Quality procedures related to Fabrication, Construction and testing activities
- Quality Control procedures

In addition, the following documents shall be considered as part of the Quality Assurance Plan:

- Software plan
- Modification control plan
- Quality control plan

#### 7.8.3 Quality Assurance Indicators

The Contractor shall define in the QAMP a set of Quality Assurance Indicators in order to assess continuously that the delivered products and services are in accordance with the requirements of the contract and the applicable standards and regulations. Those indicators, as part of the QAMP, shall be submitted to the Client's approval.



## BAGHDAD UNDERGROUND METRO

The Quality Assurance Indicators shall provide the Client with a view regarding the following, but shall not be limited to:

- Design drawings delivery and review quality status
- Procurement/Fabrication quality status
- Construction/Installation quality status
- Testing and commissioning quality status

Quality Assurance Indicators values shall be reported to the Client on a monthly basis and will be compiled graphically to show trends in a 6 months window curve Quality Assurance Plan Evolutions.

In the event that the first issue of the QAMP is incomplete, it shall be recorded as initial version until completion.

The complete QAMP shall be agreed upon by the Client and thus become contractual.

Any updates and/or additions to this QAMP shall be agreed upon internally by the Contractor before being issued for Client's approval.

### 7.9 Development Software Quality Specifications

#### 7.9.1 Software Quality System

No later than 2 months after the Commencement Date, the Contractor shall issue a Software Quality System to the Client, where the development, the implementation and the tests for software programs specific to the Project will be detailed.

#### 7.9.2 Software Quality Plan (SQP)

The SQP shall define the organization, resources, means and methodology that will enable the programming, the production, the testing, the implementation and the documentation of software development activities.

It shall also define the model of Cycle Development chosen for the software. The phased development activities and the verification stages shall be clearly defined.

It shall include the following stages as a minimum:

- General and detailed functional specifications
- Software structure and development
- Coding and parameter setting
- Unit tests
- Software integration methodology
- Software test and validation

Each of these stages shall be refined by describing:

- Input data



## BAGHDAD UNDERGROUND METRO

- Output data
- Specific quality and control actions

### **7.9.3 Transfer**

The Client shall be granted the full and unlimited license rights of all software's specifically developed for the project.

### **7.9.4 Traceability**

The Contractor shall define and implement all the necessary dispositions to ensure traceability between tests and the configuration of the tested product.

This traceability shall allow:

1. To know the state of the equipment or sub-system when being tested (material components and software's)
2. To know the state of interfaces between equipment and sub-systems
3. To recover equipment / sub-system configuration to analyse results
4. To identify changes made to the equipment

## **7.10 Modification Control**

The Contractor's modification control tools and plan shall be presented to the Client by the Contractor no later than 2 months after the Commencement Date and they shall be in compliance with its Quality Assurance Plan.

### **7.10.1 Modification Control Plan (MCP)**

The Modification Control Plan, , shall precise the modification process and the modification control tools that will be implemented on the project development, as well as the identity of the entity in charge.

### **7.10.2 Non-Conformity**

Any non-conformity noticed by the Contractor shall be treated by internal quality procedures.

## **7.11 Quality Control**

### **7.11.1 Quality Control Plan (QCP)**

The Quality Control Plan, no later than 2 months after the Commencement Date, shall precise the nature and periodicity of all internal quality controls that will be implemented on the Contractor's production, as well as the identity of the entity in charge .



## BAGHDAD UNDERGROUND METRO

### ***7.11.2 Commissioning Control***

All controls and tests of incoming products (sub-contracted products or supplied goods) shall be defined. The related results shall be recorded and managed as part of the Quality documentation of the Project.



## BAGHDAD UNDERGROUND METRO

### 8. DOCUMENTATION & CONFIGURATION CONTROL

#### 8.1 Configuration Control

The Contractor shall keep updated the Configuration of the System.

The Contractor shall implement a Configuration Control System, which scope shall cover documentation, materials and software pertaining to the Metro as a whole.

The Configuration of the System shall record the authorized version of any part, piece of software and document related to the System. It shall also record the technical breakdown of the System, including specific configuration of similar items installed at different locations, or performing different functions in the System.

This Configuration Control System shall feature all relevant procedures and tools to control and manage all evolutions and anomalies.

Such procedures and tools shall be detailed within a Configuration Control Plan, due to be submitted no later than 1 month after the Commencement Date.

The Configuration Control Plan should include software configuration, and also the following:

- Configurations item definition
- Configurations item breakdown
- Reference configuration, associated schedule and documentation

A list of configuration items shall be produced as part of the Configuration Control plan, which shall detail, inter alia:

- List of last valid specifications
- List of valid drawings
- List of control and testing procedures
- List of valid software

All documents shall be recorded featuring:

- Title
- ID number
- Revision number
- Validity date



## BAGHDAD UNDERGROUND METRO

### 8.2 Documentation Control

#### 8.2.1 Documentation Control Plan

The Contractor shall develop its procedures with regards to Internal Documentation Control through a Documentation Control Plan, which shall be due no later than 2 months after the Commencement Date.

Deliverable Documentation Control is part of the Contractor's responsibilities. The Contractor shall take all measures for assuring proper internal interface management.

The Contractor shall implement an Electronic Documentation Management System (EDMS) using a specific tools (such as Aconex or equivalent). The EDMS shall be accessible to any actor of the Project (Client, Contractor, Sub-Contractor, Client's Representative, Client's Consultants, ICE, ISA, etc...).

#### 8.2.2 Documentation Control System

The Contractor shall manage the whole Documentation System related to the Project in compliance with the Quality Plan and the Documentation Management Procedures.

