

CHAPTER 25 – RECONSTRUCTION AND REPAIR
TABLE OF CONTENTS

Section	Title	Page
25.1	General	25-14
25.1.1	Condition of Repair	25-14
25.1.2	Testing and Inspection	25-14
25.1.3	Completion Time for Work	25-14
25.1.4	Unsatisfactory Work	25-14
25.1.5	Guarantee	25-14
25.1.6	Verification of Existing Utilities	25-14
	A. Responsibility	25-14
	B. Design Modifications	25-14
25.1.7	Permit Requirements	25-22
25.1.8	Traffic Accommodations	25-22
25.1.9	Protection of Existing Improvements	25-22
	A. Surface Improvements	25-22
	B. Locates	25-22
	C. Survey Markers	25-22
	D. Repair and Responsibility	25-22
25.1.10	Equipment	25-33
	A. Trenching Equipment	25-33
	B. Tracked Vehicles	25-33
	C. Haul Routes	25-33
25.2	Utility Excavation	25-33
25.2.1	Protection of Existing Underground Utilities	25-33
	A. Types of Utility Excavation	25-33
	B. Location of Underground Structures	25-33
	C. Open Trenches	25-33
	D. Stockpiling. See the requirements of Section 25.2.3 D.	25-44
25.2.2	Relocation of Utilities	25-44
25.2.3	Removal of Pavement	25-44
	A. Open Pavement Cuts	25-44
	B. Placement of Pavement Cuts	25-44
	C. Repair of Damage Beyond Original Cut	25-44
	D. Stockpiling and Disposal of Excavated Paving	25-44
	E. Excavation Near Failed Pavement	25-44
25.2.4	Backfilling of Potholes and Trenches	25-44
25.2.5	Installing Dry Utilities Under Existing Pavement	25-55
	A. Use of PVC Sleeving	25-55
	B. Location of PVC Sleeves	25-55
	C. Boring and Casing	25-55
	D. Open Cut	25-66
	E. Gas Lines	25-66
25.3	Structures	25-66
25.3.1	Removal of Structures	25-66
	A. General	25-66
	B. Bridges, Culverts, and Drainage Structures	25-77
25.3.2	Construction Requirements	25-77
25.4	Non-Structural Concrete	25-77

25.4.1	Removal of Concrete Curb, Gutter, Sidewalk, and Driveways	25-77
	A. Saw Cut Edges	25-77
	B. Minimum Replacement Dimensions	25-77
	C. Joints	25-77
	D. Fort Collins (GMA and city limits) Specifications	25-77
25.4.2	Widening Existing Sidewalks	25-88
25.4.3	Reconstruction or Repair of Apron, Radius, Ramp Area, or Pedestrian Crossing	25-88
25.5	Pavement	25-88
25.5.1	Temporary Patch	25-88
	A. When to Use Temporary Patch	25-88
	B. Street Closure Period	25-88
	C. Placing and Maintenance	25-88
	D. Specifications for Asphalt	25-88
	E. Stockpiling	25-88
	F. Time Requirements	25-99
	G. Open to Traffic	25-99
	H. Surface	25-99
	I. Using Steel Plates	25-99
25.5.2	Permanent Patch	25-99
	A. Patch Geometry	25-99
	B. No Patches within Existing Patches	25-99
	C. Separation	25-99
	D. Series of Patches	25-99
	E. Patch Widths	25-99
	F. Longitudinal Patches	25-10+0
	G. Transitions	25-10+0
	H. Older Pavement	25-10+0
	I. Width Consistency	25-10+0
	J. Patch Thickness	25-10+0
25.5.3	Pavement Evaluation	25-10+0
	A. Minor Repairs	25-10+0
	B. Major Repairs	25-11+1
25.5.4	Base Course	25-11+1
25.5.5	Portland Cement Concrete Pavement	25-11+1
	A. Removal of Concrete Pavement, Crosspans, and Alley Intersections	25-11+1
	B. Concrete Surfacing and Patching	25-11+1
	C. Opening to Traffic	25-12+2
	D. Connection Between Existing and New Pavements (Joints)	25-12+2
	E. Reconstruction of Concrete	25-12+2
	F. Manhole Frames and Valve Box Adjustments	25-12+2
25.5.6	Bituminous Asphalt Pavement	25-13+3
	A. Removal of Bituminous Asphalt Pavement	25-13+3
	B. Materials and Application for Tack Coat, Prime Coat, and Blotter	25-13+3
	C. Minimum Repair of Cracked or Damaged Asphalt	25-16+6
	D. Temporary Surfaces	25-16+6
	E. Asphalt Joint Filling	25-16+6
	F. Patching	25-16+6
	G. Overlays	25-19+8
	H. Reconstruction	25-20+0
	I. Inclusion of Adjacent Cracks or Damage	25-21+2
	J. Manhole Frames and Valve Box Adjustments	25-21+2
25.6	Other Reconstruction and Repair	25-22+4
25.6.1	Trenches in Gravel Streets or Alleys	25-22+4
	A. Gravel Specifications	25-22+4

B. Thickness and Grade	25-2221
C. Settling	25-2222
D. Special Surface Treatment	25-2222
25.7 Developing A “Quality” Approach	25-2222
25.7.1 General.....	25-2222
25.7.2 Appearance	25-2322
A. Public Perception	25-2322
B. Appearance Guidelines	25-2323
25.7.3 Rideability	25-2423
A. Guidelines for Rideability	25-2423
25.7.4 Pavement Management	25-2424
A. Pavement Management Guidelines	25-2424
25.7.5 Future Maintenance.....	25-2525
A. Future Maintenance Guidelines	25-2525

DRAFT

LIST OF TABLES

Table 25-1 Minimum Patch Requirements.....	25-1040
Table 25-2 Blotter Material.....	25-1414
Table 25-3 Spraying Temperature of Liquid Asphalts.....	25-1515
Table 25-4 Distresses Treated by Hot In-Place Recycling.....	25-2020

LIST OF FIGURES

Figures are Located at End of Chapter

Figure 25-1	Patching (Appearance)
Figure 25-2	Patching (Rideability)
Figure 25-3	Patching (Pavement Management)
Figure 25-4	Patching (Future Maintenance)

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CHAPTER 25 – RECONSTRUCTION AND REPAIR

25.1 GENERAL

This chapter addresses reconstruction and repair of improvements within the public right-of-way and public easements.

25.1.1 Condition of Repair

All infrastructure elements that undergo reconstruction and repair shall be restored to a condition equal to, or better than, the condition prior to repairs.

25.1.2 Testing and Inspection

Street inspection and testing for all reconstruction and repair shall be performed according to **Chapter 23, Street Inspection and Testing Procedures**, unless otherwise identified in this chapter.

25.1.3 Completion Time for Work

Refer to **Chapter 6, Permits**.

25.1.4 Unsatisfactory Work

Removal and replacement of unsatisfactory work shall be completed within 15 days of written notification from the Local Entity Engineer of the deficiency unless the condition is deemed an emergency requiring immediate correction. In the event the replacement work is not completed within the specified time period, the Local Entity Engineer may take action to complete the work and charge the Developer for all related costs.

