***Amended* Agenda**
Board of Trustees
Regular Meeting
Location: The Center for Advanced Technical Studies, Multipurpose Room
Video Livestream: https://lexrich5.rev.vbrick.com/#/webcasts/boardmeeting

July 12, 2021

1. Call to order at 5:30 p.m.

2. Approval of the agenda

3. Enter Executive Session to consider the following:
    a. Selected employment items (*Exhibit A*) (Action)
    b. Selected employment items (*Exhibit B*) (Information Only)
    c. Contractual matter regarding consultation services to review the district's organizational structure to increase efficiency
    d. Legal advice regarding Board Policy BCA "Board Member Code of Ethics", Board Policy BDD "Board-Superintendent Relationship", and Board Policy AE "Accountability/Commitment to Accomplishment"
    e. Legal advice regarding water, sewer, deeds and easements at Piney Woods Elementary School *(Exhibit C)*

4. Call to order at 7:00 p.m.

5. Welcoming remarks – Jan Hammond, Board Chair

6. Invocation – Nikki Gardner, Board of Trustees

7. Pledge of Allegiance – Nikki Gardner, Board of Trustees

8. Superintendent's Report
    1. Strategic Planning
        - Vision and Mission
    2. Reentry and ESSER Update
    3. Monthly Financial Reports *(Exhibit D)*

9. Approval of the minutes of the June 28, 2021 board meeting

10. Public Participation*

ACTION AGENDA

11. Action as Necessary or Appropriate on Matters Discussed in Executive Session

12. Substitute Staffing Contract *(Exhibit E)*

13. Follow-up discussion regarding parents' and students' safety concerns across the district

DISCUSSION AGENDA

14. Discussion of results of engineering study of construction defects from 2008 bond referendum Chapin High School project *(Exhibit F)*

15. Discussion regarding conducting both Special Financial and Operational Audits

16. Board member requests for agenda items

17. Adjourn

INFORMATION AGENDA

18. Information Only: Title I, Title II, and Title IV Programs for 2021-2022

19. The next regular scheduled board meeting will be August 9, 2021 at The Center for Advanced Technical Studies.

**The Board welcomes and encourages public participation. We respectfully ask that you adhere to the procedures and the decorum provided in board policy BEDH "Public Participation at Meetings". Your comments should be limited to three minutes. Questions asked during public participation will be handled in accordance with board policy BEDH.*

Minutes
Board Meeting – June 28, 2021

The Board of Trustees of School District Five of Lexington and Richland Counties conducted an in-person meeting at the District Office with the following members present:

Mrs. Rebecca Blackburn Hines
Mrs. Nikki Gardner, Secretary
Mrs. Jan Hammond, Chair
Mr. Matt Hogan
Mrs. Catherine Huddle
Mr. Ken Loveless, Vice Chair
Mr. Ed White *(Absent)*
Dr. Christina Melton, District Superintendent *(Absent)*

The following staff members attended:

Mr. Todd Bedenbaugh, Executive Director of Operations
Mrs. Katrina Goggins, Director, Office of Communications
Mr. Michael Guliano, Chief Instructional Officer
Dr. Michael Harris, Chief Planning and Administrative Officer
Mrs. Marty Rawls, Chief Finance Officer
Dr. Tamara Turner, Chief Human Resources Officer

A livestream video link was provided to the public as a viewing option for the meeting.

Mrs. Hammond called the meeting to order at 6:59 p.m. and offered welcoming remarks. Board Member, Rebecca Blackburn Hines, led the invocation and the Pledge of Allegiance.

The minutes of the June 14, 2021 board meeting and the June 22, 2021 special-called meeting were approved.

During public participation: Ali Hendrick, Jessica Bower and Kelly Brautigam spoke on behalf of Teacher Forum to acknowledge Dr. Melton's service; and, Liesha Huffstetler spoke regarding Ed White's statement to the press.

Action Agenda

- Action as Necessary or Appropriate on Matters Discussed in Executive Session
- Discussion and Action Regarding Censure of Board Member Ed White
- Textbook Adoptions 2021-2022 Recommendations

Discussion Agenda

- Monthly Financial Reports
- Status Update on Temporary / Substitute Services Contract
- Discussion Regarding Parents and Students Safety Concerns of Students Across the District

Information Only

- No items

The meeting adjourned at 7:57 p.m.

Record of Voting

School District Five
of
Lexington and Richland Counties

Meeting of June 28, 2021

	Blackburn Hines	Gardner	Hammond	Hogan	Huddle	Loveless	White
1. M. Huddle S. Gardner Approve the agenda	X	X	X	X	X	X	A
2. M. Loveless S. Huddle Enter Executive Session to consider the following: a. Selected employment items (Exhibit A) (Action) b. Selected employment items (Exhibit B) (Information Only) c. Kelly Services - Amendment to Adopt and Ratify for 2020-2021 (Exhibit C)	X	X	X	X	X	X	A
3. M. Loveless S. Hogan I make the motion that we approve the minutes of the June 14, 2021 board meeting.	X	X	X	X	X	X	A
4. M. Loveless S. Gardner I make the motion that we approve the minutes of the June 22, 2021 special-called board meeting.	X	X	X	X	X	X	A
5. M. Loveless S. Hogan I move that we approve the selected employment items as discussed in Executive Session shown under Exhibit A (Action).	X	X	X	X	X	X	A
6. M. Huddle S. Gardner Based upon the recommendation of the administration, I move that we ratify the June 21, 2021 Amendment to the contract with Kelly Services.	X	X	X	X	X	X	A
7. M. Hammond S. Huddle Censure of Ed White: Board Policy BE states, "Robert's Rules of Order will govern all matters not covered by the rules of the board". Per chapter 72 of Robert's Rules of Order, "A deliberative assembly has the inherent right to make and enforce its own laws and punish an offender". Further, SC Law 59-19-60, as interpreted by our Attorney General, provides school boards the ability to censure a trustee. As such, I move that we censure trustee Ed White for violation of board policies BCA "Board Member Code of Ethics", BEC "Executive Session", and BEDI "News Media Services". In addition, Mr. White converted the Work Product of another attorney to his personal use and exposed Attorney-Client Privileged Information without the consent of the superintendent or the board. Further,	N	X	X	N	X	X	A

A = Absent
AB = Abstain
N = No
X = Yes
R = Recuse

	Blackburn Hines	Gardner	Hammond	Hogan	Huddle	Loveless	White
Mr. White made false statements against board members knowing full well those board members could not respond without breaching contracts and violating board policies. Mr. White has caused irreparable harm to the school district and its superintendent. While we accept Mr. White's resignation and wish to move on, if we don't acknowledge and censure a board member who disregards the trust placed in them by our superintendent, staff, students, and fellow board members, future boards will not be trusted by our community and other board members will be free to similarly disregard board policies, including disclosing other confidential personnel matters.							
8. M. Gardner S. Huddle I move that we approve the textbook recommendations as presented and shown in Exhibit E.	X	X	X	X	X	X	A
9. M. Hogan S. Huddle Adjourn at 7:57 p.m.	X	X	X	X	X	X	A

A = Absent
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EXHIBIT D

MEMORANDUM

To: Members of the Board of Trustees

Through: Dr. Akil E. Ross Sr., Interim Superintendent

From: Marty Rawls, Chief Financial Officer Marty Rawls

Date: July 6, 2021

Re: July 12, 2021 Board Meeting
Superintendent's Report
Monthly Financial Reports – May 2021

Attached for your information are the revenue and expenditure reports through May 31, 2021.

MR

Attachments

LEXINGTON RICHLAND SCHOOL DISTRICT 5
GENERAL FUND
MONTHLY REVENUE SUMMARY
FOR THE PERIOD ENDING MAY 31, 2021

	BUDGET	ACTUAL YEAR TO DATE	% Received
LOCAL SOURCES			
Property Taxes - Operations & Delinquent	67,831,629	69,318,231	102.19%
Property Taxes - Penalties & Interest	415,633	389,833	93.79%
Revenue in Lieu of Taxes (FILOT)	1,552,340	1,607,495	103.55%
Tuition - Out of District	5,000	1,514	30.27%
Rentals	120,000	39,210	32.68%
Medicaid	105,000	60,883	57.98%
Interest on Investments	350,000	76,892	21.97%
Other Local Revenue	240,000	870,742	362.81%
TOTAL - LOCAL SOURCES	70,619,602	72,364,800	102.47%
STATE SOURCES			
Education Finance Act (EFA)	42,289,607	38,765,152	91.67%
State Fringe Benefits	20,097,971	18,209,707	90.60%
Retiree Health Insurance	5,440,985	5,000,180	91.90%
State Aid to Classrooms - Teacher Salary	4,124,175	3,267,225	79.22%
Property Tax Relief - Tier I (1996: $100,000)	10,580,071	10,580,071	100.00%
Homestead Exemption - Tier II (Seniors Age 65+)	1,758,200	1,758,200	100.00%
Homestead Exemption - Tier III - (Act 388)	32,145,086	25,716,069	80.00%
Merchant's Inventory Tax	213,955	209,687	98.00%
School Bus Drivers' Salaries/Fringes	1,275,060	1,231,761	96.60%
Manufacturer's Depr. Reimbursement & Motor Carrier	572,460	441,833	77.18%
PEBA Credits	1,190,410	1,190,410	100.00%
Other State Revenue	20,000	12,385	61.93%
TOTAL - STATE SOURCES	119,707,980	106,382,680	88.87%
OTHER FINANCING SOURCES			
E I A-Teacher Salary Supplement & Fringe	5,717,090	5,137,731	89.87%
Indirect Cost - Special Revenue Funds	480,000	322,345	67.16%
Sale of Fixed Assets	-	63,462	
TOTAL OTHER FINANCING SOURCES	6,197,090	5,523,539	89.13%
OPERATIONAL BALANCE TRANSFER	3,000,000	3,000,000	100.00%
TOTAL REVENUES THROUGH 5/31/2021 *	**$ 199,524,672**	**$ 187,271,019**	**93.86%**
TOTAL REVENUES THROUGH 5/31/2020 **	**$ 200,073,496**	**$ 176,981,475**	**88.46%**

** Use of $3,000,000 from Fund Balance was approved for use in FY 2020-2021 on 12-14-2020*

*** Use of $4,278,943 from Fund Balance was approved for use in FY 2019-2020 on 1-27-2020*

LEXINGTON RICHLAND SCHOOL DISTRICT 5
GENERAL FUND
MONTHLY EXPENDITURE ANALYSIS
FOR THE PERIOD ENDING MAY 31, 2021

	ORIGINAL BUDGET	ADJUSTED BUDGET	ACTUAL YEAR TO DATE	% Expended
SALARIES AND FRINGE				
Instructional	$ 113,638,253	$ 113,664,686	$ 91,292,467	80.32%
Support & Community Services	58,401,278	58,752,570	52,032,649	88.56%
Subtotal	**172,039,531**	**172,417,256**	**143,325,116**	83.13%
CONTRACTUAL SERVICES & Oth. Obj.				
Instructional	2,612,901	2,915,764	2,203,570	75.57%
Support & Community Services	12,506,496	12,390,429	9,246,553	74.63%
Subtotal	**15,119,396**	**15,306,193**	**11,450,123**	74.81%
SUPPLIES AND MATERIALS				
Instructional	2,024,325	2,065,363	1,274,181	61.69%
Support & Community Services	6,239,719	6,396,107	5,178,901	80.97%
Subtotal	**8,264,044**	**8,461,470**	**6,453,082**	76.26%
EQUIPMENT				
Instructional	-	3,700	9,627	260.18%
Support & Community Services	83,685	48,156	17,965	37.31%
Subtotal	**83,685**	**51,856**	**27,591**	53.21%
TRANSFERS				
Pmts to Other Govt Entities-Per Proviso	20,000	20,000	20,180	100.90%
Food Service	267,897	267,897	-	0.00%
	287,897	**287,897**	**20,180**	7.01%
OPERATIONAL BALANCE **		3,000,000		0.00%
TOTAL EXPENDITURES THROUGH 5/31/2021	**$ 195,794,553**	**$199,524,672**	**$ 161,276,093**	**80.83%**
TOTAL EXPENDITURES THROUGH 5/31/2020	**$ 195,794,553**	**$200,073,496**	**$ 161,722,703**	**80.83%**

*** $2,843,370.67 was paid to employees as a Bonus in December 2020 and is reflected in the salaries/fringe above*

Board Report Revenue

From Date: 7/1/2020 To Date: 5/31/2021

Fiscal Year: 2020-2021

☐ Include pre encumbrance ☑ Print accounts with zero balance ☑ Filter Encumbrance Detail by Date Range

☐ Exclude inactive accounts with zero balance

Account Number	Description	Budget	Adjustments	GL Budget	Current	YTD	Balance	Encumbrance	Budget Bal	% Rem
100.000.0111001.0000.000	Ad Valorem Taxes - Lexington	($37,233,557.82)	$0.00	($37,233,557.82)	($37,586,899.86)	($37,586,899.86)	$353,342.04	$0.00	$353,342.04	-0.95%
100.000.0111002.0000.000	Ad Valorem Taxes - Richland	($14,994,746.18)	$0.00	($14,994,746.18)	($17,355,861.01)	($17,355,861.01)	$2,361,114.83	$0.00	$2,361,114.83	-15.75%
100.000.0112001.0000.000	Vehicle Taxes - Lexington	($7,013,376.00)	$0.00	($7,013,376.00)	($6,902,191.32)	($6,902,191.32)	($111,184.68)	$0.00	($111,184.68)	1.59%
100.000.0112002.0000.000	Vehicle Taxes - Richland	($6,781,620.00)	$0.00	($6,781,620.00)	($5,715,626.93)	($5,715,626.93)	($1,065,993.07)	$0.00	($1,065,993.07)	15.72%
100.000.0113001.0000.000	Delinquent Taxes - Lexington	($963,839.00)	$0.00	($963,839.00)	($1,016,858.96)	($1,016,858.96)	$53,019.96	$0.00	$53,019.96	-5.50%
100.000.0113002.0000.000	Delinquent Taxes - Richland	($844,490.00)	$0.00	($844,490.00)	($740,792.92)	($740,792.92)	($103,697.08)	$0.00	($103,697.08)	12.28%
100.000.0114001.0000.000	Penalties & Interest on Taxes - Lexington	($159,552.00)	($138,633.00)	($298,185.00)	($225,392.02)	($225,392.02)	($72,792.98)	$0.00	($72,792.98)	24.41%
100.000.0114002.0000.000	Penalties & Interest on Taxes - Richland	($117,448.00)	$0.00	($117,448.00)	($164,441.43)	($164,441.43)	$46,993.43	$0.00	$46,993.43	-40.01%
100.000.0115001.0000.000	Sales & Use Tax Credit - Lexington	$0.00	$0.00	$0.00	($548.35)	($548.35)	$548.35	$0.00	$548.35	0.00%
100.000.0115002.0000.000	Sales & Use Tax Credit - Richland	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0128001.0000.000	Revenue in Lieu of Taxes - Lexington	($1,509,596.00)	($42,744.00)	($1,552,340.00)	($1,607,494.60)	($1,607,494.60)	$55,154.60	$0.00	$55,154.60	-3.55%
100.000.0128002.0000.000	Revenue in Lieu of Taxes - Richland	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0131000.0000.000	Student Tuition Out of District	($5,000.00)	$0.00	($5,000.00)	($1,513.50)	($1,513.50)	($3,486.50)	$0.00	($3,486.50)	69.73%
100.000.0132000.0000.000	Tuition from Other LEAs for Regular Day School	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0151000.0000.000	Interest on Investments	($450,000.00)	$100,000.00	($350,000.00)	($68,369.78)	($68,369.78)	($281,630.22)	$0.00	($281,630.22)	80.47%
100.000.0151001.0000.000	Interest - Lexington	$0.00	$0.00	$0.00	($4,606.83)	($4,606.83)	$4,606.83	$0.00	$4,606.83	0.00%
100.000.0151002.0000.000	Interest - Richland County	$0.00	$0.00	$0.00	($3,915.66)	($3,915.66)	$3,915.66	$0.00	$3,915.66	0.00%
100.000.0174000.0000.000	Student Fees	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0190000.0000.000	Other Revenues from Local Sources	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0191000.0000.000	Rentals	($125,000.00)	$5,000.00	($120,000.00)	($39,210.21)	($39,210.21)	($80,789.79)	$0.00	($80,789.79)	67.32%
100.000.0192000.0000.000	Private Donations	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0193000.0000.000	Medicaid	($120,000.00)	$15,000.00	($105,000.00)	($60,883.00)	($60,883.00)	($44,117.00)	$0.00	($44,117.00)	42.02%
100.000.0195000.0000.000	Refund of Prior Year	($15,000.00)	$0.00	($15,000.00)	($217,510.27)	($217,510.27)	$202,510.27	$0.00	$202,510.27	-1350.07%
100.000.0196000.0000.000	Printing Revenue	$0.00	$0.00	$0.00	($14,291.71)	($14,291.71)	$14,291.71	$0.00	$14,291.71	0.00%
100.000.0199200.0000.000	E-Rate Revenue	$0.00	$0.00	$0.00	($252,648.81)	($252,648.81)	$252,648.81	$0.00	$252,648.81	0.00%
100.000.0199300.0000.000	Insurance Proceeds	($25,000.00)	$0.00	($25,000.00)	($190,228.06)	($190,228.06)	$165,228.06	$0.00	$165,228.06	-660.91%
100.000.0199400.0000.000	Receipt of Legal Settlements	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0199900.0000.000	Other Local Revenue	($200,000.00)	$0.00	($200,000.00)	($195,494.38)	($195,494.38)	($4,505.62)	$0.00	($4,505.62)	2.25%
100.000.0199901.0000.000	Other Local Revenue - Lexington	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0199902.0000.000	Other Local Revenue - Richland	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0199990.0000.000	Operational Balance	$0.00	$0.00	$0.00	($20.00)	($20.00)	$20.00	$0.00	$20.00	0.00%
100.000.0199999.0000.000	Operational Balance	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0313100.0000.000	SP Contracts	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0313200.0000.000	Home Schooling	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%

Board Report Revenue

From Date: 7/1/2020 To Date: 5/31/2021

Fiscal Year: 2020-2021

☐ Include pre encumbrance ☑ Print accounts with zero balance ☑ Filter Encumbrance Detail by Date Range

☐ Exclude inactive accounts with zero balance

Account Number	Description	Budget	Adjustments	GL Budget	Current	YTD	Balance	Encumbrance	Budget Bal	% Rem
100.000.0316000.0000.000	School Bus Driver Salary	($1,200,000.00)	($13,333.00)	($1,213,333.00)	($1,167,261.03)	($1,167,261.03)	($46,071.97)	$0.00	($46,071.97)	3.80%
100.000.0316100.0000.000	EAA Bus Driver Salary and Fringe	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0316200.0000.000	Workers Compensation School Bus Drivers	($62,270.00)	$543.00	($61,727.00)	($64,499.73)	($64,499.73)	$2,772.73	$0.00	$2,772.73	-4.49%
100.000.0318000.0000.000	State Fringe Benefits	($20,066,202.00)	($31,769.00)	($20,097,971.00)	($18,209,707.01)	($18,209,707.01)	($1,888,263.99)	$0.00	($1,888,263.99)	9.40%
100.000.0318100.0000.000	Retiree Health Insurance	($4,960,895.00)	($480,090.00)	($5,440,985.00)	($5,000,180.01)	($5,000,180.01)	($440,804.99)	$0.00	($440,804.99)	8.10%
100.000.0318600.0000.000	State Aid to Classroom - Teacher Salary	($3,863,887.00)	($260,288.00)	($4,124,175.00)	($3,267,225.17)	($3,267,225.17)	($856,949.83)	$0.00	($856,949.83)	20.78%
100.000.0319900.0000.000	State Other Scources	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0331000.0000.000	EFA Full Time Programs	($43,014,681.00)	$725,074.00	($42,289,607.00)	$0.00	$0.00	($42,289,607.00)	$0.00	($42,289,607.00)	100.00%
100.000.0331100.0000.000	EFA - Kindergarten	$0.00	$0.00	$0.00	($1,589,740.46)	($1,589,740.46)	$1,589,740.46	$0.00	$1,589,740.46	0.00%
100.000.0331200.0000.000	EFA - Primary	$0.00	$0.00	$0.00	($4,763,157.38)	($4,763,157.38)	$4,763,157.38	$0.00	$4,763,157.38	0.00%
100.000.0331300.0000.000	EFA - Elementary	$0.00	$0.00	$0.00	($9,813,848.11)	($9,813,848.11)	$9,813,848.11	$0.00	$9,813,848.11	0.00%
100.000.0331400.0000.000	EFA - High School	$0.00	$0.00	$0.00	($2,624,986.96)	($2,624,986.96)	$2,624,986.96	$0.00	$2,624,986.96	0.00%
100.000.0331500.0000.000	EFA - Trainable Mentally Handicapped	$0.00	$0.00	$0.00	($64,669.60)	($64,669.60)	$64,669.60	$0.00	$64,669.60	0.00%
100.000.0331600.0000.000	EFA - Speech Handicapped	$0.00	$0.00	$0.00	($2,888,555.03)	($2,888,555.03)	$2,888,555.03	$0.00	$2,888,555.03	0.00%
100.000.0331700.0000.000	EFA - Homebound	$0.00	$0.00	$0.00	($13,456.89)	($13,456.89)	$13,456.89	$0.00	$13,456.89	0.00%
100.000.0332100.0000.000	EFA - Emotionally Handicapped	$0.00	$0.00	$0.00	($111,548.22)	($111,548.22)	$111,548.22	$0.00	$111,548.22	0.00%
100.000.0332200.0000.000	EFA - Educable Mentally Handicapped	$0.00	$0.00	$0.00	($58,175.20)	($58,175.20)	$58,175.20	$0.00	$58,175.20	0.00%
100.000.0332300.0000.000	EFA - Learning Disabilities	$0.00	$0.00	$0.00	($2,755,692.68)	($2,755,692.68)	$2,755,692.68	$0.00	$2,755,692.68	0.00%
100.000.0332400.0000.000	EFA - Hearing Handicapped	$0.00	$0.00	$0.00	($178,299.60)	($178,299.60)	$178,299.60	$0.00	$178,299.60	0.00%
100.000.0332500.0000.000	EFA - Visually Handicapped	$0.00	$0.00	$0.00	($77,483.77)	($77,483.77)	$77,483.77	$0.00	$77,483.77	0.00%
100.000.0332600.0000.000	EFA - Orthopedically Handicapped	$0.00	$0.00	$0.00	($44,820.39)	($44,820.39)	$44,820.39	$0.00	$44,820.39	0.00%
100.000.0332700.0000.000	EFA - Vocational	$0.00	$0.00	$0.00	($7,677,626.38)	($7,677,626.38)	$7,677,626.38	$0.00	$7,677,626.38	0.00%
100.000.0333100.0000.000	EFA - Autism	$0.00	$0.00	$0.00	($1,066,253.66)	($1,066,253.66)	$1,066,253.66	$0.00	$1,066,253.66	0.00%
100.000.0333200.0000.000	EFA - Gifted and Talented Education Pupils	$0.00	$0.00	$0.00	($1,186,989.26)	($1,186,989.26)	$1,186,989.26	$0.00	$1,186,989.26	0.00%
100.000.0333400.0000.000	EFA - Limited English Proficiency	$0.00	$0.00	$0.00	($153,694.11)	($153,694.11)	$153,694.11	$0.00	$153,694.11	0.00%
100.000.0335100.0000.000	EFA - Academic Assistance	$0.00	$0.00	$0.00	($1,168,558.31)	($1,168,558.31)	$1,168,558.31	$0.00	$1,168,558.31	0.00%
100.000.0335200.0000.000	EFA - Pupils in Poverty	$0.00	$0.00	$0.00	($2,485,033.62)	($2,485,033.62)	$2,485,033.62	$0.00	$2,485,033.62	0.00%
100.000.0335300.0000.000	EFA - DUAL	$0.00	$0.00	$0.00	($42,562.79)	($42,562.79)	$42,562.79	$0.00	$42,562.79	0.00%
100.000.0337500.0000.000	EFA Education Foundation Supplement	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0339200.0000.000	EFA - NBC Excess EFA Formula	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0381000.0000.000	Local Property Tax Relief (Tier 1)	($10,580,071.00)	$0.00	($10,580,071.00)	($10,580,071.04)	($10,580,071.04)	$0.04	$0.00	$0.04	0.00%
100.000.0381002.0000.000	Local Property Tax Relief (Tier 1) - Richland	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0382000.0000.000	Homestead Exemption (Tier 2)	($1,758,200.00)	$0.00	($1,758,200.00)	($1,758,200.49)	($1,758,200.49)	$0.49	$0.00	$0.49	0.00%
100.000.0382002.0000.000	Homestead Exemption (Tier 2) - Richland	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%

Board Report Revenue

From Date: 7/1/2020 To Date: 5/31/2021

Fiscal Year: 2020-2021

☐ Include pre encumbrance ☑ Print accounts with zero balance ☑ Filter Encumbrance Detail by Date Range

☐ Exclude inactive accounts with zero balance

Account Number	Description	Budget	Adjustments	GL Budget	Current	YTD	Balance	Encumbrance	Budget Bal	% Rem
100.000.0382500.0000.000	Property Tax Relief - Tier 3	($31,656,943.00)	($488,143.00)	($32,145,086.00)	($25,716,068.80)	($25,716,068.80)	($6,429,017.20)	$0.00	($6,429,017.20)	20.00%
100.000.0383001.0000.000	Merchants Inventory Tax - Lexington	($194,013.00)	$0.00	($194,013.00)	($196,880.80)	($196,880.80)	$2,867.80	$0.00	$2,867.80	-1.48%
100.000.0383002.0000.000	Merchants Inventory Tax - Richland	($19,942.00)	$0.00	($19,942.00)	($12,805.74)	($12,805.74)	($7,136.26)	$0.00	($7,136.26)	35.79%
100.000.0384001.0000.000	Manufacturers Depr. Reimbursement - Lexington	($289,373.00)	($6,858.00)	($296,231.00)	($62,524.17)	($62,524.17)	($233,706.83)	$0.00	($233,706.83)	78.89%
100.000.0384002.0000.000	Manufacturers Depr. Reimbursement - Richland	$0.00	$0.00	$0.00	($21,533.74)	($21,533.74)	$21,533.74	$0.00	$21,533.74	0.00%
100.000.0389001.0000.000	Motor Carrier Vehicle Tax - Lexington	($185,886.00)	($25,639.00)	($211,525.00)	($246,691.67)	($246,691.67)	$35,166.67	$0.00	$35,166.67	-16.63%
100.000.0389002.0000.000	Motor Carrier Vehicle Tax - Richland	($64,704.00)	$0.00	($64,704.00)	($111,083.45)	($111,083.45)	$46,379.45	$0.00	$46,379.45	-71.68%
100.000.0390000.0000.000	Other State Revenue	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0399000.0000.000	Revenue from Other State Sources	($20,000.00)	$0.00	($20,000.00)	$0.00	$0.00	($20,000.00)	$0.00	($20,000.00)	100.00%
100.000.0399200.0000.000	State Forest Commission Revenue	$0.00	$0.00	$0.00	($12,385.08)	($12,385.08)	$12,385.08	$0.00	$12,385.08	0.00%
100.000.0399300.0000.000	PEBA On-behalf Payments	($1,190,410.00)	$0.00	($1,190,410.00)	($1,190,409.80)	($1,190,409.80)	($0.20)	$0.00	($0.20)	0.00%
100.000.0399900.0000.000	Revenue from Other State Agency	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0499000.0000.000	Other Federal Revenue	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0500000.0000.000	Other Sources	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0520000.0000.000	Interfund Transfers	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0521000.0000.000	Transfer from General Fund	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0522000.0000.000	Transfer from Special Revenue	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0523000.0000.000	Transfer from EIA	($5,758,851.00)	$41,761.00	($5,717,090.00)	($5,137,731.42)	($5,137,731.42)	($579,358.58)	$0.00	($579,358.58)	10.13%
100.000.0525000.0000.000	Transfer from Building Fund	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0527000.0000.000	Transfer from Pupil Activity	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.000.0528000.0000.000	Transfer of Indirect Cost	($350,000.00)	($130,000.00)	($480,000.00)	($322,345.03)	($322,345.03)	($157,654.97)	$0.00	($157,654.97)	32.84%
100.000.0530000.0000.000	Sale of Fixed Assets	$0.00	$0.00	$0.00	($63,462.42)	($63,462.42)	$63,462.42	$0.00	$63,462.42	0.00%
	FUND: General Fund - 100	($195,794,553.00)	($730,119.00)	($196,524,672.00)	($184,271,018.63)	($184,271,018.63)	($12,253,653.37)	$0.00	($12,253,653.37)	6.24%
Grand Total:		($195,794,553.00)	($730,119.00)	($196,524,672.00)	($184,271,018.63)	($184,271,018.63)	($12,253,653.37)	$0.00	($12,253,653.37)	6.24%

End of Report

Board Report Expenditures

From Date: 7/1/2020 To Date: 5/31/2021

Fiscal Year: 2020-2021 ☐ Include pre encumbrance ☐ Print accounts with zero balance ☑ Filter Encumbrance Detail by Date Range

☐ Exclude inactive accounts with zero balance

Account Number	Description	Budget	Adjustments	GL Budget	Current	YTD	Balance	Encumbrance	Budget Bal	% Rem
100.100.3000000.0000.000	Purchased Services	$257,509.95	($257,509.95)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.100.4000000.0000.000	Supplies and Materials	$202,432.50	($202,432.50)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
	FUNCTION: Instruction - 100	$459,942.45	($459,942.45)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	0.00%
100.111.1000000.0000.000	Salaries	$4,941,844.69	($320,522.38)	$4,621,322.31	$3,913,880.03	$3,913,880.03	$707,442.28	$970,371.51	($262,929.23)	-5.69%
100.111.2000000.0000.000	Employee Benefits	$2,334,649.47	($138,468.32)	$2,196,181.15	$1,795,720.16	$1,795,720.16	$400,460.99	$193,832.75	$206,628.24	9.41%
100.111.3000000.0000.000	Purchased Services	$2,363.83	$787.64	$3,151.47	$21,533.32	$21,533.32	($18,381.85)	($120.00)	($18,261.85)	-579.47%
100.111.4000000.0000.000	Supplies and Materials	$55,568.70	$7,324.30	$62,893.00	$47,347.76	$47,347.76	$15,545.24	$20,959.04	($5,413.80)	-8.61%
	FUNCTION: Kindergarten Programs - 111	$7,334,426.69	($450,878.76)	$6,883,547.93	$5,778,481.27	$5,778,481.27	$1,105,066.66	$1,185,043.30	($79,976.64)	-1.16%
100.112.1000000.0000.000	Salaries	$13,144,363.30	($111,342.53)	$13,033,020.77	$10,533,000.78	$10,533,000.78	$2,500,019.99	$2,636,416.47	($136,396.48)	-1.05%
100.112.2000000.0000.000	Employee Benefits	$5,839,260.30	($2,701.49)	$5,836,558.81	$4,562,545.28	$4,562,545.28	$1,274,013.53	$497,210.26	$776,803.27	13.31%
100.112.3000000.0000.000	Purchased Services	$5,833.16	($317.16)	$5,516.00	$325,419.59	$325,419.59	($319,903.59)	$0.00	($319,903.59)	-5799.56%
100.112.4000000.0000.000	Supplies and Materials	$266,217.30	$35,231.70	$301,449.00	$220,619.47	$220,619.47	$80,829.53	$46,634.53	$34,195.00	11.34%
	FUNCTION: Primary Programs - 112	$19,255,674.06	($79,129.48)	$19,176,544.58	$15,641,585.12	$15,641,585.12	$3,534,959.46	$3,180,261.26	$354,698.20	1.85%
100.113.1000000.0000.000	Salaries	$23,261,823.28	$224,357.56	$23,486,180.84	$18,849,260.50	$18,849,260.50	$4,636,920.34	$4,712,746.67	($75,826.33)	-0.32%
100.113.2000000.0000.000	Employee Benefits	$10,046,657.65	$97,095.99	$10,143,753.64	$7,953,652.59	$7,953,652.59	$2,190,101.05	$884,124.16	$1,305,976.89	12.87%
100.113.3000000.0000.000	Purchased Services	$15,931.80	($381.40)	$15,550.40	$581,466.02	$581,466.02	($565,915.62)	$0.00	($565,915.62)	-3639.24%
100.113.4000000.0000.000	Supplies and Materials	$456,234.30	$46,332.30	$502,566.60	$283,151.28	$283,151.28	$219,415.32	$37,033.12	$182,382.20	36.29%
100.113.5000000.0000.000	Capital Outlay	$0.00	$3,700.00	$3,700.00	$3,697.88	$3,697.88	$2.12	$0.00	$2.12	0.06%
100.113.6000000.0000.000	Other Objects	$0.00	$0.00	$0.00	$645.84	$645.84	($645.84)	$0.00	($645.84)	0.00%
	FUNCTION: Elementary Programs - 113	$33,780,647.03	$371,104.45	$34,151,751.48	$27,671,874.11	$27,671,874.11	$6,479,877.37	$5,633,903.95	$845,973.42	2.48%
100.114.1000000.0000.000	Salaries	$18,928,869.68	$6,883.22	$18,935,752.90	$15,183,332.76	$15,183,332.76	$3,752,420.14	$3,753,696.07	($1,275.93)	-0.01%
100.114.2000000.0000.000	Employee Benefits	$7,881,345.35	$88,706.71	$7,970,052.06	$6,223,293.25	$6,223,293.25	$1,746,758.81	$692,372.05	$1,054,386.76	13.23%
100.114.3000000.0000.000	Purchased Services	$388,688.09	$8,378.91	$397,067.00	$654,435.67	$654,435.67	($257,368.67)	$101,709.24	($359,077.91)	-90.43%
100.114.4000000.0000.000	Supplies and Materials	$648,574.11	$97,767.89	$746,342.00	$435,722.89	$435,722.89	$310,619.11	$61,382.09	$249,237.02	33.39%
100.114.5000000.0000.000	Capital Outlay	$0.00	$0.00	$0.00	$5,928.72	$5,928.72	($5,928.72)	$5,422.13	($11,350.85)	0.00%
100.114.6000000.0000.000	Other Objects	$885.00	$0.00	$885.00	$835.00	$835.00	$50.00	$0.00	$50.00	5.65%
	FUNCTION: High School Programs - 114	$27,848,362.23	$201,736.73	$28,050,098.96	$22,503,548.29	$22,503,548.29	$5,546,550.67	$4,614,581.58	$931,969.09	3.32%
100.115.1000000.0000.000	Salaries	$2,681,887.09	($100,417.85)	$2,581,469.24	$2,132,807.93	$2,132,807.93	$448,661.31	$472,899.28	($24,237.97)	-0.94%
100.115.2000000.0000.000	Employee Benefits	$1,144,571.34	($37,916.44)	$1,106,654.90	$893,600.93	$893,600.93	$213,053.97	$98,224.88	$114,829.09	10.38%
100.115.3000000.0000.000	Purchased Services	$9,540.00	$1,060.00	$10,600.00	$27,866.64	$27,866.64	($17,266.64)	$1,754.25	($19,020.89)	-179.44%
100.115.4000000.0000.000	Supplies and Materials	$103,500.00	$21,500.00	$125,000.00	$80,048.22	$80,048.22	$44,951.78	$27,917.21	$17,034.57	13.63%
100.115.5000000.0000.000	Capital Outlay	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$8,457.96	($8,457.96)	0.00%
INCTION: Career and Technology Education (Vocational) Prog - 115		$3,939,498.43	($115,774.29)	$3,823,724.14	$3,134,323.72	$3,134,323.72	$689,400.42	$609,253.58	$80,146.84	2.10%

Board Report Expenditures

From Date: 7/1/2020 To Date: 5/31/2021

Fiscal Year: 2020-2021 ☐ Include pre encumbrance ☐ Print accounts with zero balance ☑ Filter Encumbrance Detail by Date Range

☐ Exclude inactive accounts with zero balance

Account Number	Description	Budget	Adjustments	GL Budget	Current	YTD	Balance	Encumbrance	Budget Bal	% Rem
100.118.1000000.0000.000	Salaries	$81,157.58	$136,802.24	$217,959.82	$245,027.66	$245,027.66	($27,067.84)	$61,211.14	($88,278.98)	-40.50%
100.118.2000000.0000.000	Employee Benefits	$36,948.06	$83,155.97	$120,104.03	$124,732.88	$124,732.88	($4,628.85)	$13,765.19	($18,394.04)	-15.32%
100.118.3000000.0000.000	Purchased Services	$0.00	$0.00	$0.00	$674.31	$674.31	($674.31)	$0.00	($674.31)	0.00%
	FUNCTION: Montessori Programs - 118	$118,105.64	$219,958.21	$338,063.85	$370,434.85	$370,434.85	($32,371.00)	$74,976.33	($107,347.33)	-31.75%
100.121.1000000.0000.000	Salaries	$1,006,352.64	$62,345.32	$1,068,697.96	$1,211,486.45	$1,211,486.45	($142,788.49)	$334,229.04	($477,017.53)	-44.64%
100.121.2000000.0000.000	Employee Benefits	$456,020.20	$37,011.79	$493,031.99	$518,437.78	$518,437.78	($25,405.79)	$62,028.02	($87,433.81)	-17.73%
100.121.3000000.0000.000	Purchased Services	$0.00	$0.00	$0.00	$13,778.44	$13,778.44	($13,778.44)	$0.00	($13,778.44)	0.00%
100.121.4000000.0000.000	Supplies and Materials	$2,270.70	$583.30	$2,854.00	$29,307.06	$29,307.06	($26,453.06)	$416.17	($26,869.23)	-941.46%
	FUNCTION: Educable Mentally Handicapped - 121	$1,464,643.54	$99,940.41	$1,564,583.95	$1,773,009.73	$1,773,009.73	($208,425.78)	$396,673.23	($605,099.01)	-38.67%
100.122.1000000.0000.000	Salaries	$439,787.08	($1,999.88)	$437,787.20	$342,545.84	$342,545.84	$95,241.36	$84,506.70	$10,734.66	2.45%
100.122.2000000.0000.000	Employee Benefits	$184,841.23	$4,620.56	$189,461.79	$142,632.51	$142,632.51	$46,829.28	$14,778.45	$32,050.83	16.92%
100.122.3000000.0000.000	Purchased Services	$0.00	$0.00	$0.00	$1,945.42	$1,945.42	($1,945.42)	$0.00	($1,945.42)	0.00%
100.122.4000000.0000.000	Supplies and Materials	$2,935.80	($629.80)	$2,306.00	$1,956.85	$1,956.85	$349.15	($251.78)	$600.93	26.06%
	FUNCTION: Trainable Mentally Handicapped - 122	$627,564.11	$1,990.88	$629,554.99	$489,080.62	$489,080.62	$140,474.37	$99,033.37	$41,441.00	6.58%
100.123.4000000.0000.000	Supplies and Materials	$1,068.30	$590.70	$1,659.00	$512.26	$512.26	$1,146.74	($8.73)	$1,155.47	69.65%
	FUNCTION: Orthopedically Handicapped - 123	$1,068.30	$590.70	$1,659.00	$512.26	$512.26	$1,146.74	($8.73)	$1,155.47	69.65%
100.124.1000000.0000.000	Salaries	$114,614.70	$0.00	$114,614.70	$49,743.73	$49,743.73	$64,870.97	$12,541.66	$52,329.31	45.66%
100.124.2000000.0000.000	Employee Benefits	$47,348.04	($1,405.61)	$45,942.43	$18,630.65	$18,630.65	$27,311.78	$1,918.78	$25,393.00	55.27%
100.124.4000000.0000.000	Supplies and Materials	$1,656.90	$372.10	$2,029.00	$407.57	$407.57	$1,621.43	$83.42	$1,538.01	75.80%
	FUNCTION: Visually Handicapped - 124	$163,619.64	($1,033.51)	$162,586.13	$68,781.95	$68,781.95	$93,804.18	$14,543.86	$79,260.32	48.75%
100.125.1000000.0000.000	Salaries	$288,134.66	($0.03)	$288,134.63	$190,656.30	$190,656.30	$97,478.33	$47,876.35	$49,601.98	17.21%
100.125.2000000.0000.000	Employee Benefits	$116,464.29	$864.34	$117,328.63	$73,433.44	$73,433.44	$43,895.19	$7,632.30	$36,262.89	30.91%
100.125.3000000.0000.000	Purchased Services	$0.00	$0.00	$0.00	$32,798.75	$32,798.75	($32,798.75)	$26,496.25	($59,295.00)	0.00%
100.125.4000000.0000.000	Supplies and Materials	$2,563.20	$1,197.80	$3,761.00	$432.04	$432.04	$3,328.96	$363.62	$2,965.34	78.84%
	FUNCTION: Hearing Handicapped - 125	$407,162.15	$2,062.11	$409,224.26	$297,320.53	$297,320.53	$111,903.73	$82,368.52	$29,535.21	7.22%
100.126.1000000.0000.000	Salaries	$1,756,296.51	$42,904.03	$1,799,200.54	$1,467,942.28	$1,467,942.28	$331,258.26	$365,510.82	($34,252.56)	-1.90%
100.126.2000000.0000.000	Employee Benefits	$741,541.86	$56,859.57	$798,401.43	$622,796.86	$622,796.86	$175,604.57	$74,137.88	$101,466.69	12.71%
100.126.3000000.0000.000	Purchased Services	$0.00	$81,900.00	$81,900.00	$86,178.37	$86,178.37	($4,278.37)	$20,148.70	($24,427.07)	-29.83%
100.126.4000000.0000.000	Supplies and Materials	$70,362.90	$11,572.10	$81,935.00	$33,908.18	$33,908.18	$48,026.82	($136.55)	$48,163.37	58.78%
	FUNCTION: Speech Handicapped - 126	$2,568,201.27	$193,235.70	$2,761,436.97	$2,210,825.69	$2,210,825.69	$550,611.28	$459,660.85	$90,950.43	3.29%
100.127.1000000.0000.000	Salaries	$4,237,857.40	$220,576.95	$4,458,434.35	$3,412,405.42	$3,412,405.42	$1,046,028.93	$815,257.20	$230,771.73	5.18%
100.127.2000000.0000.000	Employee Benefits	$1,891,767.98	$65,641.69	$1,957,409.67	$1,449,203.58	$1,449,203.58	$508,206.09	$159,747.20	$348,458.89	17.80%

