

ITEM 19

UTILITY CUT, BACKFILL AND PATCHING

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ITEM 19

UTILITY CUT, BACKFILL AND PATCHING

19.1 DESCRIPTION OF WORK

This work shall consist of the excavation and rapid backfill of trenches for the installation or repair of utility and underground features. The work also includes utilizing temporary pavement patching materials, and final permanent pavement surfaces. The work requires the use of removable, controlled low-strength materials (CLSM) for the backfill material, as an alternative to traditional compacted soil, for trenches and cuts too small for traditional soil compaction and safe human entry for testing. Various temporary pavement materials may also be utilized, prior to permanent pavement repairs.

A. Description of removable, flowable, controlled low strength materials CLSM

The term CLSM used in this item shall mean the same as Removable CLSM or flowable backfill. This material is covered in detail due to the many time saving and engineering benefits of this type of backfill material. CLSM does not need compacting, nor moisture density compaction testing. Only a few physical tests of the CLSM properties are needed to assure durability and future removability with light excavating equipment. A low strength is desired so that surrounding utilities or structures will be accessible without causing damage if the CLSM must be removed in the future. Air entrainment is required to prevent damage and heave displacement of trench patches due to freeze-thaw damage.

In addition, CLSM may be used for other applications apart from trench or street cut backfill. These include filling voids due to pipe abandonment or undercutting of excavation in caving or normal soils. CLSM offers quick restoration of the trench and improving other subgrade conditions for roadway or structure support in a rapid time frame without the need for traditional soil backfill testing requirements or when a quick strength is needed to support upper layers. These benefits may outweigh the extra costs vs. using traditional methods that require compaction and testing.

Other applications include: backfilling behind retaining walls and abutments, filling void areas including pipe abandonment, annular spaces, undercut areas and other approved void filling applications. Other suitable applications include structural support for utilities and replacement of unstable subgrade during pavement repairs.

Utility types that can utilize CLSM include: conduits or pipes for electrical, wired or fiber optic communications, traffic signal or other utilities such as gas and water lines, sanitary and storm sewer lines, and other types of utility under existing pavements or ground surfaces to be built upon or improved later.

B. Objectives for Required Use of CLSM

The objectives of requiring the use of the CLSM specified below, instead of reusing excavated soils, is to provide a self-leveling, frost heave-resistant, non-

settling, controlled low-strength material (defined by American Concrete Institute in ACI 229 as a CLSM), that does not normally require compactive effort and compaction testing. Traditional use of compacted soil or aggregate materials for backfill will require AGENCY approval and testing for acceptance.

C. Requirements for CLSM – Flow-Fill or Flashfill

This item further specifies two distinct CLSM material products: The Flashfill products will allow trench backfill, temporary or permanent pavement restoration and traffic access to occur more quickly than Flow-Fill. The term 'CLSM' in this item shall mean either or both.

A high slump is required to aid in the self leveling and void filling objective. The visual consistency may appear to range in appearance from thin batter or mud, to thick water. It must be foremost removable with light machinery in the future, and also quickly stable to support paving operations and traffic.

Minimum air contents are required in the top 4 feet of CLSM fill to limit permanent frost heave. This air content requirement should be used for the entire depth, to aid in the ability to remove or excavate CLSM in the future. The air content requirement may be forbidden by some utility agencies, such as for thrust blocks or for pipe bedding normally used for lateral support of pressurized pipes.

A Removability Modulus (RE) is specified at a maximum 1.5, and is based on compressive strength and unit weight of the CLSM Backfill. Refer to section 19.2C.

19.2 CLSM MATERIALS

A. Flow-Fill

Flow-Fill shall consist of a controlled low-strength, self-leveling concrete material composed of various combinations of cement, fly ash, aggregates, water, chemical admixtures and/or cellular foam for air-entrainment. Generally, the **CONTRACTOR** may place Flow-Fill in approximate 3 feet thick layers, allow bleed water to rise and divert away from placement before another layer may be added. Refer to section 19.4E for more information,

The Flow-Fill shall be limited to a maximum Removability Modulus (RE, as described in section 19.2C) of 1.5 to ensure ability to excavate in the future. Slumps of less than 7 inches will not be permitted for placement, since the flowability to fill voids and avoid future settlement is impaired, and strengths may increase beyond specified removability limits.

The **CONTRACTOR** shall submit a mix design for approval by the **AGENCY**, prior to placement. The mix design shall be supported by laboratory test data verifying compliance with air content, slump, strength and removability (RE) requirements.

