

व्यापक परिचलन में मसौदा

ACB	क्रमांक
डब्लू आर डी 23/11-33	22 nd Dec' 11

तकनीकी समिति : जल संसाधन परियोजनाओं के कार्य मापन एवं लागत विश्लेषण विषय समिति (23/11-33)

- जल संसाधन विभाग परिषद् डब्लू आर डी सी के सभी सदस्य
- जल संसाधन परियोजनाओं के कार्य मापन एवं लागत विश्लेषण की विषय समिति डब्लू आर डी 23 के सभी सदस्य
- रुचि रखने वाले अन्य निकाय

महोदय/यों,

उपरोक्त तकनीकी कमेटी की 14वीं बैठक के निर्णय अनुसार निम्नलिखित मसौदों की एक कापी हमारी वेबसाइट www.bis.org.in पर पोस्ट की गई है।

Doc No.	Title
23(567)	चक्रीय वेधन और विस्फोटन द्वारा भूमिगत उत्खनन की इकाई दर के विश्लेषण के लिए प्रपत्र (आई एस 14749 का पहला पुनरीक्षण)

आपसे अनुरोध है कि आप कृपया इस मसौदों का अवलोकन करें और अपनी सम्मतियों को यह बताते हुए भेजे कि अंततः यदि यह मसौदा राष्ट्रीय मानक के रूप में प्रकाशित हो जाये तो इस पर अमल करने में आपके व्यवसाय अथवा कारोबार में क्या कठिनाइयाँ आ सकती हैं।

सम्मतियाँ भेजने की अंतिम तिथि : 25-02-2012 है।

आपसे अनुरोध है कि उपरोक्त तिथि तक हमें अपनी सम्मतियाँ संलग्न प्रोफोर्म में भरकर wrd.bis@gmail.com पर भेजने का कष्ट करें। वेबसाइट से मसौदा डाउनलोड करने में कठिनाई अनुभव करने की स्थिति में आप हमें हार्ड कॉपी के लिए लिख भी सकते हैं। यदि उपरोक्त तिथि तक हमें कोई सम्मति प्राप्त नहीं होती है अथवा सम्मति में केवल भाषा संबन्धी त्रुटि पाई जाती है तो, उपरोक्त प्रलेख पर हम आपकी अनुमति मानकर उसे अंतिम रूप दे देंगे। यदि कोई सम्मति तकनीकी प्रकृति की पाई जाती है तो, उसे विषय समिति के अध्यक्ष के परामर्श से अंतिम रूप दिया जाएगा अथवा आवश्यकता होने पर उसे विषय समिति के परामर्श के बाद अंतिम रूप दे दिया जाएगा।

धन्यवाद।

निर्लिखित

जे. सी. अरोड़ा
प्रमुख (जल संसाधन विभाग)

**DRAFT IN WIDE
CIRCULATION**

REFERENCE	DATE
WRD 23/ T- 33	22 nd Dec'11

TECHNICAL COMMITTEE: MEASUREMENT AND COST ANALYSIS OF WORKS FOR RIVER VALLEY PROJECTS
SECTIONAL COMMITTEE, WRD 23

ADDRESSED TO:

- a) ALL MEMBERS OF WATER RESOURCES DIVISION COUNCIL (WRDC)
- b) ALL MEMBERS OF MEASUREMENT AND COST ANALYSIS OF WORKS FOR RIVER VALLEY
PROJECTS SECTIONAL COMMITTEE, WRD 23
- c) OTHERS' INTERESTED

Dear Sir(s),

As per the decision taken in the 14th meeting of the sectional committee, we are posting the draft standard as mentioned below on the BIS website www.bis.org.in for your ready reference. **The additions in the document are underlined and the deletions are also suitably indicated.**

Doc No.	Title
Doc. WRD 23 (567)	Proforma for analysis of unit rate of underground excavation by cyclic drilling and blasting (first revision of IS 14749)

Kindly examine these drafts standards and forward your views stating any difficulties which you are likely to experience in your business or profession, if these are finally adopted as National Standards.

