



सत्यमेव जयते

GOVERNMENT OF INDIA

CENTRAL PUBLIC WORKS DEPARTMENT

**COMPILATION OF
QUALITY
ASSURANCE
CIRCULARS OF
CPWD**

2001

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Foreword

It gives me immense pleasure that the Directorate has brought out compilation of Quality Assurance Circulars, which is much needed Compilation for the guidance of the officials engaged on construction and maintenance of Government buildings and services. Although guidelines/Circulars have been issued from time to time, it is for the first time that the existing guidelines/circulars have been compiled at one place.

2. Government of India has been laying emphasis for quality in construction and maintenance of Government buildings and services. At the same time, the department has been striving to improve the quality of construction and maintenance and attaining higher degree of satisfaction in terms of quality as well as timely completion. It has, therefore, been felt necessary that officers should have easy and ready access to various guidelines issued by the Department on this subject so as to enable them to take timely and appropriate action. The publication of "Compilation of Quality Assurance Circulars of CPWD" fullfills this important requirement. However the department can have full satisfaction only when these guidelines are read and understood by the field officers incharge of construction and they endeavour to implement them in true spirit.

3. Even though this compilation has been made basically for use in the CPWD, it may also be beneficial to a large number of other Government organisations and Public sector undertakings who have adopted similar system of working. I am sure this will be well received by all concerned.

4. This compilation is a combined effort of a large number of officers. I would like to express my appreciation of the guidance given by Er. V.S. Dixit, Chief Engineer (CSQ) and the efforts put in by Er. S.K. Mittal, Superintending Engineer (QA) and Er. B.K. Gupta, Executive Engineer (QA) who worked for this compilation.


(N. KRISHNAMOORTHI)
DIRECTOR GENERAL (WORKS)
CPWD

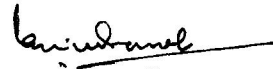
Preface

Government has always been conscious of the need to maintain quality in its construction works. The first major milestone in this direction was the creation of the Chief Technical Examiner's Organisation (CTEO) under the then Ministry of Works and Housing to conduct an independent technical audit of the works executed by Central Public Works Department. This organisation functioned independent of CPWD. When the Central Vigilance Commission was set up in pursuance of the recommendations of the Santhanam Committee on Prevention of Corruption, the CTEO was transferred to the control of CVC in 1964. The CTEO continued to conduct technical audit of the works of CPWD and thus supplemented the efforts of the Departmental officers to ensure quality of works.

As the jurisdiction of CTEO was enlarged to cover other Government departments and Public Undertakings, the Ranganathan Committee recommended that there should be an independent Quality Control and Technical Audit wing in CPWD. This QCTA Wing was set up in 1979 with 2 EEs under Chief Engineer (CDO). Simultaneously, an ASW(QC) was also attached to each Circle, directly under the SE. The Wing was strengthened in 1985 by posting one SE(QC) and 2 more EEs.

The quality control activities were further strengthened in 1995 by attaching one SE to each of the Regions directly under the ADG and by creating the post of CE(CSQ) under DGW.

This compilation covers the important circulars issued by the QC unit in the last about 20 years which are of relevance even today. The circulars cover various aspects of quality control and quality assurance in civil construction works. It is expected that such a compilation, with all important circulars available readily, will be of considerable benefit to the Engineers working in the field to maintain high standards in the construction works.



(P. Ravindranathan)
Addl. Director General (TD)

Introduction

There has been great demand both from inside and outside the department for circulars on various aspects of Quality Control and Quality Assurance issued by the Director General of Work, Central Public Works Department. In this compilation all the circulars issued by the Quality Assurance (Core Wing) Unit have been incorporated.

In addition to circulars issued by Quality Assurance (Core Wing), some circulars issued by the Central Design Organisation, office of the Director (W), D.G.(W) have also been included in the compilation as these circulars have direct relations to Quality Assurance.

In this compilation, circulars are arranged in chronological order. The Index gives circular No., subject, brief contents and page No. of each circular. On the last page, a subject-wise Index is given which shows page numbers of circulars on main subjects.

All possible efforts have been made by the Quality Assurance (Core Wing) to prepare this compilation. However, there may be some Q.A. Circulars which might not have been included due to oversight. Readers are welcome to send copies of such circulars to this unit so that the same can be incorporated in the next edition.

I hope this compilation will meet the long pending demand of the field units.

V.S. Dixit

(V.S. DIXIT)

CHIEF ENGINEER (CSQ)

Index

S. No.	Page No.	Circular No. & date	Subject	Brief Contents
1.	21	CDO/QCTA/G, dt. 19.5.82	Correct proportioning of Agg. in concreting	Regarding use of measuring boxes, avoiding use of baskets.
2.	21	CDO/QCTA/6/32, dt. 15.07.82	Quality Control & Technical Audit Wing under the Control of CDO	Setup of QCTA unit, functioning of ASW(QC) at Circle level, Circle level Lab.
3.	23	SE(D)G-46/391, dt. 10.11.82	Propping & Centring for R.C.C. slab and beams	Reg. Supporting of slab one below which is under cast, not removing support before the stipulated period.
4.	24	CDO/SE(D)/G-89/292, dt. 05.09.83	Technical Circular (Corrosion of Reinforcement)	Suitable measures for protection of reinforcement from corrosion, use of tested water, proper mixing, vibrating, adequate curing, suitable cover thickness and proper form work.
5.	25	CDO/QCTA/28/1051-1100, dt. 29.10.83, QC List No. 1	Common defects/deficiencies observed during visits by QC unit of the various works	Reg. Non availability of correction slips to CPWD Specifications, use of basket to be avoided, supporting one floor below the top most floor already casted, supporting two floor below for balcony and cantilevers, not following departmental instruction, defects in RCC bonding B.W. wire gauge not double folded, less water seal, Non supply of structural and Arch. drawing to contractors.
6.	26	CDO/QCTA/G-28/13-87, dt. 6.1.84, QC List No. 2	-do-	P.P.C. is used, vertical drops of concrete more than 1.5M, construction joints, interval of binding two bar at overlap is greater than 2d, Brick work in English bond, defects in B.W., defects in door window fittings.
7.	28	13(1)/83-WI (DG)/Cir. No. 4/84, dt. 28.02.84	Centring and shuttering for RCC work	For spans exceeding 4.5M and height exceeding 3.5M, form work shall be designed properly.

<i>S. No.</i>	<i>Page No.</i>	<i>Circular No. & date</i>	<i>Subject</i>	<i>Brief Contents</i>
8.	28	CDO/QCTA/ Tech. Cir./7/ 1075-1125, dt. 31.08.84	Sub standard Brick work	Common defects in Brick work, strict supervision during progress, at random checking at different locations by removing the bricks.
9.	29	CDO/QCTA/2/ 1525, dt. 15.11.84	Yard stick for QCTA work of ASW(QC) at Circle level	Frequency of inspections of ASW(QC), Every visit of EE/SE/CE should be in the light of quality control and bring out defects, ASW(QC) be present when inspection by Core Wing.
10.	30	CDO/QCTA/7- III/1564-1614, dt. 27.11.84	Format for recording various tests	Standard formats for maintaining results of test in register, test register to be signed by officers in token of reviewing the test results during inspection.
11.	40	CDO/QCTA/ 28/116, dt. 01.03.85 QC List 4	Common defects/deficiencies regarding floor trap.	Showing the details of correct floor trap with self cleaning design.
12.	41	CDO/SE(D)/ NMT (24)/89, dt. 01.03.85	Use of port land Pozzalana cement in CPWD Works	Use of P.P.C. in RCC framed structure and bridges be avoided, 25% test should be carried out for 28 days where P.P.C. used.
13.	42	CDO/SE-D/G- 188/301, dt. 28.08.85	Provision of confinement stirrups in beam column connections	Detailed sketch regarding provision of confinement stirrups to be provided at junctions of column and beam.
14.	44	CDO/SE-D/G- 89/85/355, dt. 18.10.85	Technical Series (overhead tanks)	Discussion on various materials of overhead tank viz., durability of RCC, Brick masonry, FRP, FRG tanks, treatments and precautions.
15.	45	CDO/SE(D)/G- 89/366, dt. 18.11.85	Corrosion of reinforcement	Regarding proper water cement ratio, use of tested water, why the corrosion takes place, use of integral water proofing compounds in RCC water retaining structure, Name of firms manufacturing admixtures, Proper grading etc., minimum cover.

<i>S. No.</i>	<i>Page No.</i>	<i>Circular No. & date</i>	<i>Subject</i>	<i>Brief Contents</i>
16.	49	CDO/QCTA/28/1244, dt. 25.11.85	Common deficiencies observed during technical audit of final bills of various works by Q.C. Core unit.	<ol style="list-style-type: none"> 1. Cement godown/cement registers not checked by AE/EE at required frequency. 2. Bill passed with holding amount for non sanction of AHR/ALR, EI/SI items, Non recording of completion certificate by SE/SA, pending clearance of CTE. 3. Bill finalised without SE/SA completion certificate and non intimation to them about completion. 4. Prior approval of competent authority sanctioning the detailed estimate for exceeding AHR items. 5. Revised A/A & E/S & T/S not obtained.
17.	49	28(2)/84 WI (DG)/Cir. No. 7/85, dt. 24.12.85	Functioning of QC Core unit	SE/CE not checking works from quality angle and not issuing inspection notes, EE/SE/CE are not inspecting site order book on their visit.
18.	50	CDO/QCTA/6-IV/1349-1400, dt. 31.12.85	Inspection of works by EE/SE/CE from the Quality Control point of view	<ol style="list-style-type: none"> (1) Copies of previous inspection ASW(QC), EE, SE, CE are not available at site. (2) SE/CE should inspect works from QC angle. (3) Important register like hindrance register, site orderbook, test result register are not reviewed by EE/SE. (4) Standard format for recording result of mandatory test be used as circulated vide Circular dated 27.11.84.
19.	51	CDO/QCTA/7-III/133, dt. 20.02.86	Format for recording various tests for road work	<ol style="list-style-type: none"> (1) Standard formats for maintaining results of tests for road works. (2) Index on first page of test register. (3) Sample taken for testing shall immediately be entered in the register as soon as the sample collected, without waiting for test results.

<i>S. No.</i>	<i>Page No.</i>	<i>Circular No. & date</i>	<i>Subject</i>	<i>Brief Contents</i>
20.	60	CDO/QCTA/ 28/368 dt. 27.03.86 QC List No. 7	Common defects/deficiencies in steel windows	List of various defects in steel windows.
21.	64	CDO/QCTA/ 28/553 dt. 10.06.86	Alkalinity in water for making concrete	(1) About excess alkalinity in water. (2) Regarding neutralisation of excess alkalinity. (3) Effects of alkalinity.
22.	65	CDO/QCTA/G- 7/188, dt. 23.02.87	Floor trap depression of RCC slab therefor	(1) Depression to accommodate floor trap etc. should be shown in the Arch. drawings as well as in structural drawing. (2) More depression may be needed for giving proper slope in horizontal pipes.
23.	66	CDO/SE(D)/G- 89/86/96, dt. 8/ 21.7.1987	Corrosion of reinforcement in RCC work and deterioration of brick work and plastering	(1) Use of water containing appreciable amount of chlorides and sulphates. (2) Testing of water as per ISI code at stipulated time. (3) Water to be tested before use. (4) Attention not given to Circulars issued on 23.08.82 and 18.11.85.
24.	66	28/7/86- WI(DG) Cir. No. 9/87, dt. 06.10.87	Quality aspect of works in CPWD enforcement of specifications	(1) Introduction of inspection register. (2) CE/SE/EE who visit the works shall record the date and time of visit, items inspected and their observations. (3) Entry of visit should be made even if no defects are observed or inspection was limited to progress of other matter. (4) Guard file to be maintained. (5) Sample of various material, fittings to be used shall be approved and displayed at site. (6) Senior inspecting officer shall review Guard file of earlier inspections, inspection registers, site order book and register of tests carried out.

<i>S. No.</i>	<i>Page No.</i>	<i>Circular No. & date</i>	<i>Subject</i>	<i>Brief Contents</i>
				<p>(7) AE & JE as well as contractor supervisors to be made fully aware of specifications.</p> <p>(8) 25% of sample for cubes and 10% for others be filled in presence of EE.</p> <p>(9) EE should carry 10% test check on centring, shuttering before permitting the laying of the concrete.</p> <p>(10) EE should ensure availability of required test equipments, copies of specifications and copies of agreement of works.</p>
25.	67	CDO/SE(D)/NMT/24/142 dt. 11.11.87	Corrosion in RCC structures and use of P.P.C. cement in RCC works	<p>(1) Use of OPC to all RCC works.</p> <p>(2) If local purchase only OPC.</p> <p>(3) Separate account and storage for OPC & PPC.</p> <p>(4) Register of record of testing of concrete cube should specify type of cement used in RCC.</p> <p>(5) Use of anti corrosive coating over steel reinforcement.</p> <p>(6) Use of PVC cover blocks should be considered.</p>
26.	69	CDO/QCTA/G-9/1332, dt. 03.12.87	Quality aspect of works in CPWD and enforcement of specifications etc.	Specimen proforma for inspection register.
27.	70	CDO/QCTA/G-28/58, dt. 13.01.88	Permissible limits of contents of deleterious material in soil for use in embankment for road construction	<p>(1) Test for deleterious contents in soil to be used in embankment for road construction is mandatory as Para 17.5.5.3.</p> <p>(2) Limits of salt like sodium sulphate and organic matter.</p>
28.	70	28/7/86-WI(DG) Cir. No. 3/88, dt. 03.03.88	Quality aspect of works in CPWD	Check features for inspecting officers in reinforcement, centring shuttering, masonry work etc.

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29.	72	CDO/QCTA/G-2/63 dt. 06.03.90	Quality Control measure	(1) CE may record their observations in inspection register in at least 50% cases. (2) CE may sign the inspection register in token of their having inspected the works in other cases.
30.	73	CDO/QCTA/G-2/126 dt. 16.03.90	Quality Assurance in CPWD making the quality control set up more effective	(1) Serious and immediate points to be attended will be written by EE(QA), SE(QA) & CE(QA) in inspection register of work. (2) Inspection Report to be issued within four weeks of inspection. (3) Concern EE should reply within four weeks from the date of receipt of report. (4) Subsequent reminder etc. within four weeks. (5) Para referred to CE/SE, they should send their comments. (6) Serious irregularities, defaults, over payment shortage etc. to be referred to CE(V).
31.	74	16/1/89-WI (DG)/Cir. 1/90 dt. 22.05.90	Yard stick for renewal of premix carpeting	At an interval of every six years.
32.	74	CDO/QCTA/SPG/G-2/270 dt. 29.04.91 QCTA Cir. 1 of 1991	Quality assurance in CPWD Inspection and follow-up action	(1) Action for delay in submission and reply by EE/SE/CE. (2) Serious irregularities to be referred to vig. (3) CE(CSQ) will write to ADG(S&P) for consideration of transfer of EE from site. (4) For EE who do not reply, CE(CSQ) will write to concern CE for writing in the C.R. of concerned.
33.	75	CDO/SPG/QCTA/G-2/279 dt. 01.05.91 QCTA Cir. 2 of 1991	Payment of sub standard work	(1) If the contractor does not rectify the defect, the work should be got redone. (2) Acceptance of work below specification or at reduce rate

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				should be resorted to only for those items where it is structurally impossible to get the work redone. (3) SE to accept sub-standard work in exceptional circumstances and for recorded reasons only.
34.	76	25/2/91- WI(DG), dt. 27.04.92	Rolling of bituminous layers	In no case fuel fabricating to be used for damping the wheel.
35.	76	CDO/QCTA/ SPG/G-2/220, dt. 23.06.92 QCTA Cir. 1 of 1992	Proper functioning of door and windows	(1) A register to be maintained for checking of doors and windows. (2) Checking to be completed before completion certificate is recorded. (3) Proforma for register for keeping the record and above checking.
36.	77	Misc/CE/SPGP/ 91 dt. 08.07.92	Avoidance of use of timber in centring and shuttering	Only steel shuttering to be used. Provision to be made in N.I.T.
37.	78	DGW/CON/50, dt. 01.10.1992	Payment of part rates for fabricated wood/steel items before fixing	(1) No part payment for pending fixing for grill, door wood shutter frame etc. (2) Only Secured Advance admissible.
38.	78	CDO/QCTA/ SPG/G-2/306, dt. 22.12.92 QCTA Cir. 2 of 1992	Plumbing details installation of floor trap.	(1) Features of standard floor trap. (2) Fixing arrangement with waste pipe and ensure completion of concrete below waste pipes. (3) Avoid shooting of waste pipe over trap. (4) Depression in RCC slab. (5) Extra precautions measure. (6) Different type of floor traps with sketches.
39.	82	CDO/QCTA/ SPG/G-2/154, dt. 22.02.93 QCTA Cir. 1 of 1993	Plumbing detail – Wash basin.	Sketches and details for installation of proper system of wash basin.

<i>S. No.</i>	<i>Page No.</i>	<i>Circular No. & date</i>	<i>Subject</i>	<i>Brief Contents</i>
40.	86	CDO/QCTA/ SPG/G-2/301; dt. 19.04.93 QCTA Cir. 2 of 1993	Fabrication and welding of steel doors, windows & ventilators made of hot rolled steel sections and MS Grill, railing & frame etc.	(1) All fabrication and welding etc. to be done in approved workshop. (2) Process of weld shall be flash butt welding.
41.	87	CDO/QCTA/ SPG/G-44/47, dt. 12/14.01.94	D.O. of DG(W) to all CE for improvements in quality of CPWD Works	(1) CE's to inspect works from quality aspects also. (2) Replies to QCTA Para not sent in time. (3) Quarterly progress report not sent in time. (4) Serious view to be taken for sub-standard work and disciplinary action to be taken against staff responsible.
42.	88	DG(W)/CON/ 67 dt. 6.5.94	Cement register	Regarding Cement Register.
43.	90	CDO/QCTA/ SPG/G-2/806, dt. 12/13.07.94 Cir. No. 1 of 1994	Use of Tee/Angle-iron section in door-windows and ventilators frames	Angle iron not to be used and only 'T' iron to be used in door frames.
44.	91	CDO/QCTA/ SPG/G-2/946, dt. 16.08.94 QCTA Cir. No. 2 of 1994	Quality Assurance in CPWD – Recording of observation on quality aspect by Senior Officers	(1) CE/SE/EE to write in inspection register. (2) If CE is not in position to do so he may direct EE to record instructions given by CE and EE to confirm in writing. (3) Observations in inspection register should be reviewed during subsequent inspections and also by QA Wing.
45.	92	CDO/QCTA/ SPG/G-2/964, dt. 18.08.94 QCTA Cir. No. 3 of 1994	Quality Assurance in CPWD – Inspection and follow-up action	– Reply by EE to be given within 4 weeks. – CE & SE (HQ) to monitor the compliance of QCTA inspection reports.
46.	92	CDO/QCTA/ SPG/G-2/1114, dt. 31.08.94 QCTA Cir. No. 4 of 1994	Regarding Construction of overhead tanks	(1) O.H. Tanks of shaft type staging not to be constructed. (2) Existing shaft type tanks to be checked for distress.

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47.	93	CDO/QCTA/ SPG/G-2/988, dt. 24.07.95 QCTA Cir. No. 1 of 1995	Standard proforma for maintenance of record of Chemical/ Paints	Specimen proforma.
48.	94	CDO/QCTA/ SPG/G-2/932, dt. 07.07.95 QCTA Cir. 2 of 1995	Centering and shuttering for RCC work – span exceeding 4.5M & height beyond 3.5M	Only Steel from work is to be used.
49.	95	CDO/QCTA/ SPG/G-2/1469, dt. 06.12.95, QCTA Cir. No. 3 of 1995	Prevention of accidents in Govt. colonies under maintenance of CPWD – Regarding steel gate in boundary wall.	(1) Special attention about welding, welding should be on both sides continuous with no gaps or holes. (2) Item of welding should be provided for, measured & paid separately on linear measurement basis. (3) Particular attention for design of steel gate. (4) Roller should be provided.
50.	96	DG(W)/MAN/ 2, dt. 17/ 24.04.96	Role and function of quality assurance units in CPWD i.e. Core Wing at the HQ and other units in the regions.	(1) SE(D) to monitor correspondence of OA paras. (2) Role and functions of Quality Assurance Wings under SE (TL&QA) in the region and SE(QA) at Headquarter.
51.	98	TSQ/QACW/ G-2/653, dt. 05.06.96 QACW Cir. No.1	Timely action/reply in QCTA wing observations	CE & SE may pay prompt attention to the observation of QC Wing & ensure field AE/EE comply the observation and take effective action to prevent defects.
52.	99	CE/TSQ/96-97/ 35, dt. 23.10.96	Time bound programme for clearance of Quality Assurance inspection reports	CE to chalkout time bound programme for clearance of outstanding QA cases.
53.	100	CSQ/QACW/ G-2/103, dt. 22.01.97, QACW Cir. No. 2	Monitoring progress of settlement of pending quality control/assurance inspection reports.	(1) Review of pending cases of observations by CE/SE/EE. (2) CE to review pending QA reports quarterly & SE monthly. (3) CE to send quarterly statement of review as per proforma

<i>S. No.</i>	<i>Page No.</i>	<i>Circular No. & date</i>	<i>Subject</i>	<i>Brief Contents</i>
54.	103	CSQ/QACW/ G-2/104, dt. 22.01.97, QACW Cir. No. 3	Sub-standard work.	(1) EE/AE/JE has no authority to accept sub-standard work. (2) SE is authorised in very rare cases. (3) Minus extra item should not be sanctioned for sub-standard work.
55.	104	CSQ/QACW/ G-2/105, dt. 22.01.97, QACW Cir. No. 4	Maintenance of buildings	(1) To maintain a register in CPWD Form 25 for all immovable Govt. properties in accordance with Para 138 of CPWD Code. (2) SE/EE/AE/JE to inspect each building periodically as prescribed in Para 139 of CPWD Code. (3) SE to bring to notice of CE all buildings which are structurally unsound and unsafe.
56.	105	CSQ/ SE(QA)CW/96/ G-2/296, dt. 11.03.97 QACW Cir. No. 5	Intimation of Award of work on contract to QC/Assurance Unit in CPWD	(1) SE (TLC&QA) will be reporting to CE(CSQ) while being under control of ADG's. (2) ASW(QC) will report to SE(TLC).
57.	106	CSQ/QACW/ G-2/97-98, QACW Cir. No. 6	Works of ADG(B)	Work under ADG(B) will be looked after by Core Wing.
58.	106	CSQ/QACW/G- 2/97-98/212, dt. 11.03.98, QACW Cir. No. 7	Quarterly Reports	(1) Discontinue of quarterly returns of A/R & M/O works and final bills. (2) Proforma for return of progress of works costing more than 70 lakhs changed to same as of CTE.
59.	107	CSQ/QACW/ G-2/97-98/209, dt. 09.03.98, QACW Cir. No. 8	Improvement of Quality of works in CPWD	(1) Detail instruction for steps to be taken at planing stage, at T/S stage and at N.I.T. stage. (2) Training of Staff (3) Control chart (4) Inspection by SE

<i>S. No.</i>	<i>Page No.</i>	<i>Circular No. & date</i>	<i>Subject</i>	<i>Brief Contents</i>
				(5) Part Rate (6) Secured Advance (7) Approval of sample (8) Deviation (9) Check list etc. (10) Responsibiling JE/AE/EE (11) Value Engineering (12) Proforma of mandatory test with each bill.
60.	121	CSQ/QACW/ G-2/111, dt. 31.03.99, QACW Cir. No. 9	Rebound Hammer Test	Detailed instruction reg. the hammer test including steps to be followed and proformas for recording test results.
61	125	CSQ/QACW/ G-2-2000/145 dt. 2.6.2000 QACW Cir. No. 10	Unsatisfactory work having serious defects	Work/items of work categorized as unsatisfactory
62	126	CSQ/QACW/ G-2-99/146 dt. 2.6.2000 QACW Cir. No. 11	Improvement of Quality of CPWD Works	(1) Stipulation of weigh batching and design mix shall be made mandatory for works costing more than Rs. 5 crores. (2) Use of water dosing attachment developed by CDO. (3) Use of proper cover blocks. (4) Storage of Steel Bars.
63	127	CSQ/QACW/ G-2-99/147 dt. 2.6.2000 QACW Cir. No. 12	Testing of BIS Marked Products	B.I.S. marked items also be got tested.

COMPILATION OF QUALITY ASSURANCE CIRCULARS OF CPWD

CENTRAL PUBLIC WORKS DEPARTMENT CENTRAL DESIGNS ORGANISATION QUALITY CONTROL, WING

D.O. No. CDO/QCTA/G/

Dated 19.5.1982

Subject : General : Correct Proportioning of Aggregating in Concreting

From

Er. G.S. RAO

Chief Engineer (D)

Dear Er.

Instances have come to our notice that specifications laid down in para 4.3.1. of CPWD Specifications 1977 Vol. I regarding use of boxes of suitable sizes is not being strictly followed. Since one of the important aspects of preparing good concrete is correct proportioning, you may ensure that the specification in this regard is adhered to. Use of baskets etc. for measuring the aggregates shall be avoided.

Yours sincerely,

Sd/-

(G.S. RAO)

CE (D), CPWD

CENTRAL PUBLIC WORKS DEPARTMENT CENTRAL DESIGNS ORGANISATION QUALITY CONTROL, WING

No. CDO/QCTA/6/32

Dated 15.7.1982

All Chief Engineers (By name)

In C.P.W.D., Except C.E. (Val.)

Subject : Quality Control and Technical Audit Wing under the control of C.D.O.

Reference : This Office Letter No. CDO/QCTA/6/1305 dated 26.4.82.

Your attention is invited to this office letter referred above, in which it was desired that Quality Control & Technical Audit Wing at the Circle level starts functioning effectively and laboratories at various levels are set up for testing purposes at the earliest. I shall be thankful if action taken in this regard so far by the S.Es/E.Es under your charge is intimated to this office by return of post.

It has also been desired in the letter under consideration that Superintending Engineers should send to this office monthly/quarter statements for works costing more than Rs. 22.5 lakhs recently awarded/completed, along with relevant records like copies of respective agreements, final bills etc. for technical audit. We have not received the statements/records from a member of E.Es/S.Es so far. The Superintending Engineers/Executive Engineers may, therefore, be instructed to send the necessary statements/records to this office in future without fail, commencing with the monthly statement for June 1982 and quarterly for the period ending June 1982.

A number of queries on the functioning of the Quality Control and Technical Audit Wing have been received by this office from various field units. A note clarifying the scope and functioning of the wing is appended herewith for guidance. (Annexure A).

It is hoped that with these clarifications, it will be possible to put into effective operation the Quality Control and Technical Audit Wing under the various circle offices without any further delay.

8 spare copies with enclosure are attached meant for S.Es.

(G.S. RAO)
CHIEF ENGINEER (CDO)

ANNEXURE 'A' TO LETTER NO. CDO/QCTA/6/32 Dated 5.7.82

**Subject : Quality Control and Technical Audit Wing under the Control
of Chief Engineer (CDO)**

Detailed instructions had been issued under this office letter No. EE/QC/QCTA-2/718-1218 dated 3.4.82 about setting up/functioning of the Quality Control and Technical Audit Wing under the overall control of Chief Engineer (CDO). This gave the outline of the quality control system, details of field testing and lab. requirements for setting up labs., functions of the quality control team, functions of the core/cell in CDO, etc. This was followed by letter No. CDO/QCTA/6/1305 dated 26.4.82 from Chief Engineer (CDO) to all Chief Engineers of the Department (except Valuation) in which the need for putting into operation the QCTA, wing was stressed. However, judging from the information received in this office as well as personal and written queries raised by some of the field units about the proper functioning of this wing, it appears that no headway has been made so far in effectively commencing the wing. Following points are again brought to the notice of all concerned to enable them to take effective steps in implementing the policy.

1. The A.S.W. in the Circle office, who will look after the QCTA work, will be the focal point for inspection of all works costing more than Rs. 2.00 lakhs and will report to the S.E. of the Circle concerned. He will also carry out the Technical Audit of works costing upto 22.50 lakhs in the circle besides other functions as mentioned in this office circular dated 3.4.82. A copy of the A.S.W's inspection report of works costing more than Rs. 22.50 lakhs must be forwarded to the core unit in C.D.O. Core Unit will carry out random inspection of works costing more than Rs. 22.50 lakhs to ensure effective functioning of the Quality Control Unit and will render any assistance/guidance required by the circle office units in this connection. Core unit will also carry out Technical Audit of works costing more than Rs. 22.50 lakhs for which copies of agreements, final bills of works will have to be made available by the respective Executive Engineers.
2. One A.S.W. and two J.Es are to be drawn up from the existing establishment of the Circle Office for the Circle level. Q.C.T.A. Wing. In case of any difficulty in sparing the necessary staff for any reason, the S.Es may take up the matter suitably with their Chief Engineers and D.G. (W), without making any reference to this office, which cannot render any assistance in this regard. The requirement of staff and their functions have been circulated by this office and it will be entirely upto S.Es to take steps to fulfil the requirement. The two J.Es will look after the testing work as well as assist the ASW in his field inspections, wherever required.
3. This office letter dated 3.4.82, gives an idea of equipments required for field laboratories/circle level laboratories. Discretion has to be used in a judicious manner to study and review the requirement of the laboratories depending on concentration of works, distribution of a number of circles at one place and availability of a Central lab, of the Deptt. The labs, can then be set up

as considered necessary and desirable. For example, in big cities like Delhi, Bombay, etc. where well-equipped central laboratories of the Department are available, the Circle offices can establish field labs. only to do tests of repetitive nature whereas for occasional or special tests, use can be made of the facilities available in the Central lab. where such facilities are not available, setting up suitable circle level lab. at a convenient place should be considered. A judicious decision may be taken, even at zonal level, regarding setting up circle level/field level labs, in order that all mandatory tests are done without much of difficulty and at the same time taking optimum utilization of resources already available in the place with the department.

4. It is for the field officers to sort out matters such as the head to which services on establishment of lab, are to be charged with their S.Es. C.E's such guidelines in this respect have already been given in this office letter dated 3.4.82.

5. Equipment required for setting up circle level/field labs, has already been published in this office letter dated 3.4.82. The labs. will have to be established by the S.Es./C.Es at their own level and the Core Unit will only assist them in supplying the details/clarifications about equipment required to be installed. A list of suppliers of such equipment in Delhi is enclosed (Annexure B) herewith for information of all. The S.Es/E.Es can obtain quotations towards etc. from these firms or other local reputed firms and procure the instruments directly obtaining total requirements.

6. Regarding training of the two J.Es in lab. testing, the concerned S.E./E.E. may send the programme for training in the Central lab. at Delhi, directly to Executive Engineer (D) V. C.D.O., CPWD, Nirman Bhawan, who will coordinate such training programmes. Normally, the training is expected to last 2 weeks.

7. In order to enable the A.S.W. to carry out effective quality control at site, it is advisable for him to carry certain field testing equipment with him. A list of such equipment is enclosed herewith for guidance. (Annexure B).

Annexure B not Enclosed

(N. VEMBU)
SUPERINTENDING ENGINEER

**CENTRAL PUBLIC WORKS DEPARTMENT
CDO, CPWD, NIRMAN BHAWAN, NEW DELHI**

No. SE(D)/G-46/391

Dated 10.11.1982

Subject : Propping and Centering for R.C.C. Slabs & Beams

During the inspection of works, one of the common defects noticed is that no supports are being provided one floor below the top floor already cast while casting the upper floor R.C.C. slabs & beams, and that even where, the supports are so provided, they are being removed before the period stipulated for striking the formwork. In this connection, para 5.2.2.2. of C.P.W.D. Specifications 1977 Vol. I, clearly states that centering and shuttering of any upper floor being cast shall be suitably supported on floor below the topmost floor already cast. Specifications giving the striking period of centring & shuttering do not give different period for removal of the supports in the lower floor. It, therefore, follows that non-provision of such supports or their removal before due date for removal of centering & shuttering are in contravention of the specifications and also may be structurally undesirable.

These instructions are brought to the notice of all concerned for strict compliance.

(G.S. RAO)
CHIEF ENGINEER(D)

**CENTRAL PUBLIC WORKS DEPARTMENT,
CENTRAL DESIGNS ORGANISATION**

No. CDO/SE(D)/G. 89/292

Dated 5.9.1983

Subject : Technical Circular

A frequent cause of the deterioration of reinforced concrete is corrosion of the steel reinforcement. The expansion of steel on oxidising or rusting causes the concrete to crack and spall off. The protection offered by concrete to steel embedded or engaged in it depends on number of factors such as the quality of water used for mixing the concrete, density of the concrete etc. The quality of water used, needs to be paid much more attention. The presence of chlorides affects to greater extent in causing corrosion of reinforcement steel. These may gain access to concrete in the form of calcium chlorides present in the water used for mixing of concrete.

The steel reinforcement in the concrete is protected from corrosion by the highly alkaline environment of the cement paste. The higher, the alkalinity, the greater becomes the protective quality of the oxide film that is formed on the surface of the steel. The presence of chlorides in the concrete changes the protective quality of the environment of the steel by electro chemical corrosion. The corrosion products, so formed, occupy a volume over twice the original volume of the steel and consequently internal pressures as high as 30N/mm may be developed. This force is many times greater than the tensile strength of the concrete and is responsible for the cracking and spalling of the concrete that subsequently occurs, the severity of the damage depends on the concentration of the chlorides present in the concrete as well as variation of the chloride concentration from one point to another point.

It is therefore essential to impose limits on the amount of chlorides present in the water used for the concreting.

Not only the chlorides, but the presence of the sulphates also affect the durability of concrete. Sulphates, in solution, attack concrete and cause expansion, deterioration and eventual disintegration. The higher the concentration of sulphates in the solution, the more serious is the attack. The suitability of water for its use in mixing with concrete has been standardised by ISI keeping in view the above said conditions and the provisions have been mentioned in IS. 456-1978 vide clause 4.3.

To prevent corrosion is easier than cure. Proper control on concrete by proper tamping and vibration, adequate curing, suitable cover thickness, proper form work shall have to be ensured. The various measures mentioned in IS. 9077-79—Code of practice for corrosion protection of steel reinforcement in R.B. & R.C.C. construction shall be ensured.

I.S. 456-78 and also CPWD Specifications stipulate the requirements of water used for mortar and concrete. Necessary test shall invariably be got done to find out the suitability of water for construction before use.

