

# Total Productivity Management

## Guidelines for the Construction Phase

June 1994

EUROPEAN  
CONSTRUCTION  
INSTITUTE



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TOTAL PRODUCTIVITY MANAGEMENT

Guidelines For The Construction Phase

PRODUCTIVITY TASK FORCE

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# European Construction Institute

## Productivity Task Force

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## **Introduction**

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 industry performance would produce major financial savings. Competition in the world and European markets has never been keener and client organisations are demanding productivity guarantees in their attempts to cap construction project costs.

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

This has, and continues to be, a very difficult task. The most reliable measure of productivity is the output being achieved at the construction site, i.e. the labour productivity. Labour costs typically contribute around 30% to the overall project costs, so maximising the output on-site is the first area to focus attention upon in order to increase an engineering contractor's performance and the value for money investment for the customer.

To assist the industry in promoting improvements in productivity, the European Construction Institute's<sup>1</sup> Productivity Task Force undertook a large investigative study involving 84 construction related companies within Europe to highlight productivity problems and to suggest remedies to solve these problems and to improve performance.

The study focussed upon construction activities specific to on-site works. The aim was to identify areas of potential loss on the output side of the equation and in so doing develop suggested best practices which can be adopted to rationalise the input side, therefore aiming to maximise the productive outputs being achieved at the workplace.

A comprehensive review of the currently available papers on this subject was also undertaken as part of the overall study which concluded that the contents of the study report are unique and of practical benefit if acted upon.

These guidelines are extracted from the study report and are intended to be of real practical use to construction managers when they need to introduce initiatives to maximise their on-site project productivity.

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<sup>1</sup> Established in 1990, the European Construction Institute brings together major clients, contractors and consultants to improve the performance of the construction industry.

## **Historical Summary**

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

Because of the many areas of influence on-site productivity, it was decided to sub-divide the Task Force into working parties.

The working parties that were set up addressed:-

- A. On-site aspects of productivity (these guidelines).
- B. National and industry factors which ultimately affected site productivity.
- C. Project specific off-site aspects and project conceptual considerations which ultimately affected site productivity.

(Items B and C will be the subjects for future ECI reports but some initial results relative to Item C have been included in Section 2 of these guidelines since they are considered to be of fundamental importance).

The report from which these guidelines were taken was undertaken by the On-Site Working Party and is directed towards the Mechanical Engineering Construction Industry.

The first phase of the investigative study was to complete a substantial postal survey from customers and contractors all over Europe. In this survey senior company representatives were asked to highlight the specific problems which, in their opinion, influenced on-site productivity.

The questionnaire was sent to 136 companies from which a response rate of 60% was achieved. This was deemed to be a very good rate for a survey of this nature and confirmed the importance given to this subject by the industry. After analysis by the Task Force the main areas which were deemed to influence productivity on-site were identified. These were:-

- the quality of the Site Manager and his management team
- the construction methods and work organisation
- motivation, team spirit, skill level and trade flexibility
- quality of engineering.

Phase II of the study explored these factors in a series of face to face interviews with 18 engineering contractors in the United Kingdom and Continental Europe and the best practices and recommendations derived from the study are contained in Section 1 of these guidelines.

A self-assessment form is appended to Section 1 so that individual companies can benchmark their own performance against the listed best practices.

## Members of the ECI's Productivity Task Force

### Members of the ECI's Productivity Task Force

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**1. Best Practice Recommendations  
from a European Study of Construction Site Productivity Influences  
(On-Site Sub Group)**

The best practice recommendations which follow emerged from the analysis, by the Productivity Task Force, of the detailed surveys carried out on 18 European companies within the Engineering Construction Industry.

The ECI stress the need for individual companies to use these best practice recommendations as a definitive guide on what has to be done in order to ensure that effective productivity is achieved at site.

A self assessment form has also been developed so that individual companies can "benchmark" their own overall attainment against these best practices. This form can be tailored to benchmark individual sites within a particular company.

The form, along with our recommended instructions for use, is attached at the end of this Section.