25.1.5 Guarantee

All work shall be warranted according to Chapter 24, Acceptance Procedures and Record Drawings/Warranty.

25.1.6 Verification of Existing Utilities

A. Responsibility.

The Developer is responsible for field locating and verifying elevations of all existing sewer mains, water mains, curbs, gutters, and other utilities at the points of connection shown on the plans, and at utility crossings prior to any reconstruction or repair.

B. Design Modifications.

If a conflict exists and/or a design modification is required, the Developer shall have the Designer revise the plans. The revised plans shall be reviewed and approved by the Local Entity Engineer prior to their implementation.

25.1.7 Permit Requirements

Refer to **Chapter 6, Permits**, for all permit requirements.

25.1.8 Traffic Accommodations.

Timing of reconstruction and repair work may be restricted by the Local Entity Engineer to certain time periods to accommodate traffic and other public uses. The Developer shall make adequate provisions to assure that traffic and adjacent property owners experience a minimum of inconvenience.

No bridges, culverts, and other drainage structures in use by traffic shall be removed until arrangements have been made to accommodate traffic and an approved permit has been issued by the Local Entity Engineer.

25.1.9 Protection of Existing Improvements.

A. Surface Improvements.

The Developer shall at all times take proper precautions and be responsible for the protection of existing street and alley surfaces, driveway culverts, street intersection culverts or aprons, irrigation systems, mail boxes, driveway approaches, curb, gutter and sidewalks and all other identifiable installations that may be encountered during construction. Existing improvements to adjacent property such as landscaping, fencing, utility services, driveway surfaces, etc., that are not to be removed, shall be protected from injury or damage resulting from the Developer's operations.

B. Locates.

The Developer shall at all times take proper precautions for the protection of existing utilities, the presence of which are known or can be determined by field locations of the utility companies. The Developer shall contact the UNCC (One Call) at 1-800-922-1987 for utility locates, a minimum of two (2) working days prior to his proposed start of work. Other unregistered utility entities (e.g. ditch company) are to be contacted individually to arrange locating their utilities. Utility service laterals shall be located prior to beginning excavation or grading.

C. Survey Markers.

The Developer shall at all times take proper precautions for the protection of property pins/corners and survey control monuments encountered during construction. Any damaged or disturbed survey markers shall be replaced by a registered land surveyor at the Developer's expense.

D. Repair and Responsibility.

The repair of any damaged improvements as described above shall be the responsibility of the Developer.

25.1.10 Equipment

A. Trenching Equipment

The use of trench digging equipment will be permitted in places where its operation will not cause damage to existing structures or features, in which case hand methods shall be employed.

B. Tracked Vehicles

No tracked vehicles shall be permitted on streets unless approved by the Local Entity Engineer. When tracked vehicles are allowed, damaged facilities will be restored to original condition at the Developer's expense.

C. Haul Routes

Haul routes for equipment and materials may be restricted as a condition of the Permit.

25.2 UTILITY EXCAVATION

25.2.1 Protection of Existing Underground Utilities

A. Types of Utility Excavation.

The construction of any repair activity within the street or alley rights-of-way shall be accomplished by open cut, jacking, boring, or a combination of these methods, as approved by the permit. The Local Entity Engineer must approve any change from the approved permit. Crossings under sidewalks or curbs may be made by tunneling only when approved by the Local Entity Engineer.

B. Location of Underground Structures.

The Developer shall proceed with caution in the excavation of the trench, so that the exact location of underground structures, both known and unknown, may be determined. The Developer shall locate all existing underground utilities, by non-destructive means, before trench excavation. Excavation and visual verification of the utility location shall be performed by the Developer when required by the Local Entity Engineer or the utility owner.

C. Open Trenches.

Once trenches are excavated, the Developer shall proceed diligently towards completion of the work and completion of the backfill. The Local Entity Engineer reserves the right to limit the length of open trench. Failure by the Developer to comply with these requirements may result in an order to stop the excavation in progress until compliance has been achieved.

D. Stockpiling. See the requirements of Section 25.2.3 D.

25.2.2 Relocation of Utilities

Relocation of utilities in an existing public right-of-way or public easement shall be done at the expense of the utility involved or the Developer.

25.2.3 Removal of Pavement

A. Open Pavement Cuts.

Open pavement cuts shall not be permitted on any street unless approved in writing by the Local Entity Local Entity Engineer Local Entity Engineer.

B. Placement of Pavement Cuts.

The pavement cut shall follow a line parallel to the roadway centerline and at least 2 feet beyond the trench side wall. All pavement cuts parallel to the direction of travel shall be placed on the lane line or at the center of the aligned travel lane. For bicycle lanes, the cut shall be at the line or the edge of the gutter. Longitudinal joints are not allowed in the wheel path.

C. Repair of Damage Beyond Original Cut.

If pavement adjoining the original pavement cut is damaged during construction, additional pavement shall be removed and repaired after trench backfilling. The additional pavement shall be removed with cuts, with the original cuts. The additional pavement damaged by the Developer shall be repaired at the Developer's expense.

D. Stockpiling and Disposal of Excavated Paving.

All excavated pavement material and concrete may be used as fill if the material meets requirements for borrow material. If the material is unacceptable, it shall be stockpiled separately and disposed of by the Developer off site at his expense and shall not be used as trench backfill material.

E. Excavation Near Failed Pavement.

When the proposed excavation falls within 3 feet of a section of failed pavement, the failed area shall be removed up to sound pavement and patched. Scarring, gouging, or other damaged pavement adjacent to a patch shall be removed and the pavement repaired.

25.2.4 Backfilling of Potholes and Trenches

Flowable fill shall be required in all voids and openings created by jetting, pumping, and pneumatic removal of the soil and where compaction equipment is unsuitable. Refer to **Chapter 22, Materials and Construction Specifications**, for criteria on flowable backfill.

25.2.5 Installing Dry Utilities Under Existing Pavement

A. Use of PVC Sleeving

The use of existing sleeves for method of installation shall be the first priority when installing utilities under existing sidewalks, curbs and pavement. Tunneling is discouraged in major intersections and will not be allowed if existing PVC conduits are available.

B. Location of PVC Sleeves

The location of PVC sleeves will be marked on the curb according to Standard Detail 12-3 and used on a first come, first serve basis. Ducts installed by, or for, the Local Entity Electric Utility, are reserved for Local Entity Electric Utility use only and are not available for use by other utility providers.

C. Boring and Casing

Utility crossings under sidewalks, curbs and pavement may be made by boring and casing and then installing the utility. However, boring and casing will not be allowed if existing PVC conduits are available. Boring for utilities shall be permitted if approved by the Local Entity Engineer.

1. Boring and Casing Materials

- a. Casing Pipe. The casing pipe shall be fabricated steel having a minimum yield strength of 35,000 psi. The size and wall thickness shall be shown below or as otherwise noted on the drawing.

Casing Diameter	Minimum Thickness
42" and larger	5/8 inch
36" and smaller	3/8 inch

- b. Casing placed by boring may be bare steel pipe unless otherwise noted on the plans.
- c. Carrier Pipe. The carrier pipe shall be approved PVC pipe, reinforced concrete pipe, vitrified clay pipe or other materials approved by the Local Entity Engineer.

