Bharat Heavy Electricals Limited
Transmission Business Group
Industry Sector
New Delhi – 110 003

TENDER DOCUMENTS

FOR

DEVELOPMENT & IMPLEMENTATION OF

KNOWLEDGE MANAGEMENT BASED

AUTOMATED DESIGN SOLUTION FOR SWITCHYARD

TENDER SPEC NO. TBEM/KM PIR/TENDER 1

DATED : 27.03.06

Bharat Heavy Electricals Limited
Transmission Business Group
Transmission Business Engineering Management,
Industry Sector, Integrated Office Complex, Lodi Road,
New Delhi – 110 003

INDEX

Sl.No.	Description	No. of Pages
1.0	Notice Inviting Tender	03
2.0	Price Schedule	01
3.0	Procedure for submission of sealed tenders	01
4.0	General Terms & Conditions	05
5.0	Vendor Qualifying Criteria	08
	ANNEXURE-A : Vendor Particulars Form	
	ANNEXURE-B : Details of similar jobs executed	
	ANNEXURE-C : Declaration regarding accuracy of details furnished in the offer.	
6.0	Technical Specification (TBEM-510-IT-003)	17

Bharat Heavy Electricals Limited
Transmission Business Group
Transmission Business Engineering Management,
Industry Sector, Integrated Office Complex, Lodi Road,
New Delhi – 110 003

NOTICE INVITING TENDER

REF: TBEM/KMPIR/TENDER 1 **DATED 27.03.06**

SUBJECT : **DEVELOPMENT & IMPLEMENTATION OF KNOWLEDGE MANAGEMENT BASED AUTOMATED DESIGN SOLUTION FOR SWITCHYARD**

1. Sealed tenders are invited for the following work :

Name of work	Time of Completion	Earnest Money Deposit (Rs.)	Tender submission Date & Time	Tender opening date & time
DEVELOPMENT & IMPLEMENTATION OF KNOWLEDGE MANAGEMENT BASED AUTOMATED DESIGN SOLUTION FOR SWITCHYARD	9 months from LOA	1,00,000/- (in form of DD or Pay Order)	**19th May '06 15:00 hrs**	**Technical Bid** : **19th May '06** 15:30 hrs and **Price Bid** : Date of opening of price bid shall be informed to tenderer subject to techno-commercial acceptance of the offer

2. Address for correspondence & submission / opening of tender:

Bharat Heavy Electricals Limited,
Transmission Business Group, Industry Sector,
Integrated Office Complex, Lodi Road,
New Delhi – 110 003
Attention : **Mr. Dilip Datta**, AGM (TBEM)
Phone : 011-4179 3241, Fax ; 011-2436 5869
Email : ddatta@bhelindustry.com

3. Offer shall strictly be in accordance with tender specification and General instructions to tenderer enclosed herewith.

4. **Pre-bid clarifications** - The Bidder shall closely peruse all the clauses, specifications and drawings indicated in the Tender Documents before submission of their bid. If the prospective bidder finds discrepancies or omissions in specifications and document or is in doubt as to the true meaning of any part, he shall at once make a request, in writing for clarifications by **17th April 2006**. BHEL will respond in writing by **28th April 2006.**

5. **Pre-bid conference** will be held on **24th April 2006** at the office of the undersigned our office in New Delhi.
   The bidders are advised to visit the TBG office at New Delhi to have a better understanding of the job. During the pre-bid conference the bidder shall familiarise themselves with the existing system (design process) & various software (e.g. design program, PDMS customisation, Wrench). The bidders are expected to seek and get all necessary clarifications, required for proper understanding of the specification requirements. Bidder shall also assess the existing facilities and infrastructure at the New Delhi office.
   All the clarifications / corrigendum / amendment (if any) shall be posted on our website by **28th April 2006**.

6. **Technical bids** will be opened in the office of the undersigned on **19th May 2006**. If required, technical discussions will be held with bidders for clarifications on the bid. Bidder's representative may be present during technical bid opening. IT WOULD BE PREFERRED THAT OFFERS ARE WITHOUT ANY DEVIATION w.r.t. TENDER SPECIFICATIONS AND THE SAME MAY BE CLEARLY MENTIONED ON THE COVERING LETTER ACCOMPANYING THE TECHNICAL BID. Offers with deviations are likely to be rejected. However, if the bidder insists on any technical or commercial deviations, from the specification and/or tender conditions, the price implication if any, of withdrawing the deviations must be submitted along with the price bid in a **separate sealed envelope** super-scribed "Price implication for withdrawal of deviations". No price implication for withdrawal of deviation shall be accepted at a later date, after the opening of technical bid.

7. **Price bids** will be opened subsequently, after technical bids of all the tenderers have been evaluated and frozen. Prices shall be fixed & firm inclusive of all taxes and duties (variations in taxes and duties, if any, at the time of billing shall be allowed as per actuals) and shall be kept valid for 120 days from the date of technical bid opening. Bidders should quote their most competitive rates, as there will not be any price negotiation. However, if felt necessary by BHEL, price negotiation will be held with lowest bidder (L-1) only.

8. The purchase preference for central PSUs shall be given as per the prevailing Government policy.

For and on behalf of BHEL

(Dilip Datta)
AGM (TBEM)

Bharat Heavy Electricals Limited
Transmission Business Group
Transmission Business Engineering Management,
Industry Sector, Integrated Office Complex, Lodi Road,
New Delhi – 110 003

TO BE FILLED BY TENDERER

Certified that the general instructions and information for tenderer have been read / complied / agreed to and each page of tender offer has been initialled and stamped.

Date: (Signature of tenderer)

Name and Designation of Authorised person(s)
Signing the tender on behalf of the tenderer

Bharat Heavy Electricals Limited
Transmission Business Group
Transmission Business Engineering Management,
Industry Sector, Integrated Office Complex, Lodi Road,
New Delhi – 110 003

PRICE SCHEDULE FOR BILL OF QUANTITY

Sl. No	Description	Unit	Price / Man-months	Remarks
1.1	Phase 1 : System Study & development of Application Programs for design calculation.	**Man month**		Bidder shall quote the number of man months in the un-priced schedule also. The bidder may be asked to re-distribute the man months.
1.2	Phase 2 : Prototype development for a typical layout arrangement.	**Man month**		
1.3	Phase 3 : Full scale development for various layout arrangements.	**Man month**		
1.4	Total of 1.1, 1.2 and 1.3	**Man month**		Total man months shall be fixed and cannot be changed after submission of bid.
1.5	Unit Rate on man month basis	**Rs.**		The man-month rate shall be filled up only in the sealed priced bid.
1.6	Prices for above (1.4 x 1.5)	**Rs.**		
2.1	Training at New Delhi	**Rs. Lumpsum**		Price shall be inclusive of travel / boarding / lodging cost/ training for 15 days each at Bhopal & New Delhi.
2.2	Training at Bhopal	**Rs. Lumpsum**		
2.3	Unit Rate on man month basis	**Rs.**		Price for addition/ deletion
3	Documentation	**Rs. Lumpsum**		
4	Self learning interactive web deployable tutorial	**Rs. Lumpsum**		
	Sub-Total of 1.6 + 2.1 + 2.2 + 3 + 4			
	Total			
	Service Tax			
	Any other tax if applicable			
	Grand total			

I / We hereby agree to execute the above work in Rs._____(In figures) _____ (in words).

Note : In case of discrepancy in amount in figures and words, the minimum will be taken into account by BHEL

Date : Signature of tenderer

Place : Name and Designation of authorised person (s) with seal.

