Total Productivity Management
Volume 1

Guidelines for the Conceptual Phase

August 1995

European Construction Institute

EUROPEAN
CONSTRUCTION
INSTITUTE

L'INSTITUT
EUROPEEN
DE CONSTRUCTION

EUROPÄISCHES
INSTITUT
FÜR ANLAGENBAU

TOTAL PRODUCTIVITY MANAGEMENT

Volume 1

Guidelines for the Conceptual Phase

PRODUCTIVITY TASK FORCE

August 1995

Publication: TF008/3/v1

EUROPEAN
CONSTRUCTION
INSTITUTE

L'INSTITUT
EUROPEEN
DE CONSTRUCTION

EUROPÄISCHES
INSTITUT
FÜR ANLAGENBAU

The European Construction Institute was conceived by a group of major construction clients, contractors and consultants. Founder members are some of the world's largest companies in their field of operation, most of them with European-wide operations. In forming ECI, these companies perceived the need in a market as large as Europe, for an Institute dedicated to improving the performance of the construction industry. The mission of the ECI is to achieve a continuous improvement in the efficiency, excellence and international competitiveness of European construction through research, development, co-operation and implementation.

ECI Sir Arnold Hall Building Loughborough University of Technology
Loughborough Leicestershire LE11 3TU United Kingdom

Telephone: +44 (0) 1509 222620 / 223640
Fax: +44 (0) 1509 260118
E-mail: i.williams@lut.ac.uk
http://info.lut.ac.uk/departments/cv/eci

EUROPEAN CONSTRUCTION INSTITUTE

PRODUCTIVITY TASK FORCE

CONTENTS

			Page
1.	Introduction		
	1.1	Introduction to Subject Matter	1
	1.2	Research Methodology	2
	1.3	Members of Task Force & contributors	3
2.	Recommendations		
	2.1	Introduction	5
	2.2	Recommended Best Practices	7
	2.3	Self Assessment Form	12

British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library

ISBN 1 873844 27 1

Published by
European Construction Institute
Sir Arnold Hall Building
Loughborough University
Loughborough
Leicestershire
LE11 3TU
United Kingdom

Reprinted February 1996

Printed by Audio Visual Services Loughborough University LE11 3TU UK

Prepared for publication with the assistance of
Vera Cole, Caroline Davis, Mary-Anne Parsons, Carol Ryan and Debbie Weston

1. Introduction

1.1 Introduction to Subject Matter

Construction is the largest industry in the world and correspondingly promises the greatest payback from an improvement in performance.

Put in financial terms, hundreds of billions of ECU are invested each year in construction activity and an improvement of even a fraction of a percent in performance would produce major financial savings. Competition in European and world markets is increasing all the time especially in the business sectors covered by the clients for whom the European construction industry undertake projects.

Productivity is the most common measure of performance in the construction industry and the clear objective therefore must be to achieve higher productivity.

It is recognised throughout the industry that if the right policies, strategies, systems and procedures are not properly thought out and designed before the project becomes a viable entity, productivity can suffer when the construction phase begins.

The European Construction Institute's Productivity Task Force[1] considered that clients and those who work with them in this phase should have the opportunity of benchmarking the own practices against the world's best with the aim of improving performance on their own future projects.

The Task Force has therefore produced a comprehensive study of those features which characterise the conceptual phase and which can have an impact on project productivity.

These guidelines are extracted from the study report and are intended to be of real practical benefit to all those involved in the initial setting up of a major project.

The best practice recommendations are presented in Sections 2.2 and a Self Assessment Form is provided to enable companies to benchmark their own conceptual phase practices against the recommendations.

[1] Established in 1990, the European Construction Institute brings together major clients, contractors and consultants to achieve a continuous improvement in the efficiency, excellence and international competitiveness of European construction through research, development co-operation and implementation.

1.2 Research Methodology

The initial remit was to review all aspects of construction productivity in Europe and the ECU's Productivity Task Force was set up in April 1991 to tackle this.

Because of the many areas of construction activity influencing project productivity, it was decided to sub-divide the Task Force into working sub-groups.

These addressed the following aspects:

- Conceptual aspects which ultimately affect site productivity (the subject of this report);
- On-Site aspects of productivity.

