

CITY OF PAWTUCKET

REQUEST FOR PROPOSALS



RFP #26-008
Citywide Sidewalk Improvements
(Construction)

February 12, 2026

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1.0 - Bid/Solicitation Information

Schedule

Pre-Bid/Proposal Conference: No Yes (Non-Mandatory)

February 25, 2026 @ 10:30 AM

Location: DPW Conference Room, Pawtucket DPW 250 Armistice Blvd,
Pawtucket, RI

Requests for Further Information:

March 2, 2026 @ 4:00 PM

Requests for information or clarification must be made electronically to the attention of:

David Taylor, Project Leader

E-mail: dtaylor@pawtucketri.gov

Please reference the RFP / LOI number on all correspondence. Answers to questions received, if any, will be posted on the internet as an addendum to this bid solicitation.

RFP Submission Deadline:

March 12, 2026 at 12:00 PM

Late submittals will not be considered.

Proposals must be mailed or hand-delivered in a sealed envelope **marked with the RFP/Bid # and Project Name** to:

Pawtucket City Hall - Purchasing Office

137 Roosevelt Avenue

Pawtucket, RI 02860

Bids will be opened March 12, 2026 at 4:00PM at a regularly scheduled purchasing board meeting, located at 100 Freight Street, Pawtucket, RI.

Bonds/Surety Required

Bid Bond: No Yes

Bidder is required to provide a bid surety in the form of a bid bond or certified check payable to the City of Pawtucket in an amount not less than five percent (5%) of the bid price.

Fidelity Bond: No Yes

Performance and Payment Bond: No Yes

(Submit upon award of contract)

Bidder is required to provide a performance and payment bond as outlined in the City's General Terms & Conditions of Purchase (Appendix B of this RFP) in an amount not less than one hundred percent (100%) of the bid price.

Miscellaneous

The bid process and resulting contract are subject to the Rules and Regulations and General Terms and Conditions of Purchase. Submission of a bid in response to this solicitation is acknowledgement and acceptance of these Rules and Regulations and General Terms and Conditions of Purchase.

The City of Pawtucket reserves the right to award on the basis of cost alone, accept or reject any or all bids, and to act in its best interest including, but not limited to, directly negotiating with any vendor who submits a proposal in response to this RFP and to award

a contract based upon the results of those negotiations alone. Proposals found to be technically or substantially non-responsive at any point in the evaluation process will be rejected and not considered further. The City of Pawtucket may, at its sole option, elect to require presentations(s) by bidders clearly in consideration for award.

2.0 - Instructions and Notifications to Bidders

- It is the vendor's responsibility to examine all specifications and site conditions thoroughly, and comply fully with specifications and all attached terms and conditions. Vendors must comply with all Federal, State, and City laws, ordinances and regulations, and meet any and all registration requirements where required for contractors as set forth by the State of Rhode Island. Failure to make a complete submission as described herein may result in a rejection of the proposal.
- All costs associated with developing or submitting a proposal in response to this Request, or to provide oral or written clarification of its content shall be borne by the bidder. The City of Pawtucket assumes no responsibility for these costs.
- A submittal may be withdrawn by written request to the Purchasing Agent by the proposer prior to the stated RFP deadline.
- Prior to the proposal deadline established for this RFP, changes may be made to a proposal already received by the City if that vendor makes a request to the Purchasing Agent, in writing, to do so. No changes to a proposal shall be made after the RFP deadline.
- Proposals are considered to be irrevocable for a period of not less than ninety (90) days following the opening date, and may not be withdrawn, except with the express written permission of the Purchasing Agent. Should any vendor object to this condition, the vendor must provide objection through a question and/or complaint to the Purchasing Agent prior to the proposal deadline.
- All pricing submitted will be considered to be firm and fixed unless otherwise indicated herein.
- The vendor has full responsibility to ensure that the proposal arrives at the Purchasing Division Office prior to the deadline set out herein. The City assumes no responsibility for delays caused by the U.S. Postal Service or any other delivery service. Postmarking by the due date will not substitute for actual receipt of response by the due date. Proposals arriving after the deadline may be returned, unopened, to the vendor, or may simply be declared non-responsive and not subject to evaluation, at the sole discretion of the Purchasing Agent. **For the purposes of this requirement, the official time and date shall be that of the time clock in the City of Pawtucket's Purchasing Office.**
- At the time and place fixed for the opening of Bids, the Owner will cause to be opened and publicly read aloud every Bid received within the time set for receiving Bids, irrespective of any irregularities therein. Bidders and other persons properly interested may be present, in person or by representative.
- It is intended that an award pursuant to this Request will be made to a prime contractor, who will assume responsibility for all aspects of the work. Joint venture and cooperative proposals will not be considered, but subcontracts are permitted, provided that their use is clearly indicated in the bidder's proposal, and the subcontractor(s) proposed to be used are identified in the proposal.
- Bidders are advised that all materials submitted to the City of Pawtucket for consideration in response to this Request for Proposals shall be considered to be public records as defined in Title 38 Chapter 2 of the Rhode Island General Laws,

without exception, and may be released for inspection immediately upon request once an award has been made.

- Vendors are responsible for errors and omissions in their proposals. No such error or omission shall diminish the vendor's obligations to the City.
- The City reserves the right to reject any or all proposals, or portions thereof, at any time, with no penalty. The City also has the right to waive immaterial defects and minor irregularities in any submitted proposal at its sole discretion. All material submitted in response to this RFP shall become the property of the City of Pawtucket upon delivery to the Purchasing Agent.
- Bids will be opened publicly at a regularly scheduled purchasing board meeting, the date of which is the same as the RFP submission deadline provided in Section 1.0.
- Interpretations or Addenda: No oral interpretation will be made to any Bidder as to the meaning of the Contract Documents or any part thereof. Every request for such an interpretation shall be made in writing to the City of Pawtucket (hereinafter called the "Owner"). Any inquiry received seven or more days prior to the date fixed for opening of Bids will be given consideration. Every interpretation made to a Bidder will be in the form of an Addendum to the Contract Documents, and when issued, will be on file in the office of the Owner at least five days before Bids are opened. In addition, all Addenda will be mailed to each person holding Contract Documents, but it shall be the Bidder's responsibility to make inquiry as to the Addenda issued. All such Addenda shall become part of the Contract and all Bidders shall be bound by such Addenda, whether or not received by the Bidders.
- Each Bidder shall, upon request of the Owner, submit a detailed financial statement on a form furnish by the Owner for that purpose. The Owner shall have the right to take such steps as it deems necessary to determine the ability of the Bidder to perform his obligations under the Contract and the Bidder shall furnish the Owner all such information and data for this purpose as it may request. The right is reserved to reject any Bid where an investigation of the available evidence or information does not satisfy the Owner that the Bidder is qualified to carry out properly the terms of the Contract.

3.0 - Overview

3.1 Project Overview

The City of Pawtucket Department of Public Works (“DPW”) seeks bids from qualified site construction contractors (“the Contractor” of “the Bidder”) for the purpose of constructing concrete sidewalks throughout the City (“the Work” or “the Project”). Bidders shall provide documentation satisfactory to the DPW that they have a minimum of three (3) years’ experience successfully constructing concrete sidewalks in a public right-of-way (ROW) setting.

The City reserves the right to award this contract to multiple contractors, in the best interest of the City.

Generally, the Contractor’s scope of Work shall consist of reconstructing existing sidewalks or constructing new sidewalks, which includes, but is not limited to, the following efforts:

- Constructing Portland cement concrete or bituminous pavement walks
- Resetting or constructing new granite or precast concrete curbing
- Constructing ADA accessible curb ramps
- Adjusting existing utility structures and signage
- Use and maintenance of temporary traffic control devices
- Administrative efforts including communication of Project schedule and coordination of site access with property owners

The Contractor shall be required to furnish all labor, materials, tools, equipment, and incidental items necessary to complete the work per the specifications, estimated quantities, and scheduling requirements described herein. The specifications for construction shall be those provided in the Rhode Island Department of Transportation’s (RIDOT) “Standard Specifications for Road and Bridge Construction,” current edition and the associated Standard Construction Details provided in Appendix E. The Work shall also comply with the requirements of the 2010 Americans with Disabilities Act (ADA) Guidelines for Accessible Design.

The term of this Contract shall be three (3) years, with an option for two (2) one (1) year extensions at the City’s sole discretion.

3.2 Project Background

City ordinances require that the cost of all sidewalk construction commissioned by its DPW under this contract shall be borne one half by the City and one half by the abutting property owner. Accordingly, the DPW administers a “50-50 Sidewalk Program” per the following standard process:

1. Property owner files application to DPW for repair of the sidewalk adjacent to their property (“the Site”), which outlines the owner’s desired scope of work.
2. DPW utilizes an engineering consultant (“the Project Engineer”) to meet with the applicant, refine the scope of work, and finalize an estimate, which is then provided to the property owner for acceptance.

3. After receipt of the applicant's payment for one half of the estimated construction cost, the DPW issues the Contractor a written notice to proceed with construction at the Site. At this point, the Contractor is given one (1) year (Winter months from approximately December 1 – March 1 is omitted) to mobilize to the Site and complete construction. The City remits payment to the Contractor following DPW's acceptance of the work.

Per this process, Work orders shall be issued to the Contractor annually: on or about March 1 - December 1. **However, the first year of work orders will NOT be available until sometime in the Summer, 2026, as a list of work orders needs to be generated following current contractor's agreement with the City, in which they are obligated to complete the existing work orders from 2025 under their contractual price agreement. Therefore, if a new contract is awarded, the agreement will begin when the new 2026 work orders are produced and delivered to the new awarded contractor.** The Work must be performed within one (1) year thereafter per the process outlined in Section 4.0. Work orders are issued per residents' applications for sidewalk repair filed at the DPW; as such, the precise quantity of Work has not yet been determined. Historically, approximately 24 Sites are addressed each year, resulting in \$125,000± in total construction value.

Also, included within the City's 50/50 sidewalk program, is to incorporate sidewalk improvements on city property only, which includes but not limited to the following:

- City Owned Facilities – Fire Stations, Police Stations, City Hall, etc.
- Parks
- City Right of Way (ROW)
- Parking Lots

3.3 Project Location

All Work shall be performed in the City of Pawtucket ("the City"), specifically: at sidewalks located within the various public ROWs of the City. Specific Work sites will be determined per applications received throughout the year.

3.4 General Requirements

- *Site Preparation:*
 - The Contractor shall be responsible for properly removing and/or protecting any obstacles (e.g. Post Office mailboxes) that may interfere with the Work at the Site, and for coordinating this effort directly with the applicant, adjacent property owners, or other affected parties as necessary. Immediately upon completion of the Work, the Contractor shall return or restore these features to their pre-construction state to the satisfaction of the DPW.
 - The Contractor shall be responsible for notifying Dig-Safe (1-888-344-7233) in accordance with Rhode Island General Laws (RIGL) Chapter 39 prior to performing any construction commissioned under this Contract. However, the Contractor is advised that not all utility companies subscribe to the Dig Safe Program. It is the Contractor's responsibility to ensure that all utility companies have been notified and all utilities have been marked

prior to commencing the work. The Contractor shall repair or replace, as necessary, any utility service damaged during the Work at no additional cost to the City.

- At a minimum, the Contractor shall adhere to the guidance set forth in the Manual on Uniform Traffic Control Devices in establishing work zone temporary traffic controls. Additionally, the Contractor is advised that diversion or detour of automobile traffic, where necessary (as per City Ordinance 351-54), shall be the responsibility of the Pawtucket Police Department. The City shall be responsible for scheduling Police details as necessary to facilitate construction. The costs associated with Police details shall be solely coordinated and compensated by the City of Pawtucket Department of Public Works (DPW).
- *Payment Applications:* The Contractor shall prepare applications for payment (invoices) that itemize the costs to construct each Site. Requests for reimbursement of police detail costs (see above) must be accompanied by documentation of the detail assignment, as provided by the Police Department.
- *Retainage:* The DPW reserves the right to withhold 5% of the total payment owned to the Contractor, per each round of construction, until all outstanding issues (i.e. “punch list” items) identified by the Project Engineer or other contract requirements have been addressed.
- ***Prevailing Wage Requirements:*** Bidders are advised that payment of the local prevailing wage, as established by the Rhode Island Department of Labor and Training, is a requirement of this Project, as outlined in Appendix B. Bidders are advised that the City will not amend this document prior to the bid due date for the purpose of notifying bidders of a superseding wage decision(s). Bidders are expected to account for the prevailing wage rates applicable to this project in the formulation of their bid.
- *Minority Business Enterprise (MBE) Goals:* The DPW intends to award a minimum of ten percent (10%) of the overall value of this contract to a Rhode-Island-registered MBE firm(s). Bidders must demonstrate that their bids include this level of participation from MBE firms, or document (to DPW’s satisfaction) that qualified MBE assistance is either unavailable, or not competitively priced.

4.0 - Scope of Work

4.1 Project Schedule

The DPW administers the “50-50 Sidewalk Program” and other associated sidewalk improvements, per the schedule included on the sample application form included as Appendix C. The DPW intends to collect applications and issue work orders to the Contractor once per year in bulk fashion. Generally, the sequence of events that comprise each application’s “life cycle” are as follows:

1. DPW collects applications during the application period. No action is taken in response to the application until the application deadline has passed.
2. After the deadline has passed, the Project Engineer arranges to meet the applicant at the Site to review the applicant’s requested scope of work, and develop a corresponding cost estimate.
3. DPW collects applicant payments until a payment deadline, at which point a list of authorized Sites and construction sketches is developed and issued to the Contractor as a bulk Work order (i.e. Notice to Proceed).
4. The Contractor must complete the Work within one (1) year (excluding the months of December 1 – March 1) days of work order issuance.

4.2 Scope Detail

A general description of the scope of Work is included below. The comprehensive scope of work is described and/or illustrated on the Site construction sketches to be developed by the Project Engineer, as well as the RIDOT Standard Specifications for Road and Bridge Construction and its associated construction details (see Appendix E), the 2010 ADA Standards for Accessible Design, and the Brick Industry Association Technical Notes 14 and 14A (see Appendix D). The Work includes, but is not limited to, the following types of construction:

4.2.1 Portland Cement Concrete Sidewalk, 4” Thickness shall be performed in accordance with Section 905 of the RIDOT Standard Specifications and the construction details (RI Standard Detail 43.1.0, notably) included in Appendix E. Portland Cement Concrete Sidewalk, 4” Thickness shall be measured for payment by the Square Yard (SY).

4.2.2 Portland Cement Concrete Driveway, 8” Thickness shall be performed in accordance with Section 905 of the RIDOT Standard Specifications and the construction details (RI Standard Detail 43.5.0, notably) included in Appendix E. Portland Cement Concrete Driveway, 8” Thickness shall be measured for payment by the Square Yard (SY).

4.2.3 Straight Precast Concrete Curb shall be performed in accordance with Section 906 of the RIDOT Standard Specifications and the construction details (RI Standard Detail 7.1.0, notably) included in Appendix E. Straight Precast Concrete Curb shall be measured for payment by the Linear Foot (LF).

4.2.4 Circular Precast Concrete Curb shall be performed in accordance with Section 906 of the RIDOT Standard Specifications and the construction details (RI Standard Details 7.1.0 and 7.6.0, notably) included in Appendix E. Circular Precast Concrete Curb shall be measured for payment by the Linear Foot (LF).

4.2.5 Precast Concrete Transition Curb 3'-0" Length shall be performed in accordance with Section 906 of the RIDOT Standard Specifications and the construction details (RI Standard Details 7.1.1 and 7.6.0, notably) included in Appendix E. Precast Concrete Transition Curb 3'-0" Length shall be measured for payment per each (EA).

4.2.6 Precast Concrete Curb 2'-0" Radius Corner shall be performed in accordance with Section 906 of the RIDOT Standard Specifications and the construction details (RI Standard Details 7.1.4 and 7.6.0, notably) included in Appendix E. Precast Concrete Curb 2'-0" Radius Corner shall be measured for payment per each (EA).

4.2.7 Precast Concrete Inlet Stone shall be performed in accordance with Section 906 of the RIDOT Standard Specifications and the construction details (RI Standard Detail 7.1.5, notably) included in Appendix E. Precast Concrete Inlet Stone shall be measured for payment per each (EA).

4.2.8 Straight Granite Curb shall be performed in accordance with Section 906 of the RIDOT Standard Specifications and the construction details (RI Standard Details 7.3.0 and 7.6.0, notably) included in Appendix E. Straight Granite Curb shall be measured for payment by the Linear Foot (LF).

4.2.9 Circular Granite Curb shall be performed in accordance with Section 906 of the RIDOT Standard Specifications and the construction details (RI Standard Details 7.3.0 and 7.6.0, notably) included in Appendix E. Circular Granite Curb shall be measured for payment by the Linear Foot (LF).

4.2.10 Granite Transition Curb 3'-0" Length shall be performed in accordance with Section 906 of the RIDOT Standard Specifications and the construction details (RI Standard Details 7.3.1 and 7.6.0, notably) included in Appendix E. Granite Transition Curb 3'-0" Length shall be measured for payment per each (EA).

4.2.11 Granite Curb 2'-0" Radius Corner shall be performed in accordance with Section 906 of the RIDOT Standard Specifications and the construction details (RI Standard Details 7.3.4 and 7.6.0, notably) included in Appendix E. Granite Curb 2'-0" Radius Corner shall be measured for payment per each (EA).

4.2.12 Granite Inlet Stone shall be performed in accordance with Section 906 of the RIDOT Standard Specifications and the construction details (RI Standard Detail 7.3.5, notably) included in Appendix E. Granite Inlet Stone shall be measured for payment per each (EA).

4.2.13 Remove, Handle, Haul, Trim, and Reset Curbing, Straight or Circular, All Types shall be performed in accordance with Section 906 of the RIDOT Standard Specifications and the construction details (RI Standard Detail 7.6.0, notably) included in Appendix E. Remove, Handle, Haul, Trim, and Reset Curbing, Straight or Circular, All Types shall be measured for payment per Linear Foot (LF).

4.2.14 Gravel Borrow Subbase Course, 8" Depth shall be performed in accordance with Section 905 of the RIDOT Standard Specifications and the construction details (RI Standard Details 43.1.0 and 43.5.0, notably) included in Appendix E. Gravel Sidewalk Base, 8" Depth shall be measured for payment by the Square Yard (SY).

4.2.15 Bituminous Pavement, 3" Depth shall be performed in accordance with Section 410 of the RIDOT Standard Specifications. Bituminous Pavement, 3" Depth shall be measured for payment by the Square Yard (SY).

- 4.2.16 Adjust Utility Frame and Cover** shall be performed in accordance with Section 707 of the RIDOT Standard Specifications. Adjust Utility Frame and Cover shall be measured for payment per Each (EA).
- 4.2.17 Adjust Curb Stop, Water Gate, or Gas Gate Box** shall be performed in accordance with Section 713 of the RIDOT Standard Specifications. Adjust Curb Stop, Water Gate, or Gas Gate Box shall be measured for payment per Each (EA).
- 4.2.18 Reset Highway Bound** shall be performed in accordance with Section 915 of the RIDOT Standard Specifications. Reset Highway Bound shall be measured for payment per Each (EA).
- 4.2.19 Saw Cut Bituminous Pavement or Sidewalk** shall be performed in accordance with Section 932 of the RIDOT Standard Specifications. Saw Cut Bituminous Pavement or Sidewalk shall be measured for payment by the Linear Foot (LF).
- 4.2.20 Saw Cut Concrete Pavement or Sidewalk** shall be performed in accordance with Section 932 of the RIDOT Standard Specifications. Saw Cut Concrete Pavement or Sidewalk shall be measured for payment by the Linear Foot (LF).
- 4.2.21 Remove and Dispose Bituminous Pavement or Sidewalk** shall be performed in accordance with Section 201 of the RIDOT Standard Specifications. Remove and Dispose Bituminous Pavement or Sidewalk shall be measured for payment by the Square Yard (SY).
- 4.2.22 Remove and Dispose Concrete Pavement or Sidewalk** shall be performed in accordance with Section 201 of the RIDOT Standard Specifications. Remove and Dispose Concrete Pavement or Sidewalk shall be measured for payment by the Square Yard (SY).
- 4.2.23 Remove and Dispose Curbing** shall be performed in accordance with Section 201 of the RIDOT Standard Specifications. Remove and Dispose Curbing shall be measured for payment by the Linear Foot (LF).
- 4.2.24 Cut and Remove Tree and Completely Remove Stump (4"-24" Caliper)** shall be performed in accordance with Section 201 of the RIDOT Standard Specifications. Cut and Remove Tree and Completely Remove Stump (4"-24" Caliper) shall be measured for payment per Each (EA).
- 4.2.25 Cut and Remove Tree and Completely Remove Stump (24"+ Caliper)** shall be performed in accordance with Section 201 of the RIDOT Standard Specifications. Cut and Remove Tree and Completely Remove Stump (24"+ Caliper) shall be measured for payment per Each (EA).
- 4.2.26 Cut and Remove Tree and Partially Remove Stump (4"-24" Caliper)** shall be performed in accordance with Section 201 of the RIDOT Standard Specifications. Cut and Remove Tree and Partially Remove Stump (4"-24" Caliper) shall be measured for payment per Each (EA).
- 4.2.27 Cut and Remove Tree and Partially Remove Stump (24"+ Caliper)** shall be performed in accordance with Section 201 of the RIDOT Standard Specifications. Cut and Remove Tree and Partially Remove Stump (24"+ Caliper) shall be measured for payment per Each (EA).

4.2.28 Remove and Dispose Loam and Grass shall be performed in accordance with Section 201 of the RIDOT Standard Specifications. Remove and Dispose Loam and Grass shall be measured for payment by the Square Yard (SY).

4.2.29 Loam and Type 1 Seed shall be performed in accordance with Sections L.01 and L.02 of the RIDOT Standard Specifications. Loam and Type 1 Seed shall be measured for payment by the Square Yard (SY).

4.2.30 Remove and Reset Brick Pavers shall be performed in accordance with Technical Notes 14 and 14A issued by the Brick Industry Association, included in this RFP as Appendix F. Contractor shall assume that in-kind replacement of 30% of existing bricks shall be necessary to perform this work. Remove and Reset Brick Pavers shall be shall be measured for payment by the Square Yard (SY).

4.2.31 Accessible Wheelchair Ramp with Precast Concrete Curbing shall be performed in accordance with Section 905 of the RIDOT Standard Specifications and the construction details (RI Standard Details 7.1.3, 43.3.0, and 43.3.1, notably) included in Appendix E. Accessible Wheelchair Ramp with Precast Concrete Curbing shall be shall be measured for payment per Each (EA).

4.2.32 Accessible Wheelchair Ramp with Granite Curbing shall be performed in accordance with Section 905 of the RIDOT Standard Specifications and the construction details (RI Standard Details 7.3.3, 43.3.0, and 43.3.1, notably) included in Appendix E. Accessible Wheelchair Ramp with Granite Curbing shall be shall be measured for payment per Each (EA).

5.0 - Insurance

The vendor shall maintain and keep in force such comprehensive general liability insurance as shall protect them from claims which may arise from operations under any contract entered into with the City of Pawtucket, whether such operations be by themselves or by anyone directly or indirectly employed by them.

The amounts of insurance shall be not less than \$1,000,000.00 combined single limit for any one occurrence covering both bodily injury and property damage, including accidental death.

The City of Pawtucket shall be named as additional insured on the vendor's General Liability Policy.

The vendor shall maintain and keep in force such Workers' compensation insurance limits as required by the statutes of the State of Rhode Island, and Employer's Liability with limits no less than \$500,000.

6.0 - Acknowledgement of Risk & Hold Harmless Agreement

In addition to the indemnity provisions in the City of Pawtucket's Terms and Conditions of Purchase and to the fullest extent permitted by law, the selected vendor, its officers, agents, servants, employees, parents, subsidiaries, partners, officers, directors, attorneys, insurers, and/or affiliates (Releasors) agree to release, waive, discharge and covenant not to sue the City of Pawtucket, its officers, agents, servants or employees (Releasees) from any and all liability, claims, cross-claims, rights in law or in equity, agreements, promises demands, actions and causes of action whatsoever arising out of or related to any loss, damage, expenses (including without limitation, all legal fees, expenses, interest and penalties) or injury (including death), of any type, kind or nature whatsoever, whether based in contract, tort, warranty, or other legal, statutory, or equitable theory of recovery, which relate to or arise out of the Releasors use of or presence in and/or on City of Pawtucket property. The Releasors agree to defend, indemnify and hold harmless the Releasees from (a) any and all claims, loss, liability, damages or costs by any person, firm, corporation or other entity claiming by, through or under Releasors in any capacity whatsoever, including all subrogation claims and/or claims for reimbursement, including any court costs and attorneys fees, that may incur due to Releasors use of or presence in and on City of Pawtucket property; and (b) any and all legal actions, including third-party actions, cross-actions, and/or claims for contribution and/or indemnity with respect to any claims by any other persons, entities, parties, which relate to or arise out of Releasors use of or presence in and on City of Pawtucket property.

The Releasors acknowledge the risks that may be involved and hazards connected with use of or presence in and on City of Pawtucket property but elect to provide services under any contract with the City of Pawtucket with full knowledge of such risks. Releasors also acknowledge that any loss, damage, and/or injury sustained by Releasors is not covered by Releasees insurance. Releasors agree to become fully aware of any safety risks involved with the performance of services under any contract with the City of Pawtucket and any safety precautions that need to be followed and agree to take all such precautions.

The duty to indemnify and/or hold harmless the City of Pawtucket shall not be limited by the insurance required under the City of Pawtucket Terms and Conditions of Purchase.

7.0 - Additional Insurance Requirements

In addition to the insurance provisions in the City of Pawtucket Terms and Conditions of Purchase, the liability insurance coverage, except Professional Liability, Errors and Omissions or Workers' Compensation insurance required for performance of a contract with the City of Pawtucket shall include the City of Pawtucket, its divisions, officers and employees as Additional Insureds but only with respect to the selected vendor's activities under the contract. The insurance required through a policy or endorsement shall include:

- A. a Waiver of Subrogation waiving any right to recovery the insurance company may have against the City of Pawtucket; and
- B. a provision that the selected vendor's insurance coverage shall be primary with respect to any insurance, self insurance or self retention maintained by the City of Pawtucket and that any insurance, self insurance or self retention maintained by the City of Pawtucket shall be in excess of the selected vendor's insurance and shall not contribute.

There shall be no cancellation, material change, potential exhaustion of aggregate limits or non-renewal without thirty (30) days written notice from the selected vendor or its insurer(s) to the City of Pawtucket's Purchasing Agent. Any failure to comply with the reporting provision of this clause shall be grounds for immediate termination of the contract with the City of Pawtucket.

Insurance coverage required under the contract shall be obtained from insurance companies acceptable to the City of Pawtucket. The selected vendor shall pay for all deductibles, self insured retentions and/or self insurance included hereunder.

The City of Pawtucket's Purchasing Agent reserves the right to consider and accept alternative forms and plans of insurance or to require additional or more extensive coverage for any individual requirement.

8.0 - Proposal Content and Organization

All bids must be submitted on the forms supplied in Section 11.0 and shall be subject to all requirements of the Contract Documents, including these instructions to bidders. All bids must be regular in every respect and no interlineations, excisions or special conditions shall be made or included in the Bid Form by the Bidder. Pricing must include all costs as specified in this solicitation.

The Owner may consider as irregular any Bid on which there is an alteration of or departure from the Bid Form hereto attached and at its option may reject the same.

Bid Documents, including the Bid, the Bid Bond, the Non-Collusion Affidavit, the Anti-Kickback Acknowledgment, and the Statement of Bidder's Qualifications (if requested) shall be enclosed in a sealed envelope which shall be clearly labeled with the words, "**Citywide Sidewalk Improvements, Bid #26-008**", as well as name of Bidder, and date of bid opening.

All Bid Forms must be signed.

If the Contract is awarded, it will be awarded by the Owner to a responsible Bidder on the basis of the lowest qualified bid price and the selected Alternative Bid items, if any.

Vendors must include on the Bid Form a list of at least four (4) references with whom they have contracted to do similar work by including the company name, telephone number, contact person, and number of years they have served this customer. Preferably, references should be municipalities which are of approximate size as the City of Pawtucket, and a website address should be included if available.

Respondents must also include an overview of their company's experience including, but not limited to, the number of years the company has been providing these services, the size of the company (including the number of employees and locations), a description of work or list of projects undertaken that is similar to what is being requested in this RFP, and, if applicable, certifications that show a knowledge of equipment that would be serviced or provided under this contract. References and documentation of experience performing similar work shall correspond wherever possible.

If any subcontractors are to be used in the performance of any work contracted for under this RFP, please list their name(s), contractor license #, address and phone number, and specific description of the subcontract work to be performed. See Proposed Subcontractors form.

Two (2) copies of your proposal—one (1) original and one digital (1) copy on a portable media device (CD, USB thumb drive, or similar)—must be submitted. Proposals must be in the following format:

Bid Form

Company overview

Length of time your firm has been in business

Length of time at current address

Documentation of experience performing sidewalk construction in public rights-of-way, as noted in Section 3.1.

All licensing (List types and business license number(s)), certification and permits as required in the Scope of Work

Please state any and all additions, deletions, and exceptions, if any, that you are taking to any portion of this proposal. If not addressed specifically, the City of Pawtucket assumes that the vendor will adhere to all terms and conditions listed in this RFP.

Submission of a proposal is acknowledgement and acceptance of the City of Pawtucket's Purchasing Rules and Regulations and General Terms and Conditions of Purchase.

9.0 - Evaluation Criteria

The evaluation of proposals will be conducted in a time frame convenient to the City.

The City of Pawtucket reserves the right to award on the basis of cost alone, accept or reject any or all proposals, and to otherwise act in its best interest including, but not limited to, directly negotiating with any Vendor who submits a proposal in response to this RFP and to award a contract based upon the results of those negotiations alone. The City reserves the right to consider as unqualified to do the work of general construction any Bidder who does not habitually perform with his own forces the major portions of the work involved in construction of the Improvements embraced in this Contract.

Further, the City reserves the right to waive irregularities it may deem minor in its consideration of proposals.

Proposals found to be technically or substantially non-responsive at any point in the evaluation process will be rejected and not considered further. The City of Pawtucket may elect to require presentations(s) by vendors in consideration for award.

Proposals will be evaluated in three (3) phases:

1. The first phase is an initial review to determine if the proposal, as submitted, is complete. To be complete, a proposal must meet all the requirements of this RFP.
2. The second phase is an in-depth analysis and review based on criteria below and their associated weights.

| <u>Evaluation Criteria</u> | <u>Importance</u> |
|----------------------------|-------------------|
| Qualifications | 20% |
| References | 10% |
| Price | 70% |

3. The third is a comparison of each proposal's weighted evaluation relative to the costs proposed.

In the event that the City requires further information and/or a demonstration of any equipment or process offered in any proposal, all vendors asked for same will do so at no cost to the City.

10.0 - Miscellaneous

- Vendors shall at all times comply with all federal, state, and local laws, ordinances and regulations and shall defend, indemnify and save harmless the City of Pawtucket against any claims arising from the violation of any such laws, ordinances and regulations, including but not limited to challenges as to the legality of any and all vendor installations.
- The City is exempt from the payment of the Rhode Island State Sales Tax under the 1956 General Laws of the State of Rhode Island, 44-18-30, Paragraph 1, as amended. Further, the City is also exempt from the payment of any excise or federal transportation taxes. The proposal prices submitted must be exclusive of same, and will be so construed.
- The City of Pawtucket reserves the right to cancel an agreement with the Vendor with thirty (30) days written notice and to award the contract to the next highest evaluated bidder.
- The City of Pawtucket reserves the right to renegotiate the terms of this contract with the Vendor for subsequent years provided the Vendor agrees to the contract terms for the renewal period.
- The payment and performance of any obligations under this contract for years beyond the first fiscal year are subject to the availability of funds.
- The City reserves the right to pay the selected Vendor via credit card at its sole discretion.