TABLE 19.2A-1

Flow-Fill Property	Flow-Fill Specification
Air Content, ASTM C231	6% Minimum
Compressive Strength, ASTM D4832	50psi – 150psi at 28 days
Slump, ASTM C143	7” – 10”
Removability Modulus, RE	1.5 Maximum

B. Flashfill

Flashfill shall consist of a controlled low-strength, self-leveling cementitious material composed of various combinations of fly ash, water, chemical admixtures and/or cellular foam for air-entrainment. No aggregate or sand is usually needed. It shall have a minimum specified air content to provide suitable resistance to frost-heave. Flashfill may generally be placed without lift thickness limits.

Higher strengths may be permitted over Flow-Fill; however, the Flashfill shall still be limited to a maximum Removability Modulus (RE) of 1.5. Slumps of less than 8 inches or spreads of less than 8 inches will not be permitted for placement, since the flowability to fill voids and avoid future settlement is impaired, and strengths may increase beyond removability limits.

The **CONTRACTOR** shall submit a mix design for approval by the **AGENCY**, prior to placement. The mix design shall be supported by laboratory test data verifying compliance with air content, slump, strength and removability (RE) requirements.

TABLE 19.2B-1

Flashfill Property	Flashfill Specification
Air Content, ASTM C231, or by Section 19.2D volumetric calculations (recommended)	15% Minimum
Compressive Strength, ASTM D4832	100psi – 300psi at 28 days
Slump, ASTM C143 (one lift, no rodding)	8” – 11”
Spread, ASTM D6103	8” – 12”, or greater

(recommended)	
Removability Modulus, RE	1.5 Maximum

C. Removability Modulus

The Removability Modulus* ,RE , is a value calculated by

$$RE = \frac{W^{1.5} \times 104 \times C^{0.5}}{10^6}$$

where: W = in-situ unit weight (pcf) and C = 28-day compressive strength

*RE was developed & is used by Hamilton County, Ohio; per the NCHRP #597 CLSM Report. A lower RE means CLSM is easier to excavate or remove.

Some examples of RE based on strength and unit weights are shown below:

**TABLE 19.2C-1
Removability Modulus (RE)**

Compressive strength, psi [C]	Unit Weight, pcf [W]										
	50	60	70	80	90	100	110	120	130	140	150
25	0.18	0.24	0.30	0.37	0.44	0.52	0.60	0.68	0.77	0.86	0.96
50	0.26	0.34	0.43	0.53	0.63	0.74	0.85	0.97	1.09	1.22	1.35
75	0.32	0.42	0.53	0.64	0.77	0.90	1.04	1.18	1.33	1.49	1.65
100	0.37	0.48	0.61	0.74	0.89	1.04	1.20	1.37	1.54	1.72	1.91
125	0.41	0.54	0.68	0.83	0.99	1.16	1.34	1.53	1.72	1.93	2.14
150	0.45	0.59	0.75	0.91	1.09	1.27	1.47	1.67	1.89	2.11	2.34
175	0.49	0.64	0.81	0.98	1.17	1.38	1.59	1.81	2.04	2.28	2.53
200	0.52	0.68	0.86	1.05	1.26	1.47	1.70	1.93	2.18	2.44	2.70
RE less than or equal to 1.50 indicates Removable							1.70	Shading indicates Not Readily Removable			

D. Air Content Volumetric Calculation

Air content can be calculated as follows (using wet unit weights before and after foaming or entraining air):

$$\text{Air Content} = \frac{(\text{Unit Weight not Air-Entrained} - \text{Unit Weight Air-Entrained}) \times 100\%}{\text{Unit Weight not Air-Entrained}}$$

E. Flow Consistency of CLSM

Flow shall be measured by ASTM D6103, which utilizes a moistened 3" diameter, 6" high open-ended cylinder, filled with the flashfill. When the cylinder is lifted, the resulting "pancake" is measured at its longest and shortest dimensions and averaged.

19.3 MATERIAL CONSTITUENTS

A. Cement

Cement shall meet the standard chemical requirements of Type II or Type IP, ASTM C150 or ASTM C595, respectively.

B. Fly Ash

Fly ash shall meet the requirements of ASTM C618 Type C or Type F. Fly ash not meeting the requirements of ASTM C618 may be used if prior testing indicates acceptable, consistent results for strength and air content.

