

From the aspect of the information transmission

Consultant Site Management Engineering

office NOB

INDEX

Preface

- 1. Outline of Site management engineering
- 2. Outline of quality control
 - 1) Role of Consultant Engineer and Contractor Engineer on Quality control
 - 2) Quality control system
 - 3) Quality control flow chart
 - 4) Check list at Commencement
 - 5) Decrease of control item from Site work
- 3. Shop drawing as information transmission means
 - 1) Necessity of Shop Drawing
 - 2) Contents and Code or Mark on Shop drawing
 - 3) Production order, Kind and Purpose of Shop drawing
 - A. Production order
 - B. Layer management
 - C. Kind and Purpose of Shop drawing
 - D. Necessity of making Overlapping drawing
- 4. Management of Site Work Control
 - 1) What is Site Work Control Management on Site engineer?
 - A. Site Engineer is Conductor of Orchestra
 - B. Job sharing on the work control including Quality Control
 - C. Management tool
 - 2) Rotate Work cycles
 - 3) Confirmation System of work result
 - A. Report system by Oral
 - B. Report system by Document
 - 4) Sample of Work management
 - A. Concrete work
 - B. Reinforcement Steel bar work
- 5. Information transmission in the Site
- 6. Time control
- 7. Financial control from Estimation to Execution
- 8. Safety control
- 9. Performance management of Building
- 10. Information transmission at the completion

Postscript

Appendix

- 1) Safety Plan
- 2) Facility Maintenance-manual
- 3)

Preface



4 die in Karachi bridge collapse

KARACHI: A portion of a bridge that was inaugurated by President Pervez Musharraf just a month ago collapsed on Saturday afternoon, killing at least four people, injuring several others and leaving an unknown number of people trapped underneath.

The Northern Bypass at Paracha Chowk in Sher Shah was built at a cost of Rs 300 million by the National Highway Authority (NHA).

The president and prime minister have called for investigations into the disaster. Architect and structural expert Zafar Razzak told to Daily Times that the bridge was heading for a collapse from the day it was built. "The bridge was not straight; it was tilted towards the right at the end," he said, adding that this structure is considered faulty by one school of thought. "Some German experts had suggested that the NHA make some modifications to reduce the risks." Speed breakers were then put in to reduce the risk of the curve. "If you look under the bridge, you will find black strips of carbon fibers that were installed on the suggestions of the foreign experts to support the curved bridge," he added.

This article tells the sudden fall accident of the expressway which occurred around Karachi. By what cause did this accident occur?

And this article tells many people's name concerning in this construction. According to the basic strategy of NHA saying "A convenient, safe highway must be made", the plan is materialized after analysing what is a convenient and what is safe on Project Formation stage. And the designer decides the place, calculates the vehicle of traffic on each hour on Feasibility stage, and, as a result, designs the structure on Design stage. The design drawing is made on Construction Document stage, it is passed to the contractor on the site on Tender stage, the contractor handles it a lot of workmen, and it is shaped at the site on Implementation stage. And after completion of the project the scene on the stage changes into the following Maintenance Period stage.

Information is subdivided, materialized at a lot of these stages, and it is passed to the next stage. There is a possibility of relating to the catastrophe in the future when as much as one transmission of information is missed.

How to transmit necessary information accurately from the source to the end is a necessary technology in the field called construction.

Up to Design stage the concerning party is limited. It is only the owner and a design group, and the difficulty is a little for the information transmission.

However when the project enters in Implementation stage, the number of people who

takes part in the information transmission increases explosively at once.

The information transmission technology at this construction stage is the most important technology and an appropriate information transmission technology leads the site to the success.

The technology called 'Information transmission technology' is the essence of Site-management-engineering.

Recently, the number of lawsuits related to various constructions, especially in the case of asking how to have managed the site has increased. Not only the building constructor but also the consultant is the lawsuit object. Information is transmitted, and it will become important more and more very in the future whether the record exists. As for the information transmission technology on the site, the aspect said that information not only is passed on for the construction period by another but also information is passed on outside after it constructs it is asked.



Flow of information (Figure-1)

1. Outline of Site management engineering

A lot of occupational categories and the people such as the owner, the designer, the site engineer, workmen, and material supply trader take part in the construction work.

Owner and designer's information is transmitted to the site as information by the method like the design drawing, the contract documents, specifications, and other many kind documents, etc. That information is analyzed by the site engineer, decomposed, and it is transmitted to the subcontractor, the workman, and the material trader. Information is transmitted there by means such as the shop drawing, the construction order sheet, the instruction sheet, memos, and oral.