The key aim is to improve productivity on individual sites, within individual companies and eventually within the European Engineering Construction Industry. By so doing, individual companies are able to improve their performance through productivity gains and maintain their capability of competing in the European and World construction market.

1. **Site Management**
2. **Planning and Organisation**
3. **Satisfaction and Motivation**
4. **Workforce Skills**
5. **Construction Methods**
6. **Self Assessment Form**

## **1. Site Management**

### **Recommendations for the Improvement of Site Management**

#### **SITE MANAGER**

- 1.1 Potential Site Managers should be TRAINED by job rotation experience on-site in order that they develop an understanding of the requirements of a Site Management Team.
- 1.2 The Site Manager must be a MANAGER and define his organisation and operational procedures to comply with the Company's BS 5750 / ISO 9000 guidelines, in particular:-
  - 1.2(a) The Site Manager should be given clearly defined TARGETS and the necessary AUTHORITY to achieve them.
  - 1.2(b) The Site Management STRUCTURE must be clearly defined at all times and have the minimum of reporting levels.
  - 1.2(c) The DUTIES, RESPONSIBILITIES AND DECISION MAKING AUTHORITY of everyone from the Site Manager to Site Supervision must be clearly defined and respected.
  - 1.2(d) The role and responsibilities of the SHOP FLOOR REPRESENTATIVES must be clearly understood and their lines of communication clearly defined.
- 1.3 The Site Manager must be a DECISION MAKER, be able to give REALISTIC TARGETS to his staff and RESPECT the work achieved by all personnel in his charge.
- 1.4 The Site Manager should be prepared to consider recommendations which could lead to improved productivity and be COMMITTED to the implementation of those deemed to have potential.
- 1.5 The Site Manager should FEED-BACK potential productivity improving recommendations by means of a formalised system which reaches the relevant HQ functions.

#### **GENERAL MANAGEMENT ASPECTS**

- 1.6 GOOD ACHIEVEMENT, at all levels, must be formally recognised by site management. This can be expressed in many forms from verbal praise through to monetary rewards or gifts.
- 1.7 Maintain GOOD RELATIONSHIPS, at all levels, with the CLIENT and attempt to ANTICIPATE THEIR REQUIREMENTS, such as:-
  - 1.7(a) COMMUNICATING EFFECTIVELY on work scope changes, preferably prior to installation, and other matters which could lead to confrontation or claim scenarios.

**1. Site Management (contd)**

- 1.7(b) ENCOURAGING EARLY INVOLVEMENT with the commissioning/ operating personnel and by so doing reducing rework or access/layout problems.
- 1.8 A FIELD DESIGN ENGINEER should be part of the site erection team and have the AUTHORITY to effect CHANGE, resolve CLASHES or assist when MISTAKES are made. Such availability minimises WAITING TIME and eliminates IMPROVISATION.
- 1.9 Supervisors must have a clear understanding of their responsibility for MOTIVATING the workforce towards ACHIEVING excellent productivity. Giving them clearly defined TARGETS and the necessary AUTHORITY to achieve them is vital.
- 1.10 Supervisors from a TRADE background to be specially trained in matters relevant to their new responsibilities.
- 1.11 Supervisors must be chosen from persons who can COMMAND AUTHORITY and they must have LEADERSHIP CAPABILITIES.
- 1.12 Supervisors should be INVOLVED in the day to day scheduling of work scope and the ALLOCATION of resource.
- 1.13 Supervisors must report ACCURATELY the daily progress and the manhours spent in achieving such progress. Such reporting must include the recording of delay situations and the means by which repetition can be avoided. Their other administrative and paperwork duties should be minimal.
- 1.14 Supervisors must actively participate in TOOL BOX TALKS which must be used to give trades people information, advice and instruction as well as being a forum which allows the workforce to PARTICIPATE in the recommendation of changes to or improvements in their working methods and their working environment.

**TRAINING (GENERAL)**

- 1.15 Training must be structured and should reach a Nationally recognised standard for all site management and must concentrate on MANAGEMENT and LEADERSHIP skills along with CONTRACT SPECIFIC REQUIREMENTS.
- 1.16 Adequate INDUCTION TRAINING will ensure familiarisation with site specific requirements and awareness of Company specific policies such as SAFETY and QUALITY, and procedures relative to employment terms and conditions.
- 1.17 Training in NEW METHODS and in the use of COMPUTERS is vital in supplementing existing knowledge and experience.