C. Water

Potable water or reasonably clean and free of chemicals injurious to the final product are to be used.

D. Chemical Admixtures

Air-entraining admixtures shall conform to ASTM C260 requirements; other chemical admixtures shall conform to ASTM C494 requirements.

E. Foaming Agents

Foaming agents shall conform to ASTM C869 and C796, or as approved by the **AGENCY**.

F. Suitability of CLSM Constituents

CLSM materials may not contain any material deemed toxic or hazardous. Material Safety Data Sheets (MSDS) must be available for any cement, flyash or admixture component of the mixture upon request. Flowable Backfill shall be compatible with bedding materials, electrochemically and otherwise if used as a metal pipe backfill application. Thermal compatibility with plastic pipes should be considered for direct contact of the CLSM with the pipe; heat generation of the mix must not exceed the softening point of the pipe material.

G. Aggregates

The final blend of aggregates for CLSM, including rock, gravel or sand, shall conform to the following gradations:

TABLE 19.3G-1

Sieve Size	% Passing
1 inch (25 mm)	100
No. 200	0 to 10

When coarse aggregate is used, 100 percent shall pass the 1 inch sieve, and it shall comprise not more than 40 percent of the total aggregate content. Other aggregate products such as aggregate base, crushed rock, pea gravel, or reject sand which has no more than 20 percent passing the No. 200 sieve and is free of organic material and other deleterious substances, may be accepted by the **AGENCY** if a flowable, workable mix can be produced without segregation of the aggregate.

19.4 CONSTRUCTION METHODS

A. Cutting Streets

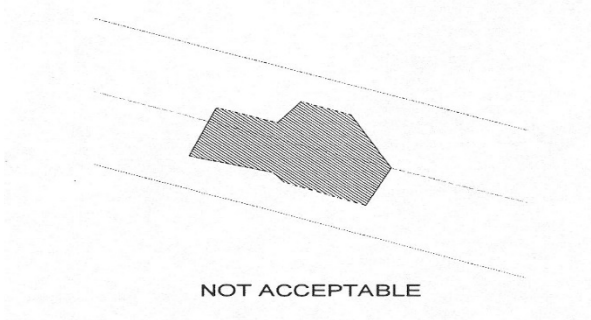
Prior to beginning work within any public right-of-way, or cutting any street surface, an encroachment permit and traffic control or barricade plan approval shall be obtained from the government entity or **AGENCY** having jurisdiction over that right - of - way. The barricading and traffic control devices shall be in place, and shall be in compliance with the **AGENCY** approved traffic control and barricade plan and the most current Manual on Uniform Traffic Control Devices (MUTCD).

Permit fees and construction restrictions shall be in accordance with the rules, regulations, and ordinances of the entity or **AGENCY** having jurisdiction.

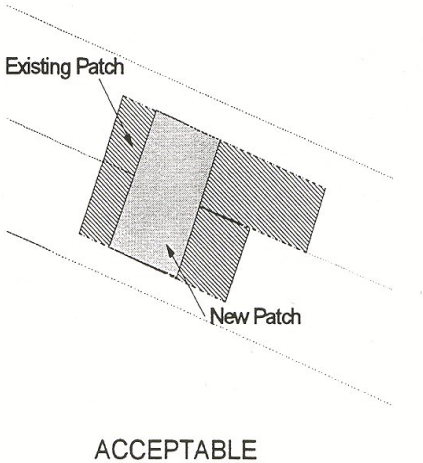
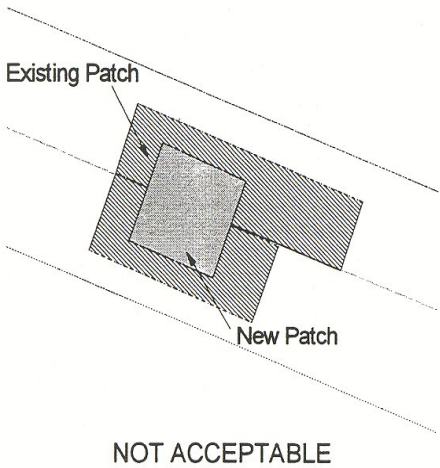
While undergoing improvements, all streets upon or within which any work is being done shall be kept open to all traffic by the **CONTRACTOR** unless otherwise approved by the **AGENCY**.

Existing pavements shall be removed to clean, straight lines, parallel and perpendicular to the flow of traffic. Asphalt and concrete pavements shall be removed by saw cutting, without damaging adjacent surfaces. Final removal of concrete will be to normal or AGENCY approved full panel longitudinal and transverse joint lines.