Sd/-
(R.S. GUPTA)
CHIEF ENGINEER (D)

**QUALITY CONTROL & TECHNICAL AUDIT WING CDO :
CPWD : NIRMAN BHAWAN, NEW DELHI**

No. CDO/QCTA/28/1051-1100

Dated 29.10.1983

Subject : Common Defects/Deficiencies Observed during Visits by Q.C. Core Unit of the Various Works

The Q.C. Core Unit has been visitings works in Delhi as well as out stations, for the past few months. During these inspections, the following common defects/deficiencies have been observed.

1. The uptodate correction slips of C.P.W.D. specifications Vol. I, as well as Vol. II as mentioned in the Agreement are not available at site. It is to be ensured that all field officers including J.Es. are aware of these correction slips and they are required to be incorporated in the specification copies available at site. In this connection, particular reference is drawn to this office letter No. CDO/QCTA/6/511-59 dated 5.7.83 in which attention has been drawn of all S.Es and E.Es regarding modification of mandatory tests as per correction slip No. 3 issued vide No. SSW/NDZ/SWI/118/307 dated 21.6.79. It is also to be ensured that frequency of mandatory tests are strictly adhered to.

2. In spite of this office D.O. No. CDO/QCTA/6/1429-78 dated 19.5.82 addressed to all S.Es and copy to all C.Es in which it was requested that it may be ensured that use of baskets for measuring the aggregate are avoided and use of measuring boxes of required size as laid down in para 4.3.1 of C.P.W.D. Specifications Vol. I, 77 be strictly followed, it is not being followed at most of the places and baskets are still being used.

3. As per para 5.2.2 of CPWD Specification Vol. I, 77 (P-102) "in case of structures with two or more floors the weight of concrete, centring and shuttering of any upper floor being cast shall be suitably supported on one floor below the top most floor already cast. In such cases normal props as per para 5.2.2.1 shall be provided for supporting the floor to be cast on the top most floor already cast. Suitable supports below this floor shall be provided preferably to come below the props of the upper floor..... In case of balconies and cantilever beams, coming one above the other, the members being cast shall be supported by props on two floors below, the floor where initial supporting has been done."

In this office No. SE(D)/G-46/391 dated 2.12.82, circulated to all C.Es, S.Es & E.Es, it was pointed out that the above provision was not being followed. It was also mentioned that specifications giving the striking period of centering & shuttering do not give different period for removal of the supports in the lower floor. It, therefore, follows that non-provision of centering and shuttering are in contravention of the specifications and also may be structurally undersirable.

In spite of such clear instructions issued for strict compliance, it is found that the instructions are not followed in most of the works visited by the Core Unit.

4. Figure 5 of C.P.W.D. Specifications Vol. I, 77 (page 399) (Clause 5.2 page 101) giving details of form work is practically not being followed anywhere.

5. In this office No. CDO/QCTA/Tech. Cir/7/295 dated 30.4.83, instructions were issued regarding hollow vertical joints in brick masonry. These instruction are not being followed.

6. Departmental instructions regarding disposal of surplus earth is not being followed. Initial levels, final levels at source as well as disposal points are not being taken and lead charts are not being maintained.

7. Hacking of concrete surfaces while green specially for slabs, beams, fins, facias, chajjas etc. are practically not being done in quite a few sites.

8. Ballies being used for form work are found to be of lesser diameter.

9. As per para 5.2.2.3., of CPWD Specifications Vol. I, 77 details of form work for spans exceeding 4.5m and height exceeding 3.5m are required to be properly designed.

10. Dimensional tests of bricks as required are not being done at a number of places.

11. Brick on edge at specified places and cut (Maru) corners are not being provided (Ref. para 6.2.6 C.P.W.D. specification Vol. I, 77-page 126).

12. Bonding in brick work between cross walls are not being taken proper care of and vertical joints are not broken properly.

Of such supports or their removal before due date for removal.

13. Synthetic resin is not being used/provided in joints of timber frames as well as in shutters.

14. As per para 9.14.2 of C.P.W.D. Specifications Vol. I, 77 (Page 182), the wire gauges are required to be turned at right angles in the rebates of styles and rails, turned back and fixed tight with blue tacks at specified intervals. The place between beading and rebates where wire gauze is bent is required to be neatly finish with putty. This is not being done practically anywhere.

15. Water seals of floor traps and P traps are found to be less at most of the places. S.C.I. pipe dimensions are not according to the I.S. specifications.

16. Inspection reports of A.S.W. (Quality Control), S.E., C.E. specially for the particular works are not normally available at site. So compliance of these instructions can not be verified by the Core Unit at most of the places.

17. Drawings, both structural as well as architectural are not being normally supplied to the contractor before the start of the work inspite of the manual provisions and instruction regarding the availability before start of work.

This issues with approval of Chief Engineer (Designs).

Sd/-
EXECUTIVE ENGINEER (QCTA)

**QUALITY CONTROL & TECHNICAL AUDIT WING CDO,
CPWD, NIRMAN BHAWAN, NEW DELHI**

No. CDO/QCTA/G-28/13-87/

Dated 6.1.1984

Subject : Common Defects/Deficiencies Observed during Visits by Q.C. Core Unit of the Various Works

In continuation to Q.C. list No. 1 issued vide this office letter No. CDO/QCTA/28/1051-1100, dated 29.10.83, following further common defects/deficiencies are observed by Q.C. Core Unit during inspections of various works. It is presumed that our earlier list No. 1 has been circulated to all concerned.

1. P.P.C. is used in all the works. In this connection, attention is drawn to D.G (W)'s Circular No. 28/10/78-W(DG)/Cir. No. 21/78, dated 13.9.78.

2. As per para 5.4.2.4 of C.P.W.D. Specifications Vol. I' 77 in case of columns and walls, the shuttering is required to be so adjusted that the vertical drop of concrete is not more than 1.5 metres at a time. Generally, this is not done with the result that the vertical drop of concrete exceeds 1.5 metres.

3. As per para 5.4.4.1. of C.P.W.D. Specifications Vol. I' 77, the position and details of construction joints shall be as shown in structural drawing or as indicated in Fig. 6 or as directed by the Engineer-in-Charge. Generally it is found that the position and details of construction joints are not shown in structural drawings and specific instructions of Engineer-in-Charge are not issued for pre determining the position and details of these joints. Fig. 6 (P-400) of CPWD Specification is also not followed with the result that proper care is not taken on this important aspect.

4. As per para 5.3.1. of C.P.W.D. Specifications Vol. I' 77 the overlapping bars shall be kept apart by 25 mm or it times the maximum size of coarse aggregate with concrete between them. But where this cannot be done, the overlapping bars shall be bound together at intervals not exceeding twice the diameter of such bars. Generally, the overlapping bars are not kept apart and instead these are bound together. But the interval of binding is always much greater than 2d.

5. As per para 6.2.4.1. of CPWD Specifications Vol. I' 77 Brick work is required to be laid in English Bond, the details of which are shown in Fig. 11, 12 & 13 of the specification. The common defect noticed in this connection is that queen closers are not used near the ends of the walls. This results in vertical joints in successive courses coming one over the other. Even when queen closers are provided, vertical joints come one over the other in successive courses due to unnecessary use of brick bats in layers of headers/stretchers.

6. In many places, the thickness of mortar joints exceeds 1.0 cm. The raking of joints is normally not done on the rough face of the brick work. Even when raking is done the depth is less than 15 mm required (Para 6.2.5.).

7. The common defects noticed in the fittings of doors & windows are as given below :—

- (a) Butt hinges. Fig. 28 of C.P.W.D. Specifications Vol. I' 77 (Page 422). Diameter of hinge pin is generally less than required size.
- (b) Sliding door bolts. Fig. 32 of specification (Page 426). The thickness of clip & staple are generally less than 3.15 mm.
- (c) Barrel tower bolts. Fig. 33 of specification (Page 427). The thickness of mild steel sheet is generally less than required.
- (d) Thickness of Hasp & staples. Fig. 39 of specifications is generally less than required (Page 433).

8. As per para 10.10.2.3. (b) of specifications, for fixing steel hinges slots shall be cut in the fixed frame and hinges inserted inside and welded to the frame. This is not done.

9. The size of fan clamps box are generally not as shown in Fig. 47 C of C.P.W.D. Specifications Vol. I' 77 (page 441). The thickness of top and bottom lids are generally less than 1.5 mm and number of holes for fixing the top and bottom lids are generally less than 4. Bottom lids is not generally provided.

This issues with the approval of the Chief Engineer (Designs)

Sd/-
EXECUTIVE ENGINEER-I (QCTA)

**DIRECTORATE GENERAL OF WORKS,
CENTRAL PUBLIC WORKS DEPARTMENT, NEW DELHI**

No. 13(1)/83-WI(DG)/Cir. No. 4/84

Dated 28.2.1984

Subject : Centring and Shuttering for R.C.C. Work

The provisions under para 5.2 of CPWD Specifications, 1977, Vol. I clearly indicate the various aspects of providing for a work for Reinforced Cement Concrete Work. If these provisions are strictly followed, there should be no cause for any mishaps due to failure of centring. Para 5.2.2.3 stipulates that in case of spans exceeding 4.5 Mts & height beyond 3.5 Mts. the formwork shall be designed properly for the self weight, weight of reinforcement, weight of fresh concrete, various imposed improved during the construction process (such as workmen & equipment). It is important to ensure that suitable & adequate horizontal as well as diagonal bracings are provided to resist lateral forces.

2. In case of long spans and high roof buildings, it is advisable to use steel centring as indicated in this office Memo No. 28/26/77-71(M) Cir. No. 18/78 dated 21.6.78.

3. It has been observed that in spite of repeated instructions, adequate care is not being exercised in the design & erection of centering and propping. During inspection of works, the Superintending Engineer and Executive Engineers should pay special attention to this item of work.

(G.S. RAO)
DIRECTOR GENERAL OF WORKS

**QUALITY CONTROL & TECHNICAL AUDIT WING CDO :
CPWD : NIRMAN BHAWAN, NEW DELHI**

No. CDO/QCTA/Tech. Cir/7/1075-1125

Dated 31.8.1984

Subject : Sub-standard brick work

Workmanship has considerable effect on strength of masonry and bad workmanship may reduce its strength considerably.

Common defects of workmanship in masonry are :— (i) Hollow vertical joints, (ii) Improper mixing of mortar, (iii) Excessive/less water cement ratio, (iv) Inadequate soaking of bricks, (v) Unduly thick joints, (vi) Improper bonding between cross walls, (vii) Non-staggering of vertical joints, (viii) Non-horizontality of bed joints, (ix) Ranking of brick work at an angle steeper than 45° for unfinished brickwork etc.

Strength of masonry may get reduced due to increase in thickness over the normal specified thickness of bed joints. Other points as detailed above in conjunction with inadequately filled up/hollow vertical joints will considerably reduce the strength of masonry and lower the resistance of walls to horizontal forces and forces due to differential settlements and effect the load distribution characteristics.

Strength of designed masonry holds good for commercially obtainable standards of workmanship with reasonable degree of supervision. If the work lacks proper supervision, there will also be reduction as compared to designed strength.

This office has been repeatedly pointing out the need for strict quality control of brick masonry. Among other things in Sr. No. 10, 11 & 12 of the list of common defects issued by this office under letter No. CDO/QCTA/28/1057-1100 dated 29.10.83 and Sr. No. 5 & 6 of list of common defects issued under No. CDO/QCTA/28/13-87 dated 6.1.84, certain common defects in brick work have been specifically pointed out.

It is once again brought to the notice of all concerned that there can be no compromise in the quality of masonry and the evils of defects in masonry must be eradicated specially in the load bearing structures. Detailed specifications as laid down should be strictly followed along with all mandatory tests of materials.

As rectification of some defects in brick work cannot be satisfactorily done after completion of the work, strict & constant supervision during the progress of the work is required to ensure that walls are raised truly plumb, vertical joints are properly staggered, inside faces of each brick is buttered with mortar before the next brick is laid and pressed against it and on completion of a course any hollows still left in the vertical joints are fully filled up from top with mortar. All face joints must be raked upto 15 mm during the progress of the work. This is usually not done on the rough side specially in lift well and shafts. This must be insisted upon. Inspecting officers also should check whether brick joints, particularly the vertical ones, are properly filled and whether the mortar has attained desired strength or not. Such tests should be made at random, frequently, particularly in layers a little below the one being laid during the inspection by removing, for a short length, one or two layers of brick work. In essence, ensuring that the work is carried out strictly as per specifications is the only solution.

A circular was issued vide CDO/QCTA/Tech. Cir/7/295 dated 30.4.1983 that A.E. should test check 30% & E.E. should check 10 per cent of vertical joints in the brick work and record certificates about soundness of the work. It has now been found that this has practical difficulties & physical limitations and it has not been able to be followed in most of the places. However, it should be possible for A.Es/E.Es to make random tests on brick work at selected locations in different walls, by removing the bricks in completed walls and checking if the vertical joints were found filled or not. Adequate tests should be made spread over the entire work so that the final result truly represents position of the entire work. Such tests should be made when the brick work is in progress (and not very old as early as possible and say within 10/15 days) and proper record should be maintained showing the location (A clear enough to relocate the spots at a later date), date of execution of brick work, date of test, observation, findings and dated initials (name). Certificates about the number of tests carried out and observations should be recorded at the time of submission and passing of the bills.

CHIEF ENGINEER (DESIGNS)

**QUALITY CONTROL & TECHNICAL AUDIT WING, CPWD,
CDO, NIRMAN BHAWAN, NEW DELHI**

CDO/QCTA/2/1476-3625/1525

Dated 15.11.1984

Subject : Yardstick for QCTA work of ASW (QC) at Circle level

1. According to the Quality Control set up of the Department, Superintending Engineers of the Circle have a key role to play, it is noticed that many circles have still not deputed/designated any ASW exclusively for Quality Control work. This should be done immediately.

2. Whenever such ASWs are designated their inspections have been inadequate, both in numbers as well as contents. Following Forms have been decided for inspections to be carried out by the ASW (QC) of the Circle office.

(a) Construction works costing more than Rs. 22.50 lacs	Each work to be inspected once in 2 months	CDO/QCTA/6/221/ dt 6.4.83
(b) Construction works costing less than Rs. 22.50 lacs but more than Rs. 2 lacs	Each work to be inspected once in 3 months	CDO/Cont/11175 dt. 3.9.1979
(c) Maintenance works costing more than Rs. 50,000/-	Each work to be inspected more than once	Now decided by DG(W)
(d) Maintenance works costing more than Rs. 20,000/- but less than Rs. 50,000/-	Each work to be inspected at least once a month	-do-

There would, however, be physical limitations on ASW due to time restraint. Hence it has been decided that every ASW should.

(1) Carry out minimum of 15 works inspections every month.

(2) Where maintenance works exist, about 10% of such inspection (one or two p.m.) should be maintenance works.

(3) In purely maintenance work ASW(CC) should inspect at least 20 works p.m.

2.2 ASW (QC) should follow the inspection proforma issued vide T.D. CDO/QCTA/6/259338 dt. 27.9.82 and send copy of the inspection note to SE. It was indicated therein that SE after his comments in part V of the proforma should send the copies to CE & CE (CDO). It is now learnt from various sites that this part of SEs comments is getting unduly delayed as a result main action is not initiated.

It is, therefore, decided that as soon as this is completed the ASW (QC) of the Circle should send copy of the report to SE & one copy to the Ex. Engineer-in-charge with a spare copy for AE in-charge & one copy to Ex. Engineer QC (CDO) New Delhi directly and action be taken by SE in part V will be independently sent by SE to EE/CE/CE (CDO) in continuation.

3.0 It is also noted that EEs, SEs & CEs do carry out inspection of works during their visits. But either no inspection notes are issued or those where issued do not refer to any defects or quality of works. Every visit of EEs, SEs & CEs should be in the light of Quality Control & bring out major defects so that action can be taken in rectifying defects.

4.0 The ASW (QC) are lacking in directions & guidance & their reports only seem to be factual & filling of forms. It would be advisable to direct ASW (QC) to be present during the inspections of Ex. Engineer (QC) Core Unit, of SE & CEs of the Circle/Zone (for local important out station works) and during the inspections by CE (CDO) & DG (W).

CHIEF ENGINEER (D)

**QUALITY CONTROL & TECHNICAL AUDIT WING CDO,
CPWD, NIRMAN BHAWAN, NEW DELHI**

No. CDO/QCTA/7-III/1564-1614

Dated 27.11.1984

To

Executive Engineers (Civil)
(Except Valuation)

Subject : Format for Recording Various Tests

In the meeting of all Chief Engineers held on 3.8.84 under the Chairmanship of D.G. (W), it was decided the Q.C. Core Unit may standardise forms for recording the tests and results at all sites.

Standard formats for maintaining results of tests have now been prepared in C.D.O. and are enclosed herewith, for adoption (by E.E./A.E.), single test register with certified page numbers shall be maintained for various tests with different sections for various tests. Index shall be written on the first page indicating different tests at different page numbers. Test registers should be signed by officers in token of reviewing the test results during inspections. Actions taken should also be noted. These forms are for some mandatory tests. Other forms for other routine tests will be finalised and circulated shortly. It is requested that the formats may be circulated amongst A.Es and J.Es in charge of works for adoption at all sites of works with immediate effect.

For CHIEF ENGINEER (DESIGNS)

1. TEST FOR SILT CONTENT COARSE SAND

(Note : Tests for fine sand should be recorded separately)

To be written on the first page of the test

Acceptable standard – Maximum permissible silt content – (Refer para 3.1.5 of specifications Vol. I 77)

Frequency of testing – Every 20 cum or part thereof or more frequently as decided by the Engineer-in-Charge.

Refer list of mandatory test at page 7 of specifications Vol. I ' 77)
(Quantity of material as per quantities of items in schedule of quantities cu.m.

Therefore number of tests required

(Note : If silt content is more, corrective action taken should be noted in column 10 and silt content rejected after such action & recorded in the register.

Serial No.	Date of testing	Height of silt above sand layer	Height of sand below silt layer	Percentage silt = $\frac{\text{column 3} \times 100}{\text{column (4)}}$
1	2	3	4	5

Acceptability	Signature of J.E.	Signature of Contractor	Checking by AE/EE	Remarks
6	7	8	9	10

2. SAME FORM AS IN (1) ABOVE FOR TEST FOR SILT CONTENT IN FINE SAND

3. TEST FOR PARTICLE SIZE DISTRIBUTION OF COARSE SAND

(Test for fine sand should be recorded separately)

To be written on the first page of the test

Frequency : Every 40 cum of sand required on RCC works only.
Refer list of mandatory tests at page 7 of specifications Vol. I '77.
Quantity of material as per quantities of items is schedule of quantitiescum.
Therefore, number of tests required

- (1) When the grading falls outside the percentage limits prescribed fit sieves other than 600 micron, 300 micron and 150 micron (IS) Sieve not more than 5%, it shall be regarded as falling within the resp. zones. This 5% can be split up, for example it could be one per cent each of three sieves and two per cent on another or four per cent on one sieve and one per cent on another. Refer para 3.1.5 of specifications Vol. I ' 77.
- (2) If grading falls outside the percentage limits against each (IS) Sieve after taking note (1) into account sand shall be screened and test shall be repeated till acceptance grading against each sieve designated is obtained and recorded with a new serial number in the register taken for screening etc. may be certified by AE.

Serial No.	Date of testing	Weight of sample	I.S. Sieve Designation	Weight retained	Weight passed
1	2	3	4	5	6
			10 mm 4.75 mm 2.36 mm 1.18 mm 600 microns 300 microns 150 microns		
% age passing for	Acceptability against each sieve designation according to zone specified	Signature of JE	Signature of Contractor	Checking by AE/EE	Remarks (Action)
7	8	9	10	11	12

4. SAME FORM AS IN (3) FOR FINE SAND

5. TEST FOR BULKING OF COARSE SAND

To be written on the first page of the test

Test for fine sand should be recorded separately
Frequently : Every 20 cum or part thereof or more frequently as decided by the Engineer-in-Charge. Refer list of mandatory tests at page 7 of specifications Vol. I '77
Quantity of material as per quantities of items in schedule of quantitiescum.
Therefore, number of tests required

Serial No.	Date of testing	Initial height of sand method 1 page 7 of specifications Vol. I ' 77 in ml	Initial height of sand in method 2 page 77 of specifications Vol. I ' 77 ml	Final height in undetected sand either method
1	2	3	4	5
			200 ml	

$\% \text{ age bulking} = \left(\frac{\text{Col. 3 or 200}}{Y} - 1 \right) \times 100$	Qty. of sand & of box	Sign. of JE	Sign. of Contractor	Checking by AE/EE	Remarks
6	7	8	9	10	11

(6) TEST FOR PARTICLE SIZE DISTRIBUTION OF 12.5 MM

To be written on the first page of the test

Graded stone aggregate.

(Test for other graded aggregate such as 20 mm, 40 mm etc. should be mandatory tests at page 7 of specifications Vol. I recorded separately) with frequency and acceptability. Refer list of mandatory tests at page 7 of specification Vol. I ' 77.

Frequency - As decided by the Engineer-in-Charge (Number of tests required as decided by the Engineer-in-Charge.)

Note : If grading falls outside the percentage limits each IS sieve coarser of finer aggregate may have added in required proportion and test reported till acceptable grading is obtained, proportion of such should be noted in col. 12 and test on the mixed same repeated and recorded with a new serial number in register.

Serial No.	Date of testing	Weight of sample	IS Sieve designation	Weight retained	Weight passed	Percentage passing
1	2	3	4	5	6	7
			20 mm 12.5 mm 10 mm 4.75 mm			

Acceptability against each sieve designation Refer page 82 of Specifications Vol. I' 77	Signature of JE	Signature of Contractor	Checking by AE/EE	Action taken
8	9	10	11	12
100 90-100 40-85 8-10				

(7) SAME FORM AS IN (6) FOR 20 MM AGGREGATE

(8) SAME FORM AS IN (6) FOR 40 MM AGGREGATE OR ANY OTHER SPECIFIED SIEVE

(9) SLUMP TEST FOR CEMENT CONCRETE ON REINFORCED CEMENT CONCRETE.

To be written on first page of the test

Frequency – At the time of commencement of concreting on every day of concreting till the w.c. ratio is fixed for desired workability for the location of concrete or everytime it is to be changed due to change in moisture in aggregate. Refer list of mandatory test at page 8 of specifications Vol. I' 77.
Acceptance Standard : Refer paras 4.3.3. and 5.4.1 of specifications Vol. '77.

Sl.No.	Work	Slump in mm.		Remarks
		Vibrators used	Vibrators not used	
1.	Mass concrete in foundation, footings, retaining walls and pavements	10-25	50-75	Actual slump to be decided by Engineering-in-charge
2.	Thin sections of flooring less than 75mm thickness	25-40	75-100	
3.	Reinforced cement concrete work			
	(a) Mass concrete in RCC foundation, footings and retaining walls	10-25	80	
	(b) Beams slabs and columns simply reinforced.	25-40	100-125	
	(c) Thin RCC section or section with congested steel	40-50	125-150	
4.	Under water concreting	—	100-180	

Note 1.1. If W.C. water cement ratio is changed as

2. Although the range of slump given is wide enough, minimum slump to achieve desired workability/consistency for the location of concrete should be used. If the

moisture in aggregate increases or decreases on different days for the required consistency recorded with a new in the register due to rains or draining etc.), quantity of water to be added should be decreased or to increased to obtain a uniform minimum slump commensurate with the location and concrete increased to be laid.

3. If w.c. water cement ratio is changed as a result of findings in cement (8) test should be repeated till the acceptable water cement ratio is obtained for the required consistency & recorded with a new in the register.

S.No.	Date of testing	Item of work and location	Vibrators used Yes/No	Quantity of water added percentage of cement Litres	Height of specimen after removal of mould in mm
1	2	3	4	5	6

Slump mm	Acceptability of result or action taken	Signature of JE	Signature of contractor	Checking for AE/EE
7	8	9	10	11

(10) REFER LIST OF MANDATORY TESTS AT PAGE 8 OF SPECIFICATIONS VOL. I ' 77

To be written on the first page of the test Frequency : (a) In slab, beams and connected columns—every 20 cum of a day's concreting

(b) In columns—every 5 cum.

(c) For all other small RCC items and where RCC done in a day is less than 5 cum, test may be carried out as required by Engineer-in-Charge.

Quantity of concrete as per quantities of items in Schedule of quantities cum. Therefore number of tests required

Acceptable standard : Refer Appendix 'C' at page 117 and para 5.4.8 of specifications Vol. I ' 77

Concrete mix	Compressive 7 days	Strength 28 days	Kg/Sq. mm
1 : 1 : 2	210	315	20
1 : 1 $\frac{1}{4}$: 2 $\frac{1}{2}$	195	290	
1 : 1 $\frac{1}{2}$: 3	175	265	
1 : 1 $\frac{3}{4}$: 3 $\frac{1}{2}$	160	240	
1 : 2 : 4	140	210	

S.No.	Date of taking sample	Item of work and location	Mix and Cement (ppc/opc)	Identification marks of cubes	Sample filled in the presence of		
					Sig. of JE	Sig. o AE/EE	Sig. of Cont.
1	2	3	4	5	6	7	8
				1A 1B 1C			
				1D 1E 1F			

7 days result (ABC) 28 days result (DEF)			Difference of max. & min. (A)	% of (A) over (B)	Increases in strength required due to delay in 28 days test
Date of test	Comp. strength obtained individual cubes (kg/cm ²)	Average strength (B) (kg/cm ²)			
9	10	11	12	13	14
			Does not arise		Does not arise

Acceptability	Tested in the presence of			Remarks (Ind. Ref. No. of the laboratory result)	
	Sign. of JE	Sign. of AE	Sign. of Contractor		
15	16	17	18	19	20

11. TESTING OF BRICK/BRICK TILES FOR DIMENSIONS

To be written on the first page of the test refer paras 6.1.1 and 6.1.7 of specifications Vol. I'77

Frequency: (a) For every 50,000 bricks or brick tiles or part thereof for brick or brick tiles designation 100.
 (b) For every 1,00,000 dimensions of brick or brick tiles or part thereof for brick designated 75, 50, 35 and brick tiles designation 75.

Designation of brick		
Quantity to be used		
No. of test required		
Acceptable standard (see note below)	Length Breadth Height	

Notes : 1. For 22.5 x 11.1 x 7/4.4 cm brick/tiles, pl. fill in dimensions as given in paras 6.1.1 and 6.1.7 of CPWD Specifications Vol.I, 1977. For other nominal sizes of bricks the dimensions may be fixed in accordance with

2. Tests should be repeated for different brand marks.

S.No.	Dt. of testing	Identification mark of the brick	Dimensions obtained for twenty bricks	Acceptability	Signature of J.E.
1	2	3	4	5	6
			Length Width Height		

Signature of Contractor	Checking by AE/EE	Action taken if any
7	8	9

12. TEST OF BRICKS/BRICK TILES FOR COMPRESSIVE STRENGTH

Refer list of mandatory tests at page 8 of specifications Vol. I '77

To be written on the first page of the test

Frequency of testing

(a) For every 50,000 or part thereof for bricks/brick tiles designation 100

(b) Two tests for first lot of one lac bricks and one test for every subsequent 2 lac bricks for designation 75, 50, 35.

Designation of bricks/tiles		100	75	50	35
Quantity to be used					
No. of test required					
Acceptable standard	Minimum average	100	75	50	35
Refer para 6.1.4 of Spfn. Vol. I 1977	comp. strength Individual brick				
		Not less than 20% of the specified average comp. strength.			

Notes :

- In case any of the test results or individual brick exceed the upper limit of the class, the upper limit of the class should be taken while averaging the results. Refer Appendix B F.132 of specifications Vol.I'77.
- Tests should be repeated for different brand marks.

S.No.	Dt. of taking sample of 5 bricks for each test	Identification mark after filling frog.	Identification mark given in presence of signature of			Date of testing	Compressive strength obtained for individual bricks kg/cm ²
			J.E.	AE/EE	Contractor		
1	2	3	4	5	6	7	8
1.		1A 1B 1C 1D 1E					
2.		2A etc.					

80% of specified compressive strength kg/cm ²	Average strength kg/cm ²	Acceptability		Tested in presence of Signature of			Remarks (i/c ref. No. of the laboratory result)
		Individual strength	Average strength	J.E.	AE/EE	Contractor	
9	10	11	12	13	14	15	16

TEST OF BRICKS/BRICK TILES FOR WATER ABSORPTION

Frequency of testing : (1) One test per source of manufacture for all brick designations.
(2) For every 50,000 or part thereof for brick tiles.

Refer list of mandatory tests at page 8 of specifications Vol. I' 77.

Designation of bricks/ brick tiles Brick tiles Brick 100 75 50 35
Quantity to be tested No. of tests required
Acceptable standard Refer para 6.1.5 of Spfn. Average water absorption shall not be
Vol. I' 77. more than 20% by weight.

Note : 1. Tests should be repeated for different brand marks.

S.No.	Dt. of taking sample of 5 bricks for each test	Identification mark	Identification mark given in presence of			Date of Testing
			Signature of JE	Signature of AE/EE	Signature of Contractor	
1	2	3	4	5	6	7
		1A 1B 1C 1D 1E 2A etc.				

QUALITY CONTROL & TECHNICAL AUDIT WING CDO,
CPWD, NIRMAN BHAWAN, NEW DELHI

No. CDO/QCTA/28/116

Dated 1.3.85

Subject : **Common defects/deficiencies regarding floor trap**

One of the most common defects observed by Q.C. Core Unit during inspection of various works is the use of non standard floor traps.

As per para 18.3.4 of CPWD Specifications Vol. II' 67 as well as para 18.1.10 of Vol. II' 77, sand cast iron floor trap shall be 'P' or 'B' type and shall be of self-cleansing design. The required shape is given below :—

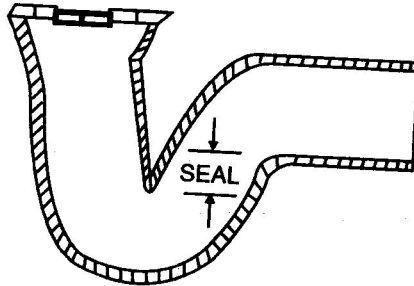


Fig. (a)

Floor traps generally found at sites are as given below :—

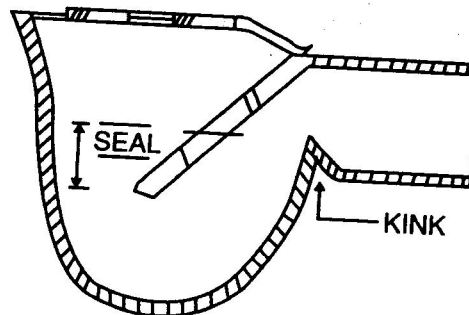


Fig. (b)

This trap shown in Fig. 'b' resembles 'Nahani type' trap in I.S. 1729-1979 but the dimensions are seldom as per required seal provided by creating an obstruction in the throat. This obstruction reduces the self-cleansing property of the trap leading to clogging.

It is therefore enjoined upon all concerned that floor trap of the type mentioned in the I.S. Code, preferably of shape as shown in Fig. (a) should only be used. Nahani traps where permitted and provided should have no kink at the mouth of the outlet and the shape and dimensions should be as per IS 1729-1979.

This issues with approval of Chief Engineer (Designs)

Table 27 of IS : 1729-1979 and the Nahani trap.

EXECUTIVE ENGINEER I (QC)
CDO, CPWD, NEW DELHI

**QUALITY CONTROL & TECHNICAL AUDIT WING CDO,
CPWD, NIRMAN BHAWAN, NEW DELHI**

No. CDO/QCTA/SE(D)/NMT (24)/89

Dated 1.3.85

Subject : Use of Portland Pozzolana Cement in CPWD Works

Reference is invited to D.G. (W) Circular No. 28(10)/78-W(DG) Cir. No. 21/78 dated 7/13-9-1978 in which the items of work where PPC can be used have been enumerated. It was specifically stressed therein that PPC should conform to the IS specifications and the use of PPC framed structures and bridges be avoided. In view of the continued difficulty in getting the OPC, many CES had pointed out that they were forced to use PPC in RCC framed structures. It was proposed in this office letter No. CDO/SE(D)/NMT. 24/123 dated 3.4.82, that PPC may be permitted in RCC work, if the situation becomes unavoidable, taking care that the PPC so used should strictly conform to IS specifications. To ensure the same, it was directed that the samples of PP cement should be tested periodically in addition to the effective and rigid control on testing of cement concrete cubes. The said letter further mentioned that the PPC shall not be permitted in prestressed concrete and bridges. It was further suggested that suitable increase in the period of retaining of centring and shuttering in position and prolonged during the specified as required. Use of PPC in corrosion prone areas was mentioned as being viewed with suspicion. Taking into account these points, the CEs were requested that in individual cases, they may permit the use of PPC in RCC works if it is unavoidable. While instances of use of PPC in RCC framed buildings are noticed, it is not clear if the precautions are being taken.

Under the joint auspices of IRC and ISI the expert group has been set up and the said group has drawn up a programme of large scale testing to collect and make available engineering data for the design of structural components using PPC and to decide whether PPC can be used for RCC components or not. This study was necessitated due to the fact that sufficient engineer data on PPC was not available.

It is learnt from the IRC that the report of the group is being compiled by them and thus it can be expected that the report of the group will be available shortly.

However the fact remains that on many works PPC is being used in RCC framed structures. But it is observed by the Quality Control Core Unit that no tests are carried out on PPC samples. From the Register of tests on the cement concrete cubes on different works it is seen that no record is kept if the cubes were cast from PPC or OPC. This should be noted in the register on the dates of taking samples. It is also seen from some sites that CC cubes with PPC, tested after 7 days, have given very high results, more than that stipulated for OPC. This raises doubts about the method of casting and testing such cubes.

It is reiterated that the PPC samples should be occasionally got tested to ensure that it conform to IS specification and such tests should be got done in a proper laboratory. Some cubes should be also got casted and tested in circle office laboratories unconnected with any work.

Comparison and co-relation of such results will also throw light on the cubes cast at site of works. In order to ascertain the strength characteristics of the PPC, it is felt that in addition to the 7 days cubes test, at least 25% of the test should be carried out for such control on PPC after 28 days, even if the results of 7 days test are satisfactory. As already mentioned in this office letter dated 3.4.82 suitable increase in the period of retention for shuttering have to be specified as required. Extra cover for the reinforcement where silt required may also be stipulated and insisted upon.