Board Report Expenditures

From Date: 7/1/2020 To Date: 5/31/2021

Fiscal Year: 2020-2021 ☐ Include pre encumbrance ☐ Print accounts with zero balance ☑ Filter Encumbrance Detail by Date Range

☐ Exclude inactive accounts with zero balance

Account Number	Description	Budget	Adjustments	GL Budget	Current	YTD	Balance	Encumbrance	Budget Bal	% Rem
100.127.3000000.0000.000	Purchased Services	$0.00	$0.00	$0.00	$57,270.86	$57,270.86	($57,270.86)	$0.00	($57,270.86)	0.00%
100.127.4000000.0000.000	Supplies and Materials	$89,937.90	$10,280.10	$100,218.00	$93,959.14	$93,959.14	$6,258.86	$5,106.75	$1,152.11	1.15%
FUNCTION: Learning Disabilities - 127		$6,219,563.28	$296,498.74	$6,516,062.02	$5,012,839.00	$5,012,839.00	$1,503,223.02	$980,111.15	$523,111.87	8.03%
100.128.1000000.0000.000	Salaries	$850,373.01	($45,731.44)	$804,641.57	$531,365.18	$531,365.18	$273,276.39	$126,210.50	$147,065.89	18.28%
100.128.2000000.0000.000	Employee Benefits	$378,924.31	($11,459.98)	$367,464.33	$240,811.55	$240,811.55	$126,652.78	$25,200.15	$101,452.63	27.61%
100.128.3000000.0000.000	Purchased Services	$0.00	$0.00	$0.00	$776.00	$776.00	($776.00)	$0.00	($776.00)	0.00%
100.128.4000000.0000.000	Supplies and Materials	$4,000.50	($276.50)	$3,724.00	$2,670.98	$2,670.98	$1,053.02	$1,931.90	($878.88)	-23.60%
FUNCTION: Emotionally Handicapped - 128		$1,233,297.82	($57,467.92)	$1,175,829.90	$775,623.71	$775,623.71	$400,206.19	$153,342.55	$246,863.64	20.99%
100.129.1000000.0000.000	Salaries	$782,856.22	$11,823.78	$794,680.00	$572,923.94	$572,923.94	$221,756.06	$123,499.31	$98,256.75	12.36%
100.129.2000000.0000.000	Employee Benefits	$318,957.82	$12,536.01	$331,493.83	$240,947.62	$240,947.62	$90,546.21	$26,518.38	$64,027.83	19.31%
100.129.3000000.0000.000	Purchased Services	$0.00	$0.00	$0.00	$160.05	$160.05	($160.05)	$0.00	($160.05)	0.00%
FUNCTION: Coordinated Early Intervening Services (CEIS) - 129		$1,101,814.04	$24,359.79	$1,126,173.83	$814,031.61	$814,031.61	$312,142.22	$150,017.69	$162,124.53	14.40%
100.135.1000000.0000.000	Salaries	$0.00	$0.00	$0.00	$1,000.00	$1,000.00	($1,000.00)	$0.00	($1,000.00)	0.00%
100.135.2000000.0000.000	Employee Benefits	$0.00	$0.00	$0.00	$83.15	$83.15	($83.15)	$0.00	($83.15)	0.00%
100.135.4000000.0000.000	Supplies and Materials	$81.00	$9.00	$90.00	$0.00	$0.00	$90.00	$0.00	$90.00	100.00%
JNCTION: Preschool Handicapped Speech (3 and 4 year olds) - 135		$81.00	$9.00	$90.00	$1,083.15	$1,083.15	($993.15)	$0.00	($993.15)	-1103.50%
100.136.1000000.0000.000	Salaries	$12,620.26	($4,425.50)	$8,194.76	$23,352.58	$23,352.58	($15,157.82)	$993.21	($16,151.03)	-197.09%
100.136.2000000.0000.000	Employee Benefits	$4,791.17	($1,208.98)	$3,582.19	$7,416.94	$7,416.94	($3,834.75)	$360.74	($4,195.49)	-117.12%
100.136.3000000.0000.000	Purchased Services	$0.00	$0.00	$0.00	$3,048.61	$3,048.61	($3,048.61)	$0.00	($3,048.61)	0.00%
FUNCTION: Preschool Handicapped Itinerant (3 and 4 yr olds) - 136		$17,411.43	($5,634.48)	$11,776.95	$33,818.13	$33,818.13	($22,041.18)	$1,353.95	($23,395.13)	-198.65%
100.137.1000000.0000.000	Salaries	$1,229,993.07	($107,577.79)	$1,122,415.28	$894,829.49	$894,829.49	$227,585.79	$218,553.87	$9,031.92	0.80%
100.137.2000000.0000.000	Employee Benefits	$549,103.08	($46,341.49)	$502,761.59	$394,384.97	$394,384.97	$108,376.62	$44,591.75	$63,784.87	12.69%
100.137.3000000.0000.000	Purchased Services	$0.00	$0.00	$0.00	$6,156.01	$6,156.01	($6,156.01)	$0.00	($6,156.01)	0.00%
100.137.4000000.0000.000	Supplies and Materials	$486.00	$54.00	$540.00	$537.45	$537.45	$2.55	($31.01)	$33.56	6.21%
INCTION: Preschool Handicapped Self Contained (3 &4 yr old) - 137		$1,779,582.15	($153,865.28)	$1,625,716.87	$1,295,907.92	$1,295,907.92	$329,808.95	$263,114.61	$66,694.34	4.10%
100.138.1000000.0000.000	Salaries	$6,793.17	($1,156.46)	$5,636.71	$3,831.72	$3,831.72	$1,804.99	$993.21	$811.78	14.40%
100.138.2000000.0000.000	Employee Benefits	$2,666.08	($464.07)	$2,202.01	$1,819.68	$1,819.68	$382.33	$360.74	$21.59	0.98%
100.138.3000000.0000.000	Purchased Services	$0.00	$0.00	$0.00	$1.90	$1.90	($1.90)	$0.00	($1.90)	0.00%
UNCTION: Preschool Handicapped Homebased (3 & 4 yr olds) - 138		$9,459.25	($1,620.53)	$7,838.72	$5,653.30	$5,653.30	$2,185.42	$1,353.95	$831.47	10.61%
100.139.1000000.0000.000	Salaries	$1,055,959.83	($291.14)	$1,055,668.69	$892,318.94	$892,318.94	$163,349.75	$219,095.99	($55,746.24)	-5.28%
100.139.2000000.0000.000	Employee Benefits	$488,307.66	$12,241.51	$500,549.17	$407,807.05	$407,807.05	$92,742.12	$43,405.86	$49,336.26	9.86%
100.139.3000000.0000.000	Purchased Services	$11,407.95	$6,815.55	$18,223.50	$18,147.68	$18,147.68	$75.82	$240.80	($164.98)	-0.91%

Board Report Expenditures

From Date: 7/1/2020 To Date: 5/31/2021

Fiscal Year: 2020-2021 ☐ Include pre encumbrance ☐ Print accounts with zero balance ☑ Filter Encumbrance Detail by Date Range

☐ Exclude inactive accounts with zero balance

Account Number	Description	Budget	Adjustments	GL Budget	Current	YTD	Balance	Encumbrance	Budget Bal	% Rem
100.139.4000000.0000.000	Supplies and Materials	$31,361.40	$937.10	$32,298.50	$19,696.76	$19,696.76	$12,601.74	$3,554.06	$9,047.68	28.01%
100.139.6000000.0000.000	Other Objects	$3,500.00	($2,000.00)	$1,500.00	$324.50	$324.50	$1,175.50	$0.00	$1,175.50	78.37%
	FUNCTION: Early Childhood Programs - 139	$1,590,536.84	$17,703.02	$1,608,239.86	$1,338,294.93	$1,338,294.93	$269,944.93	$266,296.71	$3,648.22	0.23%
100.141.1000000.0000.000	Salaries	$1,298,378.92	$137,428.45	$1,435,807.37	$1,068,215.08	$1,068,215.08	$367,592.29	$269,021.76	$98,570.53	6.87%
100.141.2000000.0000.000	Employee Benefits	$565,074.84	$61,707.23	$626,782.07	$440,632.31	$440,632.31	$186,149.76	$47,305.77	$138,843.99	22.15%
100.141.3000000.0000.000	Purchased Services	$2,819.07	($1,431.07)	$1,388.00	$1,951.24	$1,951.24	($563.24)	$81.30	($644.54)	-46.44%
100.141.4000000.0000.000	Supplies and Materials	$9,747.63	$2,977.37	$12,725.00	$1,795.10	$1,795.10	$10,929.90	$25.00	$10,904.90	85.70%
100.141.6000000.0000.000	Other Objects	$150.00	($150.00)	$0.00	$175.50	$175.50	($175.50)	$0.00	($175.50)	0.00%
	FUNCTION: Gifted and Talented Academic - 141	$1,876,170.46	$200,531.98	$2,076,702.44	$1,512,769.23	$1,512,769.23	$563,933.21	$316,433.83	$247,499.38	11.92%
100.143.1000000.0000.000	Salaries	$343,669.23	($20,681.08)	$322,988.15	$246,214.45	$246,214.45	$76,773.70	$62,252.93	$14,520.77	4.50%
100.143.2000000.0000.000	Employee Benefits	$139,757.25	($7,394.37)	$132,362.88	$101,775.73	$101,775.73	$30,587.15	$13,166.22	$17,420.93	13.16%
100.143.3000000.0000.000	Purchased Services	$0.00	$0.00	$0.00	$5,813.10	$5,813.10	($5,813.10)	$0.00	($5,813.10)	0.00%
	FUNCTION: Advanced Placement - 143	$483,426.48	($28,075.45)	$455,351.03	$353,803.28	$353,803.28	$101,547.75	$75,419.15	$26,128.60	5.74%
100.144.3000000.0000.000	Purchased Services	$7,470.00	$830.00	$8,300.00	$0.00	$0.00	$8,300.00	$0.00	$8,300.00	100.00%
100.144.4000000.0000.000	Supplies and Materials	$45,000.00	$5,000.00	$50,000.00	$9,607.24	$9,607.24	$40,392.76	$1,622.90	$38,769.86	77.54%
100.144.6000000.0000.000	Other Objects	$11,775.00	$0.00	$11,775.00	$11,749.00	$11,749.00	$26.00	$0.00	$26.00	0.22%
	FUNCTION: International Baccalaureate - 144	$64,245.00	$5,830.00	$70,075.00	$21,356.24	$21,356.24	$48,718.76	$1,622.90	$47,095.86	67.21%
100.145.1000000.0000.000	Salaries	$193,937.00	$0.00	$193,937.00	$64,662.69	$64,662.69	$129,274.31	$18,956.26	$110,318.05	56.88%
100.145.2000000.0000.000	Employee Benefits	$58,045.34	($8,612.12)	$49,433.22	$22,548.91	$22,548.91	$26,884.31	$6,120.61	$20,763.70	42.00%
100.145.3000000.0000.000	Purchased Services	$14,400.00	$1,600.00	$16,000.00	$0.00	$0.00	$16,000.00	$0.00	$16,000.00	100.00%
	FUNCTION: Homebound - 145	$266,382.34	($7,012.12)	$259,370.22	$87,211.60	$87,211.60	$172,158.62	$25,076.87	$147,081.75	56.71%
100.148.1000000.0000.000	Salaries	$157,649.71	($8,000.56)	$149,649.15	$129,522.82	$129,522.82	$20,126.33	$30,485.08	($10,358.75)	-6.92%
100.148.2000000.0000.000	Employee Benefits	$63,816.79	($4,505.53)	$59,311.26	$49,824.63	$49,824.63	$9,486.63	$5,666.85	$3,819.78	6.44%
100.148.3000000.0000.000	Purchased Services	$6,318.00	$702.00	$7,020.00	($1,383.33)	($1,383.33)	$8,403.33	$200.00	$8,203.33	116.86%
100.148.4000000.0000.000	Supplies and Materials	$2,587.50	$287.50	$2,875.00	$90.74	$90.74	$2,784.26	$0.00	$2,784.26	96.84%
	FUNCTION: Gifted and Talented Artistic - 148	$230,372.00	($11,516.59)	$218,855.41	$178,054.86	$178,054.86	$40,800.55	$36,351.93	$4,448.62	2.03%
100.149.1000000.0000.000	Salaries	$622,264.43	($40,543.35)	$581,721.08	$934,607.72	$934,607.72	($352,886.64)	$114,742.33	($467,628.97)	-80.39%
100.149.2000000.0000.000	Employee Benefits	$270,393.62	$5,881.27	$276,274.89	$318,177.49	$318,177.49	($41,902.60)	$22,177.85	($64,080.45)	-23.19%
100.149.3000000.0000.000	Purchased Services	$1,848,897.36	$471,973.04	$2,320,870.40	$337,666.38	$337,666.38	$1,983,204.02	$0.00	$1,983,204.02	85.45%
	FUNCTION: Other Special Programs - 149	$2,741,555.41	$437,310.96	$3,178,866.37	$1,590,451.59	$1,590,451.59	$1,588,414.78	$136,920.18	$1,451,494.60	45.66%
100.161.1000000.0000.000	Salaries	$967,238.73	($162,080.40)	$805,158.33	$552,014.00	$552,014.00	$253,144.33	$137,157.41	$115,986.92	14.41%
100.161.2000000.0000.000	Employee Benefits	$477,172.44	($79,550.93)	$397,621.51	$271,662.37	$271,662.37	$125,959.14	$28,894.22	$97,064.92	24.41%

Board Report Expenditures

From Date: 7/1/2020 To Date: 5/31/2021

Fiscal Year: 2020-2021 ☐ Include pre encumbrance ☐ Print accounts with zero balance ☑ Filter Encumbrance Detail by Date Range

☐ Exclude inactive accounts with zero balance

Account Number	Description	Budget	Adjustments	GL Budget	Current	YTD	Balance	Encumbrance	Budget Bal	% Rem
100.161.3000000.0000.000	Purchased Services	$0.00	$0.00	$0.00	$3,833.95	$3,833.95	($3,833.95)	$137.75	($3,971.70)	0.00%
100.161.4000000.0000.000	Supplies and Materials	$22,841.10	$2,707.90	$25,549.00	$11,278.99	$11,278.99	$14,270.01	$133.66	$14,136.35	55.33%
FUNCTION: Other Exceptional Programs - 161		$1,467,252.27	($238,923.43)	$1,228,328.84	$838,789.31	$838,789.31	$389,539.53	$166,323.04	$223,216.49	18.17%
100.172.1000000.0000.000	Salaries	$40,000.00	$0.00	$40,000.00	$9,375.51	$9,375.51	$30,624.49	$0.00	$30,624.49	76.56%
100.172.2000000.0000.000	Employee Benefits	$11,552.00	$500.00	$12,052.00	$2,824.38	$2,824.38	$9,227.62	$0.00	$9,227.62	76.57%
100.172.3000000.0000.000	Purchased Services	$0.00	$0.00	$0.00	$6,625.00	$6,625.00	($6,625.00)	$0.00	($6,625.00)	0.00%
FUNCTION: Elementary Summer School - 172		$51,552.00	$500.00	$52,052.00	$18,824.89	$18,824.89	$33,227.11	$0.00	$33,227.11	63.83%
100.173.1000000.0000.000	Salaries	$65,000.00	($65,000.00)	$0.00	$52,571.25	$52,571.25	($52,571.25)	$0.00	($52,571.25)	0.00%
100.173.2000000.0000.000	Employee Benefits	$17,999.00	($17,999.00)	$0.00	$15,837.23	$15,837.23	($15,837.23)	$0.00	($15,837.23)	0.00%
FUNCTION: High School Summer School - 173		$82,999.00	($82,999.00)	$0.00	$68,408.48	$68,408.48	($68,408.48)	$0.00	($68,408.48)	0.00%
100.175.4000000.0000.000	Supplies and Materials	$0.00	$0.00	$0.00	$131.88	$131.88	($131.88)	$0.00	($131.88)	0.00%
JNCTION: Instructional Programs Beyond Regular School Day - 175		$0.00	$0.00	$0.00	$131.88	$131.88	($131.88)	$0.00	($131.88)	0.00%
100.181.1000000.0000.000	Salaries	$114,933.01	$0.00	$114,933.01	$106,355.28	$106,355.28	$8,577.73	$9,577.73	($1,000.00)	-0.87%
100.181.2000000.0000.000	Employee Benefits	$39,436.09	$229.87	$39,665.96	$36,233.33	$36,233.33	$3,432.63	$3,286.38	$146.25	0.37%
100.181.3000000.0000.000	Purchased Services	$3,470.40	$445.60	$3,916.00	$225.00	$225.00	$3,691.00	$0.00	$3,691.00	94.25%
100.181.4000000.0000.000	Supplies and Materials	$720.00	($145.00)	$575.00	$177.14	$177.14	$397.86	($177.14)	$575.00	100.00%
100.181.6000000.0000.000	Other Objects	$691.00	($340.00)	$351.00	$351.00	$351.00	$0.00	$0.00	$0.00	0.00%
FUNCTION: Adult Basic Education Programs - 181		$159,250.50	$190.47	$159,440.97	$143,341.75	$143,341.75	$16,099.22	$12,686.97	$3,412.25	2.14%
100.182.1000000.0000.000	Salaries	$0.00	$0.00	$0.00	$2,000.00	$2,000.00	($2,000.00)	$0.00	($2,000.00)	0.00%
100.182.2000000.0000.000	Employee Benefits	$0.00	$0.00	$0.00	$166.30	$166.30	($166.30)	$0.00	($166.30)	0.00%
100.182.3000000.0000.000	Purchased Services	$450.00	($400.00)	$50.00	$0.00	$0.00	$50.00	$0.00	$50.00	100.00%
100.182.4000000.0000.000	Supplies and Materials	$4,177.26	($203.20)	$3,974.06	$821.65	$821.65	$3,152.41	$300.00	$2,852.41	71.78%
FUNCTION: Adult Secondary Education Programs - 182		$4,627.26	($603.20)	$4,024.06	$2,987.95	$2,987.95	$1,036.11	$300.00	$736.11	18.29%
100.188.1000000.0000.000	Salaries	$38,142.00	$0.00	$38,142.00	$35,362.20	$35,362.20	$2,779.80	$6,357.00	($3,577.20)	-9.38%
100.188.2000000.0000.000	Employee Benefits	$23,604.78	($4,491.64)	$19,113.14	$16,172.94	$16,172.94	$2,940.20	$1,574.96	$1,365.24	7.14%
FUNCTION: Parenting/Family Literacy - 188		$61,746.78	($4,491.64)	$57,255.14	$51,535.14	$51,535.14	$5,720.00	$7,931.96	($2,211.96)	-3.86%
100.190.1000000.0000.000	Salaries	$652,010.13	$3,478.29	$655,488.42	$533,780.99	$533,780.99	$121,707.43	$129,673.28	($7,965.85)	-1.22%
100.190.2000000.0000.000	Employee Benefits	$192,428.00	$5,070.66	$197,498.66	$158,266.92	$158,266.92	$39,231.74	$17,661.44	$21,570.30	10.92%
100.190.6000000.0000.000	Other Objects	$20,800.00	($9,100.00)	$11,700.00	$3,100.61	$3,100.61	$8,599.39	$2,352.93	$6,246.46	53.39%
FUNCTION: Instructional Pupil Activity - 190		$865,238.13	($551.05)	$864,687.08	$695,148.52	$695,148.52	$169,538.56	$149,687.65	$19,850.91	2.30%
100.211.1000000.0000.000	Salaries	$1,007,805.76	$5,958.69	$1,013,764.45	$821,896.44	$821,896.44	$191,868.01	$174,207.86	$17,660.15	1.74%
100.211.2000000.0000.000	Employee Benefits	$497,789.14	$19,673.27	$517,462.41	$380,268.76	$380,268.76	$137,193.65	$41,414.29	$95,779.36	18.51%

Board Report Expenditures

From Date: 7/1/2020 To Date: 5/31/2021

Fiscal Year: 2020-2021 ☐ Include pre encumbrance ☐ Print accounts with zero balance ☑ Filter Encumbrance Detail by Date Range

☐ Exclude inactive accounts with zero balance

Account Number	Description	Budget	Adjustments	GL Budget	Current	YTD	Balance	Encumbrance	Budget Bal	% Rem
100.211.3000000.0000.000	Purchased Services	$108,900.00	$11,100.00	$120,000.00	$4,052.80	$4,052.80	$115,947.20	$0.00	$115,947.20	96.62%
100.211.4000000.0000.000	Supplies and Materials	$2,700.00	$1,300.00	$4,000.00	$24,507.00	$24,507.00	($20,507.00)	$0.00	($20,507.00)	-512.68%
FUNCTION: Attendance and Social Work Services - 211		$1,617,194.90	$38,031.96	$1,655,226.86	$1,230,725.00	$1,230,725.00	$424,501.86	$215,622.15	$208,879.71	12.62%
100.212.1000000.0000.000	Salaries	$3,397,041.78	$29,303.12	$3,426,344.90	$2,937,098.14	$2,937,098.14	$489,246.76	$571,800.96	($82,554.20)	-2.41%
100.212.2000000.0000.000	Employee Benefits	$1,449,979.56	$27,281.98	$1,477,261.54	$1,225,509.63	$1,225,509.63	$251,751.91	$123,780.38	$127,971.53	8.66%
100.212.3000000.0000.000	Purchased Services	$3,098.70	($858.30)	$2,240.40	$22,147.55	$22,147.55	($19,907.15)	$0.00	($19,907.15)	-888.55%
100.212.4000000.0000.000	Supplies and Materials	$30,385.54	$5,371.84	$35,757.38	$22,194.89	$22,194.89	$13,562.49	($3,004.72)	$16,567.21	46.33%
FUNCTION: Guidance Services - 212		$4,880,505.58	$61,098.64	$4,941,604.22	$4,206,950.21	$4,206,950.21	$734,654.01	$692,576.62	$42,077.39	0.85%
100.213.1000000.0000.000	Salaries	$1,860,392.86	($50,205.11)	$1,810,187.75	$1,576,478.87	$1,576,478.87	$233,708.88	$400,934.64	($167,225.76)	-9.24%
100.213.2000000.0000.000	Employee Benefits	$808,664.27	($1,684.99)	$806,979.28	$671,863.54	$671,863.54	$135,115.74	$76,075.82	$59,039.92	7.32%
100.213.3000000.0000.000	Purchased Services	$55,531.80	($54,101.80)	$1,430.00	$22,678.00	$22,678.00	($21,248.00)	$0.00	($21,248.00)	-1485.87%
100.213.4000000.0000.000	Supplies and Materials	$32,131.80	$1,908.20	$34,040.00	$31,214.64	$31,214.64	$2,825.36	$2,986.08	($160.72)	-0.47%
100.213.6000000.0000.000	Other Objects	$116.00	$0.00	$116.00	$0.00	$0.00	$116.00	$0.00	$116.00	100.00%
FUNCTION: Health Services - 213		$2,756,836.73	($104,083.70)	$2,652,753.03	$2,302,235.05	$2,302,235.05	$350,517.98	$479,996.54	($129,478.56)	-4.88%
100.214.1000000.0000.000	Salaries	$1,184,873.53	$13,426.58	$1,198,300.11	$1,088,960.60	$1,088,960.60	$109,339.51	$200,644.79	($91,305.28)	-7.62%
100.214.2000000.0000.000	Employee Benefits	$466,692.08	$14,401.72	$481,093.80	$422,155.32	$422,155.32	$58,938.48	$45,001.46	$13,937.02	2.90%
100.214.3000000.0000.000	Purchased Services	$5,400.00	$600.00	$6,000.00	$588.56	$588.56	$5,411.44	$0.00	$5,411.44	90.19%
100.214.4000000.0000.000	Supplies and Materials	$5,265.00	$585.00	$5,850.00	$3,575.98	$3,575.98	$2,274.02	($346.15)	$2,620.17	44.79%
FUNCTION: Psychological Services - 214		$1,662,230.61	$29,013.30	$1,691,243.91	$1,515,280.46	$1,515,280.46	$175,963.45	$245,300.10	($69,336.65)	-4.10%
100.217.1000000.0000.000	Salaries	$84,052.83	$0.00	$84,052.83	$87,048.40	$87,048.40	($2,995.57)	$7,004.43	($10,000.00)	-11.90%
100.217.2000000.0000.000	Employee Benefits	$34,933.41	$168.10	$35,101.51	$32,705.32	$32,705.32	$2,396.19	$2,897.63	($501.44)	-1.43%
100.217.4000000.0000.000	Supplies and Materials	$931.50	$103.50	$1,035.00	$774.70	$774.70	$260.30	($177.63)	$437.93	42.31%
FUNCTION: Career Specialist Services - 217		$119,917.74	$271.60	$120,189.34	$120,528.42	$120,528.42	($339.08)	$9,724.43	($10,063.51)	-8.37%
100.221.1000000.0000.000	Salaries	$1,927,861.64	($51,503.91)	$1,876,357.73	$1,678,284.09	$1,678,284.09	$198,073.64	$268,263.62	($70,189.98)	-3.74%
100.221.2000000.0000.000	Employee Benefits	$742,992.81	($19,091.82)	$723,900.99	$639,986.50	$639,986.50	$83,914.49	$70,529.48	$13,385.01	1.85%
100.221.3000000.0000.000	Purchased Services	$550,576.80	$56,626.20	$607,203.00	$478,954.12	$478,954.12	$128,248.88	$3,461.62	$124,787.26	20.55%
100.221.4000000.0000.000	Supplies and Materials	$83,115.00	$9,235.00	$92,350.00	$26,242.18	$26,242.18	$66,107.82	$2,018.66	$64,089.16	69.40%
100.221.6000000.0000.000	Other Objects	$31,929.50	($467.00)	$31,462.50	$29,800.00	$29,800.00	$1,662.50	$0.00	$1,662.50	5.28%
JNCTION: Improvement of Instruction Curriculum Development - 221		$3,336,475.75	($5,201.53)	$3,331,274.22	$2,853,266.89	$2,853,266.89	$478,007.33	$344,273.38	$133,733.95	4.01%
100.222.1000000.0000.000	Salaries	$1,891,428.61	($24,618.15)	$1,866,810.46	$1,508,518.58	$1,508,518.58	$358,291.88	$383,124.98	($24,833.10)	-1.33%
100.222.2000000.0000.000	Employee Benefits	$892,802.83	$2,269.15	$895,071.98	$661,497.85	$661,497.85	$233,574.13	$74,129.26	$159,444.87	17.81%
100.222.3000000.0000.000	Purchased Services	$3,005.10	($2,083.39)	$921.71	$2,127.81	$2,127.81	($1,206.10)	$0.00	($1,206.10)	-130.85%

Board Report Expenditures

From Date: 7/1/2020 To Date: 5/31/2021

Fiscal Year: 2020-2021 ☐ Include pre encumbrance ☐ Print accounts with zero balance ☑ Filter Encumbrance Detail by Date Range

☐ Exclude inactive accounts with zero balance

Account Number	Description	Budget	Adjustments	GL Budget	Current	YTD	Balance	Encumbrance	Budget Bal	% Rem
100.222.4000000.0000.000	Supplies and Materials	$302,013.90	$37,655.39	$339,669.29	$270,658.21	$270,658.21	$69,011.08	$196,835.51	($127,824.43)	-37.63%
100.222.6000000.0000.000	Other Objects	$175.00	$0.00	$175.00	$175.00	$175.00	$0.00	$0.00	$0.00	0.00%
FUNCTION: Library and Media Services - 222		$3,089,425.44	$13,223.00	$3,102,648.44	$2,442,977.45	$2,442,977.45	$659,670.99	$654,089.75	$5,581.24	0.18%
100.223.1000000.0000.000	Salaries	$898,068.03	($2,609.13)	$895,458.90	$792,236.41	$792,236.41	$103,222.49	$90,399.21	$12,823.28	1.43%
100.223.2000000.0000.000	Employee Benefits	$338,712.18	$1,009.96	$339,722.14	$287,615.24	$287,615.24	$52,106.90	$24,737.36	$27,369.54	8.06%
100.223.3000000.0000.000	Purchased Services	$3,323.70	$10,425.30	$13,749.00	$348.95	$348.95	$13,400.05	$0.00	$13,400.05	97.46%
100.223.4000000.0000.000	Supplies and Materials	$925.74	$1,220.20	$2,145.94	$972.04	$972.04	$1,173.90	$0.00	$1,173.90	54.70%
100.223.6000000.0000.000	Other Objects	$351.00	($71.00)	$280.00	$280.00	$280.00	$0.00	$0.00	$0.00	0.00%
FUNCTION: Supervision of Special Programs - 223		$1,241,380.65	$9,975.33	$1,251,355.98	$1,081,452.64	$1,081,452.64	$169,903.34	$115,136.57	$54,766.77	4.38%
100.224.1000000.0000.000	Salaries	$1,956.88	$0.00	$1,956.88	$0.00	$0.00	$1,956.88	$0.00	$1,956.88	100.00%
100.224.2000000.0000.000	Employee Benefits	$541.86	$47.75	$589.61	$0.00	$0.00	$589.61	$0.00	$589.61	100.00%
100.224.3000000.0000.000	Purchased Services	$88,093.80	($5,021.80)	$83,072.00	$13,466.03	$13,466.03	$69,605.97	($515.00)	$70,120.97	84.41%
100.224.4000000.0000.000	Supplies and Materials	$8,815.50	$5,364.50	$14,180.00	$8,909.80	$8,909.80	$5,270.20	($1,319.66)	$6,589.86	46.47%
100.224.6000000.0000.000	Other Objects	$0.00	$351.00	$351.00	$0.00	$0.00	$351.00	$0.00	$351.00	100.00%
FUNCTION: Improvement of Instruction Inservice & Staff Train - 224		$99,408.04	$741.45	$100,149.49	$22,375.83	$22,375.83	$77,773.66	($1,834.66)	$79,608.32	79.49%
100.231.1000000.0000.000	Salaries	$59,076.00	$0.00	$59,076.00	$54,153.00	$54,153.00	$4,923.00	$4,922.98	$0.02	0.00%
100.231.2000000.0000.000	Employee Benefits	$17,682.00	$0.00	$17,682.00	$16,314.52	$16,314.52	$1,367.48	$1,483.11	($115.63)	-0.65%
100.231.3000000.0000.000	Purchased Services	$387,450.00	$43,050.00	$430,500.00	$328,486.58	$328,486.58	$102,013.42	($510.00)	$102,523.42	23.81%
100.231.6000000.0000.000	Other Objects	$395,000.00	$108,370.00	$503,370.00	$488,659.00	$488,659.00	$14,711.00	$0.00	$14,711.00	2.92%
FUNCTION: Board of Education - 231		$859,208.00	$151,420.00	$1,010,628.00	$887,613.10	$887,613.10	$123,014.90	$5,896.09	$117,118.81	11.59%
100.232.1000000.0000.000	Salaries	$362,518.89	($92,845.74)	$269,673.15	$262,800.19	$262,800.19	$6,872.96	$23,552.35	($16,679.39)	-6.19%
100.232.2000000.0000.000	Employee Benefits	$133,058.96	($36,993.40)	$96,065.56	$87,373.30	$87,373.30	$8,692.26	$8,075.88	$616.38	0.64%
100.232.3000000.0000.000	Purchased Services	$39,077.10	$4,341.90	$43,419.00	$3,109.69	$3,109.69	$40,309.31	$986.08	$39,323.23	90.57%
100.232.4000000.0000.000	Supplies and Materials	$6,050.70	$672.30	$6,723.00	$4,422.19	$4,422.19	$2,300.81	$57.07	$2,243.74	33.37%
100.232.6000000.0000.000	Other Objects	$7,100.00	$0.00	$7,100.00	$2,409.15	$2,409.15	$4,690.85	($87.85)	$4,778.70	67.31%
FUNCTION: Office of Superintendent - 232		$547,805.65	($124,824.94)	$422,980.71	$360,114.52	$360,114.52	$62,866.19	$32,583.53	$30,282.66	7.16%
100.233.1000000.0000.000	Salaries	$10,977,054.56	($62,086.66)	$10,914,967.90	$9,946,353.62	$9,946,353.62	$968,614.28	$1,314,845.44	($346,231.16)	-3.17%
100.233.2000000.0000.000	Employee Benefits	$4,550,969.42	$27,181.90	$4,578,151.32	$4,050,174.62	$4,050,174.62	$527,976.70	$393,113.82	$134,862.88	2.95%
100.233.3000000.0000.000	Purchased Services	$169,267.89	$1,147.20	$170,415.09	$123,351.79	$123,351.79	$47,063.30	$75,924.54	($28,861.24)	-16.94%
100.233.4000000.0000.000	Supplies and Materials	$244,615.95	$54,182.23	$298,798.18	$272,717.00	$272,717.00	$26,081.18	$10,447.29	$15,633.89	5.23%
100.233.5000000.0000.000	Capital Outlay	$0.00	$3,700.00	$3,700.00	$3,696.88	$3,696.88	$3.12	$7,312.36	($7,309.24)	-197.55%
100.233.6000000.0000.000	Other Objects	$23,502.00	($2,166.50)	$21,335.50	$16,248.48	$16,248.48	$5,087.02	$113.12	$4,973.90	23.31%
FUNCTION: School Administration - 233		$15,965,409.82	$21,958.17	$15,987,367.99	$14,412,542.39	$14,412,542.39	$1,574,825.60	$1,801,756.57	($226,930.97)	-1.42%

Board Report Expenditures

From Date: 7/1/2020 To Date: 5/31/2021

Fiscal Year: 2020-2021

☐ Include pre encumbrance ☐ Print accounts with zero balance ☑ Filter Encumbrance Detail by Date Range

☐ Exclude inactive accounts with zero balance

Account Number	Description	Budget	Adjustments	GL Budget	Current	YTD	Balance	Encumbrance	Budget Bal	% Rem
100.251.1000000.0000.000	Salaries	$56,628.37	$44,533.06	$101,161.43	$60,809.90	$60,809.90	$40,351.53	$13,362.80	$26,988.73	26.68%
100.251.2000000.0000.000	Employee Benefits	$32,317.99	$24,977.47	$57,295.46	$31,033.60	$31,033.60	$26,261.86	$2,794.87	$23,466.99	40.96%
100.251.3000000.0000.000	Purchased Services	$338,175.00	$35,825.00	$374,000.00	$55,566.51	$55,566.51	$318,433.49	$162,785.50	$155,647.99	41.62%
100.251.4000000.0000.000	Supplies and Materials	$0.00	$0.00	$0.00	$53,079.33	$53,079.33	($53,079.33)	$40,060.80	($93,140.13)	0.00%
UNCTION: Student Transportation (Federal/District Mandated) - 251		$427,121.36	$105,335.53	$532,456.89	$200,489.34	$200,489.34	$331,967.55	$219,003.97	$112,963.58	21.22%
100.252.1000000.0000.000	Salaries	$924,543.59	$15,916.53	$940,460.12	$900,182.66	$900,182.66	$40,277.46	$77,577.38	($37,299.92)	-3.97%
100.252.2000000.0000.000	Employee Benefits	$384,875.49	($6,100.19)	$378,775.30	$365,095.75	$365,095.75	$13,679.55	$31,996.53	($18,316.98)	-4.84%
100.252.3000000.0000.000	Purchased Services	$180,846.90	$21,844.10	$202,691.00	$71,131.74	$71,131.74	$131,559.26	$1,896.62	$129,662.64	63.97%
100.252.4000000.0000.000	Supplies and Materials	$48,559.50	$5,395.50	$53,955.00	$30,820.63	$30,820.63	$23,134.37	($1,799.17)	$24,933.54	46.21%
100.252.6000000.0000.000	Other Objects	$5,938.00	$0.00	$5,938.00	$3,205.12	$3,205.12	$2,732.88	$0.00	$2,732.88	46.02%
	FUNCTION: Fiscal Services - 252	$1,544,763.48	$37,055.94	$1,581,819.42	$1,370,435.90	$1,370,435.90	$211,383.52	$109,671.37	$101,712.15	6.43%
100.254.1000000.0000.000	Salaries	$6,872,350.66	$76,104.34	$6,948,455.00	$6,260,502.45	$6,260,502.45	$687,952.55	$548,804.66	$139,147.89	2.00%
100.254.2000000.0000.000	Employee Benefits	$3,379,415.74	$9,960.97	$3,389,376.71	$2,998,615.10	$2,998,615.10	$390,761.61	$269,349.85	$121,411.76	3.58%
100.254.3000000.0000.000	Purchased Services	$4,700,379.39	$368,713.67	$5,069,093.06	$4,089,937.78	$4,089,937.78	$979,155.28	$814,027.75	$165,127.53	3.26%
100.254.4000000.0000.000	Supplies and Materials	$4,494,075.40	$672,282.91	$5,166,358.31	$4,321,682.42	$4,321,682.42	$844,675.89	$83,312.39	$761,363.50	14.74%
100.254.5000000.0000.000	Capital Outlay	$83,684.89	($48,329.02)	$35,355.87	$9,288.00	$9,288.00	$26,067.87	$56,734.04	($30,666.17)	-86.74%
	FUNCTION: Operation and Maintenance of Plant - 254	$19,529,906.08	$1,078,732.87	$20,608,638.95	$17,680,025.75	$17,680,025.75	$2,928,613.20	$1,772,228.69	$1,156,384.51	5.61%
100.255.1000000.0000.000	Salaries	$3,698,345.90	$62,258.95	$3,760,604.85	$3,053,682.05	$3,053,682.05	$706,922.80	$599,469.75	$107,453.05	2.86%
100.255.2000000.0000.000	Employee Benefits	$1,689,060.24	$71,471.79	$1,760,532.03	$1,329,712.59	$1,329,712.59	$430,819.44	$142,599.05	$288,220.39	16.37%
100.255.3000000.0000.000	Purchased Services	$159,417.00	$17,713.00	$177,130.00	$84,605.60	$84,605.60	$92,524.40	$28,804.60	$63,719.80	35.97%
100.255.4000000.0000.000	Supplies and Materials	$50,850.00	$5,650.00	$56,500.00	$33,654.66	$33,654.66	$22,845.34	$7,945.70	$14,899.64	26.37%
100.255.6000000.0000.000	Other Objects	$1,000.00	$0.00	$1,000.00	$380.00	$380.00	$620.00	$0.00	$620.00	62.00%
	FUNCTION: Student Transportation (State Mandated) - 255	$5,598,673.14	$157,093.74	$5,755,766.88	$4,502,034.90	$4,502,034.90	$1,253,731.98	$778,819.10	$474,912.88	8.25%
100.256.1000000.0000.000	Salaries	$0.00	$0.00	$0.00	$120,000.00	$120,000.00	($120,000.00)	$0.00	($120,000.00)	0.00%
100.256.2000000.0000.000	Employee Benefits	$0.00	$0.00	$0.00	$12,303.70	$12,303.70	($12,303.70)	$0.00	($12,303.70)	0.00%
100.256.4000000.0000.000	Supplies and Materials	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$23,236.00	($23,236.00)	0.00%
	FUNCTION: Food Services - 256	$0.00	$0.00	$0.00	$132,303.70	$132,303.70	($132,303.70)	$23,236.00	($155,539.70)	0.00%
100.257.1000000.0000.000	Salaries	$253,767.59	$33,121.75	$286,889.34	$236,030.71	$236,030.71	$50,858.63	$23,775.92	$27,082.71	9.44%
100.257.2000000.0000.000	Employee Benefits	$106,824.90	$18,197.62	$125,022.52	$96,316.46	$96,316.46	$28,706.06	$9,599.15	$19,106.91	15.28%
100.257.3000000.0000.000	Purchased Services	$661,112.10	($3,647.60)	$657,464.50	$355,785.19	$355,785.19	$301,679.31	$7,571.03	$294,108.28	44.73%
100.257.4000000.0000.000	Supplies and Materials	$38,675.70	$4,297.30	$42,973.00	$9,985.27	$9,985.27	$32,987.73	($1,779.46)	$34,767.19	80.90%
	FUNCTION: Internal Services - 257	$1,060,380.29	$51,969.07	$1,112,349.36	$698,117.63	$698,117.63	$414,231.73	$39,166.64	$375,065.09	33.72%