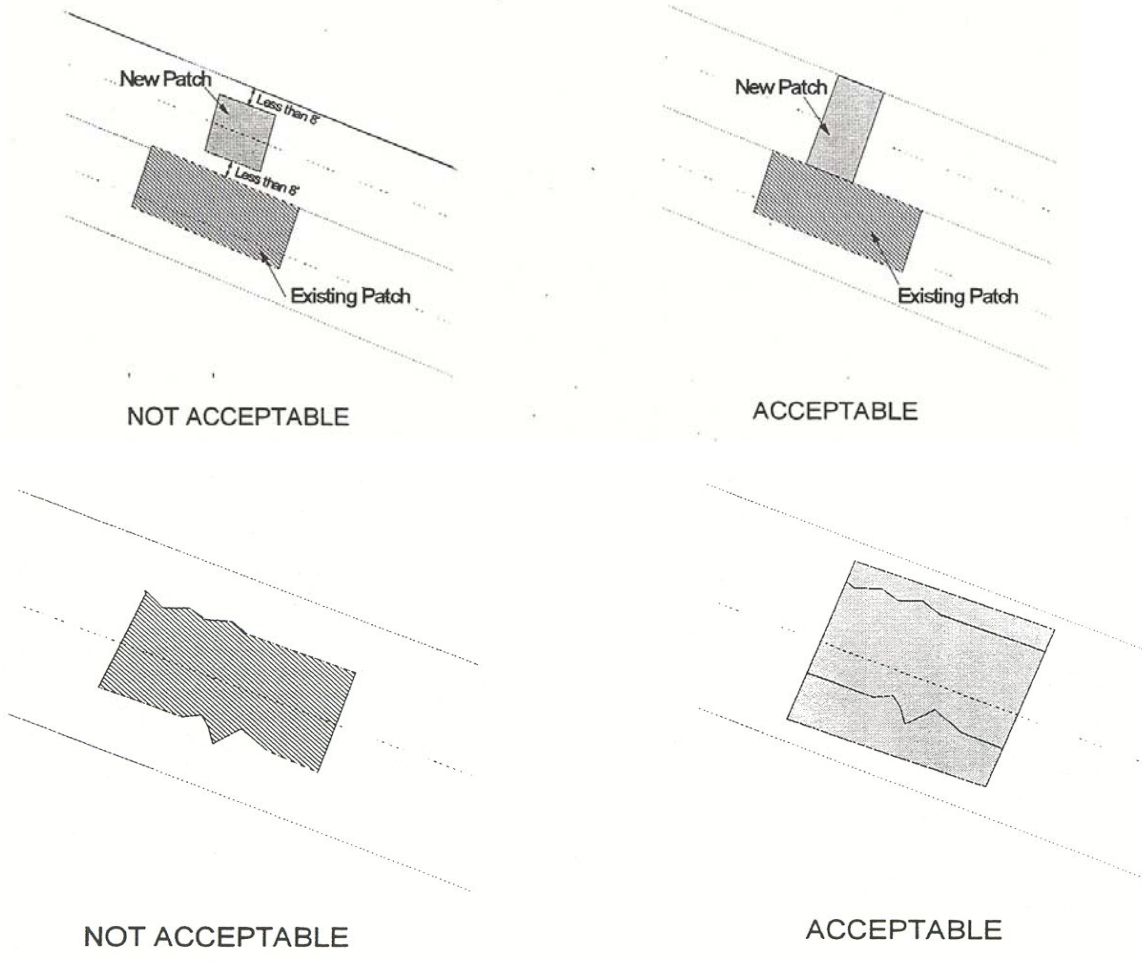
Patches with angled sides and irregular shapes will not be accepted as depicted below.



Patches surrounded by 3 or more sides within existing patches will generally not be accepted. Boundaries of the patches shall coincide. The **CONTRACTOR** shall get direction from the contracting **AGENCY** or utility when existing patches are not stable.



Existing pavement shall not leave strips of pavement less than one-half lane in width from the edge of the new patch or the lip of the gutter for commercial, industrial or non-residential streets. In the case of residential streets, strips shall not be less than 8 feet in width from the existing patches or the lip of the gutter.



Avoid breaking away the edges of the existing pavement or damaging the remaining pavement with heavy construction equipment.

