

STATE OF TENNESSEE DEPARTMENT OF TRANSPORTATION

ROADWAY DESIGN DIVISION

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CLAY BRIGHT COMMISSIONER BILL LEE GOVERNOR

INSTRUCTIONAL BULLETIN NO. 20-19

Chapter 2 Earthwork Update

Effective immediately, the Roadway Design Guidelines Chapter 2 has been revised to include updated earthwork information. The estimated grading tabulated block has been updated. Both balanced and unbalanced earthwork tab blocks have been added and will replace the requirement to add this information to the profile sheet. Projects that have already been submitted for final ROW should not remove the earthwork information from the profile sheet. A Grading Report template has been added to ensure consistent information is provided across the state. An <u>Earthwork Design Guide</u> has been developed to provide additional support for designers.

The following sections have been added or modified:

2-706.00 EARTHWORK BALANCES IN PLANS

Earthwork balances shall be computed using average end areas. Examples of how to calculate earthwork balances are as follows:

1. Calculation procedure for balanced Earthwork.

250,000 C.Y.	Exc. (Common)	
-13,000 C.Y.	Topsoil from exc.	Areas
- 5,000 C.Y.	Topsoil from emb.	Areas
232,000 C.Y.	Exc. (Common) av	vailable for balance
<u>Exc. (Com)</u> + [E	xc. (Rock) x 1.15]	vs. Emb.
<u>232,000</u>	+ (45,000 x 1.15)	vs. 253,489 C.Y.
1.15		
	201,739 + 51,750	vs. 253,489 C.Y.
	253,489 C.Y.	= 253,489 C.Y.

2. Calculation procedure for unbalanced Earthwork.

350,000 C.Y.	Exc. (Common)		
-13,000 C.Y.	Topsoil from exc. A	reas	
<u>- 5,000</u> C.Y.	Topsoil for emb. Ar	ea	
332,000 C.Y.	Exc. (Common) av	ailab	le for balance
<u>Exc. (Com) +</u> [1.15	Exc. (Rock) x 1.15]	VS.	Emb.
<u>332,00</u>	<u>0</u> + (45,000 x 1.15)	VS.	253,489 C.Y.
1.15			
	340.446 C.Y.	vs.	253.489 C.Y.

The 86,957 C.Y. of excess material has had the shrinkage factor applied to it (this assumes all excess material will be common). When this quantity is multiplied by the shrinkage factor (to "un-shrink" it), the excess then becomes 100,000 C.Y.

2-708.00 ESTIMATED GRADING QUANTITIES TABULATED BLOCK

The Estimated Grading Quantities tabulated block should be shown on Sheet 2E, Tabulated Quantities Sheet. An example of the tabulated block is shown in *Table 2-8, Estimated Grading Quantities – Balanced Example* and *Table 2-9, Estimated Grading Quantities – Unbalanced Example*.

On all projects using Item No. 203-01, Road and Drainage Excavation (Unclassified), it is to be referred to as unclassified excavation. When the Designer has received the Soils and Geology Report stating approximately what portion is common and what portion is solid rock, the Designer is to include the quantities in the block, even if the quantity is zero. If the Designer does not know the composition of the material being excavated, the Designer should use write 'UNKNOWN' in the Rock cell.

		EST	IMATED GR	ADING QUA	NTITIES				
DESCRIPTION		UNADJUSTE	UNADJUSTED VOLUMES (CY)						
			EXC.	EMB.	EXC.	SHRINK =	15 %	6 SWELL =	15 %
MAINLINE			219500	243000	190870				
SIDE ROAD)S		12500	5490	10870]			
PVT. DRIVE	ES, BUSINE	SS AND FIELD ENTRAN	CES 0	0					
INDEPEND	ENT DITCH	ES	0	0		EXC.		EMB.	
TEMPORAF	RY CONSTR	RUCTION EXITS	0	0		253490	VS	6253490)
OTHER			0	0					
PAVEMEN	Г		0						
TOPSOIL (E	EMB.)		5000		4348	AVAILABLE	=	0	
TOPSOIL (E	EXC.)		13000		11305	1			
TOPSOIL (T	O REPLAC	E STRIPPED TOPSOIL)		5000]			
ROCK	(C.Y.)		TOTALS (C.	Y.)		WASTE MATER	IAL =	0	
EXC.	EMB.	EXC. (UNCL.) EMB. (UN	ICL.) EXC (COMMO	N) EXC. (AVAIL.)	EXC. (ADJ.)]			
45000	0	250000 25349	0 232000	201740	253490				