Bharat Heavy Electricals Limited
Transmission Business Group
Transmission Business Engineering Management,
Industry Sector, Integrated Office Complex, Lodi Road,
New Delhi – 110 003

PROCEDURE FOR SUBMISSION OF SEALED TENDERS AND DOCUMENT TO BE ENCLOSED WITH THE OFFER

The tenderer must submit their tenders as required in two parts in separate sealed covers prominently super-scribed as Part-I : Technical Bid, Part-II : Price bid and also indicating on each of the covers the tender specification number and due date and time as mentioned in the tender enquiry.

These two separate covers I and II (Part – I and Part-II) alongwith "Price implication for withdrawal of deviations" (if any) shall together be enclosed in another envelope (Cover-III) along with EMD and this sealed cover shall be super-scribed with tender specification number and due date and submitted.

PART-I (TECHNICAL BID) COVER-I:

Excepting rate schedule, all other schedules, data sheets and other details called for in the specifications including offer letter containing techno commercial conditions, if any shall be enclosed in Part-I Technical Bid only.

Tenderer should enclose the following information (in prescribed formats) along with details as a proof of their credentials–

- Technical offer
- Annexure A : Vendor particulars form
- Annexure B : Details of similar job executed/under execution. List of past contracts executed with special emphasis on similar jobs carried out. The details of customers along with user certification and details of contact person shall be submitted. For contracts under execution, similar document with customer certification and contact details shall be submitted.
- Annexure C : Declaration regarding accuracy of details furnished in the offer
- Experience with BHEL – List of all software development projects carried out with any unit of BHEL along with reference details.
- Solvency certificate for current Year.
- ITCC/ PAN & Copy of IT returns filed with IT authority (letter).
- List of Manpower to be deployed on the job.
- EARNEST MONEY DEPOSIT

Offers without the above documents are liable to be rejected as "Techno Commercially Non Complying Offers:.

PART-II (PRICE BID) COVER – II :

Rate / Price schedule only shall be given in this part-II "Price Bid".

GENERAL TERMS & CONDITIONS

1.0 EARNEST MONEY DEPOSIT

1.1 "Every Tender must be accompanied by the earnest money Deposit as specified in NIT in cash (as permissible under Income Tax Act), Pay order or Demand Draft only"

CASH: The amount should be remitted by the party to cashier of Bharat Heavy Electricals Limited, at any of the following offices and "Cash Receipt" issued shall be enclosed along with tender.

i) BHEL-TBG, Piplani, Bhopal – 462 022.

ii) BHEL, Industry Sector, Integrated Office Complex Lodhi Road, New Delhi.

Demand Draft or Pay order : From State Bank of India/ Nationalised Banks in favour of Bharat Heavy Electricals Limited, New Delhi.

2.0 SECURITY DEPOSIT:

2.1 Upon acceptance of tender, the successful tenderer must deposit the security Deposit before commencement of work. The rate of Security Deposit will be as below:

Work upto Rs. 10 Lakhs	: 10%
Above Rs. 10 Lakhs upto Rs. 50 Lakhs	: 1Lakh+7.5%of the amount exceeding 10 Lakhs.
Above Rs. 50 Lakhs	: Rs. 4 Lakhs + 5 % of the amount exceeding Rs. 50 Lakhs.

The SD may be deposited in anyone of the following forms given in (i)to(vii)

i) Cash (as permissible under the Income Tax Act).

ii) Pay Order, Demand Draft in favour of BHEL.

iii) Local cheques of scheduled banks, subject to realization.

iv) Securities available from Post Offices such as National Savings Certificates, Kisan Vikas Patras etc.

(Certificates should be held in the name of Contractor furnishing the security and duly pledged in favour of BHEL and discharged on the back).

v) Bank Guarantee from scheduled Banks/ Public Financial Institutions as defined in the Companies Act subject to a maximum of 50% of the total security deposit value. The balance 50% has to be remitted either by cash or in the other form of security. The Bank Guarantee format should have the approval of BHEL.

vi) Fixed Deposit receipt issued by Scheduled Bank / Public Financial Institutions as defined in the Companies Act. The FDR should be in the name of the contractor, A/C BHEL, duly discharged on the back.

vii) Security deposit can also be recovered at the rate of 10% from the running bills. However in such cases at least 50% of the Security Deposit should be collected before start of the work and the balance 50% may be recovered from the running bills.

viii) EMD of the successful tenderer shall be converted and adjusted against the security deposit.

ix) The security deposit shall not carry any interest.

x) Security deposit shall not be refunded to the contractor except in accordance with the terms of the contract.

xi) The Head of Unit may waive the Security Deposit in respect of Public Sector Undertaking particularly on a reciprocal basis.

Note : 1) Acceptance of Security Deposit against Sl. No. (iv) and (vi) above will be subject to hypothecation or endorsement on the documents in favour of BHEL. However, BHEL will not be liable or responsible in any manner for the collection of interest or renewal of the documents or in any other matter connected therewith.

2) The BG shall be submitted only through the Banker and direct submission by the party will not be accepted. Along with the BG, the Bank shall also furnish a letter of confirmation.

3) The validity of the Bank Guarantee furnished towards Security Deposit under (v) above shall be up to three months more than the period of completion of work as stipulated in the LOI and the same will be kept valid by proper renewal till the completion of the work.

2.2 If the value of the work done at any time exceeds the accepted agreement value, Security Deposit shall be correspondingly enhanced and the extra Security Deposit shall be immediately deposited by the contractor or recovered from the payments due to him.

2.3 Failure to deposit the Security Deposit within the stipulated time, may lead to forfeiture of EMD and cancellation of the award of work.

2.4 BHEL reserves the right of forfeiture of Security Deposit in addition to other claims and penalties in the event of the contractor's failure to fulfill any of the contractual obligations or in the event of termination of contract as per terms and conditions of the contract. BHEL reserves the right to set off the Security Deposit, against any claims of any other contracts with BHEL.

2.5 **RETURN OF SECURITY DEPOSIT**: If the contractor duly performs and completes the work in all respects to the entire satisfaction of BHEL and presents an absolute "No demand certificate" and returns properties belonging to BHEL, taken, borrowed or hired by him for carrying out the said works and furnishes **performance bank guarantee** (PBG), Security Deposit will be released to the contractor after deducting all costs, expenses and other amounts that are to be paid to BHEL under this contract or other contracts entered into with the contractor. It may be noted that in no case the Security Deposit shall be refunded/released prior to passing of final bill.

2.6 No interest shall be payable by BHEL on Security Deposit or on any money due to the contractor.

3.0 **TERMS OF PAYMENT**

3.1 As per payment schedule enclosed with tender documents.

4.0 **DEDUCTION OF INCOME TAX/SALES TAX/WORKS TAX:**

4.1 BHEL shall be releasing payments against this work order after deduction of Income Tax at source as per requirements of Income Tax Rules and BHEL will issue appropriate certificates in this regard.

4.2 All taxes including sales tax / works tax / service tax, etc, if any shall be to the contractors account.

5.0 **OVER RUN CHARGES:**

5.1 No over run charges shall be payable under this contract.

6.0 **COMPLETION SCHEDULE:**

6.1 As per the NIT.

7.0 **LIQUIDATED DAMAGE :**

7.1 If the contractor fails to complete the work within the time specified contractual period or extension thereof granted by the engineer, liquidated damage will be imposed on the contractor for delay in completion of the work @ 0.5% (half percent) of the contract value , per calendar week , subject to ceiling of 10% of the contract value.

8.0 **PRICE VARIATION**

8.1 Price will be firm and no price escalation is payable through out the execution / extended period.

9.0 **FORCE MAJEURE:**

9.1 The following shall amount to force majeure conditions:
Acts of God, Act of any Government, war, sabotage, riots, civil commotion, Police action, revolution, flood, fire cyclone, earthquake, epidemic and other similar causes over which the contractor has no control.