Board Report Expenditures

From Date: 7/1/2020 To Date: 5/31/2021

Fiscal Year: 2020-2021

☐ Include pre encumbrance ☐ Print accounts with zero balance ☑ Filter Encumbrance Detail by Date Range

☐ Exclude inactive accounts with zero balance

Account Number	Description	Budget	Adjustments	GL Budget	Current	YTD	Balance	Encumbrance	Budget Bal	% Rem
100.258.1000000.0000.000	Salaries	$185,057.61	$0.00	$185,057.61	$171,203.82	$171,203.82	$13,853.79	$15,483.05	($1,629.26)	-0.88%
100.258.2000000.0000.000	Employee Benefits	$68,103.70	$476.87	$68,580.57	$65,566.43	$65,566.43	$3,014.14	$6,080.19	($3,066.05)	-4.47%
100.258.3000000.0000.000	Purchased Services	$1,787,044.23	$178,680.77	$1,965,725.00	$1,282,882.04	$1,282,882.04	$682,842.96	$762,458.83	($79,615.87)	-4.05%
100.258.4000000.0000.000	Supplies and Materials	$30,186.32	($14,186.32)	$16,000.00	$1,353.31	$1,353.31	$14,646.69	($235.22)	$14,881.91	93.01%
100.258.5000000.0000.000	Capital Outlay	$0.00	$0.00	$0.00	$4,980.00	$4,980.00	($4,980.00)	$0.00	($4,980.00)	0.00%
100.258.6000000.0000.000	Other Objects	$410.00	$0.00	$410.00	$642.67	$642.67	($232.67)	$0.00	($232.67)	-56.75%
	FUNCTION: Security - 258	$2,070,801.86	$164,971.32	$2,235,773.18	$1,526,628.27	$1,526,628.27	$709,144.91	$783,786.85	($74,641.94)	-3.34%
100.262.1000000.0000.000	Salaries	$705,842.76	$3,354.97	$709,197.73	$709,860.44	$709,860.44	($662.71)	$68,361.95	($69,024.66)	-9.73%
100.262.2000000.0000.000	Employee Benefits	$277,631.52	$2,422.53	$280,054.05	$275,633.76	$275,633.76	$4,420.29	$26,281.22	($21,860.93)	-7.81%
100.262.3000000.0000.000	Purchased Services	$8,550.00	($8,550.00)	$0.00	$59,362.03	$59,362.03	($59,362.03)	$0.00	($59,362.03)	0.00%
	FUNCTION: Planning - 262	$992,024.28	($2,772.50)	$989,251.78	$1,044,856.23	$1,044,856.23	($55,604.45)	$94,643.17	($150,247.62)	-15.19%
100.263.1000000.0000.000	Salaries	$392,722.42	$16,757.93	$409,480.35	$379,803.23	$379,803.23	$29,677.12	$35,337.53	($5,660.41)	-1.38%
100.263.2000000.0000.000	Employee Benefits	$166,855.61	$6,385.60	$173,241.21	$155,628.04	$155,628.04	$17,613.17	$14,674.31	$2,938.86	1.70%
100.263.3000000.0000.000	Purchased Services	$161,550.00	$17,950.00	$179,500.00	$65,827.04	$65,827.04	$113,672.96	$0.00	$113,672.96	63.33%
100.263.4000000.0000.000	Supplies and Materials	$27,000.00	$3,000.00	$30,000.00	$14,893.89	$14,893.89	$15,106.11	($1,307.09)	$16,413.20	54.71%
100.263.6000000.0000.000	Other Objects	$12,000.00	$0.00	$12,000.00	$8,200.93	$8,200.93	$3,799.07	($2,963.43)	$6,762.50	56.35%
	FUNCTION: Information Services - 263	$760,128.03	$44,093.53	$804,221.56	$624,353.13	$624,353.13	$179,868.43	$45,741.32	$134,127.11	16.68%
100.264.1000000.0000.000	Salaries	$826,520.04	($42,318.85)	$784,201.19	$678,704.61	$678,704.61	$105,496.58	$63,755.70	$41,740.88	5.32%
100.264.2000000.0000.000	Employee Benefits	$319,429.24	($18,790.14)	$300,639.10	$445,671.78	$445,671.78	($145,032.68)	$24,732.89	($169,765.57)	-56.47%
100.264.3000000.0000.000	Purchased Services	$25,013.25	$3,730.75	$28,744.00	$24,024.11	$24,024.11	$4,719.89	$8,918.36	($4,198.47)	-14.61%
100.264.4000000.0000.000	Supplies and Materials	$27,474.30	$2,927.70	$30,402.00	$18,858.07	$18,858.07	$11,543.93	($366.29)	$11,910.22	39.18%
100.264.6000000.0000.000	Other Objects	$951.50	($826.50)	$125.00	$1,295.50	$1,295.50	($1,170.50)	($219.00)	($951.50)	-761.20%
	FUNCTION: Staff Services - 264	$1,199,388.33	($55,277.04)	$1,144,111.29	$1,168,554.07	$1,168,554.07	($24,442.78)	$96,821.66	($121,264.44)	-10.60%
100.266.1000000.0000.000	Salaries	$1,772,640.27	($29,086.69)	$1,743,553.58	$1,632,961.91	$1,632,961.91	$110,591.67	$154,047.11	($43,455.44)	-2.49%
100.266.2000000.0000.000	Employee Benefits	$709,516.01	($9,669.76)	$699,846.25	$639,315.78	$639,315.78	$60,530.47	$60,649.01	($118.54)	-0.02%
100.266.3000000.0000.000	Purchased Services	$865,560.36	$135,910.64	$1,001,471.00	$1,055,421.15	$1,055,421.15	($53,950.15)	$9,198.52	($63,148.67)	-6.31%
100.266.4000000.0000.000	Supplies and Materials	$144,310.05	$16,209.95	$160,520.00	$17,464.01	$17,464.01	$143,055.99	($144.37)	$143,200.36	89.21%
100.266.6000000.0000.000	Other Objects	$175.50	($175.50)	$0.00	$175.50	$175.50	($175.50)	$0.00	($175.50)	0.00%
	FUNCTION: Technology and Data Processing Services - 266	$3,492,202.19	$113,188.64	$3,605,390.83	$3,345,338.35	$3,345,338.35	$260,052.48	$223,750.27	$36,302.21	1.01%
100.271.1000000.0000.000	Salaries	$1,518,127.09	$152,136.18	$1,670,263.27	$1,644,821.47	$1,644,821.47	$25,441.80	$244,301.69	($218,859.89)	-13.10%
100.271.2000000.0000.000	Employee Benefits	$473,751.00	$120,098.00	$593,849.00	$539,900.02	$539,900.02	$53,948.98	$47,668.98	$6,280.00	1.06%
100.271.3000000.0000.000	Purchased Services	$165,284.19	$72,485.26	$237,769.45	$145,532.72	$145,532.72	$92,236.73	$0.00	$92,236.73	38.79%
100.271.4000000.0000.000	Supplies and Materials	$32,400.00	($33,400.00)	($1,000.00)	$10,921.17	$10,921.17	($11,921.17)	$0.00	($11,921.17)	1192.12%

Board Report Expenditures

From Date: 7/1/2020 To Date: 5/31/2021

Fiscal Year: 2020-2021 ☐ Include pre encumbrance ☐ Print accounts with zero balance ☑ Filter Encumbrance Detail by Date Range
☐ Exclude inactive accounts with zero balance

Account Number	Description	Budget	Adjustments	GL Budget	Current	YTD	Balance	Encumbrance	Budget Bal	% Rem
100.271.5000000.0000.000	Capital Outlay	$0.00	$9,100.00	$9,100.00	$0.00	$0.00	$9,100.00	$9,097.01	$2.99	0.03%
100.271.6000000.0000.000	Other Objects	$383,228.00	$36,000.00	$419,228.00	$405,693.86	$405,693.86	$13,534.14	$0.00	$13,534.14	3.23%
FUNCTION: Pupil Service Activities - 271		$2,572,790.28	$356,419.44	$2,929,209.72	$2,746,869.24	$2,746,869.24	$182,340.48	$301,067.68	($118,727.20)	-4.05%
100.390.3000000.0000.000	Purchased Services	$15,000.00	$0.00	$15,000.00	$0.00	$0.00	$15,000.00	$0.00	$15,000.00	100.00%
100.390.4000000.0000.000	Supplies and Materials	$5,850.00	$0.00	$5,850.00	$0.00	$0.00	$5,850.00	$0.00	$5,850.00	100.00%
FUNCTION: Other Community Services - 390		$20,850.00	$0.00	$20,850.00	$0.00	$0.00	$20,850.00	$0.00	$20,850.00	100.00%
100.412.7000000.0000.000	Transfers	$20,000.00	$0.00	$20,000.00	$20,179.56	$20,179.56	($179.56)	$0.00	($179.56)	-0.90%
FUNCTION: Payments to Other Governmental Units - 412		$20,000.00	$0.00	$20,000.00	$20,179.56	$20,179.56	($179.56)	$0.00	($179.56)	-0.90%
100.425.7000000.0000.000	Transfers	$267,897.00	$0.00	$267,897.00	$0.00	$0.00	$267,897.00	$0.00	$267,897.00	100.00%
FUNCTION: Transfer to Food Service Fund - 425		$267,897.00	$0.00	$267,897.00	$0.00	$0.00	$267,897.00	$0.00	$267,897.00	100.00%
Grand Total:		$194,008,204.21	$2,516,467.79	$196,524,672.00	$161,276,092.64	$161,276,092.64	$35,248,579.36	$28,177,693.98	$7,070,885.38	3.60%

End of Report

EXHIBIT E

MEMORANDUM

To: Members of the Board of Trustees

Through: Dr. Akil E. Ross, Sr.
Interim Superintendent

From: Marty Rawls,
Chief Financial Officer

Date: July 7, 2021

Re: July 12, 2021 Board Meeting
Action Item
Substitute Staffing Contract

Attached is the Intent to Award for the Substitute Staffing Contract to ESS Southeast, LLC for approval.

MR

Attachment

INTENT TO AWARD

The District intends to award the contract noted below. Unless otherwise suspended or canceled, this document becomes the final Statement of Award effective July 19, 2021. Unless otherwise provided in the solicitation, the final statement of award serves as acceptance of your offer.

Bid Number:	2021-035
Description	**Substitute Staffing Services**
Issue Date:	June 3, 2021
Opening Date and Time:	June 18, 2021 at 11:00 am
Date of Award:	July 6, 2021
Effective Date of Award:	July 19, 2021
Awarded To:	**ESS** 9202 Northshore Drive Suite 200 Knoxville, TN 37922
Total Potential Value:	$10,000,000.00
Maximum Contract Period:	July 19, 2021 - July 18, 2026

Contractor should not perform any work or deliver any product prior to the receipt of a purchase order from the District. The District assumes no liability for any expenses incurred prior to the effective date of the award and issuance of a purchase order.

Bidders desiring to exercise protest rights under Section 4210 of the District Procurement Code should direct all correspondence to:

Lynda Robinson, Coordinator of Procurement
School District Five of Lexington and Richland Counties
1020 Dutch Fork Road
Irmo, SC 29063
Fax: 803-476-8140
E-Mail: ljrobins@lexrich5.org

EXHIBIT F

Pre-Cast Coping Investigation & Written Report

Chapin High School

300 Columbia Ave., Chapin, SC

Prepared for

Mr. Clay Cannon, PE, LEED AP
Director of Facilities Operations

School District Five of Lexington & Richland Counties
1020 Dutch Fork Road
Irmo, SC 29063

Prepared by

BUILDING ENVELOPE CONSULTANTS, LLC

Columbia/Charleston

WMBE Project No. 2021-48

Issued: May 25, 2021

Columbia Area Office
1501 Chapin Road
Chapin, SC 29036
(803) 260-4532 / (803) 422-7493

Charleston Area Office
3049 Old U.S. 52
Suite A-106
Moncks Corner, SC 29461
(843) 499-2756

wmbeconsultants.com

May 25, 2021

Mr. Clay Cannon, PE, LEED AP
Director of Facilities Operations
School District Five of Lexington & Richland Counties
1020 Dutch Fork Road
Irmo, SC 29063

Re: Fee Proposal
Consulting Services for Selective Building Envelope – Pre-Cast Coping Investigation & Written Report
Chapin High School
300 Columbia Ave.
Chapin, SC 29036

WMBEC Project Number – 2021-48

Attachments:
1. Attachments 1 – 3, Aerial Plans Showing Areas of Coping Removal
2. Attachment 4, Contract Coping Detail
3. Attachments 5 - 8, Installed Coping Details (Where Coping Removed)
4. Attachments 9 - 12, Photographs of Coping Removal Locations
5. Attachments 13 - 16, Brick Industry Association, Technical Notes on Brick Construction

Mr. Cannon,

Per your request, WM Building Envelope Consultants visited the subject facility on May 19, 2021 to perform a visual inspection of the existing pre-cast coping system components in selective areas to determine if the pre-cast coping system was installed in general accordance with the design documents and to document any deficiencies found that could cause long term moisture intrusion issues. Removal and reinstallation of the pre-cast coping system was to be performed by School District Five of Lexington & Richland Counties personnel.

I. GENERAL INFORMATION:

1. The section of the facility that is the subject of this report was designed by Stevens and Wilkinson in approximately 2011 with construction beginning in approximately 2012. Installation of the pre-cast coping system likely occurred during 2013.

2. WM Building Envelope Consultants was informed by School District Five of Lexington & Richland Counties personnel of the following during our investigation:

A. Widespread leaks were reported to have occurred on the interior face of walls throughout the areas where pre-cast coping system was installed.
B. A waterproofing contractor was contracted to install sealant at all pre-cast coping joints and at the interfaces between the parapet wall and the pre-cast coping system (both sides).

C. Since the sealant work has been completed, no widespread leaks have been reported.

3. Drawing Sheet A431, Metal Panel Wall Section Details and Typical CMU Parapet & Roof Expansion Joint Details, of the Construction Documents was provided by School District Five of Lexington & Richland Counties for review and use during our investigation. Detail 1, Cast Stone Parapet Detail @ CMU & Brick and Detail 4, Cast Stone Parapet Cap @ Brick & CFMF from the drawing sheet were the focus of our investigation.

4. Removal and reinstallation of the existing pre-cast coping system was performed by School District Five of Lexington & Richland Counties contractor personnel. Locations were selected in random locations which are shown on the attached plans (Attachment Nos. 1, 2, and 3).

II. GENERAL FINDINGS:

1. The condition of the existing pre-cast coping system appears good with darkening/staining occurring throughout which is typical of this type of porous material.

2. Sealant has been installed at all pre-cast coping joints.

3. The underside of the pre-cast stone coping system on both sides of the parapet wall has been continuously sealed.

III. ORIGINAL PRE-CAST COPING REQUIREMENTS:

1. As shown in the Construction Drawings, Detail 1, Cast Stone Parapet Detail @ CMU & Brick (Attachment No. 4), the following was required.

A. The detail shows a parapet wall assembly consisting of a brick masonry veneer, a drainage cavity with 2-inch-thick rigid board insulation, a grout filled cement masonry unit (CMU) bond beam/back-up wall system with dampproofing, and sheet metal wall panels below a pre-cast stone parapet cap (coping).

B. A continuous through wall flashing system is required under the pre-cast coping system.

C. A sloped pre-cast parapet cap (coping) is required with a drip line on the exterior side of the coping system.

D. A sheet metal drip flashing is required on the interior side of the parapet wall directly above the roof system to cover wall panels. No wall panels exist in the locations under review, however, an aluminum foil faced modified bitumen base flashing sheet was installed in lieu of metal wall panels.

E. Dowels are required to be provided for the pre-cast coping system, but no spacing requirements are not indicated.

F. No weep system is indicated in the detail; however, it is still necessary to provide a weep system between the pre-cast coping system and the through wall flashing system to allow water entering the wall system to drain to the exterior (See Attachment No. 13, pages 2 and 4).

IV. PRE-CAST COPING REMOVAL LOCATIONS:

1. Coping Removal Location No. 1 (See Attachment No. 5)

A. The section of coping removed at this location was approximately 12 inches wide.

B. The wall assembly in this location consists of a brick masonry veneer, an approximate 3-inch cavity with extruded polystyrene insulation, a grout filled cement masonry unit (CMU) back-up wall system with dampproofing, and an aluminum foil coating modified bitumen base flashing sheet (in lieu of sheet metal wall panels as shown in the detail).

C. Upon removal of the pre-cast coping system, it was noted that a self-adhering flexible waterproof membrane had been installed over the top of the wall assembly to serve as the through wall flashing system but stops well short of the outside faces of the parapet wall leaving the brick's mortar cells exposed which allows direct access for moisture intrusion should water penetrate imperfections in the pre-cast coping system. This deviates from the requirements of Detail 1, Cast Stone Parapet Detail @ CMU & Brick of the Construction Document Drawing provided to us for review. Also, standard industry practice requires that the through wall flashing extend to the outside face of the wall system. If flexible membranes are used as through wall flashings, as is the case at Chapin High School, it is also recommended that sheet metal drip edges be provided. This was not incorporated on the outside face of the parapet (see Attachment No. 14, pages 9 and 10).

D. Voids were evident along the self-adhering flexible waterproof membrane's edges where the membrane terminates leaving direct access for moisture intrusion should water penetrate imperfections in the pre-cast coping system (see Attachment No. 14, pages 9 and 10).

E. A trough existed in the self-adhering waterproofing membrane directly above the wall cavity. This can allow physical moisture to travel substantial lengths to possibly points of moisture entry. As stated in item C. above, when flexible membranes are used as through wall flashings it is recommended that sheet metal drip edges be provided. This helps in minimizing the sagging of the membrane by providing a support over the wall cavity.

F. Removal of the pre-cast stone coping system revealed water staining on the self-adhering waterproofing membrane indicating water intrusion at some point in time. This is likely due to previous leaking; however, pre-cast copings are very porous and can allow some degree of moisture to enter the wall assembly. Moisture can also enter at cracks in the coping system or imperfections at coping system terminations.

G. Dowel rods were not evident in the area where the pre-cast coping system was removed. Dowel rods are shown on the drawings, but no spacing information is noted.

H. The extruded polystyrene insulation in this location did not extend to the underside of the self-adhering waterproof membrane as shown in the detail but stopped approximately 7 1/2" short.

I. Moisture was noted to be present on the underside of the self-adhering waterproof membrane in this location. Without further investigation, the reason for the accumulation of moisture on the underside of the membrane could not be determined.

2. Coping Removal Location No. 2 (See Attachment No. 6)

A. The section of coping removed at this location was approximately 12 inches wide.

B. The wall assembly in this location consists of a brick masonry veneer, an approximate 4-inch cavity with extruded polystyrene insulation, a grout filled cement masonry unit (CMU) back-up wall system with dampproofing, and an aluminum foil coating modified bitumen base flashing sheet (in lieu of sheet metal wall panels as shown in the detail).

C. Upon removal of the pre-cast coping system, it was noted that a self-adhering flexible waterproof membrane had been installed over the top of the wall assembly to serve as the through wall flashing system but stops well short of the outside faces of the parapet wall leaving the brick's mortar cells exposed which allows direct access for moisture intrusion should water penetrate imperfections in the pre-cast coping system. This deviates from the requirements of Detail 1, Cast Stone Parapet Detail @ CMU & Brick of the Construction Document Drawing provided to us for review. Also, standard industry practice requires that the through wall flashing extend to the outside face of the wall system. If flexible membranes are used as through wall flashings, as is the case at Chapin High School, it is also recommended that sheet metal drip edges be provided. This was not incorporated on the outside face of the parapet (see Attachment No. 14, pages 9 and 10).

D. Voids were evident along the self-adhering flexible waterproof membrane's edges where the membrane terminates leaving direct access for moisture intrusion should water penetrate imperfections in the pre-cast coping system (see Attachment No. 14, pages 9 and 10).

E. A trough existed in the self-adhering waterproofing membrane directly above the wall cavity. This can allow physical moisture to travel substantial lengths to possibly points of moisture entry. As stated in item C. above, when flexible membranes are used as through wall flashings it is recommended that sheet metal drip edges be provided. This helps in minimizing the sagging of the membrane by providing a support over the wall cavity.

F. Removal of the pre-cast stone coping system revealed water staining on the self-adhering waterproofing membrane indicating water intrusion at some point in time. This is likely due to previous leaking; however, pre-cast copings are very porous and can allow some degree of moisture to enter the wall assembly. Moisture can also enter at cracks in the coping system or imperfections at coping system terminations.

G. Dowel rods were not evident in the area where the pre-cast coping system was removed. Dowel rods are shown on the drawings, but no spacing information is noted.

H. The extruded polystyrene insulation in this location did not extend to the underside of the self-adhering waterproof membrane as shown in the detail but stopped approximately 7" short.

3. Coping Removal Location No. 3 (See Attachment No. 7)

A. The section of coping removed at this location was approximately 12 inches wide.

B. The wall assembly in this location consists of a brick masonry veneer, an approximate 4-inch cavity with extruded polystyrene insulation, a grout filled cement masonry unit (CMU) back-up wall system with dampproofing, and an aluminum foil coating modified bitumen base flashing sheet (in lieu of sheet metal wall panels as shown in the detail).

C. Upon removal of the pre-cast coping system, it was noted that a self-adhering flexible waterproof membrane had been installed over the top of the wall assembly to serve as the through wall flashing system but stops well short of the outside faces of the parapet wall leaving the brick's mortar cells exposed which allows direct access for moisture intrusion should water penetrate imperfections in the pre-cast coping system. This deviates from the requirements of Detail 1, Cast Stone Parapet Detail @ CMU & Brick of the Construction Document Drawing provided to us for review. Also, standard industry practice requires that the through wall flashing extend to the outside face of the wall system. If flexible membranes are used as through wall flashings, as is the case at Chapin High School, it is also recommended that sheet metal drip edges be provided. This was not incorporated on the outside face of the parapet (see Attachment No. 14, pages 9 and 10).

D. Voids were evident along the self-adhering flexible waterproof membrane's edges where the membrane terminates leaving direct access for moisture intrusion should water penetrate imperfections in the pre-cast coping system (see Attachment No. 14, pages 9 and 10).

E. A trough existed in the self-adhering waterproofing membrane directly above the wall cavity. This can allow physical moisture to travel substantial lengths to possibly points of moisture entry. As stated in item C. above, when flexible membranes are used as through wall flashings it is recommended that sheet metal drip edges be provided. This helps in minimizing the sagging of the membrane by providing a support over the wall cavity.

F. Removal of the pre-cast stone coping system revealed water staining on the self-adhering waterproofing membrane indicating water intrusion at some point in time. This is likely due to previous leaking; however, pre-cast copings are very porous and can allow some degree of moisture to enter the wall assembly. Moisture can also enter at cracks in the coping system or imperfections at coping system terminations.

G. Dowel rods were not evident in the area where the pre-cast coping system was removed. Dowel rods are shown on the drawings, but no spacing information is noted.

4. Coping Removal Location No. 4 (See Attachment No. 8)

A. The section of coping removed at this location was an end wall termination piece and was approximately 12 inches wide.

B. The wall assembly in this location consists of a brick masonry veneer, an approximate 3-inch cavity with extruded polystyrene insulation, a grout filled cement masonry unit (CMU) back-up wall system with dampproofing, and an aluminum foil coating modified bitumen base flashing sheet (in lieu of sheet metal wall panels as shown in the detail).

C. Upon removal of the pre-cast coping system, it was noted that a self-adhering flexible waterproof membrane had been installed over the top of the wall assembly to serve as the through wall flashing system but stops short of the outside faces of the parapet wall. This deviates from the requirements of Detail 1, Cast Stone Parapet Detail @ CMU & Brick of the Construction Document Drawing provided to us for review. Also, standard industry practice

requires that the through wall flashing extend to the outside face of the wall system. If flexible membranes are used as through wall flashings, as is the case at Chapin High School, it is also recommended that sheet metal drip edges be provided. This was not incorporated on either side of the parapet (see Attachment No. 14, pages 9 and 10).

D. Voids were evident along the self-adhering waterproof membrane's edges where the membrane terminates leaving direct access for moisture intrusion should water penetrate imperfections in the pre-cast coping system (see Attachment No. 14, pages 9 and 10).

E. A trough existed in the self-adhering waterproofing membrane directly above the wall cavity. This can allow physical moisture to travel substantial lengths to possibly points of moisture entry. As stated in item C. above, when flexible membranes are used as through wall flashings it is recommended that sheet metal drip edges be provided. This helps in minimizing the sagging of the membrane by providing a support over the wall cavity.

F. Removal of the pre-cast stone coping system revealed water staining on the self-adhering waterproofing membrane indicating water intrusion at some point in time. This is likely due to previous leaking; however, pre-cast copings are very porous and can allow some degree of moisture to enter the wall assembly. Moisture can also enter at cracks in the surround brick, coping system or imperfections at coping system terminations.

G. A pre-cast coping securement system was noted at this location. The system observed was a horizontal dowel system that linked the coping caps together with a base plate that was secured to the bond beam below.

V. CONCLUSION:

In conclusion, the original installation of the pre-cast coping system is not in accordance with the details provided or the applicable industry standards (see Brick Industry Association attachments for general recommendations/requirements). The pre-cast coping system should have had a continuous through wall flashing system with sheet metal drips and a weep system provided on both sides of the parapet wall as a minimum. In my opinion and based on our experience with similar issues on similar projects, the lack of a continuous properly installed through wall flashing system is most likely the main contributor of water intrusion issues experienced prior to installation of the sealants.

The repairs made using sealant, since original installation, is not considered a long-term repair and will be an ongoing maintenance issue. Once the sealants begin to deteriorate, usually within 7 - 10 years, as well as the occurrence of natural deterioration of the pre-cast coping system and surrounding masonry, you will likely begin to experience the same issues as before the sealant work was performed. In general, relying on sealant as the primary protection from moisture intrusion is not desired. Although sealant replacement can be performed when necessary, sealants become less effective each time that they are installed. The main issue generally observed is premature adhesive failure of the sealant because of surface contaminants and residues, etc. left behind by previous sealants and the lack of proper preparation of the surfaces to receive sealants. Other causes of sealants becoming less effective, which is not a sealant issue, is the natural deterioration of the pre-cast coping system and surrounding masonry surfaces. Deterioration of these components allow water to penetrate the surfaces and ultimately bypass the installed sealants.

Unfortunately, to correct the problem long-term without changing appearance or current coping material, the pre-cast coping system would have to be removed and reinstalled along with a proper through wall flashing system with properly spaced weeps. This is considered a long-term repair that if installed properly

can provide many years of low maintenance service. These types of systems do, however, require regular cleaning to continue to be aesthetically pleasing.

If changing appearance or current materials is not an issue, installation of a properly detailed sheet metal coping system could also be performed to correct the current issues. This is also considered a long-term repair that if installed properly can provide many years of low maintenance service.

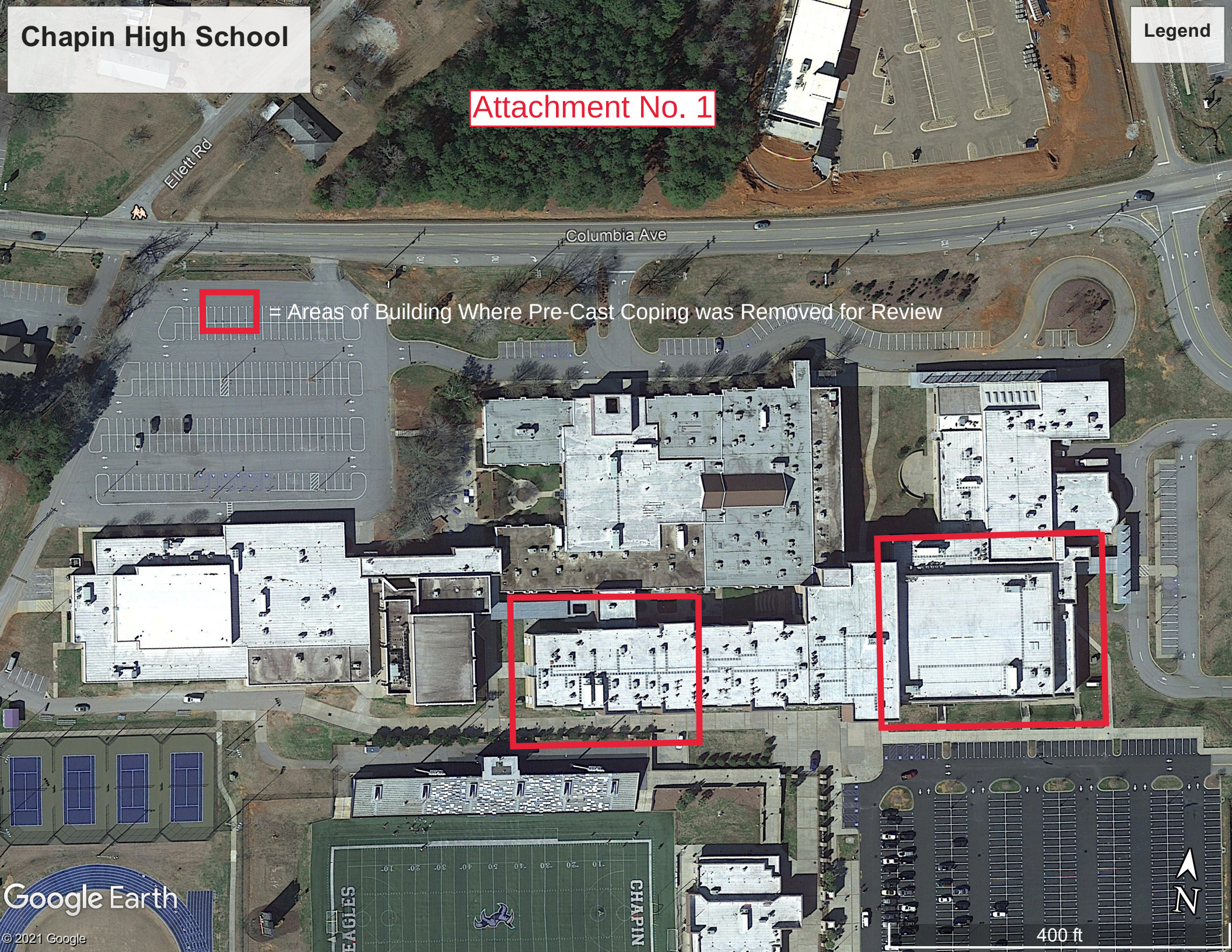
I have provided an aerial view, details, industry standards and representative photographs of our findings at the subject facility building for your reference.

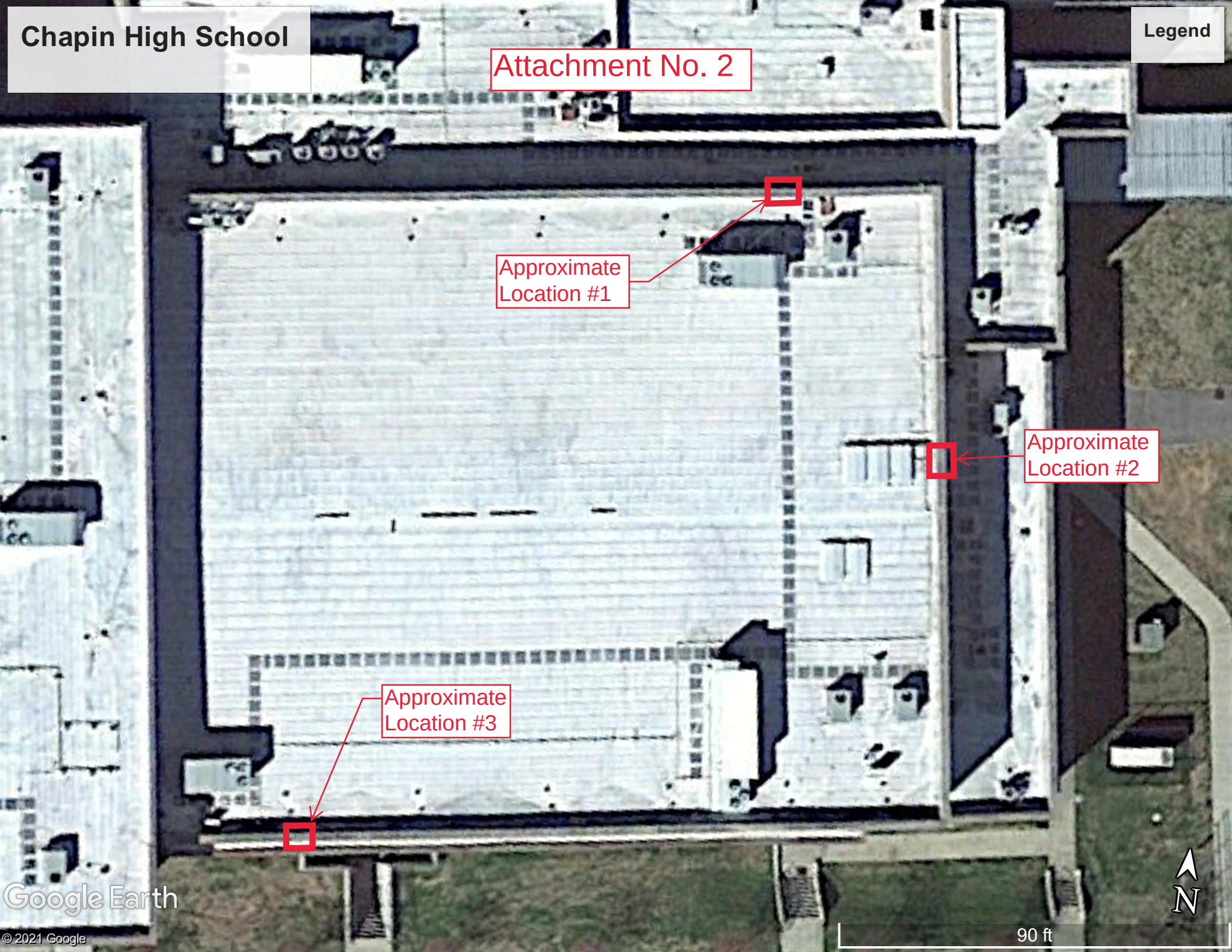
Should you need any additional information or have any questions specific to this report, please do not hesitate to give me a call.

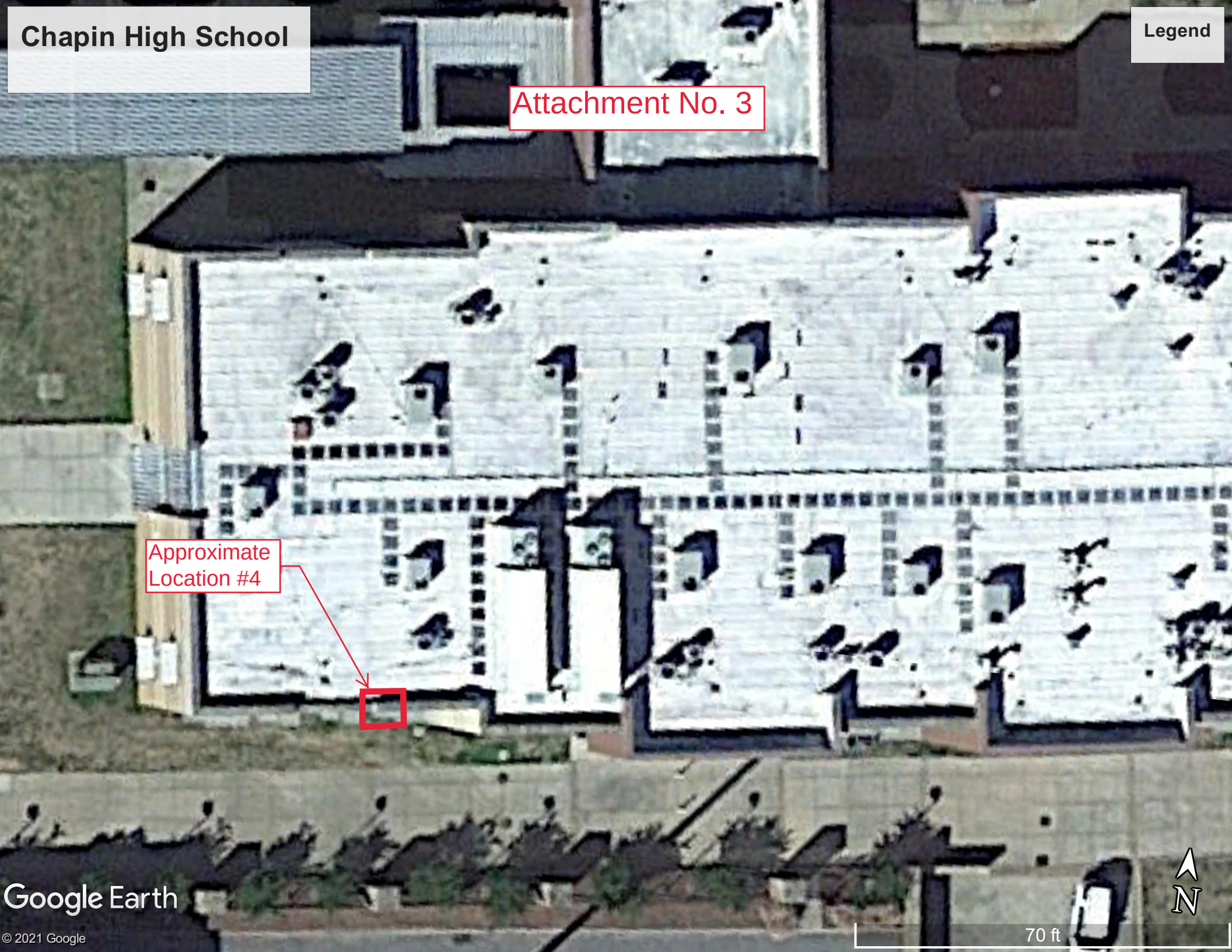
Additionally, if future assistance is needed WM Building Envelope Consultants can provide a fee proposal to generate a repair package that would include specifications, plan drawings, and job specific details for corrective measures desired.

Thank You.