The On-Site working party has completed its studies and the results have been disseminated in the following ECI publications.

Total Productivity Management: Guidelines for the Construction Phase (TF008/2/v1)
Total Productivity Management: Volume 1 - On-Site productivity (Publication TF008/2/v2)

This study from which these guidelines are extracted was undertaken in three phases. Initially, a comprehensive literature search was carried out from industry and academic databases worldwide. From this, an annotated bibliography was developed with 75 abstracts, covering ten significant conceptual phase aspects which were identified as having a major impact on productivity.

A questionnaire was then produced to obtain the opinions of experienced project management experts in the industry to confirm the definitions of the ten features and to rank them in order of importance to guide the researcher in developing best practices, tasks and processes associated with the conceptual phase. Responses were obtained from 53 organisations covering clients, contractors, consultants and a merchant bank.

Finally, six case studies were carried out by the researcher into a variety of major projects to validate the application of the best practices identified in the earlier stages of the study.

The main findings, detailed survey results and the recommendations are included in the main report *Total Productivity Management Volume 2* (Publication TF008/3/v2) from which these have been extracted.

As a result of the best practices identification process, the Task Force has produced a set of recommendations designed to promote maximum construction productivity form actions taken in the conceptual phase of projects.

The best practice recommendations and the self-assessment form contained within these guidelines are intended to be a practical working document for all those involved in the initial setting up of a major project.

1.3 Members of Task Force and Contributors

Productivity Task Force Members

C J Brown, The Christopher Brown Consultancy * Chairman)

M R B Abdul-Kadir, Loughborough University of Technology*
M D Austick, GEC Alsthom ESL
D A Cowan, Babcock Construction Ltd
J P De Bock, CFE, MBG Office
B Dunn, Brown & Root Ltd*
Professor F Harris, University of Wolverhampton
J House, Mobil Oil Company Ltd
J Howlett, Technip
I A Knights, Stone & Webster Eng Ltd*
P Le Blond BAA plc
S G Montgomery, ABB Lummus Crest Europe
R C Pemberton, Taylor Woodrow Construction Ltd*
A D F Price, Loughborough University of Technology*
P Rimmer, HVCA
J Roper, Fluor Daniel Ltd
S Tarr, Balfour Beatty Civil Engineering Ltd
F Ussher, Bechtel Ltd
I Williams ECI

*** Conceptual Phase Productivity Sub-group Members**

Research Contributors

ABB Lummus Crest BV, The Netherlands
Acer Consultants Ltd
Amoco Chemical Company, USA
Andrews Weatherfoil Ltd
Antwerp Waste Management N.V., Belgium
Badger BV, The Netherlands
Balfour Beatty Civil Engineering
Balfour Beatty Projects & Eng Ltd
Barclays Structured Finance
Bayer Antwerpen N.V., Belgium
Bechtel Ltd
BP Exploration
BP/AMEC
BP/Brown & Root
British Gas Exploration Ltd
Brown & Root Highlands Fabricators Ltd
Brown & Root Civil
Brown & Root Ltd
Davis Langdon & Everest
Faithful & Gould
Fluor Daniel Ltd
George Corderoy & Co
Gifford & Partners

GTI Rotterdam Industrie BV, The Netherlands
Haden Young Ltd
Hamilton Oil Company Neste Production Ltd
Highlands Fabricators Ltd
Hutter Jennings & Titchmarsh
ICI C&P Group
John Brown E & C BV, The Netherlands
John Brown Eng Ltd
John Mowlem Construction plc
Laing Civil Engineering
Lurgi Öl Gas Chemie GmbH Germany
Mitie Engineering Services (S.E.) Ltd
Mobil Oil Company Ltd
N G Bailey & Co Ltd
National Power plc
Nederlandse Aardolie Maatschappij B.V.The Netherlands
Nuclear Electric plc
PowerGen plc
Siemens Plc
Snamprogetti SpA, Italy
Stone & Webster Engineering Ltd
Stork MEC N.V., Belguim
Sulzer Infra (UK) Ltd
Tampella Power Inc, Finland
Taylor Woodrow
Taylor Woodrow Construction (Northern) Ltd
Taymech Ltd
Team Management Services (UK) Ltd
Tebodin Consultants & Engineers, The Netherlands
Texaco Ltd
Travers Morgan International Ltd.
VSL Norge A/S, Norway
W S Atkins Consultants Ltd
Wanner Isofi, France
Yorkshire Water Authority

2.0 Recommendations

2.1 Introduction

A common concept that links productivity, TQM and benchmarking is the establishment of tasks and processes that are deemed to be targeted for change. Establishment of tasks as a prerequisite to improvement has been recognised throughout civilisation, when the same question has been repeatedly asked, "What is the task and how is it done?"