9.2 If the contractor suffers delay in the due execution of the contract, due to delays caused by force majeure conditions, as defined above, the agreed time of completion of the work covered by this contract may be extended by a reasonable period of time, provided that on the occurrence of any such contingency, the Contractor immediately reports to BHEL in writing the causes of delay. The Contractor shall not be eligible for any compensation on this account.

10.0 **ARBITRATION :**

Except where otherwise provided for in the contract all questions and disputes relating to the meaning of the specification designs, drawings and instruction herein before mentioned and as to the quality of workmanship or materials used on the work or as to any other question, claim, right, matter or thing whatsoever in any way arising out of or relating to the contract, designs, drawings specifications, estimates, instructions, orders of these conditions or otherwise concerning the works, of the execution or failure to execute the same whether arising during the progress of the work or after the completion or abandonment thereof shall be referred to the sole arbitration of the General Manager (TBG) and if the General Manager is unable or unwilling to act, to the sole arbitration of some other person appointed by the General Manager willing to act as such arbitrator. There will be no objection if the arbitrator so appointed is an employee of TBG, BHEL and that he had to deal with the matters to which the contract relates and that in the course of his duties as such he had expressed views on all or any of the matters in dispute of difference. The arbitrator to whom the matter is originally referred being transferred or vacating his office or being unable to act for any reason such General Manager as aforesaid at inability to act shall appoint (see note) another person to act as arbitrator in accordance with the terms of the contract, such person shall be entitled to proceed with the reference from the stage at which it was left by his predecessor. It is also a term of this contract that no person other than a person appointed by such General Manager as aforesaid should act as arbitrator and if for any reason that is not possible the matter is not to be referred to arbitration at all, in all cases where the amount of the claim dispute is Rs. 50,000/- (Rupees fifty thousand) and above the arbitrator shall give reasons for the award.

Subject as aforesaid the provisions of the arbitration Act, 1940 or any statutory modification or re-enactment thereof and the rules made there under and the time being in force shall apply to the arbitration proceeding under this clause.

It is a term of the contract that the party involving arbitration shall specify the dispute or disputes to be referred to arbitration under this clause together with the amounts claimed in respect of each dispute.

The arbitrator (s) may from time to time with consent of the parties enlarge the time for making and publishing the award.

The work under the contract shall, if reasonably possible, continue during the arbitration proceedings and no payment due or payable to the contractor shall be withheld on account of such proceedings.

The Arbitrator shall be deemed to have entered on the reference on the date he issues notice to both the parties fixing the date of the first hearing.

The Arbitrator shall give a separate award in respect of each dispute or difference referred to him.

The Venue of arbitration shall be such place as may be fixed by the Arbitrator in his sole discretion.

The award of the arbitrator shall be final, conclusive and binding all parties to this contract.

Laws governing the Contract:

The contract shall be governed by the Indian Laws for the time being in force.

NOTE:- The Authority appointing the arbitrator should not be lower in rank than the Authority accepting the Agreement.

VENDOR QUALIFYING CRITERIA

Bidders who meet all the following qualifying criteria are only required to quote for this work.

1.1 Vendors having proven and established experience for at least last three years in delivering software development services for engineering industry. The software development services must include development of engineering application software facilitating generation of drawings / design documents / bill of materials.

1.2 The vendor must have handled at least one project of software development including interface with PDMS / PDS / Micro-station or any other 3D engineering software.

1.3 Vendor should have adequate number of technical and administrative personnel with necessary qualification and experience to execute the contract / project.

1.4 The Vendor shall have a minimum annual turnover of Rs. 200 lakhs.

1.5 The Vendor shall have solvency of at least Rs. 50 lakhs certified by their bankers.

1.6 The Vendor shall be willing to take up work on-site (i.e at BHEL, Lodi Road, New Delhi)

1.7 The vendor shall be willing to execute this contract using their own software, hardware and man-power requirements.

1.8 Technical Bid – Vendor shall submit all relevant documents to demonstrate their capability to take up this assignment to the satisfaction of BHEL.

2 **The bidder shall give full information in respect of the following. Information is to be furnished in the prescribed formats. Non-submission of this information may lead to rejection of the offer.**

2.1 **ANNEXURE-A** : Vendor Particulars Form
Company details & financial soundness, PAN , PF Code Number etc.

2.2 **ANNEXURE-B** : Details of similar jobs executed
A statement giving particulars of the various services rendered / in progress for similar works by the bidder- indicating the particulars of each work, the site location, the duration, date of completion etc.

2.3 **ANNEXURE-C** : Declaration regarding accuracy of details furnished in the offer.
Declaration regarding submission of the true & Complete information, due authorization and non-disclosure of BHEL proprietary information.

Note: All the data that is required as per this section needs to be furnished neatly typed, signed and stamped in the given formats only. Wherever necessary, documentary proof also needs to be enclosed. In the absence of the above information, the tender may be considered as incomplete and is liable for rejection.

ANNEXURE 1

APPLICATION FORM FOR VENDOR'S PARTICULARS

1. **INSTRUCTIONS TO SUBCONTRACTORS APPLYING FOR ENLISTMENT.**

1.1 The application form is to be filled by the subcontractor applying for enlistment returned in original to the address given below:

Mr. DILIP DATTA,
Additional General Manager (TBEM)
TRANSMISSION BUSINESS GROUP,
INDUSTRY SECTOR,
INTEGRATED OFFICE COMPLEX,
BHARAT HEAVY ELECTRICALS LIMITED,
LODI ROAD, NEW DELHI – 110 003
PHONE : 011 - 41793 241
FAX : 011 – 2436 5869.
email : **ddatta@bhelindustry.com**

1.2 The enclosed form shall be duly filled-in complete in all respects otherwise the request for enlistment as subcontractor may not be considered.

1.3 Incomplete application form/ document/ false information may lead to delay or rejection of the case.

1.4 BHEL reserves the right to accept or reject any application without assigning any reason.

1.5 Subcontractor shall send all relevant documents DULY INDEXED (preferably in A4 size neatly filed in a folder) along with this application form.

1.6 If answer to a question in enclosed form is 'YES' fill (Y), if it is 'NO' fill (N) and if it is ' Not applicable' then fill (NA).

2. CHECK LIST FOR APPLICATION FORM AND DETAILS.

2.1.1 Name of the Firm:.....

2.1.2 Address of Regd. office:.....

.....

Tel.No.....Fax .....……..

Address of all (i) .....

Regional / branch .....

offices Tel. No.....Fax.....

(ii) .....

Tel. No. ..... Fax.....

2.1.3 Date of : Establishment .....

2.1.4 Type of work for : ..... which enlistment sought

2.1.5 Preferred area for work : ..... Write name(s) of states or all over India)

2.1.6 Design work Capability available ----Yes/ No/ NA

2.2 Photocopies of following documents enclosed. (Please specify in following spaces YES or NO or NOT APPLICABLE and other information as asked).

2.2.1 Certification in incorporation :.....(Y/N/ NA).

2.2.2 Proprietary certificate :.....(Y/N/ NA).

2.2.3 Partnership deed :.....(Y/N/ NA).

2.2.4 Bank credit facility and its utilisation certificate. :-.....(Y/N/ NA).

2.2.5 Audited balance sheets for last 3 years audited by CA. :-..... (Y/N/ NA).

2.2.6 Solvency certificate :-..... (Y/N/ NA).

2.2.7 Latest Income tax clearance certificate :-..... (Y/N/ NA).

2.2.8 Power of attorney of all authorised official who shall be contacting BHEL. :-..... (Y/N/ NA).

2.2.9 List of qualified personnel working in the organisation with their experience. :-..... (Y/N/ NA).

2.2.10 List of plant & machinery and testing equipments. :-..... (Y/N/ NA).

2.2.11 List of reputed customers worked for with full postal address and details of projects executed in the last FIVE years. :-..... (Y/N/ NA).