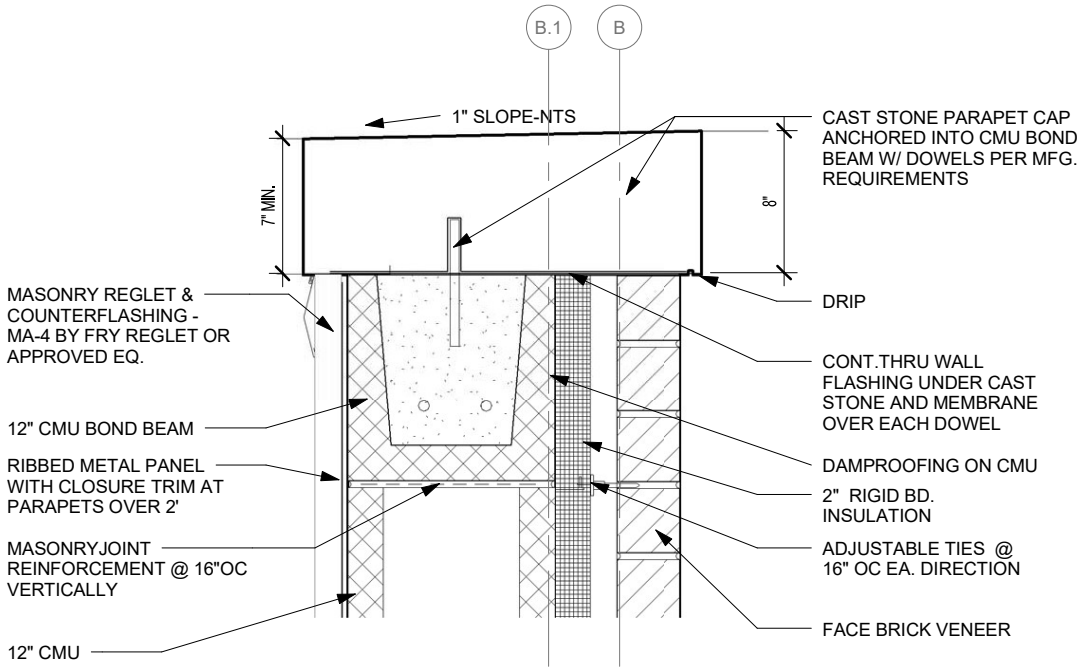
Chris Waites
Registered Waterproofing Consultant (RWC)
Registered Roof Consultant (RRC)
Registered Roof Observer (RRO)
Construction Documents Technologists (CDT)
South Carolina Accredited Commercial Energy Manager (SCACEM)
EDI Level I EIFS Inspector
EDI Level II Building Envelope Inspector

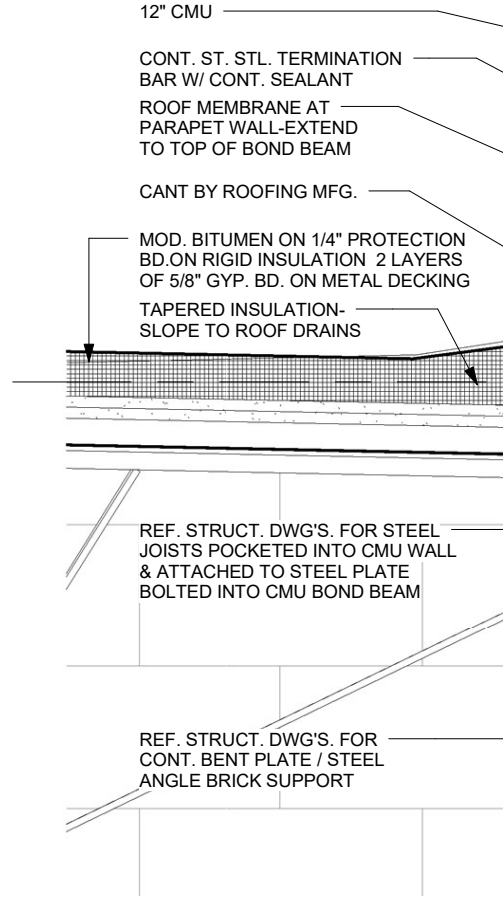

Chapin High School
Legend
Attachment No. 1
Ellett Rd
Columbia Ave
= Areas of Building Where Pre-Cast Coping was Removed for Review
CHAPIN
EAGLES
Google Earth
© 2021 Google
400 ft
N


Chapin High School
Attachment No. 2
Legend
Approximate Location #1
Approximate Location #2
Approximate Location #3
Google Earth
© 2021 Google
N
90 ft


Chapin High School
Legend
Attachment No. 3
Approximate Location #4
Google Earth
© 2021 Google
70 ft
N

Attachment No. 4

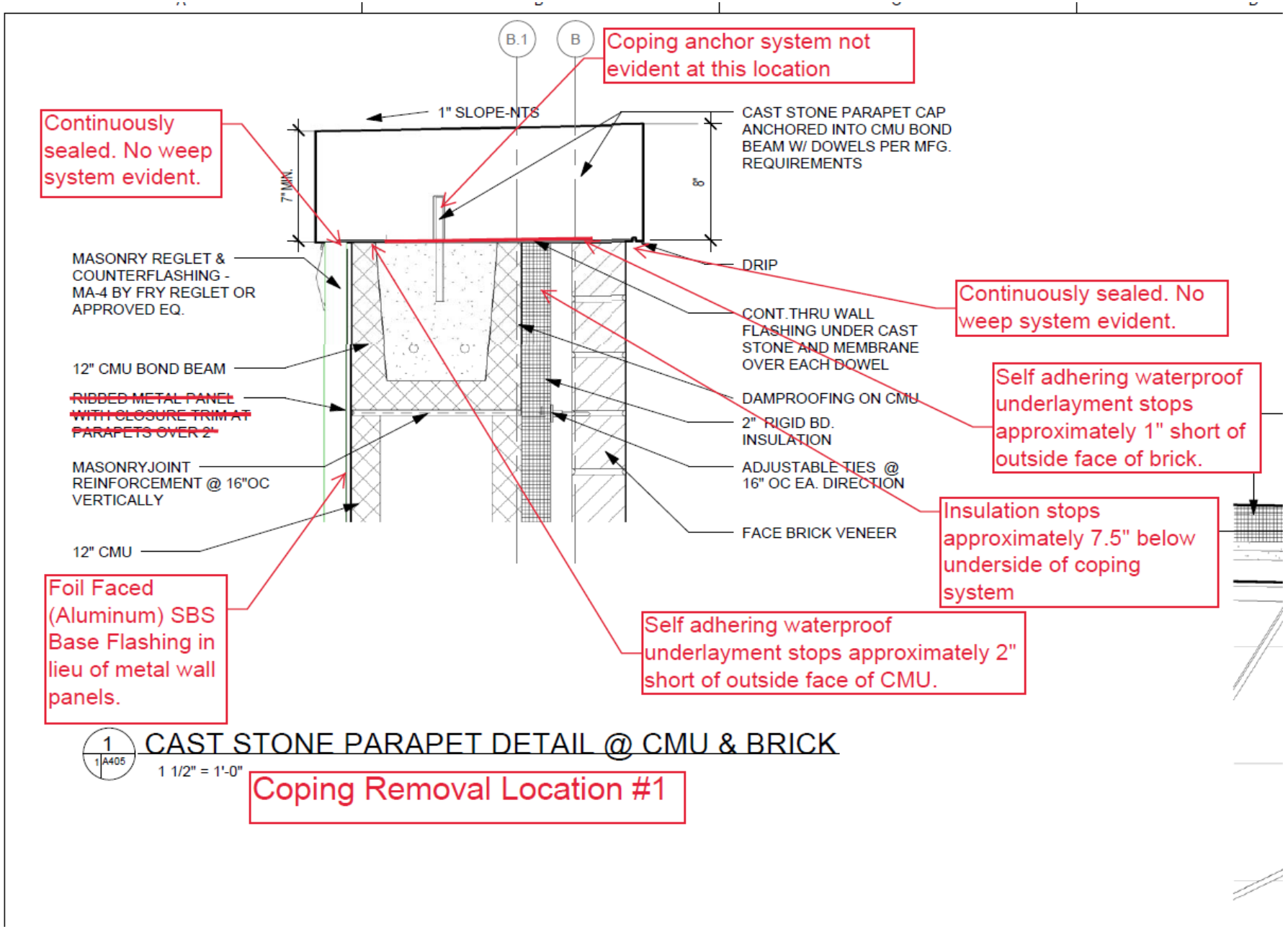


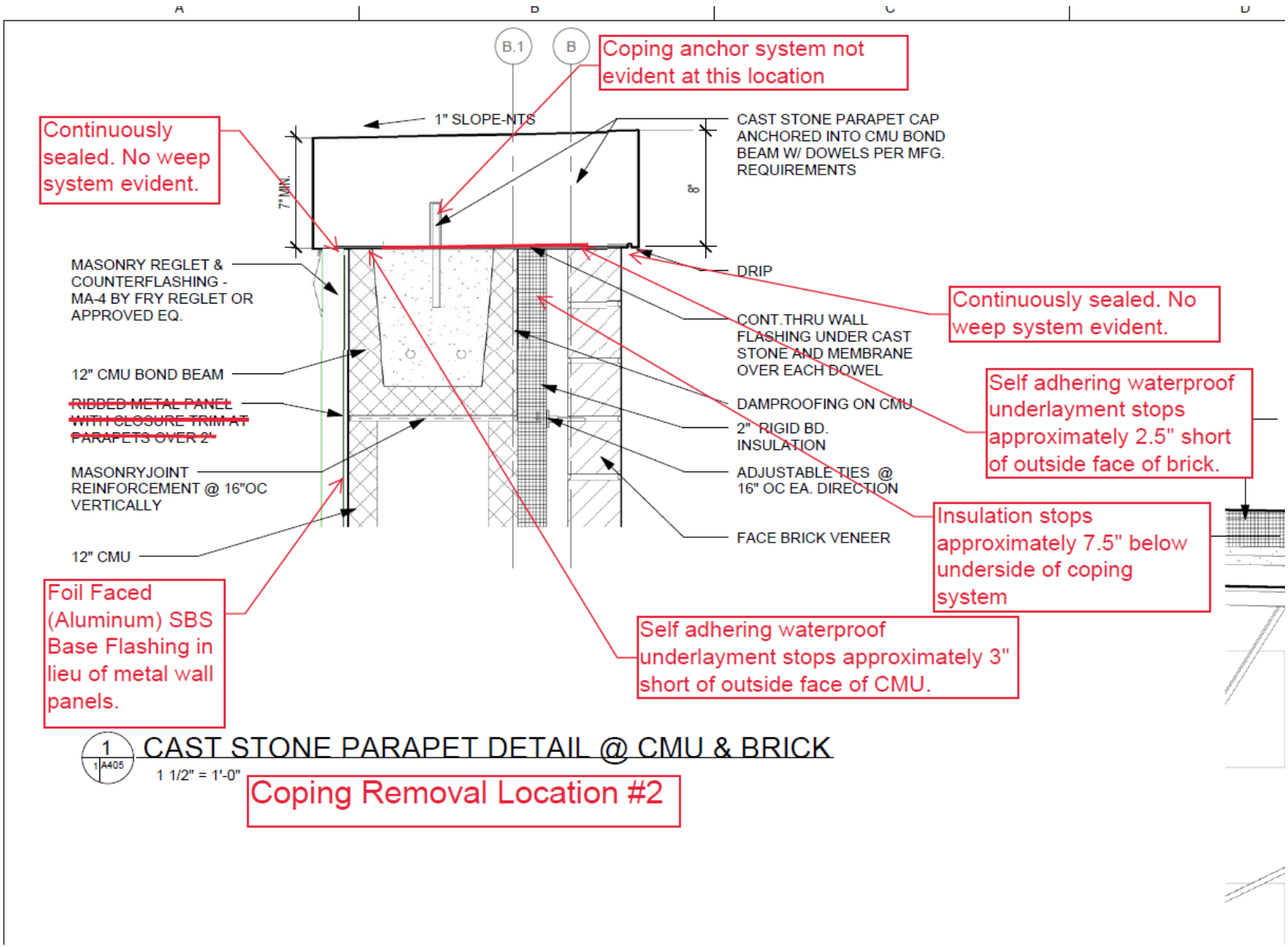


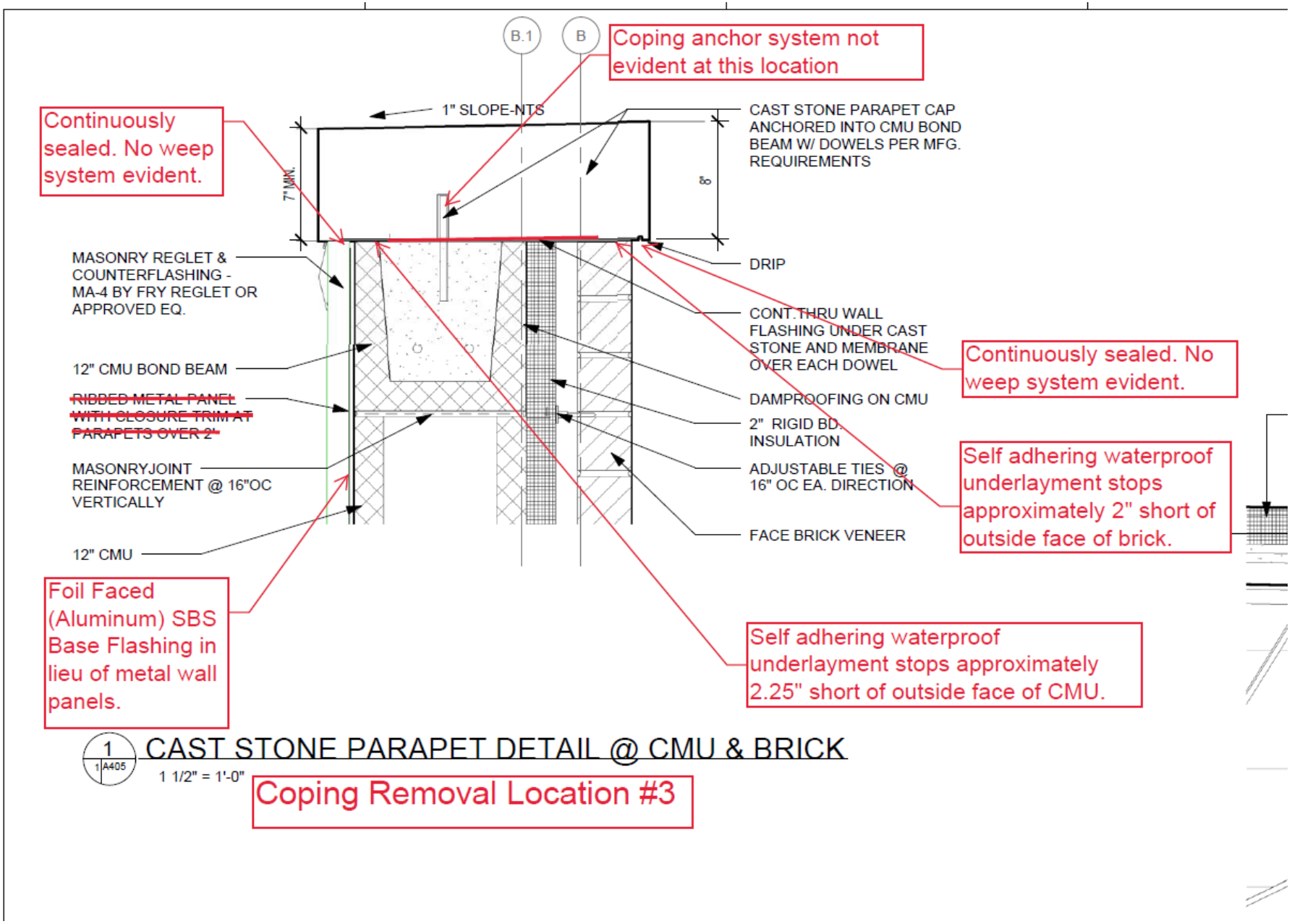
1 / 1A405 CAST STONE PARAPET DETAIL @ CMU & BRICK

1 1/2" = 1'-0"

Required Detail for Reference


B.1
B
Coping anchor system not evident at this location
Continuously sealed. No weep system evident.
1" SLOPE-NTS
CAST STONE PARAPET CAP ANCHORED INTO CMU BOND BEAM W/ DOWELS PER MFG. REQUIREMENTS
7" MIN.
8"
MASONRY REGLET & COUNTERFLASHING - MA-4 BY FRY REGLET OR APPROVED EQ.
DRIP
Continuously sealed. No weep system evident.
CONT.THRU WALL FLASHING UNDER CAST STONE AND MEMBRANE OVER EACH DOWEL
12" CMU BOND BEAM
Self adhering waterproof underlayment stops approximately 1" short of outside face of brick.
RIBBED METAL PANEL WITH CLOSURE TRIM AT PARAPETS OVER 2'
DAMPROOFING ON CMU
2" RIGID BD. INSULATION
MASONRYJOINT REINFORCEMENT @ 16"OC VERTICALLY
ADJUSTABLE TIES @ 16" OC EA. DIRECTION
Insulation stops approximately 7.5" below underside of coping system
FACE BRICK VENEER
12" CMU
Foil Faced (Aluminum) SBS Base Flashing in lieu of metal wall panels.
Self adhering waterproof underlayment stops approximately 2" short of outside face of CMU.
1
1 A405
CAST STONE PARAPET DETAIL @ CMU & BRICK
1 1/2" = 1'-0"
Coping Removal Location #1

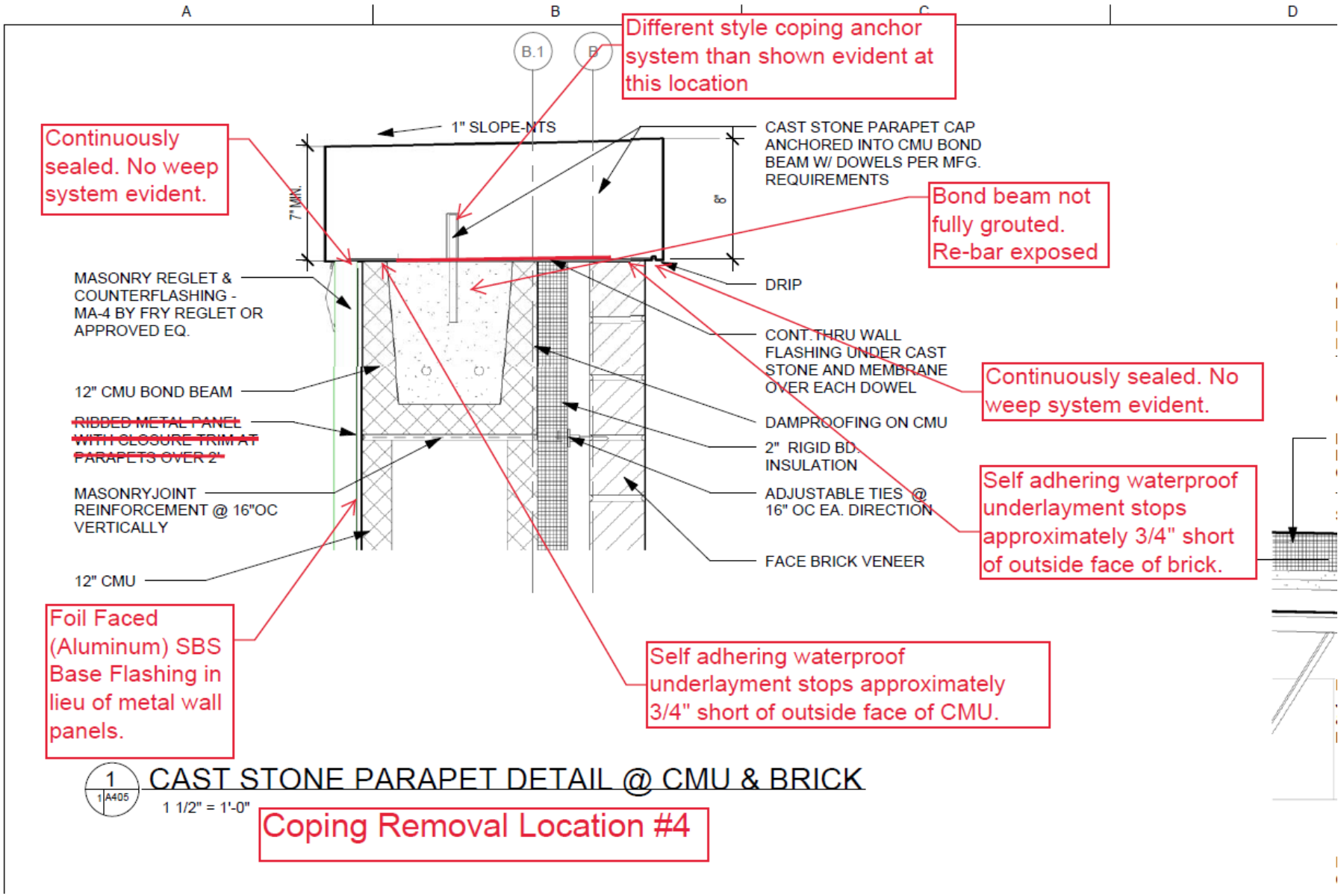

B.1
B
Coping anchor system not evident at this location
1" SLOPE-NTS
CAST STONE PARAPET CAP ANCHORED INTO CMU BOND BEAM W/ DOWELS PER MFG. REQUIREMENTS
Continuously sealed. No weep system evident.
7"MIN.
8"
MASONRY REGLET & COUNTERFLASHING - MA-4 BY FRY REGLET OR APPROVED EQ.
DRIP
Continuously sealed. No weep system evident.
CONT.THRU WALL FLASHING UNDER CAST STONE AND MEMBRANE OVER EACH DOWEL
12" CMU BOND BEAM
DAMPROOFING ON CMU
Self adhering waterproof underlayment stops approximately 2.5" short of outside face of brick.
RIBBED METAL PANEL WITH CLOSURE TRIM AT PARAPETS OVER 2'
2" RIGID BD. INSULATION
MASONRYJOINT REINFORCEMENT @ 16"OC VERTICALLY
ADJUSTABLE TIES @ 16" OC EA. DIRECTION
Insulation stops approximately 7.5" below underside of coping system
FACE BRICK VENEER
12" CMU
Foil Faced (Aluminum) SBS Base Flashing in lieu of metal wall panels.
Self adhering waterproof underlayment stops approximately 3" short of outside face of CMU.
1
1 A405
CAST STONE PARAPET DETAIL @ CMU & BRICK
1 1/2" = 1'-0"
Coping Removal Location #2



1 / 1 A405 CAST STONE PARAPET DETAIL @ CMU & BRICK

1 1/2" = 1'-0"

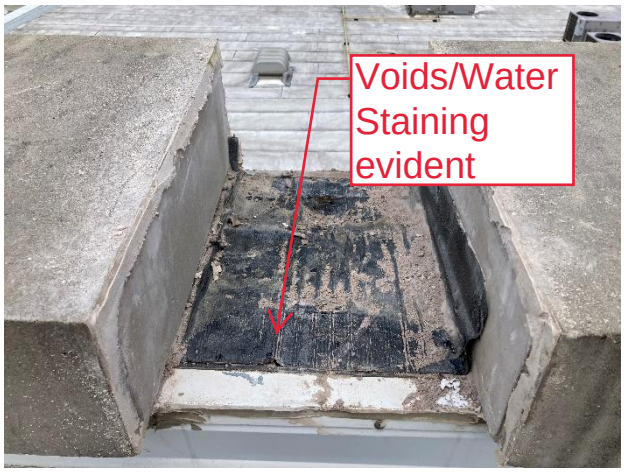
Coping Removal Location #3


A
B
C
D
B.1
B
Different style coping anchor system than shown evident at this location
Continuously sealed. No weep system evident.
1" SLOPE-NTS
7" MIN.
8"
CAST STONE PARAPET CAP ANCHORED INTO CMU BOND BEAM W/ DOWELS PER MFG. REQUIREMENTS
Bond beam not fully grouted. Re-bar exposed
MASONRY REGLET & COUNTERFLASHING - MA-4 BY FRY REGLET OR APPROVED EQ.
DRIP
CONT. THRU WALL FLASHING UNDER CAST STONE AND MEMBRANE OVER EACH DOWEL
Continuously sealed. No weep system evident.
12" CMU BOND BEAM
RIBBED METAL PANEL WITH CLOSURE TRIM AT PARAPETS OVER 2'
DAMPROOFING ON CMU
2" RIGID BD. INSULATION
MASONRYJOINT REINFORCEMENT @ 16"OC VERTICALLY
ADJUSTABLE TIES @ 16" OC EA. DIRECTION
Self adhering waterproof underlayment stops approximately 3/4" short of outside face of brick.
FACE BRICK VENEER
12" CMU
Foil Faced (Aluminum) SBS Base Flashing in lieu of metal wall panels.
Self adhering waterproof underlayment stops approximately 3/4" short of outside face of CMU.
1
1 A405
CAST STONE PARAPET DETAIL @ CMU & BRICK
1 1/2" = 1'-0"
Coping Removal Location #4

Photos - Coping Removal Location No. 1

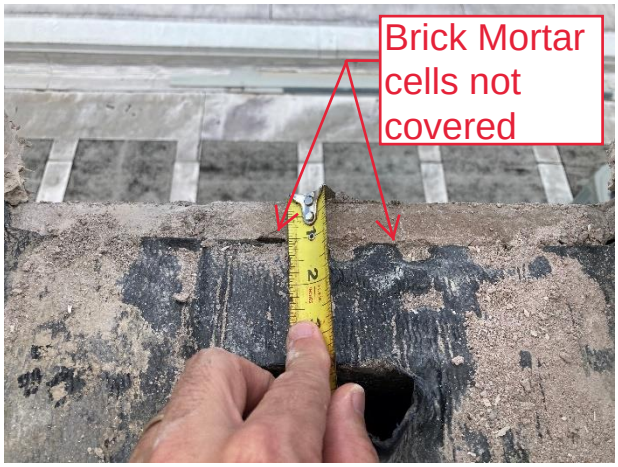
Interface of coping/parapet continuously sealed

Interface of coping/parapet continuously sealed



Coping Removal Location No. 1

Coping Removal Location No. 1



Self-Adhering waterproof underlayment does not extend to outside face of wall.

Self-Adhering waterproof underlayment does not extend to outside face of wall.

Underside of waterproof membrane wet

Underside of waterproof membrane wet

Photos - Coping Removal Location No. 2

Coping Removal Location No. 2

Self-Adhering waterproof underlayment does not extend to outside face of wall.

Self-Adhering waterproof underlayment stops approx. 2.5 inches from edge of wall.

Self-Adhering waterproof underlayment stops approx. 3 inches from edge of wall.

Interface of coping/parapet continuously sealed.

A trough exists in self-adhering waterproof underlayment.

Photos - Coping Removal Location No. 3

Coping Removal Location No. 3

Brick mortar cells not covered.

Trough and water staining evident.

Self-Adhering waterproof underlayment does not extend to outside face of wall & not adhered.

Self-Adhering waterproof underlayment does not extend to outside face of wall & not adhered.

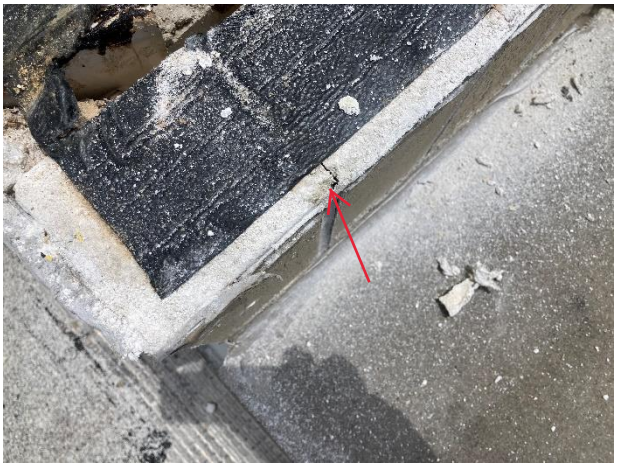
Self-Adhering waterproof underlayment does not extend to outside face of wall.

Photos - Coping Removal Location No. 4

Coping Removal Location No. 4

Self-Adhering waterproof underlayment does not extend to outside faces of wall.

Trough and water staining evident



Water staining evident at crack in mortar joint

Attachment No. 13

THE BRICK INDUSTRY ASSOCIATION

TECHNICAL NOTES on Brick Construction

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Technical Notes 36A - Brick Masonry Details, Caps and Copings, Corbels and Racking
Rev [Sept./Oct. 1981] (Reissued February 2001)

Abstract: Recommendations are provided for the development of successful details using brick masonry. Detailing of caps, copings, corbels and racking is specifically addressed. Performance, esthetic value and economics are the principal considerations in the develops meant of successful details.

Key Words: **brick**, **caps**, connections, construction, **copings**, **corbels**, design, **detailing**, **economics**, **esthetic values**, function, **performance**, **racking**, structural stability.

INTRODUCTION

This *Technical Notes* is the second in a series that discusses brick masonry details. This *Technical Notes* will address the detailing of caps, copings, corbels and racking. *Technical Notes* 36 Revised addresses the detailing of sills and soffits.

The recommended approach to detailing is covered in *Technical Notes* 36 Revised. While that *Technical Notes* is primarily for sills and soffits, it does provide the general approach applicable to all detailing. The following items should be considered in the development of a successful detail: 1. Functional considerations; 2. Esthetic value; 3. Construction considerations; 4. Economic considerations.

DEFINITIONS

Caps and Copings

The definitions for cap and coping are entirely dependent upon which dictionary or glossary is used as a reference. In addition, there are other terms which are used interchangeably with them, such as water table, canting strip, and offset. For the purpose of this *Technical Notes,* the word "coping" applies to the covering at the top of a wall, and the term "cap" refers to a covering within the height of the wall, normally where there is a change in wall thickness. The other terms cited will not be used.

Corbels and Racking

A corbel is defined as a shelf or ledge formed by projecting successive courses of masonry *out* from the face of the wall. Racking is defined as masonry in which successive courses are stepped *back* from the face of the wall.

CAPS AND COPINGS

General

The primary function of caps and copings is to channel water away from the building. The cap or coping may be a single unit or multiple units. They may be of several different materials. The tops may slope in one direction or both directions. Additionally, where caps are discontinuous, a minimum slope from the ends of 1/8 in. (3 mm) in 12 in. (300 mm) should be provided, as shown in Figures 4 and 6 in *Technical Notes* 36 Revised.

The esthetic value the designer wishes to achieve may come from the configuration of the element, its color, or its texture. Caps and copings normally do not serve any structural function, and do not present any major problems in their construction.

Materials

Caps and copings can be constructed of several materials: brick, pre-cast or cast-in-place concrete, stone, terra cotta, or metal. It should be pointed out that because of their location in the structure, caps and copings are exposed to climatic extremes. This severe exposure must be of prime concern to the designer. Because caps and copings are subjected to extreme exposure, brick masonry may not be the best choice of materials. This is because caps and copings of brick require more joints than do those made of other materials. This provides more avenues for possible water penetration into the wall. If brick is the material selected, great care must be taken to provide for the movement to which the element will be subjected and also to make sure all joints are properly filled with mortar. Concrete, stone and metal caps and copings can be installed in relatively long pieces, thus requiring less joints than do those made from brick.

Concrete, stone and terra cotta all have thermal expansion properties similar to those of brick masonry and normally present no extreme problems with differential movement when applied as caps and copings, if properly detailed. Metal has very different thermal expansion properties than brick masonry. Depending upon the metal used, its thermal expansion coefficient may be 3 to 4 times that of brick masonry. The designer should be aware of this and provide for this differential movement in the development of the details. Consideration must also be given to the drying shrinkage of the element if cast-in-place concrete is the material selected.

If brick is the material chosen for the coping, it may be desirable in some applications to use a special shape to get a positive slope in two directions. In most applications, the slope should be only in one direction, with drainage onto the roof and not down the wall face. In such case, the coping can be built using regular shapes.

Design

The prime consideration in the design of caps and copings is the performance of the element in service. The designer must take into consideration the movement of the element, differential movement between the element and the wall, joint configuration and material, connection of the element to the wall, and type and location of flashings.

The esthetic value of the detail should be evaluated. As with details of other elements, selection of material, color, texture and configuration will effect the esthetic value of the detail. The designer has a wide range from which to choose, but he must keep in mind that the performance should not be compromised to achieve esthetic value.

The economic considerations are seldom a major consideration in the development of details for caps and copings. The material selected may have a minor effect on the economics of the detail. It affects the economics not only by its own costs, but also by the economics of installation. The economic considerations should not have a deleterious effect on the performance of the details in service.

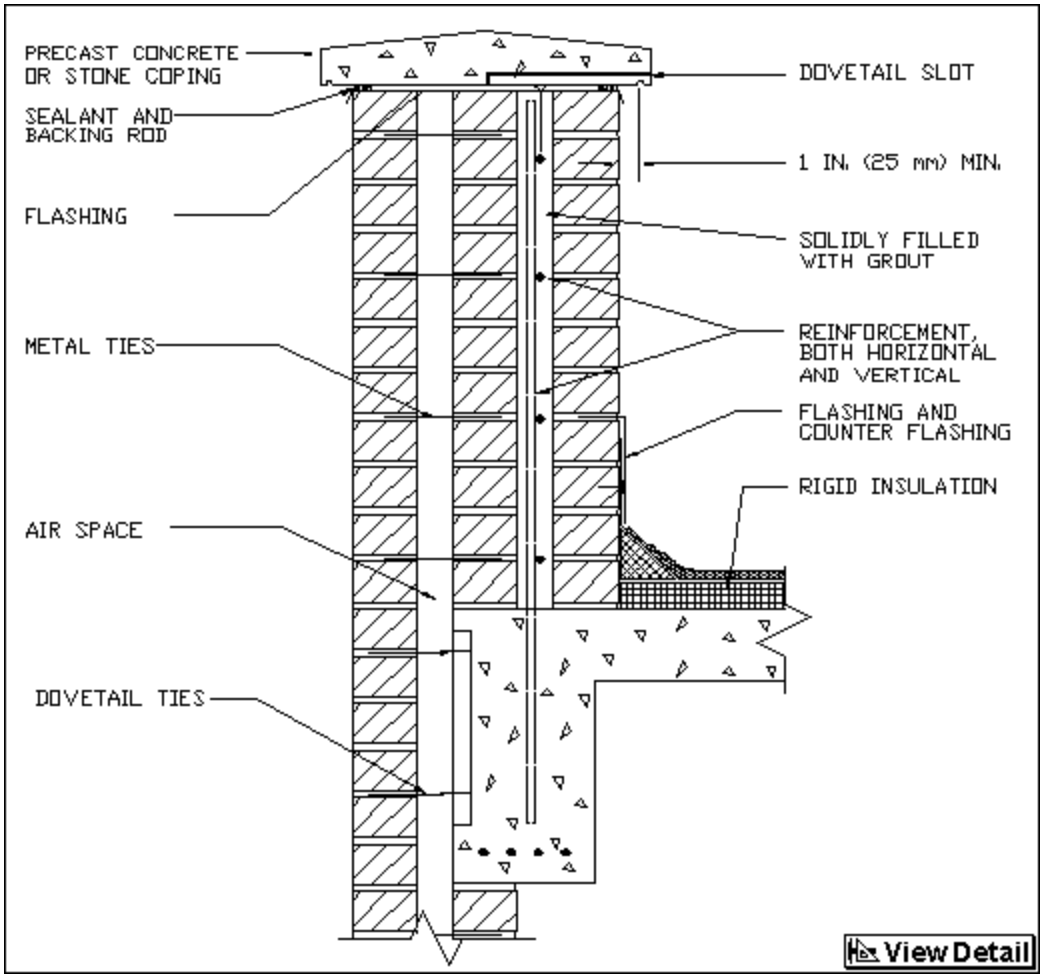
Details

General. The function of caps and copings is to prevent the entry of water into the wall where the wall becomes partially or totally discontinuous vertically. Caps should have the top surface sloping downward, away from the face of the wall above. Copings may slope in one or both directions. In all cases, the slope should be a minimum of 15 degrees from horizontal.

The caps should overhang the wall face on the exposed side. Copings should overhang the wall on both sides. The overhang should be of sufficient dimension so that the inner lip of the drip is at least 1 in. (25 mm) from the face of the wall. Since the function of caps and copings is to prevent moisture penetration, the fewer the number of joints, the more assurance that the detail will perform its function.

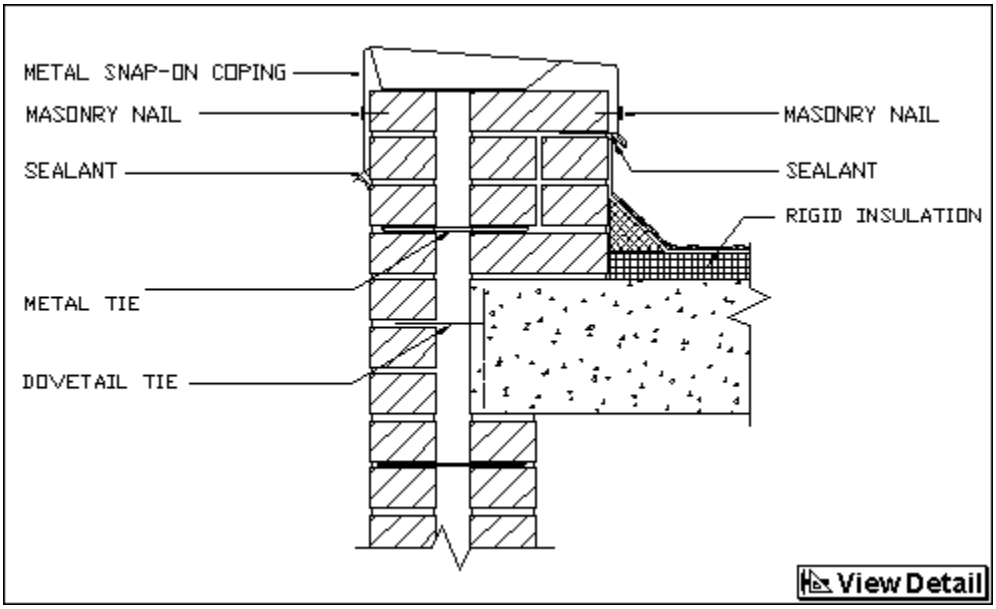
Flashing and Weepholes. Flashings for caps and copings generally serve a different function from flashings used elsewhere in the structure. Flashing used with caps and copings has as its prime function the prevention of the entry of moisture into the wall. The collection and diversion of the water from the wall becomes a secondary, although important function.

In order to properly anchor caps and copings to the wall, it may become necessary to penetrate the flashing with the anchor, see Figs. 1, 3, and 4. To prevent moisture from entering the wall, at these points, it is absolutely necessary that the penetrations be adequately sealed, or the flashing will fail to function as intended.



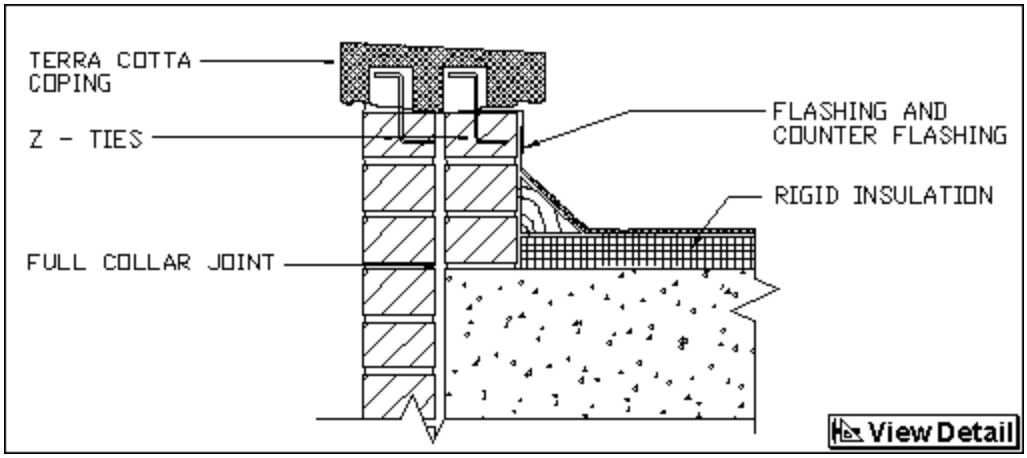
Precast Concrete or Stone Coping on Cavity Wall Parapet

FIG. 1



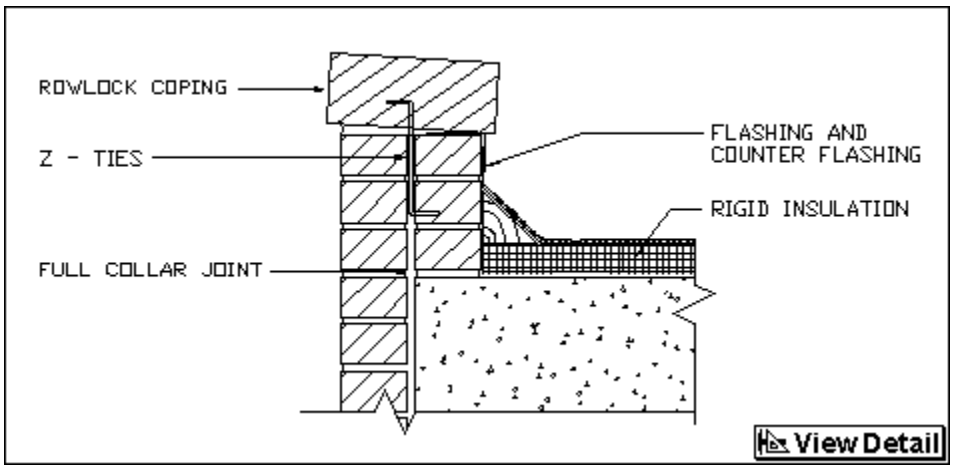
Coping for Cavity Wall Parapet

FIG. 2



Coping for Solid Masonry Parapet

FIG. 3



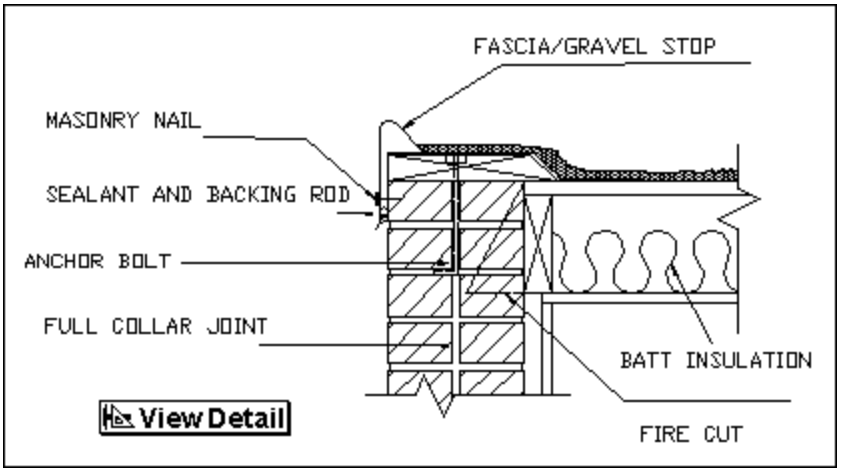
Rowlock Coping on Solid Masonry Parapet

FIG. 4

Flashings should be extended beyond the face of the wall and bent downward 1/4 in. (6 mm) to form a drip, as shown in Figs. 2, 5, and 6. Metal copings may also serve as flashings. It should be recognized that exterior flashings not contained within the wall serve the same functions as do interior flashing. Information on flashing materials is provided in *Technical Notes* 7A Revised.