Sd/-
CHIEF ENGINEER (DESIGNS)

**CENTRAL PUBLIC WORKS DEPARTMENT
CENTRAL DESIGNS ORGANISATION**

No. CDO/SE(D)/G-188/301

Dated 28.8.1985

TECHNICAL CIRCULAR

Subject : Provision or Confinement Stirrups in Beam Column Connections.

Details regarding the provision of confinement stirrups to be provided at column ends and at the beam column connections as part of the ductility requirement are given in paras 7.3 and 7.4 of IS : 4236 -76. These provisions are applicable to places, where design seismic coefficient is 0.05 or more. It is seen during the quality control inspections that proper care is not being given to provide the confinement stirrups as per drawings particularly at the beam-column junction area.

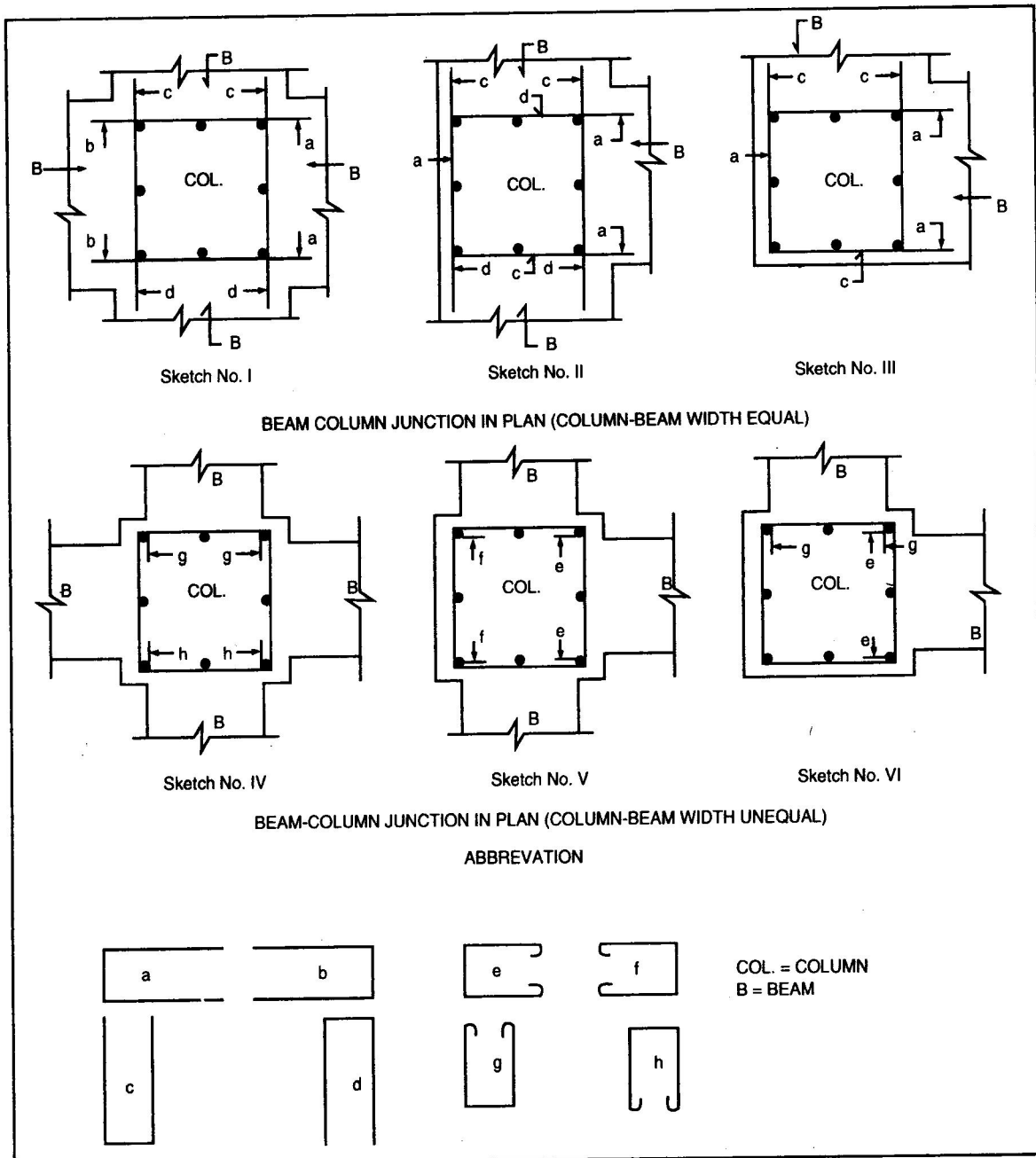
Some difficulties are being expressed regarding the provision of the closed hoops of the confinement stirrups inside the beam-column connections because of the practice of assembling the beam reinforcement cage above the floor level of the slabs and then lowering it into the completed beam form work later. To overcome this difficulty it should be emphasised basis that the beam reinforcement cage should be tied in its final position with beam bottom shuttering alone without side shutterings. Subsequently the stirrups should be tied at the junctions and then the remaining formwork should be completed.

Attention is invited to para 7.4 of the explanatory hand book of IS : 4326 which permits provision of 'U' shaped 'ties' with adequate bond length taken beyond column inside the beam so as to develop full strength of ties. Such ties can be provided. It is emphasised that full efforts should be made to provide closed confinement stirrups, as per the structural drawings, at the beam column connection at the required spacing and properly looked, around the main reinforcements at 135 degrees providing a length of 10 d beyond the curve. However, if the provision of such closed stirrups is found to be impracticable, 'U' shaped ties in pairs may be provided to form a closed stirrups with the proper development length taken inside the beam. (Sketch I to III). If due to the absence of the beam on any side or due to reduced width of the beam such development length cannot be provided, 'U' shaped ties may be hooked around main reinforcement and bent for 180° and taken for 10 d beyond the end of the curve (sketch IV to VI).

Two such 'U' shaped ties in opposite directions and crossing each other forming a pair, would be a substitute for one closed confinement stirrups. The confinement transverse reinforcement in beam column connections may be reduced to half the amount required at the column ends, provided there are beams from all four sides and that every beam has a width at least 3/4 of the column width and does not leave more than 100 mm of the column width uncovered on either side and depth of most shallow beam not less than 3/4 of the deepest beam framing into the connection.

It is once again brought to the notice of all concerned that provision of confining lateral reinforcement in the beam col. junction is important. Any better suggestions to this effect may be sent to this office.

Sd/-
(M.K. Koundinya)
CHIEF ENGINEER



Figure

Notes

1. In all cases a pair of Ustirrups placed in perpendicular or opposite direction is assumed to constitute an equivalent closed stirrup.
2. Requirement of confinement stirrups where required to comply with relevant provision in IS: 4326.
3. The legs of U stirrups a, b, c, d shall be taken inside the beam for a length equal to the development length

C.D.O

Enclosure to Tech. Circular
 Issued By CDO Vide
 SE(D)/G-188/301/23.8.85

**CENTRAL PUBLIC WORKS DEPARTMENT
CENTRAL DESIGNS ORGANISATION**

No. CDO/SE (D)/G. 89/85/355

Dated 18.10.1985

TECHNICAL SERIES

For some years now the experience of C.P.W.D in the matter of overhead tanks has not been satisfactory in respect of durability of such tanks. Whether it be mild steel tanks, R.C.C. tanks or R.C.C. Slab-cum-masonry wall tanks, corrosion has been the main enemy. Replacement of tank in 10 years or earlier has not been uncommon. Efforts have to be made, thus, to take steps to increase the longevity and durability as well as search for new techniques and new materials. No doubt such methods would increase initial costs of the tanks but such marginal increase on the entire building cost would lead to economy in the life cycle cost by way of reduced replacements and longer life.

One such treatment is ECP. 2 (vis. environmental corrosion protection) treatment for M.S. tanks. This is a liquid product which forms a tough layer providing allround protection. It is a preparatory material produced by M/S Narindra Chemicals and Allied Industries (P.) Ltd. B/4, Jaydeep Apartment, Near Pushpa Park, S.V. Road, Borivli (West), Bombay 400092. This is mainly for application, to inner surfaces. Prior to its application, the existing rust is required to be removed either by sand blasting or alternatively by another chemical product "Rust removing jelly". This treatment, if applied at the time of initial installation/renewal of tank, could extend the life of the tanks. The cost is claimed to be less than Rs. 100/- for a normal domestic tank of a quarter.

In the case of R.C.C. tanks or R.C.C. cum-Masonry tanks use of rich concrete, additional cover on reinforcement, water proofing admixture and effective quality control would be necessary.

Other alternative is to use fibre reinforced plastic tanks (F.R.P). A few manufacturers are in the field and some tanks have been used. However, experience gained by their use (users' reactions & technical appreciation) may be sent to Superintending Surveyor of Works (NDZ), New Delhi.

One more type of O.H. Tank, Fibre Reinforced Glass (F.R.G) are now being manufactured by Ashoo Model Arts, Krishna Kuteer, 21/13, Punjabi Bagh, New Delhi - 110026. Their brochure is enclosed herewith (to Chief Engineers in Delhi only). The firm is willing to give guarantee against manufacturing defects for 5 years and the rate is about Rs. 4/- per liter for capacities upto 3,000 liters and Rs. 3.50/- per litre for capacities over 3,000 litres and upto 20,000 litres, excluding sales tax, delivery at site in Delhi with lid (lockable), with tripped for support and capacity worked on net storage basis. The firm claims to have supplied these tanks to Safdarjung Hospital, P&T Depot., Delhi Gate Telephone Exchange, D.D.A. etc.

It is also to be noted that whenever O.H. tanks are placed on the terrace, there should be adequate gap between the top of the terrace and bottom of the tank for any repairs, cleaning etc. Clear height of at least 0.75 to 1.0 m is desirable. Similarly, the terrace below & around the tank should be rendered specially water proof with proper discharge of scour/over flow pipes upto nearest rainwater pipes and proper (& increased) slopes in the terrace. These supporting arrangements & locations may be so decided as to avoid any accumulation of rubbish which leads to growth of vegetations, a leakage & dampness.

Sd/-
(M.K. KOUNDINYA)
CHIEF ENGINEER

**CENTRAL PUBLIC WORKS DEPARTMENT
CENTRAL DESIGNS ORGANISATION**

No. CDO/SE (D)/G.89/366

Dated 18.11.1985

Subject : Corrosion of Reinforcement

There is a general expectation that any RCC construction is almost a long lasting and durable construction, almost permanent in the usual engineering terminology. However, this versatile material, which has revolutionised architectural forms, has by its own simplicity of construction methods become the most abused material. Such abuses in the process of construction have resulted in lowering of the economic and physical life of structures. One of the most common causes of such faster deterioration has been "corrosion" of steel. Corrosion of reinforcing steel is the worst enemy of RCC structures and it is no longer restricted only to hot and humid coastal areas, as was once felt. It should be realised that to prevent corrosion is easier than to cure it.

A technical circular was issued earlier under No. CDO/SE(D)/G.89/180 dated 23.8.82 bringing out some aspects of corrosion and preventive measures. Reference is also invited to IS: Code No. 9077-1979 for corrosion protection. However, recent observations of the quality control core unit in the slackness in control of RCC and observation of corrosion damage to structures within 10-15 years makes it necessary to emphasise, once again, the correlation between corrosion and quality of concrete.

Concrete is normally highly alkaline due to liberation of free lime and free alkalies (calcium hydroxide) during setting of concrete. High proportion of chlorides and sulphates in fresh cement react with aluminates & only a small fraction of chloride and sulphates is left. PH value of good concrete is more than 12. In such alkaline concrete, reinforcing steel has a positive potential and is passive due to a protective film formed around it by the concrete. Circumstances leading to the destruction of this passivity leads to setting of corrosion. Corrosion results in increase in the volume of the steel and its oxides and leads to reduction in the effective area of the bars as well as cracking and spalling of concrete.

One of the circumstances that destroys the passivity of steel is "Carbonation". This is due to the action of carbon dioxide present in the air and the moisture. Together with calcium hydroxide liberated during the setting of cement, this results in lowering of PH value of concrete. Lowering of PH value to 10 or below leads to destruction of the protective passive film around the bars. This in turn starts electro-chemical reaction leading to corrosion. Thus, the properties of concrete that can reduce the penetration of carbon dioxide and moisture are very important to reduce carbonation. Dense concrete with low permeability has to be achieved. Rate of carbonation is reduced to 1/10th in concrete of grade M 40 as against M 20 depth of carbonation increases 4 times if the water cement ratio is increased from 0.4 to 1.0. Improper curing leads to premature drying, resulting in micro cracks which increase carbonation. Contrary to common belief, depth of carbonation can be more in dry climate than in humid climate. Low permeability reduces access to moisture and air. Honey combing greatly increases such access. With improper cover on reinforcing bars, the depth of carbonation can reach the bars, destroy passivity around it due to lowering of alkalinity of concrete and set in motion the electro-chemical activity leading to corrosion and its ill effects.

Corrosion of reinforcement is a complex process of electro-chemical nature. Lowering of PH value of concrete enables formation of galvanic cells comprising of two electrodes, anode and cathode. Salts dissolved in moisture in the pores in the concrete form the electrolyte and an ideal condition is reached for an electrical circuit. However, presence of oxygen from air is necessary for

the reaction. Thus, moisture, air, and salts are required and absence of any of these can prevent corrosion almost completely. Such electro-chemical reaction can set in when there is a variation in the quality of concrete, when there is non uniform carbonation, when there is temperature difference due to exposure conditions, due to cracking of concrete or due to permeability of concrete. Any heterogeneity in concrete can start such electro-chemical action. Anode and cathode formations may or may not be distinct. Anode is a negative pole and reaction at the anode is that of oxidation. As long as PH value of concrete is high (above 13.5) such oxidation forms ferric (Fe_3O_4) and ferrous oxides, (Fe_2O_3) which form a protective layer and help the steel to be passive. But as PH value goes down, the protective film becomes non-protective rust $\text{Fe}(\text{OH})^2$ and $\text{Fe}(\text{OH})^3$ which expands in volume to 3 or even six times the volume of the bars and spalling of concrete takes place. As against this the cathode is a positive pole and cathode-IC reaction depends on availability of oxygen (from air) and results in electro chemical reduction. Although heterogeneity in steel is negligible the surface condition difference cause anodic or cathodic environments around it. Both the reactions are harmful to reinforcing bars. Once the corrosion sets in the galvanic activity increases and results in further corrosion. Prevention of electro-chemical reaction depends on laying good quality concrete of high PH value, mixing and laying it well to have uniform quality, using lower water-cement ratio and compacting it well to reduce porosity and permeability, curing it properly to avoid micro-cracking due to drying. High density and low permeability concrete offer increased resistance to such electrical activity.

Latest research/tests in G.B. indicate an interesting relationship in W/c Ratio and number of days of moist curing to obtain same permeability. For same permeability of 25×10^{-15} M/S, number of wet curing days reduce from 23 to 2.4 when w/c ratio is reduced from 0.60 to 0.45. For w/c ratio of 0.70, the No. of days of moisturising increase to 295.

Water used for concreting should not have soluble chlorides and sulphates. Such salts from water used in brick work, plastering, curing also can get into concrete work and hence even for such work water used should be chloride and sulphate. Chloride ions can break down passive protective film around reinforcing bars even in concrete with high PH value Chloride ions are absorbed on metal surface and displace oxygen resulting in hydration of metal ions. Ionic charge of steel in good concrete is positive. But it changes to negative charge with high chloride and sulphate content and this change of charge sets in the electro-chemical reaction of corrosion. It is thus necessary to test the water used in concrete quite frequently to keep down the chloride and sulphate contents to levels which cannot be harmful. In raw concrete of M 15 grade (1:2:4) soluble chloride and sulphate contents beyond 50 & 500 ppm resp. are harmful. Considering the fact that after setting of concrete chlorides and sulphates are reduced to 1/5th and 1/120th resp. of raw concrete and considering 10% proosity, this gives limits of 100 ppm and 500 ppm for soluble chloride and sulphates (resp.) in the capillary water as tolerance values. Admixtures like accelerators (calcium chloride) or plasticisers containing chlorides are therefore harmful and should not be used.

Above paragraphs give briefly, the factors that lead to corrosion and reduced durability of concrete. Considering our responsibility of constructing durable, long lasting structures, it is necessary to take following precautions in the works :

1. Water used in concrete work should be got tested. Merely that water is potable or is from municipal supply is not adequate; initial tests could be carried out from two independent laboratories in the case of well water. Frequency of such tests should depend upon whether water is from potable municipal supply, from shallow wells or deep tube wells or if it is brought in tankers from various sources. Quality of water drawn from wells can change progressively. Tests should be more frequent in such cases and when water is brought in tankers and also when earlier tests show marginal or deteriorating values.

2. Sub-soil and ground water should be tested for soluble chlorides and sulphates. Such aggressive soil and sub-soil water conditions, when encountered, need special precautions such as use of rich and dense concrete mix, sulphate resisting cement, protective surface treatments to concrete and special anti-corrosion treatment to reinforcement bars.

3. Use of low water cement ratio, so as to reduce porosity of concrete and make it as impermeable as possible. There is a common practice to use very high slump for thin sections like fins, drop walls, parapet walls, etc. Steel in such members has been found to corrode much faster. At the same time stiff mix can result in honey combing, which is worst. Solution will probably in using non-chloride containing plasticisers. These are available in India and it is claimed, being used on major projects. These should conform to IS : 9103-1979 and be chloride free. Some of the manufacturers who claim such admixtures are :

1. FOSROC CHEMICALS (India) Ltd.
3/11, Kaveriappa Layout, Miller Tank Bund Rd., Bangalore - 560 052.
2. THE FERRO SITE CO., 2 Cockbum Lane - Royd Street, Calcutta - 700 016.
3. ASIAN LABORATORIES (India), 88 New Okhla Industrial Complex, Phase II,
New Delhi - 110 020.
4. SAHARA CHEMICALS, 12 BBD Bag East, Calcutta - 700 001

These firms may be contacted by SSWs/CEs to get details of plasticisers, air-entraining agents, water proofing admixtures, to get names of projects/users etc. before using them. In CPWD there are not being used probably because there are no schedule items and rates. However, controlled use on special works, particularly in high rise structures, could be started by proving specific items in such works. Such material should be selected after proper scrutiny and enquiry and local tests. To start with we could use in thin non-structural members. Experience gained could be shared with other zones and could lead to its acceptance in our schedules. Need to use minimum workable water cement ratio is emphasised in C.S. No. 25 to CPWD Specifications 1977 Volume-I and it was specified that slump to be used on the works should be decided by E.Es and should not be deviated from without his permission.

4. Use of integral water proofing compounds in RCC in water retaining structures, in the RCC portions in and around lowered portions of baths/lavatories would be helpful. Slabs which are lowered should have a slight outward slope and arrangement should be made by providing small holes/outlets to drain out trapped water from any leaking pipes, traps, floor joints, etc. Introduction of such compounds on rendering of RCC surfaces of parapets, chajjas, fins columns and beams seen in elevations and subjected to alternate drying and wetting will be helpful. Such admixtures should conform with IS : 2645 - 1975 and be chloride free.

5. Proper grading of aggregates to get a dense concrete and proper workmanship in form work and concreting to get good concrete without loss of slurry and without honey-combing and prolonged moist curing are equally important.

6. No exposed concrete should be normally permitted without specially designing the mix and extra cover on steel and making concrete impermeable and water repellent. All RCC should be plastered (rendered) with 1:3 mortar, 6 mm thick, as early as possible. In coastal areas, in particular, no area of RCC should be left out from such treatment including where walls are to about or false ceiling is to be provided later. The chajjas, canopies, etc., should have distinct and pronounced slopes and substantial rounding of junctions with walls with proper cuts/outlets in raised edges for draining out water. Tops of all walls, parapets, copings chajjas, bands etc. should be sloping well so that even small irregularities will not retain water.

7. Richer mix (1:1.5:3) or higher grades be used particularly in coastal areas for all columns, external beams, fins, chajjas, structural members in/around toilets, exposed concrete, etc. Even in other areas, columns, roof slabs, exposed members around W.Cs/toilets should be in such richer mix.

8. All water pipes, soil pipes and rain water pipes should invariably be exposed and not embedded in RCC/walls. All traps should be so positioned that no joint (after the trap) is required to be embedded in walls or no pipe passes through any beam. Junctions of floors and dado should be properly rounded and floors around traps and heads of rain water pipes sealed properly. All waste water pipes to be provided under floors should be fully tested after jointing, must have anticorrosive paint and water proof concrete provided around such pipes/joints. Positions of WCs and other sanitary fittings should be such as to have minimum waste pipes under the floors. Such buried pipes must have proper slopes and the lowering of RCC slabs should be such as to provide for such slopes.

9. Reinforcement should have concrete cover and thickness of such cover exclusive of plaster or other decorative finish shall be as follows :

- (a) At each end of reinforcing bars has not less than 40 mm, nor less than twice the diameter of such bar:
 - (b) For a longitudinal reinforcing bar in a column 50 mm nor less than the diameter of such bar :
 - (c) For longitudinal reinforcing bar in a beam, not less than 40 mm nor less than the diameter of such bar:
 - (d) For tensile, compressive, shear, or other reinforcement in slab, not less than 20 mm, nor less than the diameter of such bar, and
 - (e) For any other reinforcement, not less than 20 mm nor less than the diameter of such bar:
- Note :** Maximum cover not to exceed 50 mm as per 5.2.3.1 or IS 9077 - 79.

These are mainly for coastal areas and for other corrosion prone locations in the building. For other areas it could be less by 5 mm (slabs) to 10 mm (elsewhere). For the sake of durability, covers less than 15 mm (clear) should be avoided.

10. As mentioned earlier, IS:9077 recommends certain coating over reinforcement and RCC works as protective measures. In this office circular dated 23.8.82, we have already enclosed the reports of CECRI Karaikudi giving details of their publications on the subject, remedial measures for old structures, particulars of inhibitor admixture for corrosion prevention and anti-corrosive treatment to the steel reinforcement rods, etc. Further to that we have received certain literature on this aspect from some companies dealing with such products, the addresses of which are given below. CEs/SSWs/SEs may contact these firms, and obtain their specifications, reports from other users in their areas and analyse the rate for such treatments.

- (a) The Mannar Chemical and Anti-corrosive Industries Lakshminylayam, Mannar, P.O Distt. Alleppey, Kerala State, Pin 689622.
- (b) The Interport (Asiatic) Company No. 28, 19th Street, 4th Avenue Ashok Nagar, Madras - 600 083.
- (c) Narindera Chemicals & Allied Industries Pvt. Ltd. B/4, Jaydeep Apartment, Near Pushpa Park, S.V. Road, Borivili (West) Bombay Pin 400092.

It is advised that the treatment as recommended by the above firms may be tried in coastal areas and when soil, ground water and mixing water conditions are not ideal and reported.

11. A separate note is already issued vide this office No. CDO/SE(D)/G.89/85/355 dated 18.10.85. about overhead tanks.

This issues with the approval of D.G.(W)

Sd/-
(M.K. KOUNDINYA)
CHIEF ENGINEER (D)

**QUALITY CONTROL & TECHNICAL AUDIT WING
CDO, CPWD, NIRMAN BHAWAN, NEW DELHI**

No. CDO/QCTA/28/1244

Dated 25.11.1985

Subject : Common Deficiencies Observed during Technical Audit of Final Bills of Various Works by Q.C. Core Unit.

The Q.C. Core Unit has been carrying out technical audit of final bills of various works costing more than Rs. 22.50 lacs for the past few months. During the technical audit, following common deficiencies have been observed :—

1. Cement, godown/cement register is required to be test checked by E.E/A.E fortnightly/ weekly respectively. Refer paras 25 & 11 of Sections 14 & 27 of Manual Vol. II. This is not generally being adhered to by the EEs/AEs.
2. Bills are generally being finalised by with-holding some lump-sum amounts for non-sanction of EI/SI, AHR/ALR items, R/R item statement, non-recording of completion certificate by SE/SA, pending clearance of C.T.E's observations, etc. As such there is no finality of final bills. In this connection attention is invited to D.G's Circular No. CE/CON. 789, dated 25.8.84.
3. As per paras 13 and 15 Section 5 of C.P.W.D Manual Vol. II before a work is declared as completed in all respects and final payment is released to the contractor, completion certificates shall be recorded by the S.E and S.A. Bills are generally being finalised without obtaining the completion certificate from S.E and S.A.
4. S.E and S.A are required to be intimated by E.E regarding completion of work within 15 days of the physical completion. S.E. is generally being informed after a lapse of about 3-4 months and S.A is not generally informed resulting in delay in finalisation of bill.
5. Revised A/A & E/S as well as T/S are not generally obtained wherever amounts exceed the permissible limit. Action is not being initiated in time to obtain revised sanction.
6. Prior approval of competent authority sanctioning the detailed estimate for exceeding AHR items beyond their permissible limits is not generally obtained.
7. The procedure for receipt and accounting of M.S. Rounds or reinforced bars in respect of variation between the quantities as per supplier's bills and quantities actually recd. is not being followed strictly as per D.G. Circular No. CE/CON/745, dated 15.7.82.

for CHIEF ENGINEER (DESIGNS)

**GOVERNMENT OF INDIA, DIRECTOR GENERAL OF WORKS
CENTRAL PUBLIC WORKS DEPARTMENT, NEW DELHI**

No. 28(2)/84-WI (DG)/Cir. No. 7/85

Dated 24.12.1985

Subject : Functioning of Quality Control Core Unit

The Chief Engineer (CDO), CPWD, New Delhi has brought to the notice of this Directorate the following deficiencies in regard to the above : .

"It has been observed that Superintending Engineer and Chief Engineer connected with works have not been inspecting works from Quality Control point of view. Hardly any inspection report or works have come to the notice of the Core Unit. While SE and Chief Engineer are inspecting local and outstation works and issuing sketchy tour reports about need to accelerate progress of works or some points in works programme, no paras exist about quality of work. Even in such cases when major defects are apparent there appears to be a misconception that like Chief Examiner (earlier) it is the work only of the core unit. It has to be realised that Superintending Engineer is the key figure in the present QC set up and SEs inspection with QC angle are necessary to tone up the QC by SEs. It is observed that Executive Engineer, Superintending Engineers and Chief Engineers are not even inspecting the site order books on their visits.

2. It is, therefore, requested that CEs/SEs should inspect work also from QC angle and issue inspection reports including such observation and copies of inspection reports of Assistant Surveyor of Works (QC) EE, SE and Chief Engineers should be available at site.

Sd/-
(A.K. PAUL)
DIRECTOR (WORKS)

**QUALITY CONTROL WING, CDO,
CPWD, NIRMAN BHAWAN, NEW DELHI**

No. CDO/QCTA/6-IV/1349-1400

Dated : 31.12.1985

Subject : Inspection of Works by EE/SE/CE from the Quality Control point of view.

1.0 It has been noticed during the inspections of Q.C. Core Unit that copies of previous quality control inspections by ASW (Circle office) EE, SE & CE are not available at site. It has to be realised that under the present Q.C. system, S.E of the circle is the pivot of quality control. Even if his ASW is assigned such work on his behalf SE, himself has also to examine the works from Q.C angle. And this would be ensured if C.E. also inspects work from Q.C. angle. And the most important part of inspection is to issue inspection reports or observation and that these should be available at site. In fact these should be kept with the site order book and defects got entered the site order book and got noted by the contractor. It is, therefore, brought to the notice of the SEs & CEs that

- (i) they should on their visits, inspect works from Q.C. angle.
- (ii) issue such observation through entries in site order book and inspection reports, and
- (iii) ensure that all such observation memos are available at site.

2.0 It is also observed that entries in important registers like hindrance register, site order book, test result registers etc. not reviewed by the EE/SE on their visits as a result of which the inaccuracies creep in and even major absurdities remain undetected/unrectified. It is advisable that these registers be reviewed by inspecting officers (EE/SE/CE) during their inspections.

3.0 It is also observed that standard formats for recording results of mandatory tests issued vide circular No. CDO/QCTA/7-III/1564-1614, dated 27.11.84 are still not being utilised for recording test. In some cases, samples taken were not entered in the register till the result was received. This can lead to omission of the test totally if result is not favourable. In some cases results were not issued with the laboratories. The forms sent by CDO should be followed without fail and entries should be made right from the day samples are taken.

(M.K. KOUNDINYA)
CHIEF ENGINEER (DESIGNS)

**QUALITY CONTROL & TECHNICAL AUDIT WING
CDO, CPWD, NIRMAN BHAWAN, NEW DELHI**

No. CDO/QCTA/7-III/133

Dated : 20.2.1986

Subject : Format for Recording Various Tests for Road Work

In the meeting of all Chief Engineers held on 3.8.84 under the Chairmanship of Director General (Works), it was decided the Q.C. Core Unit may standardise forms for recording the tests and results at all sites.

Standard formats, for recording results for building works were circulated under this office letter of even No. 1564-1614, dated 27.11.84.

Standard formats for maintaining results of tests for road works have now been prepared in C.D.O. and are enclosed herewith, for adoption by EEs/AEs on all works in C.P.W.D. Single test register with certified page numbers shall be maintained for various tests with different sections. Index shall be written on the 1st page indicating different tests at different page numbers. Samples taken for testing shall immediately be entered in the test registers as soon as the sample is collected, without waiting for the test result. Test registers shall be signed by the inspecting officers in token of reviewing the test results during inspections. Actions taken should also be noted.

It is requested that the formats may please be circulated amongst A.Es and J.Es in charge of works for adoption at all sites of works with immediate effect.

This issues with the approval of Chief Engineer (Designs).

EXECUTIVE ENGINEER – I (QC)

1. TEST FOR GRADING OF STONE AGGREGATES FOR ROAD WORKS

Frequency :—

Name of the course/layer	Size range mm	Quantity as per agreement	Number of tests required	Reference to Specifications 1977 Vol. II.
	1	2	3	4
Sub-base course one test per (100 cum)	90-40			Table 17-2 at p-24 & 17-13 at p-39.
Base Course one test for (100 cum)	63-40			Table 17-2 at p-24 & 17-15 at p-42
Base Course one test for (100 cum)	50-20			-do-
Sub-base & base course	12.5 screening			Table 17-9 at p-28
-do- As required by Engineer in charge	10 screening			-do-

	1	2	3	4
Base Course Bitumen Macadam then surface course Dense/semi dense (2 tests per day per plant)	75 compacted thickness grading A			Table 17-17 at p-43
-do-	50 compacted thickness grading A			-do-
Base Course Bitumen Macadam then surface course is surface dressing (2 tests per day per plant)	75 compacted thickness grading B			-do-

2. TEST FOR IMPACT VALUE OF COARSE AGGREGATE

Frequency :—

Name of the course/layer	Size range mm	Quantity as per agreement	No. of tests required	Reference to Specifications 1977 Vol. II.
	1	2	3	4
Sub-base course (200m ³)	90-40			Table 17-1 at page -23
Base Course (200m ³)	63-40			Table 17-1 at page -23
-do-	50-20			-do-
Base Course Bitumen Macadam (50-100m ³ of aggregate as required by the Engineer-in-Charge)	75/50 grading A/B			-do- (and table 17-18 at p-45 & 17-10 at p-29.
Surface course Semidense carpet (50-100 m ³ of aggregate as required by the Engineer-in-Charge)	20/25			-do- (table 17-24 at p-54)

	1	2	3	4
Surface Course Asphaltic concrete (100 m ³)	Layer thickness 25-40/25-50			Table 17-1 at P-23 (and table 17-27 at p-58)
Surface Course Bitumen Macadam under controlled condition (100m ³)	50/75 compacted thickness			-do-

Note : Separate section in the register for different sizes of aggregate shall be kept.

3. FORMAT FOR RECORDING IMPACT VALUE

Material for Course Layer Size range

Total No. of Tests to be
carried out.....

Sl. No.	Date of taking sample	Location and quantity represented by the test (cum)	Identification mark	Sample collected/tested in the presence of				Weight of oven dried sample passing through 12.5 mm sieve & retained on 10 mm sieve (gm)
				JE	AE	EE	Contr- actor	
1	2	3	4	5	6	7	8	9
			1 A 1 B 2 A 2 B & so on					

Note : The work "tested" "collected" will be struck off according to the test being carried in Lab or at site.

Weight of fraction after impact passing through 2.36 mm sieve (gm)	Impact value of each sample col. $\frac{10}{9} \times 100$	Average impact value of samples $\frac{1A + 1B}{2}$	Acceptability Refer Table 17-1 at p-23 and 17-10 at p-29 of specification	Checking by AE/EE	Action if any
10	11	12	13	14	15

$\frac{\% \text{age wear (A-B)} \times 100}{A}$	Acceptability Refer table 17-1 at page 23 & 17-10 at page 29 of Specification 1977 Vol-II	Checking by AE/EE	Action taken if any
10	11	12	13

(5) TEST FOR STRIPPING VALUE OF STONE AGGREGATE

To be written on the last page of test Separate tests for Bitumen Macadam; semidense carpet Asphaltic concrete & Bitumen Macadam under controlled conditions shall be recorded with corresponding frequency and acceptability

Frequency - 50 - 100m³ of aggregate or as required by Engineer-in-Charge.

Refer list of mandatory tests at page 8 of specification Vol-II '1977

Quantity as per agreement

Number of tests required

Sl. No.	Location & Qty. represented by test (cum)	Date of taking sample	Sample collected in the presence of				Identification mark	Weight of sample passing through 20 mm sieve & retained on 12.5 mm IS sieve at regd. temp. 200 gms.
			JE	AE	EE	Contractor		
1	2	3	4	5	6	7	8	9
							1 A 1 B 1 C 2 A 2 B 2C etc.	

Height of 8 binder 5% of Wt (sample required 10 gms)	Stripping value visually observed after immersion in water for 24 hrs	Average stripping value of 3 samples	Acceptability Refer table 17-10 at p-29 Spfn Vol-II '77	Checking by AE/EE	Action taken
10	11	12	13	14	15

(6) TEST FOR FLAKINESS INDEX OF STONE AGGREGATE

Frequency :—

Name of course/ layer	Size range mm	Qty as per agmt.	No of test required	Reference to (specification) 77 Vol-II
Base Course 1	2	3	4	5
Base Course (200 m) ³	63-40			Table 17-1 P 23
-do-	50-20	—		-do-
-do- and Bituman Macadam as required by the Engineer-in-Charge	75/50 grading A/B			-do- and table 17-18 page 45
Surface Course 80,25 Semi/dense carpet (do)	20/25			-do- and table 17-24 page 54
Surface Course Asphaltic concrete (100 m ³)	Layer thickness 25-40/25-50			-do- and table 17-27 page 58
Surface Course Bitumen Macadam under controlled conditions (100m ³)	50/75 compacted thickness			-do-

FORMAT FOR RECORDING FLAKINESS INDEX

Material for Course Total nos. of tests to be carried out
layer size range

Sl. No.	Location & Qty. represented	Date of taking sample	Identification mark	Sample collected in the presence of the			
				IE	AE	EE	Contractor
1	2	3	4	5	6	7	8
			1 A 1 B 2 A 2 B etc.				