2.2.12 Any other details not covered above, furnished in brief :-..... (Y/N/ NA).

2.2.13 It is understood that any relevant detail/ proof there-of, not enclosed along with the application form may lead to rejection.

3. NATURE OF COMPANY (State relevant information in following spaces as asked or write NA if not applicable).

3.1 Government undertaking/ organisation (central of state). :-.....

3.2 Public Ltd., or Private Ltd. :-.....

3.3 Partnership or proprietary concern. :-.....

3.4 Employee provident fund account no., if any (Attach proof). :-.....

4. ORGANISATION SET UP OF SUBCONTRACTOR

4.1 Name of the Chief Executive :-.....

4.2 Name and designation of :-.....
authorised officials (having power of attorney) to be contracted.

4.3 Total strength of organization

Graduate Engineers. :-.....

Engg. Diploma Holders :-.....

Managers :-.....

Supervisors :-.....

Skilled / Unskilled workers :-.....

Ministerial staff :-.....

Others :-.....

Total :-.....

4.4 State "No" or "YES" in the following spaces.

4.4.1 Whether banned or removed :- .....
by any Govt. organization at
any time. if yes, details may be furnished.

4.4.2 Whether enlisted with other :- .....
BHEL units. If yes, furnish details
like code nos. & category for which enlisted.

4.4.3 If related to any BHEL :- .....
employee – mentioned details
about him/ her.

4.5 Weekly holidays :- .....

5. FINANCIAL SET-UP OF SUBCONTRACTOR

5.1 Name of the subcontractor :- .....

5.2 Capital Outlay

a) Land & Building :Rs.....

b) Plant & Machinery :Rs.....

c) Working Capital :Rs.....

d) Other Assets :Rs.....

Total :Rs.....

Note :If partnership concern, then financial standing of each partner to be indicated separately.

5.3 Annual turnover of the company
for the last THREE financial years.

YEAR	TURNOVER IN RS. LAKHS

5.4 Present order book in Rs. Lakhs :.....

5.5 Name(s) of banker(s) :.....

5.6 If you are accredited with ISO
9000 or ISO 14000 certification, indicate Yes or No.
If Yes, please enclose a copy of the certificate.

Signature of Vendor's
Authorised Person

Date

Name :
Designation :
Seal of the Company:

ANNEXURE-B

SIMILAR JOBS EXECUTED IN PAST THREE YEARS

SL. NO	AGENCY BY WHOM AWARDED	PARTICULARS OF THE WORKS AWARDED	CONTRACT VALUE	DURATION OF THE PROJECT	DATE OF COMPLETION
1					
2					
3					

Vendor's Name & Address
Name & Signature of the Bidder
(Seal)

ANNEXURE-C

DECLARATION

I/We, _____ hereby certify that, all the information and data furnished by me with regard to this Tender Notification _____are true and complete to the best of my knowledge. I have gone through the specification, conditions and stipulations in detail and agree to comply with the requirements and intent of specification.

I/We, further certify that I am / we are the duly authorized representative(s) of the under mentioned tenderer and a valid power of attorney to this effect is also enclosed.

I/We, hereby declare that I/We shall treat the tender documents, drawings, specifications and other records connected with the work as secret/confidential and shall not communicate information / derived there from to any persons other than a person to whom I/We am/are authorized to communicate the same or use the information in any manner prejudicial to the safety of the same.

Vendor's Name & Address
Name & Signature of the Bidder
(Seal)

C O N T E N T S

1.0 Intent of specification ____ *3*

2.0 General ____ *3*

2.1 Obligations of Bidder & BHEL ____ **3**

2.2 Technical Bid – Technical Proposal ____ **4**

2.3 Integration with existing design programs & PDMS software ____ **4**

2.4 System Manuals and CDs ____ **5**

2.5 Training ____ **5**

2.6 Self learning interactive web deployable tutorial ____ **5**

2.7 Acceptance Test Procedure (ATP) ____ **5**

2.8 Guarantee - Technical Support of System Supplied ____ **5**

3.0 Deviations Schedule ____ *6*

4.0 Payment Terms ____ *6*

5.0 Completion of Contract ____ *7*

6.0 General terms and conditions – Technical & Intellectual Property Rights ____ *8*

7.0 Detailed terms and conditions for Services ____ *8*

8.0 Present Scenario at TBEM ____ *8*

8.1 Switchyard Design ____ **8**

8.2 Switchyard Drawings ____ **9**

8.3 Control room ____ **10**

8.4 3D Modelling ____ **10**

8.4.1 Structure & Equipment Library ____ 10

8.4.2 Forms for Layout ____ 10

8.4.3 Generation of drawings and Bill of Material ____ 11

9.0 Design of Solution for Automated Design ____ *11*

9.1 Single Line Diagram ____ **11**

9.2 System Study ____ **11**

9.3 Conceptual Line Diagram ____ **11**

9.3.1 Design calculations ____ 12

9.3.2 Interface of Conceptual Line Diagram to PDMS ____ 12

9.4 Flexibility and User Friendliness of the Module ____ **13**

9.5 Deliverables: ____ **13**

10.0 Conceptual model for knowledge based automated design solution for switchyard _____ 14

11.0 Strategy _____ 15

11.1 FIRST PHASE : System study & Development of Application programs for design calculations _____ 15
11.1.1 Time Period _____ 15

11.2 SECOND PHASE : Prototype development for a typical layout arrangement. _____ 15
11.2.1 Time Period _____ 15

11.3 THIRD PHASE : Full scale development for various layout arrangements 16
11.3.1 Time Period _____ 16

11.4 Training _____ 16

12.0 Progress Reporting and Review _____ 16

13.0 Time Schedule _____ 16

Figure 1: Conceptual Model at Final Stage 14

Table 1: Tentative Time Schedule 17

Annexures of Drawings of a Typical 220kV Sub-station and Customised PDMS

Drawings

Annexure 1. Single Line Diagram
Annexure 2 Electrical Layout : Plan
Annexure 3 Electrical Layout : Section
Annexure 4 Structure Loading Diagram
Annexure 5 Earthing Layout
Annexure 6 Yard Cable Trench Layout
Annexure 7 Cable Trench Section
Annexure 8 Control room – Electrical Layout Plan Drawing
Annexure 9 Control room – Cut –out Details
Annexure 10 Control room – Cabling inside Control room – Under-hung Trays

PDMS

Annexure 11 Write-up on **PDMS**

1.0 Intent of specification

The Transmission Business Engineering Department of BHEL requires a "Knowledge Management Based Automated Design Solution" for sub-station / switchyard project engineering.

It is not the intent to specify herein all the details of the system. However, the system shall conform in all respects to high standards of design, and shall be capable of performing to meet the requirements.

The scope consists of complete software based automated design solution and shall include the following (Refer Figure 1) –

- System study of existing design process and systems
- Development & Implementation of software integrating various design programs & interfaced with customised PDMS software (complete design, coding and testing and acceptance testing)
- Training
- System documentation, preparation of user manuals, etc. as per specifications stipulated here under.
- The various inputs generated through the software application program should be able to seamlessly integrate with existing document management system (Wrench).

Notwithstanding what is specified in this document, it shall be the vendor's responsibility to configure the total solution so that it performs satisfactorily. The vendor shall bring to the notice of BHEL any incompatibilities that could hinder proper operation or additional items that may be required to ensure completeness of the solution offered.