**QUALITY AND SAFETY MANAGEMENT**

- 1.18 Companies should have a reliable and user friendly QUALITY ASSURANCE SCHEME (as recommended by BS 5750 / ISO 9000) which all employees are OBLIGED to implement properly.

## 1. Site Management (contd)

- 1.19 Companies should have an effective SITE SAFETY MANAGEMENT SYSTEM and actively target a CONTINUOUSLY IMPROVING safety performance record.
- 1.20 Consideration should be given to the introduction, at contract commencement, of financially rewarding SAFETY PERFORMANCE CHALLENGES which are linked to productivity.
- 1.21 The Site Manager should liaise with the QA Manager and the Safety Manager to ensure EFFICIENT AND EFFECTIVE working practices exist on-site.
- 1.22 The ECI manual entitled, *Total Project Management of Construction Safety, Health and Environment*, provides a very useful reference for effective Safety Management on-site.

## 2. Planning and Organisation

The following recommendations are based on consistent comments received throughout the countries surveyed and which have proved to be effective in assisting to achieve improved productivity:-

### PLANNING

#### Progress

- 2.1 A COMPUTERISED planning system is beneficial but demands that detailed information is available at the very beginning of a project AND that such information is REGULARLY UPDATED and in a format readily understood by supervision. Erection progress assessment must be ACCURATE and REGULARLY MONITORED.
- 2.2 DETAILED schedules must be available for ENGINEERING input and MATERIAL deliveries.
- 2.3 DETAILED ERECTION PROGRAMMES should be issued WEEKLY to the Site Supervision and the progress made CONSISTENTLY monitored.
- 2.4 The total work scope requires to be planned in DETAIL and supported with:-
  - 2.4(a) A quick and effective FEEDBACK system which will highlight deviations from the original plan.
  - 2.4(b) A flexible system which allows the rapid comparison of ALTERNATIVE courses of action from which informed management decisions can be taken.
  - 2.4(c) An effective means of scheduling and then ALLOCATING human resources.

**2. Planning and Organisation (contd)**

- 2.5 Work scope installation should not commence until there is an ADEQUATE level of materials and drawings available to MAINTAIN production.

**Performance**

- 2.6 Hold REGULAR MEETINGS to review PRODUCTIVITY.
- 2.7 Develop a system which compares manhours spent and physical progress achieved against the INHOUSE targets sets. All deviations must be dealt with PROMPTLY.
- 2.8 Monitor INDIVIDUAL productivity performance on a REGULAR basis. Such information can be used for:-
- 2.8(a) Encouraging, or training for, improvement.
  - 2.8(b) Yearly individual assessment records.
  - 2.8(c) Selection for transfer, etc.

**Material Supply**

- 2.9 MATERIAL DELIVERY to site is a CRITICAL, PRODUCTIVITY RELATED, aspect which demands the introduction of a carefully developed system of monitoring and control as early as possible. Such a system needs to be:-
- 2.9(a) DETAILED so as to include items like nuts, bolts, washers and gaskets.
  - 2.9(b) Regularly updated with REAL delivery timescales.
  - 2.9(c) Fully COMPREHENSIVE and therefore covers the total scope of works.
  - 2.9(d) Regularly updated to ensure an ACCURATE scope definition.
- 2.10 The material DELIVERIES must satisfy the contract programme and recognise the need to maintain practical levels of human and equipment resources which will, in turn, allow the required progress to be achieved.
- 2.11 If possible, the erection contractor should have DIRECT CONTROL or ACCURATE KNOWLEDGE of all material deliveries. This should also involve VISITING SUPPLIERS to ensure progress is being achieved.
- 2.12 Material IDENTIFICATION and STORAGE requirements should be clearly determined before procurement orders are placed.