Wt. of 200 pieces of stone aggregate in gms. Passing through & retained on IS sieves X1 X2		Wt. of flaky materials Y(gm)	Flakiness index $\frac{Y}{X_1} \times 100$ and $\frac{Y}{X_2} \times 100$	Average flakiness Index $\frac{1A+1B}{2}$	Acceptability Refer table 17-1 at p-23 and 17-10 at p-29	Checking by AE/EE
9	10	11	12	13	14	15

(7) TEST FOR WATER ABSORPTION OF STONE AGGREGATES

To be written on the 1st page of test (Separate tests for Asphaltic concrete and bitumen Macadam under controlled conditions shall be recorded with corresponding frequency and acceptability.)
Frequency :- 100m³

Refer list of mandatory tests at page 8 specification 77 Vol. II.

Qty. as per agreement

No. of tests required :

Sl.No.	Location & Qty. represented by the sample (Cum)	Date of taking sample	Sample collected in the presence of				Identification mark	Wt. of saturated surface dry sample (X) gm
			JE	AE	EE	Contractor		
1	2	3	4	5	6	7	8	9
							1 A 1 B 2 A 2 B etc.	

Wt. of oven dry sample Y gm	Water absorption $\frac{X-Y}{Y} \times 100$ (%)	AV water absorption (%)	Acceptability Refer table 17-10 at p-29 of spfn.	Checking by AE/EE	Action taken
10	11	12	13	14	15

(8) TEST FOR BINDER CONTENT AND GRADATION (AFTER EXTRACTION OF BINDER CONTENT)

To be written on 1st page of the test. (Separate tests for Asphaltic concrete & Bitumen Macadam under controlled conditions shall be recorded with corresponding frequency and acceptability.)
Frequency :— One test for each 100 tonnes of mix subject to minimum of two tests per day per plant.

(Refer list of mandatory tests on page 8 of specification Vol. II)

Qty. as per agreement

No. of tests required

Sl. No.	Location & Qty. represented by the sample	Date of taking sample	Date of testing	Sample collected in the presence of				Identification mark	Wt. of sample taken (X) gms	Wt. of sample after binder extra (Y) (gm)	Nt. wt. binder content (Z) (gm)
				JE	AE	EE	Contractor				
1	2	3	4	5	6	7	8	9	10	11	12

%age of binder content by total wt. of sample $\frac{(Z)}{X} \times 100$ 0%	IS sieve designation	Wt. retained on each sieve (gms)	Wt. passed (gm)	%age passing (gm)	Acceptability with permissible variation given in the agt.		Checking by AE/EE	Action taken
					For binder content	For gradation		
13	14	15	16	17	18	19	20	21

(9) TEST FOR MARSHAL STABILITY & FLOW VALUE

To be written For Asphaltic Concrete

on the 1st page of the test

Frequency :- Three Marshal specimen per 100 tonnes of mix.

(Refer list of mandatory tests on page 8 of specification on 77 Vol. I).

Qty.: as per agt.....

No. of tests required

Sl.No.	Location & Qty. represented by the sample	Date of taking sample	Date of test	Sample collected/tested* in the presence of				Identification mark	Marshal value	FL Value
				JE	AE	EE	Contractor			
1	2	3	4	5	6	7	8	9	10	11
								1 A 1 B 1 C 2 A 2 B etc. 2 C		

* The word "tested" or "collected" will be struck off according to the test being carried in lab or at site.

Corresponding values from tables supplied by the manufacturers of machine		Average value		Acceptability as per agt.	Checking by AE/EE	Action taken
		Marshal value (Kg)	Flow value (mm)			
(12)	(13)	(14)	(15)	(16)	(17)	(18)

(10) TEST FOR THICKNESS AND DENSITY OF COMPACTED LAYER

To be written on first page of the test (Separate tests shall be recorded for Asphaltic concrete and Bitumen Macadam under controlled condition with corresponding frequency & acceptability).
 Frequency :- One test per 500 Sqm.

(Refer list of mandatory tests at page 8 of specifications Vol. II '77).

Surface area as per agt.

No. of tests required :

Sl. No.	Date of test	Qty. represented by the test	Location of holes	Thickness of layer		Wt. of materials removed from the carpet Hole A gm	Initial wt. of sand taken in cylinder W gm
				Individual mm	Average mm		
1	2	3	4	5	6	7	8
			1 A 1 B 1 C 2 A 2 B 2 C etc.				

Wt. of sand filling in cone of cylinder W ₁ gm	Wt. of sand remaining of in cylinder W ₂ gm	Predetermined bulk density of sand d gm/CC	Density and d $W - (W_1 - W_2)$ gm/CC	Acceptability	Checking by AE/EE	Action taken
9	10	11	12	13	14	15

(11) Test for Gradation of Filler

To be written Macadam on Ist page of test Test will be recorded separately for semidense carpet, Asphaltic concrete & Bitumen under controlled conditions.

Frequency :- One test for each consignment subject to minimum one test per 5 cum. Refer list of mandatory Tests on p-8 of specifications Vol-II' 77.

Quantity as per agreement :

Number of tests required :

Sl. No.	Date of test	Location & Qty. represented by the test m ³	Wt. of sample taken (gm)	IS sieve designation	Wt. retained on such sieve (gm)	Wt. passed (gm)	% age passing (%)
1	2	3	4	5	6	7	8

Acceptability Refer para 17.1.8 at P-27 of specifications Vol-II' 77	Signature of		Checking by AE/EE	Action taken if any
	JE	Contractor		
9	10	11	12	13

Q.C. LIST NO. 7

**QUALITY CONTROL & TECHNICAL AUDIT WING
CDO, CPWD, NIRMAN BHAWAN, NEW DELHI**

No. CDO/QCTA/28/368

Dated 27.3.1986

Subject : Common Defects/Deficiencies in Steel Windows

The following defects are being commonly observed in the item of steel windows during various Q.C. inspections :— (Paras mentioned refer to CPWD Specifications 1977 unless otherwise stated.)

1. Quite frequently the steel windows are of composite patterns having a ventilator or fixed glazing above the openable portion. Therefore as per the specifications (para 10.10.2.5) a horizontal transome coupling bar (K-12B) is required to be provided between two F-7B Sections, but instead just an integral mullion (F-4B) is used horizontally, replacing the 2 Nos. F-7B and K-12B Sections (See Figures 1 & 2).
2. As per CPWD Specifications, 1977 (para 10.10.2) the steel hinges are to be welded to the frames after cutting a slot in the frame & inserting the hinge there. However, the hinges are mostly being welded directly on the frames without cutting any slots.
3. The hinge pin has to be made of galvanised steel (para 10.10.2.3 (b) but ungalvanised M.S. pin is mostly used.)
4. The brass striking plates are either not fixed at all or M.S. Plate is used instead. (Para 10.10.2.3).
5. The peg stay which has to be 300 mm long is required to be fixed in proper relation to the peg and the hinge. Fig. 3 shows the correct position of the peg, the pivot of the pegstay with ref. to the hinge; and the holes of pegstay etc. (as per IS : 1038-1975) which is usually not observed at site.
6. The windows are to be applied with a coat of approved primer (zinc chromate yellow) before erection and after all steel surfaces are thoroughly cleaned of rust, scale and dirt (para 10.10.4). However, commonly the primer is applied without proper cleaning and sometimes after erection, leaving the inaccessible steel surfaces without any primer.

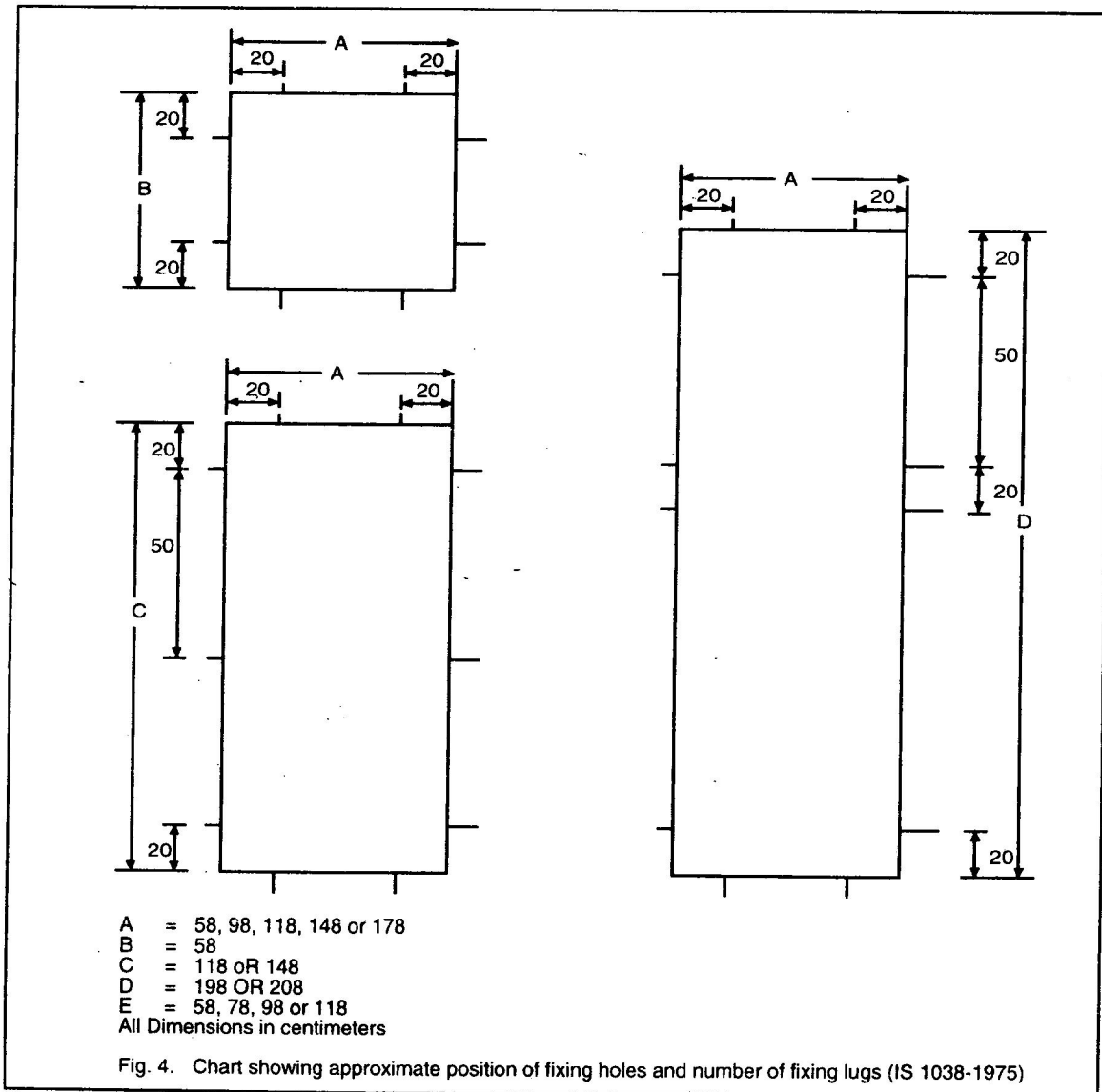
7. The fixing lugs are generally not conforming to the specifications and the lugs/screws are not located at the standard distances prescribed in the IS : 1038 mentioned in the CPWD Specification 1977. Also the fixing of top and/or bottom frame is generally omitted. (Fig. 4).

The corners of fixed and opening frames are required to be welded to achieve a solid fused welded joint either by "fresh butt welding" or any other suitable method (para 10.10.2.1). The quality of welding commonly observed is not as good as required.

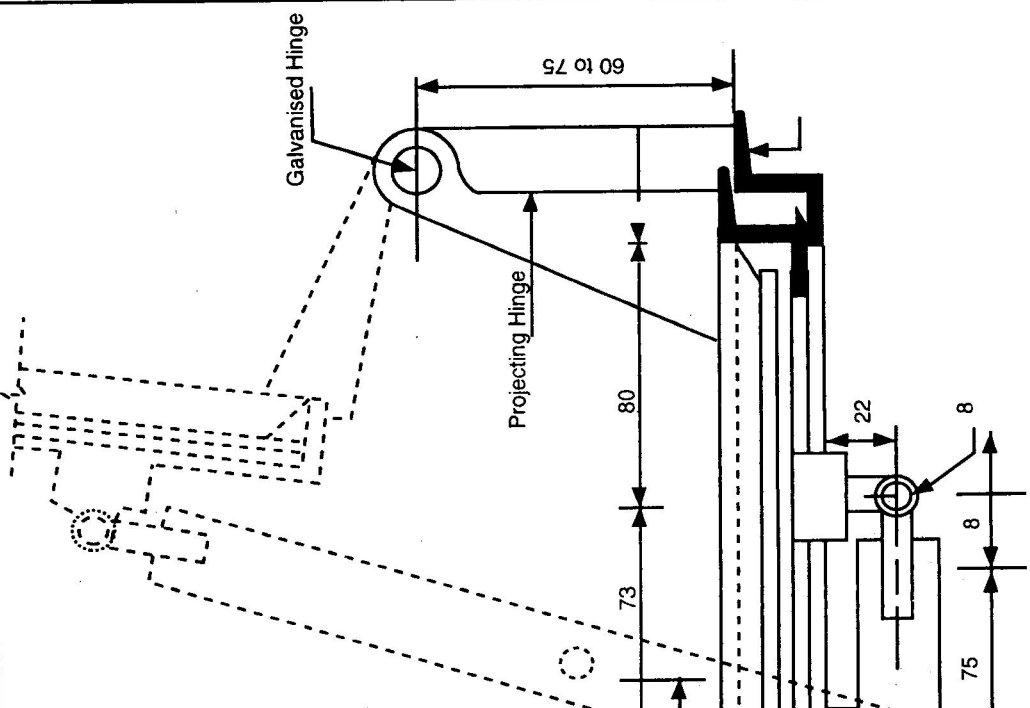
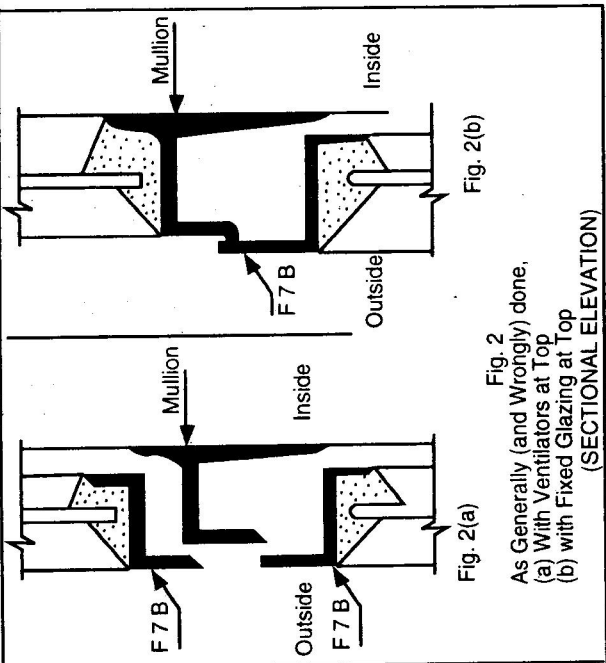
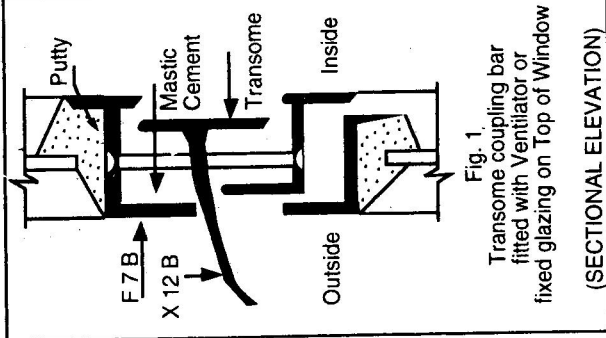
The item of steel windows have many details which are important to its functioning and it is impressed that all concerned with the execution of the items of steel windows should follow the details which are mostly covered in the book of specifications 1977.

This issues with the approval of Chief Engineer (CDO).

Sd/-
ER. K.N. AGGARWAL
SUPERINTENDING ENGINEER
QCTA WING, CDO, C.P.W.D

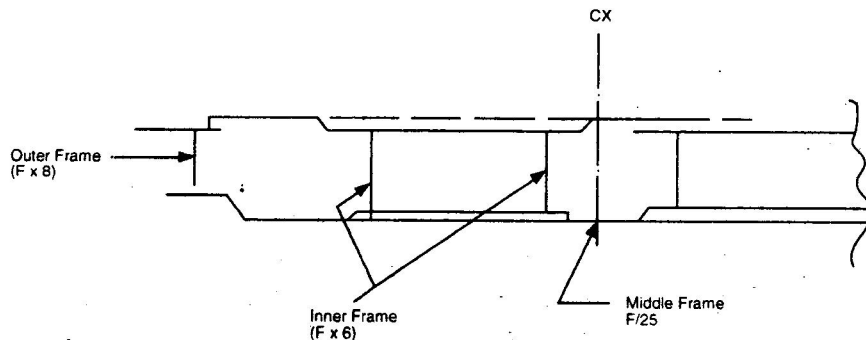


Figure



APPENDIX 'A' Based on I.S. Code
PURPOSE OR RECOMMENDED USE OF SECTIONS

Designation of Section	Situation of Uses
T2	Horizontal glazing bars for doors and sashes, horizontal glazing bars for door side-lights, sub-dividing bars for fixed-lights, vertical glazing bar for ventilators, sash bars for window, ventilators and doors where metal, aluminium or wooden beading is used fixing glasses.
T3	Vertical glazing bar for EZ7 frames.
T6	Horizontal glazing bar for standard windows and ventilators.
F2	Inner-frames for open-in-windows.
F3	Cater frames for open-in-windows.
F5, F8	(a) Inner and middle frames in centre-hung ventilators. (b) F5 is sometimes used as inner frame for open-out windows. Also used as inner frame for bottom-hung ventilator. (c) F8 is also used as outer frame for bottom-hung ventilators.
F4B	Central mullion (meeting bar for shutter for windows using F7D as inner frames, outer frame for open in windows in rainy areas, sub-division bars for openable windows and top hung ventilators.
F7D	Inner and outer frames for windows and top hung ventilators, for outer frames for centre-hung ventilators, and outer frame or door side-lights.
FX6, FZ5	Inner frames for doors.
FX3	Outer frames for doors.
EZ7	Used as outer frame for industrial sashe. Also used for outer frame for wooden doors.
K11B	(a) Vertical coupling mullion for all standard windows. (b) Can be used as horizontal coupling bar when openable windows are to be coupled above fixed ones or between two fixed windows. (c) Can also be used as horizontal coupling mullion where windows are not expose to weather.
K12B	Horizontal coupling mullion, also known as weather bar. Especially used when the coupled unit is exposed to rain..



DOUBLE LOOP DOOR HORIZONTAL SECTION
Figure

**CDO : CENTRAL P.W.D.
NIRMAN BHAWAN, NEW DELHI**

No. CDO/QCTA/28/553

Dated 10.6.1986

TECHNICAL CIRCULAR

Subject : Alkalinity in Water for Making Concrete

1. It is found in some cases that the available water for mixing concrete has excess alkalinity (Alkalinity is expressed as the requirement of 1 N Hydrochloric acid to neutralise 200ml sample of water using methyl orange as an indicator. The prescribed limit as per IS : 456 is 10 ml). The excess alkalinity in some cases has been noticed upto the value of about 12, 14 and even upto 17.
 2. While the excess alkalinity affects the initial setting time and compressive strength, it on the other hand helps in keeping the passivity of reinforcing steel and thus inhibiting corrosion. Reference in this connection may be made to CDO's Circular on "Corrosion of reinforcement" issued vide No. CDO/SE(D) G.89/366, dated 18.11.1985.
 3. In this connection reference is also invited to Para 4.3.1. of the IS : 456 which lays down the procedure to be followed in case of doubt about the suitability of water for concrete. As per the Code, tests are to be conducted for compressive strength and initial setting time with the available water and with distilled water, and the results are to be compared. If the comparison satisfies the conditions prescribed in paras 4.3.1.2 and 4.3.1.3 of IS : 456 the water is considered suitable.
 4. About such excess alkalinity of water, Cement Research Institute have vide there reference No. CIS/A 2.3 dated 3rd September, 85 advised similar as under:
"..... in a particular case, the water sample needed 14 ml of 0.1 NHCL for neutralisation against the maximum of 10 ml specified in IS : 456. Under such situations, the water sample should be checked for conformity to provisions of Cl. 4.3.1 of IS : 456. This requirement of greater amount of acid for neutralisation is indicative of the presence of carbonate and bicarbonate salts in water in excess of what is considered the permissible limit. These salts do effect the setting and strength properties of concrete and hence the requirement of Cl. 4.3.1. of IS : 456. Once this requirement is met and if the water sample satisfies all other requirements of IS : 456 it generally does not pose and problem for long-term service of reinforced concrete structures."
- Thus if the effect of the excess alkalinity on compressive strength and initial setting time is within the limits prescribed in Paras 4.3.1.2 and 4.3.1.3 of IS : 456 no treatment of water may be called for.
5. However, it has come to light, during Q.C inspections or some of the work, that hydrochloric acid is being used to neutralise the excess alkalinity in water on the advice of some local laboratory or as decided by the EEs/SEs on their own. As already stated in CDO's circular dated 18.11.1985, the alkalinity of the cement concrete protects reinforcement from corrosion and, therefore, its neutralisation should be resorted to only after establishing that its effect on the compressive strength and initial setting time are beyond acceptable limits, by conducting tests as provided in para 4.3.1. of IS : 456.
 6. Another effect of high alkalinity is the alkali-aggregate reaction which results in swelling & softening of concrete. This is a long-term effect but is normally found if aggregate with reactive silica is used. In such cases and in cases of unknown or less known aggregates, this effect could be got studied through recognised laboratories.

7. If the alkalinity in the water be so much that the requirement of compressive strength and initial setting time as stated above are not fulfilled. Some measures will have to be taken in consultation with Cement Research Institute, CBRI, CRRÍ Indian Concrete Institute of National Test House. These could be by simple solution of neutralising alkalinity by adding acid or measures like additives or increased cement content in concrete. If the use of hydrochloric acid for neutralising a part of the alkalinity is resorted to, the following precautions are necessary.
- The Hydrochloric acid should be of known concentration and its requirement should be worked out so as to neutralised only that part of the excess alkalinity which will result in the conformity of compressive strength and initial setting time as aforesaid.
 - Ensuring thorough mixing of the Hydrochloric acid in the entire body of water.
 - Testing frequently such water to which Hydrochloric acid has been added to ascertain the residual alkalinity.
 - To have a vigorous and frequent site control on the Quality of water treated with HCL an electronic PH meter (which gives an instant reading of PH value and which are now-a-days commonly and cheaply available) may be used with advantage.

This issues with the approval of Chief Engineer (Designs), CDO, CPWD, New Delhi.

Sd/-
(ER. K. N. AGRAWAL)
SUPERINTENDING ENGINEER (QC)

CENTRAL PUBLIC WORKS DEPARTMENT

No. CDO/QCTA/G-7/188

Dated 23.2.1987

TECHNICAL CIRCULAR

Subject : Floor Trap Depression of RCC Slabs there for

The problem of floor traps of inadequate seal and improper section and traps and pipes not in conformity with I.S Standards is too well known to need elaboration. In this connection a Q.C list number 4 dated 1.3.1985 may be referred to. Unless we insist we will not be able to get proper floor traps with required seal and to I.S.I. standard.

2. However, use of improper floor traps is still noticed and in most such cases the problem the field staff projects is that the depression provided in the floor slab as per structural drawing is inadequate for accommodating a proper sized floor trap. It would be seen from IS : 1729-1979 that a floor trap with an outlet of 75 mm diameter requires a clear depression in the slab of 225 mm and a floor trap of outlet dia 100 mm, require this depth of almost 300 mm. If the structural drawings do not show adequate depression in the slab, it becomes an easy excuse for the field staff and the contractors to provide a sub-standard floor trap.

3. It is therefore, impressed upon all who are concerned with the architectural and structural drawing of buildings that adequate depressions as given above should be shown in the drawings. Further these may be situations where even more depression may be needed for giving proper slope in horizontal length of pipes under the floors if the traps are away from the vertical shaft/pipe.

This issues with the approval of CE (CDO).

SD/-
(ER. K.N. AGARWAL)
SUPERINTENDING ENGINEER (QC)
CDO, CPWD, NEW DELHI

**CENTRAL PUBLIC WORKS DEPARTMENT
CENTRAL DESIGNS ORGANISATION**

No. CDO/SE (D) G. 89/86/96

Dated 8/21.7.1987

TECHNICAL CIRCULAR

Subject : Corrosion of Reinforcement in RCC Work and Deterioration of Brickwork and Plastering

It is observed that cases of corrosion of reinforcement in RCC work and deterioration of brick work and cement plastering are becoming very common of late. These result in cracking of concrete members, especially the exposed thin sections like RCC parapets/chajjas etc. and heavily reinforced exposed beams. Similarly, the cement plaster disintegrates and brick walls start cracking up. The above defects are primarily due to the use of water containing appreciable amount of chlorides and sulphates. It is observed that water that is available locally through tube wells etc. is being used without testing to ascertain its fitness for use in construction work. Consequently, new buildings which are hardly 5 to 15 years old are affected adversely with the above defects.

2. CPWD specifications stipulate that the water to be used for construction work should be got tested and ISI codes also stipulate the same. However, in practice water is not tested invariably at each site of work and periodically. It is hereby impressed once again on all the field officers that water used in construction should be invariably tested before the same is used in construction at all work sites.

3. In this connection, attention is invited to Technical Circulars No. CDO/SE(D)/G.89/180 dated 23.8.82 and No. CDO/SE(D)/G.89/366 dt. 18.11.85 issued previously for strict compliance and guidance. These instructions are very detailed and elaborate and emphasize the necessity of following those instructions. It is, however, observed that probably adequate attention has not been given to those circulars with the result that our constructions suffer. All the EEs/SEs/CEs are hereby requested to go through those circulars and follow the instructions given therein strictly in all works in their charge. In case any such defects are noticed in their works, the same will be viewed seriously and disciplinary action will be initiated against the erring field officers.

Sd/-

(S. NAGARJAN)

Additional Director General (Works)

**DIRECTORATE GENERAL OF WORKS
CENTRAL PUBLIC WORKS DEPARTMENT
NIRMAN BHAWAN, NEW DELHI**

No.28/7/86-WI (DG)/Cir. No. 9/87

Dated 6.10.1987

OFFICE MEMORANDUM

Subject : Quality Aspects of Works in CPWD and Enforcement of Specifications etc.

Instructions/orders have been issued in the past for effecting improvements on quality aspects of works in C.P.W.D. Quality Control awareness, however, will percolate down to the grass-root level only when Senior Officers in the Department participate actively and effectively in the quality control function.

To improve the quality control on works following instructions are hereby issued with immediate effect.

1. It is necessary that the usual visits of the Senior Officers to the site are not confined only to instructions on progress, coordination and general matters but also result in effective quality control inspections. An 'inspection Register' be introduced at every work site. CE/SE/EE who visit the works

shall record the date and time of visit, items inspected and their observations. Entry of visit should be made even if no defects were observed or inspection was limited to progress and other matters excluding quality control. EE/AE shall carry over such observations and defects to the site order book with cross reference in the Inspection Register.

2. A Guard File shall be maintained at all work sites with copies of all inspection reports to date, whether these be of ASW(QC), Core Wing, EE, SE or CE.

3. Properly bound and page numbered registers (preferably printed) shall be officially issued under authorisation of Executive Engineer for Register of tests on materials, Inspection Register and site order book, etc. Record of tests should be put up for entries and review to every inspecting officer.

4. Samples of various materials, fittings to be used shall be approved well in advance before placing orders and displayed at sites of works with make and name of the manufacturer/supplier.

5. The Senior inspecting officers shall not confine themselves only to review of progress, coordination and general matters but shall inspect the work from quality control aspects. This should include review of the Guard File of earlier inspections, Inspection Register, Site Order Book and registers of tests carried out.

6. The EEs should ensure that AEs and JEs as well as contractor's supervisors incharge are fully aware of specifications. Officers should go through the standard specifications for any new/fresh items of works to be taken-up in the next two weeks. AEs/JEs/Supervisors should ensure that this important aspect is not overlooked. Senior officers should guide the subordinates specifically anticipating likely defects and how these be avoided.

7. Samples for tests are taken mostly by JEs or some by AEs. Samples for 10% of mandatory tests should be collected by EE and 10% of the field tests should be got done by EEs in their presence. In concrete cubes 25% of samples should be got filled by EEs in their presence. EEs should carry out 10% test check of centring/shuttering before permitting the laying of concrete. Ten per cent test check of EEs should be spread over all important items and should not be left to the final/pre-final bill stage.

8. The defect that is most common in our buildings is dampness and leakage. EEs will ensure that proper tests are carried out for proper slopes of canopies, chajjas, terracing, drainage arrangements, water tightness of expansion joints, joints in the W/s drainage and sanitary works before these are covered/concealed and also ensure rectification of defects noticed and certify the rectification carried out.

9. EEs shall ensure availability of the required test equipments for field tests as well as an updated copy of specifications and copies of Agreements at sites of works.

Sd/-

(ER. HARISH CHANDRA)
DIRECTOR GENERAL OF WORKS

**CENTRAL PUBLIC WORKS DEPARTMENT
CENTRAL DESIGNS ORGANISATION
NIRMAN BHAWAN, NEW DELHI**

No. CDO/SE(D)/NMT/24/142

Dated 17 /

CIRCULAR

Subject : Corrosion in RCC Structures and use of Portland Pozzolana Cement

Corrosion of steel reinforcement is observed to be the primary cause of damage in RCC structures within 10-15 years of construction and thereby drastic serviceability. This risk of corrosion can be controlled only by ensuring good

concrete and its ingredients. The basic necessity against corrosion is to obtain dense and impervious (non-porous) concrete made from ingredients free from excessive amounts of chlorides/sulphates. A circular indicating the mechanism of corrosion and guidelines for corrosion prevention measures was issued under No. CDO/SE(D)/G. 89/366 dated 18.11.1985. These corrosion prevention measures are once again emphasised in the context that the results of IRG/ISI expert group study on Portland Pozzolana Cement (PPC) and its unsuitability for RCC works from corrosion point of view are now available. A brief background of this study, and its implications and the consequent departmental actions required are given herein.

Regarding the use of PPC in RCC works, a comprehensive circular covering the earlier instructions was issued under No. CDO/SE(D)/NMT(24)/89 dated 1.3.1985 (Q.C. List 5). It was then mentioned that the I.R.C./I.S.I expert study group report to make available necessary engineering data for the design of RCC components using PPC and for deciding whether PPC could be used in RCC components or not was awaited. This study was initiated in 1978 in the Ministry of Shipping and Transport through a high level group meeting consisting of the representatives of the various Government Organisations/Ministries including CPWD. The study group has now finalised their report and the high level group has given the recommendations.

The study on the engineering properties of PPC (bond, compressive and tensile strengths and shrinkage) was done by four research institutes (C.R.R.I., New Delhi, C.B.R.I, Roorkee, H.R.S., Madras and N.C.C.B., New Delhi) by collecting samples of OPC and PPC on prior intimation from 12 cement factories located in different regions of the country. As regards to the corrosion resistant properties of PPC, the results of the studies undertaken by Central Electro Chemical Research Institute C.E.C.R.I. Karaikudi has been the basis for the recommendations. The following are the main observations of the above studies :

- (i) The quality of pozzolana used by the manufacturers failed to comply with the prescribed Indian Standard, in spite of previous notice of dates for collecting samples.
- (ii) PPC was observed to have lower durability factor and higher corrosion rate compared to O.P.C.

In view of the above findings, the High Level group has decided that it is not possible to recommend the use of PPC in structural concrete (reinforced and prestressed concrete) at this stage.

The above matter was put up to D.G. (W) bringing out the implications of the study in CPWD works and the consequent departmental actions required. Accordingly the following actions approved by D.G.(W) are required to be taken up immediately :

- (a) To use only OPC for all RCC framed structures. In case we are unable to get adequate quantity of O.P.C., even in load bearing structures, at least in exposed RCC components like chajjas, balconies, roofs, open staircase external beams and slabs & beams in toilet portion only OPC should be used.
- (b) Presently due to non-availability of OPC, PPC has been used even in RCC framed structures. Now, bringing out the results of the expert study group and the recommendations of the High Level Committee, efforts should be made to get enhanced quantity of OPC. This matter should be taken up with the appropriate authorities (Ministry of Commerce/Industries, Cement Controller, Development Commissioner for Cement Industries etc.) by C.E. (NDZ) II and Central Stores Circle as well as other zonal Chief Engineers.
- (c) Whenever local purchase of non-levy cement is made, it would be invariably only for O.P.C.
- (d) Separate use of OPC & PPC are required to be ensured and accordingly following actions would be necessary :

- (i) All stores, departmental or at site, the storage and issue of cement (OPC & PPC) should be separate. This will necessitate different issue rates for the two at stores level.
- (ii) Stipulation of issue of cement in contracts should be made separately for OPC & PPC at such different rates. The two cements should be separately stipulated and special condition should be specified that OPC is for RCC works.
- (iii) At site of works, separate storage and cement registers will have to be maintained.
- (iv) Register of record of testing of concrete cubes should specify specifically type of cement used in the RCC.