11.0 – Bid Form

26-008 – Citywide Sidewalk Improvements (Construction)

Date: _____

Submitted By: _____

(Include Name, Address and Telephone No.) _____

Name and remittance address that will appear on invoices:

Physical address of business:

General Information

Is your firm a sole proprietorship doing business under a different name? ____ Yes ____ No

If yes, please indicate sole proprietorship, a name, and the name you are doing business under.

Is your firm incorporated? ____ Yes ____ No

Will any of the work spelled out in this bid be outsourced? ____ Yes ____ No

If so, please explain below:

Have you or your firm been subject to suspension, debarment or criminal conviction by the City of Pawtucket, the State of Rhode Island, or any other jurisdiction?

Yes: _____ No: _____

Have the City of Pawtucket and/or the State of Rhode Island ever terminated contracts with your firm for cause?

Yes: _____ No: _____

Has your firm ever withdrawn from a contract with the City of Pawtucket and/or the State of Rhode Island during its performance?

Yes: _____ No: _____

Have you or your firm been involved in litigation against the City of Pawtucket and/or the State of Rhode Island.

Yes: _____ No: _____

If you answered yes to any of the foregoing, please explain the circumstances below. If you or your firm has been involved in litigation against the City of Pawtucket and/or the State of Rhode Island, please include the case caption, case number and status. (If more space is needed, please attach separate sheet and submit with the bid.)

Is your company bonded? Yes ____ No ____

Please describe the nature and extent of all insurance coverage:

Addenda

The following Addenda have been received. The noted modifications to the Bidding Documents have been considered and all costs are included in the Bid Sum.

Addendum #1, Dated: _____

Addendum #2, Dated: _____

Addendum #3, Dated: _____

References

Please list at least four (4) companies with whom you have contracted to provide similar services. Preferably, references should be municipalities which are of approximate size as the City of Pawtucket, and a website address should be included if available.

Reference #1
Company Name: _____
Contact Person: _____ Telephone #: _____
Contract Dates: _____ To _____
Website Address: _____

Reference # 2
Company Name: _____
Contact Person: _____ Telephone #: _____
Contract Dates: _____ To _____
Website Address: _____

Reference # 3
Company Name: _____
Contact Person: _____ Telephone #: _____
Contract Dates: _____ To _____
Website Address: _____

Reference # 4
Company Name: _____
Contact Person: _____ Telephone #: _____
Contract Dates: _____ To _____
Website Address: _____

Pricing Proposal

26-008

Having examined RFP #26-008, we propose to enter into a contract to perform the Work, Citywide Sidewalk Improvements, per the bid specifications outlined herein for the costs listed below, subject to the additions and deductions according to the terms of the Contract Documents: (The unit prices listed below shall be valid for the three year contract period, per this RFP.)

| ITEM NO. | ITEM DESCRIPTION | APPROX. QUANTITY | UNIT OF MEASURE | UNIT PRICE (Dollars & Cents) | SUBTOTAL (Dollars & Cents) |
|----------|--|------------------|------------------|------------------------------|----------------------------|
| 1 | PORTLAND CEMENT CONCRETE SIDEWALK (4" THICKNESS) | 700 | SY (SQUARE YARD) | _____ | _____ |
| | <i>Unit Price In Words:</i> _____ | | | | per SY |
| 2 | PORTLAND CEMENT CONCRETE DRIVEWAY (8" THICKNESS) | 200 | SY (SQUARE YARD) | _____ | _____ |
| | <i>Unit Price In Words:</i> _____ | | | | per SY |
| 3 | STRAIGHT PRECAST CONCRETE CURB | 100 | LF (LINEAR FOOT) | _____ | _____ |
| | <i>Unit Price In Words:</i> _____ | | | | per LF |
| 4 | CIRCULAR PRECAST CONCRETE CURB | 30 | LF (LINEAR FOOT) | _____ | _____ |
| | <i>Unit Price In Words:</i> _____ | | | | per LF |
| 5 | PRECAST CONCRETE TRANSITION CURB 3'-0" LENGTH | 3 | EA (EACH) | _____ | _____ |
| | <i>Unit Price In Words:</i> _____ | | | | per EA |
| 6 | PRECAST CONCRETE CURB 2'-0" RADIUS CORNER | 6 | EA (EACH) | _____ | _____ |
| | <i>Unit Price In Words:</i> _____ | | | | per EA |

CUMULATIVE SUBTOTAL CARRIED FORWARD: _____

| ITEM NO. | ITEM DESCRIPTION | APPROX. QUANTITY | UNIT OF MEASURE | UNIT PRICE (Dollars & Cents) | SUBTOTAL (Dollars & Cents) |
|----------|--|------------------|---------------------|------------------------------|----------------------------|
| 7 | PRECAST CONCRETE INLET STONE | 1 | EA (EACH) | _____ | _____ |
| | <i>Unit Price In Words:</i> _____ | | | | per EA |
| 8 | STRAIGHT GRANITE CURB | 100 | LF (LINEAR FOOT) | _____ | _____ |
| | <i>Unit Price In Words:</i> _____ | | | | per LF |
| 9 | CIRCULAR GRANITE CURB | 30 | LF (LINEAR FOOT) | _____ | _____ |
| | <i>Unit Price In Words:</i> _____ | | | | per LF |
| 10 | GRANITE TRANSITION CURB, 3'-0" LENGTH | 3 | EA (EACH) | _____ | _____ |
| | <i>Unit Price In Words:</i> _____ | | | | per EA |
| 11 | GRANITE CURB 2'-0" RADIUS CORNER | 6 | EA (EACH) | _____ | _____ |
| | <i>Unit Price In Words:</i> _____ | | | | per EA |
| 12 | GRANITE INLET STONE | 1 | EA (EACH) | _____ | _____ |
| | <i>Unit Price In Words:</i> _____ | | | | per EA |
| 13 | REMOVE, HANDLE, HAUL, TRIM, AND RESET CURBING, STRAIGHT OR CIRCULAR, ALL TYPES | 600 | LF (LINEAR FOOT) | _____ | _____ |
| | <i>Unit Price In Words:</i> _____ | | | | per LF |

CUMULATIVE SUBTOTAL CARRIED FORWARD: _____

| ITEM NO. | ITEM DESCRIPTION | APPROX. QUANTITY | UNIT OF MEASURE | UNIT PRICE (Dollars & Cents) | SUBTOTAL (Dollars & Cents) |
|----------|---|------------------|---------------------|------------------------------|----------------------------|
| 14 | GRAVEL BORROW SUBBASE COURSE, 8" DEPTH | 900 | SY (SQUARE YARD) | _____ | _____ |
| | <i>Unit Price In Words:</i> | | | _____ | per SY |
| 15 | BITUMINOUS PAVEMENT 3" DEPTH | 200 | SY (SQUARE YARD) | _____ | _____ |
| | <i>Unit Price In Words:</i> | | | _____ | per SY |
| 16 | ADJUST UTILITY FRAME AND COVER | 3 | EA (EACH) | _____ | _____ |
| | <i>Unit Price In Words:</i> | | | _____ | per EA |
| 17 | ADJUST CURB STOP, WATER GATE, OR GAS GATE BOX | 50 | EA (EACH) | _____ | _____ |
| | <i>Unit Price In Words:</i> | | | _____ | per EA |
| 18 | RESET HIGHWAY BOUND | 1 | EA (EACH) | _____ | _____ |
| | <i>Unit Price In Words:</i> | | | _____ | per EA |
| 19 | SAW CUT BITUMINOUS PAVEMENT OR SIDEWALK | 1000 | LF (LINEAR FOOT) | _____ | _____ |
| | <i>Unit Price In Words:</i> | | | _____ | per LF |
| 20 | SAW CUT CONCRETE PAVEMENT OR SIDEWALK | 275 | LF (LINEAR FOOT) | _____ | _____ |
| | <i>Unit Price In Words:</i> | | | _____ | per LF |

CUMULATIVE SUBTOTAL CARRIED FORWARD: _____

| ITEM NO. | ITEM DESCRIPTION | APPROX. QUANTITY | UNIT OF MEASURE | UNIT PRICE (Dollars & Cents) | SUBTOTAL (Dollars & Cents) |
|----------|--|------------------|---------------------|------------------------------|----------------------------|
| 21 | REMOVE AND DISPOSE BITUMINOUS PAVEMENT OR SIDEWALK | 200 | SY (SQUARE YARD) | _____ | _____ |
| | <i>Unit Price In Words:</i> | | | _____ | per SY |
| 22 | REMOVE AND DISPOSE CONCRETE PAVEMENT OR SIDEWALK | 900 | SY (SQUARE YARD) | _____ | _____ |
| | <i>Unit Price In Words:</i> | | | _____ | per SY |
| 23 | REMOVE AND DISPOSE CURBING, ALL TYPES | 200 | LF (LINEAR FOOT) | _____ | _____ |
| | <i>Unit Price In Words:</i> | | | _____ | per LF |
| 24 | CUT AND REMOVE TREE & COMPLETELY REMOVE STUMP (4"-24" CALIPER) | 8 | EA (EACH) | _____ | _____ |
| | <i>Unit Price In Words:</i> | | | _____ | per EA |
| 25 | CUT AND REMOVE TREE & COMPLETELY REMOVE STUMP (24"+ CALIPER) | 2 | EA (EACH) | _____ | _____ |
| | <i>Unit Price In Words:</i> | | | _____ | per EA |
| 26 | CUT AND REMOVE TREE & PARTIALLY REMOVE STUMP (4"-24" CALIPER) | 8 | EA (EACH) | _____ | _____ |
| | <i>Unit Price In Words:</i> | | | _____ | per EA |
| 27 | CUT AND REMOVE TREE & PARTIALLY REMOVE STUMP (24"+ CALIPER) | 2 | EA (EACH) | _____ | _____ |
| | <i>Unit Price In Words:</i> | | | _____ | per EA |

CUMULATIVE SUBTOTAL CARRIED FORWARD: _____

| ITEM NO. | ITEM DESCRIPTION | APPROX. QUANTITY | UNIT OF MEASURE | UNIT PRICE (Dollars & Cents) | SUBTOTAL (Dollars & Cents) |
|----------|---|------------------|---------------------|------------------------------|----------------------------|
| 28 | REMOVE AND DISPOSE LOAM AND GRASS | 10 | SY (SQUARE YARD) | _____ | _____ |
| | <i>Unit Price In Words:</i> | | | _____ | per SY |
| 29 | LOAM AND TYPE 1 SEED | 10 | SY (SQUARE YARD) | _____ | _____ |
| | <i>Unit Price In Words:</i> | | | _____ | per SY |
| 30 | REMOVE AND RESET BRICK PAVERS | 30 | SY (SQUARE YARD) | _____ | _____ |
| | <i>Unit Price In Words:</i> | | | _____ | per SY |
| 31 | ACCESSIBLE WHEELCHAIR RAMP WITH GRANITE CURB | 4 | EA (EACH) | _____ | _____ |
| | <i>Unit Price In Words:</i> | | | _____ | per EA |
| 32 | ACCESSIBLE WHEELCHAIR RAMP WITH PRECAST CONCRETE CURB | 4 | EA (EACH) | _____ | _____ |
| | <i>Unit Price In Words:</i> | | | _____ | per EA |
| 33 | ALLOWANCE FOR PAWTUCKET POLICE DETAILS | 1 | LUMP SUM (LS) | \$15,000 | \$15,000 |
| | <i>Unit Price In Words:</i> | | | _____ | per LS |

TOTAL BID: _____

Note: Total Bid shown above shall match the Total Cost shown on the next page of this bid form. All project costs including labor, equipment, materials, overhead, and profit to complete the Work shall be included.

Pricing Proposal

26-008

Having examined RFP #26-008, we propose to enter into a contract to perform the Work, Sidewalk Improvements, per the bid specifications outlined herein for the cost listed below, subject to the additions and deductions according to the terms of the Contract Documents:

The Total Cost for Sidewalk Construction is:

| | | | | | | | | | | | | | | |
|----|--|--|--|---|--|--|--|---|--|--|--|---|--|--|
| \$ | | | | , | | | | , | | | | . | | |
|----|--|--|--|---|--|--|--|---|--|--|--|---|--|--|

Numeric

Written

Bid Form Signature

By: _____
(Signature)

(Bidder Name – Please Print)

Title: _____

Date: _____

***** **BID FORM MUST BE SIGNED** *****

Appendix A

ANTI-KICKBACK ACKNOWLEDGMENT

ALL BIDDERS/OFFERORS MUST ATTEST TO THE FOLLOWING:

The vendor acknowledges, under the pains and penalties of perjury, that he/she has not been offered, paid, or solicited for any contribution or compensation, nor has he/she been granted a gift, gratuity, or other consideration, either directly or indirectly by any officer, employee or member of the governing body of the City of Pawtucket who exercises any functions or responsibilities in connection with either the award or execution of the project to which this contract pertains.

Further, the vendor acknowledges, under the pains and penalties of perjury, that he/she has not offered, paid, or solicited by way of any contribution or compensation, nor has he/she granted a gift, gratuity or other consideration either directly or indirectly to any officer, employee, or member of the governing body of the City of Pawtucket who exercises any functions or responsibilities in connection with either the award or execution of the project to which this project or contract pertains.

SIGNATURE OF OFFEROR

DATE

TITLE

COMPANY

Title of RFP:

Appendix B

CITY OF PAWTUCKET GENERAL TERMS AND CONDITIONS OF PURCHASE

Preamble

The City of Pawtucket's Purchasing Office may, from time to time, make amendments to the General Terms and Conditions when the City of Pawtucket's Purchasing Agent determines that such amendments are in the best interest of the City of Pawtucket. Amendments shall be made available for public inspection at the Purchasing Office located in Pawtucket City Hall but shall not require formal public notice and hearing. Copies of the Terms and Conditions shall be provided to any individual or firm requesting them.

CITY OF PAWTUCKET'S PURCHASING OFFICE GENERAL CONDITIONS OF PURCHASE

All City of Pawtucket purchase orders, contracts, solicitations, delivery orders and service requests shall incorporate and be subject to the provisions of Rhode Island General Laws 8-15-4 and the City of Pawtucket purchasing rules and regulations adopted pursuant thereto, all other applicable provisions of the Rhode Island General Laws, the Pawtucket City Charter, specific requirements described in the Request or Contract, and the following General Conditions of Purchase:

1. **GENERAL**

All purchase orders, contracts, solicitations, delivery orders, and service requests are for specified goods and services, in accordance with express terms and conditions of purchase, as defined herein. For the purposes of this document, the terms "bidder" and "contractor" refer to any individual, firm, corporation, or other entity presenting a proposal indicating a desire to enter into contracts with the City of Pawtucket, or with whom a contract is executed by the City of Pawtucket's Purchasing Agent, and the term "contractor" shall have the same meaning as "vendor".

2. **ENTIRE AGREEMENT**

The City of Pawtucket's Purchase Order, or other City of Pawtucket contract endorsed by the City of Pawtucket Purchasing Office, shall constitute the entire and exclusive agreement between the City of Pawtucket and any contractor receiving an award. In the event any conflict between the bidder's standard terms of sale, these conditions or more specific provisions contained in the solicitation shall govern.

All communication between the City of Pawtucket and any contractor pertaining to any award or contract shall be accomplished in writing.

- a. Each proposal will be received with the understanding that the acceptance, in writing, by contract or Purchase Order by the City of Pawtucket Purchasing Agent of the offer to do work or to furnish any or all the materials, equipment, supplies or services described therein shall constitute a contract between the bidder and the City of Pawtucket. This shall bind the bidder on his part to furnish and deliver at the prices and in accordance with the conditions of said accepted proposal and detailed specifications and the City of Pawtucket on its part to order from such contractor (except in case of emergency) and to pay for at the agreed prices, all materials, equipment, supplies or services specified and delivered. A contract shall be deemed executory only to the extent of funds available for payment of the amounts shown on Purchase Orders issued by the City of Pawtucket to the contractors.
- b. No alterations or variations of the terms of the contract shall be valid or binding upon the City of Pawtucket unless submitted in writing and accepted by the City of Pawtucket Purchasing Agent. All orders and changes thereof must emanate from the City of Pawtucket Purchasing Office: no oral agreement or arrangement made by a contractor with a department or employee will be considered to be binding on the City of Pawtucket Purchasing Agent, and may be disregarded.
- c. Contracts will remain in force for the contract period specified or until all articles or services ordered before date of termination shall have been satisfactorily delivered or rendered and accepted and thereafter until all terms and conditions have been met, unless:
 1. terminated prior to expiration date by satisfactory delivery against orders of entire quantities, or
 2. extended upon written authorization of the City of Pawtucket Purchasing Agent and accepted by the contractor, to permit ordering of the unordered balances or

additional quantities at the contract price and in accordance with the contract terms, or

3. canceled by the City of Pawtucket in accordance with other provisions stated herein.

- d. It is mutually understood and agreed that the contractor shall not assign, transfer, convey, sublet or otherwise dispose of this contract or his right, title or interest therein, or his power to execute such contract, to any other person, company or corporation, without the previous consent, in writing, of the City of Pawtucket Purchasing Agent.

- e. If, subsequent to the submission of an offer or issuance of a purchase order or execution of a contract, the bidder or contractor shall merge with or be acquired by another entity, the contract may be terminated, except as a corporate resolution prepared by the contractor and the new entity ratifying acceptance of the original bid or contract terms, condition, and pricing is submitted to the City of Pawtucket Purchasing Office, and expressly accepted.

- f. The contractor or bidder further warrants by submission of an offer or acceptance of a purchase order or other contract that he has no knowledge at the time of such action of any outstanding and delinquent or otherwise unsettled debt owed by him to the City of Pawtucket, and agrees that later discovery by the City of Pawtucket Purchasing Agent that this warranty was given in spite of such knowledge, except where the matter is pending in hearing or from any appeal therefrom, shall form reasonable grounds for termination of the contract.

3. SUBCONTRACTS

No subcontracts or collateral agreements shall be permitted, except with the City of Pawtucket's express written consent. Upon request, contractors must submit to the City of Pawtucket Purchasing Office a list of all subcontractors to be employed in the performance of any Purchase Order or other contract arising from this Request.

4. RELATIONSHIP OF PARTIES

The contractor or bidder warrants, by submission of an offer or acceptance of a purchase order or other contract, that he is not an employee, agent, or servant of the City of Pawtucket, and that he is fully qualified and capable in all material regards to provide the specified goods and services. Nothing herein shall be construed as creating any contractual relationship or obligation between the City of Pawtucket and any sub-bidder, subcontractor, supplier, or employee of the contractor or offeror.

5. COSTS OF PREPARATION

All costs associated with the preparation, development, or submission of bids or other offers will be borne by the offeror. The City of Pawtucket will not reimburse any offeror for such costs.

6. SPECIFIED QUANTITY REQUIREMENT

Except where expressly specified to the contrary, all solicitations and contracts are predicated on a specified quantity of goods or services, or for a specified level of funding.

- a. The City of Pawtucket reserves the right to modify the quantity, scope of service, date of delivery or completion, or funding of any contract, with no penalty or charge, by written notice to the contractor, except where alternate terms have been expressly made a part of the contract.

- b. The City of Pawtucket shall not accept quantities in excess of the specified quantity except where the item is normally sold by weight (where sold by weight, the City of Pawtucket will not accept quantities greater than ten per cent [10%] of the specified quantity), or where the Request or Contract provides for awards for other than exact quantities.

- c. Purchase Orders or other contracts may be increased in quantity or extended in term without subsequent solicit with the mutual consent of the contractor and the City of Pawtucket, where determined by the City of Pawtucket Purchasing Agent to be in the City of Pawtucket's best interest.

7. TERM AND RENEWAL

Where offers have been requested or contracts awarded for terms exceeding periods of twelve (12) months, it is mutually understood and agreed that the City of Pawtucket's commitment is limited to a base term not to exceed twelve (12) months, subject to renewal annually at the City of Pawtucket's sole option for successive terms as otherwise described, except where expressly specified to the contrary. Purchase orders appearing to commit to obligations of funding or terms of performance may be executed for administrative convenience, but are otherwise subject to this provision, and in such cases the City of Pawtucket's renewal shall be deemed to be automatic, conditional on the continued availability of appropriated funds for the purpose, except as written notice of the City of Pawtucket's intent not to renew is served.

8. DELIVERY/COMPLETION

Delivery must be made as ordered and/or projects completed in accordance with the proposal. If delivery qualifications do not appear on the bidder's proposal, it will be interpreted to mean that goods are in stock and that shipment will be made within seven (7) calendar days. If the project completion date is not specified in the proposal, the date shall be determined by the City of Pawtucket Purchasing Agent. The decision of the City of Pawtucket Purchasing Agent, as to reasonable compliance with the delivery terms, and date of completion shall be final. Burden of proof of delay in receipt of order shall rest with the contractor. No delivery charges shall be added to invoices except when authorized on the Purchase Order.

9. FOREIGN CORPORATIONS

In accordance with Title 7 Chapter 1.1 ("Business Corporations") of the General Laws of Rhode Island, no foreign corporation shall have the right to transact business in this state until it shall have procured a certificate of authority so to do from the Secretary of State.

10. PRICING

All pricing offered or extended to the City of Pawtucket is considered to be firm and fixed unless expressly provided for to the contrary. All prices shall be quoted F.O.B. Destination with freight costs included in the unit cost to be paid by the City of Pawtucket, except, where the Request or Contract permits, offers reflecting F.O.B. Shipping Point will be considered, and freight costs may then be prepaid and added to the invoice.

11. COLLUSION

Bidder or contractor warrants that he has not, directly or indirectly, entered into any agreements or participated in any collusion or otherwise taken any action in restraint of full competitive bidding. In special circumstances, an executed affidavit will be required as a part of the bid.

12. PROHIBITION AGAINST CONTINGENT FEES AND GRATUITIES

Bidder or contractor warrants that he has not paid, and agrees not to pay, any bonus, commission, fee, or gratuity to any employee or official of the City of Pawtucket for the purpose of obtaining any contract or award issued by the City of Pawtucket. Bidder or contractor further warrants that no commission or other payment has been or will be received from or paid to any third party contingent on the award of any contract by the City of Pawtucket, except as shall have been expressly communicated to the City of Pawtucket Purchasing Agent in writing prior to acceptance of the contract or award in question. Subsequent discovery by the City of Pawtucket of non-compliance with these provisions shall constitute sufficient cause for immediate termination of all outstanding contracts and suspension or debarment of the bidder(s) or contractor(s) involved.

13. AWARDS

Awards will be made with reasonable promptness and by written notice to the successful bidder (only); bids are considered to be irrevocable for a period of ninety (90) days following the bid opening unless expressly provided for to the contrary in the Request, and may not be withdrawn during this period without the express permission of the City of Pawtucket Purchasing Agent.

- a. Awards shall be made to the bidder(s) whose offer(s) constitutes the lowest responsive price offer (or lowest responsive price offer on an evaluated basis) for the item(s) in question or for the Request as a whole, at the option of the City of Pawtucket. The City of Pawtucket reserves the right to determine those offers which are responsive to the Request, or which otherwise serve its best interests.
- b. The City of Pawtucket reserves the right, before making award, to initiate investigations as to whether or not the materials, equipment, supplies, qualifications or facilities offered by the bidder meet the requirements set forth in the proposal and specification, and are ample

and sufficient to insure the proper performance of the contract in the event of award. If upon such examination it is found that the conditions of the proposal are not complied with or that articles or equipment proposed to be furnished do not meet the requirements called for, or that the qualifications or facilities are not satisfactory, the City of Pawtucket may reject such a bid. It is distinctly understood, however, that nothing in the foregoing shall mean or imply that it is obligatory upon the City of Pawtucket to make any examinations before awarding a contract; and it is further understood that if such examination is made, it in no way relieves the contractor from fulfilling all requirements and conditions of the contract.

- c. Qualified or conditional offers which impose limitations of the bidder's liability or modify the requirements of the bid, offers for alternate specifications, or which are made subject to different terms and conditions than those specified by the City of Pawtucket may, at the option of the City of Pawtucket, be
 - 1. rejected as being non-responsive, or
 - 2. set aside in favor of the City of Pawtucket's terms and conditions (with the consent of the bidder), or
 - 3. accepted, where the City of Pawtucket Purchasing Agent determines that such acceptance best serves the interests of the City of Pawtucket.Acceptance or rejection of alternate or counter-offers by the City of Pawtucket shall not constitute a precedent which shall be considered to be binding on successive solicitations or procurements.
- d. Bids submitted in pencil, or which do not bear an original signature, in ink, by an owner or authorized agent thereof, will not be accepted.
- e. Bids must be extended in the unit of measure specified in the Request. In the event of any discrepancy between unit prices and their extensions, the unit price will govern.
- f. The City of Pawtucket Purchasing Agent reserves the right to determine the responsibility of any bidder for a particular procurement.
- g. The City of Pawtucket Purchasing Agent reserves the right to reject any and all bids in whole or in part, to waive technical defects, irregularities, and omissions, and to give consideration to past performance of the offerors where, in his judgment the best interests of the City of Pawtucket will be served by so doing.
- h. The City of Pawtucket Purchasing Agent reserves the right to make awards by items, group of items or on the total low bid for all the items specified as indicated in the detailed specification, unless the bidder specifically indicates otherwise in his bid.
- i. Preference may be given to bids on products raised or manufactured in the City of Pawtucket or State of Rhode Island, other things being equal.
- j. The impact of discounted payment terms shall not be considered in evaluating responses to any Request.
- k. The City of Pawtucket Purchasing Agent reserves the right to act in the City of Pawtucket's best interests regarding awards caused by clerical errors by the City of Pawtucket Purchasing Office.

14. SUSPENSION AND DEBARMENT

The City of Pawtucket Purchasing Agent may suspend or debar any vendor or potential bidder, for good cause shown:

- a. A debarment or suspension against a part of a corporate entity constitutes debarment or suspension of all of its divisions and all other organizational elements, except where the action has been specifically limited in scope and application, and may include all known corporate affiliates of a contractor, when such offense or act occurred in connection with the affiliate's performance of duties for or on behalf of the contractor, or with the knowledge, approval, or acquiescence of the contractor or one or more of its principals or directors (or where the contractor otherwise participated in, knew of, or had reason to know of the acts).
- b. The fraudulent, criminal or other serious improper conduct of any officer, director, shareholder, partner, employee, or any other individual associated with a contractor may be imputed to the contractor when the conduct occurred in connection with the individual's performance of duties for or on behalf of the contractor, or with the contractor's knowledge, approval or acquiescence. The contractor's acceptance of benefits derived from the conduct shall be evidence of such knowledge, approval, or acquiescence.
- c. A vendor or contractor who knowingly engages as a subcontractor for a contract awarded by the City of Pawtucket to a vendor or contractor then under a ruling of suspension or debarment by the City of Pawtucket shall be subject to disallowance of cost, annulment or

termination of award, issuance of a stop work order, or debarment or suspension, as may be judged to be appropriate by the City of Pawtucket's Purchasing Agent.

15. PUBLIC RECORDS

Contractors and bidders are advised that certain documents, correspondence, and other submissions to the City of Pawtucket's Purchasing Office may be voluntarily made public by the City of Pawtucket absent specific notice that portions of such submittals may contain confidential or proprietary information, such that public access to those items should be withheld.

16. PRODUCT EVALUATION

In all specifications, the words "or equal" are understood after each article when manufacturer's name or catalog are referenced. If bidding on items other than those specified, the bidder must, in every instance, give the trade designation of the article, manufacturer's name and detailed specifications of the item the bidder proposes to furnish; otherwise, the bid will be construed as submitted on the identical commodity described in the detailed specifications. The City of Pawtucket's Purchasing Agent reserves the right to determine whether or not the item submitted is the approved equal the detailed specifications.

- a. Any objections to specifications must be filed by a bidder, in writing, with the City of Pawtucket's Purchasing Agent at least 96 hours before the time of bid opening to enable the City of Pawtucket's Purchasing Office to properly investigate the objections.
- b. All standards are minimum standards except as otherwise provided for in the Request or Contract.
- c. Samples must be submitted to the City of Pawtucket's Purchasing Office in accordance with the terms of the proposals and detailed specifications. Samples must be furnished free of charge and must be accompanied by descriptive memorandum invoices indicating whether or not the bidder desires their return and specifying the address to which they are to be returned (at the bidder's risk and expense), provided they have not been used or made useless by tests; and absent instructions, the samples shall be considered to be abandoned. Award samples may be held for comparison with deliveries.
- d. All samples submitted are subject to test by any laboratory the City of Pawtucket's Purchasing Agent may designate.

17. PRODUCT ACCEPTANCE

All merchandise offered or otherwise provided shall be new, of prime manufacture, and of first quality unless otherwise specified by the City of Pawtucket. The City of Pawtucket reserves the right to reject all nonconforming goods, and to cause their return for credit or replacement, at the City of Pawtucket's option. Contract deliverables specified for procurements of services shall be construed to be work products, and subject to the provisions of this section.

- a. Failure by the City of Pawtucket to discover latent defect(s) or concealed damage or non-conformance shall not foreclose the City of Pawtucket's right to subsequently reject the goods in question.
- b. Formal or informal acceptance by the City of Pawtucket of non-conforming goods shall not constitute a precedent for successive receipts or procurements.
- c. Where the contractor fails to promptly cure the defect or replace the goods, the City of Pawtucket reserves the right to cancel the Purchase Order, contract with a different contractor, and to invoice the original contractor for any differential in price over the original contract price.
- d. When materials, equipment or supplies are rejected, the same must be removed by the contractor from the premises of the City of Pawtucket within forty-eight (48) hours of notification. Rejected items left longer than two days will be regarded as abandoned and the City of Pawtucket shall have the right to dispose of them as its own property.

18. PRODUCT WARRANTIES

All product or service warranties normally offered by the contractor or bidder shall accrue to the City of Pawtucket's benefit, in addition to any special requirements which may be imposed by the City of Pawtucket. Every unit delivered must be guaranteed against faulty material and workmanship for a period of one year unless otherwise specified, and the City of Pawtucket may, in the event of failure, order its replacement, repair, or return for full credit, at its sole option.

19. PAYMENT

Unless otherwise provided for by the Request or Contract, payment shall not be made until delivery has been made, or services performed, in full, and accepted. Payment shall not be due prior to thirty (30) working days following the latest of completion, acceptance, or the rendering of a properly submitted invoice.

- a. Payment terms other than the foregoing may be rejected as being nonresponsive.
- b. No partial shipments, or partial completion will be accepted, unless provided for by the Request or Contract.
- c. Where a question of quality is involved, or failure to complete a project by the specified due date, payment in whole or part against which to charge back any adjustment required, shall be withheld at the direction of the City of Pawtucket Purchasing Agent. In the event a cash discount is stipulated, the withholding of payments, as herein described, will not deprive the City of Pawtucket from taking such discount.
- d. Payments for used portion of inferior delivery or late delivery will be made by the City of Pawtucket on an adjusted price basis.
- e. Payments on contracts under architectural or engineering supervision must be accompanied by a Certificate of Payment and Statement of Account signed by the architect or engineer and submitted to the City of Pawtucket Purchasing Office for approval.

20. **THIRD PARTY PAYMENTS**

The City of Pawtucket recognizes no assigned or collateral rights to any purchase agreement except as may be expressly provided for in the bid or contract documents, and will not accede to any request for third party or joint payment(s), except as provided for in specific orders by a court of competent jurisdiction, or by express written permission of the City of Pawtucket's Purchasing Agent. Where an offer is contingent upon such payment(s), the offeror is obligated to serve affirmative notice in his bid submission.