2. Boring and Casing Installation

- a. Placement of Casing by Boring. Casing shall be kept on line and grade as required by the approved plans. Joints in casing shall be field welded and watertight. Welds shall be of a size to develop the full strength of the pipe materials. After welding, the joints of coated and wrapped pipe shall be primed and tarred.
- b. Placement of Carrier Pipe. Upon completion of the casing installation, the utility pipe shall be installed in the casing pipe at the designed grade. The utility pipe shall be installed by pushing the pipe into the casing on "skids"

and subsequently supporting the pipe by placing a sand bed under the pipe and around the “skids.”

- c. The voids between the carrier pipe and the casing shall be completely filled with flowable fill. Refer to **Bedding and Backfill in Chapter 22, Materials and Construction Specifications**.

3. Repair of Bore Holes

- a. Less than 6 Inches. For openings less than or equal to 6 inches in diameter, bore holes in asphalt pavement shall be filled with patching material (cold mix is not acceptable) to prevent entry of moisture. Patching material used shall be in all cases compatible with the existing surface. Subgrade shall be replaced with flowable fill and mechanically vibrated to provide necessary support to the surface. Bore holes in concrete pavement and structures shall be repaired in accordance with **Chapter 22, Materials and Construction Specifications**. The sealing of bore holes is the responsibility of the Developer.
- b. Greater than 6 inches. For openings greater than 6 inches in diameter, the limits of repair shall be identified in the field.
- c. Finished Condition. The completed job shall be flush with the surrounding pavement and have no indentations, pockets, or recesses that may trap and hold water.

D. Open Cut.

In the event that the use of existing sleeves or boring and casing is not an option, an open cut may be made and repaired with flowable fill done in accordance with Chapter 22, Construction Specifications.

E. Gas Lines.

The installation of gas lines will not require the use of the existing PVC conduits.

25.3 STRUCTURES

25.3.1 Removal of Structures

When it is necessary to remove structures or portions of structures, care shall be taken to protect surrounding improvements.

A. General

1. Preparation for Construction. Where portions of structures are to be removed, remaining portions shall be prepared to fit construction. The work shall be done in accordance with plan details.
2. Partial Abandonment. Portions of structures may remain in place when approved by the Local Entity Engineer.

3. Damage to Structure. All damage to structures remaining in place shall be repaired by, and at the expense of, the Developer.
4. Cleaning and Preparing Structures. Reinforcing steel projecting from the remaining structure shall be cleaned and aligned to join with the new construction. Dowels required by plans shall be secure within drilled holes, with an approved grout.

B. Bridges, Culverts, and Drainage Structures

1. Removing Substructures. The substructures of existing structures shall be removed according to **CDOT Specifications Section 202.08**. Steel, pre-cast concrete, and wood bridges as specified shall be carefully dismantled without unnecessary damage.
2. Removal of Pipe. All pipe designated for removal and reuse within the project shall be carefully removed, cleaned, and care taken to prevent damage to the pipe.
3. Bypass Service for Sewers. In removing manholes, catch basins, and inlets, any active drainage or sanitary sewers shall be properly bypassed in order to maintain service during the repair operation.

25.3.2 Construction Requirements

All repairs and reconstruction of structures shall be evaluated and designed according to **Chapter 22, Construction Specifications**.

25.4 NON-STRUCTURAL CONCRETE

25.4.1 Removal of Concrete Curb, Gutter, Sidewalk, and Driveways

A. Saw Cut Edges

Concrete shall be removed to edges that are neatly sawed to a minimum of one-half the concrete thickness. Sidewalks and driveways shall be saw cut in straight lines either parallel to the curb or perpendicular to the alignment of the sidewalk or curb.

B. Minimum Replacement Dimensions

No concrete section to be replaced shall be less than 5 feet in either width or length for a driveway or crossspan, and 5 feet in length, for sidewalk, curb, and gutter.

C. Joints

If a proposed saw cut in the driveway falls within 5 feet of a construction joint, expansion joint, or edge, the concrete shall be removed to the joint or edge.

D. Fort Collins (GMA and city limits) Specifications

Sidewalk shall be removed joint to joint in Fort Collins (GMA and city limits).

25.4.2 Widening Existing Sidewalks

When existing walks are widened (a minimum width of 4.0 feet), they shall be edge thickened in accordance with **Construction Drawing 2501**.

25.4.3 Reconstruction or Repair of Apron, Radius, Ramp Area, or Pedestrian Crossing

Whenever construction, alteration, or repair to an existing street affects any part of the apron, radius, ramp area, or pedestrian crossing area, the entire apron, radius, ramp area, or pedestrian crossing area shall be removed and replaced with a pedestrian ramp. Work shall be done in accordance with these standards and as required by the **Americans With Disabilities Act Guidelines, Section 14, Public Rights of Way**, as amended. Refer to **Chapter 16, Pedestrian Facilities**, for design.

25.5 PAVEMENT

All street cuts shall be patched in accordance with the requirements of **Section 25.7**.

25.5.1 Temporary Patch

A. When to Use Temporary Patch.

All trenches across traffic lanes, where it becomes necessary to remove any existing surfacing or pavement, shall be provided with temporary trench cover if the pavement is not replaced within the same day.

B. Street Closure Period.

Trenches cut across traffic lanes that cannot be permanently patched within the approved time period shall be patched with a temporary material approved by the Local Entity Engineer.

C. Placing and Maintenance.

Refer to **Section 25.5.6 D** for placing and maintenance requirements.

D. Specifications for Asphalt.

Minimum requirements for temporary patching material shall be well-compacted surfacing material conforming to “Road Mixed Asphalt Surfacing Material” of the CDOT Standard Specifications. Patching material shall match flush with the existing pavement surface and shall not be less than 4 inches thick. The mineral aggregate shall conform to the grading specified for 3/8 inch maximum aggregate ± 5 percent. **Bituminous Asphalt** binder to be mixed with the mineral aggregate shall be liquid asphalt, Grade MC-3000, and shall be an amount between 5.5 percent and 6 percent by weight of the dry mineral aggregate.

E. Stockpiling.

Temporary patching material may be stockpiled on the job site.

F. Time Requirements.

Temporary patching material shall be placed in the time frame required by the permit.

G. Open to Traffic.

Trenches patched with temporary patching material may be opened to traffic immediately following completion.

H. Surface.

The surface of the temporary patch shall provide a smooth driving surface.

I. Using Steel Plates.

Steel plates, with appropriate strength, may also be used for overnight temporary trench cover. The steel plates shall be placed such that traffic will not cause them to move.

25.5.2 Permanent Patch.

A. Patch Geometry.

Existing pavements should be removed to clean, straight lines parallel or perpendicular to the flow of traffic. Patches shall not be constructed with angled sides or irregular shaped edges.

B. No Patches within Existing Patches.

Patches within existing patches are to be avoided. Where this cannot be avoided, boundaries of the new patch shall match the existing patch.