2.0 General

The entire work covered in this Tender shall be entrusted to a **single vendor satisfying the qualifying criteria**.

2.1 Obligations of Bidder & BHEL

The software module is to be completely developed at the BHEL works. On-site work shall be carried out at TBG, New Delhi. Deployment and training shall be at New Delhi and Bhopal. The developed module shall be installed on BHEL's computer and its satisfactory operation demonstrated. BHEL reserves the right to ask for replacement of manpower provided by the vendor, in case of unsatisfactory performance.

All the required computer software (Programs, Packages, etc) and the hardware (PCs, Printers, Scanners, etc) for development of this module have to be taken care of by the bidder. BHEL does not have any spare facilities to be extended for this project.

Office space for installing computers for development and support, power, courtesies of lunch, tea, local telephone facilities, etc. would be provided by BHEL.

Any software package to be procured by BHEL shall be clearly brought out in the technical & commercial bid or during phase 1 of the execution stage. The software package will then be procured by BHEL before final deployment of the software. The software development work will be carried out on the licence of the bidder till the software package is procured by BHEL or till the development work is over.

2.2 Technical Bid – Technical Proposal

A detailed technical proposal shall be submitted detailing the following -

1. Approach of work, methodology adopted, list of deliverables with respect to design system automation requirements along with Flow chart / Block Diagram for clear understanding of scope of work
2. Limitations of technical proposal
3. Assumptions / deviations with respect to the technical specs, if any, and expected technical inputs from BHEL team during the project execution.
4. Working modalities indicating computer systems & manpower proposed to be deployed at BHEL for this project.
5. List of all software programs / packages required to be used for the development of the software modules.
6. Proposed work schedule with duration so that total duration of the project does not exceed time schedule as per NIT.

2.3 Integration with existing design programs & PDMS software

TBG has design programs (in Fortran, C, Excel etc) which are to be incorporated in the proposed knowledge based automated design solution. The design documents as outputs shall be taken from the proposed solution.

The design programs to be automated are as follows :

Se No.	Design Documents	Program Type	Program
A)	**ELECTRICAL**		
A.i)	**Layout – Design Documents**		
a)	HV cable sizing	2	Excel
b)	Design calculation for conductor sizing	1	Excel
c)	DSLP Calculation along with drawing for protection of switchyards and control room	1	Excel
d)	Short circuit force for Tubular bus	1	Excel
e)	Short circuit force for Strung bus with Spacers Spacing Calculation	1	C / Fortran
f)	Sag and swing calculation	1	Excel/ Fortran
g)	Sag tension chart	2	Excel/ Fortran
h)	Design Calculations for Earth Mat	1	Excel
i)	Soak & sump pit calculations for transformer / reactor	1	Excel
A.iii)	**Auxiliary System- Design Documents / Drawings**		
a)	LT cable sizing	2	Excel
b)	220 V & 48 V Battery Sizing	2	Excel
A.iv)	**Protection - Design Documents**		
a)	Calculations for CT/VT/CVT.	2	Excel

Type 1 - The design programs will run concurrently with the application program during the design of the switchyard and the outputs used in design of switchyard.
Type 2 - The design programs will not run concurrently with application program and the outputs shall be a design document.

The proposed solution is also to be integrated with existing customised PDMS solution available with TBG.

The construction drawings as outputs shall be taken from the PDMS which are as follows :

Se No.	**Output Documents** / **Drawings** (Refer clause 8 and annexure for details)
A.ii)	**Layout - Drawings**
a)	Plot Plan
b)	Structure Loading Diagram
c)	Electrical Layout and section elevation for switchyard
d)	Foundation Layout dawings
e)	Electrical and Physical Clearance diagrams
f)	Trench layout and section elevation for switchyard and control room
g)	Control room layout showing panels and the cutouts
h)	Earthing Layout for switchyard and control room
i)	Erection key Diagrams (including Al. tube cut lengths & BOQ of clamp, connectors, string insulator hardware
j)	Bill of Quantity (Equipment, Conductor, Al.Tube, Cables, MS Rod, GI Flat etc)

2.4 System Manuals and CDs

Systematic and detailed documentation (system write-up, inputs, outputs, program logic, program code, assumptions, limitations, etc.) of all the work done shall prepared and provided by the vendor. User manuals to facilitate easy operation of the customised solution shall also be prepared and provided for each module. Printed manuals (5 sets) & 2 CDs shall be prepared for the system supplied. A list of manuals shall be submitted for BHEL's approval.

2.5 Training

The vendor shall indicate precise training requirements as per the solution offered. The schedule for training shall be indicated by the vendor and finalised based on mutual agreement between the vendor and BHEL. The vendor shall provide training at BHEL premises.

Complete training programme including contents and course material etc. shall be approved by BHEL before commencement of training. Course material/book and faculty shall be provided by the vendor.

2.6 Self learning interactive web deployable tutorial

Interactive tutorials, with in-built evaluation system shall be provided to facilitate learning at user-defined pace.

2.7 Acceptance Test Procedure (ATP)

Conducting Acceptance Test at end of each phase shall be the responsibility of the vendor. The vendor shall submit the Acceptance Test Procedure document for BHEL's approval.

2.8 Guarantee - Technical Support of System Supplied

The developed software shall be guaranteed for trouble-free operation for a period of 12 months from its acceptance and installation at BHEL. In case of any defects observed during the operation of this module during this period, the Vendor shall render their services at no additional cost for rectification of the same.

Scope of technical support shall cover Trouble-shooting and rectification of mal-functioning in the software, fine tuning of software, updating of System documentation and user manuals as well as learning capsule.

3.0 Deviations Schedule

In case of any deviation from this specification, the same shall be indicated in the enclosed schedule of deviations. In the absence of duly filled schedule it will be assumed that the bid strictly conforms to this specification.

Vendor to note that deviations mentioned elsewhere in the bid, but not listed in the schedule of deviation will not be considered or entertained in the event of order placement.

	Schedule of Deviations	Specification Number: Sheet ___of ___
Clause Number of Specification		
We, the undersigned, hereby certify that the above mentioned are the only deviations.		
Particulars of Vendor/Authorised Representative		
Name	Designation	Signature	Date	Company Seal

4.0 Payment Terms

Payment shall be made after certification issued by BHEL Project Leader regarding the successful completion of scope of work as per the Payment Milestones defined in the Contract. The BHEL Project Leader shall be specified at the time of award of the Contract to successful Bidder.

Vendor shall submit the invoices to BHEL Project Leader within ten (10) days from the date of successful completion of job.

Payment terms shall be as follows :

Running Bill – 90% of the total value of work done – phase wise.

Final Bill – 10% after after completion of the total work as per the contract agreement (after liquidating all defects)

No Advance Payments will be made.

S. No.	*Item*	*Remarks*
1.	**Phase 1** System study & development of application program for design calculations	▪ 20% against scope sign off and submission of writeup on knowledge base ▪ 60% against development of 9 design programs (Layout – Design Documents) ▪ 15% against development of 2 design programs (Auxiliary System – Design Documents) ▪ 5% against development of 1 design program (Protection – Design Documents)
2.	**Phase 2** Prototype development for typical layout arrangement	▪ 50% against development of Conceptual Line Diagram ▪ 20% against development of interface with output of application design programs ▪ 30% against development of interface with PDMS
3.	**Phase 3** Full scale development for all types of layout arrangement	▪ 40% against further development of Conceptual Line Diagram ▪ 40% against further development of interface with PDMS ▪ 20% against deployment
4.	Training at New Delhi	After completion of respective batch. Man-day rate to be operated. Travel / Boarding / Lodging cost included in the charges
5.	Training at Bhopal	After completion of respective batch. Man-day rate to be operated. Travel / Boarding / Lodging cost included in the charges
6.	Documentation (Product / Customisation)	After successful deployment
7.	Self learning interactive web deployable tutorial	After successful deployment

5.0 Completion of Contract

Vendor shall deliver the complete scope of work within 9 months from the date of award of Contract and as per the time schedule approved during award of the contract.