21. **SET-OFF AGAINST PAYMENTS**

Payments due the contractor may be subject to reduction equal to the amount of unpaid and delinquent state taxes (or other just debt owed to the State), except where notice of delinquency has not been served or while the matter is pending in hearing or from any appeal therefrom.

22. **CLAIMS**

Any claim against a contractor may be deducted by the City of Pawtucket from any money due him in the same or other transactions. If no deduction is made in such fashion, the contractor shall pay the City of Pawtucket the amount of such claim on demand. Submission of a voucher and payment, thereof, by the City of Pawtucket shall not preclude the City of Pawtucket's Purchasing Agent from demanding a price adjustment in any case when the commodity delivered is later found to deviate from the specifications and proposal.

- a. The City of Pawtucket's Purchasing Agent may assess dollar damages against a vendor or contractor determined to be non-performing or otherwise in default of their contractual obligations equal to the cost of remedy incurred by the City of Pawtucket, and make payment of such damages a condition for consideration for any subsequent award. Failure by the vendor or contractor to pay such damages shall constitute just cause for disqualification and rejection, suspension, or debarment.

23. **CERTIFICATION OF FUNDING**

The Director of Finance shall provide certification as to the availability of funds to support the procurement for the current fiscal year ending June 30th only. Where delivery or service requirements extend beyond the end of the current fiscal year, such extensions are subject to both the availability of appropriated funds and a determination of continued need.

24. **UNUSED BALANCES**

Unless otherwise specified, all unused Blanket Order quantities and/or unexpended funds shall be automatically canceled on the expiration of the specified term. Similarly, for orders encompassing more than one fiscal year, unexpended balances of funding allotted for an individual fiscal year may be liquidated at the close of that fiscal year, at the City of Pawtucket's sole option.

25. **MINORITY BUSINESS ENTERPRISES**

Pursuant to the provisions of Title 37 Chapter 14.1 of the General Laws, the City of Pawtucket reserves the right to apply additional consideration to offers, and to direct awards to bidders other than the responsive bid representing the lowest price where:

- a. the offer is fully responsive to the terms and conditions of the Request, and
- b. the price offer is determined to be within a competitive range (not to exceed 5% higher than the lowest responsive price offer) for the product or service, and
- c. the firm making the offer has been certified by the R.I. Department of Economic Development to be a small business concern meeting the criteria established to be considered a Minority Business Enterprise.

26. PREVAILING WAGE REQUIREMENT

In accordance with Title 37 Chapter 13 of the General Laws of Rhode Island, payment of the general prevailing rate of per diem wages and the general prevailing rate for regular, overtime and other working conditions existing in the locality for each craft, mechanic, teamster, or type of workman needed to execute this work is a requirement for both contractors and subcontractors for all public works projects.

The rates of pay set forth under this contract, are the minimum to be paid during the life of the Contract. It is therefore, the responsibility of Bidders to inform themselves as to local labor conditions, such as the length of work day and work week, overtime compensation, health and welfare contributions, labor supply and prospective changes or adjustments of rates.

Certified weekly payrolls and statement of compliance forms are required from contractors and subcontractors. Submit on State of Rhode Island Department of Labor and Training forms.

See Appendix C of this document for general wage decision.

27. EQUAL OPPORTUNITY COMPLIANCE, HANDICAPPED ACCESS AND AFFIRMATIVE ACTION

Contractors of the City of Pawtucket are required to demonstrate the same commitment to equal opportunity as prevails under federal contracts controlled by Federal Executive Orders 11246, 11625, 11375 and 11830, and Title 28 Chapter 5.1 of the General Laws of Rhode Island. Affirmative action plans shall be submitted by the contractor for review by the State Equal Opportunity Office. A contractor's failure to abide by the rules, regulations, contract terms and compliance reporting provisions as established shall be grounds for forfeiture and penalties as shall be established, including but not limited to suspension.

28. DRUG-FREE WORKPLACE REQUIREMENT

Contractors who do business with the City of Pawtucket and their employees shall abide by the State's drug-free workplace policy and the contractor shall so attest by signing a certificate of compliance.

29. TAXES

The City of Pawtucket is exempt from payment of excise, transportation and sales tax imposed by the Federal or State Government. These taxes should not be included in the proposal price. Exemption Certificates will be furnished upon request.

30. INSURANCE

All construction contractors, independent tradesmen, or firms providing any type of maintenance, repair, or other type of service to be performed on City of Pawtucket premises, buildings, or grounds are required to purchase and maintain coverage with a company or companies licensed to do business in the state as follows:

- a. Comprehensive General Liability Insurance
 - 1) Bodily Injury \$500,000 each occurrence/ \$1,000,000 annual aggregate
 - 2) Property Damage \$500,000 each occurrence /\$500,000 annual aggregateIndependent Contractors
Contractual - including construction hold harmless and other types of contracts or agreements in effect for insured operations
Completed Operations
Personal Injury (with employee exclusion deleted)
- b. Automobile Liability Insurance

- Combined Single Limit not less than \$150,000 each occurrence
- Bodily Injury
- Property Damage, and in addition non-owned and/or hired vehicles and equipment
- c. Workers' Compensation Insurance
- As required by the General Laws of Rhode Island.

The City of Pawtucket's Purchasing Agent reserves the right to consider and accept alternate forms and plans of insurance or to require additional or more extensive coverage for any individual requirement. Successful bidders shall provide certificates of coverage, reflecting the City of Pawtucket as an additional insured, to the City of Pawtucket Purchasing Office, forty-eight (48) hours prior to the commencement of work, as a condition of award. Failure to comply with this provision shall result in rejection of the offeror's bid.

31. **BID SURETY**

When requested, a bidder must furnish a Bid Bond or Certified Check for 5% of his bid, or for the stated amount shown in the solicitation. Bid Bonds must be executed by a reliable Surety Company authorized to do business in the State of Rhode Island. Failure to provide Bid Surety with bid may be cause for rejection of bid. The Bid Surety of any three bidders in contention will be held until an award has been made according to the specifications of each proposal. All others will be returned by mail within 48 hours following the bid opening. Upon award of a contract, the remaining sureties will be returned by mail unless instructed to do otherwise.

32. **PERFORMANCE AND LABOR AND PAYMENT BONDS**

A performance bond and labor and payment bond of up to 100% of an award may be required by the City of Pawtucket's Purchasing Agent. Bonds must meet the following requirements:

- a. Corporation: The Bond must be signed by an official of the corporation above his/her official title and the corporate seal must be affixed over his/her signature.
- b. Firm or Partnership: The Bond must be signed by all of the partners and must indicate that they are " Doing Business As (name of firm)."
- c. Individual: The Bond must be signed by the individual owning the business and indicate "Owner."
- d. The Surety Company executing the Bond must be licensed to do business in the State of Rhode Island or Bond must be countersigned by a company so licensed.
- e. The Bond must be signed by an official of the Surety Company and the corporate seal must be affixed over his signature.
- f. Signatures of two witnesses for both the principal and the Surety must appear on the Bond.
- g. A Power of Attorney for the official signing of the Bond for the Surety Company must be submitted with the Bond.

33. **SUSPENSION, DEFAULT AND TERMINATION**

a. Suspension of a Contract by the City of Pawtucket
The City of Pawtucket reserves the right at any time and for any reason to suspend all or part of this contract, for a reasonable period, not to exceed sixty days, unless the parties agree to a longer period. The City of Pawtucket shall provide the contractor with written notice of the suspension order signed by the Purchasing Agent or his or her designee, which shall set forth the date upon which the suspension shall take effect, the date of its expiration, and all applicable instructions. Upon receipt of said order, the contractor shall immediately comply with the order and suspend all work under this contract as specified in the order. The contractor shall take all reasonable steps to mitigate costs and adverse impact to the work specified in the contract during the suspension period. Before the order expires, the City of Pawtucket shall either:

- 1. cancel the suspension order;
- 2. extend the suspension order for a specified time period not to exceed thirty (30) days; or
- 3. terminate the contract as provided herein.

The contractor shall resume performance once a suspension order issued under this section is canceled or expires. If as a result of the suspension of performance, there is a financial or schedule impact upon the contract, an appropriate adjustment may be made by, or with the approval of, the City of Pawtucket's Purchasing Agent. Any adjustment shall be set forth in writing. After a suspension order has been canceled or expires, the contractor shall provide any request for

adjustment to the City of Pawtucket's Purchasing Agent within thirty (30) days after resuming work performance.

b. Termination of a Contract by the City of Pawtucket

1. Termination for Default or Nonperformance

If, for any reason, the contractor breaches the contract by failing to satisfactorily fulfill or perform any obligations, promises, terms, or conditions, and having been given reasonable notice of and opportunity to cure such default, fails to take satisfactory corrective action within the time specified by the City of Pawtucket, the City of Pawtucket may terminate the contract, in whole or in part, the termination of all outstanding contracts or sub-contracts held by the contractor, and the suspension or debarment of the contractor from future procurements by giving written notice to the contractor specifying the date for termination. The City of Pawtucket shall endeavor to provide such notice at least seven (7) calendar days before the effective date of the termination.

A contractor who fails to commence within the time specified or complete an award made for repairs, alterations, construction, or any other service will be considered in default of contract. If contractor consistently fails to deliver quantities or otherwise perform as specified, the City of Pawtucket's Purchasing Agent reserves the right to terminate the contract and contract for completion of the work with another contractor and seek recourse from the defaulting contractor or his surety. In the event of a termination for default or nonperformance, in whole or in part, the City of Pawtucket may procure similar goods or services in a manner and upon terms it deems appropriate, and the contractor shall be liable for the excess costs incurred by the City of Pawtucket as a result of the contractor's default. The contractor, or its surety, agrees to promptly reimburse the City of Pawtucket for the excess costs, but shall have no claim to the difference should the replacement cost be less.

2. Termination Without Cause

The City of Pawtucket may terminate the contract in whole or in part without cause at any time by giving written notice to the contractor of such termination at least thirty (30) days before the effective date of such termination. The notice shall specify the part(s) of the contract being terminated and the effective termination date.

Within thirty (30) days of the effective date of the termination of the contract the contractor shall compile and submit to the City of Pawtucket an accounting of the work performed up to the date of termination. The City of Pawtucket may consider the following claims in determining reasonable compensation owed to the contractor for work performed up to the date of termination:

- a. contract prices for goods or services accepted under the contract;
- b. costs incurred in preparing to perform and performing the terminated portion of the contract; or
- c. any other reasonable costs incurred by the contractor as a result of the termination.

The total sum to be paid to the contractor shall not exceed the total contract price, less any payments previously made to the contractor, the proceeds from any sales of goods or manufacturing materials, and the contract price for work not terminated.

3. Contractor's Obligations in the Event of Termination

If the contract is terminated for any reason, or expires pursuant to its terms, the contractor shall transfer and deliver to the City of Pawtucket in the manner and to the extent directed by the City of Pawtucket:

- a. all finished or unfinished material prepared by the contractor; and
- b. all material, if any, provided to the contractor by the City of Pawtucket.

For the purposes of the contract, "material" shall include, but is not limited to, goods, supplies, parts, tools, machinery, equipment, furniture, fixtures, information, data, reports, summaries, tables, maps, charts, photographs, studies, recommendations, files, audiotapes, videotapes, records, keys, security badges, and documents.

If the contract is terminated for cause, the contractor shall not be relieved of liability to the City of Pawtucket for damages sustained because of any breach by the contractor. In such event, the City of Pawtucket may retain any amounts which may be due and owing to the contractor until such time as the exact amount of damages due the City of Pawtucket from the contractor has been determined by the City of Pawtucket Purchasing Agent. The City of Pawtucket may also set off any damages so determined against the amounts retained.

Upon termination of the contract, the contractor shall stop performance on the date specified, terminate any outstanding orders and subcontracts applicable to the terminated portion of the contract, and shall incur no further commitments or obligations in connection with the terminated performance. The contractor shall settle all liabilities and claims arising out of the termination of subcontracts and order generating from the terminated performance. The City of Pawtucket may direct the contractor to assign the contractor's right, title and interest under terminated orders or subcontracts to the City of Pawtucket or a third party.

Terminations of Purchase Order Contracts or Master Pricing Agreements shall require the signature of the City of Pawtucket Purchasing Agent or his designee. Notice of termination by either party shall be submitted in writing to the other party in accordance with the termination clause of the contract, or where no specific termination clause is included, written notice shall be provided no later than thirty (30) days before the expiration of the contract.

34. **INDEMNITY**

The contractor guarantees:

- a. To save the City of Pawtucket, its agents and employees, harmless from any liability imposed upon the City of Pawtucket arising from the negligence, either active or passive, of the contractor, as well as for the use of any copyrighted or uncopyrighted composition, secret process, patented or unpatented invention, article or appliance furnished or used in the performance of the contract of which the contractor is not the patentee, assignee or licensee.
- b. To pay for all permits, licenses and fees and give all notices and comply with all laws, ordinances, rules and regulations of the City of Pawtucket and of the State of Rhode Island.
- c. That the equipment offered is standard new equipment, latest model of regular stock product with all parts regularly used with the type of equipment offered; also, that no attachment or part has been substituted or applied contrary to manufacturer's recommendations and standard practice.

35. **CONTRACTOR'S OBLIGATIONS**

In addition to the specific requirements of the contract, construction and building repair contractors bear the following standard responsibilities:

- a. To furnish adequate protection from damage for all work and to repair damages of any kind, for which he or his workmen are responsible, to the building or equipment, to his own work, or to the work of other contractors;
- b. The contractor, its subcontractor(s) and their employees and/or agents, shall protect and preserve property in the contractor or subcontractor's possessions in which the City of Pawtucket has an interest, and any and all materials provided to the contractor or subcontractor by the City of Pawtucket;
- c. To clear and remove all debris and rubbish resulting from his work from time to time, as directed or required, a completion of the work leave the premises in a neat unobstructed condition, broom clean, and in satisfactory order and repair;
- d. To store equipment, supplies, and material at the site only upon approval by the City of Pawtucket, and at his own risk;
- e. To perform all work so as to cause the least inconvenience to the City of Pawtucket, and with proper consideration for the rights of other contractors and workmen;

- f. To acquaint themselves with conditions to be found at the site, and to assume responsibility for the appropriate dispatching of equipment and supervision of his employees during the conduct of the work;
- g. To ensure that his employees are instructed with respect to special regulations, policies, and procedures in effect for any City of Pawtucket facility or site, and that they comply with such rules, including but not limited to security policies or practices and/or criminal background checks for any employees and/or subcontractors;
- h. The contractor shall ensure that its employees or agents are experienced and fully qualified to engage in the activities and services required under the contract;
- i. The contractor shall ensure that at all times while services are being performed under this contract at least one of its employees or agents on the premises has a good command of the English language and can effectively communicate with the City of Pawtucket and its staff;
- j. The contractor and contractor's employees or agents shall comply with all applicable licensing and operating requirements required by federal or state law and shall meet accreditation and other generally accepted standards of quality in the applicable field of activity;
- k. The contractor shall secure and retain all employee-related insurance coverage for its employees and agents as required by law; and
- l. The contractor, subcontractor, and his or her employees and agents shall not disclose any confidential information of the City of Pawtucket to a third party. Confidential information means:
 - (1) any information of a sensitive or proprietary nature, whether or not specially identified as confidential or proprietary; or
 - (2) any information about the City of Pawtucket gained during the performance of a contract that is not already lawfully in the public domain.

36. **FORCE MAJEURE**

All orders shall be filled by the contractor with reasonable promptness, but the contractor shall not be held responsible for any losses resulting if the fulfillment of the terms of the contract shall be delayed or prevented by wars, acts of public enemies, strikes, fires, floods, acts of God, or for any other acts not within the control of the contractor and which by the exercise of reasonable diligence, the contractor is unable to prevent.

Appendix C

Brick Industry Association Technical Notes 14 and 14A

Paving Systems Using Clay Pavers

Abstract: This *Technical Note* presents an overview of paving systems made with clay pavers used in pedestrian and vehicular, residential and nonresidential projects. Commonly used systems that include clay pavers are discussed, and guidance is given in selecting the appropriate clay paver, setting bed and base. Site conditions and project requirements that may affect choice are discussed, including subgrade soil, pedestrian and vehicular traffic, accessibility requirements, drainage, and appearance.

Key Words: base, design, flexible, mortared paving, mortarless paving, paving, permeable paving, rigid, subbase.

SUMMARY OF RECOMMENDATIONS:

Select Paving System

- Use Table 1 to determine paving system based on application
- Use Table 2 to evaluate clay paving systems based on their general advantages and disadvantages
- Use Table 3 to verify choice of the clay paving system for specific site conditions and project requirements

Design Paving System

- Use *Technical Note 14* for design considerations and

- general specification of clay pavers, base and subbase
- Use appropriate *Technical Note* in this series to provide design and construction information specific to the setting bed of the paving system selected as follows:
 - Sand Setting Bed – *Technical Note 14A*
 - Bituminous Setting Bed – *Technical Note 14B*
 - Mortar Setting Bed – *Technical Note 14C*
- Use a design professional as necessary to verify suitability of a paving system design

INTRODUCTION

Technical Note 14 is the first in a series discussing the use of clay pavers for pedestrian and vehicular, residential and nonresidential applications (see [Photo 1](#)). It provides guidance in selecting a paving system (see [Figure 1](#)) and the appropriate clay paver, setting bed and base. Once these are determined, other *Technical Notes* in this series provide additional information specific to the setting bed chosen, including common construction for particular applications, typical details, installation practices and maintenance.

Paving systems exposed to more than 251 daily equivalent single axle loads (ESAL) from trucks or combination vehicles having three or more loaded axles are considered heavy duty vehicular applications. Such paving



Photo 1
Pedestrian Plaza with Clay Pavers

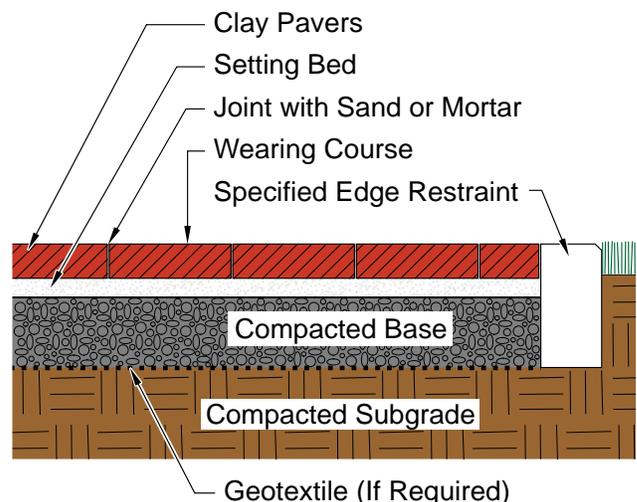


Figure 1
Typical Pavement Section

systems are beyond the scope of this *Technical Note* series. For more information on paving systems for heavy duty vehicular use, refer to *Flexible Vehicular Brick Paving – A Heavy Duty Applications Guide* [Ref. 14].

Table 1 lists acceptable paving systems for typical paving applications. **Table 2** is a comparison of paving systems listing the general advantages and disadvantages for each system. **Table 3** indicates which paving systems are appropriate for specific site conditions and project requirements.

TABLE 1
Acceptable Paving Systems

| Application | Typical Examples | Sand Setting Bed | | | | Bituminous Setting Bed | | Mortar Setting Bed | |
|-----------------------------------|---|---|---------------------------|-------------------------------|----------------------------|---------------------------|----------------------------|----------------------------|----------------------------|
| | | Aggregate Base | Asphalt Base ¹ | Cement-Treated Aggregate Base | Concrete Base ¹ | Asphalt Base ¹ | Concrete Base ¹ | Bonded | Unbonded |
| | | | | | | | | Concrete Base ¹ | Concrete Base ¹ |
| Residential | Patios and walks on property of a one- or two-family house or townhouse | A | A | A | A | A | A | A | A |
| | Driveways on property of a one- or two-family house or townhouse | A | A | A | A | A | A | A | NA |
| Commercial/ Pedestrian | Public plazas, courtyards or sidewalks | A | A | A | A | A | A | A | A |
| Light Duty Vehicular ³ | Paving with low volume ² of heavy vehicles such as streets, parking areas, turn-arounds or passenger drop-offs | A | A | A | A | A | A | A | NA |
| Heavy Duty Vehicular ³ | Paving with a high volume ² of heavy vehicles such as streets, commercial driveways or crosswalks across them | Refer to <i>Flexible Vehicular Brick Paving - A Heavy Duty Applications Guide</i> | | | | | | | |

NOTES:

1. For a paving system that uses existing asphalt or concrete as base, verify that the condition of the base is acceptable.
2. For a definition of high volume of heavy vehicles, see Introduction.
3. For these applications, a design professional should design the paving system.

KEY:

A = Acceptable
NA = Not Acceptable

TABLE 2
Comparison of Pavements Made with Clay Pavers

| Clay Pavers On: | Advantages | Disadvantages |
|---|--|---|
| Sand Setting Bed on Aggregate Base | <ul style="list-style-type: none"> • Most durable • Cost-effective • Easy access to repair underground utilities • Good as overlay to existing asphalt or concrete pavement • Allows use of semi-skilled labor • Can be designed as a permeable pavement | <ul style="list-style-type: none"> • Intensive cleaning may erode joint sand • May require a thicker base |
| Sand Setting Bed on Asphalt Base | <ul style="list-style-type: none"> • Good as overlay to existing asphalt pavement | <ul style="list-style-type: none"> • Intensive cleaning may erode joint sand |
| Sand Setting Bed on Cement-Treated Aggregate Base | <ul style="list-style-type: none"> • Good over poor soils or in small, confined areas • Good as overlay to existing concrete pavement | <ul style="list-style-type: none"> • Intensive cleaning may erode joint sand |
| Sand Setting Bed on Concrete Base | <ul style="list-style-type: none"> • Good over poor soils or in small, confined areas • Good as overlay to existing concrete pavement | <ul style="list-style-type: none"> • Intensive cleaning may erode joint sand • Requires good drainage above base • Susceptible to greater offset with subgrade movement |
| Bituminous Setting Bed on Asphalt Base | <ul style="list-style-type: none"> • Reduced horizontal movement and uplift • Enhanced water penetration resistance | <ul style="list-style-type: none"> • Repairs are more difficult and expensive • Little tolerance for paver thickness variations or inaccurate base elevations |
| Bituminous Setting Bed on Concrete Base | <ul style="list-style-type: none"> • Reduced horizontal movement and uplift • Enhanced water penetration resistance • Good over poor soils or in small, confined areas | <ul style="list-style-type: none"> • Repairs are more difficult and expensive • Little tolerance for paver thickness variations or inaccurate base elevations |
| Mortar Setting Bed Bonded to Concrete Base | <ul style="list-style-type: none"> • Greater tolerance for paver thickness variations or inaccurate base elevations • Can be used on steeper slopes and greater vehicle speeds • Drainage occurs on the surface | <ul style="list-style-type: none"> • Movement joints must align through entire paving system • Least cost-effective • Mortar joint maintenance required • Repairs are most difficult and expensive |
| Mortar Setting Bed Unbonded to Concrete Base | <ul style="list-style-type: none"> • Greater tolerance for paver thickness variations or inaccurate base elevations • Movement joints in setting bed and base are not required to align • Preferred when used over elevated structural slab | <ul style="list-style-type: none"> • Bond break must be used to avoid stresses caused by horizontal movement between layers • Least cost-effective • Mortar joint maintenance required • Repairs are most difficult and expensive |

TABLE 3
Selection of Setting Bed and Base

| Site Condition or Project Requirement | Sand Setting Bed | | | | Bituminous Setting Bed | | Mortar Setting Bed | |
|--|-------------------|-----------------|---|------------------|---------------------------|------------------|--------------------|------------------|
| | Aggregate Base | Asphalt Base | Cement- Treated Aggregate Base | Concrete Base | Asphalt Base | Concrete Base | Bonded | Unbonded |
| | | | | | | | Concrete Base | Concrete Base |
| Soft Soil in Subgrade | R | R | A | A | R | A | A | A |
| Tree Roots in/near Subgrade | R | A | NA | NA | A | NA | NA | NA |
| Expansive Soil in Subgrade | A ¹ | R | A | NA | R | NA | NA | NA |
| Snow Melt System | A ² | A ² | A ² | R ² | A ¹ | NA | R | R |
| Suspended Structural Slab | A ¹ | NA | A ¹ | R ¹ | NA | R ¹ | R | R |
| Good Surface Drainage | R | R | R | R | R | R | R | R |
| Poor Surface Drainage | R | R | R | R | R | R | NA | NA |
| Permeable Pavement | R | NA | NA | NA | NA | NA | NA | NA |
| Deep Frost Line | R ¹ | R ¹ | R ¹ | R ¹ | A ¹ | A ¹ | A | A |
| Freeze/Thaw | R ¹ | R ¹ | R ¹ | R ¹ | A ¹ | A ¹ | A | NA |
| Minimal Frosts | R | R | R | R | R | R | R | R |
| Pressure Washing | R ¹ | R ¹ | R ¹ | R ¹ | R ¹ | R ¹ | R | R |
| Vacuuming | R ¹ | R ¹ | R ¹ | R ¹ | R ¹ | R ¹ | R | R |
| Minimal Cleaning | R | R | R | R | R | R | R | R |
| ADA Compliance | R | R | R | R | R | R | A | A |
| Pedestrians Only | R | R | R | R | R | R | R | R |
| Light Vehicular Traffic | R ³ | R ³ | R ³ | R ³ | R ³ | R ³ | R | NA |

NOTES:

1. Use stabilized joint sand
2. When snow melt system is in sand setting bed, use stabilized sand in setting bed.
3. Use Application PS or PX pavers

KEY:

- R = Recommended
- A = Acceptable
- NA = Not Acceptable

DESIGN CONSIDERATIONS

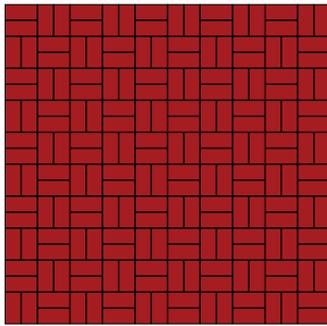
Aesthetics

The relatively small size of clay pavers creates a pavement surface with a human scale. As many pavers can be observed simultaneously, the nuances of different colors, textures and patterns can be clearly seen when standing on the pavement. Single colors can present a monolithic appearance. Multiple colors can break down the scale of the pavement (see [Photo 2](#)). Borders laid in a different color can add interest to the pavement. In larger areas, it may be desirable to introduce different colors in the form of bands or panels. Some highly decorative pavements have introduced patterns that flow, repeat and intertwine (see [Figure 2](#)).

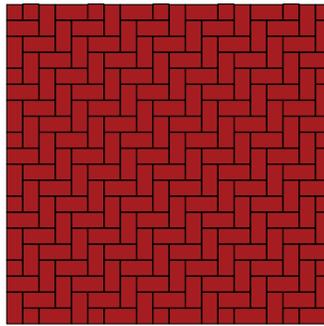
Color. Clay pavers are available in a wide range of colors. The most common are red and brown earth tones, but buff and gray colors also are produced



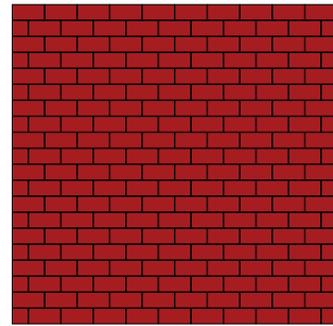
Photo 2
Multiple Colors Affect Pavement Scale



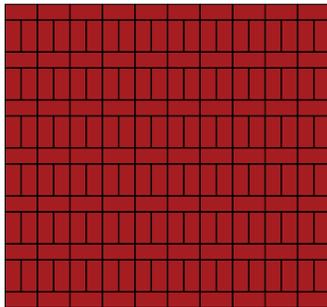
Double Basket Weave



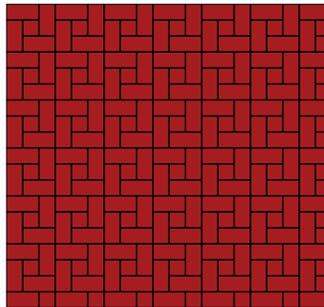
Herringbone



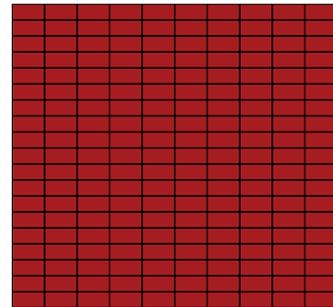
Running Bond



Single Basket Weave



Spanish Bond



Stack Bond

Figure 2
Brick Paving Bond Patterns

(see [Photo 3](#)). Single colors as well as variegated pavers can also be mixed together to form blends that expand the palette of available colors.

The color of clay pavers is typically consistent through the body of the paver and is highly resistant to weathering and fading because of its vitrified composition. Since clay pavers are made from natural materials, there may be some inherent color variations between different production runs from the same manufacturer. This is most evident in large paved areas of a single color. Using a field panel to establish acceptable color variations and laying pavers taken from different cubes of pavers helps avoid this issue.

Texture. Clay pavers are available with a range of surface textures, such as wire cut and molded. Viewed at a flat angle from a distance, a variation in paver texture can be more obvious than a variation in color. Designers may find it advantageous to change the surface texture in different areas or bands to exaggerate the contrast. The texture also has an impact on slip and skid resistance.

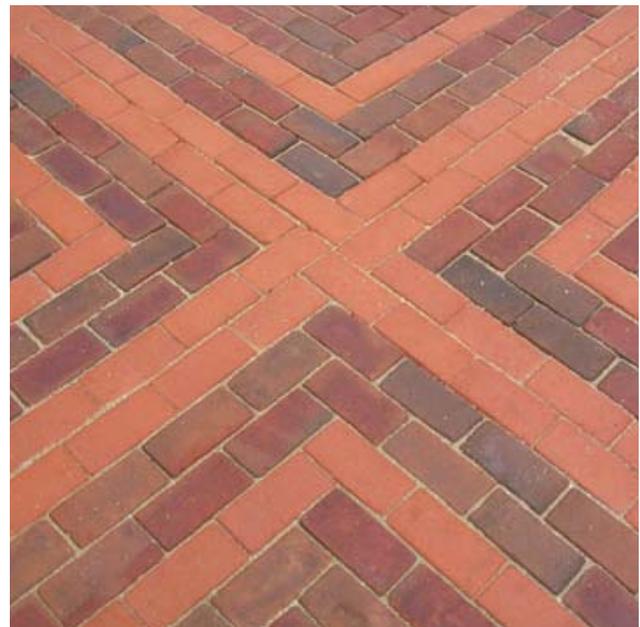


Photo 3
Clay Paver Colors

Some pavers are manufactured with a more pronounced texture or surface pattern. Surface features — including a grid of dimples or domes — also can be imprinted into the surface of the paver before firing. Pavers also can be manufactured and installed to provide a tactile/detectable warning surface. In addition, patterns and words can be engraved or laser etched into the surface of fired pavers.

Edge Treatment. Pavement texture is created not only by the character of the texture of each paver, but also by the treatment of the edges. Pavers can have square edges, rounded edges or beveled edges formed during the extrusion, molding or pressing processes. These can be uniform along the entire edge of the paver, which enhances the uniformity of the surface, or they can be made to be variable or irregular to create the feel of a historic pavement. Additionally, fired pavers can be tumbled to create distressed edges.

Pavement use and maintenance should be considered when selecting the edge treatment of pavers, as they may affect the appearance or smoothness of the paving surface. When square-edge pavers are laid with sand joints, care should be taken to ensure that they do not make direct contact with or lip under adjacent pavers. A minimum of 1/16 in. sand-filled joint should separate each clay paver. Maintaining full sand joints and taking care not to distress paver edges during snow removal procedures helps minimize potential chippage of a paver's edges. Using clay pavers with chamfers enhances drainage by channeling water away from the surface, which can improve skid resistance.