## **2. Planning and Organisation (contd)**

- 2.13 Material deliveries should be HARMONISED with the availability of "Approved For Construction" drawings.
- 2.14 Materials received on-site should be adequately covered by the SECURITY MANAGEMENT SYSTEM.
- 2.15 WASTAGE has a detrimental effect on PRODUCTIVITY and must be strictly monitored.

### **ORGANISATION**

- 2.16 An EFFECTIVE site organisation and the NECESSARY construction procedures require to be in place at the START of the site installation, as a good start to construction is vital in securing eventual success.
- 2.17 Allocate sufficient management time and resource to deal with multi-contractor INTERFACE problems.
- 2.18 A SEPARATE SQUAD should be made responsible for providing bulk Contract Material and major tools and erection equipment from the stock area.
- 2.19 Consumable items, Personal Protective Equipment and Contract Materials must be READILY AVAILABLE when required at the WORKFACE but tightly controlled and properly maintained.
- 2.20 Carry out PLANNED AND COMPREHENSIVE AUDITS on potential sub-contractors BEFORE entering into Contract.
- 2.21 Ensure that Quality Control keeps FULLY UP TO DATE with PRODUCTION, so that prompt action can be taken when rejected work is established.

## **3. Satisfaction and Motivation**

Job satisfaction and employee motivation are key aspects in promoting improved productivity. They are also aspects which are greatly influenced by National Regulations and Historical Culture and, as such, the best practice recommendations vary from country to country.

A comprehensive listing of recommendations is therefore presented for consideration.

### **REDUCE REWORKING**

- 3.1 Ensure adequate design/engineering LEAD TIME.
- 3.2 Do not allow site construction activities to get AHEAD of the design/engineering and supply functions.

**3. Satisfaction and Motivation (contd)**

- 3.3 Where possible, have experienced site field foremen/engineers REVIEW the engineering concepts and construction drawings PRIOR to initiating the site works.
- 3.4 Ensure that "Approved For Construction" drawings and schedules contain all the necessary erection INFORMATION AND that such information is readily AVAILABLE and SIMPLE to extract.
- 3.5 Ensure that the labour force, the first line supervision, the inspectors and quality assurance engineers are properly introduced to and trained in the PROJECT SPECIFIC SPECIFICATIONS, thus setting a clear definition of the REQUIRED STANDARDS and encouraging a commonality of purpose.

**IMPROVE QUERY TURNAROUND**

- 3.6 By having a DIRECT HOT LINE to the off-site design office or managing contractor thus encouraging prompt decisions.
- or
- 3.7 By having a senior design representative ON-SITE who has the CAPABILITY and AUTHORITY to make decisions.

**REDUCE WAITING TIME**

- 3.8 Provide an effective and dedicated service for co-ordinating the supply of labour, materials, tools, services and instructions to the supervisor AT THE WORKFACE.
- 3.9 Ensure that INSPECTION and other services are available WHEN REQUIRED.
- 3.10 Provide adequate and secure WORKFACE STORAGE facilities for tools and equipment.

**REDUCE WALKING TIME**

- 3.11 Position consumable and tool stores as CLOSE as possible to the WORKFACE.
- 3.12 Position messing and toilet facilities as CLOSE to the WORKFACE as possible.
- 3.13 Establish WORKFACE facilities for supervisory/engineering administration.
- 3.14 Install CLOCKING FACILITIES as close to the WORKFACE as possible and establish a "change before" and "change after" clocking regime.



**3. Satisfaction and Motivation (contd)**

**SAFETY AND THE ENVIRONMENT**

People work better when they feel SAFE and the following aspects should be considered:-

- 3.15 The WORKING ENVIRONMENT (e.g. lighting, access, scaffolding, housekeeping, power and air supply) requires to be as good as practicably possible.
- 3.16 The management of SAFETY on-site must include WORKFORCE PARTICIPATION.
- 3.17 Safety performance must be MONITORED and the key results adequately displayed.
- 3.18 Each accident must be investigated and any "lessons learnt" COMMUNICATED to the site labour force.
- 3.19 Regular tool box talks will ensure EFFECTIVE COMMUNICATION on Safety Matters.