Site-management-engineering is a transmission technology of information at the site. It is Site-management-engineering how to transmit information accuracy to the end and how to make a transmission-system.

The field called an architecture engineering (a building technique or a structural skill) is an important technical field when the building is created. However, it is one mere field in the entire technical field of the site and not all, and it shall be one of information to be transmitted. Information on the source showed in the drawing and specification is materialized after accurately transmitting to the workman who touches the construction material directly.



Site-management-Engineering field (Figure-2)

The field of Site-management-Engineering is as very wide as that of the above-mentioned, and each is intimately related to the item over many topics. This booklet shows the whole image.

2. Outline of quality control

(Quality control also is described on the other section.)

- Role of Consultant Engineer and Contractor Engineer on Quality control The required quality is achieved by the collaboration of Consultant's engineer and Contractor's Site engineer with their following obligation.
 - Site Engineer's quality control on the site is to make the required thing directed by the drawing and specification, not making some thing good.
 - Consultant Engineer's role is not only to observe the work of the site. He should check whether necessary information from the source to be expressed in the design drawing and specifications. When the information transmission is insufficiency (It is not suitable for the demand quality requested by Owner.) or technically wrong, he has to point it out meanwhile, corrects, and add or issue the necessary information to Contractor. It loses sight of the main plot when eyes turn only to the inspection.
- 2) Quality control system(See the next page Figure-3)
 - The quality control is not a thing achieved only by an inspection on the site. The quality control will be achieved by making a construction schedule chart, a working instruction sheet or a shop drawing beforehand, such as by synthesizing various information transmission techniques.
 - The information of quality control shall be transmitted by many ways, education, documents and others.
 - The education to the worker who works at the site and the site engineer directly about the quality control is needed at times by a meeting.
 - Information on the quality control is distributed in a lot of documents such as the blueprint (an architectural drawing, a structural drawing, and an equipment drawing, etc.) and specifications.
 - The purpose of the quality control system is thing to plainly transmit the information which has been described in many documents to the concerned person who is in charge the construction of the site.
 - The system does not work if collected quality control information is analyzed, a necessary matter is selected, and it does not process it to the workman like being comprehensible on the site.
 - The quality control flow chart and the check list are so useful for the quality control. It shall be provided by Site engineer of a contractor or a consultant.
 - The confirmation of the quality control system at the commencement between Contractor and Consultant is very important.
 - The quality control system in each construction work describes the concrete work and the reinforcement work as an example in the other paragraph.
 - It is necessary to minimize the items of quality control for the simplification

of the site management.



Materialization of quality information (Figure-3)

3) Record of Quality control Quality control flow chart (Omission of part)

① Quality control flow chart

The quality control flow chart concerning Concrete structure work is shown in the next page as an example. Such chart is an effective information arrangement of the quality control item which has scattered to the many documents.

Concrete work has many control items which shall be inspected and managed by the Consultant engineer and the Contractor engineer. It is necessary to do the dissemination with the document about construction work with a lot of control items beforehand.

2 Check list at Commencement

Check list is used on the many site work. Check list samples which are used on the construction work are shown in the paragraph 'Site work supervision'.

This paragraph shows 'Management Item check list' or others which is used to check overall items of the structure work, Site condition between Consultant engineer and Contractor engineer at the commencement time of the site work.



Concrete Structure Quality Control System

Sample of Concrete structure Quality Control System Chart (Figure-4)

Management Items at Commencement					
337 1	T.			Checked by	
Work	Item	Checking items	Date	Consultant	Contractor
1. Prepa	aration(Befo	re commencement)			
		Shop drawing			
Doe	cument	Specification			
		Master Schedule			
Eald	1 0	Survey drawing/ Property line			
Field	a Survey	Site condition			
Ben	ch mark	Building layout			
2. Foun	dation work				
Ge	eneral	Soil condition/ Groundwater			
Exc	avation	Method/ Shoring			
Bac	kfilling	Method/ Material			
Fou	ndation	Removal of Top soil/ Foundation bed			
Fou	Iluation	Compaction			
3. Reinf	forced Concr	ete work			
ial	Cement	Specification/ Product/ Storage			
ater	Concrete	Mixing Design			
M:	Re-bar	Specification/ Mill sheet			
	Test	Mixing/ Slump/ Testing cube			
ore ting	Batching	Plan/ Day volume/ Construction Joint			
Bef Cas	Re-bar	Bending schedule			
	Forms	Specification			
ja r	Concrete	Curing/ Test organization			
Afte astin	Forms	Stripping time			
C r	Record	Test record			
4. Masonry work					
Bloc	k/ Brick	Product/ Compression Test/Reinforcement			
5. Othe	rs			1	
Water pressure Test/ Waterproofing Test/ Electric Test etc.					