Bond Patterns. Many installation patterns can be used when laying clay pavers. Some of the most popular are herringbone bond, running bond, stack bond and basket weave, as shown in **Photo 4**. When choosing a pattern, considerations should include the setting bed of the pavement and the horizontal loads. Vehicle loads typically generate the largest horizontal load on a pavement. Sand and bituminous setting beds are more prone to paver creep, or horizontal movement. A herringbone bond best distributes horizontal forces across a pavement, reducing the potential for creep. Running bond and other patterns with continuous joints do not distribute horizontal loads as well as herringbone bond. If these bond patterns are used, continuous joints should be oriented perpendicular to the direction of traffic.

In some projects, different-colored pavers are arranged to create a pattern that aligns with adjacent features, such as building columns or trees. The size of different colored clay pavers may vary within permissible tolerances. Pavers supplied to a project may be slightly smaller or slightly larger than the specified sizes assumed in design. As such, the exact number of pavers that can be laid within a set dimension will vary unless the joint widths are slightly adjustable. Paving systems with sand or bituminous setting beds that are subject to vehicular applications can have their structural integrity reduced if joints are too wide. Therefore, the paver layout should be designed with a degree of flexibility to accommodate slight variations in the pattern. As necessary, cutting individual pavers also may be used to solve alignment and structural integrity issues.

Pedestrian Traffic

Paving systems using clay pavers exposed to pedestrian traffic for residential and nonresidential applications are common. Many residential patios and walks can be constructed with only a base layer between the subgrade and the setting bed. For more public pedestrian applications such as sidewalks and plazas, a more substantial paving system may be required.

Vehicular Traffic

Light vehicular traffic includes general access for cars and for trucks, but in smaller volumes. As stated in ASTM C 1272, high volumes of traffic are considered traffic with over 251 daily equivalent single loads (ESAL), a standard term used by pavement engineers. For further information about clay pavements subject to heavy vehicular traffic, refer to *Flexible Vehicular Brick Paving – A Heavy Duty Applications Guide* [Ref. 14].

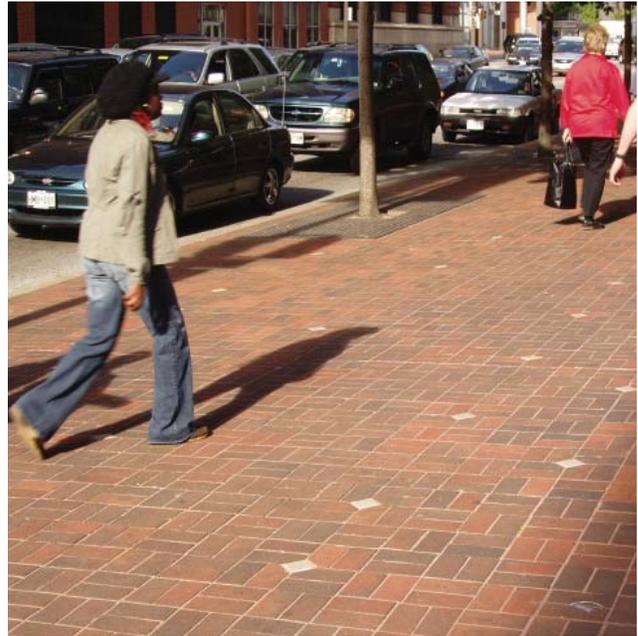


Photo 4

Clay Paver Sidewalk in Basket Weave Pattern

The load capacity of a clay paving system with a sand setting bed and aggregate base is dependent on the total pavement section rather than just the clay paver layer. Most individual clay pavers have a high compressive strength and, with sufficient thickness, can develop significant interlock with surrounding pavers to support light vehicular loads when properly constructed. Sufficient thickness and compaction of subbase, base and paver layers virtually eliminates pavement deformation under loading.

For light duty vehicular paving systems, a maximum traffic speed of 30 mph (50 kph) is considered appropriate for pavers in a sand setting bed. As vehicle speeds increase, the horizontal loading caused by accelerating, braking and turning increases. Light duty vehicular clay paving systems with sand setting beds where a herringbone bond is used, where joint width is maintained between 1/16 to 3/16 in. (1.6 to 4.8 mm), where an appropriate jointing sand is properly installed and maintained and where sufficient edge restraint is provided can perform well and substantially reduce the potential for movement of the pavers from horizontal creep.

Slip Resistance, Skid Resistance and Hydroplaning

Each of these issues relates to the slipperiness of the pavement surface. Slip resistance generally refers to the slipperiness of a pavement as experienced by pedestrians. Skid resistance and hydroplaning are related to the slipperiness of a pavement as experienced by vehicles.

The slip resistance is determined as the static coefficient of friction of a surface. A number of test procedures are available for laboratory and field testing, but they may provide different values. Slip resistance can be measured in the laboratory and the field using ASTM C 1028, *Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method* [Ref. 4]. For surfaces in an accessible route, the United States Access Board historically recommended, but did not mandate, a value of 0.6 for level surfaces and 0.8 for ramps when measured by the portable NBS-Brungraber machine using a silastic sensor shoe. Most clay pavers exceed these values.

Skid resistance is typically determined on the basis of a material's dynamic coefficient of friction, which generally decreases as speed increases. Testing usually involves either a specialized test vehicle moving at more than 30 mph (50 kph) or a portable British Pendulum Tester used in accordance with ASTM E 303, *Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester* [Ref. 11]. For paving systems exposed to light duty application pavements covered in this *Technical Note 14* series, skid resistance is not an issue. Hydroplaning also is associated with speed, but in conjunction with standing water on the pavement surface. Due to the speed restrictions imposed on clay pavements subject to light duty vehicle traffic, hydroplaning should not be a concern for clay pavements.

Slope

Paving systems can be successfully used on slopes with up to a 10 percent gradient. For projects where site conditions involve slopes exceeding 10 percent, a design professional and local codes should be consulted.

Drainage

Adequate drainage is important to the performance and durability of any clay paving system. Water should be drained from the paving system as quickly as possible. A minimum slope of 1/4 in. per ft of slope (2 percent grade) is recommended. Adequate drainage should be provided to ensure the integrity of all layers in a paving system.

Three types of drainage potentially exist in clay paving systems: surface restricted, subsurface restricted and unrestricted. Surface restricted drainage occurs on the surface of the paving system. This type of drainage is typical of clay paving systems with a mortar setting bed. Subsurface restricted drainage occurs when water drains over the surface and immediately below the paving course. This type of drainage is typical of paving systems installed with a bituminous setting bed. Unrestricted drainage involves draining water from the surface, the subsurface and through the subgrade. This type of drainage requires a sand setting bed on an aggregate base.

Drains should be selected and placed to adequately handle anticipated water flow. Drains serving paving systems should have openings not only on the surface but also on the sides. Such drains should be used for all paving systems to drain water from adjacent materials and to prevent capillary rise. Side openings should extend below the top of any impervious layer or membrane in the paving system. Drains placed in pavements with sand setting beds should have screens to prevent sand from entering the drain. Pavement edges that restrict water flow at the lowest point in the paving system where water is anticipated should have weeps at 16 in. (406 mm) on center.

Accessibility

The Americans with Disabilities Act Accessibility Guidelines (ADAAG) [Ref. 1] establish minimum design requirements that cover access for people with disabilities to public and private buildings and facilities. The Public Rights-Of-Way Accessibility Guidelines (Draft PROWAG) [Ref. 13] in draft form cover disability access provisions for pedestrian areas along public rights-of-way. Research has documented that clay paving systems can comply with the accessible provisions within these guidelines [Ref. 12 and 15].

The ADAAG and Draft PROWAG mandate several surface profile requirements applicable to all pavement systems. The designer should be aware of maximum permissible gradients and other requirements that often are overlooked (see **Photo 5**).

In addition to planning and designing in accordance with these guidelines, it is important to implement regular maintenance programs to maintain these routes in a safe and serviceable condition. Specific requirements especially pertinent to clay pavers include surface, changes in level, joints and detectable warning surfaces.

Surface. The ADAAG and Draft PROWAG require an accessible surface to be firm, stable and slip-resistant. Smoothness also may be an important criterion, because a pedestrian in a wheelchair may be more sensitive to vibration or trip hazards. Properly designed, installed and maintained clay paver surfaces achieve these properties. Besides inadequate design, installation or maintenance, all pavement systems may be subject to heaving and settlement of underlying soils that result in changes in level. Research has shown that the vibration on clay paver surfaces is comparable to or less than that of poured concrete and other common paving materials [Refs. 12 and 15].

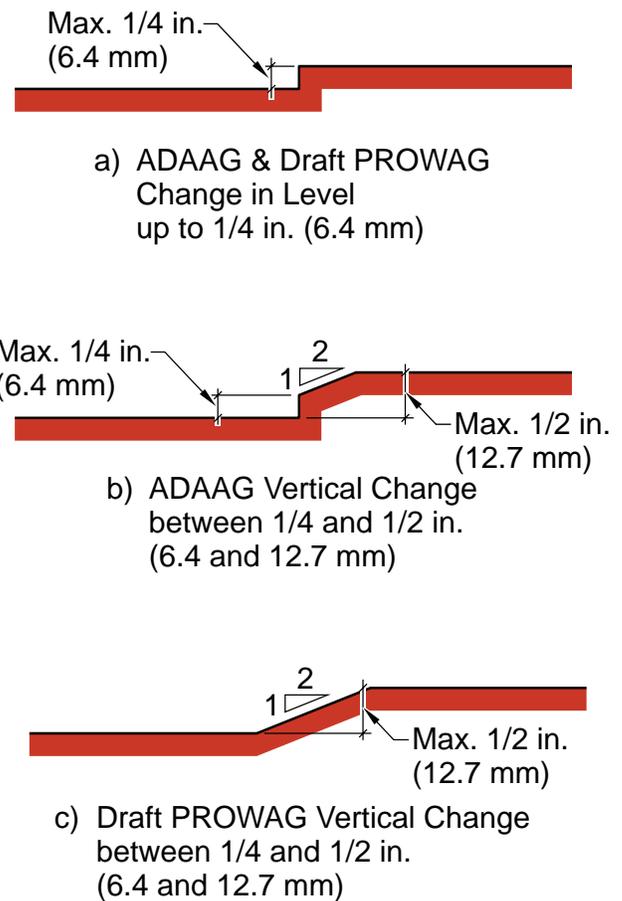
Changes in Level. Both the ADAAG and Draft PROWAG allow a change in level (surface discontinuity) up to 1/4 in. (6.4 mm) (see **Figure 3a**). Both the ADAAG and Draft PROWAG allow a change in level between 1/4 in. (6.4 mm) minimum and 1/2 in. (12.7 mm) maximum. The ADAAG requires this change in level to be sloped (beveled) not steeper than 1:2 (see **Figure 3b**). The Draft PROWAG also requires a maximum slope (bevel) of 1:2 for this change in level, but further mandates that the slope (bevel) be applied across the entire change in level (see **Figure 3c**).

With respect to pavers, sudden changes in level (differences in elevation of the top surfaces of adjacent pavers) should be kept to a minimum through careful



Photo 5

At Grade Street Crossing with ADA-Compliant Surface Texture Changes



For Vertical Changes Greater Than 1/2 in. (12.7 mm), Use Ramp

Figure 3
Requirements for Making Changes in Elevation

design and installation and should be maintained as part of a regular maintenance program. Changes in level can result from heaving or settling of the pavement; uneven joints or can occur at frames and manhole covers.

Joints. The ADAAG does not specifically cover joints, but it does have requirements for openings in gratings, which could be considered as being similar. The Draft PROWAG ADAAG has requirements for horizontal openings in walkway joints and gratings. Both guidelines allow openings up to 1/2 in. (12.7 mm) wide, more than twice the typical width of joints between pavers in pavements with sand and bituminous setting beds that are typically 1/16 in. (1.6 mm) to 3/16 in. (4.7 mm) wide. Joints between pavers in a mortar setting bed are generally 3/8 in. (9.4 mm) to 1/2 in. (12.7 mm) wide, but would not be considered an opening.

Detectable Warning Surfaces. Both the ADAAG and the Draft PROWAG require detectable warning surfaces consisting of truncated domes sized to have a base diameter of 0.9 in. (23 mm) minimum and 1.4 in. (36 mm) maximum, a top diameter of a minimum of 50 percent to a maximum of 65 percent of the base diameter, and a height of 0.2 in. (5.1 mm). Clay pavers can be made with truncated domes.

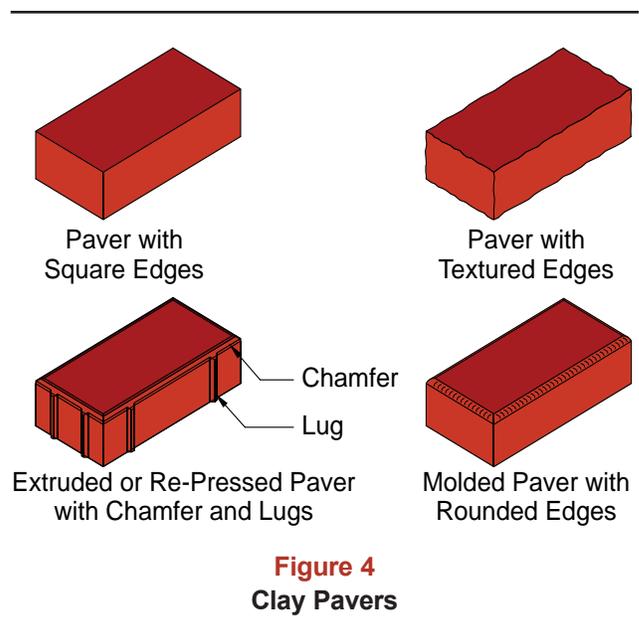
The ADAAG requires truncated domes to be placed on a square grid with a center-to-center spacing of 1.6 in. (41 mm) minimum and 2.4 in. (61 mm) maximum, and a base-to-base spacing of 0.65 in. (17 mm) minimum, measured between the most adjacent domes. The Draft PROWAG requires truncated domes to be placed in either a square or a radial grid pattern meeting the same dimensional layout requirements as set forth in the ADAAG.

Both guidelines require detectable warning surfaces to extend 24 in. (610 mm) from rail platform boarding edges. The Draft PROWAG also covers curb ramps and blended transitions that are not covered in the ADAAG. Curb ramps and blended transitions require detectable warning surfaces to extend 24 in. (610 mm) minimum in the direction of travel for their full width. Flares of curb ramps are not required to have a detectable warning surface.

CLAY PAVERS

Manufacturing

Clay pavers are manufactured in much the same way as face brick, as discussed in *Technical Note 9*. Extrusion (stiff-mud), molding (soft-mud) or dry-pressing processes are used to produce pavers (see [Figure 4](#)). Extruded clay pavers have a wire-cut texture or smooth die-skin wearing surface. Lugs (spacer bars) and chamfers may be formed on the sides and edges of the pavers during the extrusion or cutting process. Clay pavers produced by the molding or dry-pressing processes have a smooth or textured surface. Lugs and chamfers also may be formed by the sides and edges of the molds. Pavers from any of the production methods may have aesthetic features such as irregular or textured edges. Clay pavers made by the molding or dry-pressed process may have frogs or cavities on one bed surface, although they would not be exposed.



Pavers generally are manufactured with their length equal to a module of their width. Two commonly specified clay paver sizes are 4 in. wide by 8 in. long (102 mm by 203 mm) and 3 5/8 in. wide by 7 5/8 in. (92 mm by 194 mm) long. Other similar sizes are available, such as 3 3/4 in. (95 mm) wide by 7 1/2 in. (190 mm) long, and several manufacturers are able to provide custom sizes. Common specified thicknesses are 1 1/2 in. (38 mm), 2 1/4 in. (57 mm) and 2 5/8 in. (67 mm).

Standards

Clay pavers can be used as a wearing course in many exterior pavement and interior floors. Most pavers in the United States are manufactured to comply with consensus standards published by ASTM International (ASTM). Two ASTM standards define requirements for clay pavers for exterior use: ASTM C 902, *Standard Specification for Pedestrian and Light Traffic Paving Brick* [Ref. 3], and ASTM C 1272, *Standard Specification for Heavy*

Vehicular Paving Brick. [Ref. 5] For light duty applications addressed by the *Technical Notes 14* series, clay pavers complying with ASTM C 902 are normally used. Clay pavers manufactured to meet ASTM C 1272 may be used in light duty or heavy vehicular applications and may provide longer pavement service life — especially where the pavement is subject to higher volumes of vehicular traffic. Only clay pavers meeting the requirements of ASTM C 1272 are suitable for heavy vehicular applications, which are covered in *Flexible Vehicular Brick Paving – A Heavy Duty Applications Guide*.

ASTM C 902. This specification covers clay pavers suitable for patios, walkways, floors, plazas, residential driveways and commercial driveways (passenger drop-offs). It describes three Classes and three Types of clay pavers according to severity of their exposure to weather and to traffic, respectively. Three Applications also are defined, based upon the pavers' intended use, and limit their dimensional tolerances, distortion and extent of chipping.

Class - A paver's Class relates to its resistance to damage from exposure to weather and is based on compressive strength and absorption properties. Class SX pavers are intended for use where the pavers may be frozen while saturated with water. Class MX pavers are intended for exterior use where the pavers will not be exposed to freezing conditions. Class NX pavers are not acceptable for exterior use but may be used for interior areas where the pavers are protected from freezing when wet. For most exterior residential or light duty applications, Class SX pavers are used.

Type - A paver's Type relates to its resistance to abrasion. Type I pavers are intended for use where the pavers are exposed to extensive abrasion, such as sidewalks and driveways in publicly occupied spaces. Type II pavers are intended for use where the pavers are exposed to intermediate pedestrian traffic, such as heavily traveled residential walkways and residential driveways. Type III pavers are intended for use in low pedestrian traffic, residential areas such as floors and patios of single-family homes. For most exterior residential or light duty applications, Type I or II pavers are used.

Application - A paver's Application relates to its aesthetics and use. Application PS pavers are intended for general use and can be installed in any bond pattern with mortar or with sand-filled joints when not exposed to vehicular traffic. When Application PS pavers are installed with sand-filled joints for light duty vehicular applications, they should be laid in running bond or other bonds not requiring extremely close dimensional tolerances. Any bond pattern can be used when Application PS pavers are installed with mortar joints. Application PX pavers have tighter dimensional tolerances that allow consistently narrow joints between pavers. Such uses include pavements without mortar joints between pavers where exceptionally close dimensional tolerances are required as a result of special bond patterns or unusual construction requirements. Application PA pavers are characterized by aesthetic effects such as variability in size, color and texture. Such pavers have performed successfully in many historic clay paving applications and are generally used where a distinctive architectural character is desired. Such applications are often installed with mortar joints between pavers, but can be successful in sand-filled joint applications that are laid by workers with experience installing Application PA pavers in this manner. Using stabilized joint sand or applying stabilizer to joint sand will help prevent sand loss from wider sand-filled joints.

Pavers complying with ASTM C 902 are not required to have a minimum thickness. However, they are commonly manufactured to a specified thickness of 2¼ in. (57 mm) and 1½ in. (38 mm). Except for patios or walks for one- or two-family homes in southern climates with limited frost exposure, clay pavers 1½ in. (38 mm) thick are usually installed only over a rigid base.

ASTM C 1272. This standard addresses heavy vehicular pavers generally used in streets, commercial driveways and industrial applications. ASTM C 1272 designates two Types of pavers depending on their method of installation. Three Applications limit dimensional tolerances, distortion and extent of chipping.

The paver Type is based upon the compressive strength, breaking load and absorption properties of the pavers. Type F pavers are intended to be set in a sand setting bed with sand-filled joints. The minimum paver thickness is required to be 2 5/8 in. (67 mm). They also can be installed over flexible or rigid bases. Type R pavers are intended to be set in a mortar setting bed with mortar joints over a concrete base. Type R pavers also can be set on a bituminous setting bed with sand-filled joints and supported by an asphalt or concrete base. The minimum thickness for Type R pavers is required to be 2¼ in. (57 mm).

Applications PS, PX and PA are common to both ASTM standards and denote similar requirements.

Pavers complying with ASTM C 1272 may contain frogs but must be without cores or perforations.

ASTM Properties for Clay Pavers. The Class, Type and Application designations within ASTM clay paver standards are based upon physical properties and characteristics, including compressive strength, breaking load, absorption, abrasion, dimensional tolerances and extent of chipping. Pavers must be resistant to damage from the effects of traffic and the environment. In many regions of the United States, clay pavers will be exposed to severe environmental conditions. Pavers often are in a saturated condition and can experience numerous freeze/thaw cycles. Application of deicers can cause additional thermal shock to pavers. Compliance with property requirements of ASTM C 902 and C 1272 provides the required durability.

Compressive Strength, Breaking Load and Absorption - The strength and absorption requirements of pavers from the ASTM standards are shown in Table 4. Some pavers are durable, but cannot be classified under the physical requirements shown in Table 4. Using alternatives in the specifications allows pavers that are known to perform well to meet the durability requirement. It does not signify that the pavers are of a lower quality.

TABLE 4
Property Requirements

| ASTM Standard | | Minimum Compressive Strength, psi (Mpa) | | Maximum Cold Water Absorption, % | | Maximum Saturation Coefficient | | Minimum Breaking Load, lb/in. (kN/mm) | |
|---------------|-------------------|---|--------------|----------------------------------|------------|--------------------------------|------------|---------------------------------------|------------|
| | | Avg of 5 Brick | Individual | Avg of 5 Brick | Individual | Avg of 5 Brick | Individual | Avg of 5 Brick | Individual |
| C 902 | Class SX | 8,000 (55.2) | 7,000 (48.3) | 8.0 | 11.0 | 0.78 | 0.80 | ---- | ---- |
| | Class SX (molded) | 4,000 (27.6) | 3,500 (24.1) | 16.0 | 18.0 | 0.78 | 0.80 | ---- | ---- |
| | Class MX | 3,000 (20.7) | 2,500 (17.2) | 14.0 | 17.0 | No Limit | No Limit | ---- | ---- |
| | Class NX | 3,000 (20.7) | 2,500 (17.2) | No Limit | No Limit | No Limit | No Limit | ---- | ---- |
| C 1272 | Type R | 8,000 (55.2) | 7,000 (48.3) | 6.0 | 7.0 | ---- | ---- | ---- | ---- |
| | Type F | 10,000 (69.0) | 8,800 (60.7) | 6.0 | 7.0 | ---- | ---- | 475 (83) | 333 (58) |

For pavers complying with ASTM C 902 or C 1272, several alternatives are allowed. The freezing and thawing test alternative allows the cold water absorption and the saturation coefficient to be waived if a sample of five brick that meet all other requirements passes the freezing and thawing test of ASTM C 67 without breaking and with no greater than 0.5 percent loss in dry weight of any individual unit. The sulfate soundness alternative allows the cold water absorption and saturation coefficient to be waived if five brick survive 15 cycles of the sulfate soundness test with no visible damage. The performance alternative allows specifiers to waive all property requirements for pavers if they are satisfied with information furnished by the manufacturer on the performance of the pavers in a similar application subject to similar exposure and traffic.

For pavers complying with ASTM C 902, the absorption alternative allows the saturation coefficient to be waived for pavers that absorb less than 6.0% after 24 hours of submersion in room-temperature water.

Abrasion - The Abrasion Index is the ratio of the absorption divided by the compressive strength, multiplied by 100. The compressive specimen must be half pavers that are without core holes, frogs or other perforations, and the full height of the paver no less than 2¼ in. (57 mm). The volume abrasion loss is used if the height requirement cannot be met. The volume abrasion loss is determined by the loss of material created by sandblasting the surface of the paver. The abrasion requirements of pavers from the ASTM standards are shown in Table 5.

TABLE 5
Maximum Abrasion Requirements

| ASTM Standard | | Abrasion Index | Volume Abrasion Loss (cm ³ /cm ²) |
|---------------|------------|----------------|--|
| C 902 | Type I | 0.11 | 1.7 |
| | Type II | 0.25 | 2.7 |
| | Type III | 0.50 | 4.0 |
| C 1272 | Type R & F | 0.11 | 1.7 |

Dimensional Tolerances - The dimensional tolerances for pavers are based upon the dimension — width, height or length — considered. The actual dimensions may vary from the specified dimension by no more than plus or minus the dimensional tolerance. The tolerances for both C 902 and C 1272 pavers are shown in [Table 6](#).

TABLE 6
Dimensional Tolerance Requirements

| Dimension, in. (mm) | ASTM C 902 and C 1272 | | |
|--------------------------|-----------------------------|-----------------------------|----------------|
| | Application PS, in. (mm) | Application PX, in. (mm) | Application PA |
| 3 (76) and under | 1/8 (3.2) | 1/16 (1.6) | no limit |
| over 3 to 5 (76 to 127) | 3/16 (4.7) | 3/32 (2.4) | no limit |
| over 5 to 8 (127 to 203) | 1/4 (6.4) | 1/8 (3.2) | no limit |
| over 8 (203) | 5/16 (7.9) | 7/32 (5.6) | no limit |

Chippage - Clay pavers may chip in transit or during construction. [Table 7](#) shows the extent of chippage allowed by prescribing the maximum distance that chips may extend into the surface of a paver from an edge or a corner. The sum of the length of chips on a single paver must not exceed 10 percent of the perimeter of the exposed face of the paver. Cobbled or tumbled pavers that are intentionally distressed after production are classified as Application PA pavers.

TABLE 7
Maximum Chippage Requirements

| ASTM Standard | | Edge, in. (mm) | Corner, in. (mm) |
|---------------|---------------------|---------------------------|---------------------------|
| C 902 | Application PS | 5/16 (7.9) | 1/2 (12.7) |
| | Application PX | 1/4 (6.4) | 3/8 (9.5) |
| | Application PA | As specified by purchaser | As specified by purchaser |
| C 1272 | Application PS & PX | 5/16 (7.9) | 1/2 (12.7) |
| | Application PA | No Limit | No Limit |

Distortion - Both ASTM C 902 and C 1272 limit distortion and warpage of surfaces and edges intended to be exposed in use. The distortion must not exceed the maximum for the Application specified as noted in [Table 8](#).

TABLE 8
Tolerances on Distortion

| Specified Dimension, in. (mm) | ASTM C 902 & C 1272 ¹ | | |
|-------------------------------|--|----------------|----------------|
| | Maximum Permissible Distortion, in. (mm) | | |
| | Application PX | Application PS | Application PA |
| 8 (203) and under | 1/16 (1.6) | 3/32 (2.4) | no limit |
| Over 8 (203) to 12 (305) | 3/32 (2.4) | 1/8 (3.2) | no limit |
| Over 12 (305) to 16 (406) | 1/8 (3.2) | 5/32 (4.0) | no limit |

¹ ASTM C 1272 Type F clay paver required to meet Application PX

SETTING BEDS

Setting beds provide a means to adjust for dimensional variations in the height of a paver. They also support the clay pavers and transfer load to the base.

Sand Setting Bed

Individual pavers in sand setting beds are held in position by the frictional interlock that is developed in each sand-filled joint between adjacent pavers. The joints transfer vertical and horizontal forces, but can absorb expansion

and contraction of the individual pavers. If the pavement deflects slightly, the pavers will realign themselves to the new profile without significant loss in structural capacity. Interlock is developed by properly sized joints filled with consolidated joint sand. Sand setting beds may be installed directly on an aggregate base, asphalt base, cement-treated aggregate base or concrete base. For further information about pavements with sand setting beds, refer to *Technical Note 14A*.

Bituminous Setting Bed

In pavements with a bituminous setting bed, less interlock is developed by the joint material than in a pavement with a sand setting bed. However, additional restraint is provided by the adhesive nature of the tack coat. Bituminous setting beds can be set on an asphalt base or concrete base. For further information about pavements with bituminous setting beds, refer to *Technical Note 14B*.

Mortar Setting Bed

Pavers in a mortar setting bed are bonded to the underlying mortar bed and transfer most of the vertical load through direct bearing. Mortar setting beds should be used only with a concrete base and may be bonded or unbonded to it. The joints between pavers are filled with mortar that transfers horizontal load. However, mortar will not absorb expansion and contraction of individual pavers. If the pavement deflects significantly, the pavement may crack along mortar lines or across pavers. For further information about pavements with mortar setting beds, refer to *Technical Note 14C*.

BASES

The base layer in the pavement is the primary structural layer. It is subjected to the compressive, tensile and shearing stresses transmitted through the wearing course. Materials in the base layer need to be capable of resisting these stresses. Pedestrian loading is sufficiently light that a base thickness of only 4 in. (102 mm) is required when no specific site conditions dictate a thicker base. Vehicular loading requires a thicker base.

Including a subbase often provides economic benefits when the subgrade is of low strength or is susceptible to frost. Because it is lower in the pavement section, the subbase is subjected to lower stresses than the base course (see [Figure 1](#)). A subbase also can serve as a working platform to prevent subgrade damage from construction equipment. Subbase material also may be added to increase the depth of the pavement section in frost-susceptible soils. A subbase is not usually required for light duty vehicular pavements. Pedestrian-only pavements generally do not include a subbase.

Aggregate Subbase and Base

Aggregate subbase materials are typically medium-quality graded aggregates or clean sand-and-gravel mixtures. They should not be susceptible to deterioration from moisture or freezing. Subbase materials are covered by ASTM D 2940, *Specification for Graded Aggregate Material for Bases or Sub-bases for Highways or Airports* [Ref. 9]. Typical gradation envelopes are prescribed, along with other properties such as durability and plasticity. Aggregate subbase materials generally are graded from 1½ in. (38 mm) to No. 200 (0.075 mm) sizes. Aggregate subbase materials may be used directly over the subgrade soil or on top of a geotextile.

Aggregate base materials are typically high-quality, crushed, dense-graded aggregates. They usually are specified in ASTM D 2940. Aggregate base materials generally are graded from ¾ in. (19.1 mm) to No. 200 (0.075 mm) sizes. An aggregate base may be placed directly on the subgrade or over an aggregate subbase. A sand setting bed may be installed directly on an aggregate base.

It is important to compact aggregate subbase and base layers. Each layer should be compacted in accordance with ASTM D 698 to 95 percent maximum density.

Asphalt Base

Asphalt base materials consist of mixtures of aggregates and asphalt cement that are produced at a central hot-mix plant. The materials are proportioned to comply with a mix design, and the materials usually are specified in state or local standards and in ASTM D 3515, *Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures* [Ref. 10]. Asphalt aggregates usually are blended to achieve a gradation from ½ in. (12.7 mm) or ¾ in. (9.5 mm) to No. 200 (0.075 mm). An asphalt base may be placed directly on the subgrade but is more commonly laid over an aggregate subbase or base. It creates a relatively stiff and impermeable base layer.

Cement-Treated Aggregate Base

A cement-treated aggregate base material is a relatively dry, lean mixture of aggregate and portland cement that creates a stiff and impermeable base layer. These materials should be mixed at a concrete plant and laid by machine. Cement contents vary between 5 and 12 percent with sufficient water added to achieve required compaction and full hydration of cement. Compressive strengths typically are around 750 psi (5.17 MPa). A cement-treated aggregate base may be placed directly on the subgrade but is more commonly laid over an aggregate subbase. This type of base does not include reinforcement, and because of the low water and cement content, can be laid without movement joints.

Concrete Base

The compressive strength of a concrete base should be at least 4,000 psi (27.6 MPa). Concrete bases may be plain or reinforced, incorporating a grid of movement joints with load transfer devices, such as dowels. Layouts of movement joints require careful consideration of the overlying pavement system. Movement joints placed more than 12 ft (3.66 m) apart should extend through the entire pavement to prevent damage to the pavers unless using an unbonded system. A concrete base should be placed over an aggregate subbase or base.