The Vendor will use reasonable care and skill in providing the services and will be responsible for the quality of workmanship and accuracy of the deliverables. Vendor shall implement in-house quality control and shall carry out 100% quality checks before submitting to BHEL for acceptance.

The Contract shall be considered successfully completed upon acceptance of deliverables by the BHEL Project Leader.

Vendor will be responsible for adherence to the material movement and security procedures of BHEL. Vendor shall not utilize services of BHEL employees for carrying out contract jobs. In case of violation of this condition, the contract will be terminated without any notice.

6.0 General terms and conditions – Technical & Intellectual Property Rights

a. *Vendor shall treat all information that is generated in connection with this assignment as absolutely confidential. All information, analysis, reports and recommendations both in the form of hard copy or on electronic media will be the property of BHEL and must not be used by the vendor for any purpose other than this assignment. All bidders are required to sign non-disclosure agreement with BHEL.*
b. *Vendor shall indemnify BHEL any copyright or legal liabilities that may arise in use of the developed software or the methodology / models / techniques used by the vendor in development / implementation of the software module.*
c. *All source code as well as other deliverables generated under this works will become the property of BHEL.*
d. *Complete confidentiality shall be maintained by the vendor of all information/ documents as well as model data, etc. provided by BHEL for trouble shooting, etc.*

7.0 Detailed terms and conditions for Services

a. Necessary standardisation, definition of processes for transfers and integration, etc. shall be ensured by vendor.
b. Systematic and detailed documentation (system write-up, inputs, outputs, program logic, program code, assumptions, file/data structures, limitations, etc.) of all the customisation done shall be prepared and provided. User manuals to facilitate easy operation of the customised solution shall also be prepared and provided for each module.
c. BHEL shall make pro-rata deductions for unsatisfactory support performance.

8.0 Present Scenario at TBEM

8.1 Switchyard Design

The switchyard design is performed using the following programs :

A) **ELECTRICAL** -

A.i) **<u>Layout – Design Documents</u>**

a) HV cable sizing
b) Design calculation for conductor sizing
c) DSLP Calculation along with drawing for protection of switchyards and control room
d) Short circuit force for Tubular bus
e) Short circuit force for Strung bus with Spacers Spacing Calculation
f) Sag and swing calculation
g) Sag tension chart
h) Design Calculations for Earth Mat
i) Soak & sump pit calculations for transformer / reactor

A.iii) **<u>Auxiliary System- Design Documents / Drawings</u>**

a) LT cable sizing
b) 220 V & 48 V Battery Sizing

A.iv) **<u>Protection - Design Documents</u>**

a) Calculations for CT/VT/CVT.

8.2 Switchyard Drawings

TBG executes the contracts of 400, 220, 132, 66, 33kV switchyards on turnkey basis for various utilities and power stations. The design of the switchyard is done in-house by TBEM located at New Delhi and Bhopal.

Single Line Diagram - Refer Annexure 1.
The first activity after the receipt of the contract is the preparation of the single line diagram for the high voltage system.

Electrical layout and section - Refer Annexure 2 & 3
After approval of the single line diagram by the customer, the electrical layout and section is prepared based on the SLD, plot size, customer requirement and experience of TBG. The preparation of drawings is through the AutoCAD software. Concurrently, various design calculations are done (in excel /Fortran / C) for checking/ verification.

Foundation layout
After approval of the electrical layout by the customer, the foundation layout is prepared based on the tentative sizes of the foundations.

Structure Loading Diagram - Refer Annexure 4
After approval of the layout and section and design documents for calculation of forces on the structures, a structure loading diagram is prepared showing the towers, beams and the forces on the beams. This is an input for the civil & structure group.

Earthing Design and Layout - Refer Annexure 5
Earthing design is done through a program wherein the inputs are soil resistivity results and the layout. The earthing layout is prepared based on the output of earthing design calculations (distance between the grids and depth).

Trench Design and Layout - Refer Annexure 6 & 7
Trench design is done basically through the existing practices of the customer and experience of TBG. The trench layout is prepared based on the design.

Structure (Tower & beam) design
TBG also makes use of STAAD PRO, a software package for the analysis and design of structures. This package is being used by the structural engineers. They study the layout diagrams, pick up the type of towers to be designed, pick up the structural loadings from the Layout Design Group. Additionally they calculate wind and seismic loads on the towers and decide the preliminary sizes. They feed the data to STAADPRO and get the displacements at nodes and forces/moments on elements (members) and member sizes from STAAD PRO.

Foundation design
The reactions on foundations are also calculated using STAAD PRO. Using the reactions on foundation, the foundations are sized, and the reinforcements are calculated. The foundation sizes, if required are fed into the Forms, so that the actual foundation sizes are reflected in the PDMS Model.

Equipment Structure and foundation design
Methodology for design of structure and foundation for the equipment shall be same as for tower described above.

8.3 Control room

Control room – electrical layout drawing - Refer Annexure 8, 9 & 10

The basic drawing showing the size of the building and various rooms, locations of panels are prepared. After the layout drawing is approved, a drawing showing the cut-out for cables and cable tray arrangement is prepared.

Control room – Architectural design

After the electrical layout drawing for control building is approved, the architectural drawing is prepared by Consultants (outside agencies).

Control room – Civil design & drawing

After the architectural drawing for control building is approved, the civil design and drawing are prepared by Consultants (outside agencies).

8.4 3D Modelling

PDMS- Refer Annexure 11

TBG is in the process of implementing the Software Package 'Plant Design Management Systems' (PDMS) for their engineering design functions related to Switchyard Design. Two licenses of the PDMS package are available to TBG for this purpose.

TBG has got the PDMS software customized for 400 and 220kV sub-stations.

8.4.1 Structure & Equipment Library

TBG has also got the 3D models for various 400 & 220kV equipments, structures and foundations developed and stored in the equipment libraries. Vendor specific equipments have also been created. These libraries can be further enlarged in future as and when required to cover more types of equipments, structures and foundations.

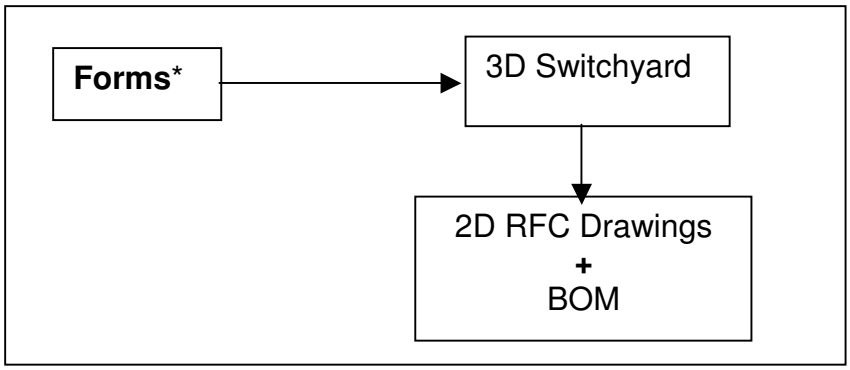
Parametric forms also have been created for preparing the models of structures (towers & beams) and foundations.

There is an interface available to pass on the final member sizes of the structures from STAADPRO to PDMS.

The forms for control room layout drawings has been developed (Parametric model). The parametric forms for control panel and HT panel has been developed.