The Documentation includes, but is not limited to:

- Project Management documentation
- Design and Build documentation
- Technical documentation (including but not limited to functional and technical specifications, software requirement specifications, purchasing specifications, installation requirement specifications, test procedures, general arrangement drawings, shop drawings, as built drawings, software programming codes...)
- Maintenance documentation
- Operation documentation
- Training documentation
- Contracts
- Reports
- Electronic documents
- Data, voice and video recordings

The Contractor shall:

- Store a non-modifiable electronic file of each version of each document
- Store a modifiable electronic file of the last version of each document issued by the Contractor
- Save monthly on an external media (DVD, tape, external hard drive...) the Documentation System and store the media outside the System premises with no limitation of time





## BAGHDAD UNDERGROUND METRO

- Save daily on an external media (DVD, tape, external hard drive...) the Documentation System and store the media inside the System premises for one month
- Make sure that files are clearly marked as applicable or non-applicable according to the case
- Make sure that printed documentation is spread over the right locations at the applicable version
- Make sure that non-applicable printed versions of the documentation are removed and marked as non-applicable

### **8.2.3 Means & Logistics**

Upon prior approval by the Client, the Contractor shall set up a numeric database. This service should be available to the Client at any time, by mean of a dedicated website.

### **8.2.4 Breakdown & Codification**

The Contractor will develop its codification system in line with the principles given by the Client.

Nevertheless, specific numbering shall be given to documents pertaining to

- Shop Drawings
- As Built Drawings
- Operation & Maintenance Documents

### **8.2.5 Transmission Procedures**

Documentation transmission procedures between the Client, the Contractor and any relevant Third Party shall be proposed by the Contractor, dealing both with paper and numeric data. These procedures shall comply with the related Quality procedures and shall be submitted to the Client and/or his Representative for approval.



## BAGHDAD UNDERGROUND METRO

### 9. DESIGN REQUIREMENTS

The Contractor shall start the Design phase as soon as the Commencement Date has been issued, based upon functional and performance specifications, and the following dispositions.

The Contractor shall be responsible of the global coordination and interface management between different design packages and with external entities. This design shall be an integrated design at the scale of the project.

The Contractor shall be responsible for performing all sites investigations including topographic surveys, geological and geotechnical surveys, utilities surveys, etc... In case data are provided by the Client, the Contractor shall take all necessary measures to check these data and make sure they are in accordance with site conditions.

The Contractor shall demonstrate in his design documentation the correlation between specifications and actual compliance during integration and functional testing.

#### 9.1 Design Process

##### 9.1.1 Identification of relevant design packages

Within 2 months after the Commencement Date , the Contractor shall provide a list of all the different design packages.

##### 9.1.2 Design production program

The Contractor will provide a list of all the technical deliverable documentation relating to each design package no later than 2 months after the Commencement Date. This list will compile all documents with their pre allocated code numbers and their envisaged date of issue.

##### 9.1.3 Design review

The Contractor shall review the current design as defined in the Contract documents.

While keeping the main functional performances, architectural outline and alignment and general layout principles, the Contractor shall improve, modify, adjust, optimize this design and develop his design.

Before starting the shop-drawing production, the Contractor's detailed design will be reviewed by the Client. Only after the Client's consent is granted, the Contractor can carry on with the following design activities.

#### 9.2 General Arrangement Drawings

The Contractor shall start the general arrangement drawings phase as soon as the Commencement Date has been issued, based upon functional and performance specifications, and the following dispositions. These drawings shall include all Metro specifications and systems related to:

- Metro alignment
- Station and technical rooms locations
- Equipment implementation,



## BAGHDAD UNDERGROUND METRO

- Equipment main characteristics,
- Rolling stock main characteristics (cross-section, dimension, performances)

The general arrangement Drawings and its related documentation shall be delivered to the Client no later than 4 months after The Commencement Date.

The Contractor shall develop his drawings production using Building Information Modelling (BIM) process. The Contractor shall perform training on BIM for 10 Client's staff.

### 9.3 Shop Drawings and Related Documentation

Design features at shop drawings level such as specifications, drawings and calculation notes shall be performed by the Contractor for all components of the Baghdad Underground Metro.

The Contractor shall define the performances, interfaces, quantities and details of the Metro components, based upon technical specifications and drawings and through performing further Design.

Consistency between Shop Drawings and all related documentation shall be the full responsibility of the Contractor.

A particular schedule shall be submitted by the Contractor to the Client, including scheduled delivery dates of the technical documentation, drawings and specifications. This schedule shall feature at least:

- Presentation note by technical discipline and geographical zone
- Technical systems (fluids, electrical, etc.)
- Materials description
- Shop Drawings
- General and detailed layouts and drawings
- Interface layouts and drawings
- Schedules
- Technical and functional specifications

All Shop Drawings and related documentation shall be delivered to the Client no later than 6 months after The Commencement Date.

#### 9.3.1 Definitions of Types of Contractor's Drawings

##### 9.3.1.1 Combined Services Shop Drawings

The combined services shop drawings refer to the drawings showing the spatial co-ordination and inter-relationship of the roads, network routes and engineering services, and their integration into the civil, structural, landscape, and architectural elements in detail. Such drawings should be provided at a scale of 1:1000, 1:500, and 1:200. The Contractor has to submit his proposed drawing scales to the Client for checking. Detail drawings shall be prepared to a scale of not less than 1:20. Combined services drawings shall be prepared in such detail as to demonstrate that the engineering services will



## BAGHDAD UNDERGROUND METRO

be properly separated from each other and can be installed, maintained and replaced in a proper workmanlike manner at the location and space provided.

With respect to underground service installations, including but not limited to drains, sewers, water and treated effluent, electrical, telecommunication, communication and control cables, combined services shop drawings will consist in detailed drawings indicating all existing and proposed below-ground services based on the installation drawings prepared at the same time for each respective service. They should include their relationship with other temporary or permanent construction works such as roads, footpaths, landscaped areas, foundations, retaining walls, service ducts, bridges and river works, etc...

### 9.3.1.2 *As Built Drawings*

As Built drawings refer to the drawings, diagrams and Schedules produced in order to provide an accurate record of all the works as installed which shall:

- (a) Show the disposition and depth of all cables, pits, ducts, pipes, etc, buried direct in the ground, recorded with all necessary dimensions at intervals and where change of direction occurs. Increase or decrease in the number of cables shall be indicated at every point where the cables enter into or emerge from cable ducts and conduits. Sections across service routes shall be included at intervals locating all services and shall show all cables in pits and ducts to a scale of 1:50, 1:20. The Contractor is to submit his proposed drawing scales to the Client for checking.
- (b) Show clearly on site drawings new constructions, together with all other existing constructions and other permanent features, with dimensions between such constructions and cables and the distance between joints, etc, clearly marked.
- (c) In respect of electrical works, show any other items required by the Installation Drawings.