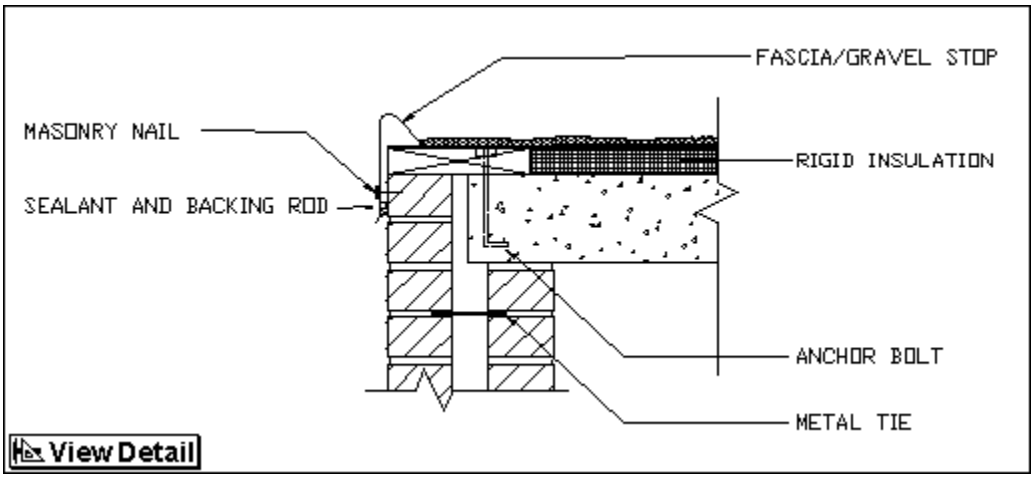
While the flashing for caps and copings may have a different prime function from normal usage, it is still necessary to provide weepholes immediately above the flashings to convey the water collected on the flashing out of the wall, unless exterior flashing is used. Weepholes should be spaced at a maximum of 24 in. (600 mm) o.c., unless wicks or hidden flashing are used. Then the spacing should be reduced to 16 in. (400 mm) o.c. maximum.

Drips. Regardless of the material selected for caps or copings, drips should be provided. When brick caps and copings are used, the drip is the lowest point on the element, as shown in Figs. 4 and 7. When metal caps and copings are used, the drips can be formed by bending the material outward from the face of the wall, see Figs. 2, 5 and 6. With heavy gauge metals, stone concrete or terra cotta caps and copings, the drip is either cut or formed in the bottom of the projection beyond the face of the wall, as shown in Figs. 1, 3, and 7. This drip can be in several configurations, and still perform. The important thing is that a drip be provided and that the inner lip be at least 1 in. (25 mm) from the face of the wall as shown in Figs. 1, 3, and 7.



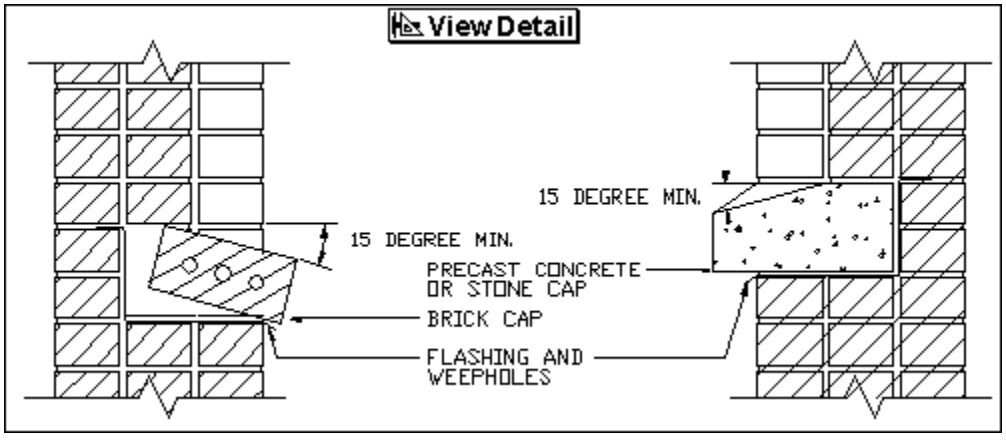
Masonry Bearing Wall Coping

FIG. 5



Masonry Cavity Wall Coping

FIG. 6



Brick and Precast Concrete or Stone Caps

FIG. 7

Connections. Elements other than caps and copings require careful consideration of their connection to the structure for the structural stability of the element. In the case of caps and copings, the structural stability becomes secondary to the climatic considerations, such as moisture and temperature. Connections which are usually provided for structural purposes are generally rigid. Because of the diversity of materials used for caps and copings in conjunction with brick masonry walls, the connection in some cases should be of a flexible nature. Brick masonry, concrete, stone and terra cotta, respond to climatic conditions in much the same manner, and rigid connections can be used with little consideration of differential movement. Because of the dissimilarity of metal and brick masonry in their reaction to climatic conditions, the connections require some flexibility.

Light gauge metal copings as shown in Figs. 5 and 6 should be nailed to the wall, and horizontal slots should be provided at nailing locations to prevent buckling of the coping due to thermal expansion. Metal caps and copings require an extension down the face of the wall, 4 in. (100 mm) min., and a sealant between the metal and the wall to prevent wind uplift and water penetration. Care should be taken to seal each penetration of the metal cap or coping where it is exposed to the exterior environment.

Expansion Joints. It is necessary to provide expansion joints in long walls to provide for movement of the wall due to thermal and moisture expansion. This is particularly true in parapet walls and other masonry walls which are exposed to the exterior climatic conditions on both sides. Expansion joints are discussed in *Technical Notes* 18 Series.

When expansion joints are required in the wall, the expansion joints should also be provided through any caps or copings in the same locations. It may be necessary to provide additional joints in metal copings. Metal copings should be so detailed and constructed that they function independently of the movement of the wall below. Expansion joints should be of a compressible material, but should also be extensible. One method of providing expansion joints is to leave the mortar from the head joints in a vertical line and insert a synthetic backer rod to the desired depth and fill the remainder of the joint with a high-quality sealant.

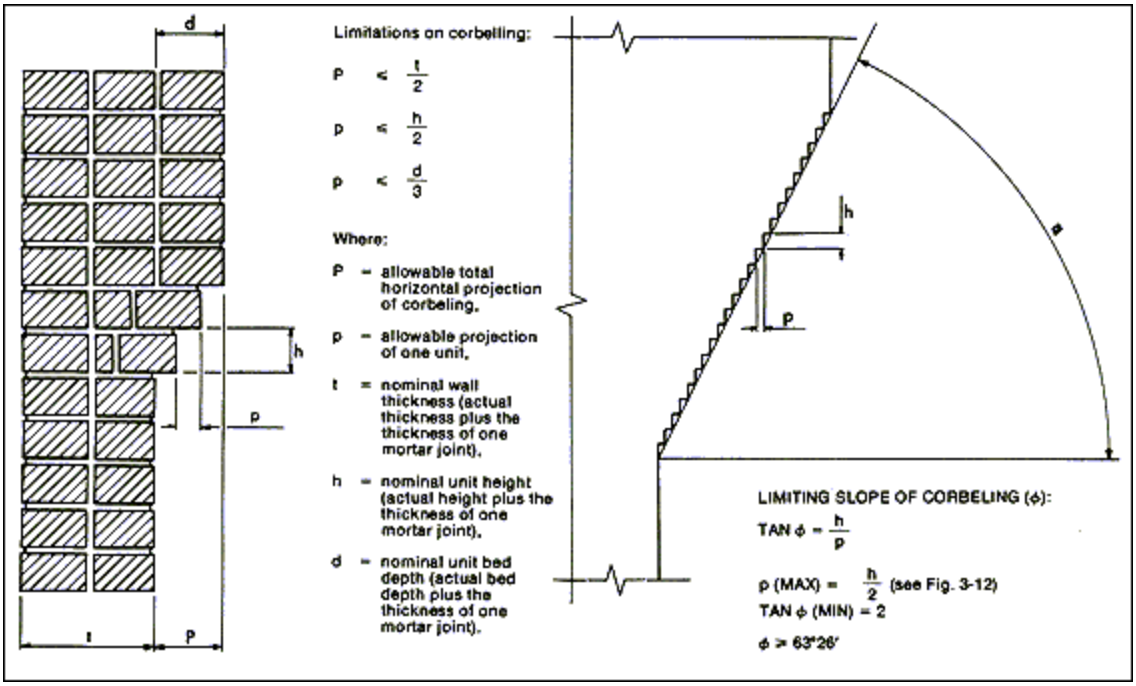
Construction. Caps and copings require no special construction skills. If brick masonry is used as the cap or coping material, great care should be taken to ensure that all head and bed joints are completely filled. If cast-in-place concrete is used, some provision must be made to allow for the initial drying shrinkage of the concrete.

If precast concrete or stone are used for caps or copings, non-compressible shims should be placed on the top of the wall at the exterior face of the wall. The shims are used because the weight of this type of cap or coping would compress the plastic mortar and a smaller joint would result. Then the mortar for the bed joint is spread and the cap or coping installed. The shims which should have a thickness equal to the bed joints should be left in place until the mortar has set. Once the mortar has set, the shims should be removed and the joint tuckpointed.

CORBELS AND RACKING

General

Corbeling of brick masonry may be done to achieve the desired esthetics, or to provide structural support. There are empirical requirements provided by most codes and standards for unreinforced corbels, as shown in Fig. 8. If these requirements are to be exceeded, then the element will require a rational design as a reinforced element.

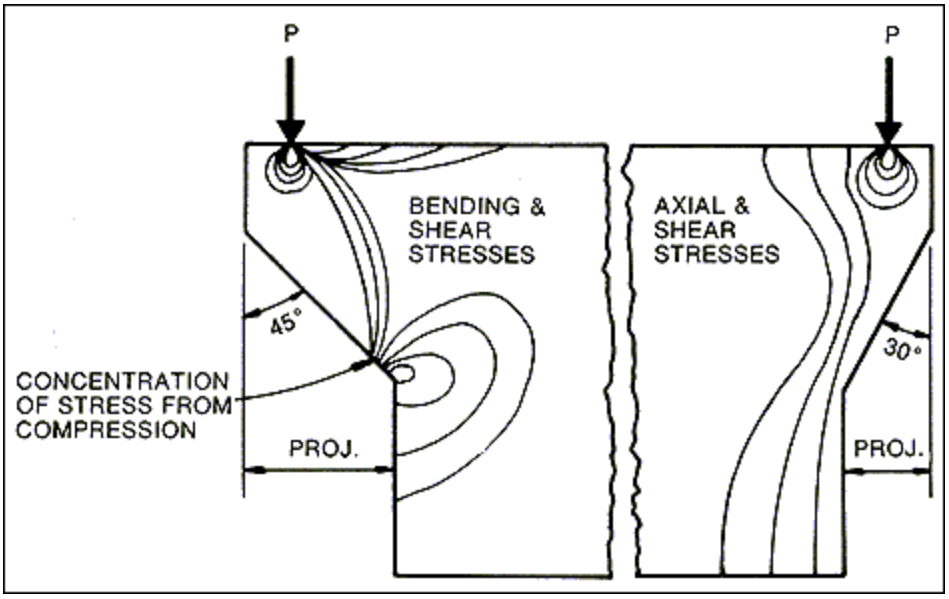


Limitations on Corbeling

FIG. 8

Corbels. The empirical approach requires that the total horizontal projection not exceed one-half the thickness of a solid wall, or one-half the thickness of the veneer of a veneered wall. It is also required that the projection of a single course not exceed one-half of the unit height or one-third of the unit bed depth, whichever is less. From these limitations, the minimum slope of the corbeling can be established (angle measured from the horizontal to the face of the corbeled surface is 63 deg 26 min. see Fig. 8). The required slope could be increased by the requirements that the unit projection not exceed one-third of the bed depth if they are more restrictive. It should be pointed out that the eccentricity induced into the wall by the corbeling must be considered in the wall design. If these limitations are exceeded, the wall should be reinforced to resist the stresses developed by the corbeling.

Fig. 9 illustrates graphically the pattern of stresses within two corbels of different configurations under identical loading conditions. The corbel on the left is 45 degrees from horizontal, which is not in accordance with building code requirements. The corbeled wall on the right has an angle of corbel 60 degrees from horizontal and is very close to the building code requirement of 63 degree 26 min discussed above. The 60 degree corbel shows a stress pattern with axial and shear stresses with the only concentration of stresses directly below the applied load, P. The shear stresses are well distributed within the wall section. The 45 degree corbel, on the other hand, has bending stresses in addition to the axial and shear stresses, and the pattern of the stresses has been drastically altered. In addition to the concentration of compressive stresses immediately beneath the load, P. there is another concentration of compressive stress at the toe of the corbel. The bending stresses require that a corbel of this configuration be rationally designed and reinforced. Those corbels having an angle from horizontal of 60 degree or greater do not require reinforcement unless they exceed the other requirements given above.



Corbeling Stress Distribution

FIG. 9

Racking. When racking back to achieve the desired dimensions, care must be exercised to insure that, since there is no limitation on the distance each unit may be racked, the cores of the units are not exposed. Preferred construction consists of a setting bed over the racked face with the uncored brick or paving brick set to provide a weather-resistant surface. Mortar washes may also be used. They may not, however, be as durable. When using a mortar wash, it should not bridge over the rack, but should fill each step individually.

SUMMARY

The designer, when developing details for caps, copings, corbels and racking should keep in mind the function of the element being detailed, the esthetic value he wishes to achieve, the structural stability of the element, and the economics of construction. It is essential to provide details which allow the elements to perform their primary functions as well as possible. In order to do this, the designer must select the proper materials, locate them in the proper place and provide sufficient information so that the element can be properly constructed. Several decisions and assumptions must be made by the designer because each project and each element on the project must be satisfactorily addressed.

The information and suggestions contained in this *Technical Notes* are based on the available data and the experience of the technical staff of the Brick Industry Association. The information and recommendations contained herein if followed with the use of good technical judgment, will avoid many of the problems discussed here. Final decisions on the use of details and materials as discussed are not within the purview of the Brick Industry Association, and must rest with the project designer, owner, or both.

Attachment No. 14

THE BRICK INDUSTRY ASSOCIATION

TECHNICAL NOTES on Brick Construction

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7A

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Water Penetration Resistance – Materials

Abstract: This *Technical Note* discusses considerations for the selection of materials used in brickwork and their impact on its resistance to water penetration. Minimum recommended property requirements and performance characteristics of typical materials are described.

Key Words: anchors, brick, coatings, corrosion resistance, flashing, grout, lintels, mortar, sealants, shelf angles, ties, water-resistive barrier, weeps.

SUMMARY OF RECOMMENDATIONS:

Brick and Mortar

- Select brick from the appropriate ASTM standard, designated for exterior exposures
- Use mortar conforming to ASTM C270
- Choose mortar materials and Types that are compatible with the brick selected to achieve optimal bond
- Use mortar Type with lowest compressive strength meeting project requirements

Grout

- Use grout conforming to ASTM C476
- Select appropriate type based on project requirements and dimensions of masonry openings receiving grout

Ties and Anchors

- Use galvanizing, stainless steel or epoxy coatings to provide corrosion resistance
- Do not use ties or anchors with drips
- Detail penetrations at face of backing

Water-Resistive Barriers

- Install when brick veneer is anchored to wood or cold-formed steel framing
- Protect from or avoid prolonged ultraviolet (UV) exposure
- Use No. 15 asphalt felt conforming to ASTM D226 or building paper, polymeric films (sheet membranes [housewraps] or fluid-applied materials), or water-resistive sheathings deemed equivalent or conforming to AC38
- For insulation or sheathings with facings intended to act as a water-resistive barrier or air barrier, tape or seal all joints
- For water-resistive barriers or air barriers, use material with appropriate permeability for wall assembly type and location within wall assembly; if necessary, use hygrothermal analysis to determine proper location and appropriate permeability

Flashing

- Use flashing conforming to applicable ASTM specifications
- Use sheet metal, plastic, rubber or composite materials
- Select flashing that is waterproof and compatible with adjacent materials
- Select materials appropriate for building service life, with higher levels of durability and UV resistance preferred
- Do not use aluminum, sheet lead, polyethylene sheeting, asphalt-saturated felt, building paper or housewraps
- For flashings that degrade when exposed to UV light, use a drip edge
- For flexible flashing anchorage, use a termination bar to anchor flexible flashing where appropriate

Weeps

- Open head joint weeps preferred
- Vents and mesh may be installed within open head joint weeps

Drainage Material or Mortar Collection Devices

- Use of material or devices is recommended
- Select either low-height material placed immediately above flashing or full-height material placed throughout air space
- For low-height material, two-level crenulated shape is recommended
- Use material that fills entire width of air space
- Do not use material that absorbs moisture or transmits moisture to backing

Sealant Joints

- Use sealants conforming to ASTM C920 with compatible movement capability to joint size and type
- Use backer rods where joints are wide enough to accommodate them
- Closed cell or bicellular backer rods recommended
- Size backer rods 25 percent larger than joint width
- Where backer rod cannot be installed, use bond break tape

INTRODUCTION

This *Technical Note* is the second in a series addressing water resistance of brick masonry and provides guidance regarding material selection of brick masonry components. Other *Technical Notes* address brickwork design and details (TN 7), construction techniques and workmanship (TN 7B) and condensation (TN 47).

The use of quality construction materials in brickwork is of prime importance in attaining a satisfactory degree of water resistance. Requiring that materials meet the minimum criteria of appropriate material specifications helps to ensure that they are of an acceptable quality.

The most recognized and widely used building material specifications for the determination of quality construction materials are those developed by ASTM International (ASTM) [Ref. 2]. The performance of products cannot be predicted by ASTM specifications alone, because design, detailing and workmanship also affect performance. However, the requirements are based on laboratory tests and field experience and, in the case of brick, are the result of experience gained over a time span exceeding 100 years.

BRICK UNITS

Selection of quality brick is very important. Units are normally chosen based on color, texture, size and cost. However, characteristics that can affect water penetration resistance should also be considered. These include durability and those properties that influence brick/mortar compatibility.

Under normal exposures, it is virtually impossible for significant amounts of water to pass directly through brick units. Brick can absorb water, but the density and pore structure of the units does not contribute to bulk water penetration through the brick matrix. Where water penetration through brick masonry occurs, it generally does so through the bond line between the brick and mortar and, depending on the level of workmanship, the mortar joint.

Durability

Because exterior masonry will be exposed to moisture and the elements, durability is a primary concern. Durability of the brickwork is affected not only by the durability of individual materials, but also by the compatibility of materials, how the assembly is designed, how materials are installed and the conditions to which the masonry is exposed.

The ASTM specifications for brick are written to provide guidance in choosing a suitable quality of brick based on specific exposure conditions. The requirements for compressive strength, absorption and saturation coefficient are used to establish the resistance of the brick to damage by freezing and thawing when saturated. Cracking, crazing, spalling and disintegration can occur if an improper choice of brick is made. Many areas of the United States fall within the designation of severe weathering, where the use of Grade SW brick is recommended. Grade SW brick is the default brick grade for brick conforming to ASTM C216 and C652.

The requirements within the ASTM specifications for brick and other component materials are not intended to serve as an indicator of the degree of water resistance of the masonry assembly, which includes brick, mortar, grout, etc. The durability of the masonry is related to the degree of water resistance in that the more water that enters the system, the greater the probability that the masonry will be in a saturated condition during freeze/thaw cycles.

Brick Standards. Each kind of brick currently in use has its own designated ASTM standard, with specific requirements for durability stipulated by physical properties of the brick. The most commonly used brick standards and the classification for the most severe exposures are the following [Ref. 2]:

- ASTM C216, Grade SW - *Facing Brick (Solid Masonry Units Made From Clay or Shale)*
- ASTM C652, Grade SW - *Hollow Brick (Hollow Masonry Units Made From Clay or Shale)*
- ASTM C62, Grade SW - *Building Brick (Solid Masonry Units Made From Clay or Shale)*
- ASTM C1405, Class Exterior - *Glazed Brick (Single Fired, Brick Units)*
- ASTM C126, *Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units* (note that this standard does not include physical requirements for the brick body; therefore, specify Grade SW within ASTM C216 or C652 as applicable)

Please see *Technical Note* 9A for additional information regarding the physical properties of brick units.

MORTAR AND GROUT

Choosing the proper Type of mortar or grout to use in a particular application is very important. To minimize water penetration, the primary concern is to choose a mortar and/or grout that will result in the most complete bond with

the masonry units chosen. The *Technical Note* 8 Series provides detailed information on mortar. *Technical Note* 3A provides further information on grout.

Mortar

The standard for specifying mortars for unit masonry is ASTM C270, *Standard Specification for Mortar for Unit Masonry* [Ref. 2]. Four Types of mortar (M, S, N and O) are covered in the standard, although building codes typically require the use of Types M, S or N. Type O mortar is generally used in repair of older brickwork where other mortar Types may be incompatible with the existing brick. ASTM C270 addresses portland cement-lime (PCL) mortars and those made with mortar cements and masonry cements. Detailed information on the provisions of ASTM C270, including mortar Types, proportion formulas and required properties, can be found in *Technical Note* 8.

No single Type of mortar is best for all purposes. As a general rule, when selecting mortar for a project, always select the mortar Type with the lowest compressive strength that meets the performance requirements of the project. Mortar with higher cement content may be more difficult to clean off the face of the wall, may increase the risk of shrinkage cracks and may decrease the workability of the mortar. Decreased workability increases the chances of partially filled joints.

This general rule must be tempered with good judgment. For example, it would be uneconomical and unwise to continuously change mortar Types for various parts of a structure. However, the general intent of the rule should be followed, using good judgment and economic sense. For most brick veneer applications, Type N mortar is appropriate. Refer to the “Brick/Mortar Compatibility” section of this *Technical Note*.

Grout

Grout is used in reinforced brick masonry to fill cells and cavities that contain reinforcing steel. This not only applies to reinforced walls, but also to beams and lintels constructed of brick masonry. In some barrier masonry walls, grout is used to fill the collar joint that bonds the outer and inner masonry wythes together.

For brickwork, use grout conforming to ASTM C476, *Standard Specification for Grout for Masonry* [Ref. 2]. The standard covers two types of grout: fine and coarse. Fine grout consists of cement and sand, while coarse grout also contains coarse aggregates such as pea gravel. Each grout type is further classified as either conventional or self-consolidating. Conventional grout requires consolidation by external means, such as vibration, while self-consolidating grout, as its name implies, does not require external means of consolidation. Within each of these classifications, the grout can be either fine or coarse, depending on the geometric constraints of the application. Grout can be prepared by mixing the components on the jobsite, or it can be obtained as a ready-mix product. The volume of material needed for conventional grout may be specified by proportions or by strength requirements; self-consolidating grout must be specified using the strength requirements. When using conventional grout in brickwork, specification by proportions is recommended. Volumes of materials used in grout (or mortar) specified by proportions should be measured consistently throughout the project via the use of a calibrated container, which is periodically checked by material weights and densities. Where possible, whole bags of components should be used to determine proportions.

Specification for Masonry Structures (TMS 602) [Ref. 12] contains requirements for the maximum height of grout pour, the minimum width of grout space and the minimum dimensions of cells receiving grout for each grout type. Fine grout requires a minimum grout space width of ¾ in. (19.1 mm) and any cells receiving grout to be a minimum dimension of 1½ × 2 in. (38 × 51 mm). Coarse grout requires a minimum grout space width of 1½ in. (38 mm) and any cells receiving grout to be a minimum dimension of 1½ × 3 in. (38 × 76 mm).

BRICK/MORTAR COMPATIBILITY

When water passes through brick masonry walls, it does so through separations that form between the brick and the mortar at the time of laying or through cracks that form after the mortar has cured. The dominant property affecting the amount of water entering brickwork from the standpoint of materials selection is the extent of bond between the brick and the mortar. Extent of bond is a measure of the area of contact at the interface between brick and mortar surfaces.

Not to be confused with extent of bond, bond strength is a measure of the adhesion between brick and mortar. Bond strength is one factor that determines whether cracks will form after the mortar cures. Brick-and-mortar combinations that have high bond strengths do not necessarily provide high resistance to water penetration. Extent of bond is more important to water penetration resistance of brick masonry than bond strength.

Extent of bond is influenced by both brick and mortar properties and is best achieved when both are considered and paired accordingly. Initial rate of absorption is the key property of the brick related to brick/mortar compatibility. Mortar properties include water retention, air content and workability.

The initial rate of absorption (IRA) of a brick is a measure of the amount of water taken into a 30 sq in. (194 cm^2) area on the bedding surface of the brick within one minute. A brick's IRA can be measured in the laboratory under controlled drying conditions or in the field. The field IRA of a brick will vary depending on the moisture condition of the brick at the time of testing.

Tests over the years have shown that the most complete bond is achieved when the IRA of a brick, at the time of laying, is below 30 g/min•30 sq in. (30 g/min•194 cm^2). As a result, TMS 602 requires brick with initial rates of absorption in excess of this value to be wetted prior to laying. Water penetration tests of masonry built with low- and high-IRA brick [Ref. 4 and Ref. 5] indicate that mismatch between brick IRA and the amount of water retentivity in the mortar may result in poor bond, which can increase the risk of water penetration. Thus, low IRA brick (less than 5 g/min•30 sq in.) should be combined with mortars that exhibit low water retention, and high IRA brick should be combined with mortars with high water retention. See *Technical Note* 8B for mortar recommendations with brick of various IRAs.

Mortar air content will also affect extent of bond because the air voids present along the bond line reduce the length of direct contact between mortar and brick. Higher air content mortars such as masonry cement mortars and those made with air-entrained cements or lime are more likely to increase water penetration.

Several studies have shown that workmanship is critical with respect to water penetration. Tooling is the first defense, as the process consolidates and densifies the mortar at the outer surface and forces the mortar against the brick surfaces. Additional information on tooling is presented in *Technical Note* 7B. With respect to mortar, many masons have more experience with certain mortar formulations than others. Allowing masons to use mortars they have experience with will generally result in better workmanship than using unfamiliar mortar formulations.

TIES AND ANCHORS

Ties and anchors in a masonry wall system connect two or more wythes together or attach the brick veneer to structural backing. Ties and anchors do not directly influence water penetration, except when related to cracking of the brickwork and resulting water entry. All ties and anchors must be corrosion-resistant. Applicable ASTM standards for corrosion resistance of masonry ties and anchors are discussed later in this *Technical Note*. More detailed information on ties and anchors can be found in *Technical Note* 44B.

Joint Reinforcement. Truss-type joint reinforcement that engages the brick wythe with fixed diagonal cross wires is permitted only in multi-wythe walls with a filled collar joint. In other walls, it can restrict differential in-plane movement between masonry wythes, which can lead to cracking and subsequent water penetration.

Drips. A drip is a bend or crimp in a tie or anchor that breaks the surface tension of any moisture traveling across the tie, forcing it to form a droplet and fall before reaching the interior masonry wythe or other backing. Ties and anchors of wire with drips are not permitted by the *Building Code Requirements for Masonry Structures* (TMS 402) [Ref. 6] because the drips reduce the compressive and tensile load capacity of the ties when transferring the lateral loads between the wythes. Detailing the penetration of the tie at the plane of the backing is a more effective method of protection against this condition.

Penetrations. Brick ties and anchors will penetrate the water-resistive barrier, air barrier and/or vapor retarder and will require additional detailing to maintain watertightness of the wall assembly. Apply compatible sealant or other approved patching materials around the penetration at the face of the membrane to ensure continuity of the water-resistive barrier, air barrier and/or vapor retarder. With fluid-applied products, care should be exercised to ensure full coverage around penetrations and protrusions. It is recommended to install self-adhered membrane directly behind brick tie base plates for additional protection with polymeric air and water-resistive barriers. Use

manufacturer-recommended accessories with fasteners, such as large-diameter plastic caps for nails, staples or screws. Metal washers with ethylene propylene diene monomer (EPDM), neoprene or equivalent gaskets are also recommended for screw fasteners.

Corrosion Resistance. Corrosion resistance is usually provided by using galvanized steel or stainless steel. Epoxy coatings are used in some situations. The level of corrosion protection required for wall ties and anchors varies with their expected exposure conditions, as follows:

- When exposed to earth or weather or to a mean relative humidity exceeding 75 percent, ties and anchors are required to be hot-dip galvanized, stainless steel or epoxy-coated.
- In other exposures, ties and anchors must be mill galvanized, hot-dip galvanized or stainless steel.

In addition, the designer should consider the potential for corrosion due to contact between dissimilar metals.

Galvanized steel items may be hot-dip or mill galvanized; however, hot-dip galvanizing is preferred. With mill galvanizing, the steel is galvanized before the joint reinforcement or wall tie is fabricated. Therefore, welds and ends cut during or after the manufacturing process are not coated. With hot-dip galvanizing, the finished fabricated item is galvanized, providing more complete coverage. Stainless steel items should be AISI Type 304 or Type 316 and conform to the appropriate specification listed below. TMS 402 also allows epoxy coatings to be used as corrosion protection. When epoxy coatings are specified, consider including touch-up material for the coating in order to restore protection when coating is scratched or cut during construction.

To ensure adequate resistance to corrosion, coatings or materials should conform to the following [Ref. 2]:

Zinc Coatings	ASTM A123 (for steel plates and bars) or A153 Class B (for sheet metal ties and sheet metal anchors) or minimum 1.50 oz/sq ft (458 g/m^2) (for joint reinforcement, wire ties and wire anchors)
	ASTM A641, minimum 0.1 oz/sq ft (0.031 kg/m^2) (joint reinforcement)
Stainless Steel	ASTM A240 (for sheet metal anchors and sheet metal ties)
	ASTM A480 (for sheet metal anchors and sheet metal ties and for plate and bent-bar anchors)
	ASTM A580 (for joint reinforcement, wire anchors and wire ties)
	ASTM A666 (for plate and bent-bar anchors)
Epoxy Coatings	ASTM A884 Class A, Type 1, minimum 7 mils (175 µm) (for joint reinforcement)
	ASTM A899, Class C, minimum 20 mils (508 µm) (for wire ties and wire anchors)

Masonry Headers. A header is a masonry unit laid perpendicular to the wythe that is used to connect two wythes of masonry. Although TMS 402 allows wythes of masonry designed for composite action to be bonded structurally by masonry headers, they are not commonly used in contemporary construction. Structural header units are no longer recommended because they provide a direct path for water penetration from the outside of the wall to the interior along the head and bed joints. Many bond patterns such as Flemish, Old English, Old English Cross, etc. use header units that can be replicated in a veneer with clipped or false headers without the risk of water penetration.

WATER-RESISTIVE BARRIERS

As discussed in *Technical Note 7*, the *International Building Code* (*IBC*) [Ref. 8] and the *International Residential Code* (*IRC*) [Ref.9], water-resistive barriers are used to prevent the passage of liquid (bulk) water to underlying materials, and some may also serve as an air barrier. The permeability of the water-resistive barrier must also be considered in order to ensure that water vapor does not remain in the wall.

Permeability. With respect to water vapor management, the unit “perm” is used to identify the permeability of a water-resistive barrier, with a higher number indicating greater permeability. This property is measured using one of the test procedures in ASTM E96, *Standard Test Methods for Water Vapor Transmission of Materials* [Ref. 2]. The manufacturer’s literature of the water-resistive barrier should include the test method when citing the perm

rating to allow for an accurate comparison among different materials. These materials are identified in the *IBC* and *IRC* as different classes of vapor retarders based on the perm rating. See Table 1.

Table 1
Vapor Retarder Classification

Vapor Retarder Class	Rating (perms)
Class I	Less than 0.1
Class II	Above 0.1 and less than or equal to 1.0
Class III	Above 1.0 and less than or equal to 10

Class I vapor retarders are sometimes referred to as vapor barriers. The *IBC* and *IRC* categorize Class III vapor retarders as vapor permeable when they have a perm rating of 5 or higher per ASTM E96, desiccant method.

Wall Assemblies. As discussed in *Technical Note* 7, wall assemblies with brick masonry at the exterior are categorized in two main groups: those with continuous insulation within the drainage cavity or air space and those with insulation in the stud cavity only.

When continuous insulation is present in the air space behind the brick veneer, the face of the sheathing or backing generally serves as the plane where bulk water, air and water vapor are controlled. In many climate zones, the vapor retarder does not need to be permeable at this location (e.g., Class I is permitted), and a single product can serve all functions. But in colder climate zones, enough continuous insulation must be placed on the exterior side of the water-resistive barrier to ensure that condensation will occur within the air space and not within the backing. The insulation thickness can be determined by hygrothermal analysis, which models the movement of heat and moisture through a building.

When insulation is only within the stud cavity, the water-resistive barrier must be vapor permeable (5 perms or higher) and serve to protect against bulk water. If feasible, the water-resistive barrier can be detailed to function as the air barrier also. Alternatively, the exterior sheathing can be detailed to serve as the air barrier by treating the seams and penetrations with sealant or tape. For more information on vapor barriers and their placement, refer to "Understanding Vapor Barriers" [Ref. 7].

Examples of water-resistive membranes include No. 15 asphalt felt, building paper, certain high-density polyethylene or polypropylene plastics (housewraps), and certain water-resistive sheathings. The various material options are discussed in detail below.

Sheet Membranes

Felt-Based Barrier. One layer of No. 15 asphalt felt is prescribed by most building codes as the baseline material for water-resistive barriers. The felt should conform to Type I of ASTM D226, *Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing* [Ref. 2]. It may be attached directly to the studs or sheathing in such a manner as to provide a continuous water-resistive, vapor-permeable barrier and should have a performance of at least two layers of water-resistive barriers complying with Type I of ASTM E2556, *Standard Specification for Vapor Permeable Flexible Sheet Water-Resistive Barriers Intended for Mechanical Attachment* [Ref. 2]. The durability of asphalt-saturated felt is adequate; however, it may be easily torn during or after installation. Asphalt-saturated felt typically has a high water vapor permeability, which increases when wet, categorizing it as a Class II vapor retarder per *IBC* (Class III when wet). Felt cannot be detailed to act as an air barrier; therefore, other methods should be used to limit air flow through the assembly.

Paper-Based Barrier. Asphalt-saturated kraft paper (generally referred to as building paper) has a long history as an approved and common substitute for No. 15 asphalt felt. Building paper for use as a water-resistive barrier should conform to the requirements of Federal Specification UU-B-790a, Type I, Grade D. This specification requires that Grade D paper have a minimum water-resistance rating of 10 minutes as determined by ASTM D779, *Standard Test Method for Water Resistance of Paper, Paperboard, and Other Sheet Materials by the Dry Indicator Method* [Ref. 2]. Characteristics of building paper are similar to those of asphalt-saturated felt. Building paper typically has less asphalt and lower permeance than felt and can offer better resistance to bending damage. One of the disadvantages of the product is that it will deteriorate if subjected to sustained moisture without sufficient drying.

Polymeric-Based Barrier. Some plastic films (building wraps or housewraps) have been approved for use as water-resistive barriers. These films may have qualities similar to those of other water-resistive barriers, but ascertaining the effectiveness of a particular plastic as a water-resistive barrier can be difficult, as a standard specification is yet to be developed.

Some plastic membranes act as vapor barriers and can potentially trap water vapor inside the stud wall, where it can condense if the temperature in the wall drops below the dew point. Thus, not all plastic membranes should be considered suitable, and caution should be exercised when specifying them as water-resistive barriers. AC38, *Acceptance Criteria for Water-Resistive Barriers* [Ref. 1], developed by the International Code Council Evaluation Service, Inc., is typically used to establish the suitability of a polymeric film as a water-resistive barrier. Under these criteria, polymeric-based barriers are proprietary polymeric sheet materials for use as water-resistive barriers that are either mechanically fastened or coated on one side with an adhesive material.

Polymeric films are generally divided into two categories: perforated and non-perforated. Non-perforated films allow water vapor to pass between the fibers of the plastic fabric, while perforated films are made from vapor-tight plastic films that are punched with small holes to allow vapor to pass through. Non-perforated films are recommended over perforated films because they resist water penetration more consistently in commonly used performance tests than perforated films.

Polymeric films are highly resistant to tearing and can often function concurrently as air barriers when detailed to do so; however, they do not tend to seal themselves when penetrated by fasteners, as felts sometimes do. Some manufacturers recommend that fasteners with large heads or plastic caps be used rather than standard fasteners to enhance water penetration resistance at fastener locations. Polymeric films can often be installed with fewer lap joints than felt and building paper, as they are supplied in larger rolls up to 10 ft (3.1 m) wide.

Self-adhered rubberized asphalt sheet membranes that are used primarily as air barriers may also function as vapor-impermeable water-resistive barriers. These consist of a rubberized asphalt backing with a polymeric facing, the same material that can be used for masonry through-wall flashing. Generally, this type of membrane has some self-healing capabilities and is significantly more resistant to tears than the sheet materials listed previously.

Fluid-Applied Films

Fluid-applied films often have the capability of serving as both vapor and air barriers, and sometimes thermal insulation, in addition to providing water resistance. These coatings are varied in type and may be applied by spray, roller or trowel; however, they generally have the benefit of providing a seamless, monolithic membrane that adheres to most substrates. Although these materials can be applied rapidly, they require skilled applicators to ensure quality and performance.

These membranes have a unique set of service requirements because they are bonded to the substrate. The effects of wet substrates, expansion and contraction at substrate joints, volume changes of building materials, and stresses caused by lateral loads must be considered so that the membrane performs successfully during its life. Membrane transition strips are frequently used in combination with fluid-applied films to address concerns with changes and variations in the substrate. Consistent installations are more difficult to achieve on substrates with rough surfaces and may require increased thicknesses, which can adversely affect the permeability of the film.

Board Products

Sheathings and other board products that are inherently water resistive or have water-resistive facings are permitted to serve as water-resistive barriers when the edges and joints of boards are completely taped or sealed. To perform successfully, the materials providing this seal must maintain their integrity and performance when subjected to moisture and other environmental conditions for the entire service life of the wall. Board products that act as water-resistive barriers should be vapor permeable except when they are also intended to serve as a vapor barrier.

SHELF ANGLES AND LINTELS

Although similar, shelf angles and lintels differ in the way each is incorporated into brickwork. A shelf angle supports brick veneer and is anchored to the structure. Shelf angles typically occur at floor lines and above ribbon

windows. A lintel, on the other hand, is a structural beam placed over an opening to carry superimposed loads. As such, it is supported by the masonry on each side of the opening and is not attached to the structure.

Lintels may be loose steel angles, stone, precast concrete or reinforced masonry. The proper specification of material for lintels is important for both structural and serviceability requirements.

Non-galvanized and non–stainless steel shelf angles and lintels should be primed and painted at a minimum to inhibit corrosion. A commercial or industrial coating instead of exterior-grade paint is an upgrade to consider for mild steel without galvanizing and is also recommended to provide additional protection for existing steel that has experienced minor corrosion. For severe climates and exposures, such as in coastal areas, consider using galvanized or stainless steel shelf angles and lintels, as well as anchors and joint reinforcing. Stainless steel components used in construction are typically Type 304. Type 316 stainless steel has an increased resistance to chlorides and is recommended for coastal areas and the most extreme exposures. Even where galvanized or stainless steel shelf angles and lintels are used, continuous flashing should be installed to protect the angle. To ensure adequate resistance to corrosion, galvanized zinc coatings should conform to ASTM A123, *Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products* [Ref. 2]. Additional discussion and details of shelf angles and lintels may be found in *Technical Notes* 21, 21A, 28, 28B, 31 and 31B.

FLASHING

Selection of a proper flashing material is of utmost importance because the flashing is a critical element to the drainage of water that may penetrate the wall system. Flashing materials must be waterproof, durable, and resist puncture and cracking during and after construction. To promote drainage, flashing should extend beyond the face of the brick to form a drip. Because flashing may be installed in advance of the exterior brick wythe, it should be able to endure some exposure to ultraviolet (UV) light without significant deterioration. When using a flashing that deteriorates with UV exposure, a metal drip edge is recommended to extend the flashing beyond the face of the brickwork. When a drip edge is not used, the flashing should stop, or be cut, flush with the face of the wall. The flashing should also resist damage from contact with metal, mortar or water and be compatible with adjacent adhesives and sealants. Minimum recommended flashing thicknesses are included in this section for each type of flashing. In general, thicker flashings are more durable but may be more difficult to form.

Flashing materials generally fall into three categories: sheet metals, composite materials (combination flashings), and plastic or rubber compounds. The selection is largely determined by cost and suitability. Only superior quality materials should be selected, since replacement in the event of failure may be expensive. Materials such as polyethylene sheeting, asphalt-impregnated building felt, building paper and housewraps should not be used as flashing materials. These materials are not necessarily waterproof, are easily damaged during installation and, in many cases, turn brittle and decay over time.

Sheet Metals

Stainless Steel. Stainless steel is an excellent rigid flashing material that has superior chemical resistance and does not stain masonry. Stainless steel flashing should conform to ASTM A240/A240M, Type 304 [Ref. 2]. The minimum thickness should be at least 0.01 in. (0.25 mm) or 32 gauge. A thickness of at least 0.016 in. (0.41 mm) or 28 gauge is recommended for drip edges and other typical masonry flashings.

Because a sheet metal brake is required to create flashing assemblies, preformed shapes are commonly used, although these are difficult to modify on-site if field adjustments are required. Stainless steel shapes, such as pans, end dams and mitered corner transitions, should have fully soldered seams to achieve watertightness; however, linear sections of flashing can be joined using cover plates and multiple parallel lines of sealant appropriate for sheet metal applications to permit expansion and contraction of the metal. Exposed edges, particularly drips, should be hemmed.

