

Sept. 13, 2004

Mr. Graig Folkers
Miller Material Co..
2405 East 85th Street
Kansas City, MO64132

Re: Masterplan Approval (Review Number 70065-04)
Belgard Retaining Wall System

Dear Sir:

I am pleased to inform you that the plans submitted for review of *Belgard Retaining Wall* are approved and the new master plan numbers are as follows:

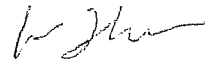
6' hg with level backfill (95% compact)	715-04-01
6' hg with slope backfill (max. 1 v : 3 h) (95% compact)	715-04-02
8' hg two tiers with Level backfill (95% compact)	715-04-03

Please inform your customers of the following procedures that they need to follow when applying for a retaining wall permit with St. Louis County:

1. Submit completed permit application form that includes the master plan number.
2. Submit four (4) copies of site plans showing the location and length of the wall, drawn to scale. Top of wall elevations and bottom of wall elevations, slopes in front and back of the wall, must be provided on the site plans. Dimension wall distance to any structures, parking lots, and property lines.
3. Submit four (4) copies of plan view of the walls.
4. Submit four (4) copies of the front elevation views of the walls with dimensions.
5. Submit four (4) copies of cross-section detail of the wall. The detail must show leveling pads dimension, wall height, geogrid type and placements, drainage materials, and slope of backfill.
6. Wall configuration and reinforcements must match the master plan in order for this office to issue a retaining wall permit.
7. Specify the soil condition on the site. *The backfill of reinforced soil shall be 95% compacted which is certified by a soil engineer.*
8. Complete construction notes from the master plan.

If you have any questions regarding this letter, please feel free to call me. I would be more than happy to guide you through our permit process.

Sincerely,



Helen Zhou
(314)615-5469
Building Code Review Section
Division of Code Enforcement

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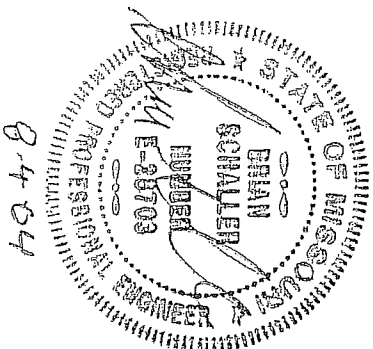
RETAINING WALL SYSTEMS

ST. LOUIS COUNTY MASTER PLANS BELGARD RETAINING WALLS

MILLER MATERIALS
 2405 East 85th Street
 Kansas City, MO 64132
 (816) 444-2244
 (816) 444-7496 Fax

INDEX OF DRAWINGS:

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Sheet 2	DESIGN PARAMETERS
Sheet 3	GENERAL NOTES
Sheet 4	TYPICAL SECTIONS
Sheet 5	LEVEL BACKFILL
Sheet 6	SLOPING BACKFILL
Sheet 7	TIERED WALLS



BELGARD® CELTIK RETAINING WALLS		RETAINING WALL DESIGN, INC. P.O. BOX 7094 KANSAS CITY, MO 64113		Miller Materials 2405 East 85th Street Kansas City, MO 64132 (816) 444-2244		TITLE SHEET	
				ST. LOUIS COUNTY MASTER PLANS BELGARD RETAINING WALLS		SHEET: 1 of 7 DATE: 8/2/04	

GENERAL NOTES:

MATERIAL PROPERTIES:

1. MODULAR CONCRETE WALL UNITS SHALL BE BELGARD CELTIK RETAINING WALL UNITS HAVING A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 8,000 PSI AND A MAXIMUM MOISTURE ABSORPTION OF 8%.
2. SHEAR CLIPS SHALL BE 2" LONG 1/2" # ABS INJECTED OR EQUIVALENT.
3. UNIT DRAINAGE FILL SHALL CONSIST OF CLEAN 1" MINUS CRUSHED STONE GRAVEL. A MINIMUM OF 12" OF DRAINAGE FILL SHALL EXTEND BEHIND THE WALL UNITS TO WITHIN 8" OF FINAL GRADE.
4. REINFORCED BACKFILL SHALL CONSIST OF MATERIAL HAVING A RELATIVELY LOW PLASTICITY WITH A LIQUID LIMIT OF LESS THAN 40 AND A PLASTICITY INDEX OF LESS THAN 15.
5. THE GEOGRID SHALL BE A HIGH DENSITY POLYETHYLENE EXPANDED SHEET OR POLYESTER WOVEN FIBER MATERIAL, SPECIFICALLY FABRICATED FOR USE AS SOIL REINFORCEMENT OF ONE OF THE FOLLOWING:
STRATAGRID 200 AS MANUFACTURED BY STRATA SYSTEMS, INC.
6. DRAINAGE PIPE SHALL BE 4" # PERFORATED OR SLOTTED PVC OR CORRUGATED HDPE.