### 9.3.1.3 *Temporary Work Drawings*

Temporary work drawings refer to the drawings, diagrams and schedules and on-site recordings which provide an accurate record of all temporary work requirements and operations.

They should:

- (a) Show clearly the extent and the requirements of the temporary works. The Contractor is to submit his proposed drawings, describe the intent and extent of temporary works to the Client for checking.
- (b) Show clearly temporary construction requirements on site drawings, together with all other existing constructions and other permanent features, with dimensions between such constructions and cables and the distance between joints, etc, clearly marked.
- (c) In respect of electrical works, show any other items required by the Installation Drawings.

### 9.3.1.4 *Drawings to be Supplied by the Contractor to the Client The Contractor shall:*

- Prepare and submit before starting the relevant work , all drawings listed here after. Drawings shall be based on the Contract Drawings and shall take into account any



## BAGHDAD UNDERGROUND METRO

modifications to the construction works incorporating details of the actual items to be installed.

- Prepare and submit all necessary Schedules of Equipment as applicable with the relevant drawings.

List of type of Contractors' drawings required to be submitted to the Client:

1. Combined Services Shop Drawings
2. Shop Drawings
3. Manufacturer's & Equipment Drawings
4. As Built Drawings

The effect of any authorized variation or site instruction shall be carried through and shown on all applicable drawings by the Contractor.

### 9.3.1.5 Signature on Contractor's Drawings

Each drawing submitted by the Contractor shall be signed by the Contractor to confirm that:

1. The work shown thereon has been co-ordinated both in sequence of installation and in physical relationship to the work of others.
2. The drawing does not contain any variations other than those authorized by the Client's instruction.
3. On re-submittal, all alterations made since initial submission have been clearly annotated on the drawing and listed separately in the title block.

### 9.3.1.6 Shop Drawings

Shop drawings refer to the drawings based on the Contract Drawings and/or Combined Services Drawings. The drawings shall be developed further, showing details of the Contractor's proposals for the execution of the Contract Works. All development of shop drawings and details shall be done upon obtaining clarification of design intent and content from the Client and shall not be based on Contractor's interpretations thereof. Based on correct design clarification, the Contractor can make proposals for the execution thereof.

The minimum scales for shop drawings shall be as follows:

- |                                |                      |
|--------------------------------|----------------------|
| - General arrangement drawings | 1:1000, 1:500, 1:200 |
| - Details                      | 1:50, 1:20, 1:10     |

The Contractor has to submit his proposed drawing scales to the Client for checking. Tender drawings or parts thereof shall not be used as base negatives for shop drawings.

In respect of drainage drawings, manholes and access points shall be shown and dimensioned to take into account walls, paving and other adjacent permanent works.

In respect of electrical installations, the drawings shall include but are not necessarily limited to:

- (a) Site general electrical reticulation and distribution including cable routes
- (b) General layout drawings of all plant and equipment



## BAGHDAD UNDERGROUND METRO

- (c) Single line drawings for main and sub-main distribution
- (d) Cabling and wiring connections, showing cable types and sizes
- (e) Lighting layouts detailing positions and types of luminaries wiring connections
- (f) Communication systems wiring, terminal equipment types and functions, wiring routes and details
- (g) Other power supply systems and changeover arrangements including schematic and detailed wiring with identification of normal/essential/emergency source

Shop drawings which are required have to be submitted to the Client. The submission shall include detailed information, templates and installation instructions required for incorporation and connection of the work concerned.

Information provided on shop drawings shall include but shall not be limited to the following, as applicable:

1. Fabrication and erection dimensions
2. Erection Layout
3. Installation dimensions
4. Provisions for allowable construction tolerances and for movements and deflections induced by shrinkage, creep, dead and live loading
5. Details to indicate construction arrangements of the parts and their connections, and interconnections with other work
6. Location and type of anchors, and exposed fastenings
7. Materials and finishes
8. Physical dimensions of materials, including thickness and gauges
9. Schedule for reinforcement bending, equipment and other items
10. Suppliers' catalogues, brochures, data sheets, standard drawings, specifications, and other descriptive data
11. Diagrams of systems, equipment and controls
12. Piping, duct and conduit systems
13. Descriptive names of equipment
14. Mechanical and electrical characteristics when applicable
15. Relationships and installation details of mechanical and electrical equipment to the spaces in which they will be installed
16. Information to verify that superimposed loads will not affect function, appearance, and safety of the work detailed as well as safety of interconnected work
17. Assumed design loading, dimensions and material specifications for load-bearing members
18. Locations of chases, sleeves, cuts, and holes in the structure





## BAGHDAD UNDERGROUND METRO

### 19. Size of all openings, penetrations and sleeves in walls, slabs and any structural part

The work shall be exactly built as shown on shop drawings. If shop practice dictates revisions, the drawings shall be revised and have to obtain approval.

One reproducible copy of each finally revised and corrected shop drawing shall be filed on site. Shop Drawing Review:

1. Shop drawing review is for the sole purpose of ascertaining general conformance with the design concept. This review shall not mean that the reviewer and Client warrant or represent that the information contained on the shop drawings is either accurate or complete, responsibility for which shall remain with the Contractor, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting design requirements and all other requirements of the Contract Documents.
2. The Contractor is responsible for confirmation and correlation of dimensions at the job site, for information that pertains to fabrication processes or to techniques of construction and installation, and for the overall coordination of the Works.
3. The Contractor shall not be awarded any extra time or compensation for modifications required to design drawings as a result of coordination and other modifications required during the course of the work.

#### 9.3.1.7 Coordination of Drawings

The Contractor shall ensure that all Drawings are co-ordinated in respect of specialist suppliers who are relevant to the complete system. These drawings shall be compatible, correctly annotated and cross-referenced at their interfaces.

The Contractor shall coordinate the shop drawings prepared for one section with the requirements of other sections before shop drawings are submitted for review to ensure the proper and complete installation of all parts of the works.