Copper. Copper is another excellent rigid flashing material that is durable, easy to form and solder, and is available in preformed shapes. The recommendations regarding fully soldered seams and hemmed edges in stainless steel apply to copper as well. Exposed copper may stain adjacent masonry, but it is not damaged by the caustic alkalis present in masonry mortars. It can be safely embedded in fresh mortar and will not deteriorate in continuously saturated, hardened mortar, unless excessive chloride ions are present. When using copper flashing, prohibit the use of mortar admixtures containing even small amounts of chlorides.

Copper flashing should conform to ASTM B370, *Standard Specification for Copper Sheet and Strip for Building Construction*, or B882, *Specification for Pre-Patinated Copper for Architectural Applications* [Ref. 2]. The Copper Development Association recommends minimum weights of 12 oz/sq ft and 16 oz/sq ft for high-yield and standard cold rolled copper, respectively, used as through-wall flashing. If copper flashing is used adjacent to other metals, then proper care should be taken to account for separation of the materials. Laminated copper flashing and combinations of copper sheet and other materials are discussed in the "Composites" section of this *Technical Note*.

Mill-Galvanized Steel. Galvanized flashing is available, but the coating is not hot-dipped, resulting in a thinner protective layer. Bending galvanized sheets to create flashing shapes will crack the coating and compromise the corrosion protection. In addition, the coating is sacrificial compared with the inert finishes of other metal flashings, which results in reduced service life and durability. Therefore, use of galvanized steel as through-wall flashing is not recommended.

Aluminum. Aluminum should not be used as a flashing material in brick masonry. The caustic alkalis in fresh, unhardened mortar will attack aluminum. Although dry, seasoned mortar will not affect aluminum, corrosion can occur if the adjacent mortar becomes wet. Anodized or organic coatings can provide some protection against this condition but are still not recommended for flashing, as they will not provide the same performance as an inert material for embedded elements. These coatings should provide adequate protection of exposed aluminum elements within the wall system, such as window frames, from precipitation runoff.

Lead. Historically, lead sheets were widely used to flash masonry walls. Because lead, like aluminum, is susceptible to corrosion in fresh mortar, a coating was applied to the lead for protection. Galvanic action can also occur where lead is only partially embedded in cured mortar with moisture present. In the United States and elsewhere, the use of lead as a building material has fallen out of favor due to environmental and worker safety concerns. Consequently, thin lead sheet is no longer recommended as a flashing material in brick masonry. Contemporary materials are available to replicate a lead flashing appearance where new flashing is required to match existing lead flashing.

Plastics and Rubbers

Plastic and rubber flashings are resilient, corrosion resistant materials that are easy to form and join. However, because the chemical compositions of these products vary widely, their durability is also variable. Thus, it is necessary to rely on performance records of the material, the reputation of the manufacturer and, where possible, test data to ensure satisfactory performance. Some of the critical areas are (1) resistance to degradation in UV light; (2) compatibility with alkaline masonry mortars; (3) compatibility with joint sealants, and (4) resistance to tear and puncture during construction. A minimum thickness of 40 mils (1 mm) is recommended for plastic and rubber flashing.

Polyvinyl Chloride (PVC). Historically, PVC flashing became brittle with age and was sensitive to UV exposure. Newer PVC flashing is formulated with different polymers, similar to those used in roofing applications, and is designed not to deteriorate or harden with time or UV exposure. Adding higher percentages of such polymers to PVC flashing can contribute to greater flexibility and durability. Therefore, these newer flashings do not require a separate drip edge, and some manufacturers make a version with an integral drip edge. PVC flashing may be self-adhered or require the use of a separate adhesive to bond to itself and the substrate.

Ethylene Propylene Diene Monomer (EPDM). EPDM is a synthetic rubber that is used as a single-ply roofing membrane as well as flashing; therefore, exposure to UV light is not a concern. It has better low-temperature performance than PVC and better weathering resistance than butyl rubber. Flashing of this type generally requires a separate adhesive to bond to itself and the substrate.

Self-Adhered Rubberized Asphalt. Self-adhered rubberized asphalt flashing adheres to other building materials and itself, speeding flashing installation and making it easier to seal flashing laps and terminations. These flashings are also self-healing, making them less susceptible to small punctures. However, dimensional stability may be a concern. Substrates should be dry and clean for proper adhesion. When self-adhered flashings are used, confirm compatibility between the flashing adhesive and sealants used in the wall. Primers may be required to ensure adequate adhesion of self-adhering flashing to some substrates.

This membrane is not intended for UV exposure, and the rubberized asphalt will bleed onto the brick face when exposed to elevated temperatures or direct sunlight. As a result, this membrane is regularly paired with a sheet metal drip edge, which allows the membrane to be recessed 1 to 1½ in. (25 to 38 mm) and still direct moisture to the exterior. Some manufacturers offer a through-wall flashing version of their typical self-adhered membrane that features a leading edge of facing material without the rubberized asphalt to serve as a drip edge.

Composites

The most common type of composite or combination flashing is a thin layer of metal sandwiched between one or two layers of another material, such as bitumen, kraft paper or various fabrics. The metal layer is usually copper, lead or aluminum. Composite flashings have the advantages of the better properties of each of their component materials. In the case of lead and aluminum composite flashings, the paper and fabric laminates reduce the potential for corrosion resulting from the metal foil contacting the mortar or adjacent dissimilar metals. These flashings also allow the use of thinner metal sheets, making them less expensive and easier to form, but also more prone to tearing and punctures. If the laminate is not durable and stable under UV exposure, then these flashings should be used with stainless steel drip edges. Adhesives are required to bond these materials to themselves and to the substrate. For surface-mounted applications where the flashing is not terminated into a masonry bed joint, termination bars are recommended. It is beyond the scope of this *Technical Note* to describe the various types of composite flashing and their properties. The manufacturers' literature should be consulted for the various types of composite flashing available.

ACCESSORIES

Insulation

Many wall assemblies include continuous insulation in the drainage cavity to improve their thermal resistance. Although thermal resistance is the most important characteristic for insulation, other properties for consideration include water absorption, combustibility, density, insect resistance and ease of installation. Insulation will generally be installed concurrently with the other components in the drainage wall. Materials for this application should conform to the following requirements:

1. Must be durable and resist rot due to moisture or dryness. Must be intended for use in the "wet zone" of the wall assembly with no degradation or loss of insulating value.
2. Must meet the building code requirements for flame propagation within the assembly.
3. Must not serve as a food source to vermin or biological growth.
4. Must permit the air space to perform its function by allowing moisture to drain without wicking to the interior.

Typical insulation types used in brick masonry walls include extruded polystyrene (XPS), polyisocyanurate, mineral wool and spray polyurethane foam (SPF). Each of these types, if properly used, will result in a more thermally efficient wall system but require individual detailing. SPF will be adhered to the backing. Mineral wool batts will be held in place with mechanical fasteners. Rigid boards can be adhered to or mechanically fastened to the backing. Special clips can be added to veneer anchors to secure the insulation. Refer to the *Technical Note* 4 Series as well as *Technical Note* 47 for further information regarding insulation and energy performance of brick wall assemblies.

Drainage Materials and Mortar-Collection Devices

When a high probability of mortar falling into the air space exists, such as for tall brick veneer without shelf angles, drainage materials and mortar diverters may be useful to help prevent mortar from bridging the air space or from blocking weeps. It is beyond the scope of this *Technical Note* to characterize the widely varying types of materials used for these purposes. However, a few basic principles should apply for any material selected for this purpose: Fill the entire width of the air space, do not absorb water and do not transmit moisture to the backing. These materials are available in two basic configurations: full height of air space and low height immediately above flashing. Manufacturers' literature should be used to compare and determine the suitability of drainage materials and mortar-collection devices. If not full height, a two-level mortar-collection device is preferred to a single-level mortar-collection device, as it better maintains a path for moisture to reach the flashing. The use of drainage

materials should not preclude good workmanship and an effort to keep the air space clean of excess mortar droppings.

Weeps

Open head joint weeps are the preferred type of weep. Other weep types include wicks and tubes. While not preferred, if used, wicks should be at least 16 in. (406 mm) long and extend through the brick wythe through the air space and along the back of the brick wythe. Weep tubes are not recommended due to an increased risk of clogging. Weeps are permitted by most building codes to have a minimum diameter of 3⁄16 in. (4.8 mm). Rope wicks should be at least 16 in. (406 mm) long and consist of cotton sash cord or other materials that wick. Items used to form weeps should not easily deteriorate or stain the brickwork. Open head joint weeps may have noncorrosive plastic, mesh or metal screens or vents installed if desired. Such weeps can serve a dual function of allowing water to drain while also allowing air to enter the cavity, resulting in more drying action and helping to keep insects out.

Termination Bars

A termination bar is a flat metal or plastic bar, approximately 1 in. (25 mm) wide with predrilled holes used to clamp and mechanically fasten flexible flashing to backing. Sealant is applied along the top edge of the termination bar to protect and encapsulate the leading edge of the flashing. The top edge of the termination bar is sometimes canted for easier sealant installation. Some manufacturers of self-adhered flashing permit termination with a compatible sealant bead encapsulating the leading edge; however, mechanical attachment is recommended for redundancy.

Sealants

Sealants are an important element in preventing water penetration around openings in masonry walls. Too frequently, sealants are relied on as a means of correcting or hiding poor workmanship rather than as an integral part of construction.

A discussion of the characteristics of joint sealants is beyond the scope of this *Technical Note*, but a few comments are in order. Sealants should be selected for their durability, extensibility, compressibility and compatibility with other materials. Other important considerations in sealant selection may include curing time, UV resistance, color stability, resistance to staining and the ability to handle a broad range of joint sizes. A sealant should be able to maintain these qualities under the temperature extremes of the climate in which the building is located. Trial applications and field adhesion testing of sealants under consideration are always helpful in determining suitability for a particular application. Additional discussion of sealants may be found in *Technical Notes* 18 and 18A.

Oil-based caulks and acetoxic silicone sealants that attack cement in mortar should not be applied to masonry. Solvent-based acrylic sealant or butyl caulk should be used only where little or no movement is expected. For joints subject to large movements, such as veneer expansion joints, an elastomeric joint sealant conforming to the requirements of ASTM C920, *Standard Specification for Elastomeric Joint Sealants* [Ref. 2], should be used. This includes neutral-cure silicones, urethanes and polysulfides. Application of a sealant primer may be required to prevent staining of some sealants on certain brick. Multiple sealants may be required in the wall system due to the variety of components and substrates present.

Backer rods are recommended behind sealants in joints large enough to accommodate them. Backer rods should be closed cell or bicellular plastic foam in most cases. Backer rods should be capable of resisting permanent deformation before and during sealant application, which is usually accomplished by sizing the backer rod approximately 25 percent larger than the joint width. Combining, twisting or braiding of the backer rod to fill larger joints is strongly discouraged. They should also be nonabsorbent to liquid water and gas, and should not emit gas, which may cause bubbling of the sealant. A bond breaking tape may be used when there is not sufficient space for a backer rod. For further information on sealants, refer to ASTM C1193, *Guide for Use of Joint Sealants* [Ref. 2].

Coatings

The use of external coatings, such as paint or clear coatings, on brick masonry should be considered only after a detailed evaluation of the possible consequences. Although coatings are not required on properly designed,

specified and constructed brick masonry, they may be used successfully to alter the appearance of a wall or to diminish the effects of certain deficiencies.

Coatings intended to reduce water penetration (water repellents) are most effective when their intended use corresponds with the nature of the water penetration problem. Use of coatings for reasons outside their intended application rarely reduces water penetration and often leads to more serious problems. Considerations in the choice of coating include compatibility with brick masonry, water and air permeability, ability to span cracks, applicability to exterior exposure, potential lifespan, and aesthetic considerations. Consult *Technical Notes* 6 and 6A when considering a coating for brick masonry.

SUMMARY

This *Technical Note* is the second in a series on water resistance of brick masonry and covers the proper selection of quality materials for water-resistant masonry work. This *Technical Note* cannot cover all available materials or all conditions. Lack of specific reference to a material should not preclude its use, providing that it results in water-resistive brick masonry.

> *The information and suggestions contained in this* Technical Note *are based on the available data and the combined experience of engineering staff and members of the Brick Industry Association. The information contained herein must be used in conjunction with good technical judgment and a basic understanding of the properties of brick masonry. Final decisions on the use of the information contained in this* Technical Note *are not within the purview of the Brick Industry Association and must rest with the project architect, engineer and owner.*

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A480/A480M	Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
A580/A580M	Standard Specification for Stainless Steel Wire
A666	Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
A899	Standard Specification for Steel Wire, Epoxy-Coated

Volume 1.04

A884/A884M	Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement

Volume 1.06

A123/A123M	Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
A153/A153M	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A641/A641M	Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
A653/A653M	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc- Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

Volume 2.01

B370	Standard Specification for Copper Sheet and Strip for Building Construction
B882	Specification for Pre-Patinated Copper for Architectural Applications

Volume 4.04
D226 Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

Volume 4.05
C62 Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale
C126 Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units
C216 Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)
C270 Standard Specification for Mortar for Unit Masonry
C476 Standard Specification for Grout for Masonry
C652 Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale)
C1405 Standard Specification for Glazed Brick (Single Fired, Brick Units) Volume 4.07 - C920, Standard Specification for Elastomeric Joint Sealants
C1193, Standard Guide for Use of Joint Sealants

Volume 4.06
E96 Standard Test Methods for Water Vapor Transmission of Materials

Volume 4.07
C920 Standard Specification for Elastomeric Joint Sealants
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Attachment No. 15

THE BRICK INDUSTRY ASSOCIATION

TECHNICAL NOTES on Brick Construction

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7

November 2017

Water Penetration Resistance – Design and Detailing

Abstract: Brick masonry walls require proper design, detailing and construction to minimize water penetration into or through a wall system. Many aspects of design, construction and maintenance can influence the resistance of a wall to water penetration. The selection of the proper type of wall is of utmost importance in the design process, as is the need for complete and accurate detailing. In addition to discussing various wall types, this *Technical Note* covers proper design of brick masonry walls and suggests details that have been found to increase water penetration resistance.

Key Words: barrier, design, detailing, drainage, flashing, installation, rain, wall types, weeps.

SUMMARY OF RECOMMENDATIONS:

Wall System Selection

- Drainage walls provide maximum protection against water penetration by use of a drainage cavity
- Barrier walls provide good water penetration resistance by holding moisture within their mass until evaporation occurs
- Single wythe masonry walls provide adequate water penetration resistance when carefully detailed and constructed

Through-Wall Flashing Locations

- Install flashing at wall bases, window sills, heads of openings, shelf angles, tops of walls and roofs, parapets, above projections (such as bay windows, balconies, decks), changes in grade, and transitions with other cladding materials
- For drainage walls, also install flashing at any other discontinuities in the cavity

Through-Wall Flashing Installation

- Extending flashing to exterior wall face is required
- Lap continuous flashing pieces at least 6 in. (152 mm) and seal with compatible sealant or adhesive
- Turn up the ends of discontinuous flashing at least 1 in. (25.4 mm) to form end dams
- Support flexible flashing across gaps and openings
- Extending flashing beyond the exterior wall face is recommended
- For UV-sensitive flashing, use a drip edge

Through-Wall Flashing Termination

- End flashing on vertical surface of backing
- Integrate flashing with weather-resistive barrier
- Protect edge of flashing from moisture:
  - Apply cap bead of sealant on edge of self-adhered flashing
  - Use of termination bar with sealant is preferred
  - Other options: Insert into bed joint in masonry or reglet in concrete

Water-Resistive Barrier

- Required for wood or cold-formed steel backing; recommended for redundancy on masonry or concrete backing
- Use sheet membranes, fluid-applied films or board materials
- Integrate with flashing in shingled fashion to direct bulk water out of wall assembly
- Vapor permeability of material used depends on climate zone, wall assembly components and code requirements

Air Barrier

- Required by building codes
- Generally placed on exterior face of backing
- Vapor permeability of material used depends on climate zone and wall assembly components

Drainage Cavity

- Provide air space that drains properly with minimal mortar droppings
- A minimum 1 in. (25.4 mm) air space* is required
- When continuous insulation is present, maintain minimum 1 in. (25.4 mm) air space* between the back of the brick and the insulation
- For air space recommendations, consult appropriate *Technical Note* for project-specific wall assembly
- Use of drainage material or mortar collection devices recommended

* An air space is allowed in the *IRC* to be a 1 in. (25.4 mm) nominal dimension and in the *IBC* to be a 1 in. (25.4 mm) specified dimension to account for construction tolerances.

Weeps

- Open head joint weeps spaced at no more than 24 in. (610 mm) o.c. preferred
- Most building codes permit weeps no less than $\frac{3}{16}$ in. (4.8 mm) in diameter and spaced no more than 33 in. (838 mm) o.c.
- When wick weeps used, spacing of no more than 16 in. (406 mm) o.c. is recommended
- Use of weep tubes is not recommended

INTRODUCTION

This *Technical Note* is the first in a series addressing water resistance of brick masonry. Design considerations and details are provided to illustrate the principles involved in addressing water penetration issues. The other *Technical Notes* in this series provide detailed guidance in the areas of material selection (7A) and construction (7B). *Technical Note* 47 provides information on condensation prevention and control.

When masonry walls encounter problems, water-related issues are often one of the primary factors. Brick masonry exposed to a disproportionate amount of water may have dimensional changes; efflorescence on exterior surfaces; and cracking, crazing, spalling or disintegration due to repeated freeze-thaw cycling. Water may also cause metals to corrode, insulation to lose its effectiveness and interior finishes to deteriorate. On susceptible wall elements, water penetration may also provide the moisture necessary for mold growth.

The water resistance of a masonry wall depends on four key factors: design, including detailing; materials; construction; and maintenance. Attention to all four is necessary to produce a wall that will perform satisfactorily. Failure to properly address any one factor can result in water penetration problems.

There are many sources of water that may affect masonry walls. Rain and snow contact exterior building materials directly. Water vapor is a constant presence in the air and can infiltrate or exfiltrate through seams and interfaces in the building envelope. Since water sources cannot be eliminated, the designer must instead control the potential for water penetration.

Historically, masonry walls functioned as both the structural system and as the exterior skin of the building. These masonry walls were quite massive, ranging in thickness from 12 in. (305 mm) up to 6 ft (1.83 m) of solid brick. Because of their thickness and their state of constant compression due to the structural loads, these walls worked quite well in keeping water out of the interior of the building. The large volume of masonry prevented moisture penetration to the interior due to the sheer mass of material. Historic mass masonry walls acted as a reservoir for any moisture absorbed, which was later released as vapor. Also, many older masonry walls were built with roof overhangs, cornices and other ornamentation that helped to protect the faces of the buildings from excessive water sheeting and subsequent water penetration to the interior.

The walls typically used today are much less massive, and the masonry may be 3 in. (76 mm) or less in thickness, greatly reducing the moisture storage capacity of the wall assembly. In many cases, walls have minimal overhang at the top, allowing sheeting of rainwater over the full height of the facade from the roof or parapet down to the ground. As a result, rainwater can be in contact with the masonry of these newer wall systems in larger quantities and for longer periods of time, leading to more opportunity for water penetration problems.

DESIGN

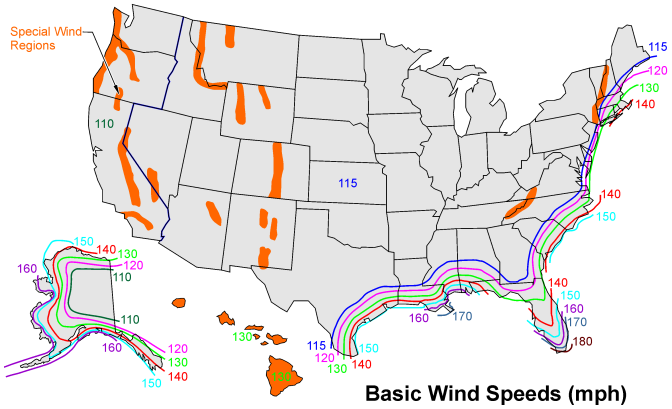
The successful performance of a masonry wall depends on limiting the amount of water penetration and controlling any water that enters the wall system. When water passes through brick masonry walls, it typically does so through minute separations between the brick units and the mortar joints. Under normal exposures, it is virtually impossible for significant amounts of water to pass directly through the brick units or through the mortar. Highly absorbent brick units will absorb some water but do not contribute to liquid (bulk) water penetration through a wall.

Design for water resistance requires evaluation of several items, including sources of moisture; selection of wall type; and the use of water-resistive barriers, flashing and weeps. This *Technical Note* addresses each of these items separately.

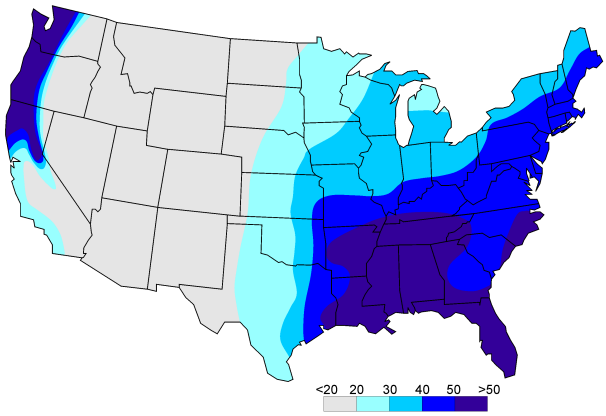
Sources of Moisture

Moisture is present almost everywhere, in the form of rain, snow, condensation, groundwater, construction runoff, etc. Some of these lend themselves to control, but some do not. This *Technical Note* addresses wind-driven rain. The control of moisture-laden air and interstitial condensation is discussed in *Technical Note* 47.

When designing a masonry wall, consideration of exposure to wind-driven rain is important. Exposures vary greatly throughout the United States, from severe on the Eastern Seaboard and Gulf Coast, where rain durations of several hours may be accompanied by high-velocity winds; to moderate in the Midwest and Mississippi Valley,



Basic Wind Speeds (mph)
Source: 2015 International Building Code
Figure 1609.3(1)



Annual Precipitation (in.)
Source: National Climatic Data Center

Figure 1
U.S. Wind Speeds and Precipitation

where wind velocities are usually lower; to slight in the arid areas of the West. No single wall design can be expected to perform equally well under all exposures. Refer to Figure 1.

Selection of Wall Type

The selection of the proper wall type to use in any given situation is very important. Under normal conditions, it is nearly impossible to keep a heavy wind-driven rain from penetrating a single wythe of brickwork, regardless of the quality of the materials or the degree of workmanship used.

The best approach to designing a water-resistive wall is to assume that some water will penetrate the outer surface. Therefore, the objective is to control the moisture once it begins to penetrate the wall. Two basic wall systems are used for this purpose: the drainage wall and the barrier wall.

Drainage Wall Systems. Drainage wall systems include cavity walls and anchored veneer walls, as shown in Figure 2, Figure 3, Figure 4 and Figure 5. Contemporary cavity walls use metal ties to connect the masonry wythes; however, a designer may encounter masonry-bonded hollow walls in historic applications. The guiding principle behind the drainage wall assumes that a heavy, wind-driven rain will result in moisture penetrating the exterior wythe of brickwork. When this occurs, the wall is designed to collect this moisture and redirect it out of the wall assembly.

The water progresses down the drainage cavity, typically on the interior face of the outer brick wythe, where it is collected on the flashing and exits the wall system through the weeps. Properly designed, detailed and constructed drainage wall systems provide excellent water penetration resistance.

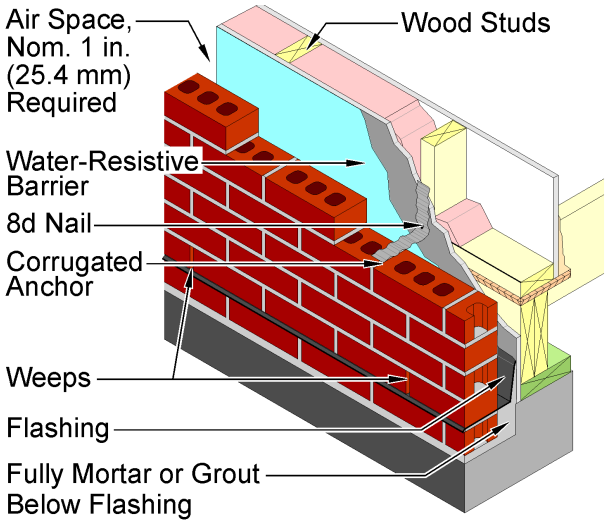


Figure 2
Brick Veneer/Wood Framing

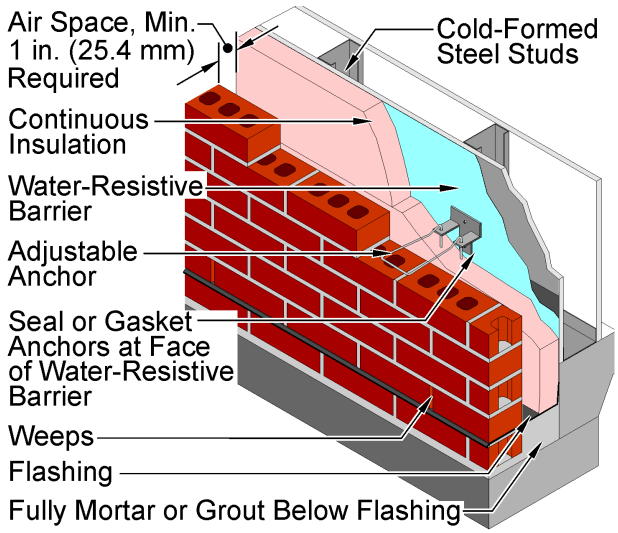


Figure 3
Brick Veneer/Cold-Formed Steel Framing

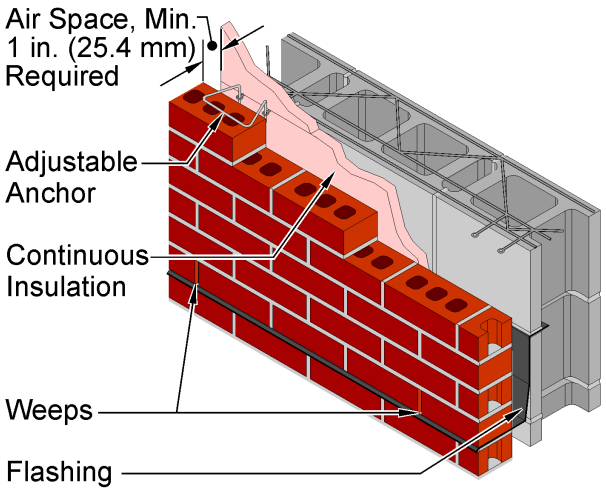


Figure 4
Brick Veneer/CMU Wall

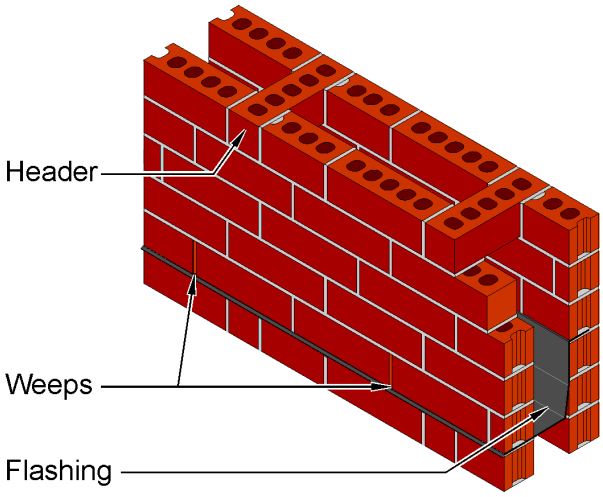


Figure 5
Masonry-Bonded Hollow Wall

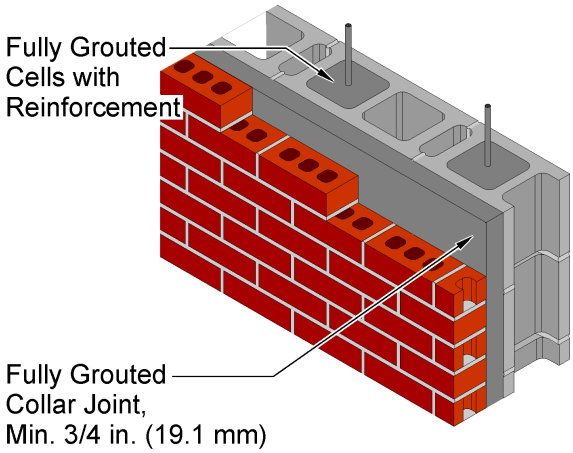


Figure 6
Reinforced Barrier Wall

Information on aspects specific to cavity wall systems can be found in the *Technical Note* 21 Series. The *Technical Note* 28 Series generically addresses both anchored and adhered veneer wall systems.

Barrier Wall Systems. Barrier wall systems, such as the one shown in Figure 6, include mass masonry multi-wythe walls with mortar or grout-filled collar joints (including composite brick/concrete block walls and composite brick/structural clay tile walls), reinforced brick masonry walls and adhered veneer walls. The system relies on the thickness of the masonry and the integrity of the mortar or grout to prevent moisture from reaching the interior during the rain event. This moisture will slowly evaporate from the wall assembly during drier weather. Critical to the performance of this wall system is the integrity of the collar joint, as well as the bed and head joints between units. These joints must be solidly filled with grout or mortar; otherwise, the gaps create pathways that direct water to the interior and bypass the storage capacity of the wall assembly. Grouting is the most effective method of ensuring that collar joints are completely filled; however, spaces less than ¾ in. (19.1 mm) should not be grouted. In these instances, the face of the inner masonry wythe should be parged and the back of brick in the exterior wythe buttered in order to fill the collar joint. Placing mortar in the collar joint with a trowel after the individual wythes are laid, commonly referred to as “slushing,” does not result in completely filled joints and is not recommended. Flashing is also integrated into barrier walls to aid in controlling water that penetrates the exterior wythe. Properly designed, detailed and constructed barrier wall systems work well with respect to water penetration resistance.

Single-Wythe Walls. Single-wythe masonry walls can be considered a variation of a barrier wall system. Single-wythe brick masonry construction can be designed with either solid or hollow units. In single-wythe walls, the masonry wythe usually exceeds the thickness of a nominal 4 in. (102 mm) exterior brick wythe. In addition to the added thickness, grouted cells help to prevent water from penetrating to the interior of the wall system. Inherently, single-wythe walls are not as resistant to water penetration as are drainage wall systems or multi-wythe barrier wall systems, and may not be appropriate for some severe exposures. With careful detailing and good construction practices, however, a single-wythe wall can perform well. For example, vertically reinforced and grouted brickwork often provides good water penetration resistance.

With single-wythe masonry, it is especially important to use a mortar joint profile that sheds rather than collects water. Concave and "V" joint profiles are preferred because they eliminate exposed horizontal surfaces on the brick, and the tooling procedure consolidates the outer surface of the mortar and compresses it against the sides of the joint, increasing the water penetration resistance of the mortar joint. See *Technical Note* 7B for further information. Penetrating water repellents can increase the moisture resistance of single-wythe walls; however, they will require periodic reapplication and are not equal to essential code-required drainage wall details. A water repellent may reduce some bulk water penetration through the brickwork, but it will not improve the ability of the wall to manage any water that does penetrate. Film-forming or acrylic-based water repellent coatings or sealers should be avoided. See *Technical Note* 6A for further information on water repellents.

DETAILING

Water-Resistive Barriers

The International Building Code (*IBC*) [Ref. 4] and the International Residential Code (*IRC*) [Ref. 5] require a weather-resistant exterior envelope to provide water resistance. They define a water-resistive barrier as a material behind an exterior wall covering that is intended to resist liquid (bulk) water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly. For exterior walls with brick veneer and wood or cold-formed steel frame backing, a water-resistive barrier is required. A water-resistive barrier is not required on projects where exterior walls have concrete or masonry backing behind brick veneer, but one may be included for redundancy.

The water-resistive barrier is typically a sheet layer or fluid-applied membrane attached to the exterior face of the backing, or a board material qualified and installed as such. It is installed to provide a continuous drainage plane and is integrated with flashing in a shingled fashion to form a system that directs bulk water out of the wall. Where the water-resistive barrier is a sheet layer, it must be lapped. Where a fluid-applied membrane is used as a water-resistive barrier, most manufacturers require that gaps in the substrate be covered with a transition sheet or tape prior to the application of the liquid material. Similarly, board materials qualified to serve as water-resistive barriers must also have the joints between boards covered.

In-depth discussion of water-resistive barriers is outside the scope of the BIA *Technical Notes*. However, there are many building science resources available as reference [Ref. 1 and Ref. 3]. In cases with complicated buildings, consultation with building envelope professionals is recommended in order to develop project-specific recommendations for materials and placement of those materials in the wall assembly. Various types of materials that may be used in the design of brick masonry and brick veneer walls are discussed in *Technical Note* 7A.

Air Barriers and Vapor Permeance

Air barriers and the vapor permeance of materials also play a role in moisture management, as they control the movement of water vapor. An air barrier controls air leakage through the building envelope, and a material's vapor permeance controls the amount of moisture that can pass through (vapor diffusion). As air movement accounts for significantly more water vapor movement in building cavities than does vapor diffusion, air barriers are generally considered to have a more significant impact on moisture control than the vapor permeance of a material. Both the *IBC* and *IRC* require air barriers in the wall assembly. For exterior walls with brick veneer, air barriers are usually placed on the exterior of the backing and may consist of a single material or a combination of materials. In some cases, a water-resistive barrier may also serve as an air barrier or a vapor retarder. Vapor retarders are classified by their level of permeance, as defined in the *IBC* and *IRC*. The vapor permeance of a material is generally more of a concern on the warm side of the building envelope. As a result, the interior side of exterior walls of wood or cold-formed steel framing of buildings located in Northern climate zones are required to have materials with a certain vapor permeance. For more information on air barriers, vapor retarders and vapor permeance of materials, refer to *Technical Note* 7A.

Through-Wall Flashing

Through-wall flashing is an impervious material installed in a masonry wall system to contain water that has penetrated the exterior wythe and direct it back to the exterior. Such flashing is required in a drainage wall system and is critical to the ability of the wall to manage moisture. In a barrier wall system, such flashing is recommended as a second line of defense to moisture intrusion. Proper design requires flashing at wall bases, window sills, heads of openings, shelf angles, projections, recesses, bay windows, chimneys, tops of walls, and roofs. Sheet

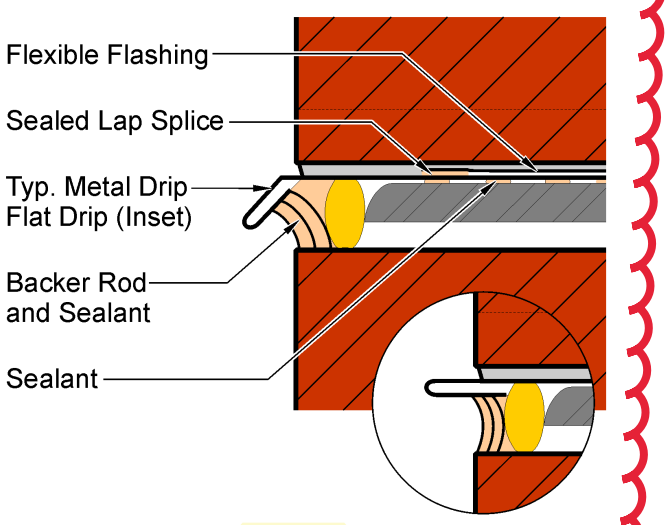


Figure 7
Drip Edge Detail

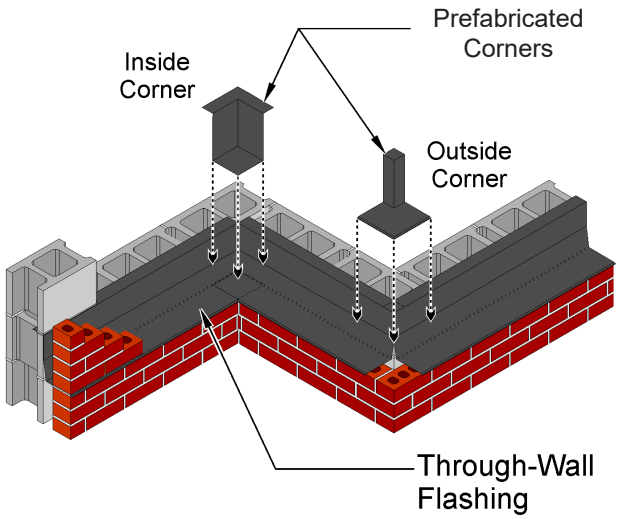


Figure 8
Installation of Prefabricated Flashing Corners

metal and flexible membranes are the materials most frequently used to create flashing. Flashing should extend vertically up the backing a minimum of 8 in. (203 mm) above the horizontal leg.

Through-wall flashing design and installation must also address the following:

Compatibility. Through-wall flashing materials and components must be compatible with one another and with the underlying substrates, including air barriers and vapor retarders. Through-wall flashing components must be compared so that materials in contact will adhere with no detrimental effects on the performance of the system. It is recommended to obtain self-adhered flashing, air barriers, vapor retarders and their auxiliary materials (including adhesive/primer and sealants) from a single manufacturer. Alternatively, provide manufacturer documentation confirming compatibility between adjacent materials in the wall assembly.

Extension Through Wall. While building codes permit flashings to be trimmed flush with the brick face, extending flashing beyond the face of the wall promotes improved drainage. When flashing does not extend beyond the brick face, surface tension can permit moisture to wick under the flashing or wet the surface of the brick below. Wherever possible, a drip should be formed to ensure that moisture exits the wall assembly and is directed away from the face of the wall below. Many popular flashing membranes deteriorate with UV exposure. In such cases, a sheet metal drip edge (typically stainless steel) can be paired with the membrane to address this issue, as shown in Figure 7. The sheet metal drip is inert under UV exposure, which allows the membrane to remain concealed but still direct moisture beyond the face of the brick. This method is also effective at avoiding bleed from rubberized asphalt-based membranes, since the edge of the membrane will be recessed. Where the appearance of drips is considered objectionable, flat sheet metal drips can be formed using only a hemmed edge, eliminating the angled projection and minimizing their exposure.

Substrate Adhesion and Support. Flashing should be fully adhered to substrate material to prevent lateral migration of moisture in case of a breach. Self-adhered membranes should be rolled to ensure good bond to the substrate and to minimize air bubbles. Rigid flashing such as drip edges or sheet metal pans should be fully bedded in sealant or liquid membrane material. Rigid flashing can be self-supporting; however, flexible flashing requires continuous support and should not span or drape across gaps. Thin corrosion-resistant sheet metal can be used as a support in these conditions. Primers may be required per the manufacturer's directions.

Continuity. While some flashing locations are discrete, such as at window openings, other locations such as shelf angles or wall bases will be continuous around the entire building. As a result, pieces must be lapped or spliced at the project site. Plain flexible flashing sections should be lapped at least 6 in. (152 mm) and the laps adhered and edges sealed with a sealant or adhesive compatible with the flashing material. Self-adhesive flashing lap lengths are typically 3 to 4 in. (76 to 102 mm) and vary by manufacturer. The manufacturer's recommended sealant or liquid membrane should be used to protect the edges of the lap splice. Splices in sheet metal elements like drip edges can consist of a simple lap joint or a separate cover plate that conceals the ends of two adjacent flashing sections. Refer to the manufacturer's requirements for lap and splice details.

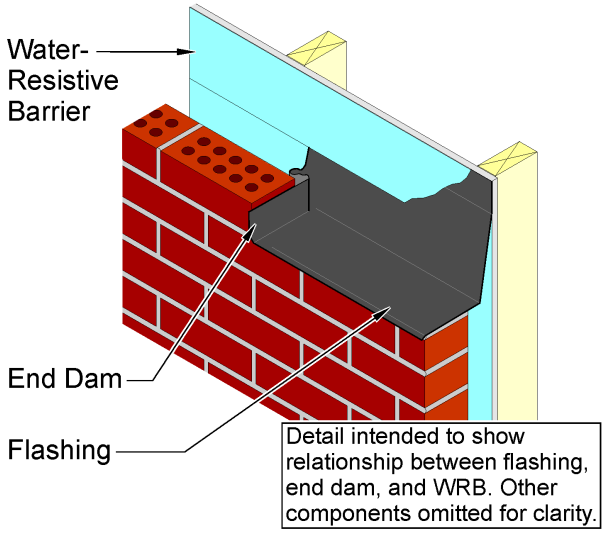


Figure 9
End Dam Detail

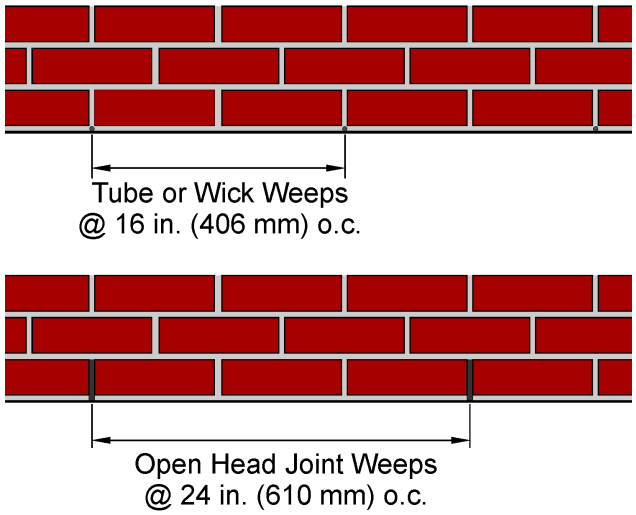


Figure 10
Spacing of Weeps

Flashing Around Corners and Projections. Continuity of flashing is critical. To achieve flashing continuity around corners, the pieces of flashing may be folded, lapped and sealed to conform to the shape of the structure. Alternatively, preformed corner and transition pieces are available, as shown in Figure 8. Specifying prefabricated flashing membrane corners reduces some of the potential for water penetration. If cuts are used, then the seams and edges should be well-sealed. Whether field-formed or prefabricated, overlap all edges and corners at least 6 in. (152 mm) and seal with an adhesive or detailing material compatible with the flashing. Inside and outside corners of stainless steel drips can be premanufactured as well to improve productivity and to achieve better quality control over soldered seams.