FOUNDATION SOIL PREPARATION:

1. FOUNDATION SOIL SHALL BE EXCAVATED AS REQUIRED FOR LEVELING PAD SHOWN ON DRAWINGS.
2. FOUNDATION SOIL SHALL BE INSPECTED BY A GEOTECHNICAL ENGINEER TO INSURE THAT THE ACTUAL SOIL STRENGTH MEETS OR EXCEEDS 2000 PSF BEARING CAPACITY. SOILS NOT MEETING THE REQUIRED STRENGTH SHALL BE REMOVED AND REPLACED WITH MATERIAL ACCEPTABLE TO THE GEOTECHNICAL ENGINEER.

3. OVER-EXCAVATED AREAS SHALL BE BACK-FILLED WITH APPROVED, COMPACTED MATERIAL.

BASE LEVELING PAD:

1. LEVELING PAD SHALL BE PLACED AS SHOWN ON THE DRAWINGS AS FOLLOWS:
LEAN CONCRETE (200 PSI) - 4" MINIMUM THICK
WELL GRADED 3/4" GRAVEL WITH FINES - 6" MINIMUM THICK
2. SAND OR GRAVEL BASE SHALL BE COMPACTED TO 95% OF STANDARD PROCTOR TO PROVIDE A LEVEL, HARD SURFACE.
3. LEVELING PAD SHALL BE CONSTRUCTED TO INSURE FULL BEARING OF RETAINING WALL UNITS.

UNIT INSTALLATION:

1. THE FIRST COURSE OF CONCRETE WALL UNITS SHALL BE PLACED ON THE BASE LEVELING PAD AND CHECKED FOR LEVEL, ALIGNMENT, AND FULL CONTACT WITH BASE.
2. UNITS SHALL BE PLACED SIDE BY SIDE FOR FULL LENGTH OF WALL. ALIGNMENT SHALL BE DONE BY MEANS OF A STRING LINE OR OFFSET MEASUREMENT FOR BASE LINE.
3. PLACE DRAINAGE FILL A MINIMUM OF 12" DIRECTLY BEHIND AND BETWEEN THE UNITS. PLACE REINFORCED BACKFILL DIRECTLY AGAINST DRAINAGE FILL AND COMPACT. EXCESS MATERIAL SHALL BE REMOVED FROM TOP OF UNITS PRIOR TO INSTALLATION OF NEXT COURSE.
4. LAY UP EACH COURSE INSURING A POSITIVE CONNECTION BETWEEN PREVIOUS COURSE IS ACHIEVED BY INSTALLING PINS THROUGH THE HOLES IN THE TOP OF THE UNIT AND INTERLOCKING WITH SLOTS IN THE TOP OF THE PREVIOUS COURSE. INSTALL 2 PINS PER UNIT.

GEOGRID INSTALLATION:

1. THE GEOGRID SOIL REINFORCEMENT SHALL BE LAID HORIZONTALLY ON COMPACTED BACKFILL, CONNECTED TO THE CONCRETE WALL UNITS AND EMBEDDED IN THE BLOCK FACING A MINIMUM OF 6".
2. PLACE GEOGRID ON CONCRETE WALL UNITS, PLACE THE NEXT COURSE OF UNITS, INSTALL PINS, PLACE THE DRAINAGE FILL, PULL GEOGRID TAUT AND ANCHOR THE GEOGRID WITH STAKES PRIOR TO BACKFILLING.
3. GEOGRID SHALL BE LAID AT THE PROPER ELEVATION AND ORIENTATION AS SHOWN ON THE DRAWINGS.
4. CORRECT ORIENTATION OF THE GEOGRID SHALL BE VERIFIED.

FILL PLACEMENT:

1. BACKFILL MATERIAL SHALL BE PLACED IN 6" MAXIMUM LIFTS AND COMPACTED TO A MINIMUM OF 95% OF MATERIALS MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D698 AT OR NEAR NEAR OPTIMUM MOISTURE CONTENT.
2. BACKFILL SHALL BE PLACED, SPREAD, AND COMPACTED IN SUCH A MANNER THAT MINIMIZES THE DEVELOPMENT OF SLACK OR LOSS OF PRETENSION OF THE GEOGRID.
3. BACKFILL SHALL BE PLACED FROM THE WALL REARWARD INTO THE EMBANKMENT TO INSURE THAT THE GEOGRID REMAINS TAUT.
4. BACKFILL SHALL BE PLACED SUCH THAT NO MORE THAN TWO COURSES OF WALL UNITS EXTEND ABOVE THE BACKFILL.
5. COMPACT BACKFILL WITHIN 3' OF THE BACK OF THE WALL TO PREVENT DISPLACEMENT OF CONCRETE WALL UNITS.
6. TRACKED CONSTRUCTION EQUIPMENT SHALL NOT BE OPERATED DIRECTLY ON THE GEOGRID. A MINIMUM BACKFILL THICKNESS OF 6" SHALL BE MAINTAINED TO OPERATE TRACKED VEHICLES OVER THE GEOGRID. TURNING OF TRACKED CONSTRUCTION EQUIPMENT SHALL BE KEPT TO A MINIMUM TO PREVENT TRACKS FROM DISPLACING THE FILL AND DAMAGING THE GEOGRID.

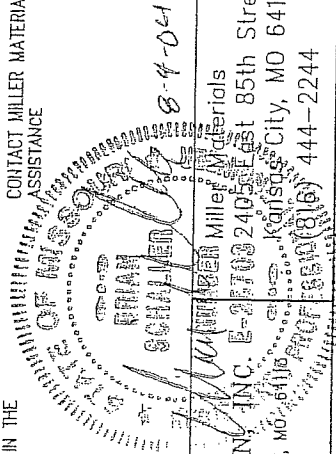
CAP INSTALLATION:

1. CAP UNITS SHALL BE ADHERED TO THE TOP UNITS USING MANUFACTURER SUPPLIED ADHESIVE BY PLACING TWO 1/4" BEADS OF ADHESIVE ON EACH UNIT ALONG THE ENTIRE LENGTH OF THE WALL. PRESS THE CAP UNITS FIRMLY INTO THE ADHESIVE AND ALLOW TO CURE.

PROTECTION OF WORK:

1. DURING CONSTRUCTION, THE BACKFILL BEHIND AND IN FRONT OF THE WALL ARE TO BE PROTECTED SUCH THAT RUNOFF IS DIRECTED AWAY FROM THE FACE OF THE WALL.
2. THE DESIGN OF THE WALLS IS BASED ON CONDITIONS AND LOADS IMPOSED ON THE WALL AT COMPLETION OF THE PROJECT. THE WALL CAN BE DAMAGED BY CONSTRUCTION ACTIVITY ADJACENT TO THE WALL. LIMIT THE SIZE OF EQUIPMENT WITHIN 4' OF THE TOP OF THE COMPLETED WALL TO 2,000 LBS.
3. THE SOIL IN FRONT OF THE WALL SHALL BE PROTECTED FROM ERODING.

CONTACT MILLER MATERIALS AT (816) 444-2244 FOR ST. LOUIS COUNTY MASTERPLAN SUBMITTAL ASSISTANCE



BELGARD®
CELTIK RETAINING WALLS

RETAINING WALL DESIGN, INC. E-24002405 East 85th Street
Kansas City, MO 64132
P.O. BOX 7094
KANSAS CITY, MO 64116
PROF. ESM (816) 444-2244

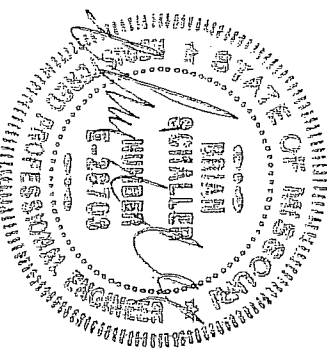
GENERAL NOTES

ST. LOUIS COUNTY MASTER PLANS
BELGARD RETAINING WALLS

SHEET: 3 of 7
DATE: 8/2/04

DESIGN PROCEDURE

THE DESIGN TABLES PRESENTED IN THESE DOCUMENTS ARE ESTABLISHED FOR THE CONSTRUCTION OF SOIL REINFORCED WALLS BASED ON THE GUIDELINES PRESENTED IN NCMA'S "DESIGN MANUAL FOR SEGMENTAL RETAINING WALLS SECOND EDITION" AND GENERALLY ACCEPTED SOIL PARAMETERS IN THE ST. LOUIS COUNTY MISSOURI AREA. A GEOTECHNICAL ENGINEER SHALL REVIEW THE SITE CONDITIONS AND THE SOIL PRESENT AT THE PROPOSED LOCATION OF THE SOIL REINFORCED WALLS TO DETERMINE IF THE ACTUAL CONDITIONS MATCH THE ASSUMED PARAMETERS LISTED WITHIN THESE DOCUMENTS. ALL SOIL PARAMETERS ASSUMED IN THE DESIGN ARE WELL DRAINED, LONG TERM STRENGTH CONDITIONS. HIGH PLASTIC SILTS AND CLAYS SHOULD NOT BE USED WITHOUT SPECIFIC DESIGN RECOMMENDATIONS FROM LOCAL GEOTECHNICAL ENGINEERS. FROST HEAVE AND SETTLEMENT NEED TO BE ADDRESSED IF WARRANTED BY CONDITIONS. ALSO, THE DESIGN PRESENTED HERE DOES NOT ADDRESS SPECIFIC CONDITIONS FOR WALLS LOCATED SUCH THAT THEY ARE IN CONSTANT CONTACT WITH WATER, I.E. RIVERS, LAKES, PONDS, ETC.