 Table 2-8

 Estimated Grading Quantities – Balanced Example

	ESTIM	ATED GRA	DING QU	NTITIES				
DESCRIPTION		UNADJUSTED VOLUMES (CY)		ADJUSTED VOLUMES (CY)	BALANCE SUMMARY			
		EXC.	EMB.	EXC.	SHRINK = 15	%	SWELL =	15 %
MAINLINE		319500	243000	277827				6
SIDE ROADS		12500	5490	10870	1			
PVT. DRIVES, BUSINES	S AND FIELD ENTRANCES			5	EXC.		EMB.	
INDEPENDENT DITCHE	S							
TEMPORARY CONSTR	UCTION EXITS				340446	VS	-253490	
OTHER								
PAVEMENT								
TOPSOIL (EMB.)		5000		4348	AVAILABLE	=	86956	
TOPSOIL (EXC.)		13000		11305				
TOPSOIL (TO REPLACE STRIPPED TOPSOIL)			5000	X	WASTE MATERIA	_ =	100000	
ROCK (C.Y.)		TOTALS (C.Y.)	1]			
EXC. EMB.	EXC. (UNCL.) EMB. (UNCL.)	EXC (COMMON)	EXC. (AVAIL.)	EXC. (ADJ.)	1			
45000	350000 253490	332000	288696	340446				

Table 2-9

Estimated Grading Quantities – Unbalanced Example

2-709.00 GRADING REPORT

All grading report sheets shall show the federal and/or state project numbers, route numbers and/or street names and county on each sheet. The Designer should use the <u>Grading Report template</u>. Each sheet shall be numbered to reflect both the individual sheet number as well as the total number of quantity sheets in the submission. See *Figure 2-22, Sample Grading Report*.