The drawings shall be prepared in a way to indicate the methods used to coordinate the installation of a system with other systems when critical relationships between each system occur. The Contractor shall ensure that all details of equipment, apparatus, and connections are coordinated.

The Contractor shall ensure that clearance required by applicable laws and regulations and necessary for proper maintenance are indicated on drawings.

In addition to the specified shop drawings, the Contractor shall prepare Combined Services drawings showing coordination of the architectural, civil, structural, mechanical and electrical works as applicable to ensure its proper, integrated and complete installation. Combined Services drawings shall show dimensions, architectural, civil and structural details, piping, conduit, equipment, fixtures and other installations to ensure adequate clearances for installation and servicing. The Combined Services drawings shall be produced at a scale consistent with the Client requirements but the scale shall not be under 1:100.

The method for coordination and the combined services drawings shall be submitted to the Client for review only in cases where conflicts affect the intent of the Contract Documents. Procedures and



## BAGHDAD UNDERGROUND METRO

conditions specified for shop drawings shall also apply to coordination and combined services drawings submitted to the Client for review.

### 9.4 As Built Drawings And Related Documentation

Upon completion of Construction works and before the issue of the Taking-Over Certificate, the Contractor shall submit a package including all As Built drawings and related documentation.

This documentation which reflects the as built configuration of the buildings and systems shall be complete and without corrections, omissions or errors.

#### 9.4.1 As Built Document Submittals

**As Built Drawings:** Prior to requesting the Client to issue the Substantial Completion Certificate, the Contractor shall prepare and submit as-built drawings.

**Record Samples:** Immediately prior to the time(s) of initial completion, the Client will meet with the Contractor on site, and will determine which of the submitted samples maintained by the Contractor during the progress of the work are to be kept for record purposes.

**Miscellaneous Record Submittals:** Immediately prior to the time(s) of initial completion, miscellaneous records shall be completed and placed in good order, properly identified and bound or filed and ready for future use and reference. They have to be submitted to the Client for record.

**Operation and Maintenance Manuals:** operation and maintenance information shall be organised into suitable sets of manageable size and bind into individual binders, properly identified and indexed (thumb-tabbed)

The Contractor shall provide all necessary storage fittings for the storage of the as-built drawings and the manuals.

#### 9.4.2 Operating and Maintenance Instructions

The Contractor shall arrange for each installer of work requiring continuing maintenance or operation to meet with the operating personnel at the project site to provide basic instructions needed for proper operation and maintenance of the entire work. The Contractor shall include instructions by manufacturer's representatives where installers are not expert in the required procedures. The Contractor shall review maintenance manuals, record documentation, tools, spare parts and materials, lubricants, fuels, identification system, control sequences, hazard procedures, cleaning and similar procedures and facilities. For operation of equipment, the Contractor shall demonstrate start-up, shutdown, emergency operations, noise and vibration adjustments, safety, economy/efficiency adjustments, and similar operations. The Contractor shall review maintenance and operations in relation to applicable guarantees, warranties, agreements to maintain, bonds, and similar continuing commitments.

### 9.5 Value Engineering

The Contractor is required to propose to the Client any modification or improvement he considers as possibly beneficial for the Client. This can include but is not limited to modifications that:

1. Reduce the global cost.



## BAGHDAD UNDERGROUND METRO

2. Improve RAM targets.
3. Reduce the time for completion.
4. Increase the system performances and/or the quality of service
5. Reduce the Life Cycle Cost.

The Contractor shall submit the proposals with a description of the technical solution, the description of the expected advantages over current design, the expected impact on cost, schedule and performances.

In the Tenderer's proposal, Value Engineering is to be presented by the Contractor through examples of modification/improvement that could be made on Baghdad Underground Metro.



## BAGHDAD UNDERGROUND METRO

### 10. TRAINING PLAN

The Contractor shall develop a Training Plan to be submitted for Client's approval.

Contractor's management plan and the set of the procedures developed by the Contractor for the purpose of the Project shall reflect them. In case of discrepancies with the main document, the latter shall prevail. All costs related to the training of Client's shall be at the Contractor's own expenses.

Two types of training shall be carried out:

- Training abroad at least for two months.
- Training in Iraq at site at least for six months.

Therefore a detailed training programme with time table, course duration, no. of trainees of each type, training location methods and information content shall be submitted by the Contractor during the execution stage according to needs and advices of Client and that the Contractor undertakes to abide without any objection without any extra cost.

#### 10.1 Content

This plan shall address how the Contractor will provide adequate technical training and how he will certify the qualification of the Operation and Maintenance staff.

#### 10.2 Pedagogic Documentation

Trainees shall be supplied with adequate documentation and tools to attend the programs, such as:

- Audiovisual documentation
- Equipment and specific tools necessary for hands-on experience

Operation & Maintenance Documentation shall be written by the Contractor in a way that it can also be utilized as a Training manual.



## BAGHDAD UNDERGROUND METRO

### 11. EXTERNAL INTERFACES

#### 11.1 Definition

External interfaces represent all facilities, works or co-activity that are outside of the Project perimeter and that could interfere with the Contractor's duty while performing his works.

These facilities, works or co-activity are also fully outside of the Contractor's scope of supply.

#### 11.2 Specifications

The Contractor shall seek the best ways of cooperation with all relevant Third Parties to control external interfaces so as not to impact the construction schedule and shall reduce potential risks generated by co-activity.

Connection to existing facilities and services that may be outside of the Contractor's scope shall be performed in a smooth and efficient way, so as to minimize impacts on adjacent works, existing functionalities and services.

The Contractor shall lead any further analysis he thinks appropriate to identify all existing and projected functional and spatial external interfaces.

The management of the external interfaces shall be detailed in the Stakeholder Management Plan.



## BAGHDAD UNDERGROUND METRO

### 12. SITE LOGISTICS

#### 12.1 Use Of Land Site Working Space

The Contractor shall take note of the area for construction operations available within the site area and shall confine his apparatus, storage lots of materials, and operations of his workforce within those confines and to the direction of the Client, and shall not unreasonably encumber the site with untidy material.