Check list Sample-1 at Commencement (Figure-5)

		Check List at the com	mence	ement		
Site	Name				Date	
No.		Check item	Ok?		Commen	nt
1	Did y purpo Consu	ou get enough information about Design rt & other important information from lltant?				
2	Did Specif Execu	you get all documents (Contract, ication. Drawings) which will be used on tion project?				
3	Did yo not de or doc	ou check the Documents & find the item ecided yet or discrepancy among documents ument and the site?				
4	Did schedu compl	you get full information about time ule, mile-stone, partial completion, etion date?				
5	Did yo author Contra	ou confirm Contractor's obligation for the rity and scope of work mentioned in act?				
6	Did yo Sched	ou confirm Payment system and Payment ule?				
7	Did y policy	ou confirm the submittals like insurance at Commencement?				
8	Did you get full information about Quality Control System on Contract?					
9	Did you confirm Daily or Monthly record form and system?					
10	Did you get information about Construction photograph report system (Duration, Interval, Location Submittal way etc.)?					
11	Did Corres	you confirm of Communication way, spondence system to Consultant?				
12	Did y drawi	rou check how and what kind of Shop ng to be made?				
13	Did yo	ou confirm Weather condition?				
14	Did yo Weekl	ou confirm Overall work schedule, Monthly, y & Approval schedule?				
15	Did yo the sit	ou check Water and Electricity supply for te?				
16	Did y neighl electri	you check the circumstance of the site, bour, existing building, retaining wall, ic pole etc.?				
17	Did you confirm the approach road or transportation way to the site?					
18	Did yo and it	ou confirm your organization and staffing schedule to execute the site work?				
19	Did yo office.	ou make Temporary work plan, Temporary Telephone, Internet, Toilet etc.?				
20		• • • • • • • • • • • • • • • • •				
21						
22						

Check list Sample-2 at Commencement (Figure-6)

4) Decrease of control item from Site work

It is one of important problems of the quality control on the site to say how to decrease the control item of a lot of materials used on the site and a lot of works.

Concrete work including the reinforcement work and the formwork has a lot of control items including the material. On the other hand, the control items of the method using industrial material produced at the factory are not so much.

When the checklist is made, what control item exists, and the thing to think how to decrease it is an important matter on the quality control of the site.



Decrease of control item (Figure-7)

Failure example by incomplete control item check

- When the oil tank was ordered, the processed iron plate was carried to the site because of the decrease of the transportation cost, it was welded on the site, and it was assembled. A lot of control items such as the supersonic wave tests and the welding positions and the welding in the weather element were planned without consideration, and, as a result, the quality level fell.
- The aluminium sashes were assembled after measuring the size of each opening which was finished by plaster and installed. As for the lack of knowledge of water processing around the window, a lot of water leaks are seen in the insufficiency. Moreover, the defect was seen on the installation reinforcement of the machine screw and many joint of the elements.
- The bent frame material carried to the site, and the steel Door frames were assembled at Site. They forgot the hole of the latch of the lock on the frame; usually it is made with the press machine when produced at the factory. It is opened with the gas after the installation because it came off the control item, and is dirty.

Of course, Site engineer has to consider cost-effectiveness always. However he must never forget what is the control item.

3. Shop drawing as information transmission means

1) Necessity of Shop Drawing

The shop drawing is an information transmission means to scrape up construction information which has scattered to a blueprint, a structural drawing, the equipment drawing, and specifications, etc., and for the workman to tell it.

The site engineer should separately pass on information which has scattered to the workman in a many documents when there is no Shop drawing. In this case, the Site engineer is always on the site, and should keep telling the workman the instruction of work for the period when the workman works on the site.

The shop drawing is a material factor for the quality control, the accuracy management, and to avoid the failure on the site.

- 2) Contents and Code or Mark on Shop drawing
 - Contents of Shop drawing are following 3 items;
 - 1. Describe of construction size
 - 2. Describe of content of construction
 - 3. Describe of division with range of construction of other occupational worker
 - Code or Mark on Shop drawing

It is important how plainly to express the above-mentioned content to the workman who sees the shop drawing.

Using the simple mark or code the system shall be made that the workman can easily understand the content of the shop drawing. And, it is necessary to tell the meaning of the mark and the code to the workman who sees it beforehand.