C. Separation.

Strips of pavement greater than 6 feet in width from the edge of the new patch to the edge of an existing patch or the lip of the gutter may remain.

D. Series of Patches.

Where three or more pavement cuts are proposed within a 75-foot-long roadway section, the pavement between the patches shall be milled and inlaid with new pavement over the entire work area. In cases where the existing pavement is in poor condition and may require overlay within the next few years, this requirement may be modified or waived by the Local Entity Engineer. A series of patches may also be repaired with an overlay. Refer to **Section 25.5.6 G.**

E. Patch Widths.

Trenches shall be patched for the entire lane width for a distance of 2-foot minimum on all sides of the trench. Transverse patch lengths shall extend across the full width of the travel lane. Minimum width for transverse patches shall be as listed in the Minimum Patch Requirements table below.

F. Longitudinal Patches.

Longitudinal Patches on Major Collector and Arterial Roadways. Edges of patches shall not fall in existing wheel paths. The edges of patches parallel to the direction of traffic shall be limited to the boundaries of lanes or to the centerline of travel lanes.

G. Transitions.

Patches should have a smooth longitudinal grade consistent with the existing roadway. Patches should also have a cross slope or cross section consistent with the design of the existing roadway.

H. Older Pavement.

In the case of older pavement where the likelihood of cracking and potholes next to the patch is greater, extend the “shoulders” of the pavement beyond the 2-foot minimum, and reinforce this area with a geotextile fabric. “T” cutting is required for all repairs in accordance with **Section 25.7.5 A.4.**

I. Width Consistency.

The width of patches shall be consistent to simplify future maintenance.

J. Patch Thickness.

The thickness of asphalt patches in asphalt streets shall typically be the thickness of the existing asphalt plus one (1) inch with the minimums listed in [Table 25-1](#) or as specified by the Local Entity Engineer.

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**Table 25-1
Minimum Patch Requirements**

Minimum Asphalt Thickness (for full depth pavement only)		Minimum Widths (Transverse Patches)
Residential – 6 inches	2" grading S on 4" grading SG	Residential – 5 feet
Collector – 8 inches	2" grading S on 6" grading SG	Collector – 8 feet
Arterial – 10 inches	3" grading S on 7" grading SG	Arterial – 10 feet

25.5.3 Pavement Evaluation.

In most cases, and particularly in the cases of extensive excavation and repairs, it is desirable to survey the existing pavement condition with the Local Entity Engineer prior to the work. After completion of the work, the pavement condition again shall be surveyed to verify that the pavement condition has been maintained or improved.

A. Minor Repairs.

In the case of minor repairs, pavement surveys can be made by visual observation.

B. Major Repairs.

In the case of major projects that involve excessive haul of materials or unusually heavy construction equipment or activity, nondestructive testing of the pavement condition before and after construction may be required.

25.5.4 Base Course.

If the existing base course is untreated, it shall normally be replaced with CDOT Class 5 or 6 aggregate base course material and compacted in layers not to exceed 6 inches thick. The resulting total compacted base thickness shall be the thickness of the removed base plus 2 inches. **Bituminous Asphalt** pavement may be used in lieu of aggregate base course in trench patches. If this option is used, the total pavement patch thickness shall match the minimum thickness for full depth pavement specified in **Section 25.6.1, A-10** above.

25.5.5 Portland Cement Concrete Pavement

A. Removal of Concrete Pavement, Crosspans, and Alley Intersections

1. Concrete Cutting. Concrete that is to remain shall be cut in a straight, true line with a vertical face, unless otherwise specified. Concrete shall be cut with a saw in accordance with **CDOT Specifications Section 202.02**. Concrete that must be dowelled shall be sawed to the full depth of the concrete.
2. Depth. Concrete pavement shall be removed to full depth.
3. Removal at Joints. If the removed portion falls within 3 feet of a construction joint, cold joint, expansion joint, or edge, the concrete shall be removed to the joint or edge.
4. Responsibility for Over-Break. The Developer shall be responsible for the cost of removal and replacement of all over-break.
5. Determining Limits of Removal. In the case of damaged concrete, the limits of removal should be identified in the field by a representative of the Local Entity Engineer.

B. Concrete Surfacing and Patching

1. Strength and Thickness of Concrete. The concrete pavement shall be replaced with 4,000 psi concrete to match the finish and thickness of the existing pavement, but not less than 8 inches thick. Mix design must meet the requirements of **Chapter 22, Materials and Construction Specifications**.
2. Curing. Concrete shall be coated and sealed with a uniform application of membrane curing compound applied in accordance with manufacturer's recommendations. Refer to **Chapter 22, Materials and Construction Specifications**, for additional curing information.

3. Quick Curing Concrete. The use of quick curing concrete (3000 psi strength within 48 hours) shall be used on all Arterial and Collector streets when repair areas are less than 500 square feet or when temperatures are below 40° F. Quick curing concrete repairs may be opened to traffic within 2 days or when the concrete has achieved a minimum strength equaling 80 percent of the 28-day design strength. Concrete cylinders shall be taken and broken according to **Chapter 23, Street Inspection and Testing Procedures**. The mix design shall be designed in accordance with CDOT specifications.
4. Extending the Repair to Adjacent Damage. Where existing cracks or damage are adjacent to the area being repaired, the repair area shall include the cracked or damaged concrete. Pavement repairs shall include all areas of damage, including leak test holes, potholes, equipment, and/or material scarring of the existing surface.

C. Opening to Traffic

Refer to **Chapter 22, Construction Specifications**.

D. Connection Between Existing and New Pavements (Joints)

1. Grade Change. Where new construction abuts existing pavement, the work shall be accomplished so that no abrupt change in grade between the old and new work results.
2. Concrete Joint Filling. Expansion joint material shall be installed between new structure slabs and existing structure slabs. Joints shall be thoroughly cleaned of all foreign material, then filled with a hot-poured elastic type joint filler conforming to M 173, ASTM D1190-80, or ASTM D1751-83, D1752-84, D3405-78, D3406-78, D3407-78. Silicone sealants or other materials may be approved by the Local Entity Engineer. Joint material shall be filled to within 1/2 inch of the surface. Excess material shall be scraped off to provide a smooth riding surface.
3. Edge Treatment. When repairing concrete, the removal perimeter shall be saw cut full depth of the concrete, and dowels inserted into the existing concrete as directed by the Local Entity Engineer.

E. Reconstruction of Concrete

When pavement has been identified to require reconstruction, the pavement shall be removed and replaced in sections from joint to joint. Replaced sections may require doweling connections. Refer to **CDOT M-Standards** for details.

F. Manhole Frames and Valve Box Adjustments.

Manhole frames, covers, and valve boxes shall be adjusted using the following criteria: The concrete edges will be a full depth saw cut and be a minimum of 1.0 foot from the manhole frame or water valve box. After removal of the old concrete, the existing slab will be drilled 8 inches deep and a 16 inch long #4 bar will be placed at 12 inches on center. Concrete pavement shall be replaced to the existing depth or a

minimum of 6 inches, whichever is greater, with a minimum mix design of 6 sacks of cement and a minimum 28-day compressive strength of 4200 psi. The concrete shall be protected from weather and rapid loss of moisture. Concrete shall be protected from vehicular traffic for a period not less than 7 days (three days with High/Early Concrete). Compressive strength of concrete shall reach 3000 psi prior to any traffic loading. Concrete patches shall be a minimum of 9 square feet. The same process of notification, inspection, and acceptance as outlined above shall apply to this method and shall occur prior to the application of the final wearing surface around these appurtenances.