B. Trench Excavation. General

Excavation including the manner of supporting excavation and provisions for access to trenches shall comply with the current regulations as determined by OSHA for bracing and safe conditions. Excavation shall include, without classifications, the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. The removal of said materials shall conform to the lines and grade shown. Excavation for pipe, wire, or conduits shall be by open trench unless otherwise specified or shown on the plans. However, the **CONTRACTOR** shall first obtain approval from the **AGENCY** prior to using tunnel or jacking methods on any portion.

The **CONTRACTOR** shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavation, and all pumping, ditching, or other approved measures for the removal or exclusion of water, including storm water and waste water reaching the site of the work from any source as to prevent damage to the work or adjoining property. The **CONTRACTOR** shall be responsible for any damage to persons or property due to interruption or diversion of potable, storm or wastewater on account of his operations. If due to delays in delivery of materials or for other reasons, and the **CONTRACTOR** is not able to fully complete the work within any excavated area in a reasonable length of time as determined by the **AGENCY**, the **AGENCY** may require the **CONTRACTOR** to backfill the excavation and re-excavate when the work can be completed expeditiously, with no additional payment.

Except as otherwise shown or provided herein, excavation shall be open cut trenches with vertical sides up to the top of the pipe, and from the top of the pipe to the ground surface. The bottom of the trench shall have a maximum width equal to the outside diameter of the pipe plus 24 inches or as shown on the plans. If the maximum trench width is exceeded, the **CONTRACTOR** shall provide either; additional bedding, another type of bedding, or a higher strength of pipe if required by the **AGENCY**, with no additional payment. The **CONTRACTOR** may be compensated by the **AGENCY** or utility when the **AGENCY** requires trench widths greater than the outside diameter of the pipe plus 24 inches for flexible pipe, to compensate for low stability soils.

Except when otherwise specified or ordered by the **AGENCY**, the bottom of the trench shall be excavated uniformly to the grade or depth indicated on the drawings. The maximum amount of open trench permitted in any one location shall be 500 feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater, unless otherwise limited by the **AGENCY**. Trench shall be considered open until backfilled to finish surface. Trenches across streets shall be completely backfilled as soon as possible after pipe, wire, or conduit installation.

Substantial bridging, properly anchored, capable of carrying the legal limit loading, in addition to adequate trench bracing, shall be used to bridge across trenches at street crossings where trench backfill and temporary patches have not been completed during regular working hours. Safe and convenient passage for pedestrians and access to all properties shall be provided.

C. Trench Over-Excavation

Wherever the excavation is made below the grade shown on the drawings, or below the grade ordered by the **AGENCY**, it shall be refilled to the required grade with CLSM; or using Agency approved methods and specifications and verified with materials and compaction testing.

D. Disposal of Unsuitable and Excess Excavated Materials

Excess material and excavated material unsuitable for backfill, shall be removed from the site of the work by the end of each working day unless otherwise approved by the **AGENCY** and disposed of by the **CONTRACTOR**.

E. Trench Backfill with CLSM

Except as otherwise provided or approved by the AGENCY, after the pipe or conduit is laid, trenches shall be backfilled with CLSM in the pipe zone as defined in the following table:

TABLE 19.4E-1

Pipe or Conduit	Pipe Zone
2-inch or less diameter	6 inches above the top of the pipe up to subgrade
Greater than 2-inch diameter, except vitrified clay pipe	12 inches above the top of the pipe up to subgrade
Vitrified clay pipe	24 inches above the top of the pipe up to subgrade

CLSM should be well mixed and discharged directly from the truck into the space to be filled, or by other methods approved by the AGENCY. The mix may be placed part depth or full depth as conditions at the site and CLSM type dictate. When used as backfill in the pipe zone, care should be taken to prevent flotation or misalignment of the pipe by means of straps, soil anchors or other approved means of restraint. Material may be placed in stages with initially lesser flowability, to prevent movement or flotation of pipe. Refer to Section 19.26 for thermal compatibility when using CLSM directly against plastic pipe materials. CLSM shall not be placed when the trench bottom or walls are frozen or contain frozen materials.

Compaction of CLSM will not be normally required. Some external pushing and hand tamping may be required to help fill voids around tightly spaced utilities or obstacles.

The maximum layer thickness for Flow-Fill shall be 3 feet at one time. Additional layers shall not be placed until the backfill has lost sufficient moisture to be walked on without indenting more than 2 inches. Allow bleed water to rise and divert away from placement area before another layer may be added. Do not place CLSM on top of bleed water or on any water above the bearing layer. Any damage resulting from placing Flow-Fill in layers that are too thick or from not allowing sufficient strength gain time between placement of layers shall be repaired at the **CONTRACTOR's** expense.