SOIL PROPERTIES:

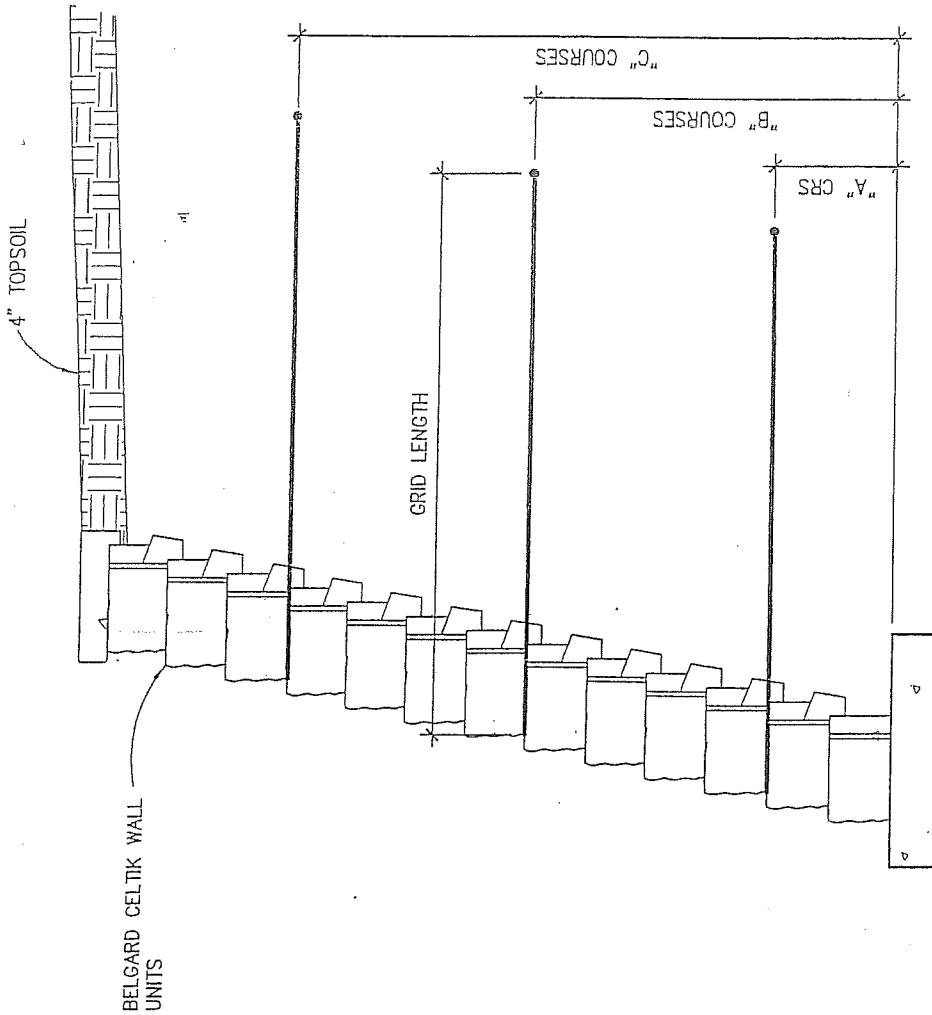
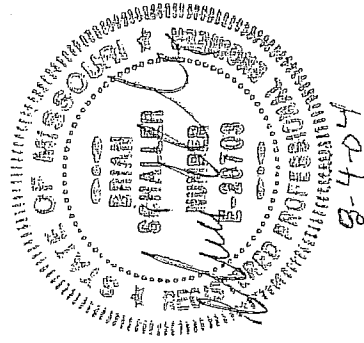
	FRICITION ANGLE (ϕ)	UNIT WT (PCF)	COHESION (PSF)
WALL FILL	28	125	0
RETAINED BACKFILL	28	125	0
FOUNDATION SOIL	28	125	0

8-4-04

MINIMUM FACTORS OF SAFETY:

- REINFORCEMENT PULLOUT = 1.5
- REINFORCEMENT RUPTURE = 1.5
- EXTERNAL SLIDING = 1.5
- OVERTURNING = 2.0
- OVERALL OF UNKNOWNNS = 1.5
- BEARING CAPACITY = 2,000 PSF

<p>BELGARD® CELTRK RETAINING WALLS</p>	<p>RETAINING WALL DESIGN, INC. P.O. BOX 7094 KANSAAS CITY, MO 64113</p>	<p>Miller Materials 2405 East 85th Street Kansas City, MO 64132 (816) 444-2244</p>
<p>DESIGN PARAMETERS</p>		
<p>ST. LOUIS COUNTY MASTER PLANS BELGARD RETAINING WALLS</p>		<p>SHEET: 2 of 7 DATE: 8/2/04</p>

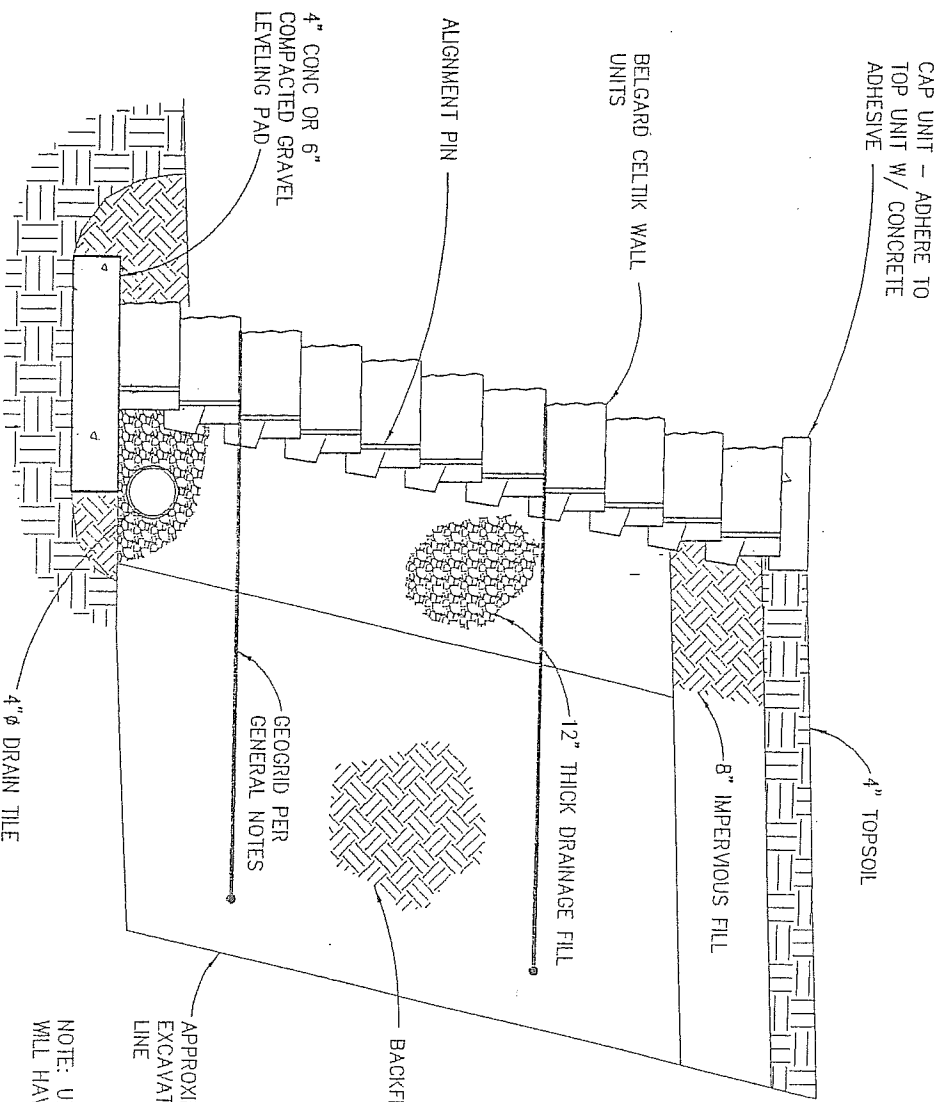


WALL HEIGHT	BELGARD CELTIK 5 1/4" WALL UNITS		
	# LAYERS OF GRID	GRID LENGTH	"A" "B" "C"
26 1/4"	0	-	- - -
36 3/4"	1	3'-0"	4 - -
47 1/4"	2	4'-0"	2 6 -
57 3/4"	2	4'-6"	4 8 -
73 1/2"	3	5'-0"	2 6 10