The example of the mark and the code will be explained in the paragraph of the concrete frame drawing and the finishing drawing on accompanying drawing.

At an initial stage of construction, the explanations of the sign and the code, etc. shall be described in the margin of the drawing because the new comer can not understand such mark or cord.

Production order, Kind and Purpose of Shop drawing A. Production order of Shop drawing



Shop drawing is usually made like as the right way.

Basic shop drawing is Common Finishing Detail Drawing. The explanation what is Common Finishing Detail Drawing is shown in the paragraph of Kind and Purpose of Shop drawing.

Production order of Shop drawing (Figure-8)

B. Kind and Purpose of Shop drawing

The range of Shop Drawing is too numerous for providing what is it however the kind, the feature, and the production point of the typical Shop drawing are described as follows.

- a. Common Finishing Detail sheet (See samples of Figure 12, 13, 14, 15)
 - Door or Window frame Detail including fixation way, Detail of Rise and Steps of Stairs and End detail of Waterproof etc. are necessary information to decide a opening size of doors and windows or a form of Stairs when the concrete frame drawing called Skelton drawing.
 - Because those details are common at almost site, it is good to always maintain those drawings as Common Finishing Detail collection.
 - The system of Common Finishing Detail sheet should be made to be able to issue the modified drawing partially as fitting each site situation by preserving as soft data.

Code	Common Finishing Detail sheet	Code	Common Finishing Detail sheet
01-01-D01	Asphalt waterproof on Concrete	10-01-D01	Steps and Riser of staircase
01-04-D08	GI sheet and Eves	10-06-D11	Handrail wooden coping
01-01-D19	Roof drain on waterproof	02-08-D23	Stucco wall on Hollow block
04-03-D05	Cement Board ceiling	04-08-D12	Ceramic Tile wall mortar setting
04-02-D02	Acoustical ceiling	05-03-D09	Floor cement finish
04-06-D05	Wall trim channel	05-05-D14	Floor precast terrazzo
03-02-D01	Door frame	05-08-D34	Floor ceramic tile
03-04-D04	Window frame	09-08-D03	Curbstone and Concrete Pavement

• Some typical Common Finishing Detail sheets are shown as follows;

Sample of typical Common Finishing Detail sheets (Figure-9)

• Code of Shop drawing is very important to arrange it and reference it from other Shop drawings. The code in the above-mentioned table is made based on the following code.

00 Structure / 01 Roof, Eaves / 02 Exterior Wall / 03 Door & Window / 04 Interior Wall & Ceiling / 05 Interior Floor / 06 Electric / 07 HVAC / 08 Sanitary / 09 Exterior works / 10 Special

- The code used in the drawing is usually related to the item of the accounting system described in the section of Work accounting system, and such coded information will be used to be arranged in computerised system.
- It introduces the code system generally used in Pakistan as follows. This code system is on Analysis of rate for Building and Road works. This code is consisted following head code in the table with material code

Code	Itom	Code	Item
Coue	Itein	Coue	Item
101	Mortars	116	Roofing other than R.C.C
102	Preparation or Site	117	Floors
103	Excavation	118	Dado Skirting and Facing
104	Filling	119	Iron Steel and Aluminium Works
105	Concrete Work in Foundation	120	Wood Works
106	C-C. Cast in situ in Foundation, Basement and Plinth	121	Fittings and Fixtures
107	Pile Foundation	122	Finishing
108	Damp proof course and water proofing roofs	123	Dismantling and Demolishing
109	Cement concrete cast in situ in superstructure	124	Miscellaneous
110	Cement Concrete Solid Block Masonry	125	Maintenance
111	Cement Concrete Hollow Block Masonry	126	Horticulture
112	Brick Masonry	127	Roads and Runways
113	Stone Masonry	128	Form-work and Labour for Concreting
114	Reinforced Cement Concrete Work	129	Rates for Extra Height of Items Beyond 15 ft
115	Prestressed Concrete Work		

and labour code.

Code system sample-1 (Fifure-10)

Following code table is on Composite Schedule of Rates(CSR). This code is consisted following head code in the table with sub-code.