The maximum layer thickness for Flashfill is not restricted except to prevent flowing or running into undesired areas.

19.5 STREET SURFACING AND PATCHING

Placement of pavement materials for vehicle traffic shall not be allowed until the removable CLSM backfill has cured 24 hours (Flow-Fill only) or achieved sufficient resistance to allow paving. CLSM (either type) should be subjected to standard proofroll criteria, or penetration resistance tests. CLSM should achieve a penetration resistance

of at least 3.6 tsf (tons per square foot) (equivalent to 50 psi) using a hand-held soil penetrometer, typically pushed to ¼" depth, in accordance with the penetrometer manufacturer's instructions. Alternately, penetration resistance shall be considered achieved when a person weighing 100 pounds by use of their body weight as an axial load, cannot penetrate the CLSM backfill with the square cut end of a ½" diameter (#4) steel reinforcing bar.

A. Temporary Pavement Selection

Whenever permanent pavement patches are not constructed immediately following trench backfilling operations, temporary pavement patch construction consisting of:

- A minimum of 3 inches of hot mix asphalt (or approved warm mix if allowed) or cold plant mix asphalt on Flashfill or cured Flow-Fill CLSM , or
- A thickness of Flash-Patch equal to existing pavement thickness on CLSM, or
- Steel plates per the **AGENCY** requirements on CLSM, must be utilized to provide the required number of paved travel lanes. Sufficient excavation of backfill shall be done to allow the temporary surfacing to be level with surrounding pavement. Use of steel plates may be left in place for a short duration as approved by the **AGENCY**. Temporary pavement patches may be left in place for a maximum of 30 working days following completion of backfilling operations unless otherwise approved by the **AGENCY**.

When Flow-Fill is used as backfill material on collector or arterials streets needed to be opened within 24 hours, it must fill the excavation, using 3 feet maximum lifts as required in section 19.4E, up to the existing pavement surface grade, less enough thickness to provide for steel plates. The **CONTRACTOR** must then plate the excavation with heavy duty steel plates adequate to carry heavy traffic and wait at least 24 hours for the Flow-Fill to cure prior to applying the Permanent Patch or another Temporary Patch. Steel plates should be set below the street surface to avoid lateral displacement; the patch size may be increased to accommodate side support and a smooth height transition. Some Agencies may not allow steel plates on arterials during snow plow operation season. Alternately, Flash-Patch may be placed as a temporary patch and driving surface over CLSM, and shall match the existing pavement thickness.

Neither Flow-Fill nor Flashfill shall be allowed for a driving surface, except for very low traffic conditions and only when allowed by the **AGENCY**.

B. Temporary Pavement Patching Materials

Various materials for temporary patching options can be selected, and include:

- **Hot Mix** (HMA) or **Warm Mix Asphalt** (WMA) conforming to MGPEC Item 20 specifications. These may be used for either concrete or asphalt streets.
- **Cold-mix** asphalt materials (with cut-back asphalt cements only allowed from October 1 to February 28 (29)). This may only be used for asphalt streets.

- **VOC compliant** Cold-mix asphalt materials, (conforming to CDPHE Regulation No. 7, 5CCR 1001-9, Section XI, required from March 1 through September 30). This may only be used for asphalt streets.
- **Flash-Patch** materials (consisting of cementitious fly ash, water and cellular foam) and shall include approximately 10 to 15% air content. This may be used for either concrete or asphalt streets. Flash-Patch can be produced with the same volumetric-mixing truck as delivers and produces the Flashfill CLSM material. Flash-Patch materials will exceed CLSM strengths, but are limited in thickness to the existing pavement thickness to allow removal.
 - Flash-Patch usage on arterial roadways will require that **Small Aggregate topping** be used. Gradations shall meet ASTM C33 for size #9, and be crushed stone or natural gravels, with gradations requirements listed below:

TABLE 19.5B-1

Sieve	3/8"	#4	#8	#16	#50
% Passing	100	85 – 100	10 - 40	0 - 10	0 - 5

C. Temporary Pavement Patch Placement

Asphalt should ideally be placed according to MGPEC Item 20 requirements. Any temporary asphalt pavement patch shall be placed and compacted and shall be maintained by the **CONTRACTOR** so that the patched surface and the surrounding area remain a single even (smooth) unbroken plane, suitable to handle the traffic, for the duration of Temporary Patch.