25.5.6 **Asphalt Bituminous Pavement**

A. Removal of **Bituminous Asphalt** Pavement

1. Edges. Pavement designated for removal shall be cut vertically with square edges such that each edge of the finished patch will be parallel or at right angles to the direction of traffic. The edge for removal will be in a straight line set by a string line, chalk line, or other means to ensure a straight removal line.
2. Scoring Edge of Removal Area. Marking or scoring the asphalt pavement shall be done in such a way that damage to the adjoining mat is minimized. Use of a power cut-off saw is an approved method of scoring or precutting the perimeter of the asphalt removal area.
3. Damage Outside Removal Limits. Any overbreak, separation, gouging, or other damage to the existing asphalt mat outside of the designated removal limits shall be repaired at the Developer's expense.

B. Materials and Application for Tack Coat, Prime Coat, and Blotter

1. Preparing Existing Surface. If needed, this work shall consist of preparing and treating an existing surface with **bituminous asphalt** material, and blotter material if required, in accordance with these specifications and in reasonably close conformity with the lines shown on the approved construction plans.
2. New and Existing Pavement Interface. This work shall be done prior to placing new pavement on top of existing pavement. Also, when new pavement is to abut existing pavement, the Developer shall cut the old pavement according to **Section 25.5.6 A** and as directed by the Local Entity Engineer. The Developer shall also paint the edge of the existing pavement with a tack coat. In this case, after placing the new asphalt, all seams (joints) between the new and existing pavements shall be sealed with an asphalt tack coat or rubberized asphalt sealant.
3. Materials.
 - a. Tack Coat and Prime Coat. The type and grade of **bituminous asphalt** material to be used for the tack and/or prime coats shall be as specified in the Pavement Design Report referenced in **Chapter 10, Pavement Design and**

Report. This material shall meet all of the requirements of **CDOT Specifications Sections 407.02, 407.03, and 702.**

- b. Blotter Material. Blotter material, if required, shall meet the gradation requirements shown in Table 25-2.

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**Table 25-2
Blotter Material**

Standard Sieve Size	Percent by Weight Passing
1/2 inch	100
No. 4	90–100
No. 16	30–75
No. 200	0–12

Blotter material shall be used in the amounts necessary to absorb excess bituminousasphalt material. Excess blotter material shall be removed prior to the placement of the subsequent courses. Blotter material shall be free from all organic matter, lumps or balls of dirt, and any other foreign matter that could cause adverse effects on the final product.

- c. Paving Fabric. Paving fabric may be used when approved by the Local Entity Engineer. Pavement thickness shall be a minimum of 2 inches over the fabric.
4. Construction. Construction will proceed as follows.
- a. Equipment. The Developer shall provide equipment for heating and applying the bituminousasphalt material and for applying blotter material. The equipment shall be capable of applying the materials in a uniform manner for the specified rates of application.
- b. Weather. BituminousAsphalt material shall not be applied when the weather conditions would inhibit the desired function. No bituminousasphalt material shall be applied to any surface that is wet, frozen, or in any other condition that the Local Entity Engineer or his authorized representative shall consider unsuitable. In any case, no bituminousasphalt material shall be applied when the atmospheric temperature is below 50° F for the top lift. Refer to the **CDOT** book for lowest temperatures (**Section 401**).
- c. Preparation of Surface. The surface upon which the bituminousasphalt tack and/or prime coat is to be placed shall conform to the established lines. Grades shall be smooth and uniform and shall be compacted to the required density. If the required density deteriorates between the time the gravel course was originally compacted and the time the prime coat is placed, for any reason whatsoever, the surface shall be recompact to the required density at the expense of the Developer.
- d. Application.
- 1) General. BituminousAsphalt material shall be applied to the width of the section to be primed by means of a pressure distributor in a uniform,

continuous spread. When traffic is maintained, not more than one-half the width of the section shall be treated in one application. Care shall be taken that the application of **bituminous asphalt** material at the junctions of spreads is not used in excess of the specified amount. Excess **bituminous asphalt** material shall be squeegeed from the surface. Skipped areas or deficiencies shall be corrected.

When traffic is maintained, one-way traffic shall be permitted on the untreated portion of the roadbed. As soon as the **bituminous asphalt** material has been absorbed by the surface and will not pick up, traffic shall be transferred to the treated portion and the remaining width of the section shall be primed.

- 2) **Tack Coat.** The tack coat shall be pressure sprayed in the form of a mist onto roadway surfaces at a uniform rate of 0.05 to 0.10 gallon residual asphalt per square yard. Emulsions shall be diluted in the ratio of 3 parts emulsion to 1 part water by volume prior to use.

Tack coat shall be applied sufficiently in advance so that a tacky surface exists at time asphalt surface mix is placed. After tack coat application, it shall be worked into the roadway surface by use of rubber-tired equipment approved by the Local Entity Engineer. Extra tack coat shall not be applied except with the specific approval of the Local Entity Engineer. The time interval between application of the tack coat and placement of the asphalt mix will be regulated by the Local Entity Engineer.

- 3) **Prime Coat.** The prime coat shall be pressure sprayed at the rate of 0.2 to 0.5 gallon per square yard. Emulsions shall be diluted as in tack coat above.

Prime coat application shall be made less than 12 hours prior to placing asphalt base course. Application methods and equipment shall be approved in advance by the Local Entity Engineer.

- 4) **Temperatures.** The temperature requirements pertaining to the application of liquid asphalts and asphaltic emulsions shall conform to the requirements of **Table 25-3**.

**Table 25-3
 Spraying Temperature of Liquid Asphalts**

Grade & Type RC, MC & SC	Distribution Spraying Temperature			
	Minimum		Maximum	
Toss	F°	C°	F°	C°
70	120	49	180	82
250	165	74	220	104
800	200	93	255	124
3,000	235	113	290	143

- e. Maintenance of Primed Surface. The primed surface shall be maintained by removing all loose sand prior to placing any pavement or surfacing material thereon. Immediately before placing asphalt concrete or asphalt concrete base, additional prime coat shall be applied as directed to areas where the prime coat has been damaged. Loose or extraneous material shall be removed.

C. Minimum Repair of Cracked or Damaged Asphalt

1. Cracks. Individual and non-deflecting cracks in the asphalt shall, at the discretion of the Local Entity Engineer, be sealed with rubberized asphalt sealant approved by the Local Entity Engineer.
2. Damage. Any damage, even superficial, to the existing asphalt surface shall be repaired at the expense of the Developer, including but not limited to gouges, scrapes, outrigger marks, backhoe bucket marks, etc. A slurry seal type covering will be considered the minimum repair. Patching may be required, at the discretion of the Local Entity Engineer. Refer to **Section 25.5.6 F** for Patching.