SUBGRADE

The subgrade is classified by the existing soil conditions, the environment and drainage. For vehicular applications, the existing soil conditions for the project should be determined by a geotechnical engineer before design of the paving system. For pedestrian and residential applications, a geotechnical engineer should be used as necessary to verify suitability of existing soil for the proposed paving system.

Environmental conditions and the quality of drainage can affect the support provided by the subgrade. In wet climates, poorly drained areas or those that experience freezing conditions, the support from the subgrade is likely to be reduced during certain periods of the paving system's life. Conversely, in arid climates or well-drained areas, it is likely that a higher degree of subgrade support will be experienced during part of the paving system's life. Where water can penetrate the subgrade, it is important to drain water quickly to alleviate any potential fluctuations in soil moisture content.

Soils are typically classified into different groups to represent their engineering properties. In general, soils consisting primarily of gravel and sand can be used to support most paving systems. In general, soil consisting of clay can usually be used to support a paving system as long as it is located in a dry environment or is drained. Soils classified as organic are not suitable for subgrade and should be removed and replaced. For further guidance regarding soil capacities, refer to *Flexible Vehicular Brick Paving – A Heavy Duty Applications Guide* [Ref. 14].

GEOTEXTILE

Geotextiles are formed from plastic yarns or filaments such as polypropylene and polyester. They may be woven or nonwoven fabrics supplied in rolls. A geotextile may be used between fine-grained subgrade materials and base or subbase layers, particularly where moist conditions are anticipated. This separates the two layers, preventing the intrusion of fine soil particles into the overlying granular layer and preventing larger aggregates from punching down into the subgrade. This enables the base to retain its strength over a longer period. Geotextiles also can provide limited reinforcement to the overlying pavement layer. As the subgrade begins to deform, the geotextile is put into tension, which reduces the loading on the subgrade, slowing rut development. The geotextile manufacturer's recommendations should be sought during selection of the appropriate geotextile for particular soil conditions.

PAVEMENT LAYER CONSTRUCTION

Subgrade Preparation

The subgrade should be excavated to achieve a uniform pavement thickness, and any substandard or soft materials should be undercut and replaced with acceptable backfill. A subsurface drainage system may be installed as perforated pipes or fin drains if necessary. All utility trenches should be properly backfilled and each layer thoroughly compacted to prevent settlement. The subgrade should be scarified and moisture conditioned

to within 2 percent of optimum moisture content as determined by ASTM D 698, *Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort* (12,400 ft-lbf/ft³ (600 kN-m/m³)) [Ref. 7], to a depth of 6 in. (152 mm). Moisture conditioning clay subgrades can be more complicated, because the clay absorbs water more slowly. It should then be graded to the appropriate profile and compacted by rolling with appropriate static or vibratory rollers. The subgrade should be compacted in accordance with ASTM D 698 to 95 percent maximum dry density for clay and 100 percent maximum dry density for sand/gravel.

Geotextile

When a geotextile is used, it should be placed immediately before spreading the aggregate subbase or aggregate base. Geotextiles are not used when other base types are constructed directly on the subgrade. Care should be taken to stretch the material as it is unrolled to remove any wrinkles. A minimum lap of 12 in. (305 mm) should be provided at the sides and ends of rolls. Construction equipment should not be allowed to operate directly on the geotextile.

Aggregate Subbase and Base

Aggregate subbase and base courses are spread in layers of up to 6 in. (152 mm) in compacted thickness, dependent upon the proposed compaction process. Material may be end-dumped from the delivery trucks and spread by grader spreaders or by hand with care to avoid segregation. The material should be moisture conditioned to within 2 percent of the optimum moisture content from ASTM D 698. It should then be compacted by rolling with appropriate static or vibratory rollers, or with a plate vibrator. When using a plate vibrator, the layer thickness must be 3 in. (76 mm) or less, and more than one layer may be required. The subbase and base layers should be compacted according to ASTM D 698 to 95 percent maximum dry density. Limited regrading is permissible to achieve correct surface profile and elevations. The maximum variation under the setting bed should be +/- 3/16 in. (4.8 mm) when tested with a 10 ft (3.05 m) straightedge laid on the surface. The minimum slope of the aggregate base should be 1 in. (25.4 mm) in 4 ft (1.22 m) to allow for drainage.

Asphalt Base

Asphalt materials are produced at a hot-mix plant. They are mixed at temperatures up to 300 °F (149 °C) and should be installed before they cool to temperatures below 200 °F (93 °C). Asphalt base layers can be spread by machine or by hand. Asphalt can be laid in lifts from 1½ to 3 in. (38 to 76 mm) in thickness depending on the aggregate size and compaction equipment. Hand spreading requires adequate compaction of the base. Machine installation using a paving machine provides initial compaction, enabling more accurate placement and elevations to be achieved. Compaction of the asphalt is accomplished by an initial “breakdown” rolling and then by a finish rolling with steel- or rubber-tired rollers. Compaction is continued until the required density is achieved. This normally is a minimum of 96 percent of the density of samples of the same material compacted in a laboratory. Once materials have cooled to the ambient temperature, the layer can receive traffic, although the asphalt continues to stiffen over several months. The maximum variation under the setting bed should be +/- 3/16 in. (4.8 mm) when a 10 ft (3.05 m) straightedge is laid on the surface. The minimum slope of the asphalt base surface should be 1 in. (25.4 mm) in 4 ft (1.22 m) to allow for drainage.

Cement-Treated Aggregate Base

Plant-mixed cement-treated aggregate bases are transported to the site for spreading by machine or by hand. When spread by a paving machine, the base should be compacted to the appropriate thickness. When spread by a grader or by hand, adequate compaction is required. A cement-treated aggregate base also can be mixed in place using special equipment. A granular subgrade or imported aggregate is thoroughly mixed with cement and water to achieve the required thickness. Materials should be placed and compacted within two hours of adding water and before initial set of the cement. The base should be compacted according to ASTM D 1557, *Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort* (56,000 ft-lbf/ft³ (2,700 kN-m/m³)) [Ref. 8] to at least 95 percent of the maximum dry density. The cement-treated layer should be cured by water misting or by applying an asphalt emulsion cure coat. Traffic should not be allowed on the base for at least seven days, but paver installation may commence after three days. The maximum variation under the setting bed should be +/- 3/16 in. (4.7 mm) when a 10 ft (3.05 m) straightedge is laid on the surface. The minimum slope of the base surface should be 1 in. (25.4 mm) in 4 ft (1.22 m) to allow for drainage.

Concrete Base

Concrete usually is plant-mixed and delivered to the site in ready-mix trucks. It is discharged between forms, where it is spread and consolidated. The formwork is set to the correct elevations, and a vibrating screed is drawn between the forms to achieve the appropriate surface elevations. Movement joints containing load-transfer devices may be formed at the edges of each pour, or the devices can be cast into the concrete between forms. Saw cutting may be undertaken to induce cracking at the desired locations. A concrete base may be finished with a broom, brush or wood float. A polished surface finish should be avoided. Care should be taken to follow proper curing procedures for at least 14 days. Vehicular loads should not be permitted for at least 7 days, but paver installation may commence after 3 days. The maximum variation under the setting bed should be +/- 3/16 in. (4.7 mm) when a 10 ft (3.05 m) straightedge is laid on the surface. The minimum slope of the concrete base surface should be 1 in. (25.4 mm) in 4 ft (1.22 m) to allow for drainage.

CLEANING AND MAINTENANCE

Clay pavers are highly resistant to absorption of stains and can be kept clean in most environments by regular sweeping. Otherwise, cleaning of brick pavements essentially is the same as cleaning vertical brickwork, as discussed in *Technical Note 20*. Mortar-filled joints generally are more resistant to aggressive cleaning methods (i.e. pressure washers). Sand-filled joints subjected to aggressive cleaning methods should contain stabilized joint sand or should be treated with a joint sand stabilizer.

Efflorescence

Efflorescence is a white, powdery substance that may occasionally appear on the surface of pavers. It is the product of soluble compounds normally found in other pavement components or underlying soils, which are deposited on the surface of the paver as absorbed water evaporates from the pavement surface. Soluble compounds absorbed by the pavement from deicing chemicals also may cause efflorescence. Efflorescence often can be vacuumed or brushed off the surface and removed from dry pavers. Washing downhill with water may temporarily dissipate soluble compounds by dissolving them. However, care must be taken to ensure that the contaminated water drains away from and does not re-enter the paving system.

In many cases, efflorescence will be minimal and will wear away naturally with traffic and weathering during the early life of the pavement. If the salts are the result of groundwater or other more persistent water ingress, proprietary cleaners are available to assist in their removal. Proper surface and subsurface drainage are critical in these situations. For further information on efflorescence, refer to *Technical Notes 23* and *23A*.

Ice Removal

Several proprietary chemical products are available for preventing and removing ice from paved surfaces that perform well and reduce potential staining of pavers. Among these are calcium magnesium acetate and urea. The former is preferred because it is more effective at lower temperatures. Deicing of pavements has been undertaken for many years using rock salt. This material contains calcium chloride and can cause efflorescence. Sand or grit used to provide traction on ice should be swept up after the freezing cycle to minimize grinding of the pavers.

Snow Removal

Clearing snow from clay pavements can be undertaken using plows, snow blowers, shovels and brushes as used for other pavements. Care must be taken to ensure that the blades of the equipment do not scrape the pavement surface in a manner that might cause chipping. Rubber or urethane blade edges can be used, or proper blade height can be maintained above the pavement surface using guide wheels. Any residual snow can be cleared with brushes. Some snow-clearing procedures use heavy equipment to stockpile and subsequently remove the snow from the property. If such equipment is used, the load capacity of the pavement should be adequately designed.

SPECIAL APPLICATIONS AND CONDITIONS

Clay pavers can be used in a number of special applications that require consideration of additional aspects. The following sections cover the design of clay paver wearing surfaces for suspended decks, permeable paving systems and hydronic snowmelt systems.

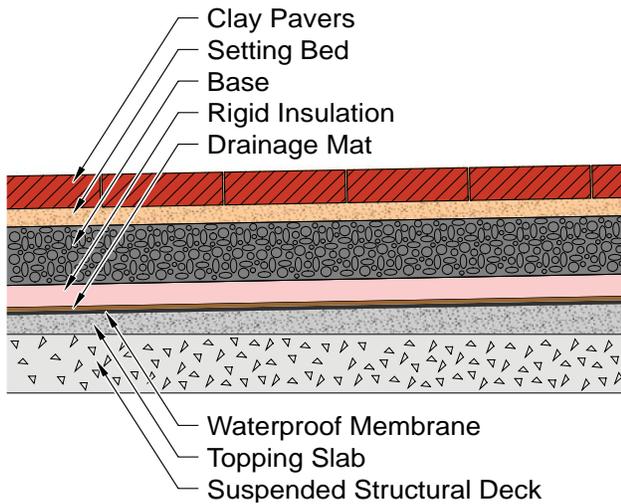


Figure 5
Typical Suspended Deck Paving Section



Photo 6
Permeable Clay Pavement

Suspended Structural Slabs

The design of pavement surfaces on suspended decks presents a special series of challenges, particularly when constructed over habitable space (see [Figure 5](#)). These include prevention of water penetration into the structure, reduction in heat loss/gain and dealing with elastic deflections.

Waterproofing. A pavement constructed over a structural concrete slab often requires a waterproof membrane. Several sheet and liquid-applied membranes are available. In most applications, a protection board is required over the waterproof membrane.

Drainage. Water inevitably will penetrate the paver system, and drainage is required to prevent it from collecting on top of the waterproof membrane. Horizontal drainage mats consisting of a dimpled three-dimensional plastic core covered with filter fabric frequently are used. A 2 percent slope should be provided toward drains to assist drainage of water. Although the core material has a high compressive strength, the filter fabric can be compressed. Consequently, horizontal drainage mats in pavements subject to vehicular traffic should not be positioned immediately below the setting bed.

Insulation. When a paved surface is located over a habitable space, it may be necessary to incorporate insulation into the section. The most common type of insulation is extruded polystyrene, available in boards of various compressive strengths and thicknesses. However, compressive strength values are measured when the insulation thickness is compressed 5 percent. As such, the material is resilient under load and should not be placed immediately under the setting bed when vehicular traffic will use the pavement.

An alternative insulating material that can be used in pavement systems on suspended structural slabs subject to vehicular traffic is foamed concrete. It is more rigid than extruded polystyrene but is less thermally efficient. This material also is available in a range of compressive strengths and insulation values.

Loading. Pavers and setting bed materials can be considered to apply a dead load of 10 lb/sq ft per inch (190 Pa per cm) of thickness.

Deflections. A maximum deflection of 1/360 of the span is recommended for flexible pavement systems installed over a suspended structural slab. If vehicular loads are anticipated, flexible pavement deflection should be limited to 1/480. When rigid paving systems are installed, the deflections should be limited to 1/600.

Permeable Pavements

Many urban development regulations require that the surface-water runoff from a new project should not exceed the original values. This may be expressed as a peak flow rate or as a total quantity of water. Permeable pavements (see [Photo 6](#)) can be used to reduce or delay entry of runoff from a pavement surface into stormwater systems or environmentally sensitive areas. In pavements with clay pavers, this can be achieved by creating wide

joints that are filled with a permeable aggregate rather than sand. The pavers are also laid on a permeable setting bed. This allows the water that falls on a pavement to filter through the surface into a permeable base. The water will be temporarily stored in the base, or it may soak into the subgrade if this is also permeable (see Figure 6).

Subgrades. If the subgrade is permeable, water that infiltrates the pavement through the surface voids can drain away over time, after a rain event. Good practice usually requires that water completely drains within three days of entering the pavement. However, compaction in preparation for placing the base material may result in significant reduction in subgrade permeability. As such, there are few permeable pavements that can rely completely on exfiltration through the subgrade. If the water will not drain, provision should be made to release the water stored in the base material through drainage pipes.

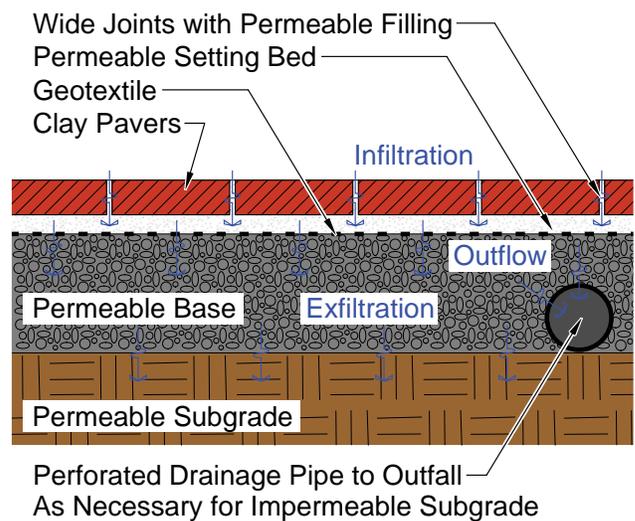


Figure 6
Typical Permeable Pavement Section

Bases. Permeable bases are constructed using single size or open graded aggregate materials. These materials typically have a void content of 15 percent to 40 percent to accommodate the water that needs to be detained. Typical single-number aggregate sizes No. 4, No. 5 and No. 6 from ASTM C 33, *Specification for Concrete Aggregate* [Ref. 2] or ASTM D 448, *Classification for Sizes of Aggregate for Road and Bridge Construction* [Ref. 6] have a high void content and are frequently used. There are several double-number size options such as No. 57 and No. 67. For these aggregate materials, the void content is less because a broader grading envelope is used, but the material may be more readily available.

Setting Bed and Joints. Similar aggregate is commonly used for the setting bed and joints. Size No. 8, No. 9 or No. 89 aggregates complying with ASTM C 33 or ASTM D 448 are most frequently used. Joints ranging from 1/4 to 3/8 in. (6.4 to 9.5 mm) are typical. There also are several systems that use plastic spacers to create consistent width joints of 1/2 to 3/4 in. (12.7 to 19.1 mm). However, the interlock between pavers is greatly reduced when joint sizes are greater than 1/4 in. (6.4 mm) or when plastic spacers are used.

Hydronic Snow Melt Systems

Hydronic snow melt systems consist of a network of plastic tubing incorporated into the pavement system, typically at 6 to 8 in. (150 to 200 mm) centers. Heated liquid is pumped around the system during near- and subfreezing conditions so that the pavement temperature is maintained slightly above freezing, thus preventing the accumulation of snow or the development of ice on the pavement surface. Continuous loops of 3/4 to 1 in. (19.1 to 25.4 mm) diameter tubing are made from cross-linked polyethylene. Tubing usually is secured to welded wire fabric during construction to establish and maintain the designed layout.

There are two common approaches to positioning the tubing in the pavement. The first is to cast the tubing into a concrete subslab, where it will be protected by the concrete. The second is to incorporate it within the bedding material under the pavers. The latter option is not recommended for pavements with frequent vehicular traffic but can be used for pavements under pedestrian loading. Adequate cover is required over the tubing, typically a minimum of 1/2 in. (12.7 mm) after compaction. Bituminous bedding materials are not appropriate for this approach, in part because of the installation temperature, but also because of the layer thickness. When a sand setting bed is used, pre-compaction of the sand before screeding is recommended to minimize the occurrence of hard spots under the pavers. This is achieved by providing approximately 1/2 in. (12.7 mm) additional cover when spreading the sand, followed by several passes of the plate vibrator to compact the sand. The top surface then is loosened slightly with a hoe or rake and screeded to the appropriate level, leaving a smaller surcharge than normal.

SUMMARY

Pedestrian and light duty vehicular pavements made with clay pavers can serve in a wide variety of applications, including plazas, sidewalks and residential driveways and commercial driveways (passenger drop-offs). Many paver sizes and colors are available, as are special shapes. Proper design and construction of a pavement's base, setting bed and pavers ensure a structurally stable, durable pavement able to meet site and project requirements. Lending intrinsic character and sophistication to any space, clay pavers can be a structurally stable, economically viable pavement option.

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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Paving Systems Using Clay Pavers on a Sand Setting Bed

Abstract: This *Technical Note* describes the proper design and construction of pavements made with clay pavers on a sand setting bed in pedestrian and vehicular, residential and nonresidential projects.

Key Words: flexible, mortarless paving, paving, rigid, sand setting bed.

SUMMARY OF RECOMMENDATIONS:

General

- Determine if application is pedestrian, light duty vehicular or heavy duty vehicular
- Implement regular maintenance program to maintain pavers in a safe and serviceable condition

Patterns

- Use herringbone pattern for pavements subject to vehicular traffic
- Design flexibility into layout to accommodate field conditions

Drainage

- Provide a minimum slope of 1/4 in. per foot (2 percent grade)
- For concrete and impermeable bases, provide weeps through base

Edge Restraints

- For pavements subject to vehicular traffic, use concrete or stone curbs or steel angles anchored to a concrete base or foundation or a proprietary system rated for traffic
- For all other pavements, use any of the above or clay pavers in a concrete foundation, proprietary plastic or metal edge restraint systems spiked into aggregate
- Use edge restraint with vertical face at paver interface

Clay Pavers

- For most residential, pedestrian and light duty vehicular applications, such as driveways, entranceways and passenger drop-offs, use clay pavers complying with ASTM C 902
- For heavy duty vehicular applications, such as streets, commercial driveways and industrial applications, use clay pavers complying with ASTM C 1272.
- Refer to *Technical Note 14* for additional recommendations

Joint and Setting Bed Sand

- Use concrete sand complying with ASTM C 33

Stabilized Joint Sand

- Use where potential sand loss or high water permeability is anticipated and not desired
- Follow paver manufacturer's recommendation regarding the use of stabilized joint sand or joint sand stabilizer
- Use performance history as a basis for selection

Concrete Base

- For concrete base on ground, provide control joints spaced a maximum of 12 ft (3.66 m) o.c.
- For elevated concrete slab, provide control joints through concrete slab and expansion joints through pavement above aligned with control joints
- Provide weeps through base for drainage

Base, Subbase and Subgrade

- Refer to *Technical Note 14*

INTRODUCTION

This *Technical Note* covers the design, detailing and specification of clay pavers when laid on a sand setting bed (see [Figure 1](#)). Refer to *Technical Note 14* for clay paver design considerations, including traffic, site conditions, drainage and appearance. Sand-set pavers are the most cost-effective method of constructing a pavement made with clay pavers. The system relies upon developing interlock in the paving course, which is generated by friction between the pavers and the jointing sand. This enables the pavers to function as part of the structural pavement system.

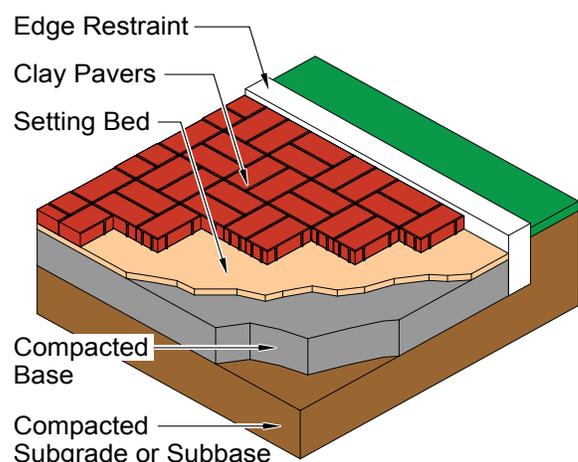


Figure 1
Typical Brick Pavement

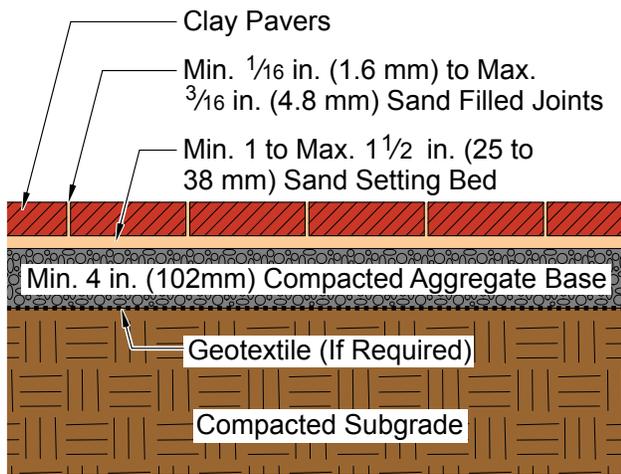


Figure 2
Typical Residential Patio or Walkway

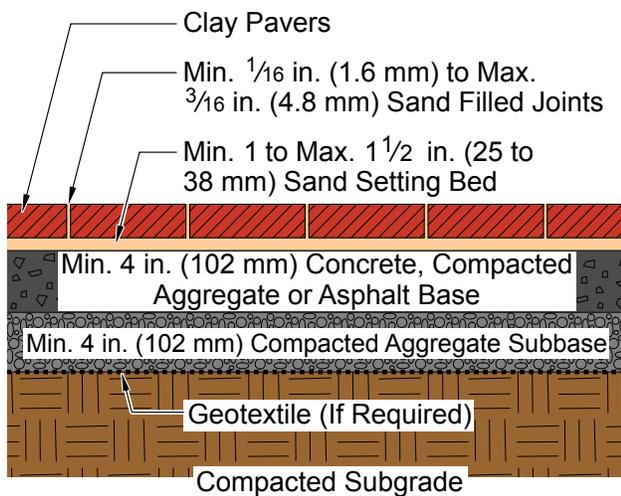


Figure 3
Typical Residential Driveway

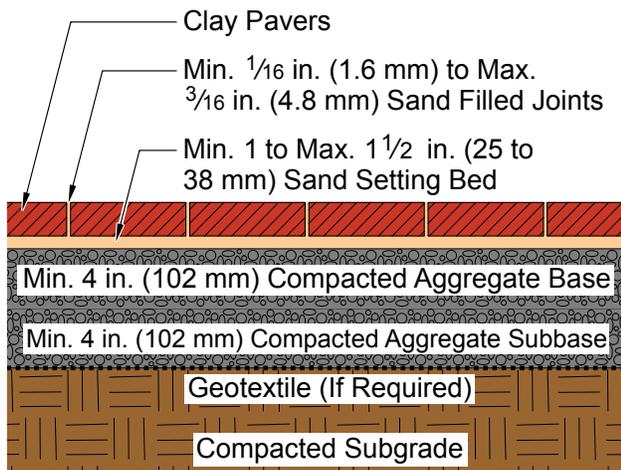


Figure 4
Typical Commercial/Pedestrian
Public Plaza/Sidewalk

Applications

Clay pavers set on a sand setting bed are appropriate for virtually any paver application, ranging from pedestrian to heavy duty vehicular traffic. At a minimum, the system requires clay brick pavers and a sand setting bed, compacted after paver placement. Depending on subgrade conditions, additional layers, base and subbase may be required.

Residential Patios and Walkways. These applications are the most common and handle the lightest loads. The sand setting bed thickness should be 1 to 1½ in. (25 to 38 mm). The sand setting bed should be separated from the subgrade by a compacted aggregate base (see Figure 2). This base typically consists of coarse aggregate (gravel) of varying gradation, compacted to a minimum thickness of 4 in. (102 mm) using mechanical tamping or vibration.

Residential Driveways. The heavier and more localized loads of vehicles on driveways serving one- or two-family houses result in a thicker paving system requiring a minimum 4 in. (102 mm) compacted aggregate subbase. The base should consist of a minimum 4 in. (102 mm) layer of coarse aggregate, cast-in-place concrete or asphalt (see Figure 3).

The sand setting bed thickness should be 1 to 1½ in. (25 to 38 mm). The base typically consists of coarse aggregate (gravel) of varying gradation, compacted to a minimum thickness of 4 in. (102 mm) using mechanical tamping or vibration.

Commercial/Public Plazas and Walkways. With increased pedestrian traffic and increased risk of injury from any localized differential displacements, these types of applications require a firm pavement, similar to that of residential driveways. For plazas, however, a minimum 4 in. (102 mm) compacted aggregate base and subbase typically are used (see Figure 4). Note that for these applications on sites consisting of silty or clayey soils, geotextile should be placed on the compacted subgrade, below the subbase.

The sand setting bed thickness should be 1 to 1½ in. (25 to 38 mm). The base typically consists of coarse aggregate (gravel) of varying gradation, compacted to a minimum thickness of 4 in. (102 mm) using mechanical tamping or vibration.

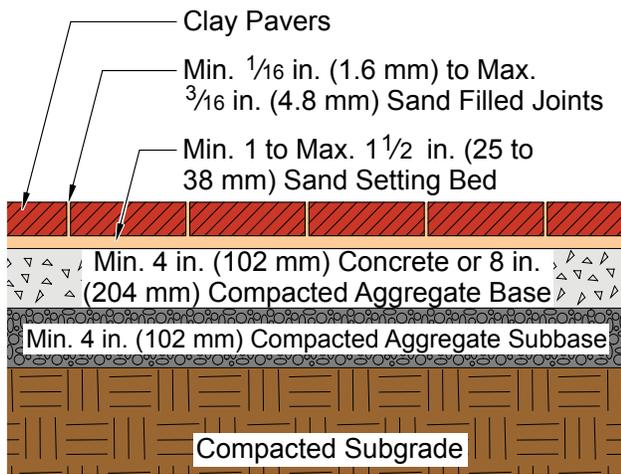


Figure 5
Typical Light Duty Vehicular

Light Duty Vehicular. For parking areas and neighborhood streets serving light duty vehicles, the brick pavement section should be similar to that of a residential driveway, but with a more substantial base. A pavement with a concrete base as depicted in Figure 5 or a thicker aggregate or asphalt base is required.

Heavy Duty Vehicular. Paving systems exposed to more than 251 daily equivalent single axle loads (ESAL) from trucks or combination vehicles having three or more loaded axles are considered heavy duty vehicular applications. Such paving systems are beyond the scope of this *Technical Note* series. For further information about heavy vehicular applications, refer to *Flexible Vehicular Brick Paving – A Heavy Duty Applications Guide* [Ref. 6].

GENERAL DESIGN AND DETAILING CONSIDERATIONS

Interlock

Sand-set pavers interlock with one another by generating friction across the joints. This is the result of tightly packing sand into the joints during the vibration process. The interlock improves as the pavement is subjected to traffic. There are three types of interlock present in a sand-set paver pavement when properly constructed: vertical, horizontal and rotational interlock. Interlocked pavers cannot be readily extracted from the pavement.

Vertical interlock allows load transfer across joints between pavers. When a load is applied to one paver, a portion is transferred through sand in the joints to adjacent pavers, as shown in Figure 6, distributing the load to a greater area and reducing the stress on the sand bed and the underlying layers. Vertical interlock allows a paving layer to act as a structural layer. Without vertical interlock, the pavers do not act as a structural layer, and localized stress on the setting bed directly under a loaded paver is increased. Pavers installed on a sand setting bed should not be laid with 1/4 in. (6.4 mm) joints, because this is too wide to achieve interlock, making the pavers unable to transfer load to adjacent pavers. The proper joint width is 1/16 to 3/16 in. (1.6 to 4.8 mm).

Rotational interlock is the result of lateral resistance from adjacent pavers and adequate edge restraints, as shown in Figure 7. It is improved with full joints that support the top of the paver. Without adequate restraint, the pavers can roll in the direction of lateral loading, which may result in an irregular surface profile.

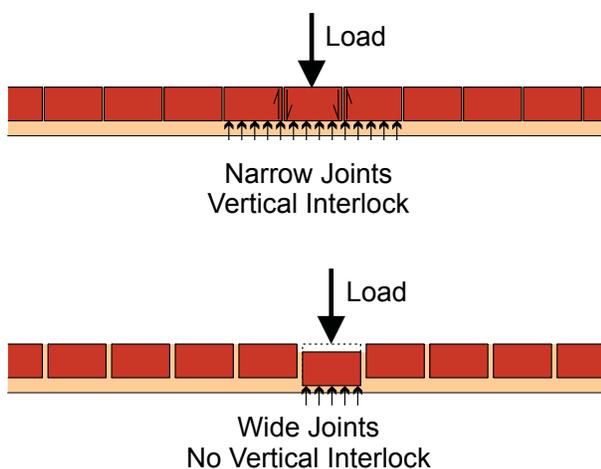


Figure 6
Vertical Interlock of Pavers

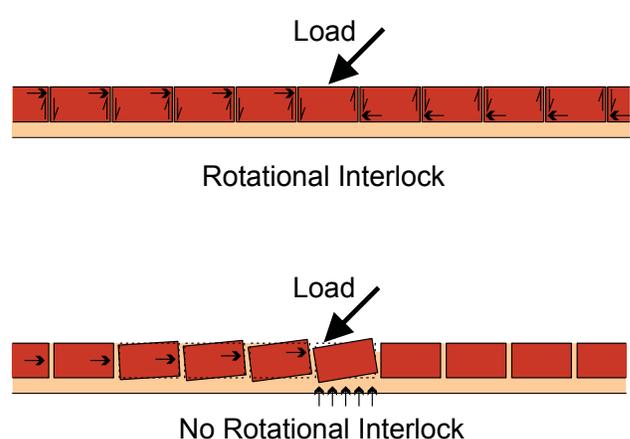


Figure 7
Rotational Interlock of Pavers

The extent of horizontal interlock depends upon the laying (bond) pattern of the pavers and the edge restraint. Patterns that have staggered joint lines allow the load to be distributed to a larger number of pavers, as shown in **Figure 8**. This reduces joint compressive stress and potential for horizontal creep of pavers. Continuous joints result in minimal load distribution and increased joint compressive stress, which may produce horizontal movement.

Pavement Section

Clay pavers over a sand setting bed can be installed over a flexible or rigid base, including aggregate, asphalt, cement-treated aggregate or concrete bases. For further information on bases, refer to *Technical Note 14*.