Flash-Patch usage on arterial roadways will require that the Small Aggregate shall be broadcast on and embedded into the surface, for increased skid-resistance. Aggregate application will occur on patches within 100 feet of approaching stop signs or signal lights on other city streets. This aggregate shall be applied at approximately 5 lb per SY of patch surface, before the Flash-Patch hardens. The **CONTRACTOR** shall be responsible to apply and embed the surface aggregate in a timely manner before set occurs.

The following surface tolerance for any temporary patches shall be observed. When a 10 foot straight edge is laid across the temporary patch parallel to the centerline of the street and in the direction transverse to the centerline, there shall be no more than a 3/4 inch rut, hump, or depression evident. Deteriorated temporary patches exhibiting ruts, humps, or depressions shall be repaired or replaced immediately. If the existing street exceeded the above tolerances prior to patching, then the temporary patch shall be equal to or better than the condition of the surrounding pavements.

Temporary patches with hot or cold mix asphalt may be opened to traffic after proper compaction and clean-up of the adjacent areas has occurred. Temporary patches of Flash-Patch may be opened to traffic usually within 1-1/2 hours after placement on arterial roadways, and usually within one hour on other streets.

D. Permanent Pavement Materials

Asphalt for replacement of Asphalt Pavement streets, shall be HMA (Hot Mix Asphalt), or WMA (Warm Mix Asphalt) if allowed by **AGENCY**, and shall meet the material requirements in MGPEC Item 20 for Grading S or SX with PG 64-22 binder, unless specified otherwise. Completion of the permanent patch in areas where an open graded surface course (SMA) exists shall include placement of a surface course to match the existing surface texture.

Concrete for replacement of Concrete Pavement Streets shall meet MGPEC Item 30, CDOT Class P specifications, or **AGENCY** standards as they require. Refer to the applicable specification for restoring tie bars, smooth dowel bars, expansion joint and joint seal materials.

E. Permanent Pavement Construction

Prior to placing the permanent patch, the existing cuts made for trenches shall be properly prepared for final pavement patching.

1. Existing Asphalt Pavement

Existing asphalt pavement shall be saw cut to a neat straight line and to a minimum 9 inches outside of the trench area. The **AGENCY** may require just the top lift be outside the trench edges. The resulting "T patch" edges shall not fall within existing wheel paths. Patches parallel to the direction of traffic and encompassing the wheel path shall extend to lane lines.

The asphalt thickness shall be the thicker of the existing depth, or the by **AGENCY** standards, except that the minimum depth shall be at least 4 inches.

A tack coat shall be applied to all edges to the existing freshly cut and/or approved well cleaned edges of asphalt pavement prior to placing new pavement.

Compaction of each lift shall be between 92 and 96 percent of T 209 using maximum theoretical (Rice) density. Average compaction of less than 92 percent of T 209 will be cause for rejection.

2. Existing Concrete Pavement

Existing concrete pavement shall be prepared by saw cutting and removal of partial panels back to existing joint lines to achieve full panels for new replacement panels or per **AGENCY** requirements. The **CONTRACTOR** shall provide CLSM to the top of subgrade/bottom of the final Concrete Pavement level or base course level. The top of loose CLSM shall be moisture adjusted and compacted and proof-rolled to a tight condition prior to adding base course and/or concrete for pavement. Jointing layout and the use of tie bars and smooth dowel bars shall be constructed according to applicable specific Agency, CDOT 'M' standards or MGPEC Item 30 specifications. Generally, deformed tie bars shall be used in longitudinal joints, and smooth load-transfer dowels in transverse joints regardless if the existing PCCP had or has them. Alignment tolerances of