D. Temporary Surfaces

1. Temporary Patches. When the final surface is not immediately installed, it shall be necessary to place a temporary asphalt surface on any street cut opening immediately after backfilling. The temporary surface installation and daily maintenance shall be the responsibility of the Developer until the permanent surface is completed and accepted. The temporary surface shall be either a hot mix or cold mix paving material. Temporary surfaces shall be compacted, rolled smooth, and sealed to prevent degradation of the repair and existing structures during the temporary period.
2. Backfilling or Covering with Steel Plates. When required by the Local Entity Engineer, trenches within Arterials or Collectors shall be backfilled or covered with steel plates (4 feet x 8 feet, 1-inch thick minimum) at the conclusion of the work done in order to open the roadway to traffic. Asphalt material shall be placed at the edges of the plate to provide a ramp at a minimum 1:12 slope.
3. Permanent Patching. Permanent patching shall occur within 2 weeks unless approved in advance by the Local Entity Engineer. The temporary patch shall be removed prior to placement of the permanent patch. Refer to **Section 25.5.6 F** for patching.

E. Asphalt Joint Filling

After placing the new asphalt, all seams (joints) between the new and existing pavements shall be sealed with an asphalt tack coat or rubberized asphalt sealant.

F. Patching

1. Conventional Patch.
 - a. Removal of Bituminous Asphalt Pavement. Refer to **Section 25.5.6 A**.

- b. Tack Coat. For patches in asphalt, a tack coat shall be applied to all edges of the existing asphalt and to the subgrade before placing the new pavement. Refer to **Section 25.5.6 B** for additional information.
- c. Protection from Solvents and Oils. The Developer shall protect the asphalt (both existing and new) from solvents and oils. Any piece of equipment leaking any fluid shall be removed from the work site immediately and shall not return to the work site until all leaks are repaired. If any piece of equipment leaks any fluid a second time, it shall be removed from the work site immediately and shall not be allowed on the work site again for the remainder of the project. The Developer shall not use diesel or other solvents to remove or prevent the sticking of asphalt to the wheels of rubber-tired rollers or other equipment used on the asphalt. Remove and replace any asphalt damaged by solvents or oils.
- d. Base Material. Aggregate base course required for any areas that have been opened up during inclement weather (rain/snow) shall be replaced at the expense of the Developer. The Developer shall protect all excavated areas from water infiltration of any type and will be responsible for any dewatering or subgrade stabilization.
- e. Placement of New Asphalt. ~~All patching shall be performed with Grading S or SG. Where the asphalt pavement is greater than 4 inches thick, the lower lifts shall be grading SG.~~ The materials must conform to requirements of **Chapter 22, Materials and Construction Specifications**. A mix design may be required. In all cases, the pavement wearing course must match the grading of the surrounding pavement. The ~~asphalt~~AsphaltHBP must be placed with a self-propelled paver if patching widths are greater than 8 feet. For patch widths greater than 4 feet and up to 8 feet, the mixture must be placed with either a self-propelled paver or a box spreader. These machines may be used to patch areas wider than 8 feet with the use of a screed extension that will extend beyond the width of the proposed patch. Patches paved with a self-propelled paver shall conform with the requirements specified in **CDOT Specifications Section 401.1**. Rollers shall move at a uniform speed with the drive roll or wheels nearest the paver. Steel-wheeled rollers shall operate at a maximum speed of 3 mph. The use of plate type compactors will not be permitted except in areas not accessible to the roller. Areas wider than the machine screed may be patched with a box spreader only if the length of the patch is less than 50 feet. Areas as wide as the street or longer than 50 feet shall be patched with an asphalt lay down machine.

Where irregularities, unavoidable obstacles, or patch widths of less than 4 feet make the use of mechanical spreading and finishing equipment impractical, the mixture shall be spread, raked, and luted by hand tools. For such areas, the mixture shall be dumped, spread, and screeded to give the required compacted thickness. New ~~HBP~~asphalt shall be added in compacted layers, until the patch thickness meets the requirements of **Section 25.5.2 J**.

2. Cold In-Place Recycling.

Patching may be achieved by cold in-place recycling. This is also used for reconstruction of larger areas of pavement as well.

3. Infrared Patch.

- a. General. Infrared patching may be allowed only where approved by the Local Entity Engineer.
- b. Preparation of Existing Surface. Refer to **Section 25.5.6 H.1.f.**
- c. Protection from Solvents and Oil. Refer to **Section 25.5.6 F.1.c.**
- d. Infrared Heating Unit. The infrared heating unit must be equipped with adjustable height controls and heating chambers capable of heating the existing **bituminous asphalt** pavement to a workable temperature without oxidizing or burning the oils. There shall be no flame in direct contact with the existing pavement surface. The infrared heating unit must be capable of heating an area that extends a minimum of 12 inches beyond the edge of the patch area.
- e. Infrared Procedure. All asphalt removed for infrared patching shall be removed to a width of 4 to 8 inches, as measured perpendicular from the face of the newly placed concrete. Heat shall be continuously applied to the patch area until the existing pavement material can be manually raked and shaped to a depth of 2 inches below the existing surface and replaced with new material. A minimum depth of 1-1/2 inches of new pavement shall be provided at the joint line.

Prior to placement of new material, the patch area will be raked, compacted, and tacked. Mechanized compaction equipment shall be used to compact bottom lifts of the patch, then a self-propelled, vibratory roller shall be used to provide complete compaction of the patch area. The tack agent shall be applied at the rate of 0.20 gallons per square yard. Excess material shall be disposed of by the Developer or used in the bottom layer of the patch.

- f. Placement of New Asphalt. Refer to **Section 25.5.6 F.1.e.**
4. Adjoining Concrete Repairs. All asphalt removed for conventional patching shall be removed to a width of 24 inches minimum, as measured perpendicular from the face of the newly placed concrete. ~~All patching shall be performed with grading C(S) HBP.~~ Patching shall generally consist of placing the lower layers of **HBP asphalt** necessary to accomplish the roadway widening. In addition, the Local Entity Engineer may authorize patching of areas prepared by in-place recycling.
5. Wheel Path. The asphalt patch area for street excavations that fall within the wheel path of the vehicular travel lane shall be increased in size to the center of the lane or adjacent lane.

G. Overlays.

The determination of need for a complete milling and overlay shall be made by the Local Entity Engineer. In streets where more than one cut is made within a 75-foot long roadway segment, an overlay of the entire street width, including the patched area may be required. All overlay work shall be coordinated with adjacent landowners such that future projects do not cut the new asphalt overlay work.

1. Protection from Solvents and Oils. Refer to **Section 25.5.6 F.1.c**.

2. Preparation of Existing Surface.

3. Tack Coat. Refer to **Section 25.5.6 B**.

~~4.~~ Materials. All materials must comply with **Chapter 22, Materials and Construction Specifications**. The Local Entity Engineer may require a mix design. ~~Materials shall comply with table 22-4. All overlays may use Grading S or SX.~~

~~5.~~ Placement of New Asphalt.

a. General. The Developer shall construct the work for asphalt overlay such that all roadway pavement placed prior to the time paving operations end for the year shall be completed to the full thickness required by the plans.

b. Procedure. There shall be no feathered edges on any type of street. When edge of existing pavement adjoins gutter, overlays should be placed by first removing the edge of existing pavement to the desired depth by grinding and then replacing the pavement with an asphalt lay down machine. Grinding shall be to a depth such that the top of overlay is no more than 1/4 inch from the top of the gutter lip.