Last date for comments : 25-02-2012

Comments, if any, may please be made in the format given in the drafts and mailed to the undersigned at the above address. Comments will be appreciated in electronic form either as soft copies (MS Word) or can be mailed to wrd.bis@gmail.com. In case you have any difficulty in accessing the document at our website, please write to us for a hard copy.

In case no comments are received or comments received are of editorial nature, you will kindly permit us to presume your approval for the above document as finalized. However, in case of comments technical in nature are received then they may be finalized, either in consultation with the Chairman, Sectional Committee or referred to the Sectional committee for further necessary action, if so desired by the Chairman, Sectional Committee.

Thanking you,

Yours faithfully,

[J.C. ARORA]
Head (Water Resources)

Encl: As above.

Sending Comments

WC-Draft	Document No.
	Title:

Sl. No.	Committee/ Organisation/ Individual	Clause/ Subclause Paragraph Figure/Table	Type of Comment [General/ Technical/ Editorial]	Comments (Justification for change)	Proposed Change
1.					

Indian Standard

**PROFORMA FOR ANALYSIS OF UNIT RATE OF UNDERGROUND
EXCAVATION BY CYCLIC DRILLING AND BLASTING**

(First Revision of IS 14749)

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Last date for receipt of comments is 25th Feb'12

FOREWORD

(Formal clauses of the foreword will be added later)

Underground excavation by cyclic drilling and blasting is very often resorted to during construction of River Valley Projects. As very large areas are involved in such operations, it becomes necessary that a proper methodology is available for rate analysis of the same. This would be helpful in integrating the economics of the project.

First published in 2000, this standard lays down a proforma for analysis of unit rate of underground excavation by cyclic drilling and blasting. In view of the experiences gained while using the standard, this revision is being undertaken to bring the existing clauses in consonance with the practices in the field. Relevant taxes and duties, wherever applicable, have been added in calculation of unit rates. This standard is one of a series of standards already published which lay down proforma for analysis of rates of concrete, masonry, cyclic drilling and blasting, earthwork, shuttering/formwork, rock excavation and embankment construction.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2: 1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

**PROFORMA FOR ANALYSIS OF UNIT RATE OF UNDERGROUND
EXCAVATION BY CYCLIC DRILLING AND BLASTING**

(First Revision of IS 14749)

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Last date for receipt of comments is 25th Feb'12

1 SCOPE

This standard lays down proforma for analysis of unit rate of underground excavation by cyclic drilling and blasting. This standard does not include provisions for underground lining.

2 CLASSIFICATION

For case of comparison of unit rates of various underground excavations, the following classification for underground excavation may be adopted:

- a) Based on geological consideration:
 - 1) Underground excavation in competent rock
 - 2) Underground excavation in incompetent rock
- b) Based on method of excavation adopted:
 - 1) Full face
 - 2) Heading and benching
 - 3) Multi-drift.

Unit cost for underground excavation by adopting heading and benching method may be the average of unit cost of heading and unit cost of benching. The average will be weighted average depending upon the area of heading and benching.

3 TECHNICAL INFORMATION

The following technical information would be helpful in framing the unit rate of underground excavation:

- 1) Name of the project.
- 2) Layout plan of the project.
- 3) Location with plan and longitudinal section of the underground component.
- 4) Purpose of the underground excavation.
- 5) Construction agency:
 - i) Departmental or contractor
 - ii) Name of department/contractor
- 6) Shape of the underground work (circular, horse shoe, elliptical, vertical walled with arch roof, vertical excavation of various shapes, etc).
- 7) Excavation size of the underground component (excavated dimensions to the pay-line).
- 8) Type of final lining.