End Dams. Where the flashing is not continuous, such as above and below openings in the wall and on each side of vertical building expansion joints, the ends of the flashing should be turned up into the head joint at least 1 in. (25.4 mm) at each end to form a dam. At window and door openings, the head flashing should be extended beyond the jamb lines on both sides prior to forming the end dams. Preformed sheet metal end dams may also be used in combination with flexible flashing. End dams for rigid sheet metal flashing should be fully soldered. Refer to Figure 9 for an example of an end dam in a flexible flashing.

Terminations. Terminate flashing on the vertical surface of the backing and integrate with the water-resistive barrier to provide positive drainage. All flashing terminations must be supported and protected to ensure that they remain in place and that moisture cannot undermine them. In most cases, the water-resistive barrier will overlap the flashing; however, fluid-applied water-resistive barrier may have manufacturer-specific requirements. The vertical leg of flashing can be terminated in a variety of different ways. Flashing, both rigid and flexible, can be terminated into the bed joint of the interior masonry wythe or into horizontal slots (reglets) in concrete construction. For flexible flashing, using a termination bar is preferred. Termination bars are generally narrow plates with predrilled holes to receive fasteners. The termination bar is placed at the top of the vertical leg of flashing, fastened to the substrate, and sealed as shown in Figure 18. Alternatively, self-adhered flexible flashing can be terminated on the backing with a bead of compatible sealant along the top edge.

Weeps

In order to adequately drain any water collected on the flashing, weeps are required at the level of the flashing at all locations. The practice of placing weeps in one or more courses of brick above the flashing will allow water to accumulate and is not recommended. An open head joint weep, formed by leaving mortar out of a joint, is the preferred type of weep. Open head joint weeps should be at least 2 in. (51 mm) high. Noncorrosive metal, mesh or plastic screens/vents can be installed in open head joint weeps if desired. These may be beneficial to discourage insect entry and to emphasize the purpose of the open head joints in order to reduce the risk of sealing during future maintenance work.

Other weep types include wicks and tubes. While not preferred, if used, wicks should be at least 16 in. (406 mm) long and extend through the brick wythe into the air space and along the back of the brick wythe. Weep tubes are not recommended due to an increased risk of clogging. Weeps are permitted by most building codes to have a minimum diameter of 3/16 in. (4.8 mm) [Ref. 2 and Ref. 5].

Spacing of open head joint weeps is recommended at no more than 24 in. (610 mm) o.c. Refer to Figure 10. Weeps are permitted by most building codes to be spaced up to 33 in. (838 mm) o.c. [Ref. 2 and Ref. 5]. If used, spacing of wick or tube weeps is recommended at no more than 16 in. (406 mm) o.c.

Drainage

To the extent possible, the air space must be kept clear of mortar and mortar droppings to achieve adequate drainage. An air space that provides drainage is permitted to contain mortar from construction. Building codes require a minimum 1 in. (25.4 mm) air space. The *IRC* requires a nominal 1 in. (25.4 mm) air space, and the *IBC* requires a specified 1 in. (25.4 mm) minimum air space. When continuous insulation is present within the air space, provide a minimum dimension of 1 in. (25.4 mm) (nominal or specified per applicable code) between the inside face of the brick and the insulation. BIA recommendations for air space dimensions vary depending on the type of construction. Consult the appropriate *Technical Note* for the project-specific wall assembly.

Drainage media may be specified that prevent mortar from entering the air space or that catch mortar droppings at the wall base. These materials are usually made of a plastic mesh or fabric porous enough to allow passage of water but that will catch or inhibit mortar from collecting at the base of the air space. The effects of mortar collection devices should be considered carefully, as they may require modifications to typical details such as extending the vertical leg of the flashing more than 8 in. (203 mm) above the weep line. Drainage media is permitted to fill the full depth of the air space. While it is not mandatory to include drainage materials, they may help in providing an air space that drains properly. However, the use of drainage media should not preclude good workmanship and an effort to keep mortar and mortar droppings out of the air space to the extent possible.

Critical Flashing Locations

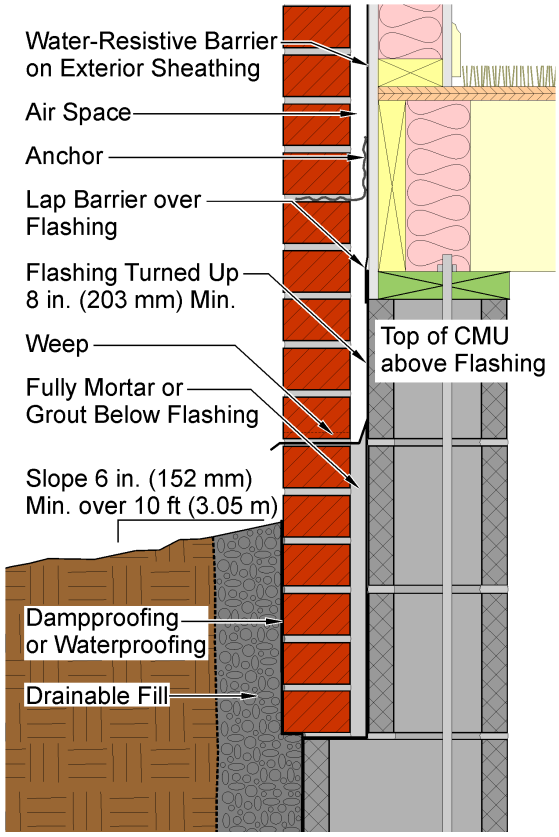
Wall Base. Moisture that enters a wall assembly gradually travels downward. Continuous flashing must be placed above grade at the base of walls to divert this moisture to the exterior. In addition, base flashing prevents groundwater from rising up into the wall system due to capillary action and helps prevent efflorescence. The elevation of flashing and weeps should be no more than 10 in. (254 mm) above finished ground level and should consider planting beds, ground coverings, sidewalks, etc. that are placed immediately adjacent to the wall. The *IRC* requires lots to be graded to drain surface water away from foundation walls and requires a minimum slope of 6 in. (152 mm) within the first 10 ft (3.05 m) of wall to provide positive drainage away from the wall.

Once the designer has determined the level for placing flashing in the wall in accordance with the grading plans, care should be taken that field modifications do not result in any section of flashing being below grade. The location of the base flashing should be stepped to conform to significant changes in grade.

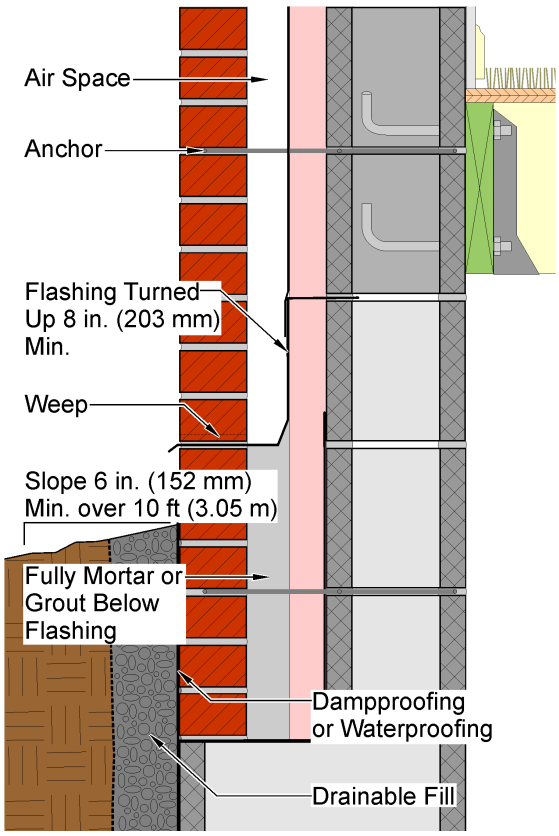
The top of the foundation wall should be above the elevation of the base flashing to prevent water from being directed toward the building interior. Refer to Figure 11. The cavity below the base wall flashing should be solidly filled with mortar or grout. Anchors or ties within the solidly filled space should be located according to the same spacing as the brick veneer above grade. Where below-grade waterproofing or dampproofing is present, the transition to the above-grade moisture management system (water-resistive barrier and flashing) should be detailed and constructed to provide continuity at the wall base.

Brickwork Below Grade. Brickwork should extend below grade only when special provisions are made in detailing and construction to minimize water penetration. If brickwork extends below grade, then the soil immediately adjacent to the brickwork should provide good drainage. If the soil does not provide good drainage, then a drainable fill, drainage mat or drainage board that is detailed and constructed to drain water away from the brickwork should be provided between the soil and the brickwork (see Figure 11a, Figure 11b and Figure 11c).

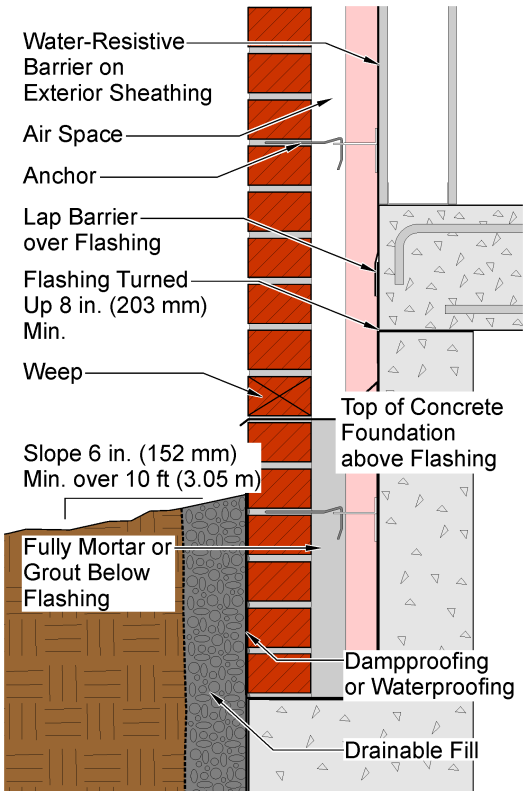
The *IRC* and *IBC* require the surfaces of walls against earth to be dampproofed or waterproofed. To avoid the application of dampproofing or waterproofing to brick veneer, the brick shelf in the foundation may be constructed above the final grade (see Figure 11d). If brickwork extends below grade, then dampproofing or waterproofing should be applied to the brickwork below grade in accordance with the *IRC* or *IBC*.



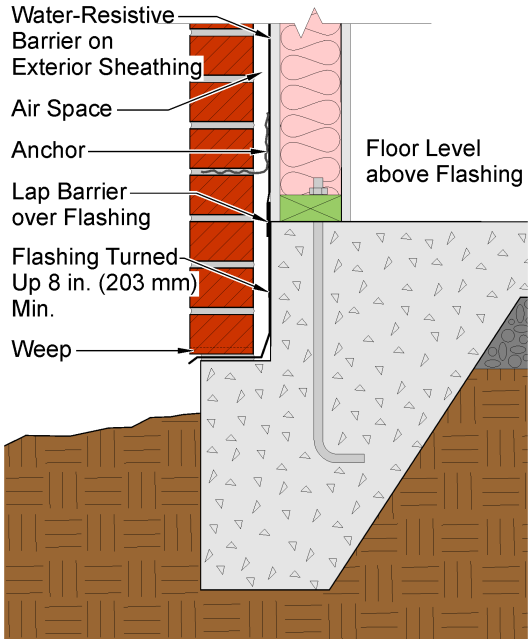
(a) Wood Stud on CMU Foundation



(b) CMU on CMU Foundation



(c) Steel Stud on Concrete Foundation



(d) Wood Stud on Turned-Down Slab

Figure 11
Flashing at Wall Bases

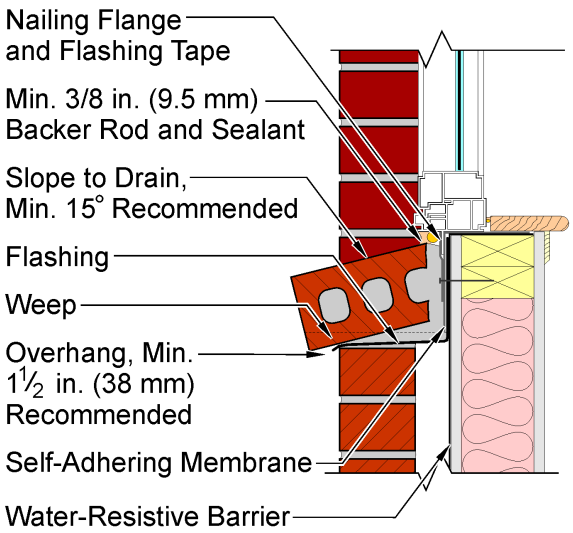


Figure 12
Flanged Window Sill Detail

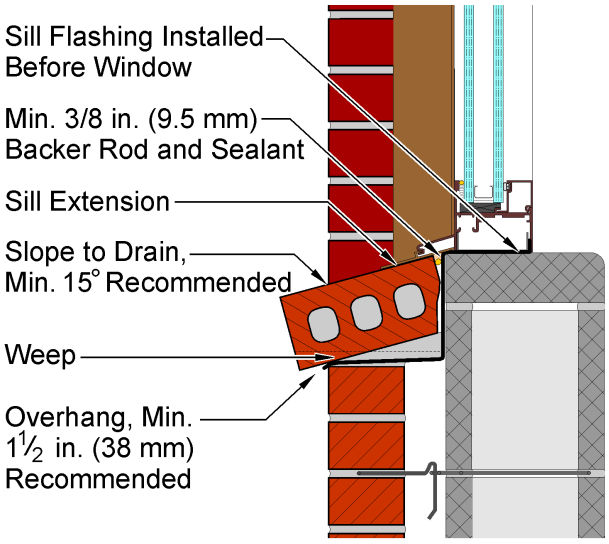


Figure 13
Window Sill in Cavity Wall

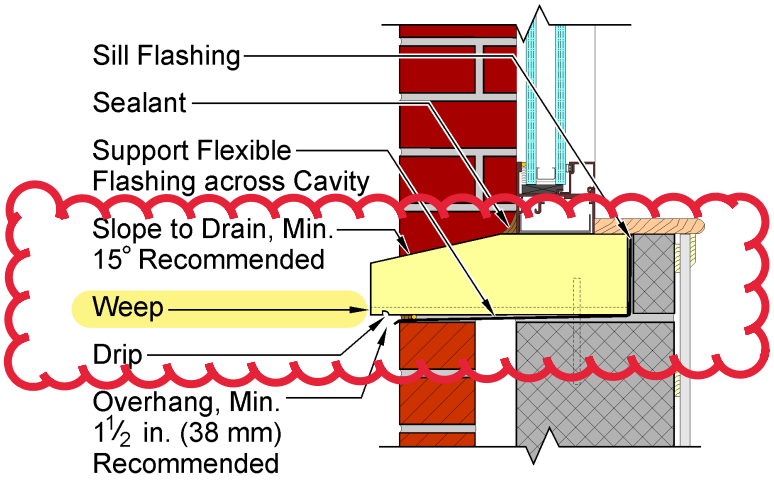


Figure 14
Stone or Concrete Window Sill

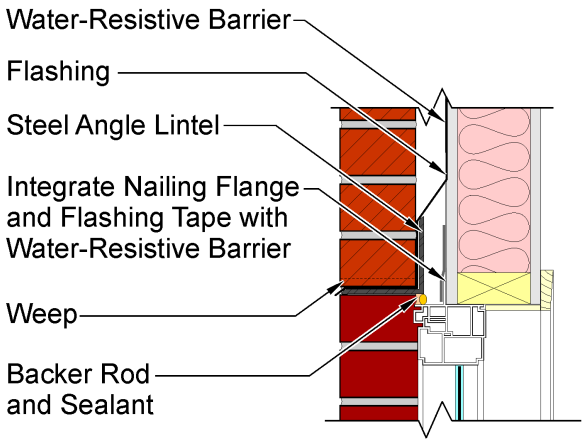


Figure 15
Flanged Window Head Detail

Brickwork is allowed to project (corbel) from the face of the supporting member by a distance of up to one-half the nominal brick (unit) thickness. To achieve this, each course of the corbel is allowed to project the lesser of one-half the nominal brick (unit) height or one-third the nominal brick (unit) width. Where corbelled brickwork occurs below grade, adequate drainage should be provided below the brickwork (see Figure 11a). Where inadequate drainage is provided for such brickwork, frost heave may result if the brick shelf is located above the frost line.

Window Sills. Window sills integrated into brick construction should be sloped to shed water; a minimum slope of 15 deg from horizontal is recommended. Through-wall flashing must be placed under all sills, as shown in Figure 12, Figure 13 and Figure 14, and turned up at the back and the ends to form a pan flashing. Soffits and deep reveals may require special flashing considerations. The *Technical Note* 36 Series contains further details and information.

Steel Lintels. Through-wall flashing is required at lintels over all openings including door and window heads, as shown in Figure 15. Weeps are required immediately above the flashing. As indicated in the previous section, the flashing is turned up at each end of the lintel to form end dams. Figure 16 shows several examples of lintels, including those anchored to structural steel members. Depending on the configuration of the structural steel member, the steel may interrupt the cavity, which requires installation of flashing on the top flange. However, this configuration leaves the beam web and top surface of the bottom flange susceptible to corrosion. In those cases,

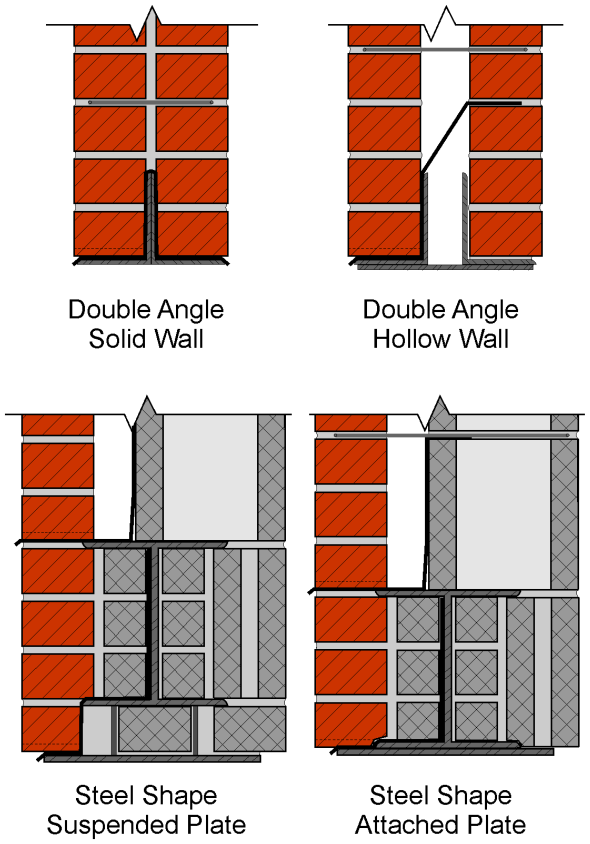


Figure 16
Structural Steel Lintels

it is recommended to apply a protective coating to the steel and install an additional line of flashing at the lowest brick course. Typical shop primer or commercial paint is generally not adequate for this application.

Shelf Angles. In concrete or steel frame buildings with the brick wythe supported on shelf angles, the entire face of the spandrel beam may be flashed, or the flashing may be held in place by a termination bar installed on the spandrel beam or integrated with moisture-proofing on the spandrel beam. In some cases, shelf angle connections may cut, puncture or otherwise interrupt the flashing. When this occurs, it is important to make sure that all openings in the flashing are tightly sealed and that the flashing is attached to these supports with compatible sealant or adhesive. Refer to Figure 17 and Figure 18. Horizontal expansion joints are required beneath shelf angles to allow for movement of the brick. For further information on expansion joints, refer to the *Technical Note* 18 Series.

Projections, Recesses and Caps. Projections, recesses and caps tend to collect rainwater and

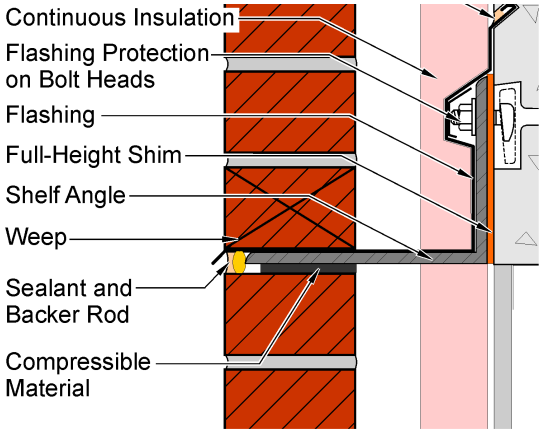
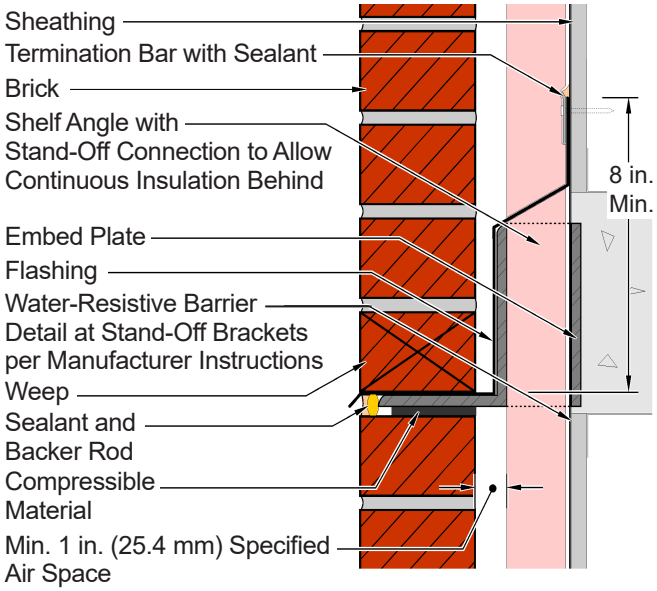
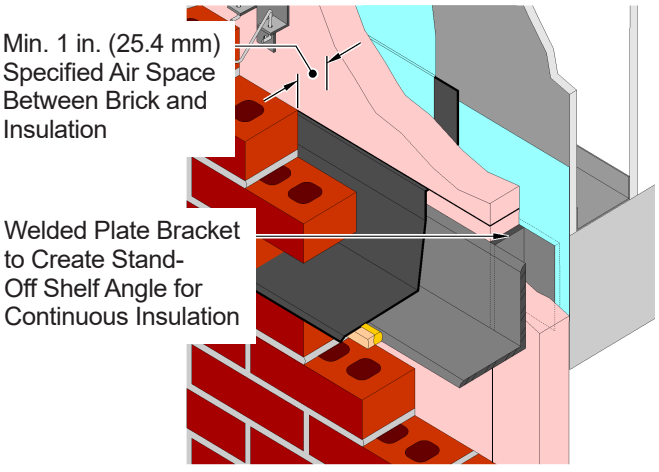


Figure 17
Shelf Angle with Concrete Frame



(a)



(b)

Figure 18
Shelf Angle with Stand-Off Attachment

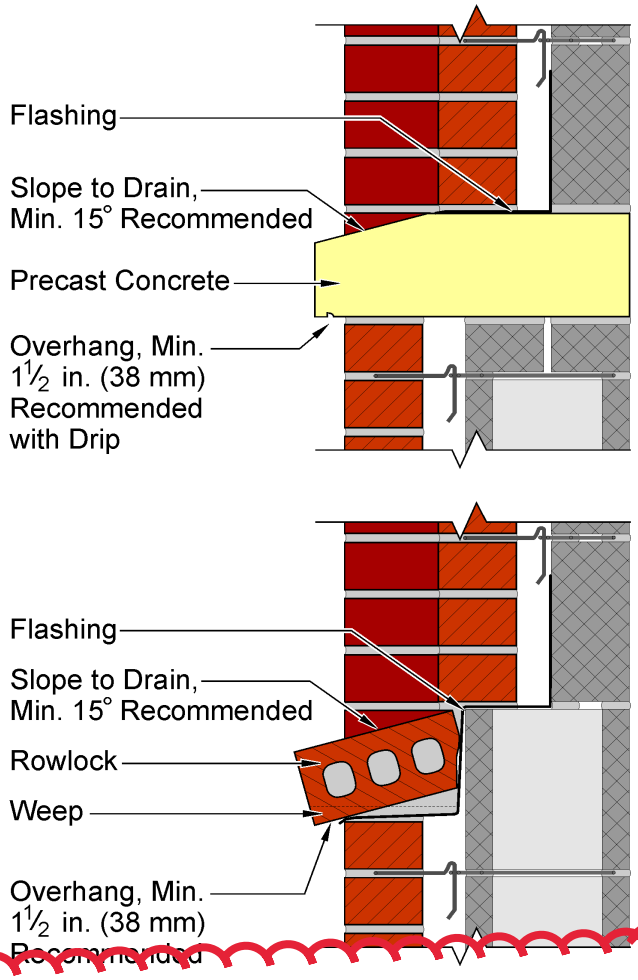


Figure 19
Projections and Caps

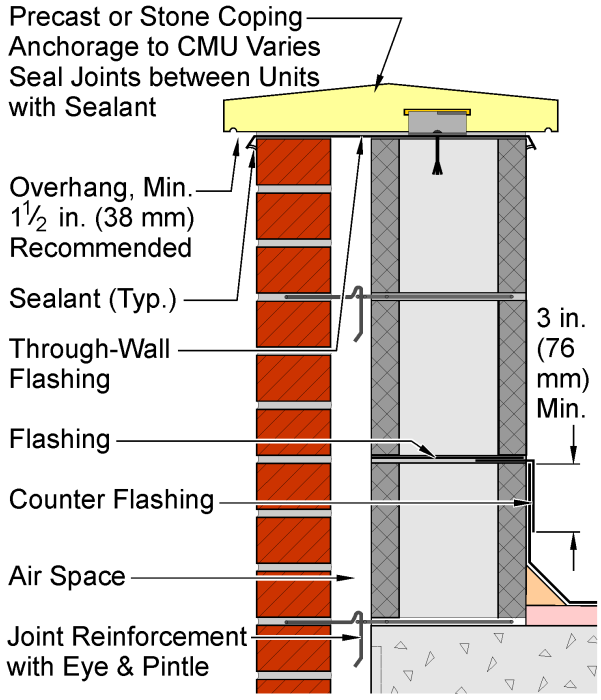


Figure 20
Precast or Stone Coping on Cavity Wall Parapet

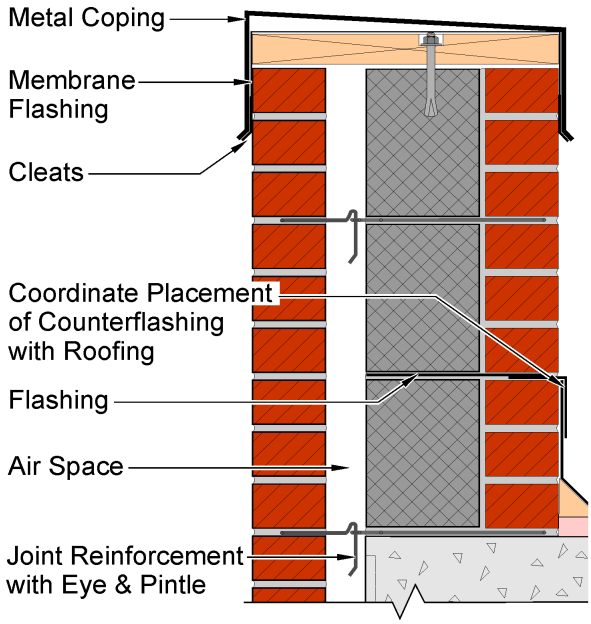


Figure 21
Metal Coping on Cavity Wall Parapet

snow. They should be sloped away from the wall to drain and should be flashed where possible, similar to sill conditions, as shown in Figure 19. Other details and information can be found in the *Technical Note* 36 Series.

Tops of Walls and Parapets. The tops of all walls and parapets must have a cap or coping, with flashing recommended directly beneath the coping. Drainage-type parapet walls, as shown in Figure 20 and Figure 21, are recommended as the best parapet system for resistance to water penetration. The *Technical Note* 36 Series provides more details and information on these subjects.

For more effective moisture resistance, metal copings, as shown in Figure 21 and Figure 22, are preferable to brick, cast stone, concrete or stone copings. Metal copings should extend down the face of the wall a minimum of two courses, with the bottom edges anchored using concealed cleats designed to resist wind loads. Flexible membrane flashing should be installed continuously below the coping to protect the blocking and the top of the wall. A membrane formulated for high-temperature use is necessary under metal copings. Copings of cast stone, concrete or stone are recommended to have joints between each element closed with sealants, or with skyward-facing mortar joints raked to permit the installation of sealant at the outer surface.

Roof/Wall Intersection. Flashing placed at the intersection of a low roof with a wall or a roof deck with a parapet is critical to resist water penetration.

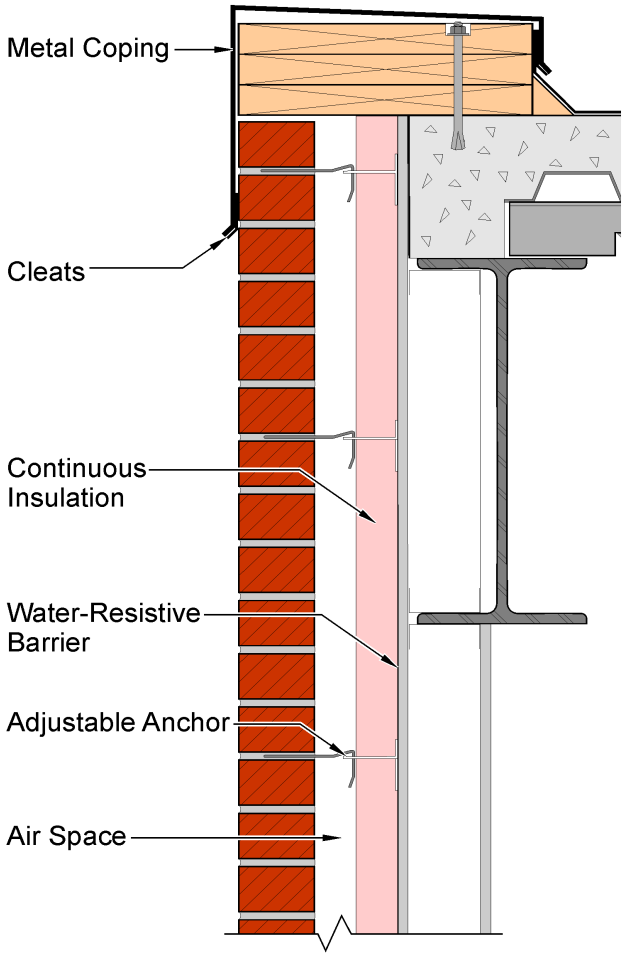


Figure 22
Metal Coping on Non-Parapet Wall

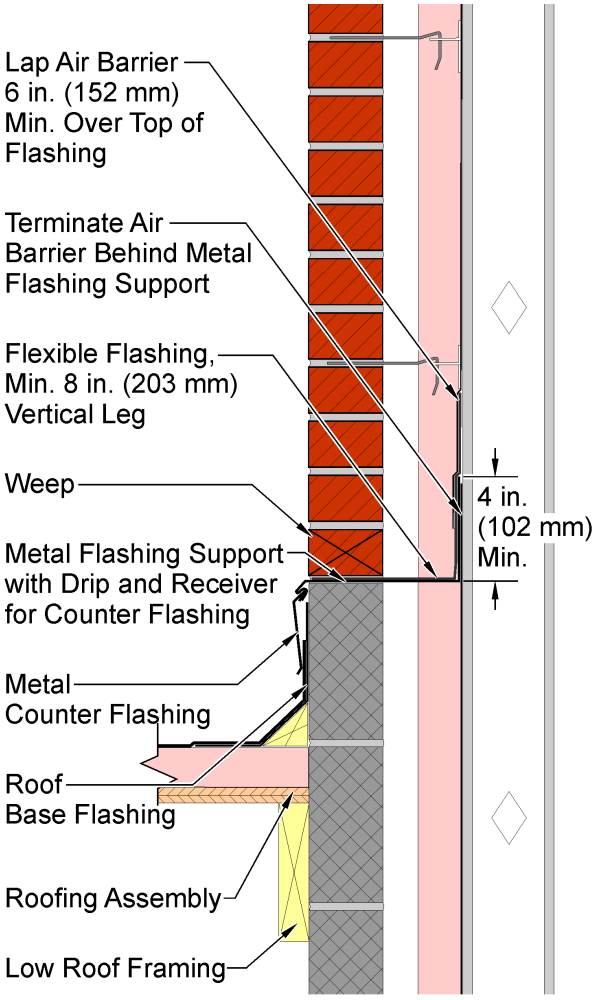


Figure 23
Wall/Roof Intersection

Depending on the type of wall, both through-wall flashing and counter flashing may be required. Counter flashing is used to protect the top edge of roof flashing that extends up the face of the brick. Generally, counter flashing is metal and overlaps roof flashing a minimum of 3 in. (76 mm). Coordination between the masonry and roofing trades is critical in order for the counter flashing to be installed in the masonry in the appropriate brick course. For a barrier wall, place counter flashing in the bed joint above the top of the roof flashing. Refer to Figure 20 and Figure 21. For a drainage wall with brick veneer, through-wall and counter flashing are required at the course above the top of the roof flashing. Install through-wall flashing that extends through the brick veneer, across the air space and turns up a minimum of 8 in. (203 mm). If flexible flashing is used, install a corrosion-resistant sheet metal support across the air space and extend up 4 in. (102 mm) minimum on the backing. Refer to Figure 23. Under the through-wall flashing, provide counter flashing that extends down the face of the brick. If a metal drip edge is used for

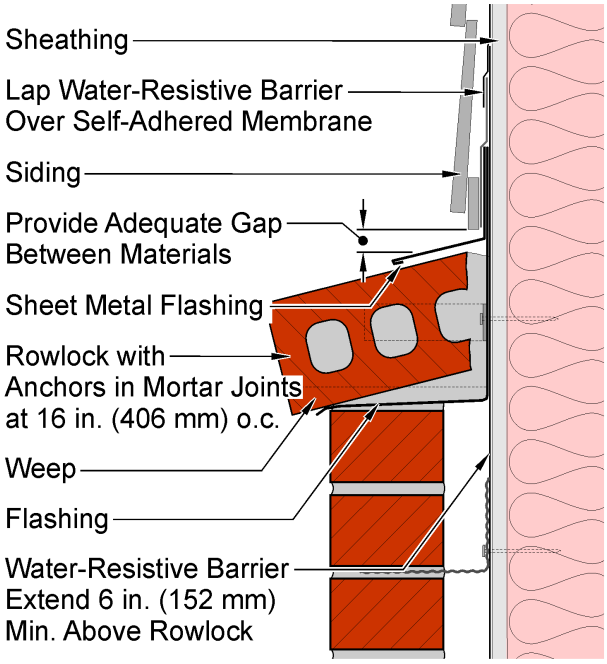


Figure 24
Brick Veneer/Siding Transition

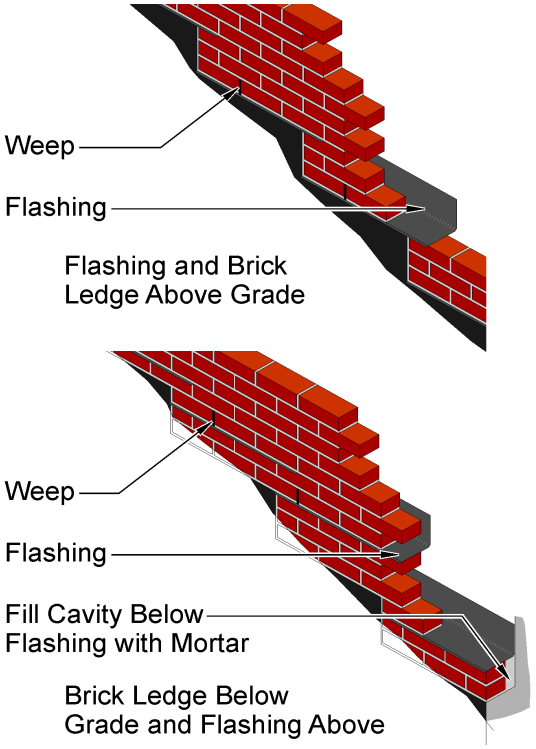


Figure 25
Stepped Flashing at Grade

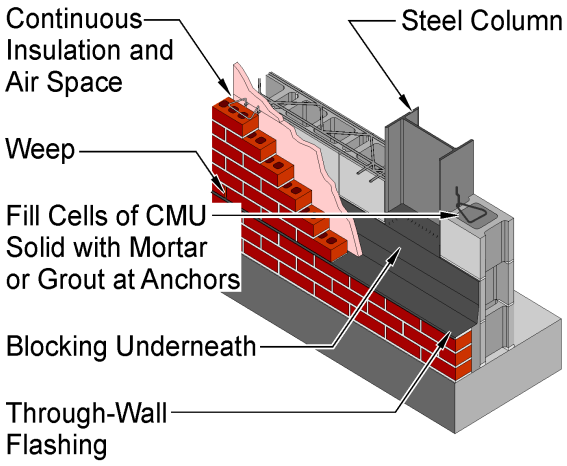


Figure 26
Flashing at Steel Column

the through-wall flashing, it can be fabricated to receive and anchor the counter flashing. Where roof line adjacent to wall is sloped, provide stepped flashing similar to Figure 25. The counter flashing will also be stepped.

Transitions with Other Materials. Frequently, brick is used in combination with other cladding materials on the same facade, some of which may be barrier-style systems or have drainage cavities that are smaller than those for brick masonry. In these cases, the brick should be constructed to be self-contained. For instance, when transitioning to a non-masonry cladding above brick, there should be a cap element to cover the top of the masonry air space and a horizontal veneer expansion joint or gap to allow for the initial moisture expansion of the brick. See Figure 24. When transitioning from brick to another material below that is not a masonry veneer, it should be treated as a wall base condition. When transitioning to the side, end dams should be installed at the flashing lines and closure brick installed along the full height of the transition.

Vertical Changes in Direction. In cases such as a sloped grade parallel to the building, stairs, retaining walls, loading docks or adjacent shelf angles, the flashing needs to account for these changes in direction. Stepped flashing is recommended for these conditions, as well as when the brick masonry surrounds a curved or sloped wall opening. See Figure 25. Rather than installing a single piece of flashing laid flat, installing several layers of flashing not in the same course of brickwork can protect the wall against moisture penetration around the opening or sloped surface. To form a step, the end of the flashing at the highest elevation should be turned up to form an end dam with the opposite end laid flat. It is recommended that stepped flashing in higher courses of brickwork overlap the layer below by 4 in. (102 mm) minimum. The lowest piece of flashing should form a pan with end dams at both ends. Weeps to direct water out of the wall should be installed at each level of the stepped flashing. Alternatively, a series of tray flashings with end dams on both sides can be used.

Balconies, Decks and Terraces. Horizontal structural elements such as balconies and terraces interrupt the drainage plane of the brick masonry and should have a wall base flashing detail installed along the full length of the balcony, deck or terrace, with end dams installed at the ends. Additional end dams are required at the jambs to the access doors. The wall base detail is not required at the door, but a sill flashing is recommended. In some designs, there may be balcony waterproofing, either on the surface or below a topping slab. The vertical termination of the balcony waterproofing will coincide with the location of the masonry wall base flashing and should be coordinated to integrate the two systems for a watertight condition.

For residential applications, the *IRC* [Ref. 5] states that deck ledgers shall not be supported on masonry veneer. In order to support a deck on an exterior wall with brick veneer, the brick in the area of the attachment must be removed and the deck framing attached to the underlying house structure. Consequently, the brick veneer above the deck will require support and flashing around the ledger. A freestanding deck not attached to the exterior wall of the house is the recommended solution for this situation. Alternatively, there are a few manufactured brackets that, when installed, provide mounting surfaces located outside the exterior face of the brick, allowing the brick veneer to be installed in the typical manner. The brackets are detailed and waterproofed at the plane of the sheathing, similar to other projections.