The Contractor shall allow site areas for sub-Contractor use and shall be responsible for his obligations upon such sub-Contractors.

The Contractor will not be allocated staging areas outside the site boundaries.

The extent of the Site shall be determined in Drawings which identify areas of potential temporary and permanent land take. The Contractor shall take into consideration:

1. Constraints defined in the request for proposal.
2. Character of works to be performed and staging.

The Contractor is responsible not only for setting the Site boundaries but also for getting all the necessary authorisations from concerned Agencies (Police, Traffic Authority, etc...).

Areas of land outside the land-take for the Permanent Works areas shall not be considered as a Site construction area unless Permanent Work is specifically identified on the construction drawings to be carried out. Should no specific boundary be marked on the drawings, the Contractor shall assume that he shall carry out his operations within the boundaries identified as intended for the Permanent Works only. The Contractor shall organise his operations to work within the available area without any additional working space.

The Contractor may, however, utilise temporary land-take areas as long as they are reinstated to the original condition at the end of the Work, at his own expense and with previous agreement of the Local Authorities.

##### *12.1.1 Protection of natural resources*

It is intended that the natural resources within the vicinity of the works shall be preserved in their existing condition, or be restored to an equivalent of the existing condition, as checked by the Client, upon completion of the work. The Contractor shall confine his site construction activities to areas defined by the drawings and specifications.

##### *12.1.2 Protection of existing highways and property*

1. Debris or rubbish of any kind shall not be dumped onto or be allowed to fall on to adjacent property, or on to highways. Care shall be taken to prevent damage and injury to personnel and vehicles using highways, or pedestrian ways. Devices shall be provided and maintained by the Contractor as required to prevent such occurrences. Any material or items falling on to adjacent property or on to highways shall be promptly removed.





## BAGHDAD UNDERGROUND METRO

2. Streets, walks and other passageways anticipated to be closed to public access due to construction, demolition, or other related activities shall not be closed until an alternative routing plan is established and written approval given by the Client, or jurisdictional authorities.

### **12.1.3 Land resources**

1. Construction Facilities: The location of the Contractor's staging area, storage area, and temporary facilities on public or privately owned property required temporarily in the performance of the work, if not shown on the drawings, shall require checking of the Client. The Contractor shall maintain the site in conformance with applicable local statutes, ordinances, regulations, and rulings. He shall not store unnecessary materials or equipment on the site and shall take care to prevent any structure from being loaded with a weight or in a manner that will endanger its security or the safety of persons. The Contractor shall not store materials or encroach upon private property without the written consent of the Clients of such private property.

### **12.1.4 Erosion and sediment control measures - Temporary protection of erosion of soils**

1. Such measures shall be taken to effectively prevent erosion, and to control sedimentation.
2. Temporary protection shall be provided on all side slopes and back slopes as soon as rough grading is completed, and as soon as sufficient soil is exposed to require protection to prevent erosion.

## **12.2 Storage**

The Contractor shall not store any materials or plant, except at locations specifically reviewed by the Client and/or his Representative. No materials or plant other than the ones specifically required to perform the task in hand, shall be stored on Site.

The Contractor's attention is drawn to the fact that on the Site only a limited space is available for the erection of Site offices, storage of materials, etc...

The Contractor shall:

- Provide at the site and maintain in good condition suitable and substantial weather-tight storage as required for materials that may be damaged by storage in the open. Position and location of storage areas shall be validated by the Client
- Co-ordinate use by trades of available storage areas. Temporary buildings shall remain the property of the Contractor and shall be removed from the site upon completion of the work. Current layout of storage facilities shall be maintained by the Contractor and be subject to the Client's checking.
- Store products immediately on delivery in accordance with the manufacturer's instructions, with seals and labels intact and legible
- Store products subject to damage in weather-tight enclosures



## BAGHDAD UNDERGROUND METRO

- Maintain temperature and humidity within the ranges specified by the manufacturer's instructions

### Exterior Storage

The Contractor shall:

- Store fabricated products above the ground, on blocks or skids, prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings, provide adequate ventilation to avoid condensation
- Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter
- Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration
- Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging

### Protection after Installation:

1. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Contractor shall be responsible for work and equipment until finally inspected, tested, accepted and a hand-over certificate is issued
2. Protect work against theft, injury or damage; and carefully store materials and equipment received on site which are not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructive material. Remove when no longer needed

### 12.3 Site Services

The Contractor shall be responsible for providing all necessary and appropriate Site services for the construction of the Works, which shall include, but shall not necessarily be limited to:

- Electricity,
- Water,
- Compressed air,
- Communication facilities,
- Temporary background lighting,
- Temporary drainage and sewage disposal,
- Ventilation
- Fire protection
- Gas,
- Fuel,
- Other relevant items.



## BAGHDAD UNDERGROUND METRO

Such services shall be provided by the Contractor and solely used for works related to the proper execution of the Contract. The Contractor shall be responsible for complying with all regulations of the Utility Companies, Local Authorities and other authorities concerned. The Contractor shall be solely responsible for the provision and maintenance of all installations associated with such services and in relation thereto shall take all reasonable precautions to protect the safety and health of all persons as well as to secure the Site. The Client and/or his Representative may direct an immediate disconnection or alteration of such installations, or portions thereof, which he considers to be prejudicial to safety, health or security. The entire Contractor's installations or parts of them no longer required for the execution of the Works shall be entirely removed and the site shall be rendered in the same condition as it was when it was taken over. A survey shall be done before the taking over of the site by the Contractor and before the return by the Client and/or his Representative.

All installations shall fully comply with the relevant statutory requirements. Pipes, tubes, ducts or cables crossing highways, footpaths, or rights of ways shall be ramped over or recessed below the surface.

Should the Contractor wish to utilize a radio system, the review of the Client and the Local Authorities must be sought for such a system to be integrated into any overall system that may be operational on the Site.

### ***12.3.1 Site Offices***

The Contractor shall provide and maintain all necessary temporary buildings for its own use and the use of any SubContractors as ICE or ISA. The buildings shall be of a design to be checked by the Client including erection, shifting, and altering when necessary and to allow for landscaping Works and removing the same on completion of the Works.