The next important item that is related to enhanced performance is the establishment of associated best practices. Best practice is taken to mean the group of the most desirable and beneficial day-to-day actions that result in superior performance. Through the adoption of the best practices, enhanced effectiveness of the off-site or conceptual phase will lead to improved productivity during the construction phase.

Conceptual phase tasks

It was established that the conceptual phase of construction projects comprised the following tasks:

Consents and permits
Project definition
Financial strategy
Project planning
Contract strategy
Project management organisation
Construction philosophy
Procurement strategy
Design of temporary works
Design of permanent works

Definition of conceptual phase tasks

TASKS	DEFINITION
Consents and Permits	Fulfilment of a society's embodiment of constitution, laws, statutes, regulations, norms and culture, which ensures rights and protections of itself in relation to the proposed project. In operational terms, any document which grants a person the right to do something; issued by a person in authority, empowering the grantee to do some act not forbidden by law, but not allowed without such authority.
Project definition	Resolution of options during the conceptual phase which culminates in statement of client's/owner's requirements.
Financial strategy	The principal means by which the capital funding of a project is justified and obtained
Project planning	Global planning of the whole project including the establishment of and commitment to defined schedules and milestones with built in incentives.
Contract strategy	A strategy that defines relationships, duties, obligations and policies which are directed/engineered towards the desired successful total project delivery in accordance with project planning, financial strategy, project definition, and consents and permits
Project management organisation	The formulation and configuration of the client's management team in accordance with the contract strategy.
Construction philosophy	The conceptual approach and method of construction that dictates the design of permanent structures and temporary works
Procurement strategy	Strategy for proactive project hardware purchasing is required to achieve complete project delivery in accordance with project schedule.
Design of temporary works	The principles of construction practices to realise the permanent works of the project which may or may not be part of the permanent works and reflects construction philosophy.
Design of permanent works	The conceptual design, preliminary layout and sketches outlining the permanent works so as to fulfil project definition

2.2 Recommended Best Practices for the Conceptual Phase

These recommended best practices have been developed through research methodology detailed in section 1.5. Some of the best practices may be more relevant to a particular situation than others. Nevertheless it is highly recommended that each best practice should be accepted or rejected consciously. The self-assessment form in Section 2.3 is meant to facilitate the conscious acceptance or rejection of all the best practices. In so doing, you are benchmarking your current practices against industry accepted best practices.

A. CONSENTS AND PERMITS

- Cost-benefit analysis should be performed for the whole process of consents and permits.
- Duration of the process of consents and permits should be assessed.
- Information and data should be established before embarking on the process of consents and permits.
- Political stability should be assessed for long term projects.
- Risk management should be performed.

B. PROJECT DEFINITION

- Project definition should be frozen throughout the project.
- Project definition should be defined clearly.
- Project definition formation process should be established.
- Project definition should be communicated to all relevant parties.

C. FINANCIAL STRATEGY

- Sources of finance should be secured.
- Method of payment should be established.
- Financial strategy should be compatible with contract strategy.
- Good estimate and cost control mechanism should be established.
- Progress performance should be linked with in-built monetary motivation.

D. PROJECT PLANNING

- Planning should be construction driven.
- Project objectives should be clearly defined.

- Project objectives should be in written form.
- Project objectives should suit all parties involved.
- An effective and simple communication system should be in place.

E. CONTRACT STRATEGY

- Choice of a particular type of contract should be rationalised against client objectives, nature of client, project size and complexity, and prevalent market conditions.
- Innovative contractual arrangements should be accepted if real benefit can be demonstrated.
- Timely selection of contract type should be ensured.
- A set of proven criteria should be established for contractor selection process.