Steel Columns. When the inside wythe of a cavity wall spans between steel columns and the column flanges are perpendicular to the masonry, special flashing detailing is required. Figure 26 illustrates one way that this condition can be addressed. The flashing is formed into a tray and adhered to the column. The flashing must be supported across this area; brick or concrete masonry units may be placed at the column base to provide support. Alternatively, in cases where the flashing terminates on the vertical surface of the inner masonry wythe, sheet metal can be used to span the column flanges, permitting the vertical leg of the flashing to continue in the typical manner. This sheet metal closure would require a tray or sloped top surface extending to the column web and a sealed perimeter to prevent moisture from undermining the flashing.

SUMMARY

Masonry walls constructed of brickwork have performed well for centuries and are a testament to the performance and durability of brick. Design and detailing that maximizes the water penetration resistance of brickwork is needed to achieve this level of service. Selection of the wall type should be based on the project's location, environmental conditions and building use. Water penetration resistance of brickwork is enhanced by including appropriate details that reduce water penetration at key points in the brickwork.

The information and suggestions contained in this Technical Note *are based on the available data and the combined experience of engineering staff and members of the Brick Industry Association. The information contained herein must be used in conjunction with good technical judgment and a basic understanding of the properties of brick masonry. Final decisions on the use of the information contained in this* Technical Note *are not within the purview of the Brick Industry Association and must rest with the project architect, engineer and owner.*

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Attachment No. 16

THE BRICK INDUSTRY ASSOCIATION

TECHNICAL NOTES on Brick Construction

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7B

November 2017

Water Penetration Resistance – Construction and Workmanship

Abstract: This *Technical Note* covers essential construction practices needed to ensure water-resistant brick masonry. Procedures for preparing materials to be used in brick construction are recommended, including proper storage, handling and preparation of brick, mortar, grout and flashing. Good workmanship practices are described, including the complete filling of all mortar joints, tooling of mortar joints for exterior exposure and covering unfinished brick masonry walls to protect them from moisture.

Key Words: air space, brick, construction, flashing, initial rate of absorption, joints, mortar, tooling, weeps, workmanship.

SUMMARY OF RECOMMENDATIONS:

General

- Store materials on job site to avoid wetting, contamination and temperatures outside manufacturer limits
- For drainage walls, keep the air space free of excessive mortar droppings
- Do not disturb newly laid masonry
- Stop in-progress brickwork by stepping back courses to create a diagonal profile
- Cover tops of unfinished walls until adjacent construction protects them from water ingress

Brick and Mortar

- Distribute brick from different straps and cubes around jobsite to blend brick
- Lab test values for the initial rate of absorption (IRA) of a given brick may vary among different production runs and different field exposures
- For brick with an IRA lower than 5 g/min•30 sq in. (5 g/min•194 cm^2), mortar with reduced water or minimized water retention by decreasing lime proportions within limits of ASTM C270 is recommended
- For brick with an IRA exceeding 30 g/min•30 sq in. (30 g/min•194 cm^2):
  - Mortar with increased water or maximized water retention by increasing lime proportions within limits of ASTM C270 is recommended
  - When used on a building designed to the *IBC*, pre-wet brick where feasible; otherwise, modify mortar mix to maximize water retention
- When mixing mortar, use accurate batching measurements and the maximum amount of water that produces a workable mortar
- For colored mortars, follow manufacturer's recommended procedures

Joints

- In exterior wythes, completely fill all mortar joints intended to have mortar
- Minimize furrowing of bed joints and prohibit slushing of head joints
- Fill collar joints completely with grout or mortar, preferably grout; do not slush collar joints
- Tool mortar joints when thumbprint hard with a concave, "V" or grapevine jointer

Mock-Ups and Sample Panels

- For residential construction, use an as-built dwelling by the same builder or mason contractor to establish workmanship
- For commercial construction, sample panels or mock-ups are recommended
- For commercial construction that has complicated facades with multiple cladding materials or that requires field testing, a mock-up is preferred

Flashing and Weeps

- Do not stop flashing behind face of brickwork
- Where required, turn up flashing ends into head joint a minimum of 1 in. (25.4 mm) to form end dams
- Lap continuous flashing pieces at least 6 in. (152 mm) and seal
- Where installed flashing is pierced, make watertight with sealant or liquid membrane compatible with flashing
- Install weeps immediately above flashing
- Install vertical leg of flashing behind water-resistive barrier sheet
- Install vertical leg of flashing over fluid-applied or self-adhered air/vapor barriers or per manufacturer's directions

Water-Resistive Barrier

- Seal penetrations from ties, anchors and termination bars
- Avoid damaging with trowels, and repair any damage as soon as possible before concealed

INTRODUCTION

The best design, detailing and materials will not compensate for poor construction practices and workmanship. Proper construction practices, including preparation of materials, are essential to achieve a water-resistant brick masonry wall.

This *Technical Note* discusses construction techniques and workmanship and is the third in a series of *Technical Notes* addressing water penetration resistance of brick masonry. Other related *Technical Notes* address brickwork design and details (TN 7), materials (TN 7A) and condensation (TN 47). Maintenance of brick masonry is addressed in *Technical Note* 46. All of these items are essential to obtain water-resistant brick masonry walls.

PREPARATION OF MATERIALS

Preparation of masonry materials before bricklaying begins is very important. Specific procedures must be followed to ensure satisfactory performance and to avoid problems. Preparation includes material storage, mixing mortar and grout, and in some cases wetting the brick.

Delivery and Storage of Materials

Masonry units are generally delivered to the site strapped in packs or cubes that are commonly on pallets. Movement of these packages around the site should be performed using methods and equipment that will limit damage to the masonry units. All materials at the jobsite should be stored off the ground to avoid damage and contamination from dirt, groundwater or other matter that may cause stains and contain soluble salts that contribute to efflorescence. Masonry units, mortar materials, ties and reinforcement should be stored off the ground, preferably in a dry location. In addition, all materials should be covered with tarps or other water-resistant materials to protect them from rain, snow and other elements. In addition, cover sand and other aggregates with a water-resistant membrane to avoid saturation and freezing in cold weather, as well as runoff and segregation of aggregates. Store flashing materials in places where they will not be punctured or damaged, and keep UV-sensitive materials in areas away from sunlight. Store roll materials on ends to avoid creasing. Store masonry accessory materials such as flashing components and joint sealant in unopened containers with labels at a location where temperatures will remain within the manufacturer's required range. All masonry materials must be stored to prevent freezing, as indicated in *Technical Note* 1.

Wetting Brick

Brick with an initial rate of absorption (IRA) greater than 30 g/min•30 sq in. (30 g/min•194 cm^2) at the time of laying tend to draw too much moisture from the mortar before initial set, which can result in cracking and poor bond. To increase bond and water penetration resistance, construction practices may need to be altered when using such brick. ASTM C67, *Test Methods for Sampling and Testing Brick and Structural Clay Tile* [Ref. 1], includes a standard procedure for measuring IRA. However, be aware that some coatings, surface treatments and textures can return an elevated IRA value in laboratory tests while not adversely affecting water content of the mortar in the field. In addition, the IRA of a given brick may vary by production run and by exposure at the site.

A crude method to determine whether brick have an elevated IRA consists of drawing, with a wax pencil, a circle 1 in. (25.4 mm) in diameter on the brick surface that will be in contact with the mortar. A quarter can be used as a guide for the circle. With a medicine dropper, place 20 drops of water inside this circle and note the time required for the water to be absorbed. If the time exceeds 1½ min, then setting the brick with typical methods should suffice; if less than 1½ min, then adjustments to typical construction practice are recommended.

The *International Building Code* (*IBC*) [Ref. 5] references the *Specification for Masonry Structures* (TMS 602) [Ref. 6] which requires brick with an IRA exceeding 30 g/min•30 sq in. (30 g/min•194 cm^2) to be wetted prior to laying to produce an IRA less than 30 g/min•30 sq in. (30 g/min•194 cm^2) when the units are placed. However, execution of this method may be impractical on large-scale construction projects, and the contractor may consider modifying the mortar mix to maximize water retention, as discussed in "Mixing of Mortar and Grout" in this *Technical Note*.

If brick are to be wetted, the method of wetting is very important. Sprinkling or dipping the brick in a bucket of water just before laying would produce the surface wet condition, as shown in Figure 1b, which may not be

sufficient. The units should have a saturated interior but be surface dry (also referred to as “saturated surface dry”) at the time of laying, as shown in Figure 1d.

Satisfactory procedures for wetting the brick consist of letting water run on the packs or cubes of brick, or placing them in a large tank of water. This should be done the day before the units are laid, or not later than several hours before the units will be used, so that the surfaces have an opportunity to reach a surface dry condition before the brick are laid. Wetting low-absorption brick or excessive wetting of brick may result in saturation, as shown in Figure 1c. This may prevent adequate absorption of water, resulting in excess moisture or “bleed” from the mortar joints and cause the brick to slide more readily—a condition commonly referred to by masons as “floating” of the brick.

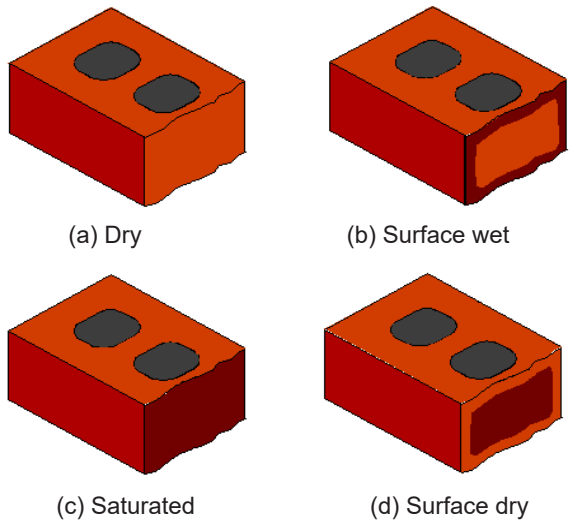

Figure 1
Moisture Content of Brick

Mixing of Mortar and Grout

Typically, a high water content in the mortar is necessary to obtain complete and strong bond between mortar and brick. In general, the mortar should be mixed with the maximum amount of water that produces a workable mortar. Factors such as the jobsite environment and the IRA of the brick should be considered when determining the proper amount of water to include in the mortar.

Mortar to be used with brick that have an IRA greater than 30 g/min•30 sq in. (30 g/min•194 cm^2) should be mixed to maximize water retention by increasing mixing water or lime content within the limits of ASTM C270, *Standard Specification for Mortar for Unit Masonry* [Ref. 2]. This is particularly important when pre-wetting the brick to reduce the IRA is impossible or impractical. Admixtures designed to increase the water retention of the mortar may also be used to improve the compatibility of mortar with high-IRA brick. Only admixtures with test data showing no deleterious effects should be used.

Mortar for use with brick that have an IRA less than 5 g/min•30 sq in. (5 g/min•194 cm^2) should be mixed with reduced amounts of water or lime to minimize water retention. Lime proportions should remain within the limits of ASTM C270.

When brick with widely different absorption rates are used together in brickwork, it is important to maintain the correct water content in the mortar used with the different brick.

All cementitious materials and aggregates must be mixed for at least three minutes and not more than five minutes in a mechanical batch mixer. If, after initial mixing, the mortar stiffens due to the loss of water by evaporation, then additional water should be added and the mortar remixed (retempered). Pigmented or colored mortars are sensitive to retempering, which can result in significant color variations. Consult the colored mortar manufacturer’s literature for requirements and recommendations that may vary from standard practice. All mortar should be used within 2½ hr (2 hr in hot-weather conditions, see *Technical Note* 1) of initial mixing, and grout should be used within 1½ hr of introducing water into the mix. No mortar or grout should be used after it has begun to set.

One of the most common problems with mortar is oversanding. Oversanded mortar is harsh and unworkable, and results in poor extent of bond and reduced bond strength, increasing the potential for water penetration problems. The cause of oversanding is frequently due to the shovel method of measuring the sand. The amount of sand that a shovel will hold varies depending on the moisture content of the sand, the person doing the shoveling and the different sizes of shovels used on jobsites. To alleviate this problem, proper batching methods must be used. Measurement of sand by shovel should not be permitted. Instead, a bucket or box of known volume will provide more consistent results. *Technical Note* 8B provides detailed guidelines for various methods of more accurately batching mortar.

Blending of Brick

While not related to water penetration resistance, blending of brick at the jobsite is an important preparation task related to workmanship and the acceptable appearance of brickwork. Because brick is made from natural materials that differ in physical properties, variations in color may occur between production runs and occasionally within the same run. Modern manufacturing processes use automatic equipment that may not permit inspection of each brick unit, resulting in minor color and texture variations. For these reasons, straps of brick from different cubes should be placed together around the wall. The mason should then select brick from adjacent straps when laying a given section of brickwork. By blending the brick throughout the wall in this manner, the effect of potential color variations on the finished brickwork is minimized.

WORKMANSHIP

The importance of good workmanship to attain quality brickwork cannot be overemphasized. While design and the quality of materials contribute to the water penetration resistance of brickwork, workmanship is a highly important factor in the construction of water-resistant masonry.

Mock-Ups and Sample Panels

Building a mock-up or sample (field) panel on-site prior to the start of construction can provide a tangible reference of the quality and level of workmanship to be expected on the project for the building owner and the construction team. Although more common in commercial construction, sample panels or mock-ups may be considered for a custom residential project. For one- and-two-family residential construction where mock-ups or sample panels are not provided, an as-built dwelling in the same development or one constructed by the same builder or mason subcontractor may be used as a basis of workmanship.

The brick used in a sample panel or mock-up is intended to demonstrate the final brick texture, color range, bond pattern and mortar color. Any issue with the brickwork must be resolved before the panel is accepted. Once the sample panel or mock-up is accepted, it becomes the standard for quality for all brick and brickwork on the project and should be used as a reference for bond pattern, brick, mortar joints, workmanship, and general appearance. A sample panel is intended only to show the brickwork. It is important that all aspects of the brickwork are shown in the sample panel, such as filling and tooling all mortar joints and cleaning the brick. Typically, sample panels give the best overall indication of the final brickwork.

A mock-up is generally larger than a sample panel because it includes more elements than brick and mortar and is intended to show the relationship between the brickwork and other facade elements, like doors and windows (fenestration) and other cladding materials. A mock-up includes all the underlying components of the wall assembly, such as air/vapor barriers, flashing and veneer anchors. By including these elements, the installation methods of these items can be evaluated and varied as required to achieve the desired results. On large commercial projects, this mock-up is often subjected to field testing in order to evaluate the performance of the wall assembly and the fenestration with respect to water and air penetration.

Subcontractors involved with constructing the mock-up include all trades associated with installing these elements in the building. Similar to a sample panel, a mock-up sets the project standard for appearance and workmanship. Work that is subsequently concealed as part of the mock-up construction should be photographed and the images maintained on-site for reference during the project.

Placing Flashing and Weeps

Flashing must be installed properly and integrated with adjacent materials to form an impervious barrier to moisture migration to the interior of the building. The flashing should be wide enough to start outside the exterior face of the brick wythe, extend across the cavity, and turn up vertically against the backing or interior wythe at least 8 in. (203 mm). The top (vertical) edge should be placed in a mortar joint of the inner wythe, in a reglet in concrete backing, or attached to sheathing or backing with a termination bar, as shown in Figure 2. Some manufacturers of self-adhered flashing permit termination with a compatible sealant bead encapsulating the leading edge. The vertical leg of the flashing is generally installed behind a water-resistive barrier and over a fluid-applied membrane or self-adhered sheet membrane air barrier/vapor retarder. Manufacturers' details for the water-resistive barrier, air barrier and/or vapor retarder should be consulted for recommended installation.

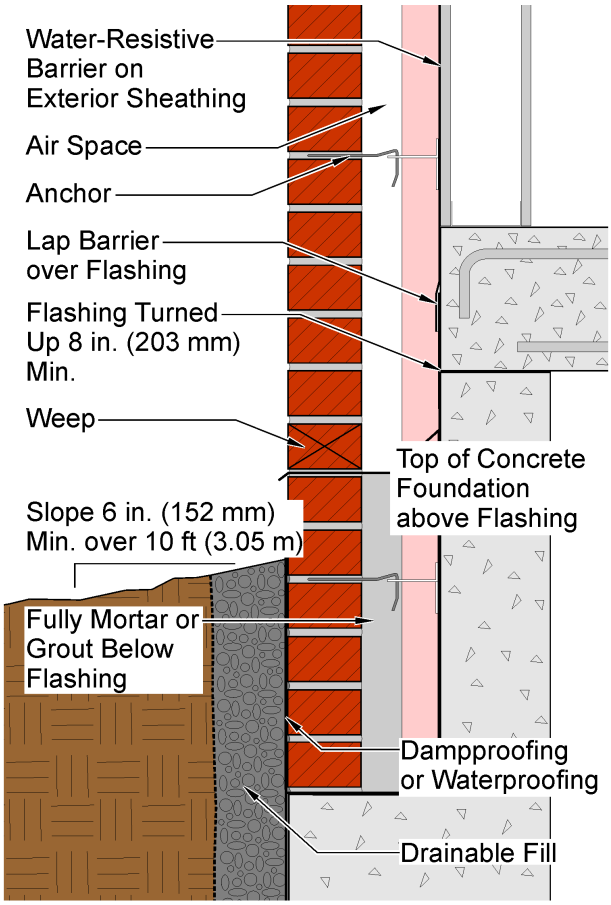

Figure 2
Placing Flashing and Weeps

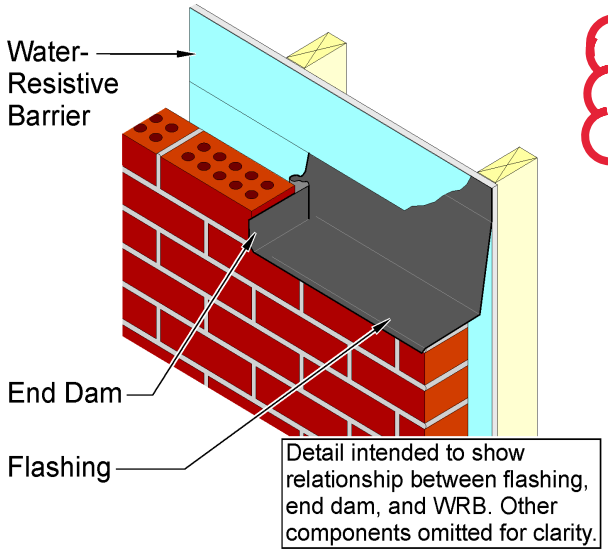

Figure 3
End Dam Detail

As a general rule, sections of flashing are to be overlapped at least 6 in. (152 mm) and the lap sealed with a compatible adhesive. Water-resistant sheet membranes should overlap the flashing in a shingled fashion by at least 6 in. (152 mm). Manufacturers' installation requirements for specific flashing materials may vary from these recommendations and should be consulted.

Flexible flashing is placed so that the outside edge projects from the face of the wall. Although the formation of a drip is recommended, this flashing may be cut flush with the face of the brickwork. Sheet metal flashings are intended to project past the face of the wall and form a drip. In no circumstances should the flashing be stopped behind the face of the brickwork. Continuity at corners and returns is achieved by cutting and folding straight sections or using preformed corner pieces. Discontinuous flashing should terminate with an end dam in a head joint and turn up at least 1 in. (25.4 mm), as shown in Figure 3.

Flashing must be placed without punctures or tears. Openings created for reinforcement or anchors must be protected with application of a compatible sealant. Care should be exercised to ensure full coverage of any membrane, adhesive or sealant around penetrations or protrusions, such as brick veneer anchors at the point of contact with the wall. Many self-adhered membrane flashing manufacturers offer such a sealant as an accessory to the system. Additional protection may be needed around bolts fastening shelf angles to the structure.

Weeps are required and should be placed in mortar joints immediately above the flashing. Open head joints, formed by leaving mortar out of a joint, are the recommended type of weep. Open head joint weeps should be at least 2 in. (51 mm) high. Noncorrosive metal, mesh or plastic screens can be installed in open head joint weeps if desired. Weep openings are permitted by most building codes to have a minimum diameter of 3⁄16 in. (4.8 mm). This smaller opening results in reduced drainage capability and increased risk of clogging; therefore, use of tube weeps is discouraged. The practice of specifying the installation of weeps one or more courses of brick above the flashing is not recommended, as it requires a head of water to accumulate on the flashing before drainage can occur. Noncorrosive metal, mesh or plastic screens can be installed in open head joint weeps if desired.

Spacing of open head joint weeps at no more than 24 in. (610 mm) o.c. is recommended. If used, spacing of wick weeps is recommended at no more than 16 in. (406 mm) o.c. These are closer spacings than the 33 in. (838 mm) o.c. spacing permitted by most building codes; however, they improve drainage. Ensure that weeps are clear of all mortar to allow the wall to drain. Rope wicks should be flush with, or extend ½ in. (12.7 mm) beyond, the face of the wall to promote evaporation. The rope should continue into the bottom of the air space, placed along the back of the brick, and be at least 16 in. (406 mm) long.

Tie/Anchor Installation

With respect to water penetration resistance, protecting ties and anchors from corrosion is critical. Anchors for veneer require a minimum mortar cover of ⅝ in. (15.9 mm). This cover requirement also applies to longitudinal wires of joint reinforcement. Where this cover cannot be achieved in non-veneer applications of hollow units, placement of the wire tie or joint reinforcement in center of face shell is recommended. See the "Interface with Water-Resistive Barrier" section of this *Technical Note* for information regarding fasteners used with face-mounted ties and treatment of penetrations caused by these fasteners. For more information on ties and anchors, including spacing, corrosion resistance and material specifications, refer to *Technical Note* 44B.

Interface with Water-Resistive Barrier

Multiple elements of masonry veneer are in contact with or penetrate the water-resistive barrier, which also may serve as an air barrier and vapor retarder. These elements are intended to prevent moisture ingress to the interior and damage to the backing.

Brick ties or anchors penetrate this layer and flashing is applied to it or under it. If a termination bar is used, then its fasteners will penetrate this layer as well. Sealing penetrations is critical. It is preferable to place sealant behind ties or anchors, termination bar fasteners and other items that penetrate these layers. Applying the sealant as these items are being installed is necessary and generally done by the mason.

Once laying of brick has begun, there is additional risk of tearing or scraping the water-resistive barrier due to the mason working in close proximity to the layer. Breaches in the water-resistive barrier have the potential to permit ingress of bulk water and moisture-laden air, which can cause significant damage to the underlying materials. Therefore, the mason should coordinate with the installer of the water-resistive barrier if this work was performed by others in order to quickly repair any damage that occurs before it is concealed.

Filling Mortar Joints

To reduce water penetration, there is no substitute for proper filling of all mortar joints that are designed to receive mortar. Improperly filled mortar joints can result in leaky walls, can reduce the strength of masonry, and may contribute to disintegration and cracking due to water penetration and subsequent freezing and thawing. This behavior and performance has been confirmed by extensive laboratory tests [Ref. 4] as well as observations of masonry buildings in service.

A uniform bed of mortar should be spread over only a few brick units, and furrowed lightly, if at all. Filled joints result when plenty of mortar is placed on the end of the brick unit to be laid and it is shoved into place so that mortar is squeezed out of the top of the head joint, as shown in Photo 1. After placement, mortar squeezed out of the bed joint should be cut off prior to tooling, as shown in Photo 2. When placing closures, plenty of mortar is needed on the ends of brick in place and on the ends of the brick to be laid. The closure should be shoved into place without disturbing brick on either side, as shown in Photo 3.

Photo 1
Shoving Brick into Place

Photo 2
Cutting Excess Mortar

Photo 3
Placing the Closure

Bed Joints. A bed joint is the horizontal layer of mortar on which brick are laid. The length of time between placing the bed joint mortar and laying the succeeding brick influences the resulting bond. If too much time elapses, then poor extent of bond will result. Brick should be laid within about 1 minute after the mortar is placed.

Full bed joints (covering the entire bedding surface) are an inherent requirement for water-resistant brick masonry construction. For solid brick, bed joints should be constructed without deep furrowing of the mortar. For hollow brick used in a veneer application, full bed joints are recommended. For ungrouted hollow brick in non-veneer applications, full bed joints provide the highest level of water penetration resistance. However, bed joints in this application may be laid with face shell bedding (mortar placed only on the front and back face shells) and still provide adequate water penetration resistance. Both face shells must be completely covered with mortar.

Head Joints. A head joint, sometimes called a cross joint, is the vertical mortar joint between two brick units. For both solid and hollow brick, it is important that head joints be completely filled. The best head joints are formed by completely buttering the ends of the brick with mortar and shoving the units into place against previously laid brick.

"Slushing" (throwing mortar into the joint with the edge of a trowel) does not adequately fill joints or compact the mortar, resulting in joints that are less resistant to water penetration. Examples of methods used to form head joints are shown in Figure 4.

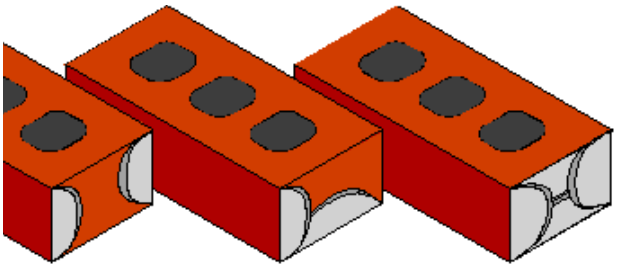

Figure 4
Head Joints

Tooling of Mortar Joints

Proper tooling, or "striking," of mortar joints helps to seal the wall surface against moisture penetration. Mortar joints should be tooled when they are "thumbprint" hard, (pressing the thumb into the mortar leaves an indentation, but no mortar is transferred to the thumb) with a jointer slightly larger than the joint. It is important that joints are tooled at the appropriate time, as this affects both their effectiveness and appearance. The duration to achieve thumbprint-hard mortar may vary throughout the work day. Joints that are tooled too early often smear mortar onto the adjacent brick and result in rough-surfaced joints. If tooling is delayed too long, however, the surface of the joint cannot be properly consolidated and bonded to the adjacent brick. Each portion of the completed brickwork should be allowed to set for the amount of time necessary to achieve thumbprint-hard mortar before tooling in order to ensure a uniform mortar shade. Early tooling often results in joints of a lighter color. Later tooling results in darker shades.

Concave, "V" and grapevine joints (Photo 4 and Photo 5) best resist water penetration in exterior brickwork. These joints produce a dense and weather-tight surface, created as the mortar is pressed against the brick and consolidated during tooling. For interior masonry work, other joints such as the weathered, beaded, struck, flush,

Photo 4
Concave Mortar Joints

Photo 5
"V" Mortar Joints

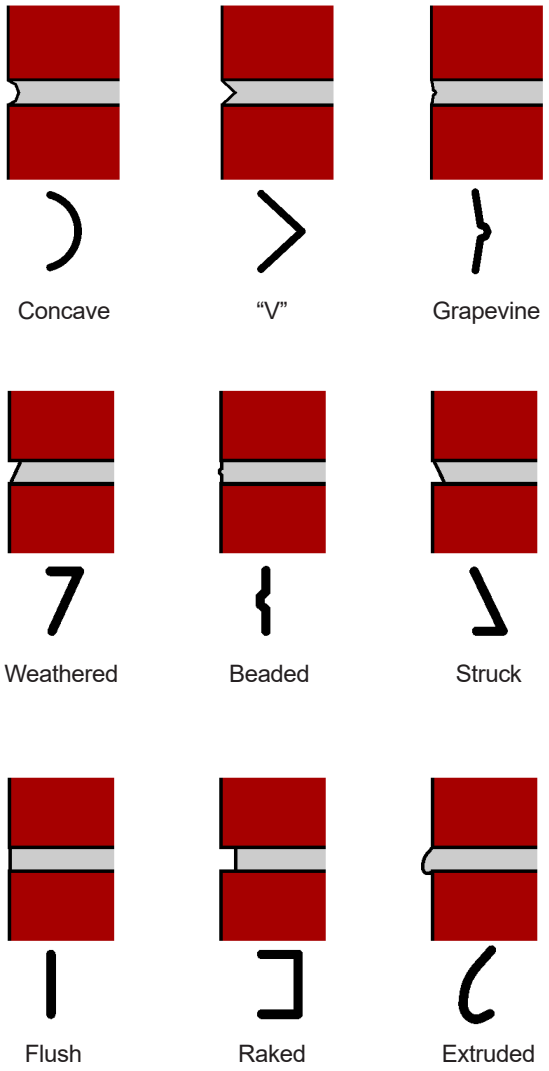

Figure 5
Types of Mortar Joints

Photo 6
Poorly Filled Collar Joint

raked or extruded joints shown in Figure 5 also may be used. These joints are not recommended for exterior use because the methods used to form them do not consolidate the outer portion of mortar, or they create horizontal ledges on which water can pond and saturate the masonry.

Collar Joints

The vertical, longitudinal joints between wythes of masonry are called collar joints. The manner in which these joints are filled is very important. Grouting is the most effective method of ensuring that collar joints are completely filled. However, grouting in spaces less than ¾ in. (19.1 mm) wide is not permitted. Mortar protrusions (fins) that extend more than ½ in. (12.7 mm) into a cell or cavity that will be grouted must be removed prior to grouting. For mortar-filled collar joints, the outer face of the inner masonry wythe should be parged and the back of brick in the exterior wythe buttered in order to fill the collar joint.

"Slushing" of collar joints is not effective because it does not completely fill all voids in the joint, as shown in Photo 6. Frequently, the mortar is caught and held before it reaches the bottom of the joint, leaving openings between the face brick and the backing. Even when this space is filled, there is no way to compact the mortar. The mortar does not bond with the brick over its entire surface, and channels are left between the mortar and the brick. Some of these channels may allow water to reach the back of the wall. A properly constructed collar joint is completely filled with grout or mortar.

Parging

Parging is the process of applying a coat of portland cement mortar to masonry. Parging the outer face of the inner wythe of a multi-wythe wall with Type M or S mortar as dampproofing may help resist rain penetration and can also reduce air leakage. Membranes or fluid-applied materials usually provide superior performance to parging, which will crack if the wythe cracks. Once cracked, the parging loses most of its effectiveness. However, parging can provide a smooth base for these materials. If parging alone is to resist water penetration, then proper curing is necessary to reduce shrinkage cracks. Parging the back side of the exterior wythe is not recommended for drainage-type walls, as this may result in more debris in the air space.

The face of the wall to be parged must not have any mortar protrusions. Protruding mortar can cause bond breaks in the parge coat, resulting in a leaky wall. When applied in multiple layers, each should be a minimum thickness of ¼ in. (6.4 mm). The first coat should be allowed to partially set,

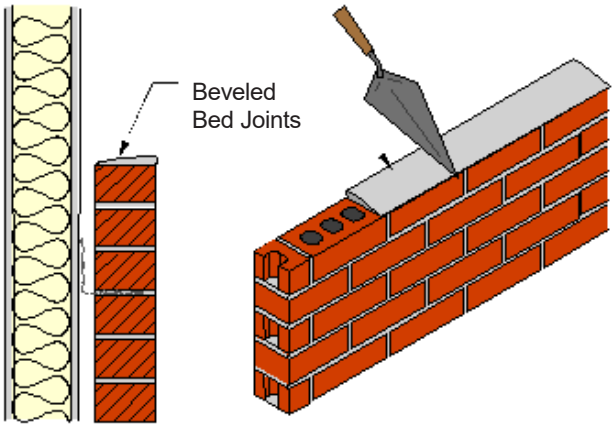

Figure 6
Beveled Bed Joints

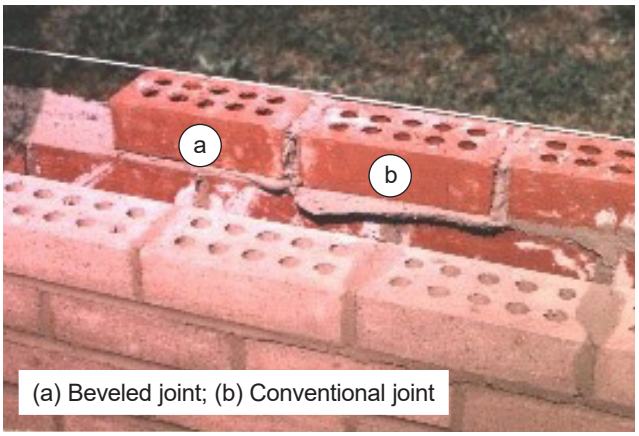

Photo 7
Beveled and Conventional Mortar Joints

roughened and allowed to cure for 24 hours. It is then moistened for application of the second coat. The parged surface should be troweled smooth so that it sheds water easily. When completed in adjacent areas, the edges of the parging should be feathered, and new parging should overlap existing parging by a minimum of 6 in. (152 mm). Lap joints should be spaced no closer than 6 ft (1.83 m).

Constructing a Functional Air Space

In a drainage wall system, such as a cavity wall or an anchored veneer wall, it is essential that the air space be kept as clear of mortar droppings as possible. If it is not, then mortar droppings may clog the weeps, protrusions may span the air space (mortar bridging) and water may penetrate to the interior.

To the greatest extent possible, mortar droppings should be prevented from falling into the air space or cavity. Good workmanship can go a long way to minimize the occurrence of mortar droppings. However, it is unreasonable to expect a mason to maintain a cavity completely clear of mortar droppings or protrusions. Therefore, an air space that provides drainage is permitted to contain mortar from construction. An aid to prevent mortar droppings is to bevel the bed joint away from the air space or cavity, as shown in Figure 6. When brick are laid on a beveled bed joint, a minimum of mortar is squeezed out of the joint, as shown in Photo 7. The mortar squeezed from the joints on the air space or cavity side may be troweled onto the units. This same procedure may be used for laying the exterior wythes of grouted and reinforced brick cavity walls.

Another method allows access to the base of the cavity for cleaning. When the brickwork is initially constructed, every third or so brick unit in the course above the flashing of the exterior wythe is omitted. Once the brickwork is complete, mortar droppings at the base of the cavity can be easily removed and weeps provided when the omitted brick are placed in the wall with mortar.

Drainage materials and mortar collection devices (mortar dropping collection devices) may also be used to keep the air space adjacent to the weeps free from mortar. The use of a mortar collection device in combination with good workmanship to maintain an unobstructed cavity is an effective method to ensure functional moisture management and is becoming standard practice in the industry. The use of a mortar collection device does not eliminate mortar bridging or absolve the mason from minimizing mortar droppings in the cavity.

Disturbance of Newly Laid Masonry

Newly laid brick should never be pushed, shoved, tapped or otherwise disturbed once they are laid in their final position and the mortar has begun to set. Any disturbance at this point will break the bond and may lead to a leak. If adjustments are necessary, then the incorrectly placed brick should be removed and relaid in fresh mortar.

Unfinished Brickwork

When brickwork progress ends in the field of the wall, it is recommended to stop horizontal runs with a setback of one-half unit length over each course below, creating a diagonal end profile. By doing so, when work begins

again, the new brick are laid as normal. Ending work in a toothed profile results in more effort when work resumes, requires pointing bed joints for the projecting units, and creates a condition where achieving full joints and good bond is difficult, increasing the risk of water penetration.

Covering of masonry walls at the end of each work day, and especially in times of inclement weather, is essential for satisfactory performance. Otherwise, excessive moisture enters the wall system, requiring an extended drying period and increasing the risk of persistent efflorescence. Covering unfinished walls with tarps or other water-resistant materials, securely tied or weighted to adequately resist wind, should be rigorously enforced. Mortar boards, scaffold planks and light plastic sheets (less than 10 mils thick) weighted with brick should not be accepted as suitable cover. Metal clamps, similar to bicycle clips, are commercially available in a variety of sizes to meet various wall thicknesses. These are used in conjunction with plastic sheets or water-repellent tarps and offer excellent protection for extended periods of time.

Tops of walls should also be covered after the mason's work is finished if a permanent coping is not attached immediately after the brickwork is completed. Coverings extending 24 in. (610 mm) down the vertical face on each side are recommended and should be maintained until the wall construction is completed or protected by adjacent materials. Protection of openings in brickwork such as those for windows, movement joints, etc. should also be considered, as they may allow moisture ingress from rain and snow and can lead to moisture-related problems such as efflorescence and in some cases could affect the final mortar color.

Poor wall performance can sometimes be attributed to the freezing of mortar before it has set, or the lack of protection of materials and walls during cold weather construction. Therefore, when building in cold weather, proper protection against freezing is required for all materials and walls under construction, as indicated in *Technical Note* 1 and in TMS 602.

SUMMARY

Quality construction practices and good workmanship are essential to achieve brickwork that is resistant to water penetration. This *Technical Note* does not cover all construction practices but describes material storage, preparation procedures, construction practices and installation techniques that are indicative of high quality and, when combined with proper design, detailing and materials, result in brickwork that is resistant to water penetration.

> *The information and suggestions contained in this* Technical Note *are based on the available data and the combined experience of engineering staff and members of the Brick Industry Association. The information contained herein must be used in conjunction with good technical judgment and a basic understanding of the properties of brick masonry. Final decisions on the use of the information contained in this* Technical Note *are not within the purview of the Brick Industry Association and must rest with the project architect, engineer, and owner.*

REFERENCES

1. ASTM C67, "Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile," *Annual Book of Standards*, Vol. 04.05, ASTM International, West Conshohocken, PA, 2016.
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3. *The BDA Guide to Successful Brickwork*, Third Edition, The Brick Development Association, London, England, 2006.
4. Drysdale, R.G., Hamid, A.A., and Baker, L.R., *Masonry Structures: Behavior and Design*, Third Edition, The Masonry Society, Boulder, CO, 2008.
5. *International Building Code*, International Code Council, Country Club Hills, IL, 2015.
6. *Specification for Masonry Structures* (TMS 602), The Masonry Society, Longmont, CO, 2016.

District Five
OF LEXINGTON & RICHLAND COUNTIES

MEMORANDUM

To: Members of the Board of Trustees
Dr. Akil E. Ross, Sr., Interim Superintendent

From: Michael Guliano, Chief Instructional Officer MG

Date: July 7, 2021

Re: July 12, 2021 Board Meeting – *Information*
Title I, Title II, and Title IV Programs for 2021-2022

Attached to this memo you will find information regarding the following:

- Title I 2021-22 Program
- Title II 2021-22 Program
- Title IV 2021-22 Program

In order to determine the appropriate use of funding, Title I, Title II, and Title IV federal grants require stakeholder (teachers, school administrators, parents, and para-professionals) involvement from both Title I and non-Title I schools. Stakeholder feedback is submitted to the South Carolina Department of Education as a verification of stakeholder involvement and as a justification for funding decisions.

I will be present at the Board Meeting to answer any questions you may have regarding this information.

Exhibits: Title I Program
Title II and Title IV Programs

District Five OF LEXINGTON & RICHLAND COUNTIES

TITLE I
2021-2022

2021-2022 Program Proposal

FY 21-22 (***Projected***) New Grant Funds	$ 1,973,000.00
FY 20-21 (***Projected***) Carryover Funds	200,000.00
TOTAL 21-22 *PROJECTED* FUNDS	**$ 2,173,000.00**

Title I Served Schools:

All of the following schools have 40% F/R lunch count, or higher and have conducted a Needs Assessment in their school to make the community decision for allocating Title I funds.

School	Title I Programs
Seven Oaks Elementary	*Reading Intervention* *Math Intervention* *Academic Tutoring*
Harbison West Elementary	*Reading Intervention* *Math Intervention* *Academic Tutoring*
Dutch Fork Elementary	*Reading Intervention* *Math Intervention* *Academic Tutoring*
Leaphart Elementary	*Reading Intervention* *Math Intervention* *Academic Tutoring*
Nursery Road Elementary	*Reading Intervention* *Math Intervention* *Academic Tutoring*
H. E. Corley Elementary	*Reading Intervention* *Math Intervention* *Academic Tutoring*

Title I *funds will be expended for teachers' salaries/benefits, parent involvement needs, instructional materials and supplies, professional training, and academic tutoring (during the school year and during summer).*

Program Purposes:

(As stated in Federal Regulations)

Programs that provide extended learning time for disadvantaged children to assist in the acquisition of performance standards expected for all children. Programs may include extended school year; before- and after-school or summer programs; and, accelerated, high-quality curriculum including applied learning. Programs should minimize removing children from the regular classroom during regular school hours for instruction and should coordinate with and support the regular education program in the classroom. Programs supported by Title I funds may also include counseling, mentoring, and other pupil services; college and career awareness and preparation; services to transition students from school to work; services to assist preschool children; and, professional development opportunities to provide teachers with strategies to use in the classroom and with promoting parental involvement in their children's education.

TITLE II, Part A Program
Improving Teacher Quality
and
TITLE IV
Student Support and Academic Enrichment
2021-2022

2021-2022 Program Proposal

FY 21-22 (***Projected***) New Title II Grant Funds	$ 420,000
FY 21-22 (***Projected***) New Title IV Grant Funds	$ 100,000
Total 21-22 Projected Funds	**$520,000**

Program Purposes:

Per our District's Strategic Plan, Title II monies will be used to support our district initiatives, professional development in the core content areas, paraprofessional training, as needed, and recruitment and retention of highly qualified staff, as outlined in Title II guidelines.

District Five has opted to target Title IV funds for professional development activities to grow our teachers in content knowledge and teaching best practices. We target these funds for continued Data Team training and coaching for instructional improvement based on data.