8.4.2 Forms for Layout

Various 'Forms' have been developed to enable input of data to PDMS. The work is schematically given below :



Note: * Following forms have been developed covering the following functions:

1. Grid – For creating grids
2. Layout – For placement of Tower, Equipment (along with structure) and Foundation
   2.1. Placement of Towers (Column) along with foundation and Gantries (beam)
   2.2. Placing equipments, support structure and foundation
   2.3. Gantries - Placement of Gantries (beam)
3. Parametric : Structures & Foundations
4. Conductor – For stringing of conductor between gantries (including string insulator & spacers).
5. Shield wire – For connecting shield wire between tower peaks
6. Connector – For connecting the equipments
7. Earthing – For creating earthing layout.
8. Trenches – For creating cable trench layout, Pipe & cabling
9. Road – For creating layout (straight roads, bends, cross etc)
10. Control Room Building - Parametric form for creating model of control room building
11. Transformers – Parametric form for creating model of dry type and oil filled transformers
12. HT Panel – Parametric form for creating model of panels

Forms are helpful in simplifying the input to PDMS and making it faster and more accurate to use. Once the data is entered into the Forms in the PDMS, the 3D model is constructed.

8.4.3 Generation of drawings and Bill of Material

The desired deliverables 2D Construction drawings and BOM are extracted through PDMS.

9.0 Design of Solution for Automated Design

9.1 Single Line Diagram

The approved SLD, system parameters will be the basic document for this development.

9.2 System Study

The bidder shall study the rules, practices and standards being followed by TBG to create the design Documents, Construction Drawings and Bill of Material.

A knowledge base of these rules, practices, standards, experience and expertise of TBG will be compiled.

9.3 Conceptual Line Diagram

Through an automatic process involving minimum human intervention, incorporating the knowledge base & design calculations, a conceptual line diagram* will be prepared.

**Conceptual Line Diagrams will contain orientation of bus arrangement and various feeders, location of bus towers and gantries, location of equipment gantries, type and orientation of isolators & earth switches, location of post insulators & conductor types.*

Necessary arrangement (Shield wire/ Lightning Mast) for Direct Stroke Lighting Protector (DSLP) shall also be incorporated.

A software application program will be developed to generate the Conceptual Layout Diagrams. This conceptual line diagram will be approved before the data is sent to the PDMS package.

The Conceptual Line Diagrams generated by the application program will be having intelligence built into it. The logics will be developed in such a way, that any input given at any stage will verify whether it is likely to violate, any of the rules already used in the application program for developing the CLD. This may involve some iterative processes within the application program. Also, all the user input will be systematically saved and made available, if required, to the user for verification and/or reuse at later stages.

In the grid sub-station projects, the customer requirements (SLD, Plot Plan, Orientation of switchyards and lines) are clearly defined and therefore all inputs for proposed design automation engine shall be available for generation of desired outputs. However, calculations shall be performed internally for verification of design.

In power projects or negotiated sub-station projects, the detailed technical specification and drawings (SLD, Plot Plan, Orientation of switchyards and lines) are not clear or are absent. A lot of design changes (rework) take place for finalisation of the layout. In the proposed system, the design automation engine will suggest the various alternatives for freezing of the conceptual line diagram. The approval of the customer will be taken at this stage eliminating future rework.

9.3.1 Design calculations

The engineering inputs required for the above shall be taken from the design calculation program outputs. Presently the design calculations are in Excel/ C program, which shall be converted into a common platform in the software package.

9.3.2 Interface of Conceptual Line Diagram to PDMS

After the conceptual line diagram is approved, the software will interface with PDMS and directly generate a 3D digital model of the switchyard to be constructed. Construction Drawings and Bill of Material shall then be extracted from the 3D digital model as required.

Interfaces shall be developed to TBG's existing software packages or the existing packages will be converted to fit into the new development.

The list of various outputs so generated are as given below :

Se No.	**Output Documents / Drawings**
A)	**ELECTRICAL** -
A.i)	**Layout - Design Documents**
a)	HV cable sizing
b)	Design calculation for conductor sizing
c)	DSLP Calculation along with drawing for protection of switchyards and control room
d)	Short circuit force for Tubular bus
e)	Short circuit force for Strung bus with Spacers Spacing Calculation
f)	Sag and swing calculation
g)	Sag tension chart
h)	Design Calculations for Earth Mat
i)	Soak & sump pit calculations for transformer / reactor
A.ii)	**Layout - Drawings**
a)	Plot Plan
b)	Structure Loading Diagram

Se No.	**Output Documents / Drawings**
c)	Electrical Layout and section elevation for switchyard
d)	Foundation Layout drawings
e)	Electrical and Physical Clearance diagrams
f)	Trench layout and section elevation for switchyard and control room
g)	Control room layout showing panels and the cut-outs
h)	Earthing Layout for switchyard and control room
i)	Erection key Diagrams (including Al. tube cut lengths & BOQ of clamp, connectors, string insulator hardware
j)	Bill of Quantity (Equipment, Conductor, Al.Tube, Cables, MS Rod, GI Flat etc)
A.iii)	**Auxiliary System- Design Documents / Drawings**
a)	LT cable sizing
b)	220 V & 48 V Battery Sizing
A.iv)	**Protection - Design Documents**
a)	Calculations for CT/VT/CVT.

9.4 Flexibility and User Friendliness of the Module

The software module shall be highly interactive in nature. User intervention is to be permitted at every stage of the design process.

The software module should have provision for editing / modifying the output results after every stage by the user.

The software module should be amenable for modification by BHEL after installation, if required.

The software module should be compatible with or able to migrate on new versions of the software packages used for development / running of the module.

The software module should be amenable for installation on more than one computer system, preferably a LAN version.

9.5 Deliverables:

The following are the deliverables of this Project:

- Application Program
  - Generating conceptual line diagram
  - Generating design documents
  - Generating structure loading diagram
  - Generating interface with Forms of PDMS for creating 3D model
- User/Operator Manuals
- Program documentation.

The above shall be provided in two sets of CDs.