(Dispute)

- Adversarial attitudes should be eliminated from forms of contract.
- A procedure for resolving disputes should be provided.

(Contract Document)

- Specification should be reviewed in detail by owner, designers and contractors personnel and served to simplify the field construction process.
- All unnecessary material should be removed from the contract document.
- Quality assurance should be built into the contract document.
- Risk should be distributed equitably between client and contractor.

(Work Organisation)

- Very large work packages should be avoided.
- Number of packages should be limited.

F. PROJECT MANAGEMENT ORGANISATION

(Client Project Management Team)

- Client project management organisation should be headed by a senior manager with excellent leadership qualities.
- Criteria for team membership should be set.
- The project team should be kept down to the smallest effective number of people.
- Team building activities should be instituted to foster team work and team approach.
- The Client team should be autonomous from the parent company.
- Continuity of project team key personnel should be achieved throughout the project duration.

(Client / Contractor Relationship)

- Team building activities should be initiated between clients' and contractors' teams.
- Each team from client and contractor should have clear senior management support.
- An atmosphere of trust and co-operation between clients' and contractors' teams should be nurtured.
- Informal communication and physical proximity should be facilitated between clients' and contractors' teams.
- Unity of purpose of client and contractor should be cultivated.
- Clients and contractors should be aware of foreign cultures when the need arises.

G. CONSTRUCTION PHILOSOPHY

(Standardisation)

- To facilitate design and construction, elements should be standardised.
- To facilitate construction, the benefits of pre-assembly or pre-fabrication should be reviewed.
- Modularisation should be reviewed.

(Site Constraint)

- Layout of site should consider site efficiency.
- Site activities should be minimised.

(Constructability Review)

- Design should address construction under site weather conditions.
- The constructability concept should be incorporated in the earliest stage of design.
- Design should promote accessibility of manpower, material and equipment.
- Clash checking should be instituted.
- A systematic material handling and tracking system should be installed.
- Complete certification of material and equipment should be achieved before entering site.

(Resources)

- Local labour resources should be investigated.
- Local industrial relations practices should be investigated.
- Any working pattern restrictions should be identified.
- Sources of raw material should be ascertained.

H. PROCUREMENT STRATEGY

(Resources)

- Availability of resources should be ensured.
- Systems that will improve vendor selection should be implemented.

(Planning)

- Timely supply of material with the right quality and quantity should be ensured.
- Long lead equipment or facilities should be identified.
- "Just in Time (JIT)" material deliveries should be evaluated.
- Shipping and manufacturing problems which could delay delivery deadlines should be identifed.
- Procurement strategy should give flexibility to construction needs.

I. DESIGN OF TEMPORARY WORKS

(Site Layout)

- Site layout should promote efficiency of construction operations and maintenance.
- Temporary works should promote safety, construction accessibility of personnel, material and equipment.

(Facilities)

- A good transportation system should be well established in advance.
- Storage areas should be planned taking account of transportation system and construction schedule.
- Adequate provision of area for workforce camp facility should be ensured.

J. DESIGN OF PERMANENT WORKS

(Simplification)

- Simplified design should be the aim in the detailed design.
- Design procedure should be standardised.
- Pre-assembly designs or factory finished components should be prepared to facilitate transportation and installation.

(Efficiency)

- Design should promote efficiency during construction and maintenance.
- CAD systems should be used.
- Standard procedures and specification should be upgraded so as to translate into new projects.
- Design team continuity for a particular project should be maintained.

(Schedule)

- Design schedule should be driven by construction requirements.
- Detail engineering of long delivery items should be given priority.

2.3 SELF ASSESSMENT BENCHMARKING FORM

The self assessment form is for you to benchmark project practices against an accepted best practice generally recognised by industry. Assess the good practices for each task for your last project and state whether: the best practices were adopted; the best practices should have been adopted; the best practices could have been adopted; or the best practices could not be adopted. *Please circle the appropriate number. Spaces are provided for comments.*

A CONSENTS AND PERMITS

The key issues addressed during the consents and permits task are: the generation of information and data relating to the facility to be constructed; and an estimation of cost and time associated with obtaining future consents and permits. The social, economic and political issues must also be addressed, and the correct environment for successful projects must be established.