The design of the base is beyond the scope of this *Technical Note*, and the advice of a qualified and experienced pavement designer should be sought. For preliminary design, it is reasonable to assume that a minimum of 4 in. (102 mm) of concrete, cement-treated aggregate, asphalt or aggregate base will be needed for sand and gravel subgrades. For residential driveway, commercial/pedestrian and light duty vehicular applications with clay or silt subgrades, an additional 4 in. (102 mm) of aggregate subbase or base should be added to each option. Additional thickness may be required when the subgrade is susceptible to frost heave or when the pavement must support heavy axle loads from trucks.

Concrete bases should be reinforced with welded wire fabric or reinforcement bars and should have control joints spaced at 12 ft (3.66 m) intervals to control expansion and contraction. To minimize movement of slabs, detail movement joints as shown in **Figure 9**. Control joints in suspended structural slabs should extend through the entire slab and align with an expansion joint through the pavement above. Control joints should have dowels or a keyway to limit vertical separation across the joint.

Vehicular Traffic

For light duty vehicular paving systems, a maximum traffic speed of 30 mph (50 kph) is considered appropriate for pavers in a sand setting bed. When frequent vehicular traffic is anticipated, additional attention is required to ensure that joints between pavers remain filled with sand. Higher speed applications require more vigilance, as the interlock between pavers is reduced with sand loss. Paving systems for vehicular traffic applications usually will include a compacted subbase to distribute loads (see **Figure 5**).

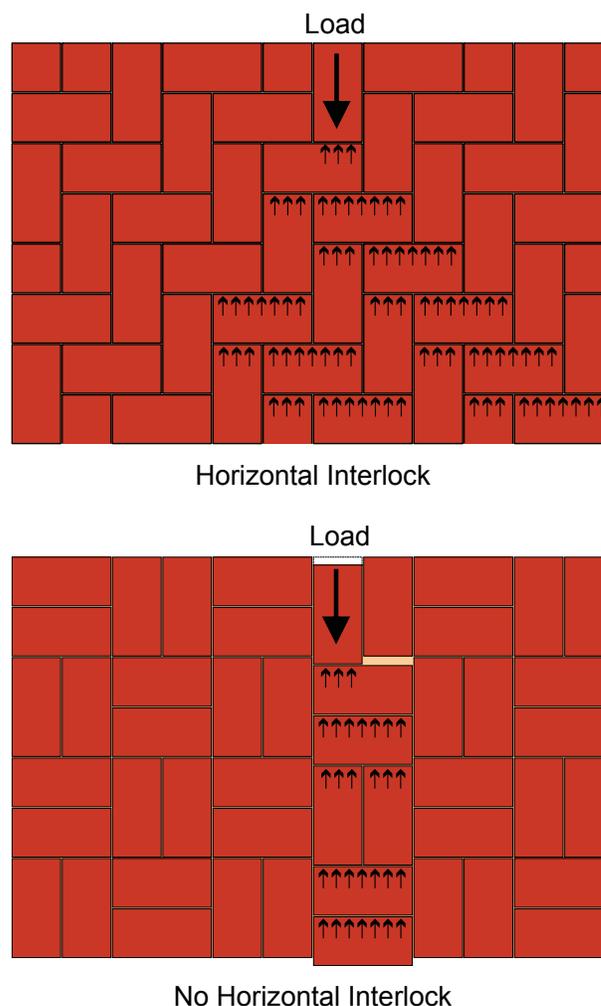


Figure 8
Horizontal Interlock of Pavers

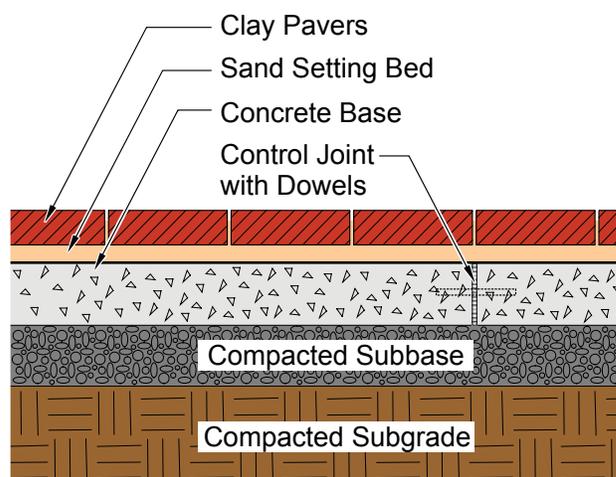


Figure 9
Control Joints

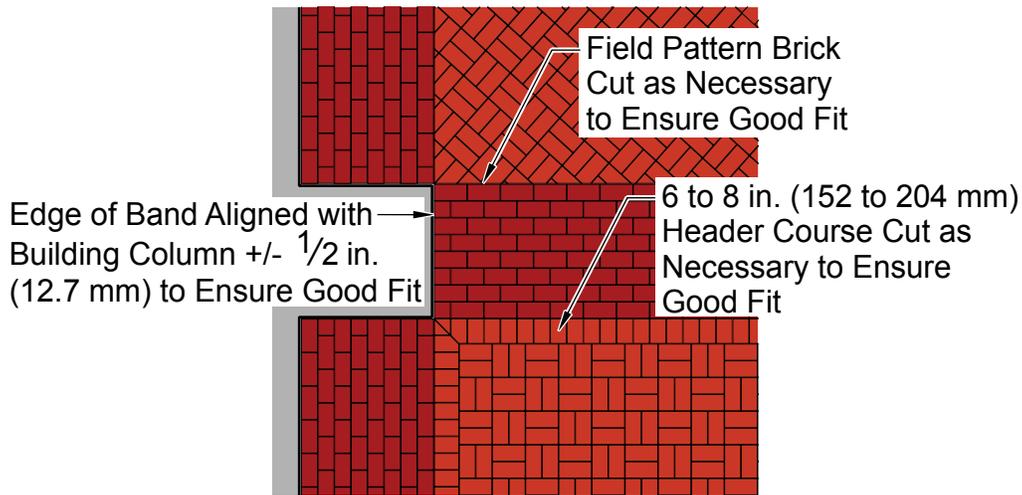


Figure 10
Pattern Options to Maintain Specified Joint Widths

The designer should consider the bond pattern for vehicular traffic applications. Any pattern may be used under foot traffic. When vehicles operate on a pavement, patterns that distribute horizontal loads (i.e., loads from turning, accelerating or braking vehicles) across multiple pavers, such as herringbone, are recommended. Patterns with continuous joints, such as stack bond or running bond, are more susceptible to creep from horizontal loading. Where such patterns are used in vehicular pavements, continuous joint lines should be oriented perpendicular to the direction of vehicle travel.

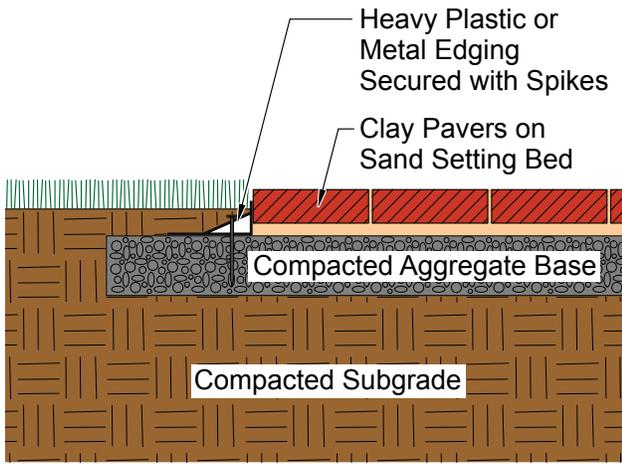
Bond Patterns/Layout

The size of pavers may influence the selection of a suitable bond pattern. Pavers for use on a sand setting bed typically are manufactured in sizes that accommodate a joint width of approximately 1/8 in. (3.2 mm) to encourage optimal interlock.

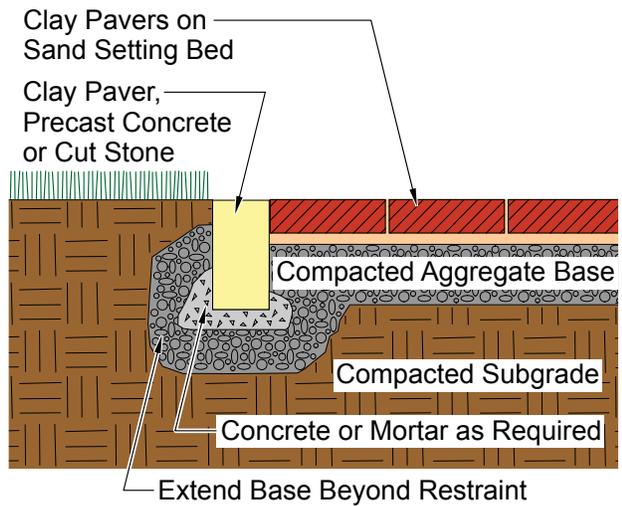
Bond patterns such as herringbone, basket weave and others make use of the 1:2 or 1:3 ratios between the pavers' length and width to maintain the pattern and joint alignment. Pavers sized to accommodate joint widths of approximately 3/8 in. (9.5 mm) do not achieve these ratios. Such pavers typically are used in pavements with mortar joints. When they are laid on a sand setting bed, only a running bond, stack bond or chevron pattern should be used, since these patterns do not depend on these ratios.

An individual clay paver's dimensions may be slightly different from the dimensions of another clay paver from the same run. The inherent variability of their dimensions is a result of their manufacturing process. Pavers may be larger or smaller within allowable tolerances of their specified size. This variability may not be consistent, because actual dimensions may be greater or smaller than the specified dimensions. As such, the pavers may not be able to be placed in a standard modular pattern. Blending of pavers from multiple cubes during installation can overcome this issue. The installer should constantly monitor paver size during installation to ensure that the bond pattern and joint size are maintained.

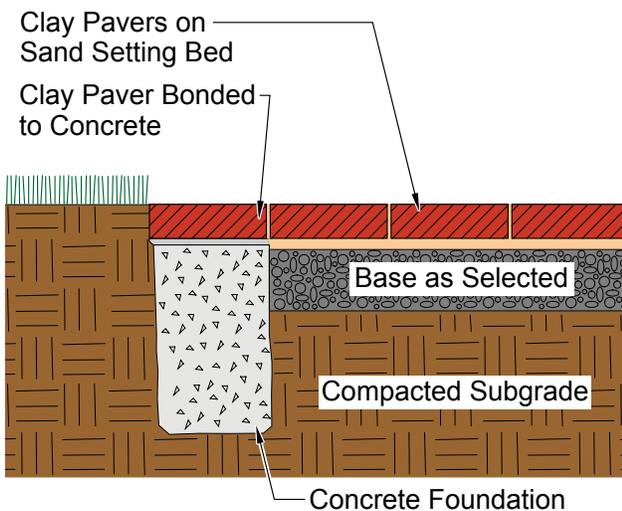
When designing an installation pattern with changes in bond and color, incorporating some tolerance in the placement of certain paver features is recommended. This can be achieved by using saw cut pavers at junctions of colored areas or by allowing approximate dimensions and realistic tolerances when placing certain paver features. Two examples are depicted in [Figure 10](#).



(a) Proprietary Edge Restraint System



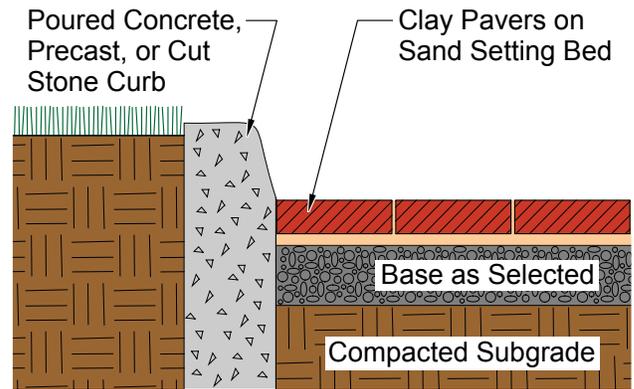
(b) Clay Paver, Precast Concrete or Cut Stone Edge Restraint



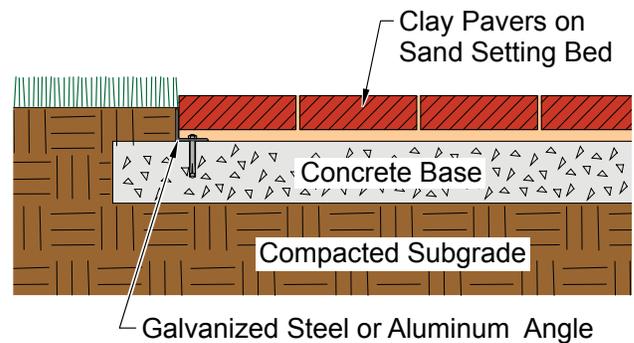
(c) Bonded Clay Paver Edge Restraint

Edge Restraints

Edge restraints are critical in a pavement with a sand setting bed to enable consistent interlock and resist horizontal loads transferred from pavers. Selection of edge restraint will depend on pavement section and use. Figure 11 (pages 6 and 7) presents various options, in increasing order of load capacity. Concrete curbs or steel angles attached to a concrete foundation or concrete base layer are the most robust edge restraints. They are recommended for all pavements subject to regular vehicular traffic. Edge restraints for other applications may include pavers bonded to a concrete foundation, and a range of proprietary plastic and metal edge restraint systems that are typically spiked into aggregate bases. Timber edging and concrete backing poured to restrain edge pavers may not be effective over the long term. It is important that all edge restraints have a vertical rather than inclined face for the pavers to butt against.

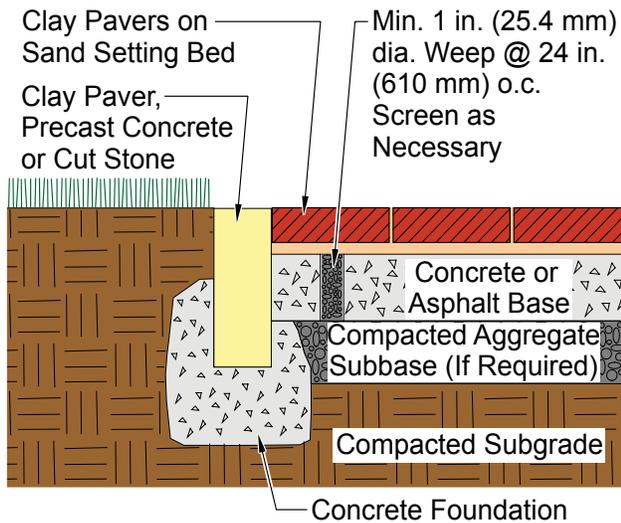


(d) Curb Edge

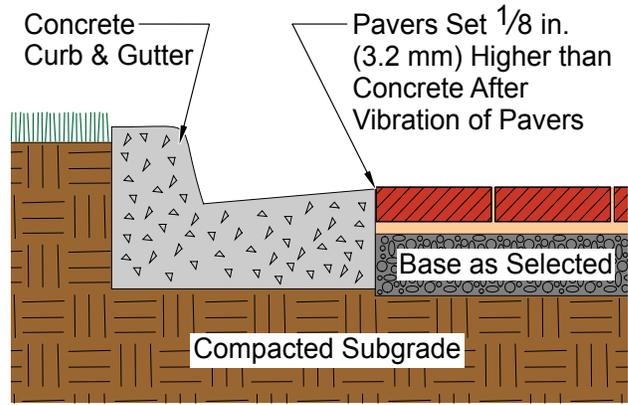


(e) Steel Angle Edge Restraint

Figure 11
Edge Restraints



(f) Clay Paver, Precast Concrete or Stone Edge Restraint



(g) Poured Concrete Curb and Gutter Edge Restraint

Figure 11 (continued)
Edge Restraints

Drainage

Adequate drainage is important to the performance and durability of any clay paving system. Water should be drained from the paving system as quickly as possible. A minimum slope of 1/4 in. per foot (2 percent grade) is recommended. Adequate drainage should be provided to ensure the integrity of all layers in a paving system.

A sand setting bed will continue to consolidate slightly after construction is complete. Pavers should be finished slightly higher than drainage inlets and other low edges of a pavement. This will minimize water puddling at these locations. Typically 1/8 in. (3.2 mm) will be adequate and will not present a short-term tripping hazard.

Over time, small amounts of water will migrate through sand joints. Consequently, a sand-set paving system with an impermeable base will require weep openings at low points in the pavement. Weep openings permit moisture to seep out of the pavement rather than saturating the setting bed. Even a well-compacted aggregate base may benefit from installing weep openings. Sand is less durable in a saturated state than when dry or slightly damp.

Several weep opening options are available. A small-diameter (1½ to 2 in. [38 to 51 mm]) pipe with ends wrapped in geotextile may be placed through the side wall of drain inlets or through edge restraints. Such weeps should be installed at spacings of 2 to 6 ft (0.60 to 1.83 m) depending on pavement geometry and profiles, environmental conditions and pavement use. As an alternative, a drainage mat may be placed vertically through the base. This may be used in conjunction with small pipes at drain inlets. For a concrete base, holes may be drilled or formed through the slab to weep water to the subbase. Locating holes away from the impact of wheel loads is necessary since subbase materials may be moisture-sensitive.

Penetrations

Large and small features that penetrate through the paver layer should be properly detailed. These features include utility covers, tree pits, light pole bases, signposts and street furniture. Features may either penetrate the entire pavement section to an independent structure or foundation, or be anchored to a concrete subslab. Such features can present some issues in cutting the pavers to form a uniform joint around them.

Some utility covers and other frames are relatively shallow, or have buttresses, inclined faces, anchor bolts or other features that may interfere with the bottom of a paver. Where possible, features should be specified,

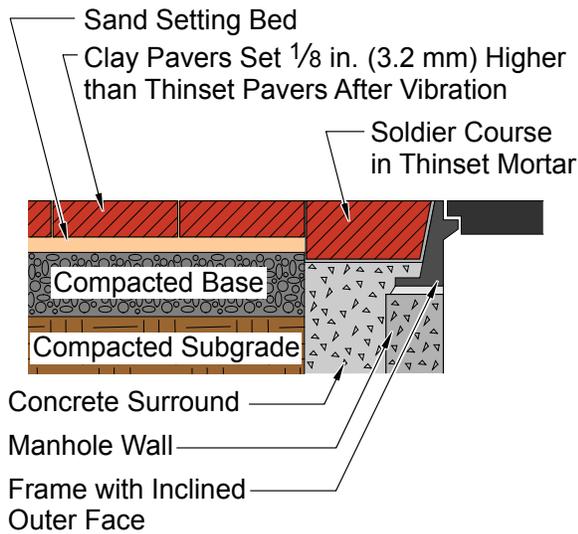


Figure 12
Large Penetration

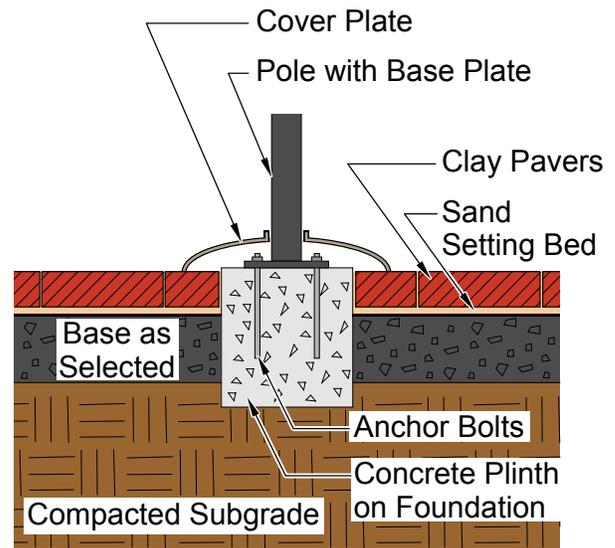


Figure 13
Small Penetration

designed and installed deeper than the setting bed. Where this is not possible, casting a concrete collar around the frame and thin-setting a header course of pavers on the concrete may clear obstructions to the sand setting bed interface, as shown in [Figure 12](#).

Accurately cutting and placing pavers against small features may prove difficult. An alternative is to construct a concrete plinth up to the pavement surface and to install a cover plate to conceal the anchorage of the feature, as shown in [Figure 13](#). This also allows easy access for repairs, without removing pavers.

MATERIALS

Subgrade

For design purposes, the subgrade is considered to be either sand/gravel or clay/silt. The latter are more sensitive to moisture and frost and may require the use of subbase layers and proper drainage to protect against shrinkage, swelling and frost heave. The advice of a properly qualified and experienced pavement designer should be sought in regard to the preparation of the subgrade.

Base and Subbase

Base materials for pavers laid in a sand setting bed may be of aggregate, cement-treated aggregate, asphalt or concrete. When a subbase is required, aggregate generally is used. Aggregate materials should comply with ASTM D 2940 and be compacted in accordance with ASTM D 698 to 95 percent maximum density. Asphalt should meet ASTM D 3515. Concrete should have a minimum compressive strength of 4,000 psi (27.6 MPa) and should have control joints spaced a maximum of every 12 feet (3.66 m). For a more detailed discussion of base and subbase materials, refer to *Technical Note 14*.

Geotextiles

Geotextiles are used on top of silt or clay soils to help stabilize subgrades and under sand setting beds to prevent loss of sand through weep openings and other gaps in the pavement base or at edge restraints or penetrations. The preferred type of geotextile is a woven, polypropylene fabric complying with ASTM D 4751, *Test Method for Determining Apparent Opening Size of a Geotextile* [Ref. 5], with an approximate opening size from a No. 70 to No. 100 sieve size opening. Nonwoven geotextiles can be used for light-traffic applications. Geotextiles should be lapped at the sides and ends of rolls a minimum of 12 in. (305 mm). Care should be taken to not locate laps directly under anticipated wheel paths. Geotextiles should extend 6 in. (152 mm) beyond potential areas of sand

loss. These may be adhered in place, but generally will stay in position once covered by the sand setting bed. Geotextiles should not be allowed to span over unfilled holes or pits in the surface of the base that are greater than 1 in. (25.4 mm).

Setting Bed Sand

A sand setting bed provides a strong support layer under pavers and accommodates variations in paver thickness to produce a smooth surface profile. A portion of setting bed sand penetrates the joints during vibration and initializes the development of interlock between the pavers. Sand for the setting bed should be clean, naturally occurring material with angular and subangular shaped particles, with a maximum size of about 3/16 in. (4.8 mm). Concrete sand conforming to the requirements of ASTM C 33, *Specification for Concrete Aggregate* [Ref. 1], or local department of transportation standards is recommended for use as setting bed material. This provides a more stable and durable setting bed than mason sand or screenings, which have a more rounded shape and should not be used. Sand rich in silica-based minerals is desirable, because carbonate-based minerals are softer and can break down when saturated. Manufactured limestone sand usually causes efflorescence and should be avoided unless it has a proven track record on similar projects.

Clay Pavers

A wide selection of colors and textures is available in clay pavers. Further information on clay pavers can be found in *Technical Note 14*.

Pavers generally are manufactured with their length equal to a module of their width. Two commonly specified clay paver sizes are 4 in. wide by 8 in. long (102 by 203 mm) and 3¾ in. wide by 7½ in. long (95 by 190 mm). Other similar sizes are available, such as 3⅝ in. wide by 7⅝ in. long (92 by 194 mm), and several manufacturers are able to provide custom sizes. Common specified thicknesses are 1½ in. (38 mm), 2¼ in. (57 mm) and 2¾ in. (70 mm) [2⅝ in. (67 mm) excluding chamfered edge].

All clay pavers covered by ASTM C 902, *Specification for Pedestrian and Light Traffic Paving Brick* [Ref. 3], and ASTM C 1272, *Specification for Heavy Vehicular Paving Brick* [Ref. 4], can be installed on a sand setting bed. The designer should select the appropriate Application, Type and Class of the paver for the project based on aesthetics, use, abrasion resistance and the required resistance to damage from weather exposure. For more detailed information on specifying clay pavers, refer to *Technical Note 14*.

When square-edged pavers or pavers without lugs are laid with sand joints, care should be taken to ensure that they do not make direct contact with or lip under adjacent pavers. A minimum 1/16 in. (1.6 mm) wide sand-filled joint should separate each clay paver to minimize potential chipping. However, the maximum joint width should be no more than 3/16 in. (4.8 mm) to minimize the potential for horizontal movement under vehicular traffic. If pavers with spacers and/or a rounded or chamfered edge are installed, there is less potential for direct paver contact. When lugs are used, the potential for creep is reduced.

Jointing Sand

Sand within pavement joints creates interlock between pavers by generating friction across the joint. Larger particles present in joints reduce the potential for lateral movement. Finer particles act to reduce contact stresses around the larger particles, reducing the potential of the particles breaking down. The sand also accommodates the variations in paver size and reduces the potential for contact between pavers that can lead to chipping. ASTM C 33 concrete sand should be placed in joints before vibration to maximize interlock at the bottom portion of joints. However, coarse particles that do not fall into joints should be brushed off the pavement surface rather than worked in. After vibration, finer jointing sand may be placed so that it penetrates to the bottom of the joints and achieves better filling. When the typical joint dimension exceeds 3/16 in. (4.8 mm), stabilized sand or joint sand stabilizer should be used.

Joint Sand Stabilizers

In conditions where potential sand loss or high joint permeability may not be desirable, a joint sand stabilizer is recommended. These conditions include intensive cleaning practices, high surface water flows and flat areas with moisture-sensitive subgrades. There are several different types of joint sand stabilizers. These include breathable polymeric liquids that can be sprayed onto the pavement surface and squeezed into the joints with a squeegee, as

well as dry products that can be mixed with the joint sand before installation. Pretreated sands also are available for joint filling. Strict adherence to the stabilizer manufacturer's recommendations is required to achieve successful installations. When selecting a stabilizer, it is important to choose one with a proven history that does not discolor the surface or peel over time. The paver manufacturer's recommendation regarding joint sand stabilizers should be followed. Joint sand stabilizers should be applied to the completed paver surface. Stabilizers should be applied to the pavement surface before the application of other coatings to enhance the appearance of the pavers or to protect against staining. For further guidance on selecting coatings for use on brick pavements, refer to *Technical Note 6A*.

INSTALLATION AND WORKMANSHIP

Subgrade

The subgrade should be brought to the proper level and cleared of organic material. Compaction should comply with ASTM D 698 to 95 percent maximum dry density for clay and 100 percent maximum dry density for sand/gravel. For a more detailed discussion of subgrade preparation, refer to *Technical Note 14*.

Base and Subbase

Base and subbase materials should be placed per the design. Aggregate should be compacted in accordance with ASTM D 698 to 95 percent maximum density. The maximum variation under the setting bed should be +/- 3/16 in. (4.8 mm) when a 10 ft (3.05 m) straightedge is laid on the surface. The minimum slope of the concrete base surface should be 1 in. (25.4 mm) in 4 ft (1.22 m) to allow for drainage. For a more detailed discussion on the installation of base and subbase materials, refer to *Technical Note 14*.

Setting Bed

Whenever possible, the direction of installation should be planned to protect the paving against premature use or damage by rain or other construction activities. The surface of the underlying base material should be thoroughly clean and dry before installation of the bedding sand. Elevations should be verified to ensure that the sand setting bed will be a consistent thickness after compaction. The setting bed should not be used to bring the pavement to the correct grade. Isolated high and low spots should be corrected before sand placement to avoid an uneven pavement surface resulting from variable sand setting bed thicknesses. Lines should be established for setting out the pattern. The contractor should become aware of size variations in the pavers to maintain the pattern without localized opening or closing of joints to meet a fixed edge. All areas of potential sand loss should be covered with geotextile.

Screed rails should be set on the surface of the base to proper line and level. They are typically placed 8 to 12 ft (2.44 to 3.66 m) apart, or closer when working on a grade. An allowance should be made in the thickness of the setting bed for compaction of bedding sand as pavers are installed, as well as additional consolidation in service. An experienced contractor will be aware of the proper thickness for different conditions to achieve the correct long-term surface profiles. The bed thickness should be established so that when the pavers are compacted, their top surface will be 1/8 in. (3.2 mm) above the required grades to allow for limited settling in service.

To prevent disturbance, setting bed sand should not be spread too far ahead of the paver laying face. Voids left after removing the screed rails should be filled. The screeded bedding sand may be affected by wind or rain as well as by wayward construction operations. If sand is disturbed, it should be loosened and rescreeded. Extensive areas of screeded sand should not be left overnight unless they are properly protected from disturbance and moisture. Moisture content of setting bed sand should be kept as uniform as possible to minimize undulations in the pavement surface. The sand should be kept in a damp condition conducive to packing. Water should not be applied except by very light misting. Stockpiled sand should be covered to protect it from wind and rain.

Paver Installation

The pavers are laid on the setting bed working away from an edge restraint or the existing laying face while following the pattern lines that have been established. Full pavers should be laid to the required pattern with 1/16 to 3/16 in. (1.6 to 4.8 mm) wide joints. The optimum joint width for vehicular traffic is between 1/16 and 1/8 in. (1.6 and 3.2 mm), but some wider joints may be required with Application PS pavers, and particularly with

Application PA pavers. Lugs enable the correct joint width to be achieved when the pavers are placed in contact with one another. Pavers should not be forced together, resulting in excessive contact, because this may cause the pavers to chip during installation or compaction. At least two cubes of each color of pavers should be drawn from at one time, and the manufacturer's recommendations on color blending should be followed. The pavers should be adjusted to form straight pattern lines while maintaining the correct joint widths.

Several feet of pavers should be installed before beginning to add cut pavers as infill against edge conditions. Bench-mounted masonry saws are the best means of cutting the pavers to achieve a neat edge and a vertical cut face. Use of a wet saw or dust collection system is recommended to control dust. Guillotine cutters also may be used, but their cuts typically are not as straight and neat. Convex curves can be formed using multiple cuts, but this requires a skilled craftsman to meet allowable joint tolerances. Concave curves are very difficult to form and should be avoided when possible.

Pavers should be compacted at the end of each day to prevent any damage while left unattended. The pavement surface should be compacted using a plate compactor. These typically have a plate area of 2½ to 3 sq ft (0.23 to 0.28 sq m) and operate at a frequency of 80 to 100 Hz. To prevent pavers from chipping during vibration, a little bedding sand material can be swept into the joints, or the underside of the plate compactor can be fitted with a rubber mat. Pavers also can be covered with a sheet of geotextile or sheets of plywood during vibration. For molded pavers, vibration is especially important since irregularities and dimensional variations on the underside could lead to air gaps or improper support if not properly compacted into the sand setting bed. Compaction should not be carried out within 4 ft (1.2 m) of unfinished edges.

The vibrated surface should be slightly above adjacent pavement surfaces, drainage inlets and channels to allow for secondary compaction of the bedding layer under traffic. The maximum variation in surface profile should be less than 3/16 in. (4.8 mm) in 10 ft (3.05 m). Water should drain freely from the surface and not form puddles. Lipping between adjacent pavers should not be greater than 1/8 in. (3.2 mm) if the pavers have chamfers, or 1/16 in. (1.59 mm) if they have square edges.

After vibration of the pavers to finished elevations, dry fine-grained jointing sand is brushed over the surface of the pavement and additional vibration is undertaken until all of the joints are completely filled with sand. Surplus jointing sand should be maintained on the surface to enhance the process of joint filling. Typically the sand should be level with the bottom of the chamfer or approximately 1/8 in. (3.2 mm) below the top of square edge pavers.