			0	INADING	REPOR	1			
COMPUTED BY:	AIMY LOREN	Z					SH	HEET 1 OF 1	
CHECKED BY: D/	AWN PRUETT	-				STA	TE NO.:830	27-3221-94	
PIN: 124717.00					FEI	DERAL PROJE	CT NO: BR-S	TP-174(27)	
ROUTE NO. OR	STREET: SR 1	74					COUNT	Y: SUMNER	
		EST	IMATED G		G QUA	NTITIES			
DI	ESCRIPTION		UNADJUSTE	D VOLUME \$	(CY)	ADJUSTED VOLUMES(CY)	BALA	NCE SUMMAR	ŧΥ
			EXC.	EN	(B.	EXC.	SHRINK= 2	0 % SWELL=	20 %
MAINLINE			4235	65	78	3529		_	_
SIDE ROADS			2341	63	54	1951	EXC.	EM	В.
PVT. DRIVES, BUS	INESS AND FIELD	ENTRANCES					16883	VS72	32
PAVEMENT			542			452]		
TOPSOIL (EMB.)							AVAIL	VBLE= 965	i1
TOPSOIL (EXC.)							1		
TOPSOIL (TO REP	LACE STRIPPED	TOPSOIL)					WASTE MATE	RIAL= 115	81
		IOTA	LS(C.Y.)				-		
ROCK EXC.	.(UNCL.) EM	B. (UNCL) E	EXC (COMMO	N) EXC. (A	VAIL)	EXC. (ADJ.)			
	******	*****	*********** SR 1	74 ********		10883	******	k	
Naterial Name	End Areas	Unadjusted	Adjusted	74 ********** Mult Mult Volumes	lass Fact	Accum Cor Ordinate	Accum Unadj Vol	Adj Vol	
Naterial Name	************	Unadjusted	Volumes (cu. yd.)	74 ********** Mult Mult Mult Mult Mult Mult Mult Mult	lass Fact	Accum cor Ordinate	Accum Unadj Vol (cu. yd.)	Adj Vol (cu. yd.)	
Naterial Name tation 100+43.56 EART	End Areas	Unadjusted (sq. ft.)	Adjusted (cu. yd.)	74 ********** Mult Mult Mult Mult Mult	lass Fact	Accum cor Ordinate	Accum Unadj Vol (cu. yd.)	Adj Vol (cu. yd.)	
Naterial Name ation 100+43.56 EART	End Areas FH Excavation Fill	Unadjusted (sq. ft.)	Adjusted Volumes (cu. yd.)	74 *********** Mult Mult Mult Mult Mult Mult Mult Mult	lass Fact .) 0.85	Accum cor Ordinate	Accum Unadj Vol (cu. yd.)	Adj Vol (cu. yd.)	
Material Name Cation 100+43.56 EART	End Areas FH FH Excavation Fill	Unadjusted (sq. ft.) 20 0	Volumes (cu. yd.) 0 0	74 ********** Mult Mult Volumes (cu. yd. 0 0	Nass Fact .) 0.85 1.00	Accum cor Ordinate	Accum Unadj Vol (cu. yd.) 0 0	Adj Vol (cu. yd.) 0 0	-
Naterial Name Cation 100+43.56 EART 100+50.00 EART	End Areas FH Excavation Fill FH	Unadjusted (sq. ft.) 20 0	Volumes (cu. yd.) 0 0	74 ********** Mult Mult Volumes (cu. yd. 0 0	Nass Fact) 0.85 1.00	Accum Accum cor Ordinate	Accum Unadj Vol (cu. yd.) 0 0	Adj Vol (cu. yd.) 0 0	-
Naterial Name tation 100+43.56 EART 100+50.00 EART	End Areas FH Areas FH Excavation Fill TH Excavation	Unadjusted (sq. ft.) 20 0 22	0 0 0 5	74 ********** Mult M Volumes (cu. yd. 0 0 4	Aass Fact) 0.85 1.00 0.85	Accum cor Ordinate	Accum Unadj Vol (cu. yd.) 0 0	Adj Vol (cu. yd.) 0 0	
Naterial Name tation 100+43.56 EART 100+50.00 EART	End Areas TH Excavation Fill TH Excavation Fill	Unadjusted (sq. ft.) 20 0 22 0	Adjusted Volumes (cu. yd.) 0 0 5 0	74 ******** Mult Mult M Volumes (cu. yd. 0 0 4 0	Aass Fact) 0.85 1.00 0.85 1.00	Accum Accum Cor Ordinate	Accum Unadj Vol (cu. yd.) 0 0 5 0	Adj Vol (cu. yd.) 0 0 4 0	
Naterial Name tation 100+43.56 EART 100+50.00 EART	End Areas FM Areas FM Excavation Fill FM Excavation Fill Fill	Unadjusted (sq. ft.) 20 0 22 0	With a second se	74 ******** Mult P Volumes (cu.yd. 0 0 4 0	Aass Fact) 0.85 1.00 0.85 1.00	Accum Accum cor Ordinate 0 4	Accum Unadj Vol (cu. yd.) 0 0 5 0	Adj Vol (cu. yd.) 0 0 4 0	
Naterial Name tation 100+43.56 EART 100+50.00 EART 100+75.00 EART	End Areas End Areas TH Excavation Fill TH Excavation Fill TH Excavation	Unadjusted (sq. ft.) 20 0 22 0 51	000 Adjusted Volumes (cu. yd.) 0 0 0 5 0 34	74 ******** Mult Mult Volumes (cu. yd. 0 0 4 0	Nass Fact) 0.85 1.00 0.85 1.00 0.85	Accum Accum cor Ordinate 0 4	Accum Unadj Vol (cu. yd.) 0 0 5 0 39	Adj Vol (cu. yd.) 0 0 4 0 33	