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- 9) Location plan and longitudinal section of adits and shafts.
 - 10) Description of alignment including mention of bends, transitions, approach adit/tunnel.
 - 11) Type of rock bored (igneous, sedimentary or metamorphic) and physical properties such as compressive strength, abrasive value and modulus of elasticity.
 - 12) Orientation of excavation with respect to dip, strike joint pattern.
 - 13) Description of rock cover, depressions and *khuds* crossing over the underground cavity along its alignment.
 - 14) Physical defects of rock formations (joints, faults, etc).
 - 15) Ground water conditions, locations and quantity of seepage water at various periods of the year.
 - 16) Inflammable and obnoxious gases, if encountered (brief description).
 - 17) Methods adopted for tackling underground excavation {full face, heading and benching, multiple drifting, pilot tunnel/shaft (by manual labour or by raise boring), forepoling, providing double steel ribs and invert struts etc):
 - i) Reaches of competent rock strata;
 - ii) Reaches of incompetent rock strata (sheared and fractured);
 - iii) Reaches with inadequate rock cover and adverse ground water conditions;
 - iv) Reaches showing rock distress;
 - v) Reaches of bad rock strata which may lead to causing break through conditions; and
 - vi) Any other adverse geological conditions.
 - 18) Equipment at each underground heading:
 - i) Drill jumbo
 - Type
 - Overall dimensions
 - Number of drills/booms
 - Motive power
 - ii) Drilling machines
 - (hydro-booms, ladder drilling system with fast rock drills, other drills)
 - Number and type.
 - iii) Drill steel and drill bits (a brief description)
 - iv) Mucking machine: Make, model and capacity, number of machines
 - v) Haulage equipment
 - Locos (diesel/ electrical): Number, make, model and capacity
 - Mine cars:
 - Rubber tyred carriers: Model and capacity
 - vi) Ventilation
 - a) Ventilation duct: Diameter and type
 - b) Main blowers: Make, model, type, capacity and spacing

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- vii) Pumping arrangements (underground)
 - Number of pumps - main/feeder
 - Type of pumps : Type and capacity
 - Spacing of pumps
 - Length, size and nature of pipelines - main/feeder
 - viii) Supporting arrangement
 - ix) Communication arrangement inside and outside
 - x) Instruments for monitoring
 - xi) Location and lead of dump yard from portal
- 19) Air supply - Installed capacity of compressors, pipe size.
Water supply - Capacity of tank, pipe size, length, etc
- 20) Electrification
- Main supply voltage
 - Transformer details
 - Lighting voltage
- 21) Excavation data (in reaches of competent rock strata)
- i) Type of strata for drilling and blasting:
 - a) Average number of drill holes and size of holes per round/cycle,
 - b) Type of cut holes pattern,
 - c) Number and size of cut holes,
 - d) Average depth of drill holes,
 - e) Average actual advance,
 - f) Type of explosive and detonators used,
 - g) Quantity of explosive used for round/cycle, and
 - h) Explosive factor (kg cum)
 - ii) Time cycle
 - a) Moving drill jumbo up to the face and drilling cycle (h/min)
 - b) Average drilling rate - (cm/min)
 - c) Loading cycle, removing drill jumbo from the muck pile, scaling down loose rocks and mucking out - (h/min)
 - d) Time for secondary blasting - (h/min)
 - e) Time for installation of support system (shotcreting, rockbolting, structural steel support, lagging, backfilling) - (h/min)
 - f) Description of support system including spacing, etc.
 - g) Average time lost due to hold ups/derailments in case rail mounted equipment is used
 - h) Average cycle time - (h)
 - j) Average advance/excavation in one cycle - (m or m³)

- k) Overall advance/excavation in a month - (m or m³)
 - m) Percentage of overbreak of the excavation up to payline
- 22) Date of commencement and completion of underground excavation
- 23) Monthly progress from the date of start of excavation to completion of excavation as per the following format:

Year	Month	Progress (m or m ³)	Underground excavation condition
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- 24) Incentive payment schemes for underground crews and results obtained (if any) - a brief description
- 25) Industrial disputes (if any) and their effect on progress - a brief description
- 26) Safety arrangements including first aid, medical and rescue operations.
- 27) Accidents during underground excavation
 - Fatal accidents - No. of persons dead
 - Major accidents - No. of persons disabled
 - Reasons of accidents - A broad split up be given
- 28) Geological forecast of strata and that actually obtained during underground excavation- Current forecast; A brief description outlining the major variations be given
- 29) Lessons learnt

4 PROFORMA FOR ANALYSIS OF UNIT RATE OF COST FOR UNDERGROUND EXCAVATION

4.1 The proforma recommended for use in the analysis of unit rate of underground excavation is as given in Table 1.

TABLE 1 PROFORMA FOR ANALYSIS OF UNIT RATE OF COST FOR UNDERGROUND EXCAVATION

(Clause 4.1)

Volume of rock excavated per cycle	=
No. of cycle per day (depending upon cycle time)	=
Volume of rock excavated per day	=

A CYCLE OF OPERATIONS

S. No.	Item of Operation	No. of Working Hours
a)	Survey and marking profile/holes	
b)	Positioning of jumbo and drilling	
c)	Charging and blasting	
d)	Defuming	
e)	Scaling	
f)	Mucking	
g)	Mapping	
h)	Average time for shotcreting, rock bolting/rib erection and backfill concreting	
Total cycle time =		

B CHARGES

B-1 Labour Charges *

i) Foreman/Supervisor (No. × Wage)	@ `	per day	`
ii) Blaster (No. × wage)	@ `	per day	`
iii) Electrician (No. × wage)	@ `	per day	`

(Continued)

TABLE 1 PROFORMA FOR ANALYSIS OF UNIT RATE OF COST FOR UNDERGROUND EXCAVATION *Contd.*

iv) Helper to Electrician/Blaster	@	per day	
v) Beldars (No. x wage)	@	per day	
vi)			
vii)			
Add for indirect charges of labour =			
Total labour charges =			
Rate of labour per cum =			

*Other than those employed for operation and maintenance of equipment as the same are covered under unit rate cost of equipment.

B-2 Machinery Charges:

Sl. No.	Equipment	Number	Working hours per cycle	Total working hours per cycle	Unit rate cost per hour,	Amount in
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Drilling Equipment (Drill Jumbo/Jack hammer/.....)					
ii)	Mucking Machine (Mucker/wheel loader/.....)					
iii)	Hauling Equipment (locos/dumpers/.....)					
iv)	Mucking Equipment (Mine cars/.....)					
v)	Miscellaneous Equipment (Dozer/loader/excavator/.....)					
Total machinery charges per cycle :						
Quantity of rock excavated per cycle		=	m ³			
Rate per cum = $\frac{\text{Total machinery charges}}{\text{Quantity of rock excavated}}$		=				

B-3 Material Charges:

B-3.1 Drilling

Cross – sectional area of tunnel	=	
No. of holes required per face	=	100, say
Depth of holes	=	L
Total drilling length	=	100 L

Cost of drilling accessories

Item	No. Reqd.	Cost	Life	Cost/metre
a) Shank adapter				
b) Drill steel/Driller rod				
c) Couplings				
d) Bit				
Total cost per metre of drilling	=	x, say		

Table 1 (Continued)