Joint Sand Stabilizers

The paver manufacturer's recommendation regarding joint sand stabilizers should be followed. Jointing sand that is pretreated with a stabilizer product should be brushed or blown off the pavement surface as soon as possible and not be allowed to become stuck in the surface texture of the pavers. If pretreated sand or a joint sand additive is used, the stabilizer should be activated by lightly misting the surface with water. If a liquid joint sand stabilizer is used, it should be sprayed onto the pavement surface and forced into the joints with squeegees. It may be necessary to fill the tops of the joints with the liquid several times before it sets to achieve adequate penetration. The stabilizer manufacturer's instructions should be followed closely, because each stabilizer is slightly different. Probing several joints to verify that the sand is stabilized to an adequate depth of approximately two times the joint width — rather than just forming a crust — is recommended.

MAINTENANCE

Cleaning

Sand-set pavers can be kept clean in most environments by regular sweeping. In situations that lead to a greater degree of buildup of grease, tire marks or other stains, the pavers can be cleaned by pressure-washing. The sand-filled joints generally are resistant to this treatment if the nozzle surface is clear and the water jet is not directed along the joints. Aggressive pressure-washing can cause localized removal of the joint filling material and can even undermine the pavers. More stubborn stains, including paint and gum, can be cleaned by scraping off the hard residue and then scrubbing with a stiff-bristled brush and a proprietary cleaner or scouring powder. In damp or shady areas where moss and lichen have grown in the joints, these can be killed with a bleach-water mixture or with proprietary treatments.

Snow Removal

Snow prevention and removal can be carried out by hand, by machine or by chemicals. Hand methods include shovels and brooms. Mechanical methods include snow blowers, snowplows, and buckets or brushes attached to tractors. Shovel and machine removal methods can chip the edges of the pavers, particularly if excessive lipping is present. This equipment should be properly adjusted so that it does not damage the pavement surface.

Skid-steer snow removal equipment also may move pavers, causing distortion of pattern lines and some chipping of the pavers if the equipment is driven aggressively. When tractor and particularly skid-steer mounted equipment is used, the pavement must be able to support the wheel loads without damage.

A range of anti-icing and deicing chemicals are used for pavements. Deicing chemicals can cause thermal shock in a pavement by “supercooling” the pavement surface. This can lead to spalling or surface damage on pavers of Class NX or MX pavers. Deicing agents should be used with care, as chemical residue left on the surface can penetrate into the joints and result in staining and efflorescence. Class NX should not be used where subject to freezing.

Resanding

Over time, due to wind, rain and other means, the sand within the top portions of joints can be eroded. Therefore, the joints should be periodically resanded using the same methods described above for applying jointing sand after vibration of the pavers.

Repairs

Underground utilities frequently pass beneath paved areas on congested sites. Access to these utilities frequently is required for repair or to install new lines. Sand set pavers readily accommodate such work, as they can be removed and reinstated with little evidence of the work having been carried out. Repairs to the paving also can be made if they are overloaded or otherwise damaged.

Removal can be undertaken by prying or breaking out the initial paver so that it can be removed without damaging adjacent units. It is then possible to work the adjacent pavers loose using a hammer and chisel or pry bars in the joints and under the paver. Some chipping of the pavers should be expected, and a few spare pavers will be required for reinstatement. The bedding sand can be removed as necessary. Traffic should be kept at least 4 ft (1.2 m) from the unrestrained edge. If a trench is open for a significant amount of time, the adjacent pavers should be temporarily restrained to stop them from moving laterally. Trenches should be filled with proper care paid to compaction of the backfill. The base should be replaced to match the original section.

To reinstall the pavers, the bedding sand should be replaced with an adequate pressure to allow for compaction. The pavers should be replaced in the appropriate pattern and fresh sand spread into the joints. The repair area should be leveled by hammering on a wooden pack if the area is small or with a plate vibrator if it is large enough. The joints should be refilled with sand and new stabilizer applied if necessary.

SUMMARY

Pedestrian and light duty vehicular pavements of clay pavers laid on a sand setting bed provide the most cost-effective system for pedestrian and light duty vehicular pavement. When properly constructed, the interlock of the pavers provides the necessary stability for the desired service life of the pavement. This *Technical Note* provides the basic information required to properly select materials, design, detail and construct brick pavements over sand setting beds. Further information about the properties of other brick pavements and concepts not unique to sand setting beds is discussed in the *Technical Note* 14 series.

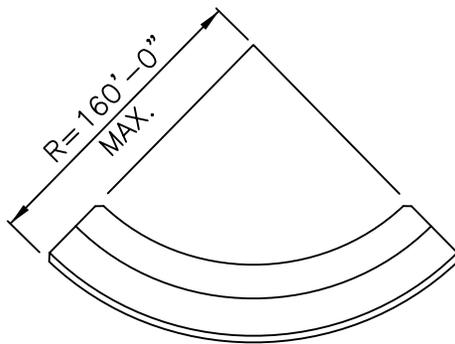
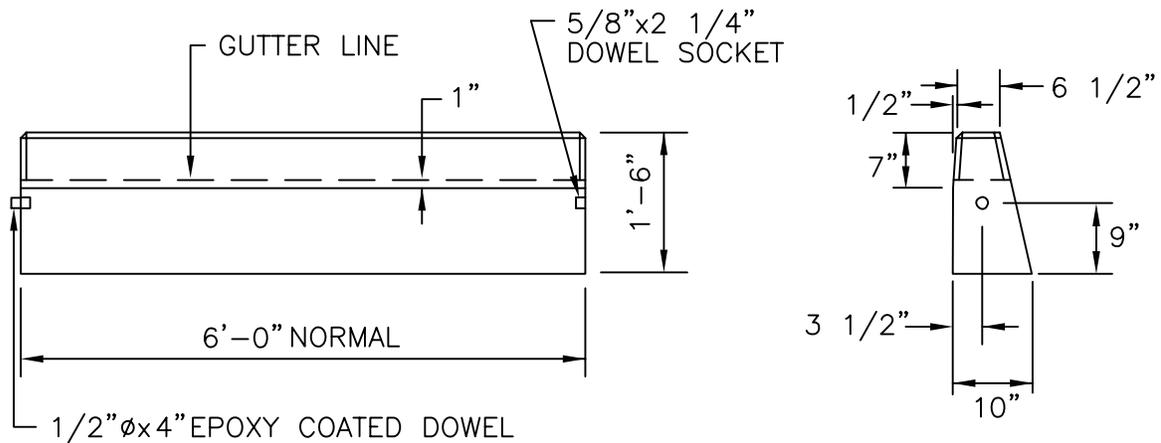
The information and suggestions contained in this Technical Note are based on the available data and the combined experience of engineering staff and members of the Brick Industry Association. The information contained herein must be used in conjunction with good technical judgment and a basic understanding 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 C 33, Standard Specification for Concrete Aggregate, *Annual Book of Standards*, Vol. 04.02, ASTM International, West Conshohocken, PA, 2006.
2. ASTM C 144, Standard Specification for Aggregate for Masonry Mortar, *Annual Book of Standards*, Vol. 04.05, ASTM International, West Conshohocken, PA, 2007.
3. ASTM C 902, Standard Specification for Pedestrian and Light Traffic Paving Brick, *Annual Book of Standards*, Vol. 04.05, ASTM International, West Conshohocken, PA, 2007.
4. ASTM C 1272, Standard Specification for Heavy Vehicular Paving Brick, *Annual Book of Standards*, Vol. 04.05, ASTM International, West Conshohocken, PA, 2007.
5. ASTM D 4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile, *Annual Book of Standards*, Vol. 04.13, ASTM International, West Conshohocken, PA, 2007.
6. *Flexible Vehicular Brick Paving – A Heavy Duty Applications Guide*, Brick Industry Association, Reston, VA, 2004.

Appendix D

RIDOT Standard Construction Details



CIRCULAR CURB

NOTES:

1. SHALL BE IN ACCORDANCE WITH SECTION 906 OF THE R.I. STANDARD SPECIFICATIONS.
2. MINIMUM LENGTH OF STRAIGHT OR CIRCULAR FILLER PIECES TO BE 3'-0".
3. EXPOSED SURFACES TO HAVE A SPONGE FLOAT FINISH.
4. CIRCULAR CURB IS REQUIRED ON CURVES WITH RADII OF 160'-0" OR LESS. STRAIGHT CURB TO BE USED ON CURVES OF MORE THAN 160'-0" RADIUS.
5. EXPOSED EDGES TO HAVE A 3/4" CHAMFER.

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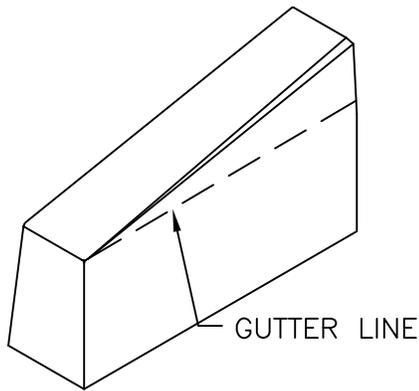
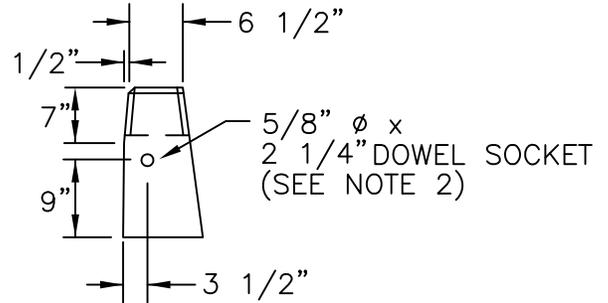
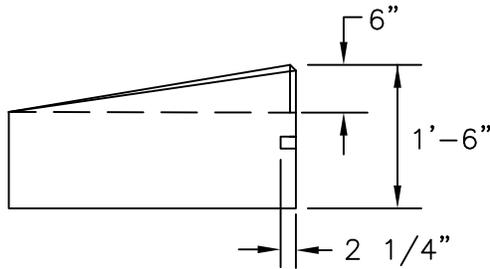
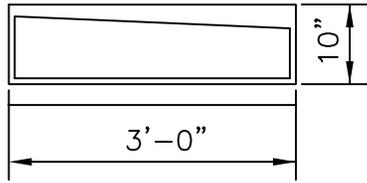
PRECAST CONCRETE CURB

James A. Capaldi
 CHIEF ENGINEER
 TRANSPORTATION

Edmund J. Parker Jr.
 CHIEF DESIGN ENGINEER
 TRANSPORTATION

JUNE 15, 1998
 ISSUE DATE





NOTES:

1. SHALL BE IN ACCORDANCE WITH SECTION 906 OF THE R.I. STANDARD SPECIFICATIONS.
2. DRAWING SHOWS TRANSITION CURB FOR ONE DIRECTION, FOR OTHER DIRECTION USE OPPOSITE HAND AND INCLUDE A 1/2" ϕ x 4" EPOXY COATED DOWEL.
3. EXPOSED SURFACES TO HAVE A SPONGE FLOAT FINISH.
4. EXPOSED EDGES TO HAVE A 3/4" CHAMFER.
5. LEFT AND RIGHT SECTIONS SHALL BE INSTALLED AS REQUIRED.

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**3'-0" PRECAST CONCRETE
TRANSITION CURB**

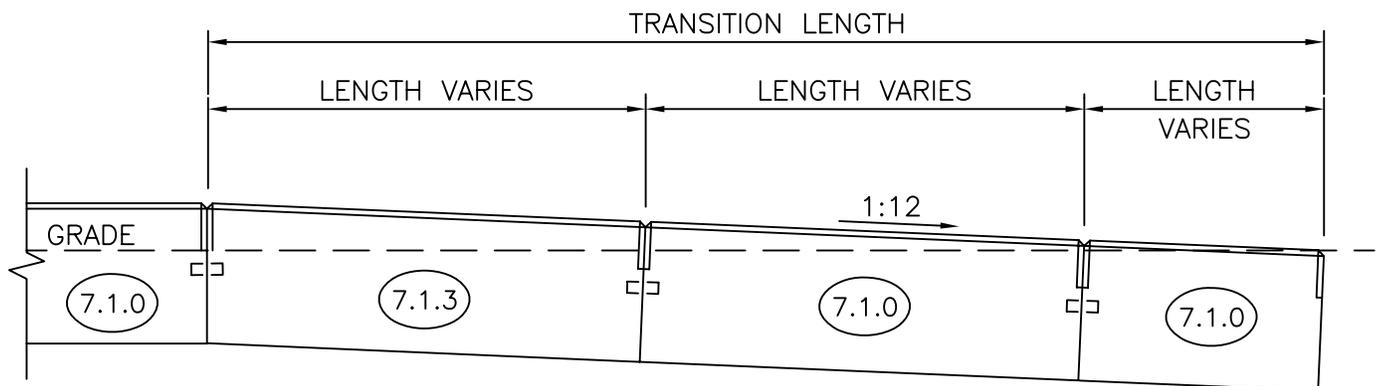
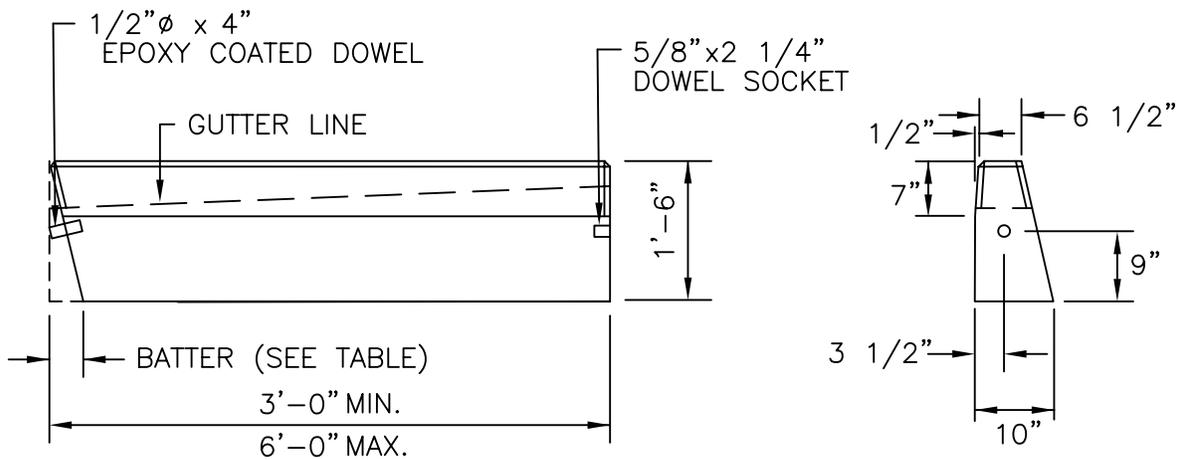
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 TRANSPORTATION

Edmund J. Parker Jr.
 CHIEF DESIGN ENGINEER
 TRANSPORTATION

JUNE 15, 1998
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| TRANSITION LENGTH (FT.) | BATTER (IN.) |
|-------------------------|--------------|
| 6.0 | 1.5 |
| 7.0 | 1.3 |
| 8.0 | 1.2 |
| 9.5 | 1.0 |
| 11.5 | 0.8 |
| 15.0 | 0.6 |
| 18.0 | 0.5 |

NOTES:

1. SHALL BE IN ACCORDANCE WITH SECTION 906 OF THE R.I. STANDARD SPECIFICATIONS.
2. CIRCULAR CURB IS REQUIRED ON CURVES WITH RADII OF 160'-0" OR LESS. STRAIGHT CURB TO BE USED ON CURVES OF MORE THAN 160'-0" RADIUS.
3. EXPOSED EDGES TO HAVE A 3/4" CHAMFER.
4. EXPOSED SURFACES TO HAVE A SPONGE FLOAT FINISH.
5. MINIMUM LENGTH OF STRAIGHT OR CIRCULAR CURB FILLER PIECES TO BE 3'-0" (GREATER LENGTHS PREFERRED).

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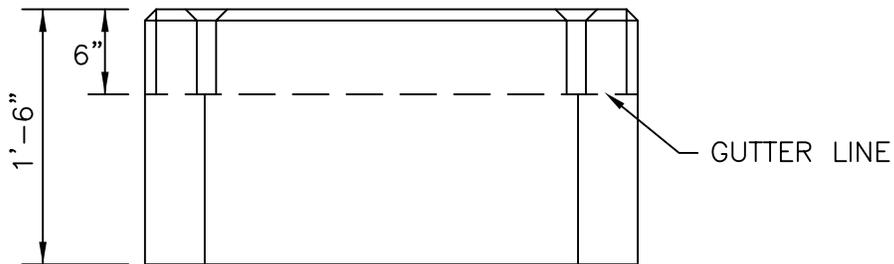
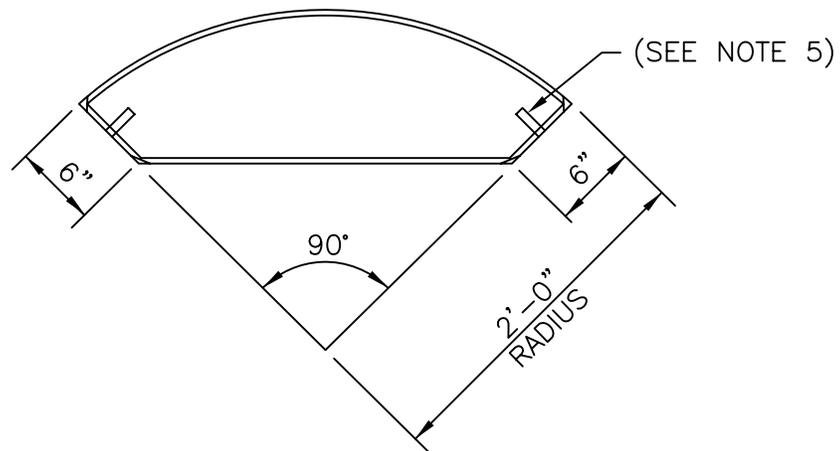
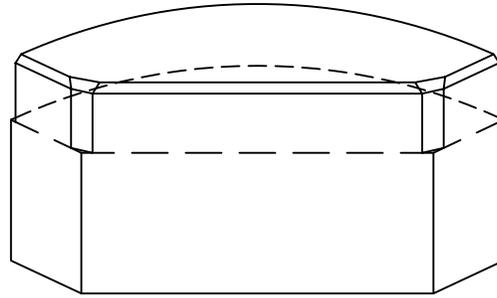
**PRECAST CONCRETE WHEELCHAIR RAMP
TRANSITION CURB**

James A. Caspelli
CHIEF ENGINEER
TRANSPORTATION

Edmund J. Parker Jr.
CHIEF DESIGN ENGINEER
TRANSPORTATION

JUNE 15, 1998
ISSUE DATE





NOTES:

1. SHALL BE IN ACCORDANCE WITH SECTION 906 OF THE R.I. STANDARD SPECIFICATIONS.
2. EXPOSED SURFACES TO HAVE A SPONGE FLOAT FINISH.
3. NO REINFORCEMENT REQUIRED.
4. EXPOSED EDGES TO HAVE A 3/4" CHAMFER.
5. SEE STD. 7.1.0 FOR DOWEL SOCKET LOCATION.

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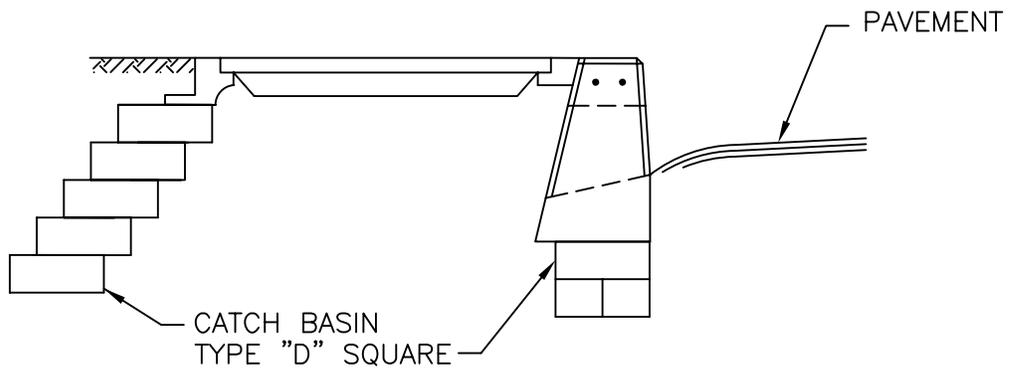
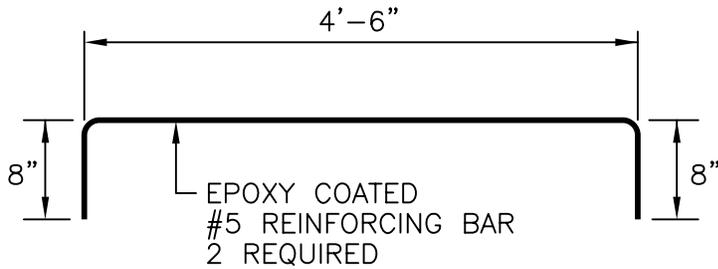
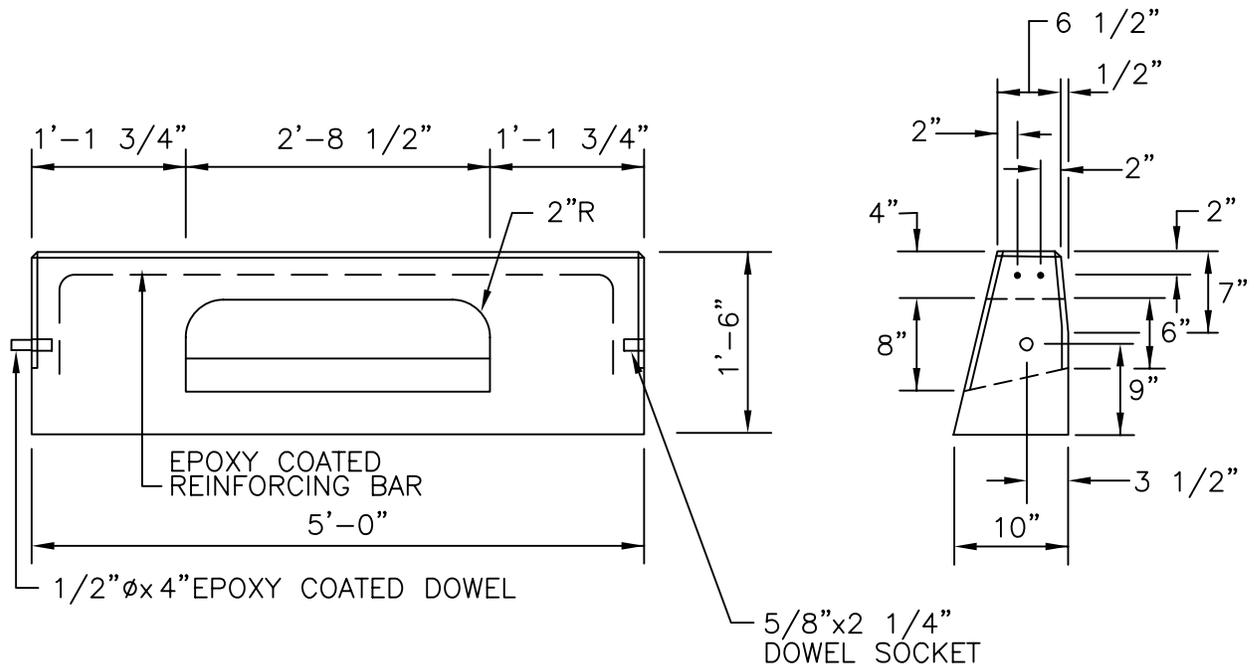
**PRECAST CONCRETE
2'-0" RADIUS CORNER**

James H. Casaldi
CHIEF ENGINEER
TRANSPORTATION

Edmund J. Perkins Jr.
CHIEF DESIGN ENGINEER
TRANSPORTATION

JUNE 15, 1998
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NOTES:

1. SHALL BE IN ACCORDANCE WITH SECTION 906 OF THE R.I. STANDARD SPECIFICATIONS.
2. EXPOSED SURFACES TO HAVE A SPONGE FLOAT FINISH.
3. EXPOSED EDGES TO HAVE A 3/4" CHAMFER.

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**PRECAST CONCRETE INLET STONE
(FOR SQUARE CATCH BASIN)**

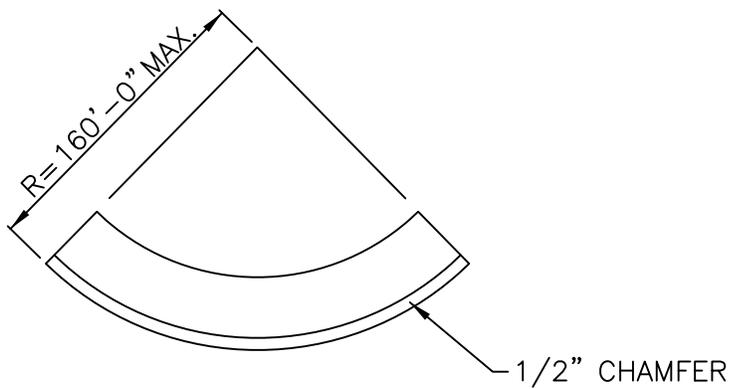
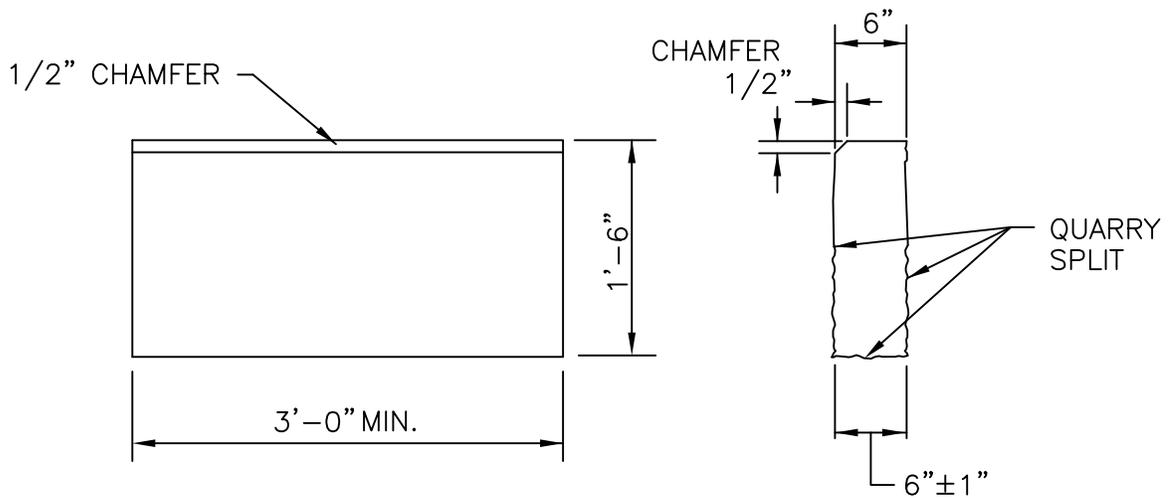
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CHIEF ENGINEER
TRANSPORTATION

Edmund J. Parker
CHIEF DESIGN ENGINEER
TRANSPORTATION

JUNE 15, 1998
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CIRCULAR CURB

NOTES:

1. SHALL BE IN ACCORDANCE WITH SECTION 906 OF THE R.I. STANDARD SPECIFICATIONS.
2. TOP SURFACE TO BE DRESSED BY SAW. REMAINDER MAY BE QUARRY SPLIT.
3. MINIMUM LENGTH OF STRAIGHT OR CIRCULAR PIECES TO BE 3'-0".
4. CIRCULAR CURB IS REQUIRED ON CURVES WITH RADII OF 160'-0" OR LESS. STRAIGHT CURB TO BE USED ON CURVES OF MORE THAN 160'-0" RADIUS.

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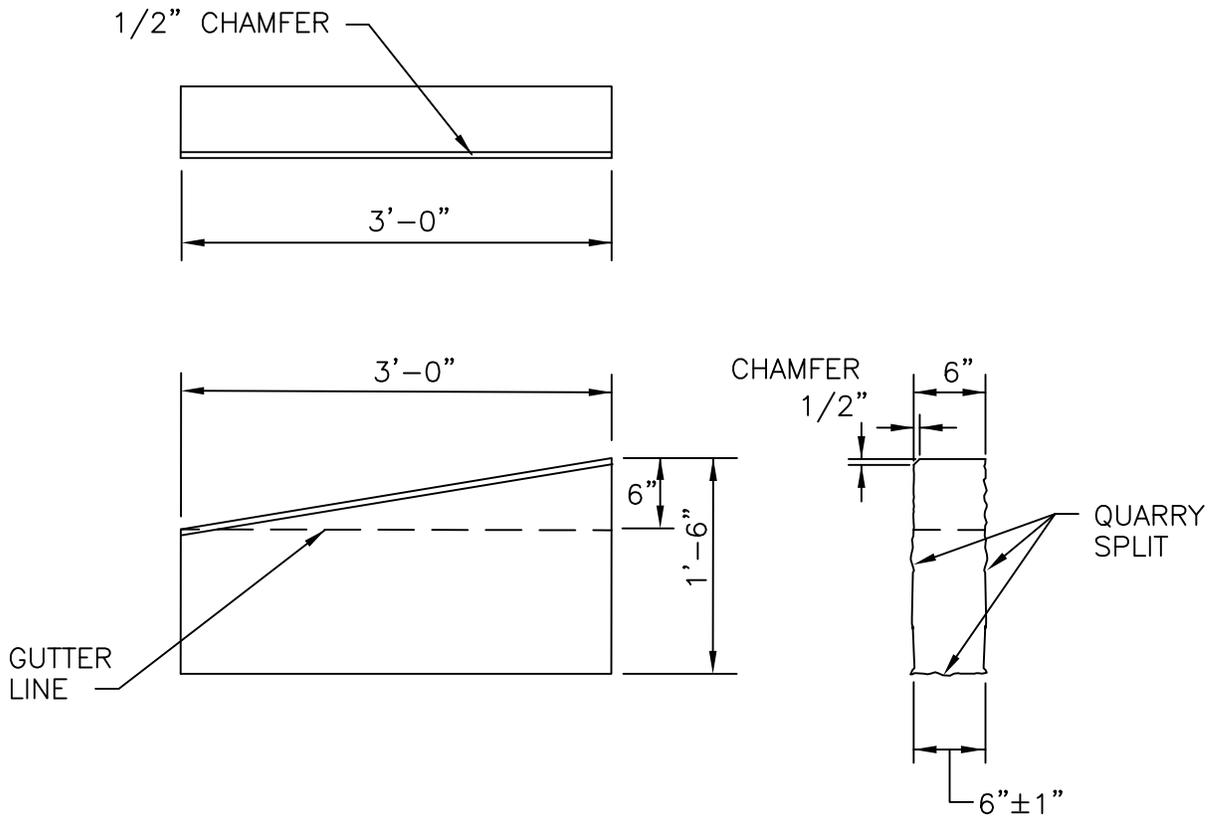
GRANITE CURB

James H. Casabelli
 CHIEF ENGINEER
 TRANSPORTATION

Edmund J. Parkes Jr.
 CHIEF DESIGN ENGINEER
 TRANSPORTATION

JUNE 15, 1998
 ISSUE DATE





NOTES:

1. SHALL BE IN ACCORDANCE WITH SECTION 906 OF THE R.I. STANDARD SPECIFICATIONS.
2. TOP SURFACE TO BE DRESSED BY SAW. REMAINDER MAY BE QUARRY SPLIT.