DEFINITION: Fulfilment of a society's embodiment of constitution, laws, statutes, regulations, norms and culture, which ensures rights and protections of itself in relation to the proposed project. In operational terms, any document which grants a person the right to do something; issued by a person in authority, empowering the grantee to do some act not forbidden by law, but not allowed without such authority.

BEST PRACTICES	best practices were adopted	best practices should have been adopted	best practices could have been adopted	best practices could not be adopted
Cost-benefit analysis should be performed for the whole process of consents and permits.	1	2	3	4
Duration of the process of consents and permits should be assessed.	1	2	3	4
Information and data should be established before embarking on the process of consents and permits.	1	2	3	4
Political stability should be assessed for long term projects.	1	2	3	4
Risk management should be performed.	1	2	3	4

B PROJECT DEFINITION

Project definition addresses key issues such as project feasibility and definition of project needs at a very early stage. Project definition must be effectively communicated to all relevant parties as early as possible.

DEFINITION: Resolution of options during the conceptual phase which culminates in statement of client's/owner's requirements.

BEST PRACTICES	best practices were adopted	best practices should have been adopted	best practices could have been adopted	best practices could not be adopted
Project definition should be frozen throughout the project.	1	2	3	4
Project definition should be defined clearly.	1	2	3	4
Project definition formation process should be established.	1	2	3	4
Project definition should be communicated to all relevant parties	1	2	3	4

C FINANCIAL STRATEGY

The key issues considered during the development of a financial strategy are conceptual estimating, including source and cost of finance. Ensuring the right choice of currency, the appropriate political climate, a stable economic system, and security of funding sources during the whole project life-cycle are among the issues which should be addressed as part of the financial strategy. Compatibility with other tasks must also be achieved.

Definition: The principal means by which the capital funding of a total project is justified and obtained.

BEST PRACTICES	best practices were adopted	best practices should have been adopted	best practices could have been adopted	best practices could not be adopted
Sources of finance should be secured.	1	2	3	4
Method of payment should be established.	1	2	3	4
Financial strategy should be compatible with contract strategy.	1	2	3	4
Good estimate and cost control mechanism should be established	1	2	3	4
Progress performance should be linked with in-built monetary motivation.	1	2	3	4

D PROJECT PLANNING

The main issues to be considered during project planning are the deadlines for finalising all other tasks in the conceptual phase, and the other phases of detailed engineering, procurement, construction and handover of a construction project. Other issues such as identification of resources, objective setting, and establishing communication and information systems are also to be addressed. The main outcome of project planning should be a defined schedule with easily identifiable milestones.

DEFINITION: Global planning of the whole project including the establishment of and commitment to defined schedules and milestones with built in incentives.

BEST PRACTICES	best practices were adopted	best practices should have been adopted	best practices could have been adopted	best practices could not be adopted
Planning should be construction driven.	1	2	3	4
Project objectives should be clearly defined.	1	2	3	4
Project objectives should be in written form.	1	2	3	4
Project objectives should suit all parties involved.	1	2	3	4
An effective and simple communication system should be in place.	1	2	3	4

E CONTRACT STRATEGY

The main issues considered as part of the contract strategy are the type of contract, methods of equitable allocation of risk and establishing availability of competent contractors. Amongst other issues to be considered are appropriate pricing policy, establishing the appropriate contract document and project control, setting quality standards, and finalising work package organisation.

DEFINITION: A strategy that defines relationships, duties, obligations and policies which are directed/engineered towards the desired successful total project delivery in accordance with project planning, financial strategy, project definition, and consents and permits

BEST PRACTICES (Contract Type)	**best practices were adopted**	**best practices should have been adopted**	**best practices could have been adopted**	**best practices could not be adopted**
Choice of a particular type of contract should be rationalised against client objectives, nature of client, project size and complexity, and prevalent market conditions.	1	2	3	4
Innovative contractual arrangements should be accepted if real benefit can be demonstrated.	1	2	3	4
Timely selection of contract type should be ensured.	1	2	3	4
A set of proven criteria should be established for contractor selection process.	1	2	3	4