Code	Item	Code	Item
01	Carriage	12	Wood Work, Wooden/aluminium joinery
02	Loading, Unloading and Stacking	13	Painting and Varnishing
03	Earthwork(Excavation and Embankment)	14	Plumbing, sanitary Installation and GAS Fittings
04	Dismantling(Demolition)	15	Electric Installations
05	Mortar	16	Roads and Bridges
06	Concrete	17	Lining of Canals
07	Brick Masonry	18	Sheet Piling
08	Stone Masonry	19	Protection and Diversion Works
09	Roofing	20	Outlets
10	Flooring	21	Sinking of Wells
11	Surface Rendering	22	Surface Drainage
Code	Item	Code	Item
23	Sewerage	25	Iron Work
24	Tube well and Water Supply	26	Miscellaneous

Code system sample-2 (Fifure-11)



• The examples of several Common Finishing Detail sheet are published as follows. (Samples of Common Finishing Detail sheet Figure 12, 13, 14, 15)

Sample of Common Finishing Detail sheet-1 (Figure-12) (Water proofing Detail of Concrete finishing Roof)



Sample of Common Finishing Detail sheet-2 (Figure-13) (Door Frame Detail of Hollow Block Wall)



Sample of Common Finishing Detail sheet-3 (Figure-14) (Roof slub with water proofing)



Sample of Common Finishing Detail sheet-4 (Figure-15) (Skirting Detail of Hollow Block Wall)

- b. Excavation drawing and Temporally work drawing
 - Excavation drawing is made based on a structure drawing but it is different from it. Since the digging depth or location building will be different from a structural design drawing because of the situation of the stratum to the settling ground or according to the position of the building of the site at vertical intervals.
 - Moreover, it is used to multiply the amount of the digging soil, and it is used to calculate the work days by the calculation result. It becomes basic of the retaining wall plan by the situation.
 - Excavation drawing is one of a temporary drawing, so it is made with another subject in that it. The following example drawing describes vertical interval of site for making Excavation plan and also Existing Building for making dismantlement plan. From this drawing the information how to start the excavation and the demolition can be planed.



Sample of Excavation and Demolition plan (Figure-16)

• On the commencement stage those drawings give us many kind of information for making a schedule, getting work volume, a temporary road position and correcting the foundation structure etc.



The left drawing is a sketch of Foundation section for deciding a digging depth getting from above drawing.

Sketch of Foundation section (Figure-17)

• The kind of the temporary work drawing extends to many topics. Kind of

16	emporary	work	drawing	are s	hown	tollowin	g;
----	----------	------	---------	-------	------	----------	----

	Temporary Drawing Name	Contents or Comment
1	Synthesis Drawing	This drawing describes all temporary work during all terms of
		the construction, and the whole of temporary work can be
		understood by this. As a result, a lot of information like the
		term of works and the amount of money of the temporary, etc.
		can be obtained.
2	Temporary Fence	Position / Material / Detail
3	Site Entrance Plan	It is necessary to change the position of gate by the progress of
		construction, and speed up construction around gate. Position /
		Material / Detail /
4	Lifting Plan	The energy spent on rifting of Material in various work in
		building construction is very large and the lift transportation
		ability to be proportional to square of the number of stories is
		needed compared with the horizontal transportation.
5	Concrete Plant Plan	Concrete plant is a big element in a material supply route,
		depository of Sand, Gravel and Cement, Water pool and
		Concrete lifting, and so important for the site management.
6	Excavation Plan	(Mentioned above)
7	Shoring Plan	Outside wall line / Kind of shoring and strut / Digging depth /
		Foundation position / Soil condition / Cofferdam / subsurface
		obstacles etc.
8	Assembly base Plan	It is made above excavation area for execution of basement
-		structure.
9	Demolition Plan	(Mentioned above)
10	Safety facility Plan	Safety net or Handrail for Floor opening etc.
11	Scaffolding Plan	Height / Material / Distance from wall or Ceiling / Loading
		capacity / Collapse prevention plan
12	Construction office Plan	Staff number / Rooms number / Usable term / Position /
		Structure /
13	Temporary water supply	Inside of Building / Construction office / Lodging house /
	and Drainage Plan	Concrete plant / Laboratory / Toilet
14	Temporary electricity Plan	All site / Temporary Houses / All kind of Electric machines / All
		communication device / Generator plan
15	Toilet Plan	Location / Usable term / User number / Drainage / Treatment
16	Lodging house	User number / Location / Usable term
17	Laboratory Plan	Location / Curing pool /
18	Site Factory Plan	Production in Site / Location / Capacity of Electricity

Kind of Temporary work drawing (Figure-18)



D.H.Q BATTAGRAM HOSPITAL MAIN BUILDING

- Concrete frame drawing is used on the concrete work including shattering work and the reinforcement work.
- The method of expression of Concrete frame drawing is different from the ordinary design drawing. Concrete frame drawing of Ground floor shows the ground floor column, wall and 1st floor beam, slub. That information which has been distributed in two structure drawings on Ground floor and 1st floor plan is expressed, and consolidates information which should be understood on the site in one drawing.