Strict measures against corrosion of steel reinforcements in RCC components should be taken both during design and construction. The departmental circulars on corrosion prevention measures should be followed by all S.Es/S.S.Ws for strict compliance. Specific attention is drawn on the following aspects :

- (i) It is absolutely necessary to use a low W.C. Ratio. Advantages of use of richer mix will be lost if the W.C. ratio is increased for the sake of workability. Tendency to use more water to get workability with increased slump has to be avoided as it results in porous concrete. If better workability is required then use of non-chloride super plasterizer should be adopted even on extra payment if necessary under the contract.
- (ii) As regards to ensuring proper cover to steel reinforcement, use of P.V.C cover blocks should be considered. Provision of items in the contract could even be made towards extra payment on account of such block.
- (iii) Necessity of use of anti-corrosive coatings over steel reinforcement developed by C.E.C.R.I. Karaikudi, in case of highly corrosive environment with high sulphates/chloride contents in the sub-soil and/or sub-soil water could be considered. Use of galvanised reinforcements may also be considered in such adverse environments. However, it should be ensured, by tests, that galvanising does not affect strength and elongation and deterioration of the cold twisted ribbed bars. Regular tests should be conducted on galvanised samples of bars to ensure this. Some tests have been made recently in western zones. Who it was found that galvanising did not affect, bars of higher dia meters and in lower diameter elongation characteristic was affected a little but such bars are used in slabs or binders.

Chief Engineers may ensure that the importance of the above circular is brought to the specific attention of all the departmental officers and compliance reported.

Sd/-
(M.K. KOUNDINYA)
CHIEF ENGINEER (D)

**QUALITY CONTROL AND TECHNICAL AUDIT WING
CDO, CPWD, NIRMAN BHAWAN, NEW DELHI**

No. CDO/QCTA/G-9/1332

Dated 3.12.1987

Subject : Quality Aspects of Works in C.P.W.D and Enforcement of Specification etc.

An 'Inspection Register' is required to be maintained at each work site, as per para 1 of the DG(W)/O.M.No. 28/7/86-WI(DG)/Cir.No. 9/87 date 6.10.87. For the sake of uniformity a format of the Inspection register has been finalised as given overleaf which should be uniformly adopted by all concerned in the department.

This issues with the approval of CE (CDO)

Sd/-
(Er. K.N. AGRAWAL)
SUPERINTENDING ENGINEER (QC)

TYPICAL PAGE OF AN "INSPECTION REGISTER" OF A WORK

Sl.No.	Date	Office & Designation	Items inspected and specific defects noticed and action to be taken	Signature	Defects taken over to site Order Book/Letter		Final action/ result.
					Site Order/ Letter No.	Date AE/EEs sign.	
1	2	3	4	5	6		7

**QUALITY CONTROL & TECHNICAL AUDIT WING,
CDO, CPWD, NIRMAN BHAWAN, NEW DELHI**

No. CDO/QCTA/G-28/58

Dated 13.1.1988

TECHNICAL CIRCULAR

Subject : Permissible Limits of Contents of Deleterious Material in Soil for Use in Embankment for Road Construction.

The test for deleterious contents present in soil to be used in embankment for road construction is mandatory as per list of mandatory tests of CPWD Specifications Vol. II 1977 of which para 17.5.5.3 is also relevant. The specification is however silent about the types of deleterious constituents and their permissible limits beyond which these are harmful. The Indian Road Congress Special publication No. 11 titled, "The Handbook of quality control for construction of roads and runways" in its para 2.5.5. has a provision in this regard as under :

"2.5.5. Deleterious Constituents : The soil should be free of harmful salts like sodium sulphate and organic matter (permissible limits of 0.2% & 1% respectively). The test will be done as and when required."

2. The same is brought to notice of all concerned in the deptt. for their guidance and also for their comments with a view to eventually incorporate a similar para in our CPWD Specifications.

This issues with the approval of CE(D).

Sd/-
(K.N. AGRAWAL)
SUPERINTENDING ENGINEER (QC)

DIRECTORATE GENERAL OF WORKS, CPWD, NEW DELHI

No. 28/7/86 WI (DG)
Cir. No. 3/88

Dated 3.3.1988

OFFICE MEMORANDUM

Subject : Quality Aspects of Works in CPWD

Instructions have been issued (Vide No. 28/7/86-WI(PG) S.No. 9/87 dated 6.10.87) for the introduction of an INSPECTION REGISTER at every work site wherein senior officers all enter their observations on quality aspects after each of inspection. With a view to be more objective the inspection should be made with reference to three most probable defects each item of work as listed in the attached statement "check features". The items inspected and the reading should be entered the

inspection register-whether it be give or defective. The inspecting officers may also enter additional remarks aspects covered by the check features.

A copy of the "check features" shall be kept with the Inspection Register for reference by inspecting officers.

Sd/-
(P. RAVINDRANATHAN)
DIRECTOR OF WORKS (CPWD)

Type of work	Check Features
1. <i>Concrete</i> Plain and reinforced	(a) Strength of concrete cube test. (b) Quality of exposed surface (Honey combing etc.) (c) Lines Levels and verticality.
2. Reinforcement	(a) Bending, Binding and cage size w.r.t. drawings. (b) Cover to reinforcement. (c) Staggering of laps, adequacy of length of laps and anchorage.
3. Centering and Shuttering	(a) Gap and cracks, evenness of surfaces of shuttering materials and form work. (b) Centering supports size, spacing, side supports and cross bracing (Structure aspects of arrangements). (c) Evenness and camber of surface to come in contact of concrete.
4. Masonry work	(a) Filling of mortar in Joints and mortar strength. (b) Lines levels of courses and verticality. (c) Staggering of Joints, Bonding in courses and at junctions (Bondstones for stone masonry)
5. Wood Joinery Work	(a) Quality of timber, absence of sap and knots. (b) Finishing of edges and surface proper joinery work, process of warping. (c) Fixing, gaps, cracks in panels & members.
6. Flush Door Shutters	(a) Finish of edges and surface, absence of warpage and coventry. (b) Fixing, Convenience of Operation of openable shutters. (c) Tests.
7. Windows/Doors	(a) Ease/convenience of operations of openable shutter. (b) Proper welding/grinding. (c) Details like hinges, striking plate, handles and stays etc.
8. Flooring	(a) Surface finish and joints. (b) Slope of floor and surface finish (c) Soundness of floor.
9. Roofing (Point Roofs)	(a) Soundness and geometry of sheets. (b) Adequacy and uniformity of slopes and overlaps of sheets and troughs. (c) Fixing of sheets, j/books, attach bolts.
10. Roof Treatment	(a) Slopes and drainage. (b) Proper junction with parapet and with rain water pipes (KHURRAH) (c) Evenness and soundness of finished surface and grouting of joints

- | | |
|---|--|
| 11. Finishing Plasters and wall tiling etc. | (a) Soundness of the finishing layers, flashing.
(b) Surface evenness, outward slopes of chajjas and inward slopes of top of parapet, rounded junction with walls.
(c) Lines, levels in general. |
| 12. Pipes work for Drainage and Sewerage | (a) Jointing, verticality, concentricity and water tightness.
(b) Gradient and slopes.
(c) Waterheat and Gap between top of trap and top of floor (Jali) |
| 13. Pressure Pipes Work | (a) Jointing and water tightness.
(b) Proper alignment and fixing of exposed pipes. |
| 14. Door, Window Fittings. | (a) Dimensions and weights.
(b) Finish of fittings.
(c) Use of adequate no. and proper type screws. |
| 15. CP/Brass Fittings | (a) Plunger, washer, seating of washer.
(b) Convenient working.
(c) Weight and finish. |
| 16. Sanitary Wares | (a) ISI marking and CPWD specification.
(b) General shape, size and absence of visual defect.
(c) Fixing, Gaps, water tightness & jointing of W.C. pans with the trap. |
| 17. Pipes and Fittings | (a) Dimension and weights.
(b) Coating internal and external.
(c) Fixing. |

**CENTRAL DESIGNS ORGANISATION
CENTRAL PUBLIC WORKS DEPARTMENT
NIRMAN BHAWAN, NEW DELHI - 110011.**

No. CDO/QCTA/G-2/63

Dated 6.3.1990

OFFICE MEMORANDUM

Subject : Quality Control Measures

Attention of all CEs is invited to the Circular No. CDO/OC/G-2/812, dated 21.11.1989 wherein it has been enjoined upon that all the inspecting officers must enter their visits in the inspection register and make entries of their findings during their sites visits and also review the material test registers, Site Order Books and other site records as stipulated in DG(W)'s O.M. No. 29.7.86-VI (DG) Cir. No. 9/87 dated 6.10.1987. Some representations have been received that it may not be possible for the field CEs to record their findings every time during their inspections.

The matter has been carefully considered at the level of DG(W). CEs have a major role in quality control and recording the observations in the inspection register during their site visits is the fastest way to make their observations known. It has, therefore, been decided that the procedure of recording the observations shall continue. However, CEs may record their observations with remarks at least in 50 cases and in other cases at least inspection register may be signed by CEs in token of their having inspected the works.

Compliance of this may be strictly adhered to.

Sd/-
(Er. B.V. SUBRAMNAYAM)
CHIEF ENGINEER (DESIGNS)

**QUALITY CONTROL & TECHNICAL AUDIT WING
CDO, CPWD, NIRMAN BHAWAN, NEW DELHI.**

No. CDO/QCTA/G-2/126

Dated 16.3.1990

OFFICE MEMO

Subject : Quality Assurance in CPWD : Making the Quality Control set up more effective.

Detailed instruction about procedure to be followed in implementing Quality Control measures have been issued vide Circular No. EE(QC)/QCTA/2/718-1278 dated 3.4.82 followed by many other circulars/orders on the subject for affecting improvement on quality aspects of works in C.P.W.D.

It has been observed that observations made in reports are not complied/replied promptly by Executive Engineers/Superintending Engineers. In some cases the replies have not been received for several years, despite reminders defeating the very purpose of Quality Control inspections.

In order to make the quality control inspections and follow up more effective, so that they really make an impact on the quality of our constructions, the existing procedure has been reviewed by D.G (W) and following instructions are issued with immediate effect.

(i) As soon as an inspection is done, the Executive Engineer (QC) or Superintending Engineer (QC) or Chief Engineer (Designs), who inspects, will report the serious and immediate points to be attended to, in the register to be maintained at site for this purpose, at the end of inspection by the QC Core Wing.

(ii) A regular inspection report in the proper form will be issued within four weeks at the maximum, with copies to the concerned Superintending Engineer and Chief Engineer. Any point considered serious enough to be brought to the specific notice of the concerned Superintending Engineer/Chief Engineer, will be indicated in the endorsement to the inspection memos.

(iii) Executive Engineer concerned should reply within a period of four weeks from the date of receipt of inspection report at the most.

(iv) All subsequent rejoinders also will have to be sent by QC Wing and replied by concerned Executive Engineer within four weeks of the receipt of reply/letter respectively.

(v) Where some observations have been brought to the notice of Superintending Engineer/Chief Engineer, they should send their comments/replies after personal inspection. The present practice of Superintending Engineers/Chief Engineers only drawing attention to the replies of Executive Engineers/Superintending Engineers shall cease.

(vi) A close watch will be kept and in the event of default on more than one occasion Chief Engineer (Designs) will write to the concerned Superintending Engineer/Chief Engineer.

(vii) In the event of default on three occasions the matter will be referred to be ADG/DG who will take note of negligence/delay and issue 'caution' letters.

(viii) If such defaults persist in any division or a circle on more than three occasions it will attract vigilance action and will be referred to Chief Engineer (Vig.) by Chief Engineer (Designs).

(ix) Notwithstanding the above, serious irregularities, defaults, overpayments, shortages, etc., will be referred to Chief Engineer (Vigilance) directly/the Chief Engineer (D) with the approval of ADG(W)/DG(W).

All pending cases for more than three months (as on the date of issue of this memo) are to be dealt with on the basis of above guidelines.

This issues with the approval of Director General (Works)

Sd/-
(B.V. SUBRAMANYAM)
CHIEF ENGINEER (DESIGNS)

DIRECTORATE GENERAL OF WORKS, CPWD, NEW DELHI

No. 16/1/89-WI (DG)/Circular No. 1/90

Dated 22.5.1990

CIRCULAR**Subject : Yardstick for Renewal of Pre-mix Carpetted Roads**

The renewal period of pre-mix carpetted roads will be six years, i.e., resurfacing works are to be taken up at an interval of every six years.

Sd/-
(K.E. AYYAR)
(DIRECTOR OF WORKS (P. & W.A.))

**QUALITY CONTROL & TECHNICAL AUDIT CORE CELL
CENTRAL DESIGNS ORGANISATION/SPG : CENTRAL P.W.D
ROOM NO. 419, WING-A, NIRMAN BHAWAN, NEW DELHI**

No. CDO/QCTA/SPG/G-2/270

Dated 29.4.1991

Q.C.T.A CIRCULAR NO. 1 OF 1991**Subject : Quality Assurance in CPWD: Inspection & Follow-up Action**

It has been observed that observations made in the Inspection Report are not complied/replied promptly by Executive Engineers/SEs. In some cases, replies have not been received for several years despite repeated reminders, thus defeating the very purpose of Quality Control Inspections.

In order to ensure the Quality Control Inspections and follow-up more effective so that the quality of works in CPWD is maintained. ADG reviewed the prevailing state of affairs of Quality Control. On review, the ADG expressed serious concern over the deteriorating quality of works in CPWD. In order to make Quality Control Inspections more meaningful and effective, the following decisions have been taken, as per directions of the Director General of Works :—

1. The Executive Engineer concerned shall take action on the observations and send compliance on rectification of defects/deficiencies within a period of 4 weeks from the date of receipt of the Inspection Reports at the most. Any point considered serious enough to be brought to the specific notice of the concerned SE/CE will be intimated by SE(QC)/CE(SPG) through a separate letter by name in addition to the normal report which shall be sent by the E.E. (QC).
2. Where some observation paras have been brought to the notice of the SE/CE, they should send their comments/replies after personal inspection in case the work is located at the same station/headquarter. For outside works, SE/CE can take the assistance of ASW(QC)/SE(HQ) in order to ensure that the replies are sent within 4 weeks from the date of receipt of Inspection Reports/letters from SE(QC)/CE(SPG). The present practice of SE/CE's only drawing attention to the replies of EEs/SEs shall cease. A close watch will be kept and in the event of any default, CE(SPG) shall write to the concerned SE/CE : if still no reply is received within a fortnight, the matter shall be referred to the Chief Engineer (Vig.), presuming that they have no comments to offer.
3. Notwithstanding the above, serious irregularities/defaults, over-payments, shortages, frauds like wrong certification or wrong report of rectification of defects, etc. may be referred to CE(Vig.) immediately by CE(SPG).

4. Where the general quality of works in a Division is found largely sub-standard, CE(SPG) shall write to ADG(S&P) for consideration of transfer of EE from the site. When the transfer is done on this basis, there shall be a ban on reposting of that EE to site for a period of three years.
5. For EE/SEs who do not respond to the QCTA letters/reminders in a constructive/positive manner, the CE(SPG) shall forward a brief note to the Chief Engineer concerned for suitably incorporating the remarks in the Annual Performance Report/Annual Confidential Report of the concerned officer.

Sd/-
(U.V.S. TYAGI)
CHIEF ENGINEER (SPG) &
INCHARGE QUALITY CONTROL

**QUALITY CONTROL & TECHNICAL AUDIT WING
C.D.O, SPG : CPWD : NIRMAN BHAWAN, NEW DELHI**

No. CDO/SPG/QCTA/G-2/279

Dated 1.5.1991

QCTA CIRCULAR No. 2 of 1991

Subject : Payment for Sub-standard Work

The scrutiny of final bills and the replies of QCTA observations paras received from EEs/SEs indicate that Reduced Rate Statement is sanctioned by SEs in lieu of rectification of defects, (b) replacement of inferior fittings and fixtures, and (c) resorting to marginal recovery limited to areas inspected by QCTA. Such practice is highly objectional and irregular too.

The contractors are required to execute all works satisfactorily and according to the specifications. Timely action alone can prevent occurrence of defects which will be difficult to rectify later on.

If the contractor does not rectify the defect, the work should be got redone or rectified departmentally in terms of clause 14 of the contract.

Acceptance of work below specification and payment of reduce rates should be resorted to only for those items where it is structurally impossible to get the work redone.

Superintending Engineers should bear in mind while accepting sub-standard work at reduced rate that it is resorted to under special circumstances and that too for recorded reasons. The deduction in rate should be commensurate with the defect.

The detail instructions related to payment for sub-standard work are contained in Section 31 of CPWD Manual Volume-II.

Sd/-
(U.V.S. TYAGI)
CHIEF ENGINEER (SPG) &
INCHARGE, QUALITY CONTROL

**DIRECTORATE GENERAL OF WORKS
CENTRAL PUBLIC WORKS DEPARTMENT,
NIRMAN BHAWAN, NEW DELHI**

No. 25/2/91-WI (DG)

Dated 27.4.1992

Subject : Rolling of Bituminous Layers

Enclosed please find a copy of letter No. RW/NH-33045/1/90-S&R, dated 31.3.92 from the Ministry of Surface Transport (Roads Wing) on the captioned subject for information and necessary action.

Sd/-
(A.K. SHARMA)
SECTION OFFICER
for DIRECTOR GENERAL OF WORKS

Copy of letter No. RW/NH-33045/1/90-S&R, dated 31.3.92 from the Ministry of Surface Transport (Roads Wing) addressed '*inter alia*' to DGW (CPWD).

During inspection of some bituminous works on National Highways recently, it has come to the notice that some contractors are following the practice of wetting the roller wheels with diesel or some lubricating oil while rolling bituminous layers. In this connection, kind attention is invited to para 504.3.6 of the Ministry's Book of Specification which states as below :

"The rolling wheel shall be kept damp, if necessary to avoid bituminous material from sticking to the wheels and from being picked-up. In no case shall fuel lubricating oil be used for this purpose, nor excessive water poured on the wheels."

2. It is requested that the above points may please be brought to the notice of all field engineers including quality control staff once again to ensure strict compliance of the instructions. In case there are instances of the contractors not complying with this requirement the bituminous work completed by them should be rejected and got relaid at their expenses.

**QUALITY CONTROL & TECHNICAL AUDIT CORE CELL
CENTRAL DESIGNS ORGANISATION : SPG/CENTRAL P.W.D.,
ROOM NO. 419, WING-'A', NIRMAN BHAWAN, NEW DELHI - 110011.**

No. CDO/QCTA/SPG/G-2/220

Dated 23.6.1992

QCTA CIRCULAR NO. 1 OF 1992*

Subject : Proper Functioning of Doors and Windows

(1) During the inspection of the QCTA officers at site, it is a common observation that doors and windows do not properly function *i.e.* either they do not close and if closed require excessive efforts to open them. At times, the sliding door bolts, tower bolts and handles are not fixed properly as a result their utility is lost.

(2) These small deficiencies of workmanship and lack of supervision cause considerable inconvenience to the user and bring bad name to the department.

(3) In order to avoid such situation, the following system is introduced.

(4) A register shall be opened at all the buildings/project sites, both residential and non-residential, wherein quarter-wise and location-wise entries be made by A.E. and J.E. to the effect that all doors and windows are checked and verified for their smooth opening and closing. All tower bolts, sliding door bolts and handles are properly fixed and are functioning smoothly. The sample proforma for the Register is also enclosed.

(5) This exercise is to be completed before the completion certificate is recorded or in case the buildings/quarters are handed over in phases for occupation, this exercise be completed before their occupation.

Sd/-
(U.V.S. TYAGI)
CHIEF ENGINEER (SPG) &
INCHARGE OF QUALITY CONTROL

RECORD/REGISTER OF CHECKING THE SHUTTERS AND THEIR ALLIED FITTINGS FOR THEIR SMOOTH FUNCTIONING AND SATISFACTORY PERFORMANCE

Name of Work :
Agreement No. :
Name of J.E.(s) :
Name of A.E. (s) :

For Residential Building(s), Qr. No. & Block No., if any	For Non-Residential Building(s); Location /Room	Dated Initial of J.E. who checked	Dated initial of A.E who verified	

**OFFICE OF CHIEF ENGINEER S.P.G. PROJECT
CENTRAL PUBLIC WORKS DEPARTMENT**

No. Misc./CE/SPGP/91

Dated 8.7.1992

MEMORANDUM

Subject : Avoidance of use of Timber in Centering and Shuttering

As you are aware that use of wood in CPWD works has been banned with effect from 1.4.93. Therefore earnest effort be made to reduce the use of timber right now. One of the major item where timber is used is centering and shuttering. In order to avoid the use of timber and to get better finish surface of concrete, please discourage use of timber in the ongoing projects/works. In the case of new projects/works suitable provision in the N.I.T. be made to ensure that timber is not used for centering and shuttering. Preferably steel centering and shuttering may be specified.

Sd/-
(U.V.S. TYAGI)
CHIEF ENGINEER (SPG) &
INCHARGE QUALITY CONTROL &
STANDARDS & SPECIFICATIONS

**DIRECTORATE GENERAL OF WORKS
CENTRAL PUBLIC WORKS DEPARTMENT**

No. DGW/CON/50

Dated 1.10.1992

MEMORANDUM

Subject : Payment of Part Rates for Fabricated Wood/Steel Items before Fixing

1. The Chief Technical Examiner during inspection of some CPWD Works had observed that panelled doors/window shutters and M.S. Grills kept in contractor's site stores or fabrication yards were paid under the relevant agreement items at part rates before being fixed in position. In such cases only payment of secured advance is permissible and not payment of the item at part rates.
2. All concerned are, therefore, advised to note that the practice of payment of part rates for door/window shutters, T iron frames, M.S. Grills, flush door shutters and items of similar nature not fixed in position is not correct. Only secured advances as admissible under the terms of contract can be paid in such cases.

This issues with the approval of DGW.

Sd/-
(S. SATAKOPAN)
F.O. TO D.G (WORKS)

**QUALITY CONTROL & TECHNICAL AUDIT CORE CELL
CENTRAL DESIGN ORGANISATION/SPG: CENTRAL P.W.D
ROOM NO. 419, WING- 'A', NIRMAN BHAWAN, NEW DELHI - 110011.**

No. CDO/QCTA/SPG/G-2/306

Dated 22.12.1992

QCTA CIRCULAR NO. 2 OF 1992

Subject : Plumbing Details – Installation of Floor-trap

1.0 During QCTA inspections, the use of incorrect type of floor traps and their improper installations have been observed. These two deficiencies, to a great extent, are instrumental for dampness in the building portion adjacent to kitchen, bath, W.C. and wash-basin.

2.0 Features of standard floor trap :

- 2.1 Sand cast iron floor trap shall conform to IS : 1729-1979, Fig. (1) (enclosed with this Circular) shows correct type of floor trap with relevant dimensions which should be checked by field officials.
- 2.2 Correct type or Standard Trap has water seal of 50 mm (in case of two-pipe system with gully trap, upto 35 mm is permitted).
- 2.3 Fig. (2) shows floor trap "Nahani" type. It has two deficiencies compared to floor trap shown in Fig. (1) as it is not self-cleansing and inside projection causes clogging. It is not therefore recommended for use as floor trap.
- 2.4 Fig. (3) shows incorrect type of Nahani trap with constricted neck. It is also not self-cleansing, secondly it gets clogged due to inside projection and thirdly, the outlet diameter near the neck is tremendously reduced. The water seal in such trap may be as low as even zero. Such defective trap fails to check ingress of foul gases from sewers and causes frequent chokages also.

3.0 Fixing arrangement with waste pipe :

3.1 Avoid shorter length of waste pipe & ensure compaction of concrete below waste pipe :

Fig. (4) shows a situation when pipe is discharged into the floor trap which is provided below the floor level. The junction of waste pipe with the floor trap is made of cement concrete. The portion of cement concrete in the region marked 'A' is below the waste pipe and this is vulnerable as leakage point due to non-feasibility of proper compaction of concrete layer below the waste pipe. Precaution, therefore, is to be taken to provide waste pipe of such proper length that it rests on the inner face of vertical wall of P-trap as shown in Fig. (5) and concrete is properly compacted especially below the waste pipe.

3.2 Avoid over-shooting of waste pipe in trap :

Fig. (6) shows horizontal pipe which is protruding the inner face of wall of the P-Trap as the waste pipe has not been cut to the exact size. The projected portion of pipe shall cause flooding of water and it will give scope for seepage of water into the floor through area marked 'B'. Precaution, therefore, is to be taken to provide waste pipe of correct/exact size as shown in Fig. (5).

3.3 Suggested method :

As an illustration, one of the correct methods of making joint with waste pipe and floor trap is shown in Fig (7). Engineer-in-Charge may adopt any other jointing method depending on site requirement.

4.0 Depression of RCC Slabs :

In order to accommodate a standard floor trap, RCC slab is required to be depressed at least by 250 mm for 75 mm nominal diameter trap and by at least 325 mm for 100 mm nominal diameter. It is very essential to show such depression in architectural and structural drawing of building. The practice of depressing the entire area of kitchen, bath etc. is not economical.

5.0 Extra precautionary measures :

Apart from the use of standard floor trap, its proper fixing arrangement and adequate depression in slabs, the following points should also be kept in view :—

5.1 The discharge from one floor trap to the other floor trap should be avoided. Each waste pipe should be taken out and combined through Y-Junction to main stack. Where this is not possible, discharge of one trap to the other should be through Tee-Junction as shown in Fig. 7.

5.2 The depressed slab portion should be properly made water-proof.

5.3 The floor trap shall be encased in rich concrete (1:2:4 mix or higher) preferably of 75 mm thickness but not less than 50 mm (if site conditions do not permit).

5.4 The pipe from the floor trap to the stack shall have slope not flatter than 1 in 50. Secondly, collar joints shall be avoided in this portion of pipe.

5.5 The use of specified quantity of lead for jointing of pipes with trap should be ensured. Secondly, the joint should be properly caulked. Thirdly, smoke test (as required under para 18.6.3 of CPWD Specifications, Vol. II) shall be carried out before covering the joints from the trap to the stack.

5.6 As far as possible, there should not be any gap between grating and the top rim of the floor trap so as to avoid chances of ingress of water through such gaps.

6.0 It has been experienced that some SEs allow use of incorrect/non-standard floor trap at Reduced Rates. Such practice should be stopped.

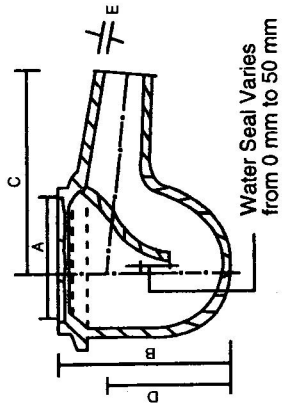
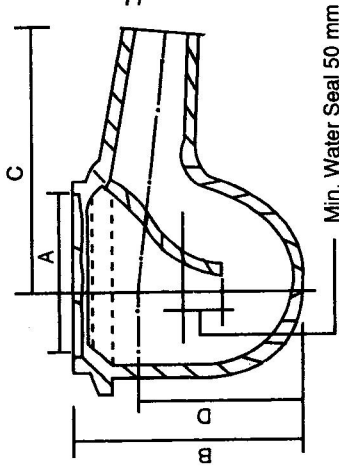
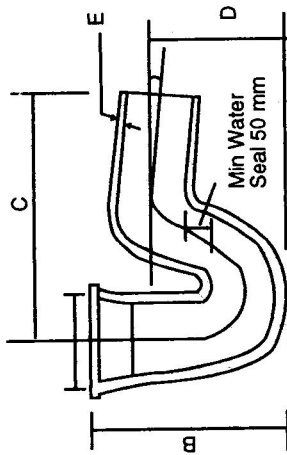
7.0 This issues with the approval of DG(W).

Sd/-

(U.V.S. TYAGI)

CHIEF ENGINEER; SPG PROJECT &
INCHARGE QUALITY CONTROL

DIFFERENT TYPES OF FLOOR TRAPS



Nomi- nal Dia- meter of out let	A mm	B mm	C mm	D mm	E mm	Appro- ximate weight	Nomi- nal Dia- meter of out let	A mm	B mm	C mm	D mm	E mm	Appro- ximate weight	Nomi- nal Dia- meter of out let	A mm	B mm	C mm	D mm
75	100	225	275	165	3.5	4.8 kg	75	165	225	215	165	4	6.5 kg	75 to 50 Apprx.	135 to 165	175 to 225	150 to 215	140 to 265

Note -1 Gratings may be hinged or screwed down
 Note -2 Hinges shall be of galvanised iron

Note - This is a partition type trap which is not self-cleansing. It has inside projection where it closed

Note - This trap is now cleansing type inside projection causes clogging and constricted neck reduces outlet can get Dia.

Fig. 1 - Correct Type of Floor Trap (IS:1729-1979)

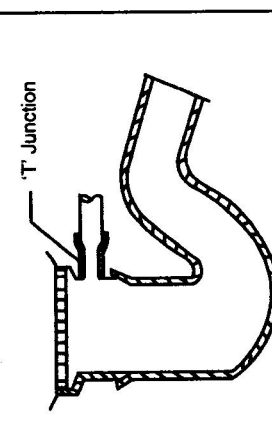
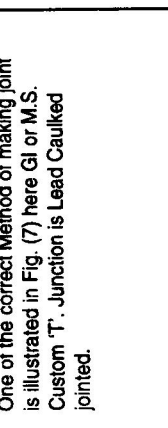
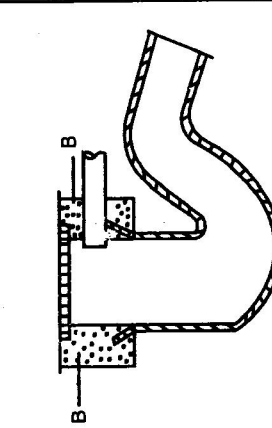
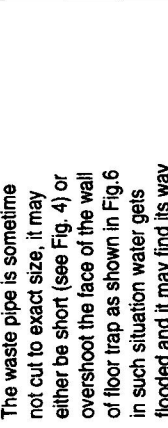
Fig. 2 - Partition type of Floor Trap (Nahani)

Fig. 3 - Incorrect type of Floor Trap (Constricted Neck).

QCTA Core Cell
 CDO/SPG/C.P.W.D. Nirman Bhavan, New Delhi - 110 017

QCTA Circular No. 2 of 1992

**DIFFERENT TYPES OF FLOOR TRAP
(FIXING ARRANGEMENT WITH WASTE PIPE)**

 <p>Leakage Point (A) Waste Pipe Floor Trap</p>	<p>The Cement Concrete portion (marked A). Below the waste pipe is vulnerable as leakage Area due to inadequate compaction of concrete below pipe</p>		<p>Fig. 5 Waste pipe of exact/ Correct Length</p>
	<p>The waste pipe is sometime not cut to exact size, it may either be short (see Fig. 4) or overshoot the face of the wall of floor trap as shown in Fig.6 in such situation water gels flooded and it may find its way into the floor through concrete Area marked 'B'</p>		<p>One of the correct Method of making joint is illustrated in Fig. (7) here GI or M.S. Custom 'T' Junction is Lead Caulked jointed.</p> <p>Fig. 7 - Waste pipe fitted with T-junction</p>

QCTA Core Cell
CDO/SPG/C.P.W.D. Nirman Bhavan, New Delhi - 110 017

QCTA Circular No. 2 of 1992

**QUALITY CONTROL & TECHNICAL AUDIT CORE CELL
CENTRAL DESIGN ORGANISATION/SPG: CENTRAL P.W.D.
ROOM NO. 419, WING-'A', NIRMAN BHAWAN, NEW DELHI**

No. CDO/QCTA/SPG/G-2/154

Dated 22.2.1993

QCTA CIRCULAR NO. 1 OF 1993

Subject : Plumbing Details – Wash-Basin

(1) During QCTA inspections, it is experienced that due care is not taken while installing wash basin, in spite of the fact that para 18.12 at page 95 of C.P.W.D. Specifications Vol. II (1977 Edition) contains descriptive details and Fig. 85 at page 220 shows plans and elevations of different types of wash basins. To correct this malady, DG(W) has approved the following :

(2) To ensure proper installation of wash basin, three sketches showing wash basin in position are enclosed and marked as Fig. 1.1, Fig. 1.2, Fig. 1.3. These are typical vertical section for three different situations of discharge, namely, (a) Waste pipe open to view, (b) Waste pipe concealed type and (c) Waste pipe discharging in open semi-circular channel.

(3) Different methods of discharge from wash basin can be as stated below.

- (a) Directly to vitreous semi-circular open drain discharging to a floor trap and finally to the vertical stack; (Fig. 1.3)
- (b) In case of ground floor, either directly to the gully trap or through floor trap;
- (c) In upper floors through floor trap to the waste pipe stack (refer enclosed Fig. 1.1. & 1.3)
- (d) If waste pipe is concealed from view (refer enclosed Fig. 1.2) or crosses the wall, it can be through non-ferrous trap like PVC engineering plastic or C.P. brass and union (Fig. 1.2 shows a PVC bottle trap).

(4) C.P. brass trap and union are not to be used if discharge is as described above under 3(a), 3(b) and 3(c). In method 3(d) only, these are to be provided. These are paid for separately, where so specified, as per para 18.12 of Specifications Vol. II.

(5) Special supervision and care is required on following counts :-

- (a) The height from the floor to top of the rim of basin must be within 750 mm to 800 mm if supported on brackets;
- (b) Cast iron brackets should conform to IS (Refer Fig. 1.3) and be embedded in c.c. (1:2:4 block of 100 x 75 x 150 mm in horizontal position. Use of mild steel angle or section as bracket is not permitted.
- (c) The wall plaster on the rear should be cut to rest over the top edge of basin so as not to leave any gap for water to seep through between wall plaster and skirting of basin;
- (d) S.C.I. floor trap conforming to IS : 1729-1979 having 50 mm water seal (minimum 35 mm in two pipe system with gully trap) should be used;
- (e) Waste pipes laid horizontally should have gradient not flatter than 1 in 50 and not steeper than 1 in 10.

(6) It has been experienced that some Superintending Engineers allow use of non-standard C.I. brackets and floor trap at Reduced Rates. Such practice should be stopped.