REINFORCED RETAINING WALL - LEVEL BACKFILL

SCALE: 3/4" = 1'-0"

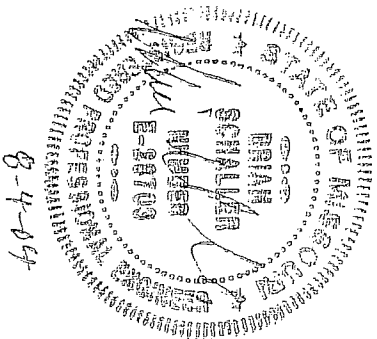
BELGARD® CELTIK RETAINING WALLS	RETAINING WALL DESIGN, INC. P.O. BOX 7094 KANSAS CITY, MO 64113	Miller Materials 2405 East 85th Street Kansas City, MO 64132 (816) 444-2244	LEVEL BACKFILL ST. LOUIS COUNTY MASTER PLANS BELGARD RETAINING WALLS
			SHEET: 5 of 7 DATE: 8/2/04



NOTE: UNREINFORCED WALL
WILL HAVE NO GEOGRID.

TYPICAL REINFORCED RETAINING WALL SECTION

SCALE: 3/4" = 1'-0"



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RETAINING WALL DESIGN, INC.
P.O. BOX 7094
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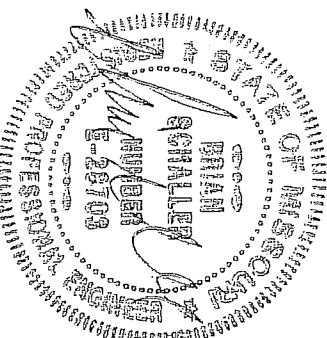
TYPICAL SECTION

ST. LOUIS COUNTY MASTER PLANS
BELGARD RETAINING WALLS

SHEET: 4 of 7
DATE: 8/2/04

DESIGN PROCEDURE

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SOIL PROPERTIES:

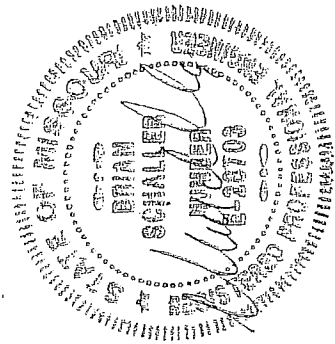
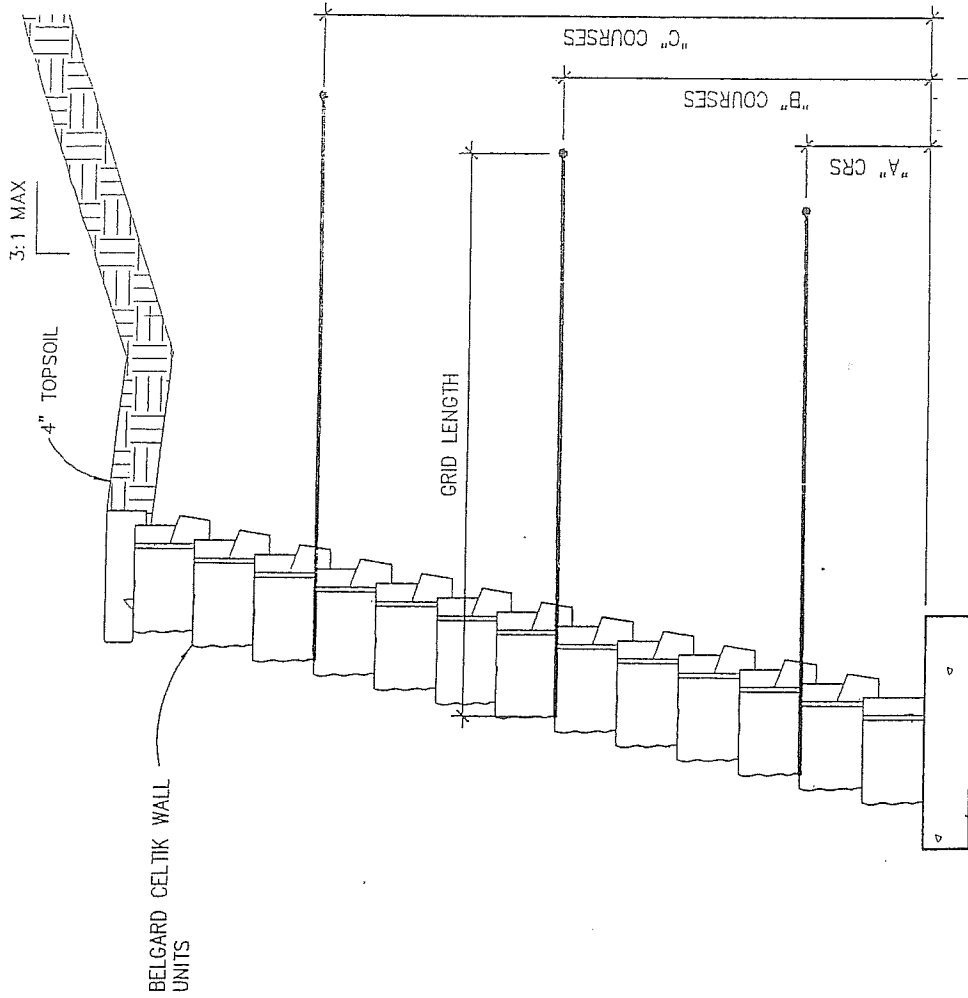
	FRICTION ANGLE (ϕ)	UNIT WT (PCF)	COHESION (PSF)
WALL FILL	28	125	0
RETAINED BACKFILL	28	125	0
FOUNDATION SOIL	28	125	0