Explanation section of Concrete frame Shop drawing above (Figure-19)



Sample of Concrete frame Shop drawing-1(Figure-20)

- Above drawing shows the ground floor, an underground beam and walls above the floor level, and pillars in one drawing. Information such as reinforcement under the opening and the wall distribution reinforcement bar becomes clear by this notation in one drawing.
- This drawing shows also sleeve's position for piping of Drainage, HVAC work or Electric work.



Sample of Concrete frame Shop drawing-2(Figure-21)

- This drawing shows 1st floor wall, column, 2nd floor beam and 2nd floor slab.
- Information of the formwork and the reinforcement steel bar work from the 1st floor above the floor level to the 2nd floor is transmitted to the carpenter and the reinforcement steel bar worker only in this drawing.
- It is easy for Form worker to understand the drawing if a simple cross section showing the height of story is described in the above drawing.

- The method of describing the size in the drawing shall be considered easily to understand the size of the formwork and also easily to check it on the site.
- The example of the mark and the code used in the concrete frame Shop drawings is shown as follows. (See following Figure-19)



Mark and the code in the concrete frame Shop drawings (Figure-22)

Item to be described in	Concrete frame	Shop drawing
-------------------------	----------------	--------------

	Item	Detail of Item		Item	Detail of Item
1	Axis	X-Y axis line	7	Opening	Manhole / Access hatch /
				(Floor)	Machine hatch / Marking hole /
					Temporary opening /
2	Position	Column / Beam / Wall from	8	Sleeve	HVAC pipe / Electric pipe /
		Axis			Water Supply pipe / Drainage
					pipe / Vend pipe / Others
3	Level	Column / Beam / Wall from	9	Box	Electric Board / Switch / Fire
		Specified standard level			extinguisher /
4	Size	Column / Beam / Wall	10	Anchor	Wall / Machine / Window / Steel
					Frame / Handrail / Ladder /
					Elevator / Ceiling Fan
5	Code	Column / Beam / Wall / Slab /	11	Joint	Construction Joint (Beam, Wall,
		Door / Window			Slab) / Expansion Joint
6	Opening	Door / Window / Duct /	12	Others	Waterproof rise / Finishing
	(Wall)	Temporary opening / Others			(Monolithic floor)

Item in Concrete frame Shop drawing (Figure-23)

- d. Bar arrangement drawing
 - It is preferable that the bar arrangement drawing is made for all part of reinforcement steel bar work, however a lot of similar drawings will be made. So typical part of beam, column and slab are often made as a standard bar arrangement drawing.
 - This drawing of a bearing wall, a cantilever slab or beam and a special installing part, etc. are written.
 - The bar arrangement drawing is used for checking a detail how to install of steel bar in the specified size of structure and also for making a bending-list or cutting list of steel bar.
 - Typical bar arrangement drawings and description are in following table(Figure-24)

	Drawing	Item to be described in Drawing
1	Column	Size, Number and Kind of bar of main Reinforcement / Code / Protective cover / Hoop bar size & interval/ Splice / Bend way and length of Top and Bottom /
2	Beam	Size, Number and Kind of bar of main Reinforcement / Code / Protective cover / Stirrup bar size & interval/ Splice / Bend way and length of End /
3	Slab	Size, Number, interval and Kind of bar of Reinforcement / Code / Protective cover / Splice / Bend position
4	Wall	Size, Number, interval and Kind of bar of Reinforcement / Code / Protective cover / Splice
5	Foundation	Size, Number, interval and Kind of bar of Reinforcement / Code / Protective cover / Splice / Bend position / Hook
6	Stairs	Size, Number, interval and Kind of bar of Reinforcement / Code / Protective cover / Splice / Bend position / Anchor length
7	Eaves	Size, Number, interval and Kind of bar of Reinforcement / Code / Protective cover / Splice / Bend position / Anchor length



Item in Bar arrangement drawing (Figure-24)

Left photograph is a reinforcement bar work of the bearing wall at the big site making hotel in Islamabad.

The spaces between the reinforcement bars are too narrow, and any room where concrete enters does not exist. The reinforced concrete structure combines with concrete and the reinforcement bar and demonstrates strength.

Such a mistake can be prevented by the bar arrangement drawing.