10.0 Conceptual model for knowledge based automated design solution for switchyard

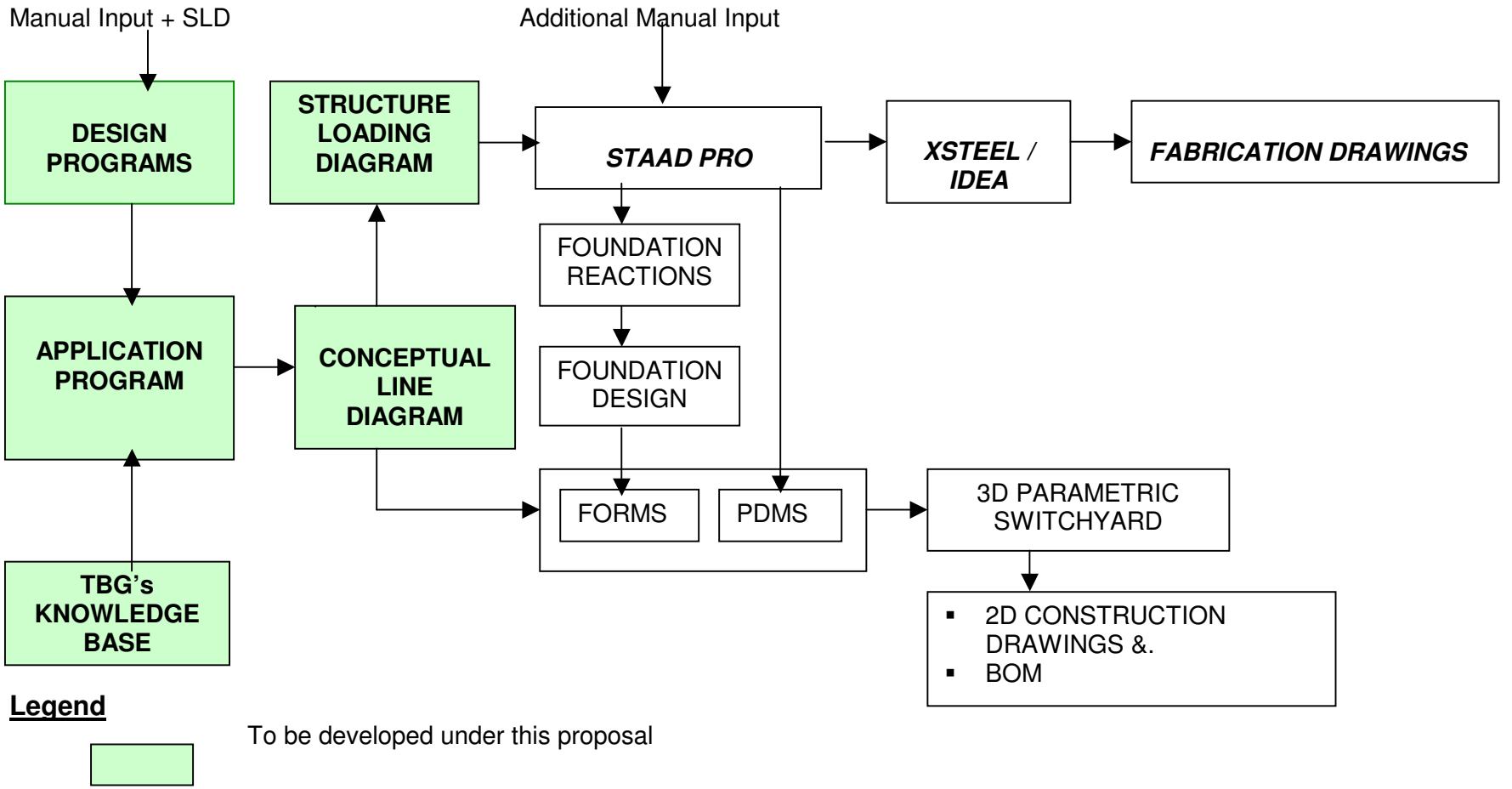


Figure 1: Conceptual Model at Final Stage

11.0 Strategy

An incremental and evolutionary approach to development of software design, rather than a pre-defined, fixed approach would be deployed, considering the nature of the application and the wide variations in perceptions and needs of the stakeholders.

While minimum requirement is defined below, further requirements would emerge after detailed discussions and as the system gets deployed and used.

11.1 FIRST PHASE : System study & Development of Application programs for design calculations

1. Detailed study of existing design process (design calculations, Drawings), programs & customisation of 3D software already carried out at TBG
2. Creating application programs for the design calculation
3. Report of the work carried out in this phase and detailed plan for the next phase.
4. Joint review of the report and clearance for the next phase, along with revised guidelines / procedures (if any)

11.1.1 Time Period

This phase shall be completed in two months.

11.2 SECOND PHASE : Prototype development for a typical layout arrangement.

1. Identification of a particular electrical layout configuration for automation
2. Defining switchyard boundary conditions
3. Configure parametric structural arrangement and defining logical association with electrical layout
4. Defining of design rules for the pilot project
5. Development of software program for creating CLD - The layouts of foundations, structures, equipments and electrical scheme will be done in a manual mode, meaning the placement will be through an interactive process.
6. Interface with outputs for the design calculation
7. Integrating the CLD with existing 3D design customisation
8. Generating output documents of pilot project for design validation
9. Report of the work carried out in this phase and detailed plan for the next phase.
10. Joint review of the report and clearance for the next phase, along with revised guidelines / procedures (if any)
11. BHEL reserves the right to terminate the project at this stage in case the deliverables for the first and second stage does not meet the requirements / expected results.

11.2.1 Time Period

This phase shall be completed in three months.

11.3 THIRD PHASE : Full scale development for various layout arrangements

1. Identification of all possible electrical layout configurations for automation. These pre-defined configurations of the switching scheme will be interactively selected and deployed.
2. Interface with outputs for the design calculation
3. Defining design rules for each of the above electrical layout configuration. Compilation of knowledge base {rules, standards, procedures, and expertise for creation of knowledge base will be done}.
4. Augmentation of software program for creation of CLD. The layouts of foundations, structures, equipments and electrical scheme may be done in a semi-automated manner, meaning the rules regarding foundations, structures, equipments and electrical scheme may be computerized fully, but their placement may be interactively verified by the user during the progress of the work.
5. Integrating the CLD with existing 3D design customisation
6. Automation of complete engineering (reducing manual interventions after detailed testing)
7. Generating output documents of test projects for design validation
8. Testing of software, Verification and validation of program
9. Report of the work carried out in this phase and detailed plan for the next phase.
10. Joint review of the report

11.3.1 Time Period

This phase shall be completed in four months.

11.4 Training

1. Software training shall be imparted by well-qualified and experienced faculty.
2. Training curriculum shall include training on the complete system including new software (if any) so that the engineers are able to operate the system and generated all the deliverables (design document & Training).
3. Complete training programme including contents and course material etc. shall be approved by BHEL before commencement of training.
4. The training shall be conducted at BHEL New Delhi and Bhopal as per BHEL's requirements.
5. Minimum hardware configuration to be deployed for training, in case hardware is to be provided by the vendor, to be mentioned.

12.0 Progress Reporting and Review

Fortnightly progress reports shall be submitted by the vendor to BHEL, indicating progress, bottlenecks, resource deployment. Review meetings shall be held monthly with BHEL.

13.0 Time Schedule

A tentative time schedule format for project implementation after placement of order is given below. Each activity would generally culminate in a formal signed document. The vendor shall provide a detailed schedule for BHEL's approval.

In the event of placement of order by BHEL, immediately on receipt of order, the vendor shall depute technical personnel with requisite specialisation and experience to interact on collection of inputs, details of existing design process, solution proposed, details of interface required for PDMS, finalisation of schedule of customisation, etc.

Table 1: Tentative Time Schedule

Sl. No	ACTIVITY	DURATION (Months)																
		1		2		3		4		5		6		7		8		9
1	**PHASE 1 :**																	
	SYSTEM STUDY & APPLICATION PROGRAM																	
1.1	Detailed study of existing design process, programs & customisation of 3D software carried out at TBG	X	X															
1.2	Creating application programs for the design calculation		X	X	X													
2	**PHASE 2 :**																	
	PILOT PROJECT																	
2.1	Identification of a particular electrical layout configuration for automation & Defining switchyard boundary conditions					X												
2.2	Configure parametric structural arrangement and defining logical association with electrical layout					X												
2.3	Defining of design rules for the pilot project					X	X											
2.4	Development of software program for creating CLD							X	X									
2.5	Integrating the CLD with existing 3D design customisation								X	X								
2.6	Generating output documents of pilot project for design validation										X							
2.7	Review of output and detailed plan for third phase										X							
3	**PHASE 3 :**																	
3.1	Identification of all possible electrical layout configurations for automation.										X	X						
3.2	Defining design rules for each of the above electrical layout configuration.											X	X					
3.3	Augmentation of software program for creation of CLD.											X	X	X				
3.4	Integrating the CLD with existing 3D design customisation												X	X	X			
3.7	Generating output documents of test projects for design validation															X		
3.8	Verification & validity of program															X		
3.9	Automation of complete engineering & integration of programs																X	X
3.3	Training																	X

The Implementation Schedule shall be furnished by bidder within two weeks of LOA for approval.