BEST PRACTICES (Dispute)	**best practices were adopted**	**best practices should have been adopted**	**best practices could have been adopted**	**best practices could not be adopted**
Adversarial attitudes should be eliminated from forms of contract.	1	2	3	4
A procedure for resolving disputes should be provided.	1	2	3	4

(cont.' E CONTRACT STRATEGY)

BEST PRACTICES (Contract Document)	**best practices were adopted**	**best practices should have been adopted**	**best practices could have been adopted**	**best practices could not be adopted**
Specification should be reviewed in detail by owner, designers and contractors personnel and designed to simplify the field construction process.	1	2	3	4
All unnecessary material should be removed from the contract document.	1	2	3	4
Quality assurance should be built into the contract document.	1	2	3	4
Risk should be distributed equitably between client and contractor.	1	2	3	4

BEST PRACTICES (Work Organisation),	**best practices were adopted**	**best practices should have been adopted**	**best practices could have been adopted**	**best practices could not be adopted**
Very large work packages should be avoided.	1	2	3	4
Number of packages should be limited.	1	2	3	4

F PROJECT MANAGEMENT ORGANISATION

Project management organisation involves the formation and configuration of the client's management team. It must establish the extent of power and responsibility, whilst facilitating a team building process. Establishing a mechanism for dispute resolution, team decision making process, and communication networks are important issues to be considered in this task. Ensuring the right motivating work environment must also be taken into consideration.

DEFINITION: The formulation and configuration of the client's management team in accordance with the contract strategy.

BEST PRACTICES (Client Project Management Team)	**best practices were adopted**	**best practices should have been adopted**	**best practices could have been adopted**	**best practices could not be adopted**
Client project management organisation should be headed by a senior manager with excellent leadership qualities.	1	2	3	4
Criteria for team membership should be set.	1	2	3	4
The project team should be kept down to the smallest effective number of people.	1	2	3	4
Team building activities should be instituted to foster team work and team approach.	1	2	3	4
The Client team should be autonomous from the parent company.	1	2	3	4
Continuity of project team key personnel should be achieved throughout the project duration.	1	2	3	4

(cont.' F PROJECT MANAGEMENT ORGANISATION)

BEST PRACTICES (Client / Contractor Relationship)	**best practices were adopted**	**best practices should have been adopted**	**best practices could have been adopted**	**best practices could not be adopted**
Team building activities should be initiated between clients' and contractors' teams.	1	2	3	4
Each team from client and contractor should have clear senior management support.	1	2	3	4
An atmosphere of trust and co-operation between clients' and contractors' teams should be nurtured.	1	2	3	4
Informal communication and physical proximity should be facilitated between clients' and contractors' teams	1	2	3	4
Unity of purpose of client and contractor should be cultivated.	1	2	3	4
Clients and contractors should be aware of foreign cultures when the need arises.	1	2	3	4

G CONSTRUCTION PHILOSOPHY

Construction philosophy involves the evaluation of alternatives and characterises the degree of standardisation, modularisation, and prefabrication. It also represents policy towards neighbouring operations and structures. Construction philosophy is heavily influenced by weather, resources availability, safety and quality requirements.

DEFINITION: The conceptual approach and method of construction that dictates the design of permanent structures and temporary works

BEST PRACTICE (Standardisation)	**best practices were adopted**	**best practices should have been adopted**	**best practices could have been adopted**	**best practices could not be adopted**
To facilitate design and construction, elements should be standardised.	1	2	3	4
To facilitate construction, the benefits of pre-assembly or pre-fabrication should be reviewed.	1	2	3	4
Modularisation should be reviewed.	1	2	3	4

BEST PRACTICES (Site Constraint)	**best practices were adopted**	**best practices should have been adopted**	**best practices could have been adopted**	**best practices could not be adopted**
Layout of site should consider site efficiency.	1	2	3	4
Site activities should be minimised.	1	2	3	4

BEST PRACTICES (Constructability Review)	**best practices were adopted**	**best practices should have been adopted**	**best practices could have been adopted**	**best practices could not be adopted**
Design should address construction under site weather conditions.	1	2	3	4
The constructability concept should be incorporated in the earliest stage of design.	1	2	3	4
Design should promote accessibility of manpower, material and equipment.	1	2	3	4
Clash checking should be instituted.	1	2	3	4