Sample of a checking mistake of bar arrangement drawing (Figure-25)

- e. Masonry structure drawing
 - In general, masonry wall is described in Concrete frame drawing. But in case of being many partition wall of Hollow block, Masonry structure drawing is produced independently to clarify the steel bar anchor and the opening.
 - The example of Hollow block wall drawing is shown below.



Sample of Hollow block wall drawing (Figure-26)

- f. Finishing plan
 - Finishing plan describe all finishing item like as a finishing material, a exact location of all opening, a fixed furniture and also a large-scale equipment which relates to the size of carrying-in entrance etc. a lot has been included.
 - It shall be made at the early stage of construction and such information shall be reflected to the concrete frame shop drawing.



• By this drawing many adjustment or mistake on the site can be evaded.

Sample of Finishing plan (Figure-27)

- g. Finishing detail drawing
 - A lot of shop drawings for finishing detail have to be made on the site by a lot of different designs. The site engineer has to check the design drawing and find the part where will be needed to make the detail drawing on the commencement. And he has to decide which drawing is the priority level high and which part shall be reflected to the concrete frame shop drawing.
 - The concrete of the counter of the telephone corner was constructed later by having delayed the issue of detailed design by the designer.



Sample of Finishing detail drawing (Figure-28)

h. Building Utility drawing

-		
	Drawing Name	Contents
1	Electric	Electric services / Telephone / Public address / Other communication
		way / Generator / Lightning protection system / Electrical clock /
		Battery system / etc.
2	Water Supply	City water supply / Well / Water purifying / Sanitary ware / Hot water
		service / Kitchen equipment / etc.
3	Drainage	Soil water / Waste water / Sewage disposal / etc.
4	Septic tank	Septic Tank
5	Gas	Gas piping / Gas supply station / etc.
6	HVAC	Heating services / Boiler / Ventilation / Air conditioning / etc.
7	Incinerator	Incinerator
8	Fire extinguish	Fire alarm system / Smoke detector / Heat detector / Sprinkler / Fire
		damper & door / Fire hydrant / etc.
9	Emergency facility	Escape guiding system / Refuge system / etc.
10	Lifting	Elevator / Escalator / Dumbwaiter / etc.
11	Others	Medical Gas / Nurse call / Vibration isolation / etc.

There are many Building Utility drawings as Shop drawing as follows;

List of Building Utility drawings (Figure-29)

• Those drawings will be provided as Design drawings. However Site engineer shall check such as drawings and find the part of shortfall of information to be reflected to the other shop drawings.

C. Necessity of making Overlapping drawing

• Layer layout management

Before making Shop drawing by CAD, it shall be decided what drawing is drawn on each layer of CAD. And when Sub-contractor produces the equipment shop drawing, it shall be repeatedly made on the basic shop drawing.

- If the CDA data of the blueprint can be acquired from the consultant at an initial stage of construction for using the origin of the layer, it becomes shortening time and saving money to make the shop drawing.
- And when those shop drawings are overlapped the discrepancy will be easily found. As a result, the production mistake can be prevented.
- Overlapping drawing's image is follows;



Image of Overlapping drawing (Figure-30)

IMAGE OF OVERLAPPING DRAWING



- This drawing is overlapped Electric, Water supply and Drainage drawing on Building plan.
- This building is very simple, but from this overlapped drawing we can find many matters, like as the drainage line under Slope, position of lighting fixture etc.

4. Management of Site Work Control

- 1) What is Site Work Control Management on Site engineer?
 - A. Site Engineer is Conductor of Orchestra

Site Engineer is like as Conductor of Orchestra.

Players in Orchestra are like as Workmen in Site. Music instruments used by players are tools like as a hammer, plane, saw and chisel used by workmen.

Conductor understands the change of the sound and the flow, and leads the performance of the orchestra. The site engineer is same like as Conductor. The site engineer should command the concert said, "Construction work" without the any practice though the orchestra is possible to practice many times.

B. Job sharing on the work control including Quality Control

The work control including Quality control cannot be achieved by only Consultant. The item number which shall be watched during in the progress of construction is so huge.

The work control including Quality Control can be achieved by the collaboration between Consultant Engineer, Contractor Engineer and Worker. This is most important view of the site work control including Quality Control.

It is important that the contractor is made to know clearly what kind of the surveillance system will be adopted for the site work control before the commencement of the work.

The worker shall be known what the point of quality control on his work is.

The consultant shall inform clearly to the contractor the step of the work control system and the role of each other, and what kind of documents should be maintain on the progress of construction, and preserved the information after completion of the building.

Moreover, clear transmitting of basic policy to the contractor for quality control that Consultant will check and approve, and Contractor Engineer shall check the item of the work, and the worker shall be known what he has to report to Engineer.