~~6.~~ Cooling to Prevent Rutting. Overlaying layers of ~~HBP~~ asphalt shall not be placed until the lower layer has cooled sufficiently to provide a stable material that will support the equipment without rutting, shoving, or moving in any manner. ~~The temperature of the first asphalt layer shall be less than 150°F before applying the second asphalt layer.~~ All paving on each street shall ~~be~~ shall be completed in one continuous operation, weather permitting, unless otherwise approved in writing by the Local Entity Local Entity Engineer.

~~7.~~ Tandem Paving. Refer to Chapter 22, Materials and Construction Specifications.

~~8.~~ Temporary Pavement Layer. The Developer shall schedule the work so that no planed or recycled surface is left without resurfacing for more than 10 calendar days between October 1 and March 1.

a. Application of Material. The Developer shall immediately place a temporary hot ~~bituminous~~ asphalt pavement layer on any surface that has been planed or recycled and can not be resurfaced in accordance with the above temperature requirements within 10 calendar days after being planed or recycled. The

minimum thickness of the temporary hot **bituminousasphalt** pavement layer shall be 2 inches.

- b. Quality Control. The Developer shall perform the quality control required to assure adequate quality of the hot **bituminousasphalt** pavement used in the temporary layer. All applicable pavement markings shall be applied to the temporary layer surface.
- c. Developer Responsibility. The Developer shall maintain the temporary layer for the entire period that it is open to traffic. Distress that affects the ride, safety, or serviceability of the temporary layer shall be immediately corrected to the satisfaction of the Local Entity Engineer. The temporary hot **bituminousasphalt** pavement layer shall be removed when work resumes.

H. Reconstruction

1. Hot In-Place Recycling.

- a. General. Hot in-place recycling is a mixture of RAP, rejuvenating agent, and virgin hot mix. The mixture is produced at the paving site by use of special in-place heating and mixing equipment.
- b. Projects Not Suited for Hot In-Place Recycling. Projects with the following characteristics are not recommended for hot in-place recycling:
 - 1) Unstable subgrades
 - 2) Asphalt stripping from aggregates
 - 3) Wide transverse thermal cracks
- c. Projects Appropriate for Hot In-Place Recycling. Two types of applications have been identified for hot in-place recycling: maintenance and Local Entity Engineering. Maintenance applications are those that are used to maintain the existing roadway in a usable condition. Local Entity Engineering applications are those where hot in-place recycling is part of the structural rehabilitation or reconstruction of the pavement. Table 25-4 shows the types of possible distresses and the applications to treat the pavement.
- d. Mix Design. The design shall be performed by **CPL-5140**. For Local Entity Engineering applications, 55 to 110 pounds per square yard of additional **HBPasphalt** should be used, and for maintenance applications, a minimum of 55 pounds per square yard of additional **HBP-asphalt** is recommended.

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**Table 25-4
Distresses Treated by Hot In-Place Recycling**

Type of Distress	Maintenance Application	Local Entity Engineering Application
Narrow Cracks in a Thin Pavement	Yes	Yes

Narrow Cracks in a Thick Pavement	Yes	Yes
Leveling	Yes	Yes
Rutting	Yes	—
Corrugation or Ride Improvement	Yes	—

- e. Structural Design. The structural layer coefficient will be a minimum of 0.35 and a maximum of 0.44. For Local Entity Engineering applications, design structural requirements will be met, and a minimum 2 inch overlay will be used in conjunction with the hot in-place recycling. For maintenance applications, a chip seal coat may be used as a wearing surface, if needed.
- f. Construction Considerations. The depth to be recycled will be a minimum of 1-3/4 inches for all applications. There should not be any hot in-place recycling done closer than 1 inch above the bottom of the existing mat. Hot in-place recycling is a good choice for treatment of the old pavement prior to an overlay and should be considered a better alternative than a leveling course. Hot in-place recycling can be performed either full width or in the driving lanes only. It should be noted that when 110 pounds per square yard of additional **asphaltHBP** is added to the recycled mix, the driving lane will be approximately 1 inch higher than the shoulder, and lane/shoulder drop off needs to be taken into consideration. Traffic control for a long paving train must be taken into consideration.

For Local Entity Engineering applications, the variability of the amount of virgin mix and rejuvenating agent will be determined by data from Developer supplied testing.

I. Inclusion of Adjacent Cracks or Damage

Where existing cracks or damage are adjacent to the area being repaired, the repair area shall include the cracked or damaged asphalt.

J. Manhole Frames and Valve Box Adjustments

Manhole frames and covers and valve boxes shall be adjusted using the following criteria: Excavate the pavement around the object to clear the object by at least 2 feet from the outside edge of the device and 8-inches deep. This area shall be filled with asphalt lifts and compacted ~~per as outlined in Chapter 22, to at least 95 percent density as determined by ASTM D 2041-78, D 2726-83, and D 2950-82.~~ The same process of notification, inspection and acceptance as outlined above shall apply to this method and shall occur prior to the application of the final lift around these appurtenances.

25.6 OTHER RECONSTRUCTION AND REPAIR

25.6.1 Trenches in Gravel Streets or Alleys

A. Gravel Specifications.

When trenches are excavated in streets or alleys that have only a gravel surface, the Developer shall replace such surfacing on a satisfactory compacted backfill with RAPgravel conforming to CDOT Class 5 or Class 6 aggregate base course or as approved by the Local Entity Local Entity Engineer.

B. Thickness and Grade.

The thickness of gravel replacement shall be 1 inch greater than the thickness of the original gravel surface, but not less than 4 inches. The surface shall conform to the original street grade.

C. Settling.

Where the completed surface settles, additional gravel base shall be placed and compacted by the Developer immediately after being notified by the Local Entity Engineer, to restore the roadbed surface to finished grade.

D. Special Surface Treatment.

Some streets may have been previously treated with a special surface treatment to control dust and/or bind the aggregates together. In these cases, the Developer is responsible for installing the gravel surface in the same manner. Such surface treatments shall be of the same chemical composition as what existed prior to the excavation work. The Local Entity Engineer shall note on the permit the surface treatment that will be required.

25.7 DEVELOPING A “QUALITY” APPROACH

25.7.1 General

Every street and street repair situation is unique. Design criteria and construction standards cannot address every situation but, in order to maintain some form of consistency, these standards have been developed. In most cases, they provide the minimum acceptable standards for construction or repair. Consequently, when strictly applied, they will provide the minimum acceptable product. Therefore, this criteria has been developed to maintain the same integrity of the street pavement and subsurface condition as existed prior to its being cut for utility installations or repairs.