**ABSENTEEISM AND OVERTIME WORKING**

- 3.20 Establish an EFFECTIVE means of controlling and monitoring absenteeism of all types from day one on-site.
- 3.21 Avoid REGULAR overtime in excess of 6 hours per week.
- 3.22 Avoid REGULAR night shift working.
- 3.23 When overtime is necessary select workers from those who VOLUNTEER.

**FINANCIAL INCENTIVES**

- 3.24 Do not give bonus "automatically" - financial incentives must be EARNED.
- 3.25 Practices vary considerably according to National regulations and tax structure. Cultural heritage and practical experience also influence the following summary:-
  - 3.25(a) Type of Scheme
    - Site Wide Fixed Payment
    - Site Wide Productivity Related
    - Team Productivity
    - Individual Productivity
  - 3.25(b) Performance Assessed
    - Monthly
    - Fortnightly
    - Weekly
    - Daily

**3. Satisfaction and Motivation (contd)**

- 3.25(c)      Payment Type
- Money
  - Gifts
  - Time off while paid
- 3.26      Financial incentives are more effective when applied to SMALL TEAMS of workers and displaying team performance can also encourage productivity improvements.
- 3.27      When bonuses are used, the work done must be easily MEASURABLE and ACCURATELY measured.

**MISCELLANEOUS**

- 3.28      Encourage trade FLEXIBILITY.
- 3.29      Pay particular attention to MAINTAINING productivity at the END of a project especially if employees cannot be assigned to another site.
- 3.30      National or site agreements should be used whenever possible on major projects in order to MINIMISE Industrial Relation problems by giving the total workforce similar employment conditions.

**4. Workforce Skills**

The following recommendations, which relate to the improvement of workforce skills, are relevant to all countries:-

- 4.1      Introduce practical SKILL TESTS for all trades PRIOR to employment.
- 4.2      Develop MULTI-SKILLED tradesmen from the apprenticeship stage.
- 4.3      ENCOURAGE trade flexibility through training in new methods and practices followed by the allocation of suitable work tasks.
- 4.4      Introduce a system of regular INDIVIDUAL ASSESSMENT covering quality and quantity of work output. The results should be communicated to the employees and, along with the general status on behaviour, be a feature on which SELECTION for redundancy and/or transfer is decided.
- 4.5      Consider the advantages of "DE-SKILLING" many of the Site Construction tasks.
- 4.6      Retraining in NEW methods, skills and procedures to supplement existing skill levels and experience.

## **5. Construction Methods**

The following are recommended to increase the efficiency of construction:-

- 5.1 Construction methods should be **SELECTED** to provide the **MOST PRODUCTIVE** result based on a cost effective analysis of safety, cost, time, practicability, quality achievable and the availability and utilisation of resources. Three current examples are:-
  - 5.1(a) The prefabrication of concrete pipe racks.
  - 5.1(b) The use of disposable cardboard formwork for circular columns.
  - 5.1(c) The use of diamond tip trepanning equipment to make late cable/pipe routes in concrete foundations or walls.
- 5.2 **CONTRACTOR** be given the opportunity to **INPUT** into the **DESIGN** mechanism to provide **EXPERT** advice on the most **SIMPLE** and **EFFECTIVE** construction method.
- 5.3 All **CRITICAL CONSTRUCTION METHODS** should be written down into formal statements of intent and **APPROVED**.
- 5.4 Changes in methods and procedures should be implemented with the full **CO-OPERATION** of the workforce and this aspect requires effective communication between all parties on-site.