8-4-04

MINIMUM FACTORS OF SAFETY:

REINFORCEMENT PULLOUT = 1.5
 REINFORCEMENT RUPTURE = 1.5
 EXTERNAL SLIDING = 1.5
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DESIGN PARAMETERS		ST. LOUIS COUNTY MASTER PLANS BELGARD RETAINING WALLS
		SHEET: 2 of 7 DATE: 8/2/04



8-1-04

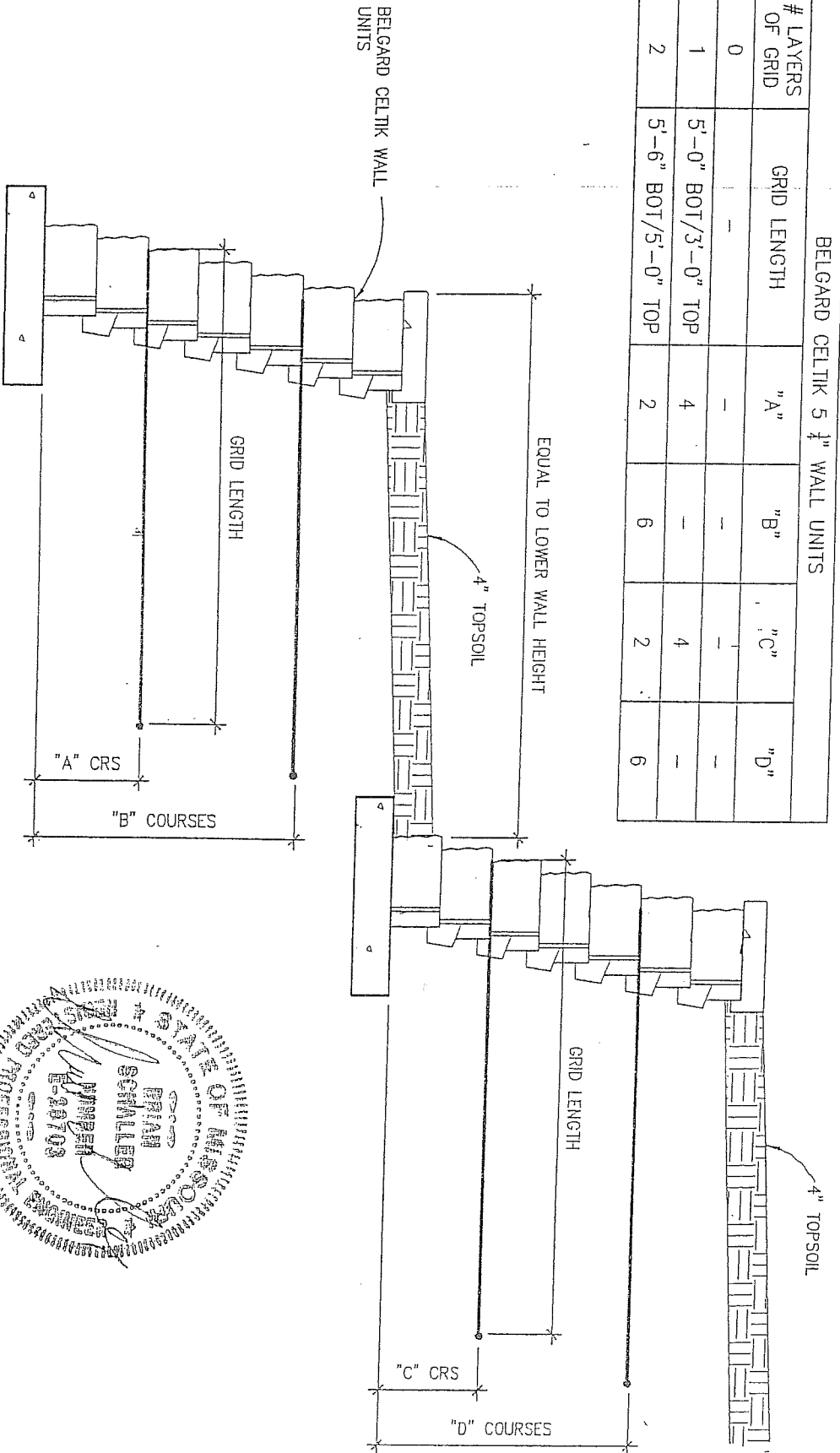
WALL HEIGHT	BELGARD CELTIK 5 1/4" WALL UNITS				
	# LAYERS OF GRID	GRID LENGTH	"A"	"B"	"C"
26 1/4"	0	-	-	-	-
36 3/4"	1	3'-6"	4	-	-
47 1/4"	2	4'-6"	2	6	-
57 3/4"	2	5'-0"	4	8	-
73 1/2"	3	5'-6"	2	6	10