Total cost of drilling per cycle	=	100 L x	
Quantity of rock excavated per cycle	= cum	
Rate for drilling per cum =	$\frac{\text{Total cost of drilling}(100 \text{ Lx})}{\text{Quantity of rock excavated}}$		
B-3.2 Blasting			
i) Cost per cycle			
Gelatine	=	~	
AN/FO	=	~	
PVC pipes	=	~	
Total	=	_____	
ii) Cost of detonators/fuse coils	=	~	
iii) Cost of consumables = connecting wires, cordex fuse, blasting cable, etc. – per cycle	=	~	
Hence rate per cum =	$\frac{(i) + (ii) + (iii)}{\text{Quantity of rock excavated}}$		
B-3.3 Timber for Supports, Not Measured and Accounted for Separately			
Rate per cum, Lumpsum	=	~	
B-3.4 Miscellaneous Supplies			
Such as wire ropes: manila ropes, v-clamps, rubber gloves, shackles and artificial respirators, etc rate per cum, lumpsum			
Total material charges-per cum [B-3.1 + B-3.2 + B-3.3 + B-3.4]	=	~	
= ~.....+ ~.....+ ~.....+ ~.....	=	~	
B-4 Charges for Ventilation			
Unit rate cost of blower per working hour	=	~	
No. of working hours of blowers per cycle	=	<u>h</u>	
Total charges of blower per cycle	=	~	
Cost of ventilation duct including erection charges per cycle (Total cost of vent pipes and accessories/No. of cycles in full length of tunnel)	=	~	
Total ventilation charges per cycle	=	~	
Quantity of rock excavated per cycle	=	~	
Hence rate per cum =	$\frac{\text{Total ventilation charges}}{\text{Quantity of rock excavated}}$		
B-5 Shop Charges			
i) Machine shop including four dry foundry and emithy smithy , lumpsum	=	~	
ii) Structural shop, lumpsum	=	~	
iii) Steel metal shop, lumpsum	=	~	
iv) Air and water pipe shop, lumpsum	=	~	
v) Carpentry shop, lumpsum	=	~	
Total shop charges per cum	=	~	_____
B-6 Electrical Material Charges per cum Covering			
i) Electric cables/wires	=	~	
ii) Electrical consumables	=	~	
iii) Electrical accessories	=	~	
iv) Booster/Step-down transformer	=	~	
B-7 i) Railway track and accessories charges per cum, lumpsum	=	~	
ii) Road charges per cum, lumpsum	=	~	

(Continued)

Table 1 (Continued)

B-8	Water supply system charges per cum, lumpsum	=	✓
B-9	Surveying charges per cum (Control survey and day-to-day) , lumpsum	=	✓
B-10	Communication charges per cum (to include walkie telephones, etc.), lumpsum	=	✓
C ABSTRACT OF CHARGES			
1	Labour charges	=	✓
2	Machinery charges	=	✓
3	Material charges	=	✓
4	Ventilation charges	=	✓
5	Shop charges	=	✓
6	Electrical materials charges	=	✓
7	Track/road charges	=	✓
8	Water supply charges	=	✓
9	Surveying charges	=	✓
10	Communication facilities	=	✓
	Total	=	✓
C-I Add for			
C-I.1	Ancillaries incidentals:		
1	Provision of:		
	i) Labour and staff quarters		
	ii) Service roads		
	iii) Electric power supply		
	iv) Water supply system		
	v) Sanitation system		
	vi) Drainage system		
	vii) Other amenities including first aid, medical facilities and safety arrangements and rescue operation		
2	Maintenance/Operation of items mentioned above		
3	Supervisory works establishment		
C-I.2	Quality control		
C-I.3	Contingencies		
	NOTE - Item C-I.1 to C-I.3 above need to be accounted for and suitable allowance made.		
C-I.4	Overheads and profit		
	This would include establishment, office stationery, general tools and plant, staff cars, their running and maintenance, insurance, workman's compensation, statutory benefits, telephone and telecommunication facilities, interest, liabilities on borrowings from the owner and bank guarantee charges		

Table 1 (Continued)

C-I.5 Taxes and duties: This list is just indicative

- 1) Sales Tax on works
- 2) Services tax
- 3) Labour cess
- 4) VAT
- 5) Entry tax

NOTES –

1 All items mentioned above shall include depreciation, installation, operation, repairs and maintenance, mobilization and demobilization and dismantling of machinery where used. All items of labour mentioned above shall include indirect statutory and other benefits payable to the labour.

2 Separate analysis of rate may be done in case of pilot tunnel/shaft for manual labour and raise bore methods.

3 Contractors Overheads and profit are generally taken as 20% of prime cost.