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3'-0" GRANITE TRANSITION CURB

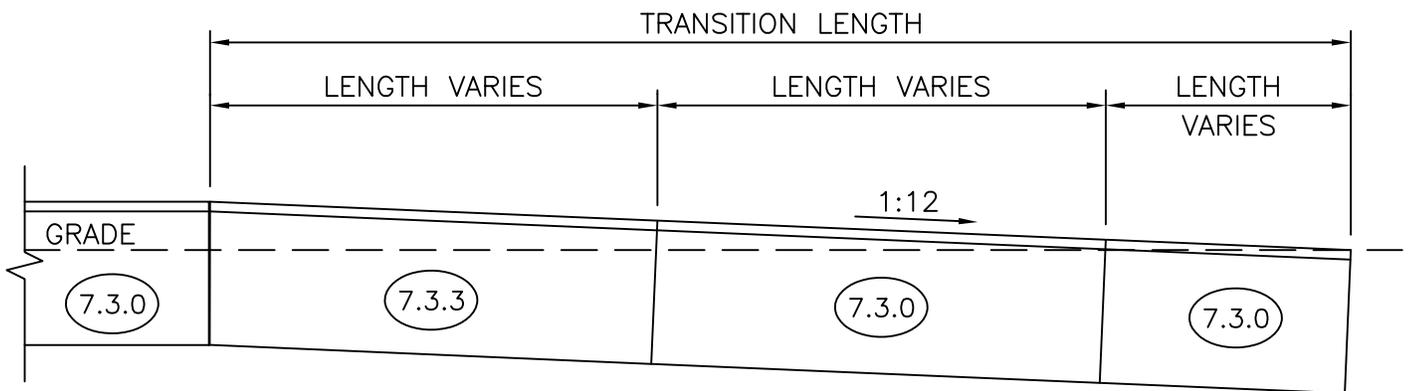
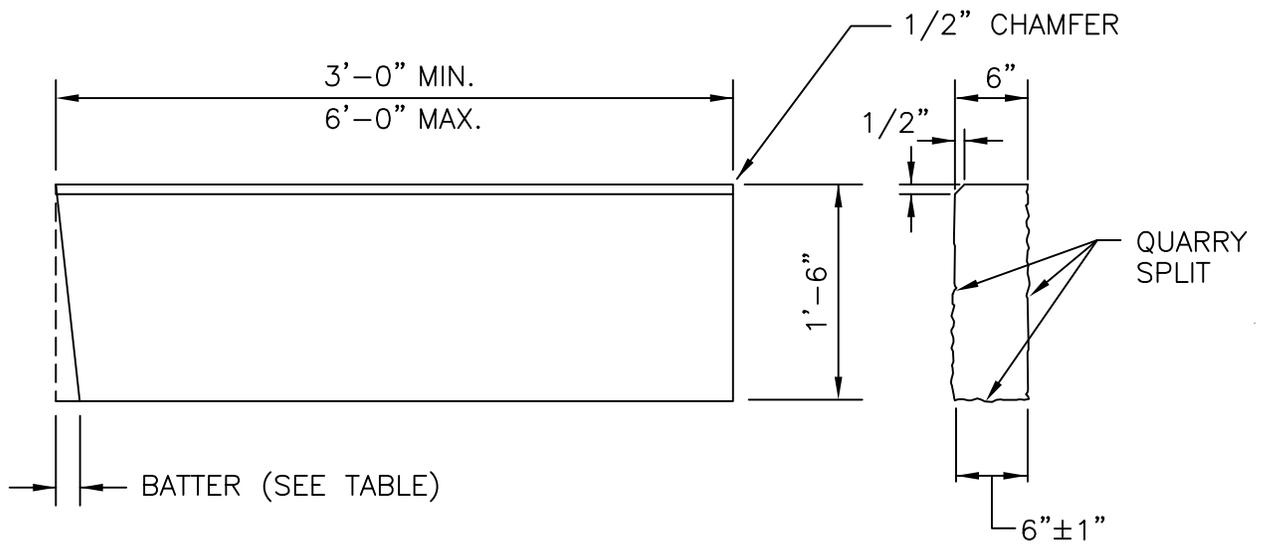


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Edmund J. Parker Jr.
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 TRANSPORTATION

JUNE 15, 1998
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| TRANSITION LENGTH (FT.) | BATTER (IN.) |
|-------------------------|--------------|
| 6.0 | 1.5 |
| 7.0 | 1.3 |
| 8.0 | 1.2 |
| 9.5 | 1.0 |
| 11.5 | 0.8 |
| 15.0 | 0.6 |
| 18.0 | 0.5 |

NOTES:

1. SHALL BE IN ACCORDANCE WITH SECTION 906 OF THE R.I. STANDARD SPECIFICATIONS.
2. THE CONTRACTOR MAY CUT EXISTING CURB SECTIONS AS REQUIRED TO MEET THIS DETAIL AND THE R.I. STANDARD SPECIFICATIONS, WHERE OLD CURBING IS BEING REUSED.
3. MINIMUM LENGTH OF STRAIGHT OR CIRCULAR CURB FILLER PIECES TO BE 3'-0" (GREATER LENGTHS PREFERRED).
4. TOP SURFACE TO BE DRESSED BY SAW. REMAINDER MAY BE QUARRY SPLIT.

RHODE ISLAND DEPARTMENT OF TRANSPORTATION

**GRANITE WHEELCHAIR RAMP
TRANSITION CURB**

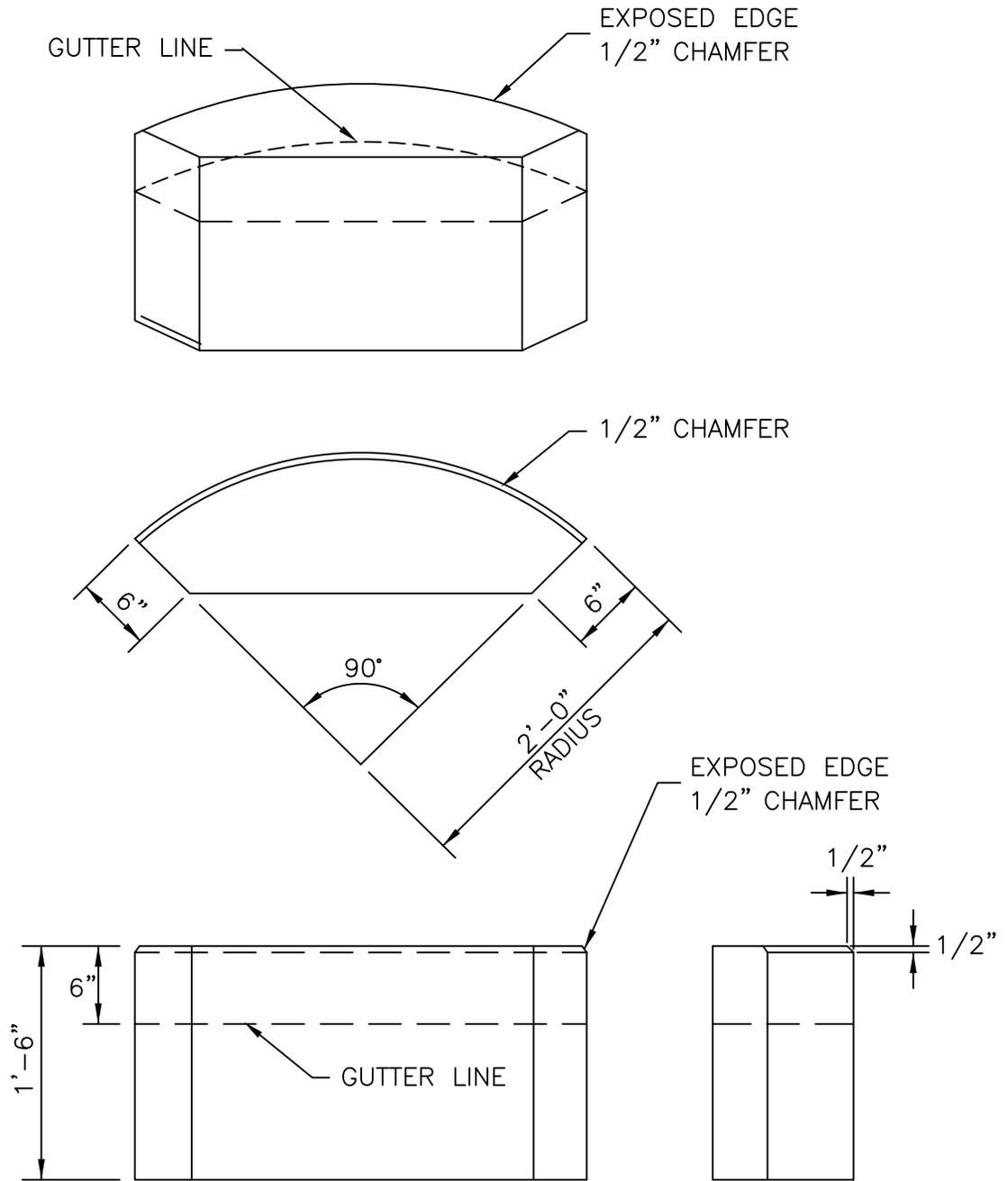
R.I.
STANDARD
7.3.3

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NOTES:

1. SHALL BE IN ACCORDANCE WITH SECTION 906 OF THE R.I. STANDARD SPECIFICATIONS.
2. TOP SURFACE TO BE DRESSED BY SAW. REMAINDER MAY BE QUARRY SPLIT.

RHODE ISLAND DEPARTMENT OF TRANSPORTATION

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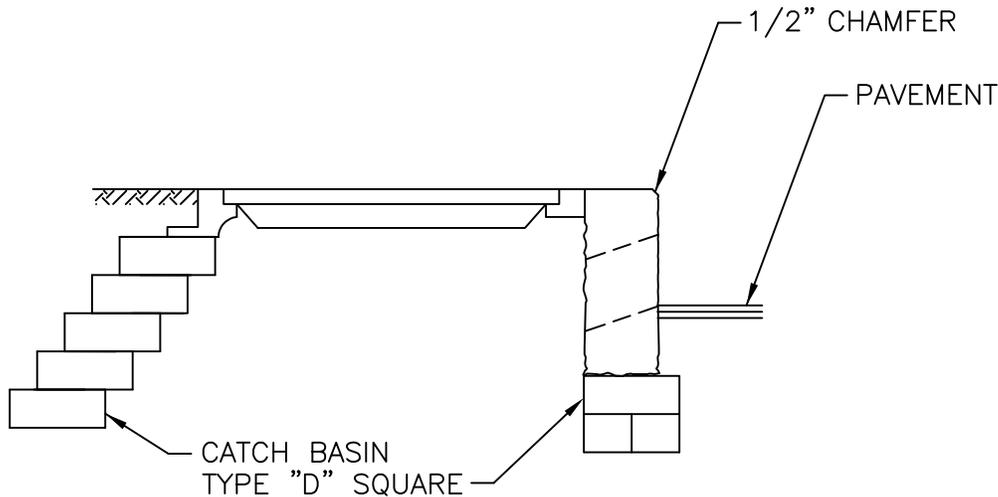
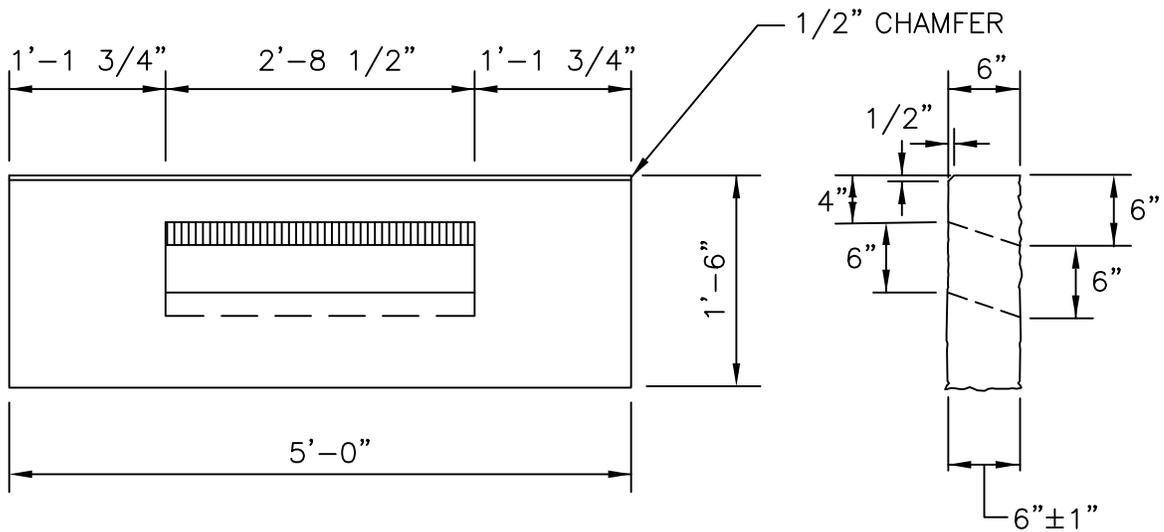
GRANITE 2'-0" RADIUS CORNER

James A. Capaldi
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 TRANSPORTATION

Edmund T. Parker Jr.
 CHIEF DESIGN ENGINEER
 TRANSPORTATION

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NOTES:

1. SHALL BE IN ACCORDANCE WITH SECTION 906 OF THE R.I. STANDARD SPECIFICATIONS.
2. TOP SURFACE TO BE DRESSED BY SAW. REMAINDER MAY BE QUARRY SPLIT.

RHODE ISLAND DEPARTMENT OF TRANSPORTATION

**GRANITE INLET STONE
(FOR SQUARE CATCH BASIN)**

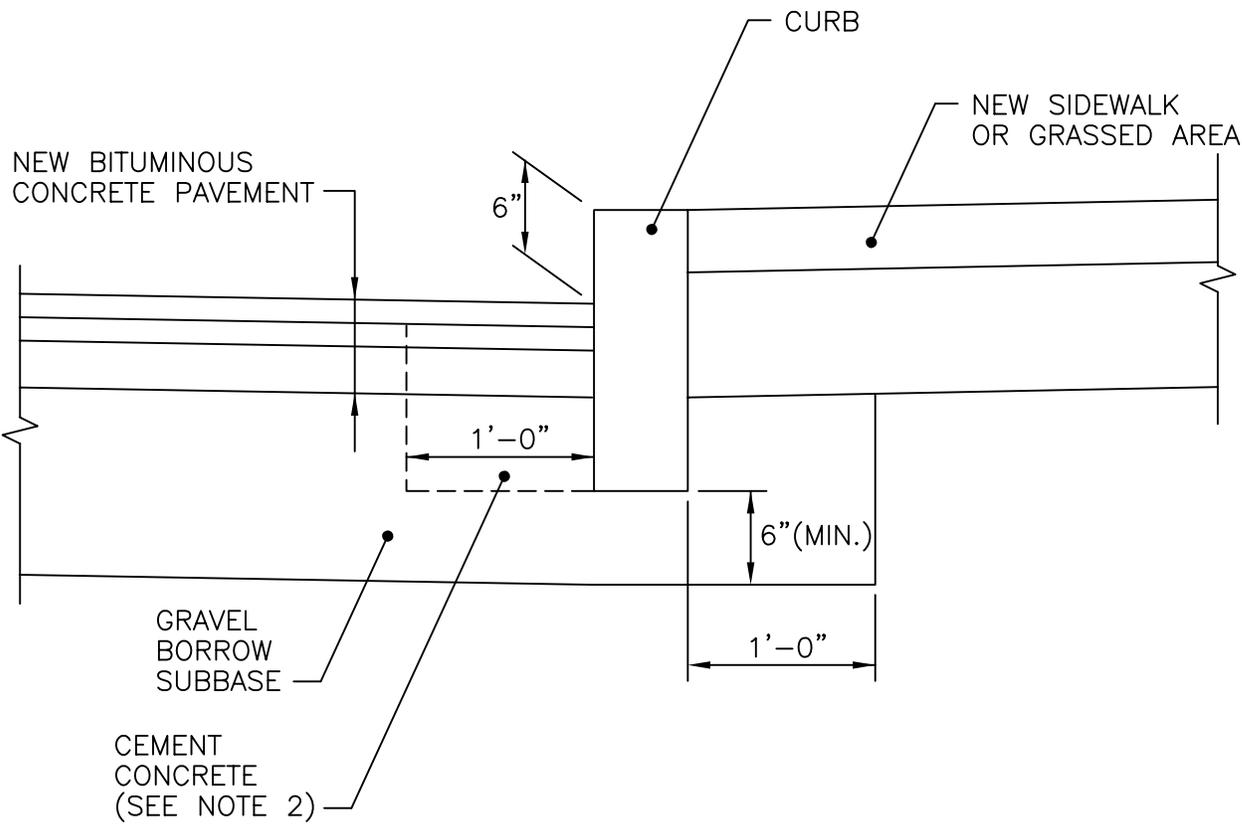


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CHIEF ENGINEER
TRANSPORTATION

Edmund Parker Jr
CHIEF DESIGN ENGINEER
TRANSPORTATION

JUNE 15, 1998
ISSUE DATE



NOTES:

1. SHALL BE IN ACCORDANCE WITH SECTION 906 OF THE R.I. STANDARD SPECIFICATIONS.
2. CEMENT CONCRETE SHALL BE USED ONLY WHEN THE CURB IS SET AFTER THE BASE AND/OR BINDER COURSES ARE IN PLACE, OTHERWISE THE CEMENT CONCRETE WILL BE ELIMINATED AND THE GRAVEL BROUGHT UP TO BOTTOM OF THE BASE COURSE.

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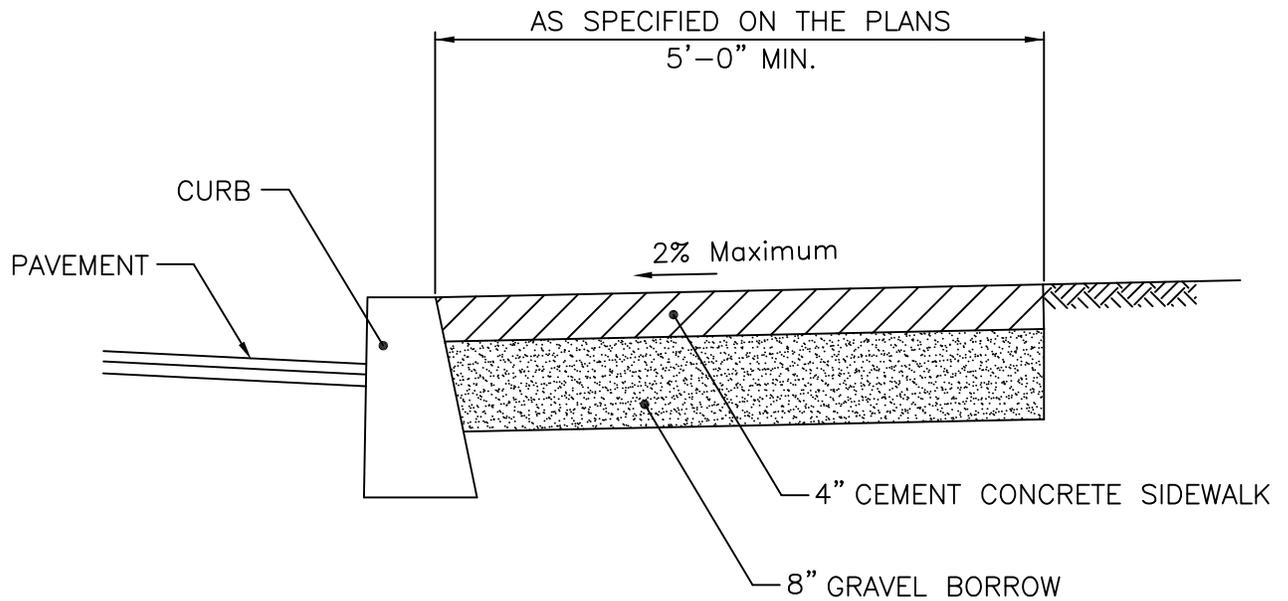
CURB SETTING DETAIL


CHIEF ENGINEER
TRANSPORTATION


CHIEF DESIGN ENGINEER
TRANSPORTATION

JUNE 15, 1998
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NOTES

1. SHALL BE IN ACCORDANCE WITH SECTION 905 OF THE R.I. STANDARD SPECIFICATIONS.
2. FOR CURB SETTING DETAIL REFERENCE STD. 7.6.0.

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CEMENT CONCRETE SIDEWALK

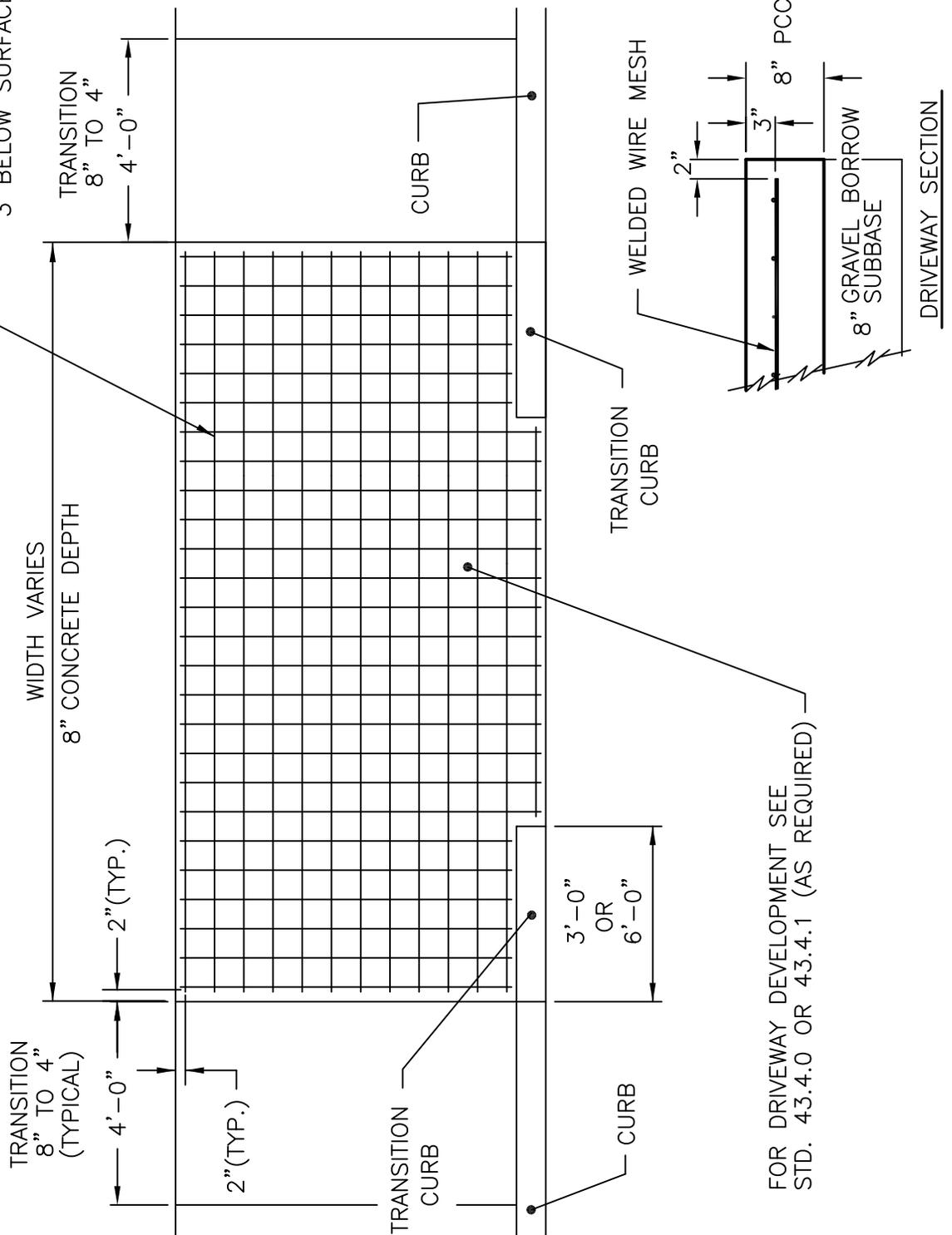
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 CHIEF ENGINEER
 TRANSPORTATION

Edmund J. Parker Jr.
 CHIEF DESIGN ENGINEER
 TRANSPORTATION

JUNE 15, 1998
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6" x 6" - W4 x W4
WELDED WIRE MESH
3" BELOW SURFACE



FOR DRIVEWAY DEVELOPMENT SEE
STD. 43.4.0 OR 43.4.1 (AS REQUIRED)

NOTE:

SHALL BE IN ACCORDANCE WITH SECTION 905 OF THE R.I. STANDARD SPECIFICATIONS.

RHODE ISLAND DEPARTMENT OF TRANSPORTATION

CEMENT CONCRETE DRIVEWAYS

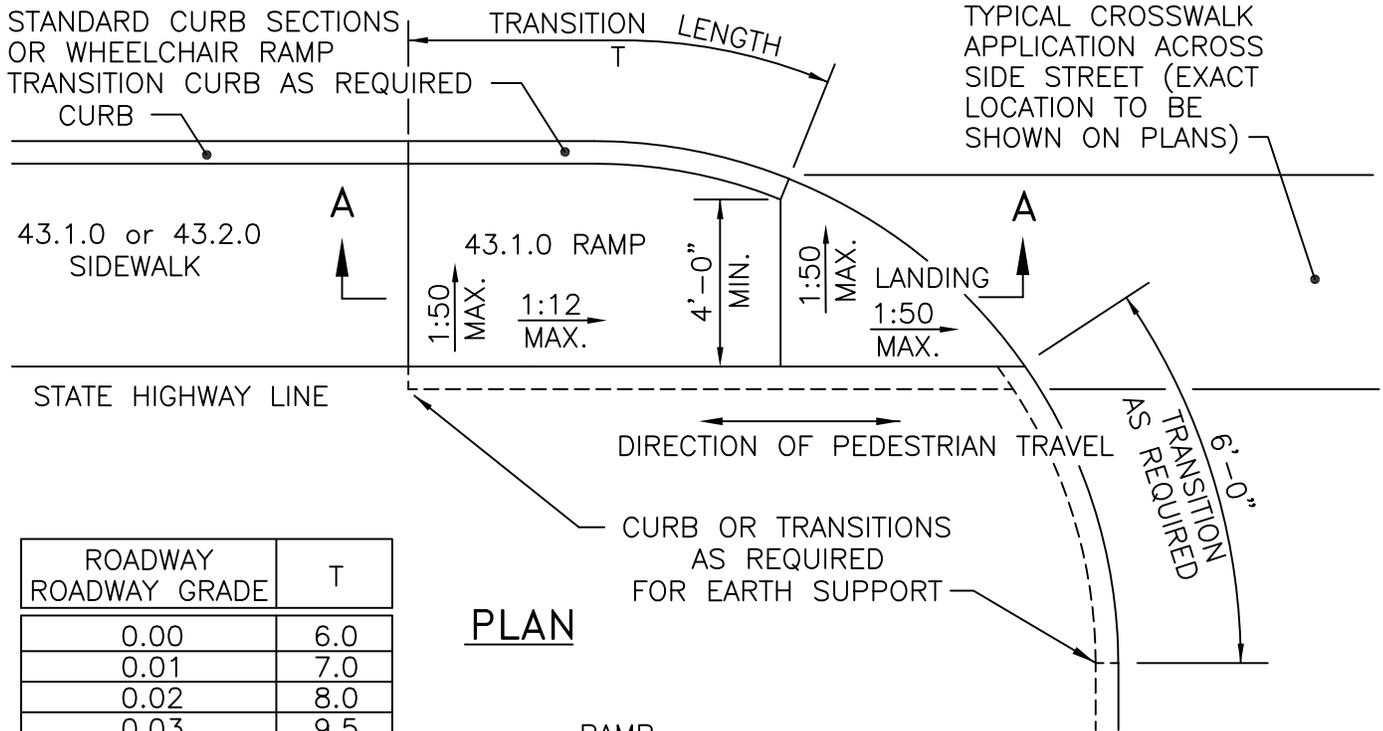
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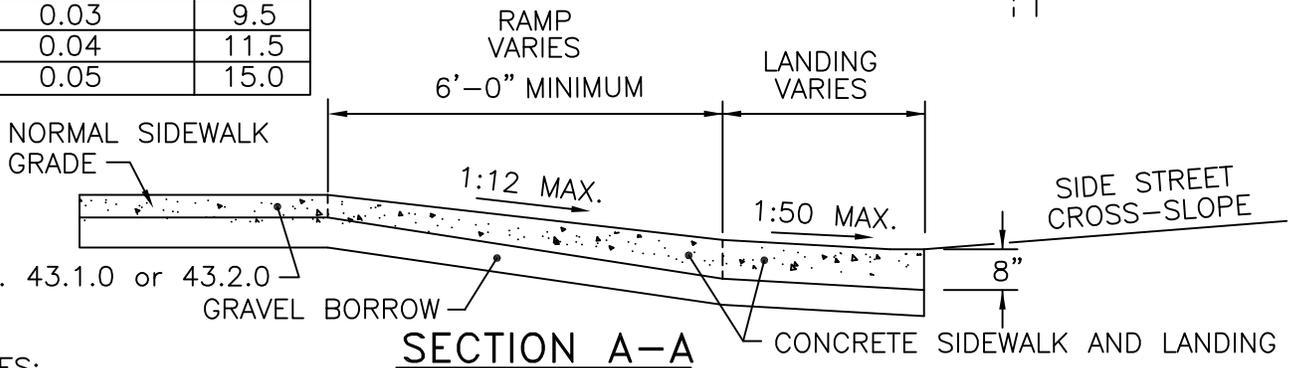
JUNE 15, 1998
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| ROADWAY ROADWAY GRADE | T |
|-----------------------|------|
| 0.00 | 6.0 |
| 0.01 | 7.0 |
| 0.02 | 8.0 |
| 0.03 | 9.5 |
| 0.04 | 11.5 |
| 0.05 | 15.0 |

PLAN



SECTION A-A

NOTES:

1. SHALL BE IN ACCORDANCE WITH SECTION 905 OF THE R.I. STANDARD SPECIFICATIONS.
2. THIS DETAIL IS TO BE USED ONLY WHEN STATE RIGHT-OF-WAY IS LIMITED TO BACK OF SIDEWALK, AND SIDEWALK IS NARROW WITH NO PEDESTRIAN TRAFFIC FROM SIDE STREET.
3. WHEN ANY OBSTRUCTION LOCATED IN THE SIDEWALK FALLS WITHIN A CROSSWALK AREA, IF POSSIBLE, THE OBSTRUCTION SHALL BE PLACED SUCH THAT IT FALLS OUTSIDE OF THE RAMP.
4. AT NO TIME IS ANY PART OF THE WHEELCHAIR RAMP TO BE LOCATED OUTSIDE OF THE CROSSWALK, AND IT IS TO BE CENTERED WHENEVER POSSIBLE.
5. DRAINAGE FACILITIES ARE TO BE LOCATED UP-GRADE OF ALL WHEELCHAIR RAMPS.
6. LOCATION OF WHEELCHAIR RAMPS IS AS SHOWN ON CONTRACT DRAWINGS.
7. ALL REQUIRED CUTTING OF CURB PIECES TO BE PAID FOR UNDER COST OF CURB.
8. WHERE THE ROAD PROFILE EXCEEDS 5% THE TRANSITION LENGTH (T) SHALL BE EIGHTEEN FEET (18'-0").
9. THE ENTRANCE OF THE WHEELCHAIR RAMP SHALL BE FLUSH WITH THE ROADWAY.
10. MINIMUM LENGTH OF STRAIGHT OR CIRCULAR FILLER PIECES TO BE 3'-0" (GREATER LENGTHS PREFERRED).
11. AN UNOBSTRUCTED PATH OF TRAVEL WITH A MINIMUM WIDTH OF 4'-0" SHALL BE MAINTAINED.

RHODE ISLAND DEPARTMENT OF TRANSPORTATION

WHEELCHAIR RAMP FOR LIMITED RIGHT-OF-WAY AREAS

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James H. Capaldi
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TRANSPORTATION

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TRANSPORTATION

JUNE 15, 1998
ISSUE DATE