REINFORCED RETAINING WALL - SLOPING BACKFILL

SCALE: 3/4" = 1'-0"

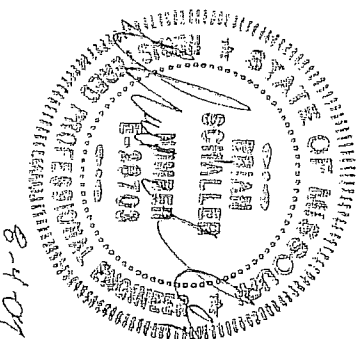
BELGARD® CELTIK RETAINING WALLS	RETAINING WALL DESIGN, INC. P.O. BOX 7094 KANSAS CITY, MO 64113	Miller Materials 2405 East 85th Street Kansas City, MO 64132 (816) 444-2244	SLOPING BACKFILL
	BELGARD CELTIK 5 1/4" WALL UNITS	ST. LOUIS COUNTY MASTER PLANS BELGARD RETAINING WALLS	SHEET: 6 of 7 DATE: 8/2/04

WALL HEIGHT (EACH TIER)	# LAYERS OF GRID	BELGARD CELTIK 5 1/4" WALL UNITS				
		GRID LENGTH	"A"	"B"	"C"	"D"
26 1/4"	0	-	-	-	-	
36 3/4"	1	5'-0" BOT/3'-0" TOP	4	-	4	
47 1/4"	2	5'-6" BOT/5'-0" TOP	2	6	2	6



REINFORCED RETAINING WALL - TIERED WALLS

SCALE: 3/4" = 1'-0"



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(816) 444-2244

TIERED WALLS
ST. LOUIS COUNTY MASTER PLANS
BELGARD RETAINING WALLS

SHEET: 7 of 7
DATE: 8/2/04

PROJECT: Laboratory Services

REPORT DATE: April 4, 2003

TOTAL PAGES: 31

Mr. Gary Poindexter
Schuster's Building Products, Inc
901 East Troy Avenue
Indianapolis, Indiana 46203

ATC PROJECT NO.: 07938.0001

ATC WORK ORDER NO.: 7845

FILE NUMBER: 07938.0001

SAMPLE RECEIVED: 01-20-03

SAMPLE DESCRIPTION:

90mm Tan/Gray Celtic Wall CMU

Absorption of Segmental Retaining Wall Units (ASTM C-140) --

Specimen No.	7845-135	7845-136	7845-137	Average	Spec.
Condition	Good	Good	Good		
Received Weight (lb)	38.4	37.8	38.2		
Overall Width (in)	8.7	9.1	8.9		
Overall Length (in)	17.0	17.0	17.0		
Height (in)	3.5	3.5	3.5		
Vol. (ft ³)	0.2996	0.3133	0.3065	0.3065	
Density (pcf)	129	125	129	128	
Absorption (pcf)	11	13	11	12	13 max.

The specimens tested DO meet the absorption requirements outlined in ASTM C-1372.



Oldcastle®

OLDCASTLE APG MIDWEST, INC.
Schuster's Building Products

901 East Troy Avenue
Indianapolis, IN 46203-5192

Tel: (317) 787-3201
Fax: (317) 788-5906
www.schusters.com

March 19, 2004

To: Brad Smith
Miller Material

This letter is to certify that Schuster's Building Products retaining wall systems meet the compressive strength requirements and absorption requirements outlined in ASTM C-1372.

Gary Poindexter
Gary Poindexter
O.C. Manager
Schuster's Building Products