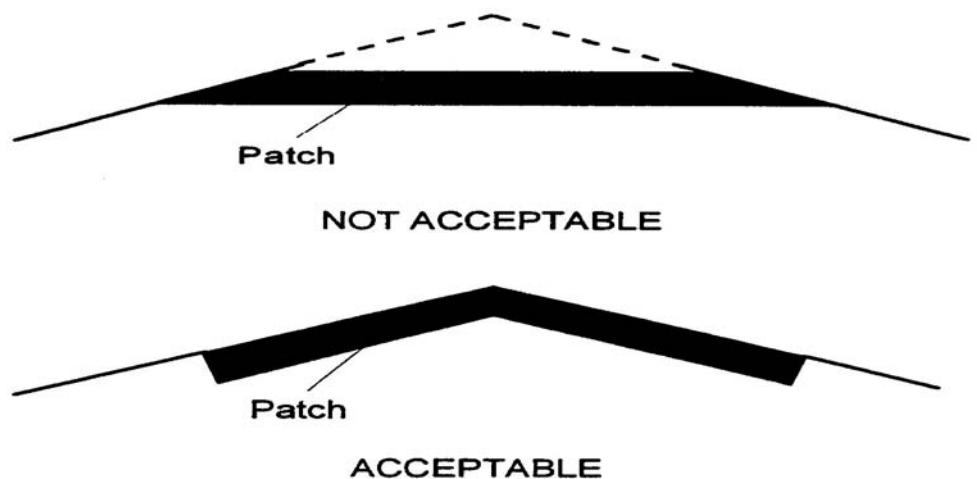
the dowel bars shall be followed to assure natural lateral movement and proper performance.

The top of CLSM placed for temporary paving or for steel plates in section 19.4A shall be excavated to the top of subgrade/bottom of the final asphalt or concrete pavement level. The depth of excavation shall allow for the permanent pavement section to be equal to, or greater than, the existing section, or the section required by the **AGENCY**.

Any improvements in the right-of-way or on private property disturbed or damaged during construction shall be replaced prior to placement of the permanent pavement patch. Damaged sections of concrete sidewalk shall be removed and replaced to the nearest expansion joint or score line. Damaged concrete curb and gutter shall be removed and replaced to the nearest contraction joint. Replacement of less than a standard length of curb and gutter will not be permitted. Integral curb, gutters, and/or sidewalk shall be replaced in their entirety.

The following surface tolerance for permanent pavement patch for asphalt (or concrete), including any surface treatment before stripping, shall be observed. The surface shall be thoroughly compacted (leveled), smooth (broomed), and free from ruts, humps, depressions, or irregularities. When a 10 foot straight-edge is laid across the permanent patch parallel to the centerline of the street and in a direction transverse to the centerline, the surface shall not vary more than 1/4 inch from the lower edge of the straight edge. Patches exhibiting deviations greater than 1/4 inch shall be replaced prior to acceptance of the patch. If the existing street exceeds the above tolerances, then the patch shall be equal or better than the condition of the surrounding pavement.

Patches shall also have a cross slope or cross section consistent with the design of the existing roadway.



F. Traffic Control Devices

All traffic control devices removed or disturbed during construction must be replaced upon completion of the permanent patch including but not limited to delineation, paint, thermoplastic pavement markings, and traffic signal detector loops. Temporary lane lines and other markings used during construction shall be permanently removed, to the satisfaction of the AGENCY, prior to placing the new traffic stripes or markings.

19.6 MEASUREMENT

The following measurement items shall be followed, unless the AGENCY or utility contracting the work uses or requires their own methods.

A. Length of Trench

The length of trench will be measured by the CONTRACTOR and verified and approved by the AGENCY. The dimensions shall be the centerline length dimension or an average of both trench side lengths; and shall be no more than previously agreed upon by the AGENCY. This length shall include all CONTRACTOR costs for traffic control, excavations regardless of width, material removal and disposal, shoring, dewatering, utility materials and installation, and materials and installation of pavement materials, and final striping.

B. Cubic Yard Volume of CLSM Materials

The cubic yard volume of CLSM materials shall include all CONTRACTOR costs to supply and install CLSM backfill previously planned and agreed upon by the AGENCY, and will include overages for void filling accepted by the AGENCY. The volume shall be only for actual materials installed for the work in the trench or cut area, as approved by the AGENCY.

19.7 PAYMENT

When any trench over-excavation below the specified level of bedding material and additional backfill material is ordered or approved by the AGENCY because unsuitable materials are encountered, payment shall be made separately by the appropriate contract item.

In the event that changes in elevation of the trench of less than 6 inches (150 mm) are ordered by the AGENCY, no changes in the contract amount will be allowed. When such changes in elevation are more than 6 inches or changes in alignment are made that change the character of the work required, the work shall be performed as specified by the AGENCY and agreed upon with the CONTRACTOR.

<u>Item</u>	<u>Description</u>	<u>Payment</u>
19.7-1	Utility Cut & Installation, Pavement, Striping	linear feet (LF)
19.7-2	CLSM Backfill(Materials and Installation)	cubic yards (CY)