## 6. Self Assessment Form

PRODUCTIVITY TASK FORCE SELF ASSESSMENT FORM				
REF	RECOMMENDATION	PRESENT POSITION	CHECKING METHOD (Yes/No)	TO BE IMPLEMENTED (Yes/No)
1	<b>SITE MANAGEMENT</b>			
1.1	Potential site managers should be trained by job rotation on-site			
1.2(a)	The site manager should be given defined targets and authority			
1.2(b)	The site management structure should be clearly defined			
1.2(c)	The site management positions should be defined through job tickets			
1.3	The site manager must be a decision maker			
1.4	The site manager should consider productivity improvement recommendations			
1.5	The site manager should feed back to the head office productive recommendations			
1.6	Good achievement should be formally recognised			
1.7	Client requirements should be anticipated			
1.8	A field engineer should be part of the site erection team with adequate authority			
1.9	Supervisors should be responsible for achieving excellent productivity			
1.10	Supervisors from a trade background should be trained for their new responsibilities			
1.11	Supervisors should have leadership capabilities			
1.12	Supervisors should be involved in daily work organisation			

**PRODUCTIVITY TASK FORCE  
SELF ASSESSMENT FORM**

REF	RECOMMENDATION	PRESENT POSITION	CHECKING METHOD (Yes/No)	TO BE IMPLEMENTED (Yes/No)
<b>1</b>	<b>SITE MANAGEMENT (contd)</b>			
1.13	Supervisors should report accurately daily manhours spent and progress			
1.14	Supervisors should participate in tool box talks			
1.15	Training should concentrate on management and leadership skills and contract specific requirements			
1.16	Induction training should be given in site specific requirements and Company policies			
1.17	Training in new methods and the use of computers should be implemented			
1.18	A quality assurance scheme should be implemented and its use enforced			
1.19	Improvement of the safety performance record should be sought			
1.20	Implementation of safety performance challenges should be considered			
1.21	The site manager should liaise with QA and safety to ensure efficient and effective working practices on-site			

PRODUCTIVITY TASK FORCE SELF ASSESSMENT FORM				
REF	RECOMMENDATION	PRESENT POSITION	CHECKING METHOD (Yes/No)	TO BE IMPLEMENTED (Yes/No)
2	<b>PLANNING &amp; ORGANISATION</b>			
2.1	Progress assessment should be accurately and regularly monitored, preferably through a computerised system			
2.2	Detailed schedules should be available for engineering input and material deliveries			
2.3	Weekly erection programmes should be issued to the site supervision and progress consistently monitored			
2.4	The total work scope should be planned in detail.			
2.5	Work scope installation should not commence until there is an adequate level of materials and drawings available to maintain production			
2.6	Regular meetings should be held to review productivity			
2.7	A system should be developed to compare manhours spent against in house targets			
2.8	Individual productivity performance should be monitored			
2.9	A monitoring and control material supply system should be used and regularly updated			
2.10	Material deliveries should allow sufficient work volume availability			
2.11	The erection contractor should have accurate knowledge of material deliveries status			

PRODUCTIVITY TASK FORCE SELF ASSESSMENT FORM				
REF	RECOMMENDATION	PRESENT POSITION	CHECKING METHOD (Yes/No)	TO BE IMPLEMENTED (Yes/No)
2	<b>PLANNING &amp; ORGN (contd)</b>			
2.12	Purchase orders should specify material identification and storage requirements			
2.13	Material deliveries should be harmonised with the availability of AFC drawings			
2.14	Materials received on-site should be covered by the security management system			
2.15	Wastage should be strictly monitored			
2.16	An effective site organisation and operational procedures should be in place at start of construction			
2.17	Multicontractor interface problems should be monitored by the site management			
2.18	A separate squad should be in charge of bringing materials to the workface			
2.19	Materials, tools and equipment should be readily available at the workface			
2.20	Potential subcontractors should be audited prior to subcontract award			
2.21	Quality control should keep fully up to date with production			

**PRODUCTIVITY TASK FORCE  
SELF ASSESSMENT FORM**

REF	RECOMMENDATION	PRESENT POSITION	CHECKING METHOD (Yes/No)	TO BE IMPLEMENTED (Yes/No)
<b>3</b>	<b>SATISFACTION &amp; MOTIVATION</b>			
3.1	Adequate design / engineering lead time should be ensured			
3.2	Construction activities should not be allowed to get ahead of design / engineering and supply			
3.3	Site field foremen / engineers should review drawings prior to initiating site works			
3.4	AFC drawings and schedules should contain all necessary information in a simple form			
3.5	The workforce and supervision should be trained in project specific specifications			
3.6/ 3.7	A senior design representative should be assigned to site			
3.8	Co-ordinate the delivery of materials tools and services to the workplace			
3.9	Inspection and other services should be available when required			
3.10/ 3.11	Workface storage facilities should be provided			
3.12	Workface messing and toilet facilities should be provided			
3.13	Workface supervisory /engineering facilities should be provided			
3.14	Workface clocking facilities should be provided			
3.14	A "change before" and "change after" clocking regime should be established			
3.15	A good safe working environment should be provided			
3.16	The management of safety on site should include workforce participation			