The site offices shall include the following:

- (a) Storage sheds for materials and materials of SubContractors
- (b) Workshops
- (c) Office for Contractor
- (d) Sanitary accommodation

All buildings shall be fully equipped for the purpose for which they are to be used and kept clean and properly maintained at all times.

The Contractor will be required to provide its own site facilities after Taking Over Certificate to the extent that is required to fulfil its obligations during the whole of the Defects Notification Period.

The Contractor shall construct, operate and maintain whatever camp facilities that he deems necessary for housing and feeding the employees of the Site. All such camp construction shall conform to applicable Local and National Health Regulations. The camp facilities provided shall be subject to the review of the Client.

Upon completion of the construction work, the camp shall be removed by the Contractor and the camp sites shall be cleared and cleaned to the satisfaction of the Client of the land on which the camp sites have been located.



## BAGHDAD UNDERGROUND METRO

The camp buildings shall be of adequate size and type of construction and shall be suitable to the climatic conditions. Adequate measures shall be taken to maintain law and order in the camps, and to safeguard against fire and electrical hazards. All necessary rules of hygiene shall be observed and the camps shall be kept clean and free of refuse.

The Contractor shall provide resources including skilled workmen, tools, plant and materials to ensure that all temporary buildings and equipment are kept fully maintained and in a good state of repair.

### ***12.3.2 Client/ Representative and Other Consultants Facilities***

#### **Clients Offices**

##### **(a) Office Buildings**

The Contractor shall provide for the sole use of the Client, his Representative and its Consultants offices for 200 persons per line and of a design to be agreed with the Client, including erecting, shifting and altering, when necessary and removing on completion. Individual office surface will not be less than 6 m<sup>2</sup>.

The buildings shall include at least but not limited to:

1. General office for the use of two typists/ secretaries and 1 receptionist, capable of holding the relevant desks and storage cupboards required
2. Separate meeting room of a capacity up to 20 people
3. Executive Offices
4. Individual offices
5. Large space plan office (Area = 100m<sup>2</sup>)
6. Kitchen
7. Bathrooms with two compartments for the installation of W.C. and washing facilities
8. Storeroom of 20m<sup>2</sup> with shelves/racking as required

##### **(b) Office Fit Out**

The offices shall be fully air-conditioned, carpeted, and furnished as scheduled. If the offices are of prefabricated construction then brochures, photographs, etc. must be submitted for the Client's review, prior to their installation.

The offices shall be located separately from the Contractor's facilities and well protected by a security and visual barrier to the satisfaction of the Client.

The facilities shall be fully maintained and cleaned and attendance provided at all times. The Contractor shall provide supplementary labour, as required in the relevant paragraph herein, skilled or otherwise as necessary, to carry out typing (English and Arabic) and similar administrative duties, clean and maintain the offices, maintain all equipment, prepare and serve refreshments and provide general attendance on the Client and/or his Representative, its staff or its Consultants.

All utilities shall be provided continuously and maintained at the Contractor's expense. The telephone shall be installed and maintained by the Contractor including service and connection charges, and local call charges.

The Contractor shall notably provide:



## BAGHDAD UNDERGROUND METRO

- Fully equipped computers (Microsoft Office, AutoCAD, PrimaVera,...) connected to Internet,
- Photocopying facilities,
- Plotter
- 10 all-terrain vehicles per line,

The maintenance of all the facilities listed above shall include the cost of all consumable required for the proper functioning of the offices, such as, but not limited to; paper for photocopying and typing, cleaning fluids and equipment, drinking water, various substances for the proper functioning of photocopying equipment.

### (c) Measurement and payment

The Client's offices cost specified in (a) above shall be included in the lump sum price.

The site facilities shall be provided for the use of the Client, his Representative and its Consultants up to the end of the Contract Period, or for such shorter time period as may be directed by the Client. At the end of the Construction Period, or such earlier time as may be designated by the Client, the offices, facilities, furniture and equipment, which shall remain the property of the Contractor, shall be removed by the Contractor from the Site, the Site being left clean to the satisfaction of the Client.

### 12.4 Contractor's Site Accommodation

The Contractor shall provide and maintain, at his own cost, Site accommodations at locations consented by the Client and/or his Representative. Offices, sheds, stores, canteens, workshops and other accommodation on the Site shall be maintained in a clean, stable and secure condition.

The Contractor shall be responsible for adapting the space inside the Site according to his own requirements. He shall bear all costs including all associated utility costs. The Contractor shall be responsible for providing Site accommodation buildings with water, electricity, telephone, sewage and drainage facilities. The Contractor is responsible for making all arrangements with and obtaining the necessary consent from the relevant authorities for the facilities.

All temporary structures shall be kept neat, tidy, orderly and in acceptable condition and appearance. The Contractor shall provide facilities including skilled workmen, tools, plant and materials to ensure that all temporary buildings and equipment are kept fully maintained and in a good state of use.

The Contractor shall adequately maintain and repair all temporary facilities, and ensure that all installations operate efficiently.

All areas being used for Site accommodation cannot go past the Works Site boundaries.

### 12.5 Material And Storage General Requirements

As on Site storage of materials is strictly limited, the Contractor will be required to deliver only materials necessary for immediate incorporation into the Works. All materials being used for the Works must be stored within the confines of the Works Site boundaries. No storage or standing shall be permitted on adjacent roads or access routes.

Such areas shall be prepared by the Contractor to a standard suitable for receiving a particular material and shall be maintained in a clean and orderly manner that keeps them vermin free at all times.



## BAGHDAD UNDERGROUND METRO

All costs associated with provision, preparation, maintenance and occasional relocating of the Contractor's accommodation and storage areas are deemed to be included.

Use of private area can be considered by the Contractor at his own cost and with prior permission of the concerned entities.

### **12.6 Rubbish Removal**

The Contractor shall arrange daily collection and removal of all rubbish and debris arising from the Works. Loading, removal and disposal of all collected rubbish from the Site shall be the responsibility of the Contractor.