Sd/-

(U.V.S. TYAGI)

**CHIEF ENGINEER; SPG PROJECT &
INCHARGE QUALITY CONTROL**

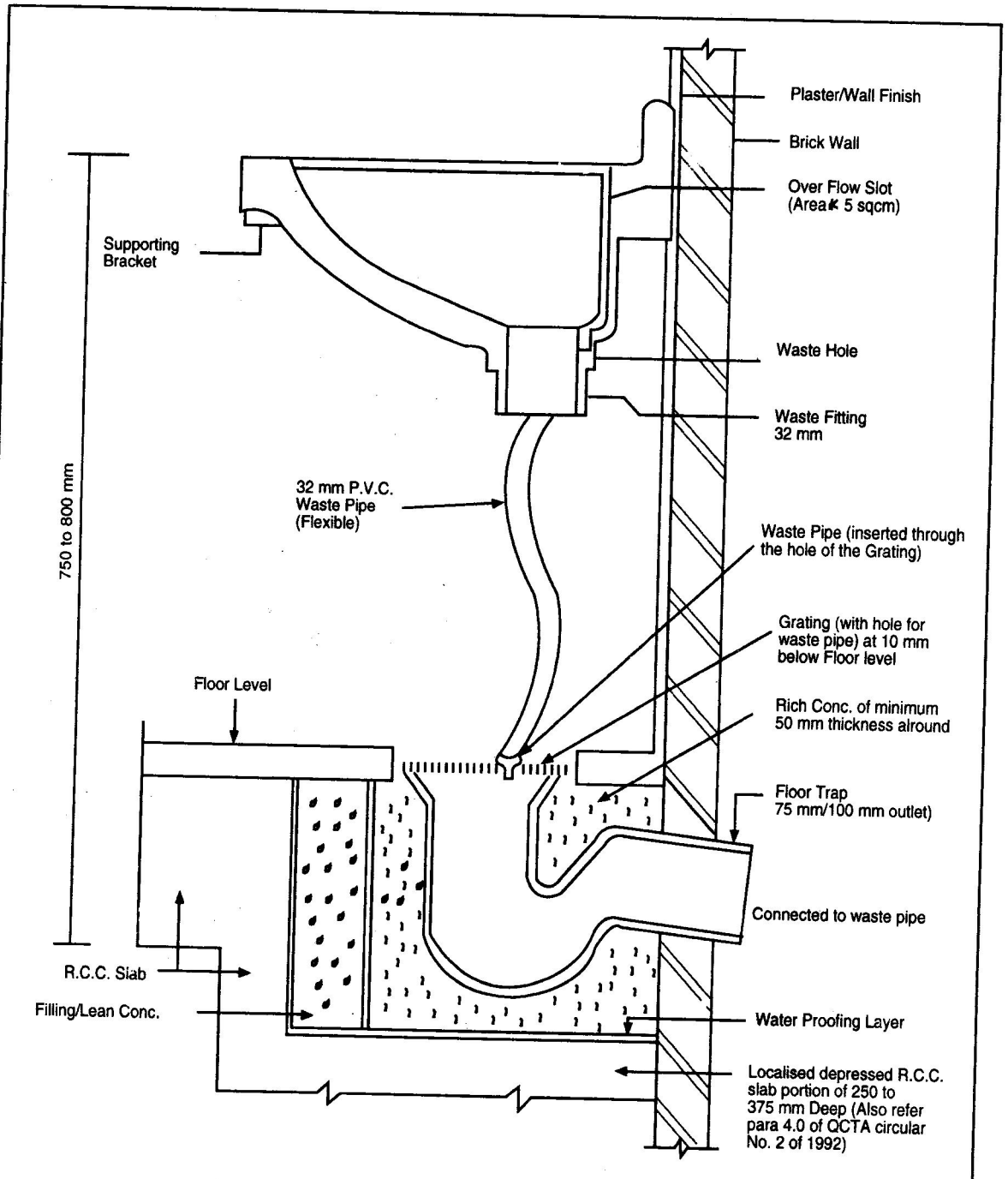


Fig. 1.1
Typ. Vertical Section of Wash Basin
(Waste Pipe Open to View)

Note :
Recommended for use upto Type III quarters
& in general offices.

QCTA. CORE CELL
CDO/SPG/C.P.W.D. Nirman Bhawan
New Delhi - 110 011

G.C.T.A. Circular No. 1 of 1993

Figure

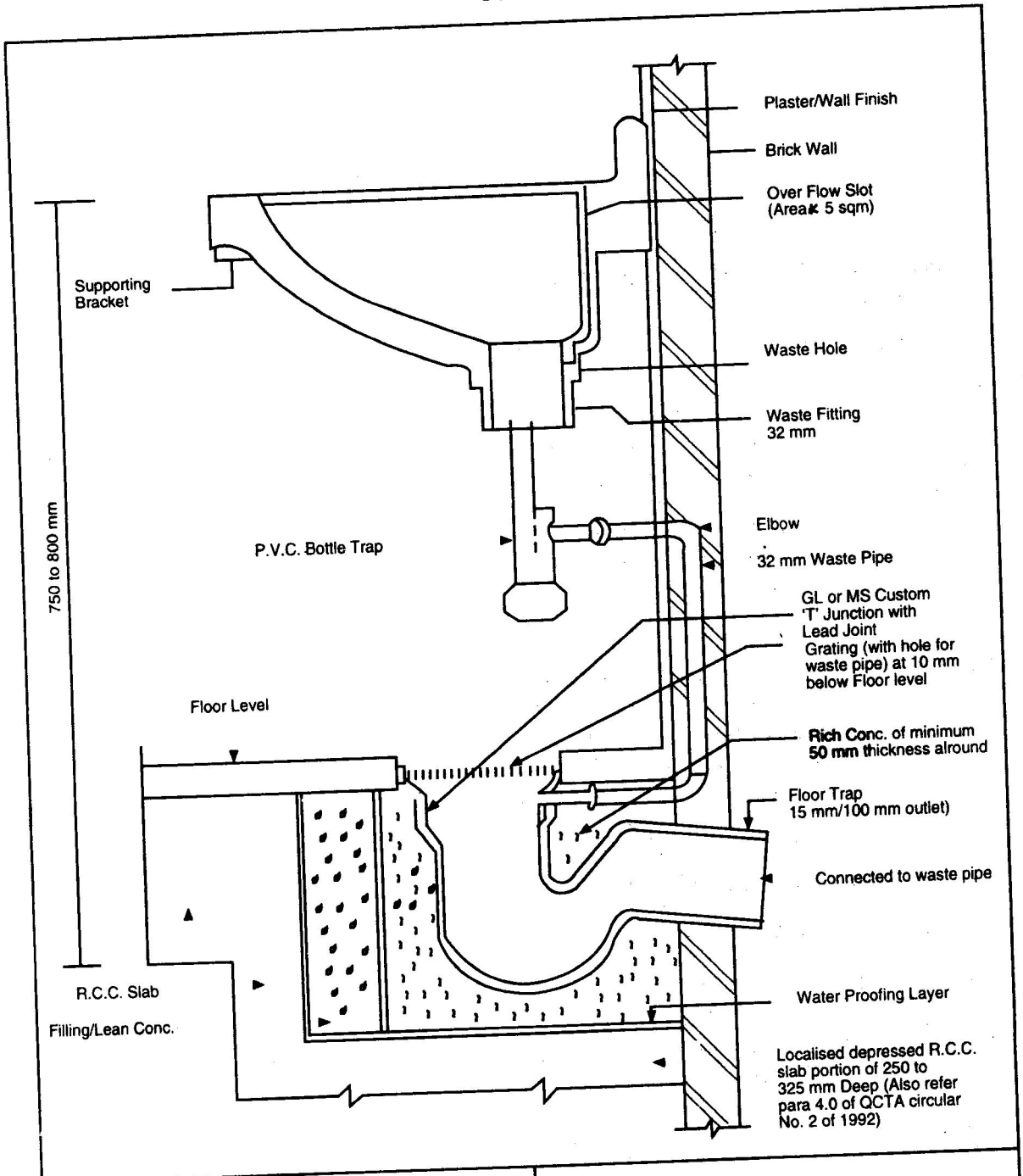


Fig. 1.1
Typ. Vertical Section of Wash Basin
(Waste Pipe Open to View)

Note :
Recommended for type IV & above quarters/
Bungalows, VIP locations, five star hotels & for
personalised use.

QCTA. CORE CELL
CDO/SPG/C.P.W.D. Nirman Bhawan
New Delhi - 110 011

Q.C.T.A. Circular No. 1 of 1993

Figure

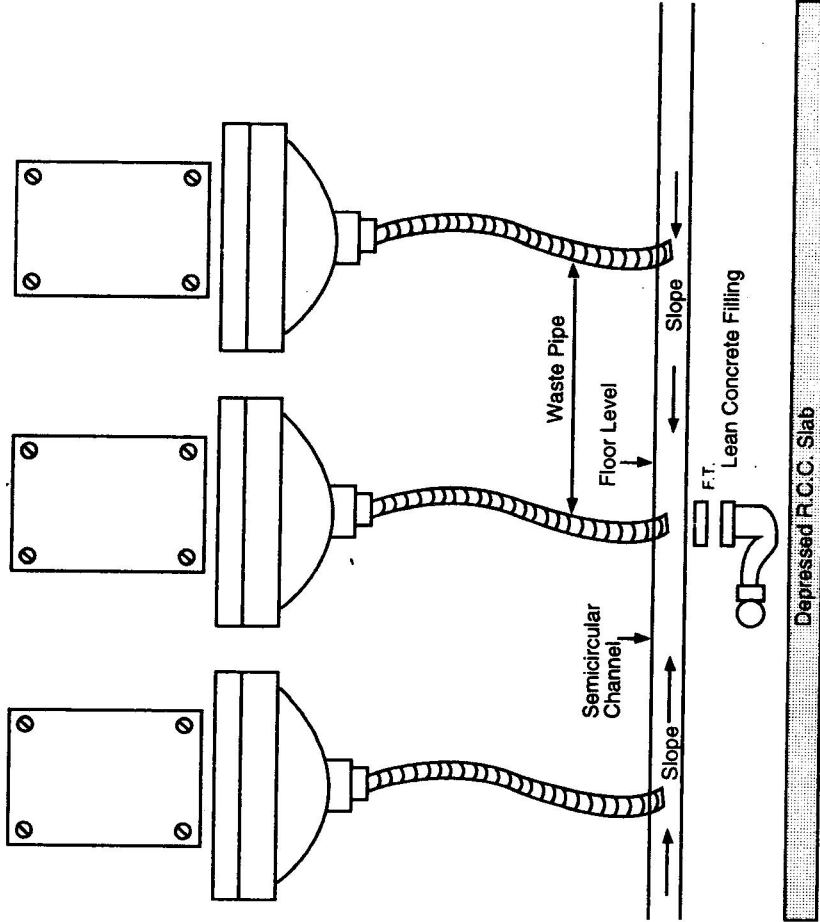
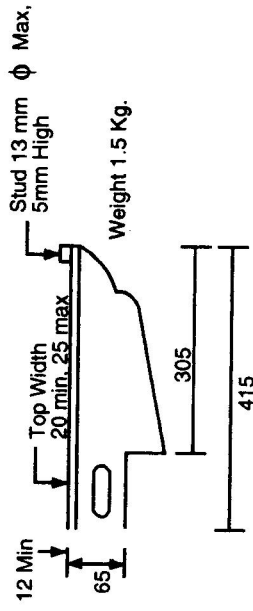
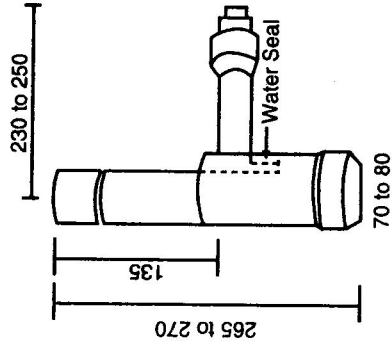


Fig. 1.3

TYPICAL ELEVATION OF 3 WASH BASINS IN A ROW

LOCATION :- GENERAL OFFICES - WASTE DISCHARGING IN SEMI CIRCULAR OPEN CHANNEL AND COLLECTED IN FLOOR TRAP).
 NOTES (1) SLOPE :- 1 IN 50 (2) F.T. - REFER QCTA CIRCULAR NO. 2 OF 1992
 WASTEPIPES :- PVC FLEXIBLE TYPE (32 MM ϕ)
 F.T. LOCATION PREFERRED IN CENTRE TO ACHIEVE MAX. SLOPE THEIR SUPPLY CONNECTIONS NOT SHOWN.



Note : Stud shall be provided for supports intended for glazed earthenware VIFEO-ware wash basins only.

QCTA CORE cell

CDO/SPG/-CPWD NIRMAN BHAWAN
 NEW DELHI - 110 011

QCTA. CIRCULAR NO. 1 OF 1993

**QUALITY CONTROL & TECHNICAL AUDIT CORE CELL
CENTRAL DESIGN ORGANISATION/SPG; CENTRAL P.W.D.
ROOM NO. 419, WING-'A', NIRMAN BHAWAN, NEW DELHI-110 011**

No. CDO/QCTA/SPG/G-2/301

Dated 19.4.1993

QCTA CIRCULAR NO. 2 OF 1993*

Subject : Fabrication and Welding of Steel Doors, Windows and Ventilators made of Hot Rolled Steel Sections and M.S. grills, Railings and Frames etc.

During the inspections by Quality Control Core Cell, it is noticed that generally contractors are fabricating and welding steel doors, windows, ventilators made of hot rolled sections, and mild steel grills, railings angle/tee section frames etc. at site. Invariably, the final product so obtained is found to be of unsatisfactory quality.

Under these circumstances, the DG(W) has decided as follows :—

The Engineer-in-Charge should ensure :

- (a) that all fabrication and welding etc. is done in an approved workshop;
- (b) that process of welding shall be flash butt welding for steel windows, ventilators and doors made from rolled steel sections. In other cases where flash butt welding is not possible the welding be done by suitable method to form solid fused welded joints conforming to IS : 1038-1983, para 6.1.1;

The Zonal Chief Engineers can approve the workshops after satisfying themselves about the equipment and performance of the workshops.

This order should be implemented with immediate effect.

Sd/-

(U.V.S. TYAGI)

**CHIEF ENGINEER; SPG PROJECT &
INCHARGE QUALITY CONTROL**

* During 1991, only two number 'QCTA Circulars' were issued, namely, (1) QCTA Circular No. 1 of 1991 Vide No. CDO/QCTA/SPG/G-2-270 dated 29th April, 1991 regarding "Quality Assurance in CPWD : Inspection & Follow-up Action". (2) QCTA Circular No. 2 of 1991 vide No. CDO/SPG/QCTA/G-2/279 dated 1st May, 1991 regarding "Payment for sub-standard work." In 1992, QCTA Circular No. 1 of 1992 was issued vide No. CDO/QCTA/SPG/G-2/220 dated 23rd June, 1992, regarding "Proper functioning of doors & windows". Second QCTA Circular has been issued, namely, QCTA Circular No. 2 of 1992 vide No. CDO/QCTA/SPG/G-2/306 dated 22.12.1992 regarding "Plumbing details - Installation of floor-trap". In 1993, QCTA Circular No. 1 of 1993 has been issued vide No. CDO/QCTA/SPG/G-2/154 dated 22nd February, 1993 regarding "Plumbing details - Wash Basin."

**DIRECTOR GENERAL OF WORKS
CENTRAL PUBLIC WORKS DEPARTMENT
NIRMAN BHAWAN, NEW DELHI - 110011**

No. CDO/QCTA/SPG/47

Dated 14.1.1994

Dear Shri

I am sure you share my concern for ensuring quality in works being executed by CPWD, both construction and maintenance. Today, it is not merely a matter of good policy to have 'quality' as a credo quality-consciousness is an inescapable need for survival and growth of an organisation, especially for a service organisation like C.P.W.D.

2. For quite sometime, widespread concern has been expressed about deterioration in quality of CPWD works. In order to maintain our credibility and to continue to enjoy the confidence and trust of the clients, measures for quality-assurance and adherence to the norms of quality system set-up in CPWD has to be accorded the topmost priority. In this endeavour, commitment from management can hardly be over-emphasized. Leadership, motivation and drive has to come from top and percolate down the organisation.

3. As demonstration of this commitment to quality assurance, you would agree, Chief Engineers should not just concern themselves with review of progress, coordination and general matters. You should undertake inspection of works, as frequently as possible, and must focus on quality-aspects of the works.

It is a matter of regret that various instructions/guidelines issued in the past from time to time, for making inspections of Q.C.T.A. Core Wing and Senior Officers (CE/SE/EE), effective in improving the quality of works, do not appear to have been taken seriously.

4. Further, I understand from QCTA Core Wing that replies to their inspection reports and observations are not furnished by the supervisory officers in time. Even the quarterly progress report of the works in progress required to be submitted to QCTA Core Wing, is rarely sent in time. I have to request you to look into this personally to remedy the situation.

5. I would like to press upon all the supervisory officers starting from Chief Engineers down below, that no compromise on quality would be tolerated. Serious view shall be taken of execution and acceptance of sub-standard work and disciplinary action initiated as and when deemed fit. Effective and timely supervision is required to prevent occurrence of defects and prompt action is to be taken to rectify/replace the defective work as and when it is noticed. It is felt that the sub-standard work should not be accepted even at the reduced rates.

It is impressed that no quarter should be given to complacency and casualness towards quality-control measures in our concerted effort to make excellence in quality hall-mark of CPWD works.

With best wishes

Yours Sincerely

Sd/-
(K.K. MADAN)

**DIRECTORATE GENERAL OF WORKS
CENTRAL PUBLIC WORKS DEPARTMENT
NEW DELHI**

No. DG(W)/CON/67

Dated 6.5.1994

MEMORANDUM

Attention of all the officers of the department is invited to paras 27.6.1 to 27.6.8 of C.P.W.D. Manual Vol. II, 1988 edition. In order to ensure adequate safeguards against pilferages and malpractices, it is imperative that the departmental officers should be meticulous in following these instructions.

Paras 27.6.1 to 27.6.8 of C.P.W.D. Manual Vol II, 1988 edition, are extracted and given in Annexure-I for ready reference. Other relevant instructions aimed at eliminating the incidence of pilferages are reiterated in the following paras.

1. In order to minimise the chances of pilferage of cement from the site of works, the cement godowns should be properly and effectively doubled locked, keys of one of the locks remaining with the department and that of the other with the contractor.
2. The pages of cement register should be as per Annexure-38, machine numbered and each page initialled by the E.E. The cement godown and the register should be checked by the A.E./ E.E. incharge of the work as per following :—
 - (i) At least weekly or fortnightly, respectively, in case of works at the headquarters of A.E./ E.E. and
 - (ii) Whenever they visit the site of work in case of works located outside the Sub-divisional/ Divisional headquarters.
 - (iii) In case of large concentrated projects like bridges etc. the E.E. should check the cement register at least fortnightly.
3. It will be the duty of the Executive Engineers to see that these instructions are strictly followed by all the Assistant Engineers working under them by actual inspection.

In addition to the existing instructions, the following instructions should also be strictly adhered to in future as additional safeguards against pilferage of diversion of materials issued from the central stores :—

- (a) For all works costing more than Rupees 10 lakhs and using cement, the contractor shall distinctly display a board at work site on the cement store indicating the opening balance on a particular date, receipt during the day, issue during the day and closing balance at the end of the day (The entries for receipts and issues shall be updated immediately on physical receipt and physical issue and also at the end of the day).
- (b) While issuing an indent for fresh cement/steel the balance material available at the site should be checked. The A.E. must record on the body of the indent, the balance of such material available at the time and date of issue of the indent which should be taken into account by the Executive Engineer before signing the indent.

- (c) At the time of receipt of the materials, not only the date but also the time of receipt may be mentioned in the cement register as well as in the MAS register. The entries should be made separately for each truck giving the gate pass number. The consignee should also indicate the time/date of receipt of material on the gate pass returned to the Central Stores through the transporter. Gate pass should be countersigned by A.E. for all quantities of cement received against indents of 10 tonnes and above.
- (d) The cement/steel & other materials received from Stores/Local purchase etc. on any particular day, shall not be used in the work or transferred to any other work for 24 hours from the time of receipt at site; for physical check and verification except in rare cases where there is emergent need and A.E. incharge permits and authenticates such use/transfer personally. Cement already available in the Store should ordinarily be consumed first, before issue from the new consignment. Similarly new steel items should be stacked in countable shape before these are used to facilitate physical check.

Sd/-
(N.S.K. RAO)
F.C to Director General of Works

(Issued from File No. 16/10/94 – VS.I)

Paras 27.6.1 to 27.6.8 of CPWD Manual Vol. II, 1988 edition

27.6.1 An unstamped but dated acknowledgement detailing full particulars of the materials including rates and value chargeable to him should immediately be taken from the contractor as soon as any materials required for issue to the contractor is made over to him.

27.6.2 Cement and steel are the major items which are stipulated for issue in most of the contracts in the Deptt. It should be clearly borne in mind that stores issued to the Contractors under the term of their contract are intended for the exclusive use and consumption on the work, for which these are issued. There is inherent risk of their pilferage and misuse if such stores are issued in bulk to contractors long in advance of their actual requirement. It should be ensured that the materials are not issued to contractors arbitrarily and without keeping eye on the actual requirements at site. To safeguard and prevent such invisible losses to Government it is essential that issues to contractors should be regulated and restricted to actual requirements.

27.6.3 Although the contracts for works provide for comparison of actual consumption of cement issued to the contractors and theoretical consumption after the completion of the works, the EEs should keep a broad check on the consumption of cement at various intermediate stages of works also to make sure that there is no pilferage and misuse of cement.

27.6.4 The theoretical consumption statement for consumption of cement on the work executed from the start of the work upto and including the work included in the bill should be invariably prepared along with every running bill. This should be got signed from the Contractor at the time of obtaining his signature on the running account bill so that he is aware of the basis on which the theoretical quantity of cement is worked out and it may be possible for the Contractor as well as the Department to exercise a check over the consumption of cement during the execution of the work. The theoretical quantity so worked out should be compared with the actual issue of cement as per cement register as on the last date of the measurement of the work. Should there be any difference beyond the normal limits of variations between these two quantities, such difference should be properly explained both for less or more consumption and the EE should go into such explanations and give his directions about the actual progressive recovery to be made from that bill. Any undue excessive variation should be reported to the SE of the circle for such orders as he may deem fit.

27.6.5 Various instructions regarding checking of cement godowns should be followed vigorously. It would be very desirable to check the cement godowns before a fresh indent for cement to the contractor.

27.6.6 For making comparison of the actual consumption of steel with the theoretical consumption, each diameter of steel bars should be treated as an individual item issued Departmentally and check on theoretical consumption should be applied to each diameter.

27.6.7 Theoretical consumption on statement for steel bars should be prepared along with every running bill. Should there be any case of issue being less or just equal in any particular diameter/section than the actual consumption, this should be properly investigated. If such issue diameterwise/sectionwise or in total is very much higher than the consumption, it should be generally ensured that balance steel is available at site in good condition and this should be certified by the Asstt. Engineer. Any serious discrepancies noticed should be reported to the SE. The issue of reinforcement or structural steel should not be made too much in advance of the actual requirements at site. Normally issue should not exceed beyond the requirements of the next two/three months at the site. However, depending on the type and importance of the work, availability and scarcity of steel, if more quantities are required to be issued in advance for any particular work, this should be done with specific approval of the EE. The steel issued to the contractors should be properly stacked at the site in a proper accountable manner till it is consumed in the work.

27.6.8 Similar precautions should be taken in the case of all other materials issued by the Department.

**QUALITY CONTROL & TECHNICAL AUDIT WING
CDO, CPWD, NIRMAN BHAWAN, NEW DELHI**

No. CDO/QCTA/SPG/G-2/806

Dated 13.7.1994

CIRCULAR NO. 1 of 1994

Subject : Use of Tee/Angle – Iron Sections in Door, Window and Ventilator Frames

During inspection of works by QCTA, it has been noticed that at places angle-iron sections are used for door/window frames. It has also been observed that in some cases, the agreement items provide for use of T-iron/Angle-iron frames. CPWD Specifications, however, provide for use of T-iron sections only, for door/window frames.

2. There is practical difficulty in fixing of screws for hinges in shutters wherever angle-iron frames are provided. This invariably results in poor workmanship in fixing of shutters.
3. It is, as such, brought to the notice of all concerned that only T-iron (and not angle-iron) sections are to be used for door, window and ventilator frames, as per CPWD Specifications. While preparing the NITs, this aspect may be kept in view and alternative provision for use of angle-iron section in frames should be deleted in the nomenclature of items and in particular specifications, as the case may be.

Sd/-
(P.B. VIJAY)
CHIEF ENGINEER (SPG) & INCHARGE, QUALITY CONTROL

**QUALITY CONTROL & TECHNICAL AUDIT CELL
C.P.W.D., NIRMAN BHAWAN, NEW DELHI**

No. CDO/QCTA/SPG/G-2/946

Dated 16.8.1994

Q.C.T.A. CIRCULAR NO. 2 of 1994

**Subject : Quality Assurance in CPWD – Recording of Observation on Quality Aspects
by Senior Officers**

The DGW, vide O.M. No. 28/7/86-WI(DG)/Cir. No.9/87, dt. 6.10.87, issued instructions that an 'Inspection Register' be introduced at every work site, in which CE/SE/EE, who inspect the works, shall record their observations along with the date and time of visit. It was emphasised that the visit of the Senior Officers to the site are not confined only to issues concerning progress, coordination and general matters, but also to exercise of effective quality control. Accordingly, it was desired that entry of the visit in the Inspection Register should be made even if no defects were observed or the inspection was limited to progress and other matters excluding quality control. Where necessary, EE/AE shall carry over such observations and defects to the site order book with cross reference in the Inspection Register.

2. Instructions on this subject have been reiterated from time to time. However, during inspections by the QCTA Wing, it has been observed that, in general, these instructions are not being observed and observations regarding defects in the work are not being entered in the Inspection Register by the Senior Officers. In a few cases, even the Inspection Register itself, has not been maintained. This is despite the fact that, in some cases, serious defects have been pointed out even during QCTA inspections.

3. It is imperative that control on the quality of work is exercised right from the beginning regularly by the Inspecting Officers and clear instructions are issued in this regard. It is also necessary to ensure compliance of these instructions in a properly recorded manner, as otherwise the system tends to become lax.

4. It is therefore, enjoined that CE/SE/EE, during their inspections record observations on quality and other important aspects in the Inspection Register. If for some reasons, the CE is not in a position to do so, he may direct the EE to record his observations in the Inspection Register and send a copy of those observations, to the CE by way of confirmation. Alternatively, the officers may issue inspection notes, copies of which should be pasted in the Inspection Register. It will be the responsibility of the Executive Engineer to ensure that the observation of the Inspecting officers for each and every visit are available in the Inspection Register either through recorded notes or through pasting the inspection notes. The underlying intention is that observations on the quality of work by different Inspecting Officers including those from QCTA set-up are available at one place.

5. It is also necessary that observations recorded in the Inspection Registers are reviewed during subsequent inspections to ensure their compliance. These are also required to be reviewed during QCTA inspections to assess the effectiveness of Quality Control Systems emanating from CE/SE/EE. Non-compliance of these instructions will be reported to ADG/DGW for suitable action.

Sd/-

(P.B. VIJAY)

**CHIEF ENGINEER (SPG) &
INCHARGE QUALITY CONTROL**

**QUALITY CONTROL & TECHNICAL AUDIT CELL
C.P.W.D., NIRMAN BHAWAN, NEW DELHI**

No. CDO/SPG/QCTA/G-2/964

Dated 18.08.1994

Q.C.T.A. CIRCULAR NO. 3 of 1994

Subject : Quality Assurance in CPWD – Inspection and Follow-up Action

From time to time, instructions have been issued regarding immediate compliance of the observations made by the QCTA core wing on the quality of works. These were reiterated in QCTA Circular No. 1 of 1991 issued vide No. CDO/QCTA/SPG/G-2/270, dated 29.4.91, in which it was emphasised that compliance reports should be sent by the EEs within 4 weeks of the receipt of Inspection Reports. CEs/SEs were also requested to pay personal attention to the issues considered serious enough. Further, in this office letter dated 14.1.94 addressed to all the Chief Engineers, it was impressed that no quarter should be given to complacency and casualness towards quality-control measures in our concerted effort to make excellence in quality a hall-mark of CPWD works.

2. In spite of this, not only the replies to Inspection Reports are inordinately delayed, the replies in many cases, are found to be evasive and not to the point. Timely responses are also not forthcoming from CEs/SEs wherever specific issues of serious nature are brought to their notice. Such a state of affairs is a matter of serious concern, which compromises the effectiveness of Quality Control System.

3. It is, therefore, necessary that compliance of the observations on the quality of works are closely monitored and reviewed. It will be the responsibility of the CEs and SE(Hq) of the Zone wherever posted, to monitor the compliance of QCTA Inspection Reports. Review of pending cases should be made by the Chief Engineers every month so that corrective actions are taken in time and action initiated against officers concerned for serious lapses. Non-compliance of these instructions will be viewed seriously.

Sd/-
(K.K. MADAN)
DIRECTOR GENERAL (WORKS)

**QUALITY CONTROL AND TECHNICAL AUDIT WING
CDO, CPWD, NIRMAN BHAWAN, NEW DELHI**

No. CDO/QCTA/SPG/G-2/1114

Dated 31.8.1994

CIRCULAR NO. 4 OF 1994

Some overhead tanks were constructed at various locations during eighties with the following parameters :

- (i) RCC shaft type staging
- (ii) 100 mm wall thickness for the shaft staging
- (iii) Single layer nominal vertical reinforcement in the shaft wall
- (iv) Single layer nominal hoop/circumferential reinforcement in the shaft
- (v) Spiral staircase with stairs coming out of the shaft either inside or outside the shaft wall.

Though the stresses in various components of such structures, when calculated on the basis of normal vertical and horizontal loads as laid down in various IS codes, may, *prima facie*, be within the permissible limits, some of these tanks have failed to perform well in the field.

There have been some instances of failure wherein the above type of staging has collapsed after a period ranging from 1 1/2 to 14 years from the date of commissioning, suggesting thereby, possibility of development of long term stresses and strains which may have triggered the collapse. The shaft wall in these cases is found to be almost entirely crushed and there are hardly any pieces retaining the semblance of their original shape.

Chief Engineers are advised that they should ensure that, in future, over head tanks with the above mentioned set of shaft parameters are not constructed in CPWD.

Attention of Chief Engineers is also invited to provisions of IS Code IS : 11682-1985 which lays down the minimum wall thickness and minimum reinforcement etc. to be provided in the shafts of such RCC tanks. It also lays down the design criteria to be followed for designing the shafts of such tanks. Some of the tanks constructed in late seventies and in eighties do not meet the criteria laid down in IS : 11682-1985, which came into force in the latter part of eighties.

Action should be taken immediately to get the overhead tanks of the above type, if existing anywhere, inspected thoroughly for signs of any distress in them. Suitable strengthening measures should be taken, wherever any signs of distress are observed. If necessary, CDO may be consulted for suitable strengthening measures.

Leakages, if any, from the tanks should be attended on top priority.

Sd/-
G.S. TAWARMALANI
ADG (TD)

**QUALITY CONTROL & TECHNICAL AUDIT CELL
C.P.W.D., NIRMAN BHAWAN, NEW DELHI**

No. CDO/QCTA/SPG/G-2/988

Dated 24.7.1995

Q.C.T.A CIRCULAR NO. 1 of 1995

Subject : Standard Proforma for Maintenance of Record of Chemicals/Paints

At present there is no proforma formally prescribed for the record of chemicals for anti-termite treatment and other chemicals used in the works. It has been observed that at some sites, the Proforma as for Cement Register, prescribed at Appendix-38 Page 308 of CPWD Manual Vol.-II of 1988 is being followed for chemicals also. This proforma for Cement register does not contain information regarding Batch No., Date of Manufacture and expiry of each lot of material, which is very important in the case of chemicals.

Accordingly, a proforma is enclosed for circulation to all field units of CPWD, for maintaining a record of chemicals. This Proforma shall also be used for paints/chemicals of all type and shall replace the proforma of any other type presently being followed.

Sd/-
S.L. KARUNAKARAN
CHIEF ENGINEER (SPG) &
INCHARGE QUALITY CONTROL

PROFORMA FOR PAINTS/CHEMICALS REGISTER

NAME OF PAINT/CHEMICAL										
Particulars of Receipt										
Date of receipt	Source of receipt with details if any	Batch No.	Dt. of manufacture	Dt. of expiry	Qty. received	Progressive Total	Dt. of Issue	Qty. Issued	Items of work for which Issued	Qty. Returned at the end of day's work
1	2	3	4	5	6	7	8	9	10	11

Particulars of Issue						
Net Qty. Issued	Progressive Total	Daily Balance in Hand	Contractor's Initial	J.E.'s Initial	Periodical check	
					By AE	By EE
12	13	14	15	16	17	18

**QUALITY CONTROL & TECHNICAL AUDIT WING
CDO, SPG, CPWD, NIRMAN BHAWAN, NEW DELHI**

No. CDO/SPG/QCTA/G-2/932

Dated 7.7.1995

Q.C.T.A. CIRCULAR NO. 2 of 1995

Subject : Centering and Shuttering for R.C.C. Works – Span exceeding 4.5 mtrs. and Height beyond 3.5 mtrs.

From time to time instructions have been issued to preferably use steel centering for long spans and higher roof heights. C.P.W.D. Specifications '77 Vol. I in para 5.2.2.3 stipulates that for spans exceeding 4.5 m and heights 3.5 m, the formwork has to be properly designed with horizontal and diagonal bracings to withstand various loads. Further, at paras 5.2.1 and 5.2.2 the specification provides steel as one of the alternatives to be used for formwork and centering.

In the light of the above, it is a matter of serious concern that the formwork, even for long spans and higher roof heights continues to be used without proper design, particularly when timber members are used. This has resulted in failure of centering and shuttering and consequent collapse of R.C.C members in few cases, recently.

It is, hereby, decided that henceforth for spans exceeding 4.5 mtrs. and for heights beyond 3.5 mtrs. only steel formwork shall be used. Necessary stipulation to this effect shall be made in all the NITs. For current agreements, if for some reasons, the use of steel centering and shuttering has not been specified, the staging shall have adequate horizontal and inclined bracings to ensure rigidity in both the directions as specified in para 5.2.2.3 *ibid*.

The JE/AE/EE incharge of the work will be held personally responsible for violation of the above instructions.

CEs shall bring the content of this circular to the notice of all concerned for immediate necessary action.