To achieve the goal of “Quality” or “Excellence” in street repairs, these criteria shall be viewed as guidelines when used in conjunction with good planning and judgement. This will restore the street to an acceptable condition with minimal patching failures. In many cases, it will be necessary to **exceed** the minimum standards to achieve a quality repair.

Issues that shall be considered in a quality approach to street repairs are as follows (these criteria must all be balanced against the long-term maintenance needs of the utility):

25.7.2 Appearance

Does the final appearance of the street suggest the repairs were planned, or that they happened by accident?

A. Public Perception

Consciously or not, the driving public “rates” the appearance of the street system—including street repairs—every day. Street repairs which are satisfactory from a functional point of view may produce a negative reaction from the public if they give the appearance of being poorly planned or executed.

B. Appearance Guidelines

The public’s perception of the street repairs is based primarily on shape, size, and orientation—the geometry of a patch. Refer to **Figure 25-1, Patching (Appearance)** for graphic illustrations of the following patching guidelines. for the geometry of a quality patch:

1. Existing pavements should be removed to clean, straight lines **parallel** and **perpendicular** to the flow of traffic. Do not construct patches with angled sides and irregular shapes. (See **Figure 25-1**, item A)
2. Avoid patches within existing patches. If this cannot be avoided, make the boundaries of the patches coincide. (See **Figure 25-1**, item B)
3. Do not leave strips of pavement less than one-half lane in width from the edge of the new patch to the edge of an existing patch or the lip of the gutter. (See **Figure 25-1**, item C)
4. Asphalt and concrete pavements should be removed by saw cutting or grinding. Avoid breaking away the edges of the existing pavement or damaging the remaining pavement with heavy construction equipment. (See **Figure 25-1**, item D)
5. In concrete pavements, sidewalks and other public use areas where the surface is in good repair, **remove sections to existing joints**. In damaged concrete, the limits of removal should be determined in the field by a representative of the Local Entity Engineer. (See **Figure 25-1**, item D)
6. In the case of a **series of patches** or patches for service lines off a main trench, repair the pavement over the patches by **overlay** shall be required when the spacing between the patches is less than 75 feet (in cases where the existing pavement is in poor condition and may require overlay within the next few years, this requirement may be modified or waived by the Local Entity Engineer). (See **Figure 25-1**, item E)

25.7.3 Rideability

Completed street repairs shall have rideability at least as good as, or better than, the pavement prior to the repairs being made. Street repairs may be visible but, should not be “felt” when driving over them.

A. Guidelines for Rideability

Refer to **Figure 25-2, Patching (Rideability)** for graphic illustrations of the following patching guidelines:

1. Do not construct asphalt overlays in such a manner that create a bump to the motoring public. If the leading edge of an overlay is substantially noticeable to a car it is likely to be significant to the snow plow trucks. The Local Entity Engineer shall determine whether or not the rideability of the overlay is acceptable. If the transition is not smooth the Developer shall remove and replace the pavement to provide a smooth leading edge to the satisfaction of the Local Entity Engineer. (See **Figure 25-2**, item A)
2. Surface tolerances for street repairs should meet the standard for new construction. That is, the finished surface of the street repair, when tested with a ten (10) foot straightedge parallel to the centerline or perpendicular across joints, will show variations measured from the testing face of the straightedge to the surface of the street repair which do not exceed one-quarter (1/4) inch. (See **Figure 25-2**, item B)

25.7.4 Pavement Management

Street repairs should leave a pavement in a condition at least as good as, if not better than, the condition prior to the repairs.

A. Pavement Management Guidelines

Refer to **Figure 25-3, Patching (Pavement Management)** for graphic illustrations of the following patching guidelines:

1. In most cases, and particularly in the cases of extensive excavation and repairs, it is desirable to survey the existing pavement condition with a representative of the Local Entity Engineer prior to the work. After completion of the work, survey the pavement condition again to verify that the pavement condition has been maintained or improved.
2. In the case of minor repairs, these pavement surveys can be made by visual observation. However, in the case of major projects that involve excessive haul of materials or unusually heavy construction equipment or activity, non-destructive testing of the pavement condition before and after construction is required.
3. Consideration of pavement management issues may also identify opportunities for joint efforts between the utilities and the Local Entity Engineer.

For example, suppose the repair of a utility line requires an overlay on half of a street, and that the condition of the remaining half of the street might also warrant an overlay. We may decide at that point to overlay the entire street, with Local Entity Engineer’s street authority and the utility splitting the cost of the overlay.

In such a case, the utility may be able to save the cost of grinding half the street. The Local Entity Engineer’s street authority will allocate a reasonable percentage of their annual overlay program to accommodate their share of these situations. This includes minor (2-3 block) maintenance projects and larger capital improvement projects (water main line extensions). Coordination for these types of cooperative repairs shall occur as far in advance of actual construction as possible.

4. Transverse patches shall be replaced across the entire street width for a distance of one (1) foot minimum on both side of the trench, thus creating a ‘T’ shaped patch above the trench. (See **Figure 25-3**, item A)
5. Do not allow the edges of patches to fall in existing wheel paths. The edges of patches parallel to the direction of traffic shall be limited to the boundaries of lanes or to the centerline of travel lanes. (See **Figure 25-3**, item B)
6. Patches should have a **smooth longitudinal grade** consistent with the existing roadway and crown. Patches should also have a cross slope or cross section consistent with the design of the existing roadway. (See **Figure 25-3**, item C)

25.7.5 Future Maintenance

Excavations and street repairs, even well constructed street repairs, shorten a pavement’s life. Several types of street distress, settlement, alligator cracking, and potholes, often show up around patches. Quality street repairs should **attempt to include adjacent minor damage** and reduce the chances of associated growth out to these types of distress.

A. Future Maintenance Guidelines

Refer to **Figure 25-4, Patching (Future Maintenance)** for graphic illustrations of the following patching guidelines:

1. Avoid weakening or destroying the existing pavement around an excavation with heavy construction equipment, stockpiling or delivery of materials, etc. When damage does occur, remove the damaged pavement, extending the limits of the street repair, before replacing the pavement. Remember, no stockpiling of backfill or road building materials is permitted on the pavement. (See **Figure 25-4**, item A)
2. When the proposed excavation falls within three feet of a section of failed pavement, the failed area shall be removed to sound pavement and patched. Scarring, gouging, or other damaged pavement adjacent to a patch shall be removed and the pavement repaired. (See **Figure 25-4**, item A)

3. With older pavement where the likelihood of cracking and potholes next to the patch is greater, it shall be necessary to extend the “shoulders” of the pavement beyond the one-foot minimum. When the adjacent deterioration is less than 3’ away, reinforce this area with a geotextile fabric. (See **Figure 25-4**, item B)
4. “T” cutting shall be required for all asphalt repairs in all streets.
5. For patches in asphalt, a tack coat shall be applied to all edges of the existing asphalt before placing with the pavement.
6. After placing the new asphalt, all seams (joints) between the new and existing pavements shall be sealed with an asphalt tack coat or rubberized crack seal material.
7. Avoid frequent changes in width of patches. For future maintenance, this simplifies removal of adjacent pavement failures. (See **Figure 25-4**, item C)

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