**PRODUCTIVITY TASK FORCE  
SELF ASSESSMENT FORM**

REF	RECOMMENDATION	PRESENT POSITION	CHECKING METHOD (Yes/No)	TO BE IMPLEMENTED (Yes/No)
<b>3</b>	<b>SATISFACTION &amp; MOTIVATION (contd)</b>			
3.17	Safety performance should be monitored and results displayed			
3.18	Each accident should be investigated and the "lessons learned" communicated to the site labour			
3.19	Safety matters should be addressed during the tool box talks			
3.20	An effective means of controlling absenteeism should be established			
3.21	Regular overtime in excess of 6 hours per week should be avoided			
3.22	Regular nightshift working should be avoided			
3.23	Overtime workers should be selected from volunteers			
3.24	Bonuses should not be automatic but earned			
3.25	Financial incentives should be established in accordance with national culture and regulations			
3.26	Financial incentives should be implemented at team level			
3.27	Work subject to bonuses should be easily measurable and accurately measured			
3.28	Trade flexibility should be encouraged			
3.29	Particular attention should be paid to maintaining productivity at the end of a project			
3.30	National or site agreements should be used to give the workforce similar employment conditions			

PRODUCTIVITY TASK FORCE SELF ASSESSMENT FORM				
REF	RECOMMENDATION	PRESENT POSITION	CHECKING METHOD (Yes/No)	TO BE IMPLEMENTED (Yes/No)
4	<b>WORKFORCE SKILLS</b>			
4.1	Practical skill tests should be made prior to employment			
4.2	Multi skilled training should be given to tradesmen from the apprenticeship stage			
4.3	Trade flexibility should be encouraged			
4.4	Individual assessment of labour productivity and quality should be regularly made			
4.5	Many of the site construction tasks should be deskilled			
4.6	Training in new methods, skills and procedures should be provided			

PRODUCTIVITY TASK FORCE SELF ASSESSMENT FORM				
REF	RECOMMENDATION	PRESENT POSITION	CHECKING METHOD (Yes/No)	TO BE IMPLEMENTED (Yes/No)
<b>5</b>	<b>CONSTRUCTION METHODS</b>			
5.1	Productivity improving new construction methods should be investigated and implemented			
5.2	Construction contractor should be involved in the constructability activity			
5.3	All critical construction methods should be formalised and approved			
5.4	Changes in methods and procedures should be implemented with the co-operation of the workforce			
	TOTAL	/83		

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## **2. Off-Site Aspects**

### **The Effect of Off-Site Aspects On-Site Productivity**

The Productivity Task Force, the companies who contributed to the postal survey and those who were involved in the detailed face to face interviews made very clear reference to the considerable influence which off-site aspects of design, specification, procurement and prefabrication had on the eventual productivity of tradesmen at the workplace.

Attached to this section is a listing of the key aspects which should be addressed by those companies who have a responsibility for such off-site aspects.

The European Productivity Survey highlighted that off-site aspects play a major role in influencing productivity achievement on-site.

This Section defines those key aspects and includes observations made from the Task Force membership under the following headings:-

- 1. Design**
- 2. Construction Methods**
- 3. Use of Sub-Contractors**
- 4. Partnering**

## **1. Design**

### **Controlling Changes**

Since late changes in design and scope of work constitute a major cause of delay and productivity loss on-site the following recommendations are listed:-

- 1.1 A design and work scope FREEZE date needs to be set to coincide with the start of site erection.
- 1.2 The client, the design team AND THE SITE ERECTION CONTRACTOR should be involved in the evaluation of any potential design changes contemplated AFTER the freeze date.
- 1.3 The ESSENTIAL changes deemed necessary after the freeze date should be clearly instructed and carried out as efficiently and quickly as possible.
- 1.4 Design changes requested as a result of site installation problems, should only be approved if absolutely necessary and a CONTROL MECHANISM should exist to ensure that such a policy is followed.