Sd/-
(K.K. MADAN)
D.G. (W)

**QUALITY ASSURANCE CORE WING,
C.P.W.D., NIRMAN BHAWAN, NEW DELHI**

No. CDO/SPG/QCTA/G-2/1469

Dated 6.12.1995

Q.C.T.A. CIRCULAR NO. 3 of 1995

**Subject : Prevention of Accidents in Government Colonies under the Maintenance of
CPWD – regarding Steel Gates in Boundary Wall**

It has been reported that a child died recently in an accident due to falling of one of the panels of a gate in the boundary wall of a Central Government Housing Colony, under CPWD maintenance, apparently due to damage to the gate in an earlier incident which was not duly reported to CPWD by the security staff of the colony under the client department. To prevent such accidents in future, following measures should be adopted by the field officers in respect of steel gates in the boundary wall of colonies etc. under their charge.

1. Special attention should be paid by the field officers to the quality of welding. The welding should be on both sides, continuous with no gaps or holes. Short lengths of structural members should not be allowed to be made up by welding. The excess flux should always be got removed.
2. The item of welding involved in steel gates should be provided for, measured and paid separately on linear measurement basis by deleting the welding element from the structural steel fabrication item of gates so as to ensure that the Contractor does not try to save on the same.
3. (a) Particular attention should be paid to the design of steel gates which should invariably provide for bracings and diagonal members in the panel so as to increase the structural rigidity.
(b) When the size of the gate opening is 4 meter or more, the guide-rails and rollers should invariably be provided regardless of the weight of the panel to ensure that the load of the panel is supported at both the ends and cantilever effect is avoided. Even where the gate is provided on such locations of the ground/road which is sloping, the area of opening should be perfectly levelled to enable provision of guide rails & rollers properly.

4. During maintenance, the gates should be inspected frequently to ensure that the damaged gates are detected even if not reported by residents, etc. During their inspection of the colonies, EEs should also specifically inspect the condition of heavy gates.

Sd/-
(S.C. Gupta)
CHIEF ENGINEER (SPG)
& INCHARGE OF QUALITY ASSURANCE

**DIRECTORATE GENERAL OF WORKS
CENTRAL PUBLIC WORKS DEPARTMENT**

No. DG(W)/MAN/2

Dated 24.4.1996

MEMORANDUM

Subject : Role and Functions of Quality Assurance Units in CPWD i.e. Core Wing at the Headquarters and other units in the Regions

The role and functions of Quality Control and Technical Audit wing are contained in Section 58 of CPWD Manual Vol. II with the restructuring and creation of Regions in CPWD and setting up of Quality Assurance Units in the Regions, the role and functions to be performed by the Quality Assurance Core Wing under CE(TSQ) and Regional Units headed by SE(TLQA) are given in the enclosed Annexure.

2. Quality Assurance operations cover much larger area in comparison to Quality Control functions and these have to be clearly understood by the officers manning the Q.A Units. Direct responsibility for ensuring proper quality of works as per approved specifications rests with the construction team i.e. EE, AE & JE. Quality control functions are also exercised by the ASW(QC) of the Circle as contained in paras 58.6 to 58.9 of CPWD Manual Vol. II. The Superintending Engineer exercises key role for management of Quality Systems and Procedures for works under his charge, who also takes final decision regarding acceptance of sub-standard work at reduced rates.

3. It is enjoined on all concerned that observations made by the Q.A. Units are attended to on priority and compliance reported. The SE(HQ)/SSW-cum-SE(HQ) of the zone shall be responsible to monitor the compliance of observations made by the Q.A. Units and bring cases to the notice of the CE for appropriate action where there is delay of more than 3 months.

4. The Regional Quality Assurance Units shall follow the guidelines and norms relating to Quality Systems and Procedures as laid down by the Quality Assurance Core Wing from time to time. Though the Regional Q.A Units will function under the direct control of the ADG concerned, the CE(TSQ) shall exercise general superintendence over the work of these units and obtain periodical reports, from these units.

5. Necessary amendment to CPWD Manual Vol. II Section-58 shall be issued separately.

Sd/-
(P.K. MATHUR)
SUPERINTENDING ENGINEER
(CONTRACTS & MANUAL)

ANNEXURE TO ORDER No. DG(W)/MAN/2 dated 17.4.96

Role and Functions of Quality Assurance Units in C.P.W.D. i.e. Q.A. Core wing at the Headquarter and Q.A. Units in the Regions

1. QUALITY ASSURANCE UNIT UNDER SE (TL&QA) IN THE REGION :

In general the Q.A Units shall exercise the role for management of Quality Systems & Procedures to achieve and sustain Quality of works executed by the CPWD and to offer necessary guidance to the field units in this regard.

Major Functions assigned to Q.A. Units are as under :

- (i) To carry out inspection of original works costing more than the SE's power of acceptance of tenders in general and maintenance works (including functioning of Enquiry Offices) from Quality Assurance angle on selective basis. Q.A. Units may also inspect any work irrespective of its value at its discretion.
In selecting works for inspection their uniqueness, complexities and special characteristics if any shall be kept in view. For effective quality assurance any major work shall be inspected 3 to 4 times during the progress of the work at various stages. Each Q.A. Unit headed by EE shall inspect 4 to 6 works per month out of which at least 25% works shall be maintenance/ special repair works.
- (ii) To carry out comprehensive examination & technical audit of at least 6 to 8 original works in a year (at least 2 works per zone) costing more than Rs. One crore. Such examination shall encompass all aspects of the work right from the requisition stage till its completion and payment of final bill.
- (iii) To provide guidance in setting up laboratories at various stations/work sites.
- (iv) To carry out periodic survey of new building materials & technologies coming to the market and make this information available to the field formations to ensure use of the best available materials/technologies in the works and also maintain uniformity of standards.
- (v) To review the performance of new materials and techniques introduced in the Department from time to time on the basis of the feed-back reports coming from the field.
- (vi) To convey observations regarding Electrical works having bearing on the planning and execution of civil works to the appropriate Unit in Electrical Wing.
- (vii) To inspect any work or carry out investigations and enquiries with regard to quality related aspects assigned by the A.D.G concerned/D.G.W.
- (viii) To submit quarterly reports in brief to CE(TSQ) as the headquarter covering.
 - list of major works inspected, common defects/deficiencies observed in the work and highlight of the functioning of the regional Q.A. Set-up.
 - comments on the performance of new materials and techniques observed during field inspections.
 - suggestions for enhancing the effectiveness of the Quality Systems and Procedures.

2. QUALITY ASSURANCE CORE WING AT THE HEAD QUARTER

The Quality Assurance Core Wing at the headquarters shall carry out the functions of Regional Q.A. Unit for New Delhi Region and Delhi Region. In addition, it shall perform following other functions :

- (i) To deal with policy issues pertaining to Total Quality Management System (TQM) for the C.P.W.D as a whole.

- (ii) To review the existing procedures regularly on the basis of feed back from regional units and to issue guidelines/instructions to ensure uniformity, consistency, and reliability in implementation of quality Systems and Procedures in the department.
- (iii) To lay down norms/guidelines for periodic inspection and effective functioning of Q.A. Units in the Regions/Quality Control teams at Circle level.
- (iv) To keep itself update with modern testing equipments and methods and disseminate information in this regard to all concerned in the Department.
- (v) To lay down the tolerance limits in respects of finished items for which such limits are not specified in C.P.W.D. specifications. Such tolerance limits will be fixed based on the accumulated experience of various works.
- (vi) To issue guidelines/instructions for assigning accountability at different levels for ensuring proper quality for execution of different items of works.
- (vii) To carry out investigations & enquiries with regard to quality related aspects for specific works or any other functions assigned by CE(TSQ)/ADG((TD)/DGW.

**QUALITY ASSURANCE (CORE WINGS)
CL, (TSQ), CPWD, NIRMAN BHAWAN, NEW DELHI**

No. TSQ/QA(CW)/G-2/653

Dated 5.6.1996

Q.A.C.W. CIRCULAR NO. 1

Subject : Timely Action/Reply to Q.C.T.A. Wing Observations.

Instructions have already been issued by the DG(W) vide QCTA Circular No. 3 of 1994, issued vide No. CDO/SPG/QCTA/G-2/964, dated 18.8.94 for close monitoring of the Q.C.T.A. inspection reports. SE(HQ) of the zone was also given the responsibility of monitoring the Q.C.T.A. inspection reports for the whole zone. Still it is seen that adequate attention is not being paid for timely compliance of the observations of the Quality Control Inspections.

In the case of one work recently, DG(W), CPWD has observed that senior officers do not respond timely to the letters of Quality Control Wing and any delay in taking action on the letters of Quality Control Wing defeats the very purpose of Quality Control which can be exercised during the progress of the work.

I am, therefore, directed to intimate all the CEs and SEs to pay prompt attention to observations of the QC Wing and to ensure that the field officers viz AE's and EE's comply with the observations of QC Wing and take effective action to prevent defects in the works.

Sd/-
(S.L. KARUNAKARAN)
CHIEF ENGINEER (TSQ)

DIRECTORATE GENERAL OF C.P.W.D.
OFFICE OF THE CHIEF ENGINEER
TECHNOLOGY DEVELOPMENT, STANDARDS & QUALITY ASSURANCE
ROOM NO. 424-A, NIRMAN BHAWAN, NEW DELHI - 110011

No. CE/TSQ/96-97/35

Dated 23.10.1996

Subject : Time-bound Programme for Clearance of Quality Assurance Inspection Reports

Your kind attention is invited to this office Memo. No. CE(TSQ)/CE's Estt./7 dated 26.7.96 detailing therein the activities of this zone. In that Office Memo., emphasis was laid on quality assurance aspect.

During a meeting with the senior officers of the CPWD, the Hon'ble Minister of U.A. & E. emphasised the importance of quality assurance in CPWD works and desired that CPWD officers should pay greater attention to the quality assurance aspect through personal involvement at all levels, particularly at higher levels.

A Presentation on "Quality Systems and Quality Management in CPWD" was made by the Department before the Hon'ble Minister of U.A. & E. on 1.10.96.

It cannot be denied that CPWD is a premier construction organisation and has created some wonderful structures and has earned laurels for the same. However, it is also a fact that the general perception of the quality of CPWD works has been that it is not the best and a lot needs to be done to improve the quality of works in general.

Vide DG(W)'s O.M. No. DG(W)/MAN/2 dated 17/24.4.96, the roles and functions of Quality Assurance Units in CPWD have been detailed. QCTA Circular No. 1 of 1991 details action to be taken on the Inspection Reports of the Quality Assurance Units.

On a review of pending Quality Assurance Cases, the situation appears to be distressing. More than one thousand cases have been pending for years together for want of positive response from the field units. In certain cases, there has been no response at all from any level other than the E.E. It is not known-how bills are allowed to be finalised without final settlement of quality assurance cases. The inevitable inference is that bills are being finalised by keeping some nominal amounts against QA paras and thereafter everybody forgets Quality Assurance Inspection Reports.

From QCTA Circular No. 1 of 1991, it may be seen that delay in attending to QA paras or unsatisfactory response to these paras may invite severe actions against the field staff. QCTA paras remaining un-settled for years together is unthinkable, in case we are serious about producing good quality work. In this connection, a copy of QCTA Circular No. 3 of 1994 issued vide CDO/SPG/QCTA/G-2/964, dated 18.8.94 is enclosed.

This office cannot allow a back-log of over one thousand Quality Assurance cases to remain pending further and will, therefore, be taking action in accordance with QCTA Circular No. 1 of 1991 after allowing for a grace period of two months from the date of issue of this letter.

All the Chief Engineers are requested to kindly chalk out a time-bound programme for clearance of all outstanding QA cases in their Zones. They may draw out their own programmes for final

settlement of all the outstanding QA cases of their Zones. I would request that the outer time limit may not be more than six months, but results should start showing in a period of one month. This office is preparing data for monitoring at its own level. Similar monitoring may be done at they Zonal and Circle levels.

Sd/-
(Shyam Kishore)
CHIEF ENGINEER (TSQ)

**DIRECTORATE GENERAL OF WORKS
CENTRAL PUBLIC WORKS DEPARTMENT**

No. CSQ/QACW/G-2/103

Dated 22.01.1997

QACW CIRCULAR NO. 2

To
All Zonal Chief Engineers (Civil)

**Subject : Monitoring progress of Settlement of Pending Quality Control/Assurance
Inspection Reports and Paras**

A review of pending Quality Control/Assurance Inspection Reports has indicated a huge backlog. In Delhi Region itself the total backlog in November, 96 was 1148. Out of this, about 40% have been pending for more than 5 years and out of these 40% about 40% are more than 10 years old. This indicates both the gravity of the situation and the indifference at various levels in setting the cases. The situation in other regions may not be different.

It may be that when CEs/SEs/EEs review the pending cases they would find that majority of the paras of the old IRs would be such where action has already been taken but reply from the appropriate level has not been sent to the QA Unit. There could be some paras where decision would still be needed at CEs/SEs/EEs level.

You would kindly appreciate that non-settlement of IRs results in non-settlement of final bills which gives rise to arbitration claims by the contractors. Non-settlement also sends wrong signal to the field staff and the contractors that quality is not of much importance and they need not worry unduly about quality as observation of QA units can be allowed to be buried over a period of time. This very thinking has perhaps led to the deterioration in quality in recent times and has necessitated strengthening of QA Units.

Though neglect in attending to Q.A. inspection reports promptly and properly calls for quite stringent action as already brought out in various circulars, yet, so far, it has been avoided. But now it may become inevitable in some cases if prompt action is not taken for settlement of old cases. You are, therefore, requested to kindly advise your EEs/AEs suitably in the matter.

DG(W) has desired that all CEs should have regular quarterly review of pending IRs. Similar review should be done at SEs level at monthly intervals. After such reviews CEs should send quarterly

statements to this office for DG(W)s perusal. The statement may be sent in the enclosed proforma. The first such report may be sent for the period ending 31.12.96 so as to reach this office by 20.1.97 and thereafter for every quarter ending March, June, September and December so as to reach this office by 20th of the succeeding months. A copy of these reports may also be sent to the respective regional SE(TLCQA) or SE(QA) as the case may be. While taking review meetings of their SEs the CEs may also review the work being done by the ASW(QA) attached to the circles and issue suitable instructions as needed, to the SEs though no report on this need be sent to this office.

Contents of this circular may please be brought to the notice of all EEs/AEEs/AEs under your control and the importance of the matter emphasised on them so as to avoid action being taken against them in accordance with QCTA Circular No. 1 of 1991 in case of their failure to act.

Sd/-
(SHYAM KISHORE)
CHIEF ENGINEER (CSQ)

1. ADG(TD), CPWD for his kind information.
2. SE(QA) Core Unit & Incharge Delhi Region, CPWD.*
3. 6 SEs(TLCQA) NR, ER, WR & SR*

* They will monitor timely submission of the quarterly report by the CEs of their respective regions and on receipt of copies of reports in their units, consolidate and send the consolidated zonewise statement to this office by the end of Jan., April, July and October for review in this office and for perusal of ADG(TD)/DG(W). The proforma attached should be suitably modified for this purpose. They should also obtain separate quarterly reports from the SEs of their region reg. Inspection Reports of the ASWs(QA) posted in the circles and carrying out QA works at circle level. This report should be reviewed at their level and shall not be sent to this office unless specifically asked for. But they should always be ready with the information so that whenever the same is asked for by this office they should be in a position to furnish the information promptly without any back reference to SEs.

All of them should computerise the data. They should seek access to computer from one of the CEs at their Headquarters, in case they do not already have a separate computer of their own.

They are also required to prepare a statement of pending cases immediately on the pattern of the statement prepared for Delhi Region and send the same to this office for perusal of ADG(TD)/DG(W).

They are also required to send a monthly statement of the inspection conducted by them in the enclosed proforma so as to reach this office by 10th of the succeeding month.

4. CE(Elect)I, CPWD, Vidyut Bhawan, New Delhi. He may introduce similar monitoring and review system in respect of electrical works and intimate to this office for perusal of DG(W).

5. Director of Horticulture, CPWD, I.P. Bhawan, New Delhi. He is requested to examine the Quality Assurance needs of horticultural works, if any, and suggest modalities. How the quality of new works and maintenance works is being ensured at present and what is the monitoring system. A detailed report in this regard may be sent to this office.

Sd/-
CHIEF ENGINEER (CSQ)

TARGET FOR THE YEAR 1996 - 97

WORKS COSTING RS. 50 LAKHS OR MORE	-	Nos.
" COSTING LESS THAN RS. 50 LAKHS	-	Nos.
" INTENSIVE EXAMINATION	-	Nos.
" MAINTENANCE WORKS	-	Nos.

Sl. No.	Name of			No. of works inspected during the month and how many intensive			No. of inspection Reports issued during the month	No. of rejoinders to replies issued during the month	No. of cases & paras finally closed during the month	Remarks
	Zone & C.E.	Circle & S.E.	Division & E.E.	Costing Rs. 50 Lakhs or more	Costing less than Rs. 50 Lakhs excl. maint. works	Maintenance works				

Total upto the end of this month during the current financial year :

No.

Dated :

Submitted to CE(CSQ), CPWD, A-424, Nirman Bhawan, New Delhi. (SE/QA/SE(TLCQA))

QUARTERLY REVIEW OF PENDING INSPECTION REPORTS RELATING TO QUALITY ASSURANCE

(Cases pending for more than 3 months from the date of issue of Inspection Report)

Region :

Zone :

Quarter ending :

Sl. No.	Name of Circle with name of the S.E.	Total No. pending at the start of the Quarter		No. settled during the quarter		No. added during the quarter		Total No. pending at the end of the quarter		Remarks (Indicate how many IRs/Paras settled are older than 5 years.)
		I/Reports	Paras	I/Reports	Paras	I/Reports	Paras	I/Reports	Paras	

No.

Dated :

- Submitted to CE(CSQ), CPWD, A-424, Nirman Bhawan, New Delhi.
- Copy to SE(QA)/SE(TLCQA) of the Region.

Notes :—

- This statement has been seen by the C.E.
- Last review meeting of the SEs was taken by the C.E. on.

SE(HQ) cum SSW

**DIRECTORATE GENERAL OF WORKS
CENTRAL PUBLIC WORKS DEPARTMENT**

No. CSQ/QACW/G-2/104

Dated 22.1.1997

QACW CIRCULAR NO. 3

To
All Superintending Engineers (C&E)
Central PWD
Director of Horticulture.

Subject : Sub-standard work

The CPWD Agreements with the Contractors do not provide for any sub-standard work and, therefore, as a matter of principle no sub-standard work should be allowed to be done. In case any sub-standard work has been done by the contractor, the same is to be got dismantled immediately and redone in accordance with the specifications. EE/AEE/AE/JE have no authority to accept or allow acceptance of sub-standard work.

SE of CPWD has, however, been authorised that in very rare cases he may decide for recorded reasons not to demolish a particular sub-standard work and accept it at reduced rate subject to the condition that such an accepted sub-standard work has been certified to be structurally sound for the purpose for which it has been designed. No officer less than the EE has to give such a certificate of structural soundness except in the contracts within the competence of AEE/AE where AEE/AE himself may give such a certificate.

It has come to notice during Quality Assurance Inspections that in some cases EEs/AEEs/AEs/JEs have accepted or allowed acceptance of sub/standard works at their own level, for which they were not empowered and it became embarrassing for the SE to give any cogent reasons for acceptance of such defective works.

It is also noticed that minus extra items are being sanctioned in many cases for the sub-standard work done to avoid the substandard work coming to the notice of SE. This practice is not desirable and should be stopped forthwith.

It is enjoined on all SEs/EEs/AEEs/AEs/JEs not to allow any substandard work to be executed. SEs while exercising their discretion for acceptance of substandard work, should be very careful and should have adequate recorded reasons for not dismantling such substandard work. In case rectifiable defective work is accepted, even at reduced rates, it will indicate failure on the part of the SE and his team to abide by the quality policy and the quality objectives of the department.

The above applies to materials used in the works and the workmanship also. It equally applies to the supply of materials/products procured/taken by the Department through any source. IS certification mark on factory produced materials/goods will not absolve the field engineers from their responsibility of exercising quality control/assurance through appropriate field/laboratory tests etc.

SEs of the circle, who exercise quality assurance/control through their ASW(QA) should brief them suitably in the matter regarding sub-standard works/workmanship/materials as explained above. While writing the ACRs of their field staff as well as the contractors, they should keep their attitude to quality aspect of the works also in view.

Contents of this circular may be brought to the notice of all EEs/AEEs/AEs/JEs under your control for strict and effective compliance.

Sd/-
(SHYAM KISHORE)
CHIEF ENGINEER (CSQ)

**DIRECTORATE GENERAL OF WORKS
CENTRAL PUBLIC WORKS DEPARTMENT**

No. CSQ/QACW/G-2/105

Dated 22.1.1997

CIRCULAR NO. 4

To
All Zonal Chief Engineers

Subject : Maintenance of Buildings

In accordance with Para 138 of CPWD Code, "Each divisional officer will maintain a register, in the prescribed form i.e. CPWD Form 25 of all immovable Government properties in charge of the Department within his division".

Para 139 of CPWD Code lays down that all buildings, whether permanent or temporary, residential or non-residential, which are under the administrative charge of the CPWD shall be regularly inspected by the JE every six months and the JE shall maintain a register of inspection of buildings for all buildings in his charge for this purpose wherein he will record the result of his inspection. The JE should bring out defects of serious nature to the notice of his AE. The AE will similarly inspect each building in his charge once a year and record the results of his inspection in the register. He will take remedial action for the defects brought out to his notice by the JE as well as those discovered by him during his inspection. He will bring to the notice of his EE any serious defect requiring his attention.

The EE will inspect all the buildings where serious defects have been brought to his notice and make sure that adequate steps have been taken to remove them. He will also inspect the more important buildings at least once a year and ensure that the AE and the JE have discharged their duties properly in this respect.

The EE should bring to the notice of his SE cases where he has reasons to doubt the structural soundness of any building and the SE will take such action as he considers necessary.

The SE should as far as possible, inspect periodically all important buildings and furnish to his CE a complete report in the month of February every year, to the effect that all the buildings in the charge of his circle have been duly inspected by the respective officers as prescribed in Para 139 of CPWD Code and suitable action taken to preserve them in good condition. He should also bring to notice any specific cases of buildings which he considers structurally unsound and unsafe.

The CE, on the basis of SE's report regarding structurally unsoundness and unsafe buildings, will take decision to either strengthen or demolish such buildings.

The above guidelines of the CPWD Code are brought to the notice of all concerned for strict compliance. In case the above practice is not being followed in any particular Zone/Circle/Division/Sub-Division/Section, the same should be followed henceforth to avoid any mishaps in future and also to keep a proper watch and control over proper and effective utilisation of maintenance and special repairs funds. There have been complaints of improper or mis-utilisation of such funds.

Though there are no guidelines in the CPWD Code for such regular inspections for structures other than buildings, similar periodical inspection of overhead water supply tanks with independent stagings are needed in view of some past and recent failures of such overhead tanks. Similar regular periodic inspections are needed for effective and fault free functioning of Electric sub-station systems. Central Air Conditioning Systems, Lift Systems, Electricity Generation Systems, Bulk Sewage Treatment Systems and bridges & roads being maintained by CPWD. For some of these, systems of regular periodic inspections for their effective functioning have been prescribed, though not strictly followed and for the others a system has to be devised.

It is enjoined on all the officers concerned with the maintenance of buildings and other structures as well as various services to maintain a system of regular periodic inspection with a view to maintain their structural soundness and effective functioning for the purpose for which they are meant and for the period for which they are required to serve effectively

It is suggested that while assessing the performance of their subordinates the officers should keep in view their subordinates performance in maintaining the buildings and other structures as well as the various services in sound and functional condition also.

The provisions of the CPWD Code and Manuals regarding effective and qualitative maintenance of buildings, other structures and various services may please be brought to the knowledge of all the field officers upto the level of JEs. A very close and effective coordination with the occupants of the buildings is needed to improve the image of the department.

Sd/-
(SHYAM KISHORE)
Chief Engineer (CSQ)

**DIRECTORATE GENERAL OF WORKS
CENTRAL PUBLIC WORKS DEPARTMENT**

No. CSQ/SE(QA)CW/96/G2/296

Dated 11.3.1997

QACW CIRCULAR NO. 5

To
All Superintending Engineers (Civil) CPWD
(Incharge of Circles)

**Subject : Intimation of Award of Work on Contract to Quality Control/Assurance Unit in
C.P.W.D.**

It is already known to all that, with the creation of the post of Chief Engineer (CSQ) at the Headquarters of CPWD and that of SEs(TLC & QA) at Regional levels, the Quality Assurance set up has been strengthened as well as decentralised. At the headquarter level, SE(QA) and at the circle level, ASW(QC) have already been functioning.

Whereas, Regional SEs(TLC & QA) will be reporting to Chief Engineer (CSQ), while being administratively under the regional ADGs, ASWs(QC) will be reporting to regional SEs(TLC & QA), while being administratively under the SEs of the circles. As such it is necessary that SEs (TLC & QA) and SE(QA) Core Unit only will endorse copies of their inspection reports and will send required periodical review reports and reports on new technologies and materials, etc. to Chief Engineer (CSQ). ASWs (QC) will not send copies of their inspection reports to Chief Engineer (CSQ) except in case of works costing more than Rs. 1.00 crore. They will, however, endorse copies of all their inspection reports and also send periodical review reports and reports on new technologies and materials etc. to the respective regional SEs(TLC & QA). However, for any clarifications and guidance on policy matters, which only the Core Unit can provide, the ASWs(QC) may write direct to Chief Engineer (CSQ)/Superintending. Engineer (QA) Core Unit.

Superintending Engineers are requested to bring the contents of this Circular to the notice of their ASWs(QC).

Sd/-
CHIEF ENGINEER (CSQ)

**DIRECTORATE GENERAL OF WORKS
CENTRAL PUBLIC WORKS DEPARTMENT**

No. CSQ/QACW/G-2/97-98

QACW CIRCULAR NO. 6

It has been decided that Q.A. Inspections of the civil works of ADG(B) i.e., Border Fencing works along Indo-Pak Border and I.B.B. Works along Indo-Bangladesh Border shall be looked after by Quality Assurance Core Wing only.

Sd/-
(SHYAM KISHORE)
CHIEF ENGINEER (CSQ)

**DIRECTORATE GENERAL OF WORKS
CENTRAL PUBLIC WORKS DEPARTMENT**

No. CSQ/QACW/G-2/97-98/212

Dated 11.03.1998

QACW CIRCULAR NO.7

DG(W), after reiew of the returns being received by Quality Assurance Units has decided that the following returns are not serving any fruitful purpose and should be discontinued :

1. Quarterly statement showing the progress of A/R & M/O and S/R works costing Rs. 50,000/- & above.
2. Quarterly return of final bills for works costing Rs. 50 lakhs and above.
3. Quarterly report for monitoring progress of settlement of pending Quality Control/Assurance inspection reports and paras.

It was also decided that only the following return is required to be submitted to the Quality Assurance Units :—

“Quarterly Statement showing the progress of original works costing Rs. 70 lakhs and above”.

The proforma for this report will be the same as the proforma on which the report is being sent to CTE. However, this report shall be sent by the SEs directly to the concerned SE (Quality Assurance) Core Wing/S.E.(TLCQA) of the region, with a copy of CE (CSQ).

Sd/-
(V.S.DIXIT)
CHIEF ENGINEER (CSQ)

**DIRECTORATE GENERAL OF WORKS
CENTRAL PUBLIC WORKS DEPARTMENT**

No. CSQ/QACW/G-2/97-98/209

Dated 9.03.1998

QACW CIRCULAR NO. 8

Subject : Improvement of Quality of C.P.W.D. Works

A committee was formed by DG(W), CPWD to give recommendations on the issue of improving quality of CPWD Works. The recommendations made by the committee have been accepted by DG(W).

A copy of the report is sent herewith for implementation with immediate effect.

Sd/-
(V.S.DIXIT)
CHIEF ENGINEER (CSQ)

**REPORT OF COMMITTEE CONSTITUTED FOR
“IMPROVEMENT OF QUALITY OF CPWD WORKS”**

1.0 Introduction

A meeting was held under the chairmanship of DG(W) on 27.1.97 to discuss the measures to be taken to improve the quality of CPWD works. It was decided to form a Committee to deliberate on issues relating to improvement in quality of CPWD works.

The following were decided to be the members of the Committee as conveyed vide letter No. CSQ/QACW/G-41/139, dt. 04.02.97 :—

- | | |
|--|--------------------------|
| 1. Shri Chandra Pal, CE (now ADG) | — Chairman |
| 2. Shri S.C. Gupta, CE (since ret'd.) | |
| 3. Shri Deepak Narain, CE | |
| 4. Shri Jag Mohan Lal, CE | |
| 5. Shri S.L. Karunakaran, CE | |
| 6. Shri Shyam Kishore, CE (since ret'd.) | |
| 7. Shri S.K. Mittal, SE | — Coordinating Secretary |

2.0 Terms of Reference

The Committee was required to give recommendation on the issue of improving quality of CPWD works including fixing responsibility of officers of CPWD at each level in respect of planning as well as execution of various items of works including maintenance works. The Committee was also required to evolve a check list for guidance of planning and site staff and suggest punitive and deterrent measures when quality is not upto the mark.

3.0 Meetings

The Committee held 16 meetings for deliberation on the specific issues. (26.2.97, 25.3.97, 24.4.97, 29.4.97, 11.8.97, 20.8.97, 29.8.97, 11.9.97, 22.9.97, 30.9.97, 7.10.97, 14.10.97, 20.11.97, 12.1.98, 13.1.98 and 9.2.98).

4.0 Recommendations :—

1. Planning Stage

- (a) Sr. Architect/Chief Architect should convene a meeting with officers of Civil and Elect. Incharge of Planning and execution, before sending preliminary drawings to clients.

The meeting should be convened by :—

For important projects – Chief Architect

For other projects – Senior Architect

- (b) Technical scrutiny of detailed drawings should be done before technical sanction, involving all disciplines (in planning and field) and client keeping in view the following :—

(i) Availability of local materials and construction practices

(ii) Feasibility of services

(iii) Life of project

(iv) Maintenance aspects

(v) No. of parts into which the project is to be divided and sequence for inviting tenders alongwith Bar Chart.

- (c) Following should be available at the time of T/S :

(i) Architectural – Detailed drawings and specifications including items where rates depend on pattern & size.

some such items are :—

- Wardrobe details
- Flooring & dado pattern – size of tiles/slabs
- Toilets
- Kitchen
- Staircase & Railing
- Grills

(ii) Structural drawings for foundation

(iii) Structural drawings of superstructure upto slab at level 2

(iv) Plans of internal and external services. Planning and design of external services should be got vetted from the authority who has technically sanctioned the main building.

(v) Value Engineering analysis essential for projects costing more than Rs. 5 crores, optional for others. This has been explained briefly in Annexure 1.

(d) Preparation of NIT – Steps to be taken for Quality Control are to be spelt out, *inter-alia* the following :—

- (i) Whether pre-qualification required.
- (ii) Whether specialised agencies required.
- (iii) Confirming that adequate trained staff is available for the work.
 - SE/EE to give site training by asking new staff to see similar on going projects.
 - Continuity of officers necessary for sufficient period especially for major works.
- (iv) Confirming that materials to be issued to the contractor are available.
- (v) Emphasis in NIT on requirement of special T & P and resources like shuttering material etc. including trained workmen and supervisory staff.
- (vi) In case of important and specialised works the provision in standard contract form regarding the employment of Engineer may be suitably improved in respect of qualification, experience, number of Engineers, and duration of their presence at site of work. Special condition may be incorporated over and above clause 36 of the standard contract form.
- (vii) Confirming the availability of site, approval of local bodies to plans and funds.
- (viii) Provision of sample quarter/unit in prescribed time frame. Also refer para 4 (v).
- (ix) Suitable provision for control chart [Refer Para 4(ii)]
- (x) Authority approving NIT may consider whether one or more sources/quarries for material like bricks, sand, ballast etc. are required to be mentioned.
- (xi) Monopoly/Proprietary items should be avoided to the extent possible.
- (xii) If brands are to be specified, minimum 3 brands of equivalent prices may be specified.
- (xiii) Where cement and steel are to be arranged by contractor, four or more major reputed brands of equivalent prices may be specified with the approval of Chief Engineer.
- (xiv) Special efforts may be made for getting steel/aluminium doors/windows fabricated from proper workshops.

2. Training of Staff

- (a) (i) 3 months compulsory foundation training of JEs, within one year of joining, preferably at the time of joining.
- (ii) More emphasis on specifications and site visits during foundation training.
- (iii) Compulsory to pass departmental exams. in simple accounts and specifications after training. Probation to be extended till exam. is passed.

(In CPWD Manual Vol. I, Section 4, Para 13(d)(iv) the following modification may be made :—

Existing

Junior Engineers : The Junior Engineers have to pass a departmental examination in simple accounts within two years.....

Revised

Junior Engineers : The Junior Engineers have to pass a departmental examination in simple accounts & specifications within two years

- (b) In refresher courses of AE/EE level, course on Quality Assurance with emphasis on specifications, to be included.

3. Enlistment and Performance of Contractor

- (a) The benchmark for quality of works completed in last 5 years for enlistment in Class-I and below should be not less than "GOOD" and for enlistment to Class-IA it should be not less than "VERY GOOD". The element of subjectivity in assessing the quality may be reduced to the extent possible. For assessing the Quality of non CPWD works, a team of 3 officers headed by one SE may inspect and assess the quality. One of the members of the team may preferably be SE(QA)/EE(AQ) of the region.
- (b) For contracts amounting to more than Rs. 1 crore, a copy of letter of award should also be endorsed to CE(CSQ) for keeping a watch on receipt of performance reports of concerned contractors. The endorsement should indicate the Registering authority, category, registration number, date, period of validity and zone of operation.
- (c) The performance report dossier should be invariably consulted at the time of enlistment/ revalidation.

4. Execution

(i) Materials

- (a) EE to keep a watch on availability of materials stipulated for issue.
- (b) Samples of materials should be approved by EE and signed by him and contractor and preserved till end of the project.
- (c) Although testing of materials is a very important requirement for quality control, often testing is not carried out by AE/JE at site till the lapse is pointed out by an Inspecting Officer. It is essential that the officers who have to get the work executed at site should be aware of the various tests required to be carried out during the progress of work and should be adequately prepared for the same before the actual work starts. A consolidated test register duly signed by EE should be issued from the Division Office soon after the award of work.

It will be convenient for the EE to keep a watch over regular testing of materials while making payment at the stage of each running bill. For this purpose, a proforma as given in Annexure-2 may be prescribed. The first five columns of the proforma should be filled by the AE/JE and checked by EE in advance and copies as required made thereof. The remaining columns will be filled by AE/JE with each running bill and checked by EE before making payment.