Naterial Name Cation 100+43.56 EART 100+50.00 EART 100+75.00 EART	End Areas FM Excavation Fill FM Excavation Fill FM Excavation Fill	Unadjusted (sq. ft.) 20 0 22 0 51 0	00000000000000000000000000000000000000	74 ********* Mult M Volumes (cu. yd. 0 0 4 0 29 0	Mass Fact) 0.85 1.00 0.85 1.00 0.85 1.00	Accum Accum cor Ordinate 0 4	Accum Unadj Vol (cu. yd.) 	Adj Vol (cu. yd.) 0 0 4 0 33 0	
Naterial Name tation 100+43.56 EART 100+50.00 EART 100+75.00 EART	End Areas FH Excavation Fill FX Fill Fill Fill Fill Fill Fill Fill	Unadjusted (sq. ft.) 20 0 22 0 51 0	0 4 4 4 4 4 4 4 0 4 0 4 0 0 0 0 0 0 0 0 0 0 0 0 0	74 ************************************	Mass Fact) 0.85 1.00 0.85 1.00 0.85 1.00	Accum cor Ordinate 0 4 33	Accum Unadj Vol (cu. yd.) 0 0 5 0 39 0	Adj Vol (cu. yd.) 0 0 4 0 33 0	-
Naterial Name tation 100+43.56 EART 100+50.00 EART 100+75.00 EART 101+00.00 EART	End Areas FH Excavation Fill FH Excavation Fill FH Excavation Fill TH Excavation Fill	Unadjusted (sq. ft.) 20 0 22 0 51 0	With a second se	74 ************************************	Mass Fact 0.85 1.00 0.85 1.00 0.85 1.00	Accum Cor Ordinate 0 4 33	Accum Unadj Vol (cu. yd.) 0 0 5 0 39 0	Adj Vol (cu. yd.) 0 0 4 0 33 0	-
Naterial Name tation 100+43.56 EART 100+50.00 EART 100+75.00 EART 101+00.00 EART	End Areas End Areas Fill Fill Fill Fill Fill Fill Fill Fil	Unadjusted (sq. ft.) 20 0 22 0 51 0 117	0000 0000	74 ************************************	Mass Fact 0.85 1.00 0.85 1.00 0.85 1.00 0.85 1.00 0.85	Accum cor ordinate 0 4 33	Accum Unadj Vol (cu. yd.) 0 0 5 0 39 0 117	Adj Vol (cu. yd.) 0 4 0 33 0 99	
Naterial Name tation 100+43.56 EART 100+50.00 EART 100+75.00 EART 101+00.00 EART	End Areas FM Areas FM Excavation Fill TH Excavation Fill FIL FIL TH Excavation Fill TH Excavation Fill	Unadjusted (sq. ft.) 20 0 22 0 51 0 117 0	******** SR 1 Adjusted Volumes (cu. yd.) 0 0 0 5 0 34 0 78 0	74 ********* Mult M Volumes (cu. yd. 0 0 4 0 29 0 8 66 0	Mass Fact) 0.85 1.00 0.85 1.00 0.85 1.00 0.85 1.00	Accum Accum cor Ordinate 0 4 33 99	Accum Unadj Vol (cu. yd.) 0 0 5 0 39 0 117 0	Adj Vol (cu. yd.) 0 4 0 33 0 99 0	
Naterial Name tation 100+43.56 EART 100+50.00 EART 100+75.00 EART 101+00.00 EART 101+25.00 EART	End Areas FH Excavation Fill FXCavation Fill FIL FXCavation Fill FH Excavation Fill FH	Unadjusted (sq. ft.) 20 0 22 0 51 0 117 0	0 4 4 4 4 4 4 4 0 4 0 7 8 0 7 8 0 7 8 0 0 0 0 0 0 0 0 0 0 0 0 0	74 ********* Mult M Volumes (cu. yd. 0 0 4 0 29 0 66 0	Aass Fact) 0.85 1.00 0.85 1.00 0.85 1.00 0.85 1.00	Accum cor Ordinate 0 4 33 99	Accum Unadj Vol (cu. yd.) 0 0 5 0 39 0 117 0	Adj Vol (cu. yd.) 0 4 0 33 0 99 0	
Naterial Name tation 100+43.56 EART 100+50.00 EART 100+75.00 EART 101+00.00 EART 101+25.00 EART	End Areas End Areas FH Excavation Fill FH Excavation Fill TH Excavation Fill TH Excavation Fill TH Excavation Fill	Unadjusted (sq. ft.) 20 0 22 0 51 0 117 0 115	******** SR 1 Adjusted Volumes (cu. yd.) 0 0 5 0 34 0 78 0 140	74 ************************************	Aass Fact) 0.85 1.00 0.85 1.00 0.85 1.00 0.85 1.00 0.85 1.00 0.85	Accum Accum or Ordinate 0 4 33 99	Accum Unadj Vol (cu. yd.) 0 0 5 0 39 0 117 0 257	Adj Vol (cu. yd.) 0 0 4 0 33 0 99 0 218	

Figure 2-22 Sample Grading Quantities Sheet

IB 20-19

This IB Voids RDG Section 4-203.45 and 4-203.55 due to an update and inclusion into RDG Chapter 2.

Chapter 2 has been not been updated on the Roadway Design Website. The <u>Estimated Roadway Quantities</u> file has been updated to include the new earthwork tab block. The <u>Earthwork Design Guide</u> can be found on the Roadway Design Training website.

ΡE Jennifer L Civil Engineering Director Roadway Design Division

KJL:JDK:ADP:LHC:NHP September 23, 2020