(cont.' G CONSTRUCTION PHILOSOPHY)

BEST PRACTICES	best practices were adopted	best practices should have been adopted	best practices could have been adopted	best practices could not be adopted
A systematic material handling and tracking system should be installed.	1	2	3	4
Complete certification of material and equipment should be achieved before entering site.	1	2	3	4
BEST PRACTICES (Resources)				
Local labour resources should be investigated.	1	2	3	4
Local industrial relations practices should be investigated.	1	2	3	4
Any working pattern restrictions should be identified.	1	2	3	4
Sources of raw material should be ascertained.	1	2	3	4

H PROCUREMENT STRATEGY

Procurement strategy establishes the policy on the whole procurement task ensuring availability and timely supply of resources such as material, plant and equipment and power. Achieving the required standards and specifications is also of concern.

DEFINITION: Strategy for proactive project hardware purchasing is required to achieve complete project delivery in accordance with project schedule.

BEST PRACTICE (Resources)	best practices were adopted	best practices should have been adopted	best practices could have been adopted	best practices could not be adopted
Availability of resources should be ensured.	1	2	3	4
Systems that will improve vendor selection should be implemented.	1	2	3	4

BEST PRACTICES (Planning)	best practices were adopted	best practices should have been adopted	best practices could have been adopted	best practices could not be adopted
Timely supply of material with the right quality and quantity should be ensured.	1	2	3	4
Long lead equipment or facilities should be identified.	1	2	3	4
"Just in time (JIT)" material deliveries should be evaluated.	1	2	3	4
Shipping and manufacturing problems which could delay delivery deadlines should be identifed.	1	2	3	4
Procurement strategy should give flexibility to construction needs.	1	2	3	4

I DESIGN OF TEMPORARY WORKS

The design of temporary structures very often reflects the construction philosophy taking account of site layout, site facilities, efficiency and safety.

DEFINITION: The principles of construction practices to realise the permanent structures of the project which may or may not be part of the permanent structure and reflects construction philosophy.

BEST PRACTICES (Site Layout)	**best practices were adopted**	**best practices should have been adopted**	**best practices could have been adopted**	**best practices could not be adopted**
Site layout should promote efficiency of construction operations and maintenance.	1	2	3	4
Temporary works should promote safety, construction accessibility of personnel, material and equipment.	1	2	3	4

BEST PRACTICES (Facilities)	**best practices were adopted**	**best practices should have been adopted**	**best practices could have been adopted**	**best practices could not be adopted**
A good transportation system should be well established in advance.	1	2	3	4
Storage areas should be planned taking account of transportation system and construction schedule.	1	2	3	4
Adequate provision of area for workforce camp facility should be ensured.	1	2	3	4

J DESIGN OF PERMANENT WORKS

The design of permanent works must take account of construction philosophy, and realise simplification and standardisation of design that will promote efficiency and conformity to the required schedule and standards.

DEFINITION: The conceptual design, preliminary layout and sketches outlining the permanent works so as to fulfil project definition.

BEST PRACTICES (Simplification)	best practices were adopted	best practices should have been adopted	best practices could have been adopted	best practices could not be adopted
Simplified design should be the aim in the detailed design.	1	2	3	4
Design procedure should be standardised.	1	2	3	4
Pre-assembly designs or factory finished components should be prepared to facilitate transportation and installation.	1	2	3	4

BEST PRACTICES (Efficiency)	best practices were adopted	best practices should have been adopted	best practices could have been adopted	best practices could not be adopted
Design must promote efficiency during construction and maintenance.	1	2	3	4
CAD systems should be used.	1	2	3	4
Standard procedures and specification should be upgraded so as to translate into new projects	1	2	3	4
Design team continuity for a particular project should be maintained.	1	2	3	4

BEST PRACTICES (Schedule)	best practices were adopted	best practices should have been adopted	best practices could have been adopted	best practice could not be adopted
Design schedule should be driven by construction requirements.	1	2	3	4
Detail engineering of long delivery items should be given priority.	1	2	3	4

ECI, John Pickford Building
Loughborough University
Loughborough
LE11 3TU, UK

T +44 (0)1509 222620
F +44 (0)1509 260118
E eci@lboro.ac.uk
www.eci-online.org