#### ***12.6.1 Contractor's cleaning responsibility***

The Contractor shall collect rubbish and old materials resulting from the work on a daily basis. The Contractor shall remove from the work area site debris, resulting from the work on a daily basis or as often as necessary if those rubbish interfere with the Works or presents a fire hazard. An adequate number of cleaning personnel shall be provided during working hours, who shall keep all parts within and adjacent to the project free from debris.

#### ***12.6.2 Rubbish disposal***

The Contractor will furnish containers at central collection locations as designated on the site to receive construction debris. Containers shall be removed as often as necessary to minimise interference with work in progress. Cost of rubbish disposal shall be the responsibility of the Contractor.

#### ***12.6.3 Site cleaning***

The Contractor shall co-ordinate the cleaning of the site around the project and shall maintain it clean and free from food and beverage containers, waste and other debris. The Contractor shall provide and rigidly enforce the use of waste receptacles by all construction personnel. Burning of refuse is not permitted.

#### ***12.6.4 Salvaging materials***

All construction salvage materials, not including items specified elsewhere to be returned to the Client, shall become the property of the Contractor and shall be taken from the project. Storage of materials and equipment on the site, other than for this project will not be permitted.

All rubbish, debris, etc, found on the site at the start of the work shall be removed from the project. Existing buildings, channels, chambers, pipes, etc., which are not meant to remain, shall be demolished and removed by the Contractor upon receipt of the Client's written approval.

#### ***12.6.5 Control and disposal of wastes***

The term wastes includes elements for non-inert, inert and organic (such as tree, plant, and sludge treatment) wastes



## BAGHDAD UNDERGROUND METRO

Excess excavated material that is checked by the Client as suitable may be disposed of on site if a soil disposal area(s) has been identified on the drawings. If no such site is approved the material shall be disposed of.

Trash shall be picked up and placed in containers that shall be emptied on a regular basis. Handling and disposal shall be so conducted as to prevent contamination of the site and other areas. On completion the area shall be left clean and natural looking.

The Contractor shall transport all wastes off the site and dispose of it in a manner that complies with local requirements. The Contractor shall secure all necessary permits or licenses prior to transporting any material off the site. Waste materials shall not be burned on the site.

For construction projects located in an area where garbage collection is accomplished on a scheduled basis, the Contractor shall place garbage in an appropriate container for pickup and disposal. In areas where there is no scheduled garbage collection, the Contractor shall transport the garbage to a pickup point or disposal area checked by the Client. The Contractor shall pay all costs and fees levied in relation to such garbage collection.

Sewage may be disposed of through connection to the existing sanitary sewage systems subject to approval of the Authority. Where such systems are not available, chemical toilets or comparably effective units shall be used with wastes periodically emptied. Provisions shall be included for pest control and for masking or elimination of odours.

Chemical waste shall be stored in corrosion resistant containers, removed from the project site, and disposed of as necessary; but not less frequently than monthly. Disposal of chemical waste shall be in accordance with standard established practices as approved by the Authorities. Fuelling and lubricating of equipment and motor vehicles on site shall be conducted in a manner which affords the maximum protection against spills and evaporation. Lubricants to be discarded, including burned oil, shall be disposed of in accordance with approved procedures meeting local regulations. For oil and hazardous material spills that may be large enough to violate local regulations, the Client shall be notified immediately.

### 12.7 Cleaning

The Contractor shall collect rubbish and construction debris resulting from the work on a daily basis. The Contractor shall remove from the work area site debris resulting from the work daily or as often as necessary if the debris interferes with the work or presents a fire hazard. An adequate number of cleaning personnel shall be provided during working hours who shall keep all areas within and adjacent to the project free from debris.

### RESPONSIBILITY

The Contractor will furnish containers at central collection locations as designated on the site to receive construction debris. Containers shall be removed as often as necessary to minimise interference with work in progress. Cost of rubbish disposal shall be the responsibility of the Contractor.





## BAGHDAD UNDERGROUND METRO

### 12.8 Lighting

The Contractor shall supply all safety lighting required for the Works. The Contractor shall provide, adapt, maintain and clear away after completion his own lighting equipment required for the Works.

In indoor and underground structures an emergency lighting system shall remain in place in case of failure of the main system. The emergency lighting system shall be supplied with batteries which can provide the proper lighting along all the possible evacuation ways for a period long enough as to permit a safe evacuation from any part of it.

The Contractor shall provide all labour, materials, tools, appliances and equipment and perform all operations necessary for the complete execution of a temporary electrical light and power distribution system throughout the project suitable for supplying electrical energy for illumination and for power tools and equipment. Such system shall be installed and maintained in place as required and removed as soon as the permanent equipment can fulfil the same functions . Maintaining shall also mean and include energising and de-energising the electrical systems as need be. The Contractor shall make arrangements with the local utility company for temporary electrical service. If adequate electrical power is not available from utility when needed, the Contractor shall provide temporary diesel generator equipment as needed for construction operations.

### 12.9 Wiring Standards

Temporary wiring and equipment shall conform to the requirements of the applicable local regulations and laws. Terminations shall be provided complete with circuit breakers, disconnect switches and other electrical devices as required to protect the power supply system.

### 12.10 Energy Costs

The Contractor shall pay the Electrical and Water Utility bills, as they become due, for all electrical and water energy used for temporary lighting, power and water, which will be required to perform the Works.



## BAGHDAD UNDERGROUND METRO

### 13. TEST, COMMISSIONING AND SYSTEM INTEGRATION

#### 13.1 System Validation Plan

The Contractor shall develop and submit for Client's review and acceptance a System Validation Plan. It will be the Contractor's responsibility to identify the tasks/activities that will be conducted to satisfy the System Validation Plan. For each test activity determined in the System Validation Plan, the Contractor shall prepare an appropriate test procedure and submit these procedures for the Client's review.

One month after the Commencement Date, a recap of functional, performance and safety requirements set forth in the present document shall be constituted including the "Performance Verification Matrix".

This matrix shall be approved by the Client, and updates shall be made during the Project to integrate changes to the technical reference.