How to make "Self-control checking system" for quality control is most important for Site Work Control Management.

C. Management tool

Work management is job surely to passes the construction information to the site, and inspects, and confirms the site whether to be shaped like as information.

Construction information is transmitted by the following methods.

Working instruction sheet / Shop Drawings / Work order sheet / Oral / Balance sheet / Time schedule chart / etc. Construction information which shall be transmitted to a lot of concerned parties and workmen should adopt the suitable method of transmission surely from the site engineer with the document as much as possible.

Construction information sheet can be used as common on many project sites. You may always make and preserve it as an archive.

2) Rotate Work management cycles

How smoothly to rotate of the work cycle called instruction-execution- check is a point of Work management at the site.

Site Engineer makes system for information not only is issued but also the report from the workman who work at the site is surely received.

And it is necessary to inform to the worker what he has to report and on which timing with Working instruction sheet on the commencement of his work.



Image of Rotate Work cycles (Figure-31)

3) Confirmation System of work result

The situation of the site differs hour by hour, every day and every day, and changes toward the final purpose called completion. The site engineer should always grasp the change in his site and command the all concerned parties or men. And he has to confirm whether the all performances of the workers are adapted to the required standard of the quality.

However the changes in a day in his site are so much and he cannot check it all. If he has to confirm everything what workers are doing, he has to stand by the worker all day like as a prisoner watcher.

Then Confirmation System of work result shall be provided from commencement of the project, and this system shall be decided between Consultant and Contractor.

There are many methods to confirm the situation of the site. When Engineer decides the work cycle before starting the site, many combination ways fitting the site situation shall be selected to grasp the site situation.

A. Report system by Oral

There are many ways to report the site situation by Oral.

Confronting report

In case of the report on face-to-face, Engineer can get the detail which he wants to get. But he can get the limited information from the one person. If he wants to grasp the over view of the site, this way is not suitable. And he can transfer the information to the others.

Meeting

The report on a meeting is useful to spread a information to many concerned parties and many parsons can grasp the site situation at once. But there is difficulty many concerned parties to gather at once.

Report system by Meeting is descried on the other section again.

B. Report system by Document

For keeping his job level, Consultant Engineer and Contractor Engineer should change from the previous management way such as All-time-Observation & Supervision Style and Total Inspection to Sampling Inspection which consists of the autonomous management by the Contractor and abstraction some samples selected by the Engineer. The Contractor carries out Total Inspection according to the Check-list and the Engineer abstracts samples based on the Check-list at the Site. This situation will cause that the Engineer can control the quality for many sites at the same time and keep process records. As a result, the quality guarantee system will be established.

- 4) Consultant Engineer job at the commencement (Omission)
- 5) Sample of Work management
 - A. Concrete work (Omission)
 - B. Reinforcement Steel bar work (Omission)
 - C. Other works (Omission)

6) Time control (Omission)

5. Financial control (Omission)

6. Safety control (Omission) 7. Information transmission in the Site (Omission)

8. Performance management in Building (Omission) 9. Information transmission at the completion (Omission)

Appendix

- 1. Safety Plan
- 2. Facility Maintenance-manual

Postscript

This time, this booklet "Site-management-engineering introduction" was mad from the point of view of the section of the information transmission, and this field can be seen from the section in the other respects like the technology, the organization, the passage of time, money, and legal affairs, etc. Site-management is one of the engineering areas handling various elements such as above mentions which are complexity intertwined each other.

In general, there are many books for Site engineer introducing Architectural engineering. However Architectural engineering is only a part of the area of Site-management-engineering. It is just a technique of the work.

This booklet named "Introduction of Site-management-Engineering" introduces just an essence of the site management engineering but shows many skill and many types of Sample sheets for the transmission of information at the site work. I hope that it is assumed to be a radical by on business using it, a different information transmission means will be developed, and Site-management-engineering refined more is developed.

And I hope that this book is at least helpful because you of Site Engineer untie the intertwined element complexly on the site, and the work of the site is done more clearly.

Moreover, to understand the whole image of Site-management-engineering, this introduction has included a part of necessary information as a construction company which supports the site engineer's work. For instance, the part such as encoding and common finishing detail sheet which becomes a property as a construction company when it creates it once is described.

By this information I additionally hope to the manager's effort as to make up a more systematic site, to secure the demand quality by a proper profit and a proper term of works.

Nobuyoshi FURUICHI

Site-management-Engineering Consultant office NOB E-mail: office.nob@gmail.com