### **Involvement of the Constructor by the Design Team**

- 1.5 The site erection contractor should be given the opportunity to influence the design, based on his construction experience, and should therefore be involved PRIOR to the design and work scope freeze date.
- 1.6 The principle of VALUE ENGINEERING (applying a value for money criteria) should be a key feature of the initial design phase. It is considered that continuing to apply such criteria during the site construction phase will prove disruptive and will lead to changes and, as such, VALUE ENGINEERING should be disbanded just prior to producing the "Approved For Construction" drawings.
- 1.7 Cost effective changes proposed by the SITE INSTALLATION CONTRACTOR have traditionally proved to be successful and should be encouraged by the client and his design team.

### **Clash Avoidance**

- 1.8 Improvements are needed in the PREVENTION of clashes at site during installation. This can be readily achieved by the regular use of CAD and 3D systems.
- 1.9 A more prescriptive approach to DIMENSIONAL CONTROL in specifications is required. (e.g. the rationalisation of component tolerances - pipe and supports in a pipework contract).

## **1. Design (contd)**

### **Approved for Construction Drawings**

- 1.10 The "Approved for Construction" drawings must be made available in a **TIMELY** manner and must be prepared with the following aspects in mind:-
- 1.10(a) They must clearly detail **ALL** construction requirements.
  - 1.10(b) They must readily **CROSS REFERENCE** to other scheduled information (e.g. valve and material schedules).
  - 1.10(c) They must **REFER CLEARLY** to all primary and secondary supporting arrangements/sketches.
- 1.11 If the pipework scope design "Approved for Construction" drawings are presented in **ISOMETRIC** format then consideration should be given to providing the constructor with **GENERAL ARRANGEMENT** drawings and/or a **SCALE MODEL** of the installation.

### **Phasing of the Design**

- 1.12 The application of the CAD process for pipework system design determines that the design information is produced in the following **SEQUENCE**:-
- (i) The pipe.
  - (ii) The pipe support or the primary support.
  - (iii) The secondary steelwork support.

However, the site installation requires the "Approved for Construction" information, and the material supply in the **REVERSE ORDER** - design contractors please note!!

## **2. Construction Methods**

- 2.1 The designer must be aware of the optimum, or preferred, **CONSTRUCTION PHILOSOPHY** and **ERECTION METHODS** and take these into account during the design phase.
- 2.2 The **PREFABRICATION** or **MODULARISATION POTENTIAL** must be realised at the design phase and cognisance taken of potential transport and installation difficulties or limitations.
- 2.3 **LOCAL TO SITE** prefabrication should also be evaluated at the design phase as such an arrangement makes the control of delivery more realistic and minimises the on-site costs.

### **3. Use of Sub-Contractors**

- 3.1 The party to the contract responsible for procurement of plant and equipment must have established systems for **VALIDATING** suppliers and **INSPECTING** the purchased items during and at the completion of manufacture.
- 3.2 Allowances should be made in the initial material procurement listings for **MINOR ITEMS** such as fittings, which are traditionally "missed" from the designers material take-off but are a mandatory item during the prefabrication and erection phases.

### **4. Partnering**

- 4.1 The concept of Partnering suggests that, by creating a business environment which is driven by the desire to constantly improve performance, then the **ENHANCEMENT OF SITE PRODUCTIVITY** is a natural consequence of the arrangement.
- 4.2 Partnering requires **OPEN, HONEST RELATIONSHIPS** between clients, contractors and suppliers and a contract form and payment arrangement which encourages this principle.
- 4.3 By combining their strengths and resources, Partners will improve productivity on-site by **RESOLVING POTENTIAL PROBLEMS** and **SOLVING ACTUAL PROBLEMS** in a **COST EFFECTIVE MANNER**.





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