It shall:

- Be created at the beginning of the Contract,
- Address each Analysis (A), each Qualification Test (QT), each Inspection (I) and each Verification Test (T) that each piece of equipment, sub-assembly, sub-system and system to be implemented during the complete development cycle of the Project in order to demonstrate the System operates and performs as planned. Once the "Performance Verification Matrix" has been approved by the Client, it shall be used as an input to the Testing & Commissioning and System Integration Plan.
- Be developed during design phase with relevant calculus notes and drawings
- Be completed upon completion of functional testing, with justification that requirements are met (reports)
- Be finalized upon System commissioning

#### 13.2 Testing & Commissioning (T&C) and System Integration Plan

No later than 12 months before the scheduled start date for testing and commissioning, the Contractor shall submit to the Client a Testing & Commissioning Plan and Integration Plan which shall include as a minimum, the list of tests and their conditions of realization. These tests shall prove compliance with the requirements set in the Contract.

All resources and means necessary to perform the Testing phase shall be mobilized and supplied by the Contractor.

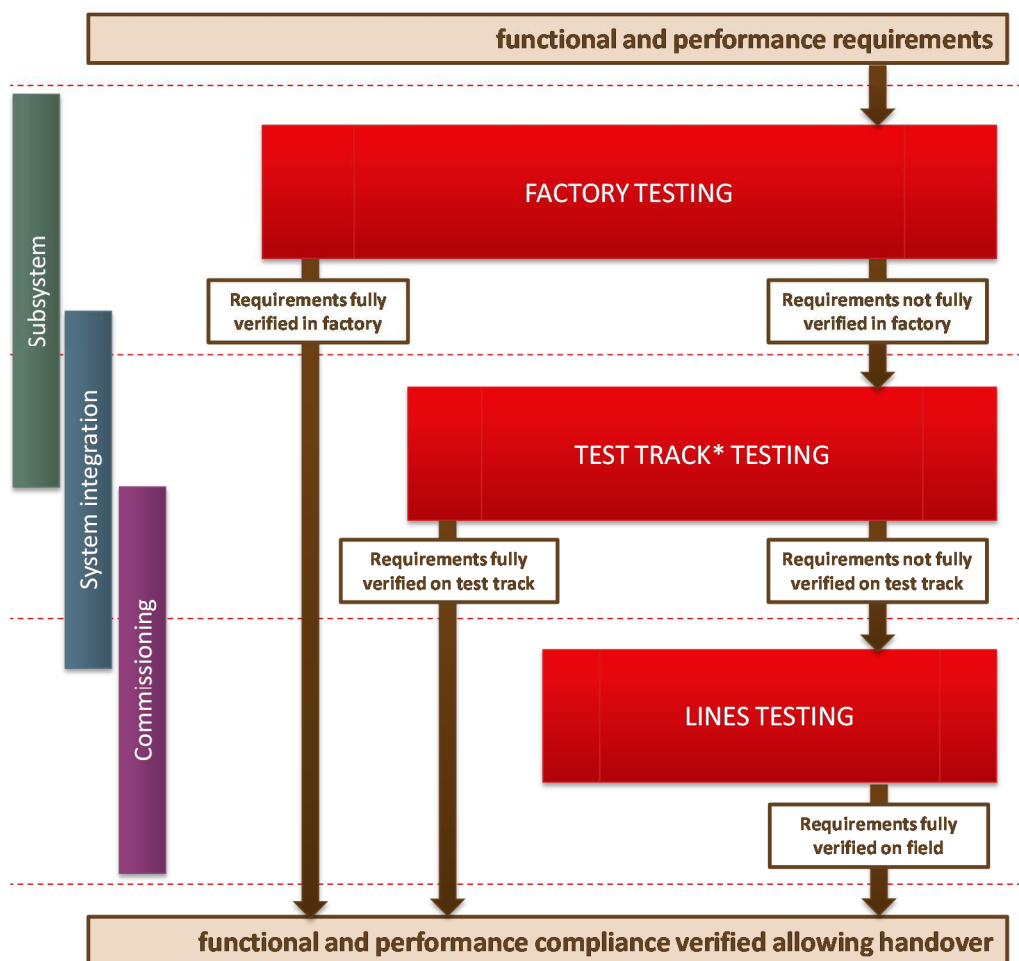
Within the Testing & Commissioning Plan and Integration Plan, the Contractor shall identify all the steps that shall prove the Client that functional, performance and Operating & Maintenance requirements are met. The Testing & Commissioning and Integration Plan shall specify all relevant functional and performance test procedures with reference to the Contract, not be limited only to the Rail System, but shall also include the elements / equipment of the Civil Works that participate to the performance of the Baghdad Underground Metro System.

These procedures shall be submitted to the Client for approval.

## BAGHDAD UNDERGROUND METRO

The below diagram shows the Testing and Commissioning components. The T&C Plan to be developed by the Contractor shall detail each component of the T&C Phase:

**Figure 5: System Testing and Commissioning Components**



\* Test track can be an independent piece of line for type testing purposes, or a designated part of the targeted mainline constructed with anticipation for type testing

### 13.3 Special Requirements

All costs related to tests either on-site or abroad shall be at the Contractor's own expenses. For tests performed abroad, the Contractor shall consider that two Client's Representative will attend the tests.



## BAGHDAD UNDERGROUND METRO

### 14. SHIPMENT

The Contractor shall notify the Client and/or his Representative at least 15 days in advance of any expected date of shipment and give further notice of the actual shipment date.

Two copies of packing list and test certificates shall be attached to each package to be shipped. One copy shall be placed in the package and the other in a water tight cover on the outside of each package. A copy of packing list and test certificates shall be sent to the Client and/or his Representative.

The Contractor shall clear the packages through customs at Baghdad airport or sea port in Iraq and be responsible for all legal requirements such as custom duties, taxes.



## BAGHDAD UNDERGROUND METRO

### 15. DELIVERY

The Contractor shall deliver all the equipment to be supplied under the contract to the site.

The Contractor shall unload all the items at the designated delivery point and positioning or storing them.

Any parts of the equipment that is damaged shall not be considered as delivered unless repairs or replacements have been made.

All documents, manuals, drawings and other deliverables shall be supplied to the Client and/or his Representative.