(ii) Control Chart

Handling the entire project at a time during inspection for the purpose of quality control is a very tedious exercise and results are not commensurate with the efforts put in.

In order that the inspection of work and recording of measurements are carried out systematically, the Project may be divided into a convenient number of parts with the help of a control chart. The convenient parts into which the contract may be split up for control purposes may be (a) one floor of one block, or (b) one floor of the wing, or (c) length of road work, etc. A sample control chart for construction of 64 quarters in 4 blocks with each block providing for 16 quarters is enclosed at Annexure-3. The first column shows the items for which work will be inspected at a time for the purpose of record of measurements. This is really a summary of major items in schedule of quantities of Agreement.

In this control chart, the entire project has been divided into 608 parts (4 x 152). It will be quite convenient for AE/JE at site to check one part at a time and to satisfy himself that the same has been executed properly as per specifications. In the sample control chart, one part for brick work has been taken as one floor consisting of 4 quarters. For this item, at a particular point of time, there are two possibilities. Either the brick work in this floor is completely in order or there is a deficiency in some

part. In the first case, it can be measured, while in second case, it is not to be measured. Similarly, the water supply and sanitary pipes, joints etc. should be completed and inspected at a time at least in one floor before these are concealed. Similarly, during inspections it is found that some fitting or the other is missing from doors and windows. If the parts in control chart show door and window fittings in one floor, the AE/JE will not enter measurements even if a single fitting in the floor is missing or not functioning properly.

The JE/AE incharge of work should keep the chart upto date by colouring etc. of portions of chart which have been completed satisfactorily and found fit for measurement. Measurement of work included in a part should not be recorded till JE/AE have coloured that parts in token of satisfactory completion of work represented by that part.

While the importance of inspection of work during progress cannot be over-emphasised, it will take much less time for the EE to check a work which is in order as compared to the time required to go on pointing out each and every defect observed during inspection. This chart will also facilitate the contractor to point out parts which he has completed satisfactorily so that these are duly taken in measurements.

In new works, the chart should be made in consultation with the contractor and should be duly signed by both the parties i.e. the Contractor and the Executive Engineer.

(iii) Sub-standard work

- (a) As a pre-requisite for Quality Assurance, Sub-standard Work should not be measured for payment.
- (b) Where it is not possible to dismantle and redo the substandard work and structural soundness is not adversely affected, such work and any other subsequent work connected to it may be measured only after written permission of the EE in case of works costing upto Rs. 30 lakhs. For works beyond Rs. 30 lakhs, written approval of SE will be necessary.

(iv) Part Rate/Secured Advance

The work of providing and fixing should not be paid on part rates on the ground that providing has been done and fixing has not been done. In such cases secured advance should only be paid, as applicable.

(v) Approval of samples for items of work

Before taking up the finishing work on a large scale, full scale sample should be prepared for repetitive items. Such samples should be approved by EE/SE. Some examples are :—

- (a) Frames and shutters for doors/windows.
- (b) Water supply, drainage and sanitary lines & fittings.
- (c) External & internal finishing.
- (d) Flooring including levels and slopes and dado.
- (e) Electrical switch board/electrical fittings/points.
- (f) Door/window fittings.
- (g) Kitchen.
- (h) Sample quarter for Residential areas.
- (i) Sample unit like corridor, toilet, room in case of non-residential areas.

(vi) Deviation

No deviation in the quantity of any item should be made at site without the prior approval of the

competent authority. No extra/substituted item should be executed without the prior approval of the authority who has accorded technical sanction.

(vii) **Contractor's Engineer**

It should be ensured that contractor's engineers are present at site and supervise the work effectively in terms of the agreement.

5. Inspections

(a) (i) The programme of Inspection of all works in a division, should be drawn up by EE quarterly. The minimum number of inspections, for each work, will be 1 for every 2 bills for works at HQ and 1 for every 3 bills for works outside the HQ. A copy of this programme should be sent to S.E.

(ii) Similarly, SE will draw up programme for inspection of various works in his circle. In particular, for contracts accepted by SE and above and other important works, the programme for inspection shall be so drawn that at least one inspection is carried out during execution of each work and for each of the following stages :—

At SE's HQ

- (a) Upto 3rd RA Bill
- (b) 4th to 6th RA Bill
- (c) 7th to 9th RA Bill and so on

Outside SE's HQ

- Upto 5th RA Bill
- 6th to 10th RA Bill
- 11th to 15th RA Bill and so on.

(iii) All officers shall ensure issue of instructions after inspection. These may be issued by way of recording in the inspection register at site or by issue of inspection notes, a copy of which is required to be pasted in the inspection register. The inspection note of SE during the stages mentioned above should be available on record before passing 3rd/5th RA Bill, 6th/10th RA Bill, 9th/15th RA Bill and so on. If this is not available on record, prior permission of Chief Engineer shall be taken before payment is released. However, the inspection shall be carried out before the next bill.

The instructions to be complied by contractor shall be carried on to Site Order Book for ensuring compliance. Action taken report on the inspection note issued by an Inspecting Officer, should be given by EE within one month. During next inspection, earlier Inspection notes should be reviewed by Inspecting Officers.

(b) **Check list**

As and when any important item is taken up for execution, JE/AE should go through the specifications and make a check list. This check list should be got approved from EE. The 'important' items *inter-alia* include foundation including excavation/lean concrete, RCC work/concrete work including reinforcement and shuttering, brickwork, cast-in-situ mosaic flooring, doors & windows, plumbing i/c water supply pipe lines, roof treatment, earth filling etc.

Sample check lists for items of concrete for raft, columns/beams/slabs, water supply lines, brick work and plastering are enclosed for guidance.

6. Coordination meetings at site

During execution of works, coordination meetings should be held at regular intervals. For tenders approved by CE and above, these meetings shall be convened by SE. For tenders approved by SE and EE, these meetings can be convened by EE. For works located at Headquarters, co-ordination meeting shall be held at least once in a month. For works located outside the Headquarters, the meeting shall be held at least once in three months. Minutes of such meetings shall invariably be issued.

Representatives of all departments/agencies involved in the works should attend these meetings. Architects/planners should also be invited, whenever needed.

In the co-ordination meeting, along with progress of work, various co-ordination problems, hindrance etc. should be sorted out. It will be necessary to prepare sequencing of various activities involved. Therefore, an Integrated bar chart/CPM chart for various activities including services should be prepared and reviewed in the meetings.

Some of the co-ordination problems which are generally noticed are mentioned below :

- (a) Non-availability of various drawings i/c services drawings.
- (b) Chase cutting for conduits after plaster work is completed.
- (c) Non-laying of pipes in time for entry of cables inside the building.
- (d) Not deciding location of Junction Boxes and providing the same before plastering.
- (e) Lightning conductors are laid on roof damaging the water proofing treatment.
- (f) Requirements for Water Supply & electrical lines for wet riser & fire alarm system not visualised.
- (g) For fixing electrical fittings, openings are not left and false ceiling is cut.

Co-ordination for handing over project on its completion to the client will rest with the SE(C). However, in predominantly electrical works, this responsibility will rest with SE(E).

7. Responsibility for Quality

In respect of all works, the responsibility of various officers for checking of materials and workmanship of items of works shall be as given below. However, this does not absolve Junior Engineer and other officers of their responsibility to get the work executed as per specifications and provisions of Manual.

	Works > 30 Lakhs	Costing upto 30 Lakhs
A. Materials		
(a) Sand, stone metal & chips, bricks, ord. glass panes	JE & AE	JE
(b) Timber, paints, polish, door, shutters, windows, door/window fittings, sanitary and water supply pipes & fittings, special glass panes	JE & AE	JE
(c) Marble, granite, kota stone and similar items	AE & EE	AE
(d) Cement and steel	AE & EE	JE & AE
B. Items of work		
(a) Foundations upto plinth	AE & EE	JE & AE
(b) Brick masonry/Stone masonry	JE & AE	JE
(c) Centering & Shuttering excluding sunshades/shelves	AE & EE	JE & AE
(d) Reinforcement & RCC	AE & EE	JE & AE
(e) Structural steel work	AE & EE	AE
(f) Steel work	AE	JE & AE
(g) Aluminium work	AE & EE	JE & AE

Works	Costing > 30 Lakhs	upto 30 Lakhs
(h) Wood work/wood substitutes	AE & EE	JE & AE
(i) Flooring - CC, mosaic, glazed/ ceramic tiles	AE & EE	JE & AE
(j) Flooring & Cladding - marble, granite, kota, sandstone etc.	AE & EE	AE
(k) Plastering, painting & polishing	JE & AE	JE
(l) Joints in pipes i/c testing, slopes in flooring i/c verandah, balcony, toilets, terrace	AE & EE	JE & AE
(m) Bitumen painting of roofs	JE & AE	JE
(n) Water proofing treatment	AE	JE & AE
(o) Fittings of doors/windows	AE	JE & AE
(p) False ceiling work	AE & EE	AE
(q) (i) Storage tanks	AE & EE	JE & AE
(ii) Sluice valves, fire hydrants	AE	JE & AE
(iii) CI/Hume pipes & specials and their lead caulked joints	AE & EE	JE & AE
(r) (i) Manholes i/c covers & frames	JE & AE	JE
(ii) CI inspection bends & chambers	JE & AE	JE
(s) General quality of work with particular reference to lines & levels/adherence to drawings & specifications & functionality	EE & SE	AE & EE
C. Other important materials/items	To be decided by tender accepting authority	

5.0 Conclusion

Quality Assurance can not be achieved only by random inspection of works in progress. In order that good quality of work is achieved, we have to strive for it right from the initial planning stage. Staff entrusted with the execution has to be properly trained. Continuous efforts are necessary to enlist contractors of proven track record. The work has to be divided into suitable number of parts for facilitating Quality Control during execution. The involvement of Senior Officers in works and frequent inspections by them will go a long way in improving the quality of works. The co-ordination and synergy amongst the various disciplines is essential for better clients satisfaction by way of improved quality.

The committee is of the view that with the adoption of the measures recommended in the report, there will be more cohesiveness in the performance of the Department; more sense of responsibility at various levels and alround improvement in the quality and speed of construction.

Sd/- (CHANDRA PAL) ADG(S&P) CHAIRMAN	Sd/- (SHYAM KISHORE) CE (RETD)	Sd/- (S.L. KARUNAKARAN) CE	Sd/- (JAG MOHAN LAL) CE
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Sd/- (DEEPAK NARAIN) CE	Sd/- (S.C.GUPTA) CE(RETD)	Sd/- (S.K. MITTAL) COORDINATING SECRETARY
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ANNEXURES

SL. NO.	REFERENCE	PARA
1.	Concepts of Value Engineering	1 (c) (v)
2.	Proforma for Mandatory Tests	4 (i) (c)
3.	Control Chart	4 (ii)
4.	Check Lists	5 (b)
	(a) Raft	
	(b) Columns/Beams/Slabs	
	(c) Brick work	
	(d) Plastering	
	(e) Water supply lines	

ANNEXURE - I

VALUE ENGINEERING

1. **Introduction.** Value Engineering is an organized, creative technique directed at analysing the functions of a product, service or a system with the purpose of achieving the required functions at the lowest overall cost consistent with all the requirements which comprise its value, such as performance, reliability, durability, maintainability, appearance, etc. Value Engineering aims at cost improvement, not necessarily cost reduction, but in most cases VE leads to cost reduction. Value is defined as needed performance at minimum cost. In actual application VE consists of a series of step by step techniques to identify unnecessary cost and then eliminate it. Since VE is an organised, systematic approach, implementation is carried out in well defined steps or phases as explained below.

2. **Selection of Project :** A subject item or project for VE study is selected either on the basis of the estimated cost or on the basis of high potential for cost reduction. If at the conceptualisation and project planning stage, the project is examined through VE technique, maximum benefit can be achieved as the cost incurred by that time is almost Nil. More delay means more investment and less scope of saving. In a building project, it is appropriate if this technique is applied when the draft detailed estimate has been prepared. At this stage, architectural drawings basic structural drgs. as well as cost of various items are available. With these details it is most convenient to carry out the VE study.

3. **Selection of Participants :** Participants for the VE study are taken from all concerned disciplines and organisations such as

- (a) Users/clients.
- (b) Planners, Architects, Structural Designers and Services Planners
- (c) Construction Engineers i.e. Civil & Electrical Engineers, Incharge of Project
- (d) Maintenance Engineers both Civil & Electrical.

4. **Team Formation :** For detailed analyses either all the participants can work in a group or may be divided into a few *inter alia*.

- (a) Space utilisation
- (b) Structural systems
- (c) Specifications, finishing and ancilliary items
- (d) Services.

5. **Information Phase :** All information relevant to the project is collected which includes surveyed site plan, Geo-technical investigation report, Architectural & Structural drawings, specifications, processes, material and process cost, etc.

6. **Function Phase :** In this phase function analysis is done and basic and secondary functions of the project and its components are identified. The cost of each component is ascertained and also inter-relationship of cost and functions is analysed.

7. **Creative Phase :** This is an important and interesting phase generating maximum ideas for alternative means of accomplishing the basic functions. Every idea, howsoever ridiculous or bizarre, generated during this brain storming session is considered. The objective is to generate maximum number of ideas.

8. **Analytical Phase :** The ideas generated in the creative phase are subjected to the process of comparison and screening with reference to function and performance such as reliability, durability, appearance etc. The different ideas are clubbed, divided or modified to arrive at a final set of alternatives to accomplish the desired functions in conformity with the specifications.

9. **Evaluation Phase :** Attempts are made to estimate cost for each of the feasible alternatives selected in the previous phase in order to arrive at comparative evaluation. The selected alternatives are then arranged in order of suitability considering all aspects, especially cost on a total life-cycle basis.

10. **Recommendation Phase :** The selected alternatives are presented to top management/competent authority bringing out the full comparative position of cost as well as technical ranking. Major changes in design are also described briefly with sketches, drawings & models as appropriate.

11. **Implementation Phase :** If the recommendations are accepted, the alternative design of the scheme is put through for construction. The VE Team maintain a close watch on implementation.

These phases are not water tight divisions. These can be suitably modified as per requirement.

ANNEXURE-2

PROFORMA FOR MANDATORY TESTS TO BE ATTACHED WITH RUNNING BILLS

Name of the work :
Agreement No. & Date :

Division/
Sub-Division

Sl.No.	Item	Quantities as per Agreement	Frequency as per Specification	No. of tests reqd.	R.A. Bill No.	Upto date Qtys.	No. of tests reqd.	No. of tests Actually carried out	Remarks
1	2	3	4	5	6	7	8	9	10

Signature of JE
Signature of AE
Signature of EE

Sig. of JE
Sig. of AE
Sig. of EE

CONTROL CHART
CONSTRUCTION OF 64 QUARTERS (LOAD BEARING
FOUR STOREYED + MUMTY)

	BLOCK I							BLOCK II						
	FP	GF	FF	SF	TF	TER	EXT	FP	GF	FF	SF	TF	TER	EXT
Excavation & Lean Concrete	1													
RCC in FP	2													
BW in FP & DPC	3													
Lean Concrete for Flooring		4	5	6	7	8								
BW upto Lintel Level		9	10	11	12	13								
Door/Window Frames		14	15	16	17	18								
Lintels		19	20	21	22	23								
BW above Lintel		24	25	26	27	28								
Shuttering		29	30	31	32	33								
Reinforcement		34	35	36	37	38								
Concreting		39	40	41	42	43								
Rendering		44	45	46	47	48								
BW in partition walls		49	50	51	52	53								
Internal Plaster		54	55	56	57	58								
GI Pipes Internal		59	60	61	62	63								
SCI Pipes below Floor		64	65	66	67	68								
WP of Depressed Floor		69	70	71	72	73								
Railings		74	75	76	77									
Tank at Terrace						78								
GI Pipes External						79	80							
RWP							81							
SCI stacks						82	83							
External Plaster/Finishing	84	85	86	87	88	89	90							
WS Fittings		91	92	93	94	95	96							
Sanitary Fittings/Drainage		97	98	99	100	101	102							
Door & Window Shutters		103	104	105	106	107								
Shelves		108	109	110	111	112								
Cupboards/Pelmets		113	114	115	116									
Kota Stone Platforms		117	118	119	120									
Internal White Wash - 2 coats		121	122	123	124	125								
External Colour Wash - 2 coats	126	127	128	129	130	131	132							
External Connections							133							
Repair to Finishing	134	135	136	137	138	139	140							
Final Coat on Walls	141	142	143	144	145	146	147							
Final Coat of Painting		148	149	150	151	152								

ANNEXURE - 4 (A)

CHECK LIST OF RCC RAFT

Name of Work	:
Name of Contractor	:
Agreement No.	:
1. Date of Inspection	
2. Location	

3. Material used for concrete whether tested :	
(a) Sand	Yes/No
(b) Coarse aggregate	Yes/No
(c) Water	Yes/No
(d) Admixture, if any	Yes/No
4. Raft top levels whether provided as per details.	Yes/No
5. Architectural /structural drawing correlated	Yes/No
6. Whether location of construction joint has been discussed with EE & he has approved	Yes/No
7. Cleaning over water proofing surface & construction joint done	Yes/No
8. C.C. cover blocks of 60 mm, thickness provided (min. 2 in one square metre area)	Yes/No
9. Reinforcement placement as per relevant structural drawing checked	Yes/No
10. Layout of columns as per relevant structural drawing checked	Yes/No
11. Placement of shuttering plates and key board for proper construction joint with shuttering oil	Yes/No
12. Cement slurry applied on construction joint before pouring of concrete	Yes/No
13. Trained masons available	Yes/No
14. Concreting to start from farthest point to nearest point with respect of weight batching plant	Yes/No
15. Concrete mix has been designed	Yes/No
16. Plasticiser being used	Yes/No
17. Adequate number of Concrete Vibrators in working condition available	Yes/No
18. Slump checked	Yes/No
19. Sample cubes taken	Yes/No
20. Signature of JE	
21. Signature of AE/AEE	
22. Signature of EE	

ANNEXURE - 4 (B)

CHECK LIST FOR COLUMNS/ BEAMS/ SLABS

1. Date of Inspection	
2. Drawing No.	
3. Location	
4. Whether materials used conform to relevant specifications ?	
(a) Sand	Yes/No
(b) Coarse Aggregate	Yes/No
(c) Water	Yes/No
(d) Admixture, if any	Yes/No/N.A.
5. Whether structural drawings correlated with Architectural drawings ?	Yes/No
6. Whether the centre line of column/beams checked with reference to grid lines as per Architectural Drawings	Yes/No
7. Whether treatment of Expansion joint, wherever required, is done ?	Yes/No
8. Whether cleaning, repairing and approval of shuttering plate, application of quality shuttering oil is done ?	Yes/No
9. Whether shuttering is in true plumb & vertical and properly done & maintained during concreting	Yes/No

10. Whether reinforcement detailings, there placement are as per structural drawings ?	Yes/No
11. Whether proper gauge binding wire is used and with full cross binding & tightening of reinforcement bars with stirrups ?	Yes/No
12. Whether required minimum cover to reinforcement is maintained ?	Yes/No
13. Whether stainless steel cramps, angle irons for holding stones & any holding arrangement for electrical/ mechanical services placed in position as per requirement ?	Yes/ No/ N.A.
14. Whether conduits for various electrical/mechanical/ fire fighting/ other services have been seen & approved by JE(E)/AE(E) ?	Yes/No
15. Whether concrete of approved design mix within maximum permissible water cement ratio is used ?	Yes/No
16. Whether admixture of good brand (quality approved by Engineer-in-Charge) is used ?	Yes/No
17. Whether technical supervision at batching Plant/mixer and at point of concreting done ?	Yes/No
18. Whether concreting is placed within initial setting time of mixing ?	Yes/No
19. Whether proper compaction with vibrator is done ?	Yes/No
20. Whether the concreting has been done in a lift not exceeding 1.5 m ?	Yes/No
21. Whether cubes as per requirement filled for testing ?	Yes/No
22. Signature of JE	
23. Signature of AE/AEE	
24. Signature of EE	
Post Concreting :	
25. Whether shuttering stripped off as per specification and laitance removed immediately thereafter ?	Yes/No
26. Whether proper arrangement of curing & curing period maintained as per specification ?	Yes/No
27. Whether hacking of RCC surface by proper hacking tool for subsequent plastering/ finishing is carried out.	Yes/No
28. Signature of JE	
29. Signature of AE/AEE	
30. Signature of EE	

ANNEXURE - 4 (C)

CHECK LIST FOR BRICKWORK

1. Date of Inspection	
2. Drawing No.	
3. Location	
4. Whether materials used conform to relevant specifications & whether mandatory tests done ?	
(a) Sand	Yes/ No
(b) Bricks	Yes/ No
(c) Water	Yes/No
5. Whether structural drawings co-related with Architectural drawings ?	Yes/No
6. Whether the centre line of brickwork with reference to grid lines as per Architectural Drawings ?	Yes/No
7. Whether bricks soaked in water before use for sufficient period ?	Yes/No
8. Whether queen closers are used at junction of walls ?	Yes/No

9. Whether brickwork is in true plumb & vertical and all layers truly horizontal ?	Yes/No
10. Whether graduated wooden straight edge or storey rod being used for keeping height of brick courses uniform ?	Yes/No
11. Whether wall height being constructed in a day is being restricted to 1 m height ?	Yes/No
12. Whether parts of wall left at different levels are raked back at an angle of 45 degrees or less with the horizontal ? (Toothing is not to be permitted)	Yes/No
13. Whether top courses of all plinths, parapets, steps and top of walls below floor and roof slabs laid with brick on edge ? Whether marucona provided at corners in such brickwork ?	Yes/No
14. Whether thickness of joints in brickwork is kept 1 cm +/- 20% ?	Yes/No
15. Whether mortar of approved mix within maximum permissible water cement ratio is used ?	Yes/No
16. Whether all horizontal and vertical joints are being filled ?	Yes/No
17. Whether proper arrangement of curing & curing period maintained as per specification ?	Yes/No
18. Whether date of work done written ?	Yes/No
19. Signature of JE	
20. Signature of AE/AEE	
21. Signature of EE	

ANNEXURE - 4 (D)

CHECK LIST FOR PLASTERING

1. Date of Inspection	
2. Drawing No.	
3. Location	
4. Whether materials used conform to relevant specifications & whether mandatory tests done ?	Yes/No
5. Whether surface cleaned of all loose mortar and efflorescence ?	Yes/No
6. Whether all conduiting and electrical piping done ?	Yes/No
7. Whether all doors, windows etc. fixed ?	Yes/No
8. Whether all defects of brickwork/CC/RCC rectified ?	Yes/No
9. Whether pre-curing of surface done ?	Yes/No
10. Whether 2.5 m long aluminium straight edge & plumb bob being used to check verticality and evenness of surface ?	Yes/No
11. Whether 15 cm x 15 cm bunda at every 2 m horizontally & vertically being provided to serve as gauges ?	Yes/No
12. Whether uniform groove provided at junctions of wall plaster and ceiling plaster ?	Yes/No
13. Whether mortar of approved mix within maximum permissible water cement ratio is used ?	Yes/No
14. Whether proper arrangement of curing & curing period maintained as per specification ?	Yes/No
15. Whether date of work done written ?	Yes/No
16. Signature of JE	
17. Signature of AE/AEE	
18. Signature of EE	

CHECK LIST FOR WATER SUPPLY LINES

1. Date of Inspection	
2. Drawing No.	
3. Location	
4. Whether materials used conform to relevant specifications & whether mandatory tests done ? Yes/No	
5. Whether plumber employed is licensed plumber or not ?	Yes/No
6. Whether plan for piping system has been prepared and got approved ?	Yes/No
7. Whether all pipes and fittings are ISI marked ?	Yes/No
8. Whether a sample system has been prepared and got approved ?	Yes/No
9. Whether clamps provided at specified spacing ?	Yes/No
10. Whether pipe lines checked at required pressure before covering ?	Yes/No
11. Whether weight of flushing pipe checked ?	Yes/No
12. Whether flushing cistern is ISI marked and internally painted with bitumastic paint ?	Yes/No
13. Whether fittings like wash basin, sink pan, cistern, bib cock, stop cock, wheel valves etc. are ISI marked ?	Yes/No
14. Whether PVC water storage tank is ISI marked ? If not, whether sample sent for testing ?	Yes/No
15. Signature of JE	
16. Signature of AE/AEE	
17. Signature of EE	

**DIRECTORATE GENERAL OF WORKS
CENTRAL PUBLIC WORKS DEPARTMENT**

No. CSQ/QACW/G-2/111

Dated 31.03:1999

QACW CIRCULAR NO. 9

Subject : **Rebound Hammer Test**

As per list of mandatory test for concrete, given in Chapter 5 of CPWD Specifications 1996, Vol. II, Rebound Hammer Test is a mandatory test. But during site inspections, it is seen that site staff is still unaware of this test and the test is not being conducted. It is therefore necessary that all EEs should procure Rebound Hammer immediately and conduct this mandatory test without fail, in case of all works where CPWD Specifications 1996 are applicable. SEs should monitor the procurement of rebound hammer and also should ensure hammer testing of each structural member, before rendering work is started.

This test involves two operations. Firstly the rebound hammer is to be calibrated as per site conditions. This calibration is to be done for each type of mix i.e. 1:2:4, 1:1½:3 etc. Secondly, the testing of each and every RCC structure is to be done at each floor on attaining 28 days strength. Detailed procedure is given in Specifications. However, a step-by-step procedure is enclosed herewith as Annexure-A for ready reference. Also the proformas for entering the test results are enclosed as Annexure-B.

Sd/
(V.S. DIXIT)
CHIEF ENGINEER (CSQ)

HAMMER TEST RECORD (PART - I)

TABLE 1 : RECORD OF TESTING OF REFERENCE CONCRETE TEST CUBES

Reference Cube Set No
Water/ Cement Ratio
Cement **Concrete Mix**
Brand/Make of Cement
Location of Cement Plant
Stone Aggregate **Sand**
Source of stone Aggregate **Source of sand**
Nominal size **Grading Zone**

Reference cubes filled in presence of (Sign)														Tested in Presence of (Sign.)				
			Cont.			Deptt.			7-Day Strength			28 Day Strength		Cont.		Deptt.		
Date of Sampling	Serial No. of cube	Identification of Cube	Engr.	Cont.	J.E.	A.E.	E.E.	Date of test	Age at test (days)	Individual cube strength	Average cube strength	Individual cube strength	Average cube strength	Contr. Engn.	Contractor	J.E.	A.E.	E.E.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	1.									√	√	-	-					
	2.									√	√	-	-					
	3.									√	√	-	-					
	4.									-	-	√	√					
	5.									-	-	√	√					
	6.									-	-	√	√					

Whether Reference set of cubes passes or fails :

Passes/ Fails

P.S. If Fails Cross the Table with Red ink and Start afresh

TABLE 2 : REFERENCE REBOUND INDEX MEASUREMENT

Rebound Values As Read during Hammer Test on Two cast side faces										Contr's Signature			Dated Sign of Inspecting Officer		
Cube Sl.No.	Cube Identification No.	Date of concreting	Date of test	Age at Test (days)	Face	Reading on each face	9 Av. Rebound Index	Corrected Rebound Index (R.L.)	Reference Rebound Index (Av. of cubes)	Contr. Engr.	Contractor	Jr. Engr.	Asstt. Engr.	Exec. Engr.	Remarks
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DATUM REFERENCE															
4.															
5.															
6.															
STANDARD REFERENCE															
7															
8.															
9.															
10.															
11.															
12.															
13.															
14.															
15.															
16.															
17.															
18.															
<p>Note : 1. If Rebound value of a cube varies by more than $\pm 25\%$ of datum reference, values of those cubes are to be excluded.</p> <p>2. If more than 4 cubes are thus excluded, all cubes are to be rejected and process repeated.</p>															

HAMMER TEST RECORD (PART-II)-REBOUND INDEX MEASUREMENT OF STRUCTURE

Location of structural Element													Contr's Signature Officers			Dated Sign. of Inspecting		
Bl- ock No/ floor level	Stru- ctural Ele- ment No.	Date of concre- ting	Date of test	Age at Test (days)	Loca- tion of Test Spot	Dire- ction of Ham- mer (Horiz/ Up/ Dn)	Re- bound Values As Read- ing During Hammer Test	Av. rebo- und Read- ing with out corre- ction	Corre- cted Rebo- und Read- ing	Average correct- ed Re- bound Index (R.I.)	Corre- cted R.I. Refer- ence R.I.	Grad- ing	Contr. Engr.	Contr- act	Jr. enr.	Asstt. Engr.	Exec. Engr.	Re- mar- ks
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
					Top													
					Left													
					Mid													
					Bot/ Right													
					Top													
					Left													
					Mid													
					Bot/ Right													

Grading to be given in Col. 13

Grading	If value in Col. 12 is	Grading mean
A	> 125%	Very Good
B	125% < Value > 100%	Good
C	100% < Value > 75%	Satisfactory
D	75% < Value > 50%	To be accepted at Reduced Rates
E	Value < 50%	To Reject work

**CENTRAL PUBLIC WORKS DEPARTMENT
DIRECTORATE GENERAL OF WORKS
QUALITY ASSURANCE CORE WING**

No. CSQ/QACW/G-2-2000/145

Dated 2nd June, 2000

QACW CIRCULAR NO. 10

Subject : Unsatisfactory Work Having Serious Defects

It is noticed that in some areas, the buildings have started showing distress much before their designed life is over. This is apparently due to substandard quality of construction done. To check such substandard quality of construction, DG(W) has decided that the following procedure shall be adopted :—

- A. Chief Engineer (CSQ), while inspecting a work, shall categorize that work/important item of work as 'Unsatisfactory' which contains defects serious enough to affect the life and utility of that work/item of work.
- B. If Superintending Engineer (QA), Core Wing finds a work/important item of work as unsatisfactory during his inspection, he shall immediately refer such case to Chief Engineer (CSQ) for inspection.
- C. Similarly, if Superintending Engineer (TLQA) of a region finds a work/important item of work as unsatisfactory during course of his inspection, he shall immediately refer such case to ADG of the region. ADG may inspect the work if he feels necessary. On the basis of such inspection or otherwise, ADG may either refer the case to CE (CSQ) for inspection or he may himself take necessary action to get the work rectified.
- D. In cases, where reference is made to him, CE (CSQ) shall inspect the work and if he finds that there are serious defects in the work/important item of work, which may affect its life and utility, he may categorise the work/item of work as unsatisfactory.
- E. Once a work/item of work has been categorized as unsatisfactory, a D.O. letter shall be written by the CE (CSQ) within 2 weeks of such inspection, to the Zonal Chief Engineer with copies to ADG (S&P), ADG (TD), Regional ADG, Chief Engineer (Vig.) and Superintending Engineer-in-charge of work, for taking immediate corrective action. Chief Engineer (CSQ) shall also depute Superintending Engineer (QA) to prepare a detailed report about such unsatisfactory work/important item of work with photographs etc.
- F. In such cases of unsatisfactory work, Chief Engineer (CSQ) shall inform the concerned authority for immediate action to :
- (i) Transfer EE/AE/JE responsible, to non-field post for a minimum period of 3 years.
 - (ii) Send complete case to Chief Engineer (Vig.) for further investigation in a time-bound manner.
 - (iii) Debar contractor for suitable period.
- G. The Technical Sanctioning Authority shall ensure that the defective work/item of work is rectified in a time-bound manner. Suitable corrective steps to dismantle and redo the work or to rehabilitate the work shall be taken.
- H. In respect of unsatisfactory work/items of work, the date of completion and completion certificate shall not be recorded till defects are rectified to the satisfaction of the authority who has technically sanctioned the work.

Sd/-
(V.S. DIXIT)
CHIEF ENGINEER (CSQ)

**CENTRAL PUBLIC WORKS DEPARTMENT
DIRECTORATE GENERAL OF WORKS
QUALITY ASSURANCE CORE WING, NIRMAN BHAWAN, NEW DELHI**

No. CSQ/QACW/G-2/99/146

Dated June 2, 2000

QACW CIRCULAR NO. 11

Subject : **Improvement of Quality of CPWD Works**

DG(W) has decided that henceforth the following should also be incorporated in the NIT, for improvement of quality of works:

1. Stipulation of mixer machines in the contract having arrangement of weighing water for controlling W.C. ratio in case of volumetric mix :

For works costing more than Rs. 5 crores, weigh batching and design mix shall be made mandatory. However, on smaller works, where weigh batching cannot be adopted, concrete mixers having arrangement of weighing water and controlling W.C. ratio should be stipulated in the contract for proper control on W.C. ratio. A simple water dosing attachment has been developed by CDO and details of the same have already been circulated to all Chief Engineers for adoption in the works.

2. Use of proper cover blocks :

The main cause of corrosion of reinforcement in concrete is inadequate cover available to the reinforcement bars. To avoid displacement of bars in any direction and to ensure proper cover, only factory made round type cover blocks should be used. This may be made mandatory in agreements.

3. Storage of steel bars :

It is seen that in many cases, the reinforcement bars are placed directly on the ground. In rainy season, due to lack of drainage, the water accumulates causing considerable corrosion of steel. To avoid this, the steel bars should be stored about 30 to 45cm above ground. A coat of cement wash should be given to steel bars, which are likely to be stored for a long time. In places where rainfall is heavy, steel bars may be stored in protective environment to reduce corrosion. Necessary provision be made in the NIT for the above.

Sd/-
(V.S. DIXIT)
Chief Engineer (CSQ)

**CENTRAL PUBLIC WORKS DEPARTMENT
DIRECTORATE GENERAL OF WORKS
QUALITY ASSURANCE CORE WING, NIRMAN BHAWAN, NEW DELHI**

No. CSQ/QACW/G-2/99/147

Dated June 2, 2000

QACW CIRCULAR NO. 12

Subject : **Testing of BIS Marked products**

As per CPWD specifications and Circular No. CSQ/SE (S&S)/EE-I/04-61 dated 07.01.98, it is not mandatory to test the B.I.S. marked materials. Accordingly, in general, materials bearing B.I.S. mark are not being tested.

However, it has been observed that, in some cases, the materials bearing B.I.S. mark, have failed when subjected to required tests.

DG(W) has, therefore, decided that B.I.S. marked items should also be got tested, beyond certain quantity of the various items, required on the works. Only important tests, which govern the quality of the product, may be carried out and their frequency may also be kept lower. The Technical Sanctioning Authority may decide the quantity limit as well as the test categories.

Sd/-
(V.S. DIXIT)
CHIEF ENGINEER (CSQ)