SECTION 2200 – PAVING

CITY OF BELTON, MISSOURI

SUPPLEMENTAL SPECIFICATIONS

The City of Belton hereby adopts Section 2200 of the Kansas City Metropolitan Chapter of APWA Construction and Material Specifications, current edition. The following additions, deletions and/or revisions are adopted as a part of Section 2200 for use within Belton.

Add Section 2201.6 as follows:
2201.6 Subgrade Stabilization – Cement Treated Base

Section 1.0 General Requirements
In Cement Treated Base (CTB) construction, the objective is to thoroughly mix a soil/aggregate material with the correct quantity of portland cement and enough water to permit maximum compaction. The resulting CTB must be adequately cured to provide the necessary moisture needed for cement hydration to fully harden the CTB mixture.

The fundamental control factors for quality CTB are:

1. Proper cement content
2. Adequate moisture content
3. Thorough mixing
4. Adequate compaction
5. Proper curing

The construction steps are:

- Preparation
    - Checking and calibration of equipment
    - Correcting any soft subgrade areas
    - Shaping the area to proper crown and grade
- Mixed-in-Place Processing
    - Spreading portland cement and mix
    - Applying water and mix
    - Compacting
    - Finishing
    - Curing

The area to be paved must be shaped to proper crown and grade. Proper compaction is one of the fundamental requirements for CTB construction. If the subgrade is soft and cannot support the

compaction equipment, adequate density will not be obtained. Therefore, soft areas should be located and made stable before CTB material is mixed or placed.

Section 2.0 Mixed-in-Place Method

Guide stakes should be set to control the width of treatment and to guide the operators during construction.

Soil/aggregate in required quantity should be distributed on an accurately graded, well-compacted subgrade in an even layer or in a uniform windrow, depending upon the type of mixing equipment to be used.

For maximum efficiency, the day's work should be broken down into several adjacent sections rather than one or two long sections.

Bulk cement is normally hauled to the jobsite in bulk transport trucks. Cement is then transferred to job cement storage trucks, which are usually enclosed or fitted with canvas covers. Cement is transferred into the cement storage trucks pneumatically by a screw or belt conveyor. Prior to cement spreading, truckloads of cement are weighed on portable platform scales or at a nearby scale.

A mechanical cement spreader is attached to the dump truck. To obtain a uniform cement spread, the spreader should be operated at a constant slow speed with a constant level of cement in the hopper. The mechanical cement spreader can also be attached directly behind a bulk cement truck. Cement is moved pneumatically from the truck through an air separator cyclone that dissipates the air pressure. Cement falls into the hopper of the spreader. Skirts are sometimes used to minimize windblown dust. Placing dry portland cement in an uncontrolled manner by blowing under pressure should always be avoided. Typical spread rates are shown in Table 2.

Cement is most commonly applied dry but can also be applied in a slurry form. With a slurry application, it is important that the slurry be dispersed uniformly over the placement area so that it will not pool or run off in any manner.

Materials that contain excessive amounts of moisture will not mix readily with cement. However, granular materials can be mixed effectively with moisture contents slightly above optimum.

Procedures for applying water and mixing will depend on the type of mixing machine used. A thorough mixture of soil/aggregate, cement, and water must be obtained. Uniformity of the mix is easily checked by digging trenches or series of holes at regular intervals for the full depth of treatment and inspecting the color of the exposed mixture. Uniform color and texture from top to bottom indicate a satisfactory mix; a streaked appearance indicates insufficient mixing.

Table 2. Cement Spread Requirements

Percent cement by weight		Percent cement by volume	Cement spread requirements in pounds per square yard (kg/m^2) for compacted thicknesses				
115 pcf (1842 kg/m^3)	125 pcf (2002 kg/m^3)		5 in. (125 mm)	6 in. (150 mm)	7 in. (175 mm)	8 in. (200 mm)	9 in. (225 mm)
2.5	2.3	3.0	10.6 (5.7)	12.7 (6.8)	14.8 (7.9)	17.0 (9.1)	19.1 (10.2)
2.9	2.7	3.5	12.4 (6.6)	14.8 (7.9)	17.3 (9.3)	19.8 (10.5)	22.3 (11.9)
3.4	3.1	4.0	14.1 (7.5)	16.9 (9.1)	19.8 (10.5)	22.6 (12.1)	25.5 (13.6)
3.8	3.5	4.5	15.9 (8.5)	19.1 (10.2)	22.2 (11.8)	25.4 (13.6)	28.7 (15.4)
4.2	3.9	5.0	17.6 (9.4)	21.2 (11.3)	24.8 (13.3)	28.2 (15.1)	31.8 (17.0)
4.7	4.3	5.5	19.4 (10.3)	23.3 (12.4)	27.2 (14.6)	31.0 (16.5)	35.0 (18.7)
5.2	4.7	6.0	21.2 (11.3)	25.4 (13.6)	29.6 (15.8)	33.9 (18.1)	38.1 (20.4)
5.6	5.1	6.5	21.9 (11.7)	27.5 (14.7)	32.1 (17.1)	36.6 (19.6)	41.2 (21.9)
6.0	5.6	7.0	24.7 (13.2)	29.6 (15.8)	34.6 (18.5)	39.5 (21.1)	44.4 (23.7)
6.5	6.0	7.5	26.5 (14.2)	31.7 (16.9)	37.0 (19.8)	42.3 (22.5)	47.6 (25.4)
7.0	6.4	8.0	28.2 (15.1)	33.8 (18.0)	39.5 (21.1)	45.1 (24.1)	50.8 (27.2)
7.4	6.9	8.5	30.0 (16.0)	36.0 (19.2)	42.1 (22.4)	48.0 (25.6)	54.2 (28.9)
7.9	7.2	9.0	31.8 (17.0)	38.1 (20.4)	44.6 (23.7)	50.8 (27.2)	57.6 (30.7)
8.4	7.7	9.5	33.5 (17.9)	40.2 (21.5)	47.1 (25.1)	53.6 (28.6)	59.8 (31.9)
8.9	8.2	10.0	35.2 (18.8)	42.3 (22.5)	49.5 (26.5)	56.4 (30.1)	62.0 (33.4)

Section 3.0 Single-Shaft Traveling Mixing Equipment

CTB construction with single-shaft traveling mixers varies depending on the type equipment used. Some equipment can thoroughly mix the CTB in a single pass. Other equipment requires more than one mixing pass. However, the basic principles and objectives are the same.

Shaping the roadway and scarification are the first steps of preparation. The larger mixers can scarify as well as mix an existing pavement surface and tough soil/aggregate material. For smaller equipment, the soil/aggregate may need to be loosened with a scarifier. Pre-wetting the soil/aggregate is common practice. Applying water at this stage of construction save the time during actual processing operations because most of the required water will already have been added to the soil/aggregate when cement is spread. Pre-wetting prevents cement from sifting to the bottom of the mix by causing it to adhere more readily to the soil/aggregate particles. Moisture should be applied uniformly during pre-wetting. Evaporation losses are reduced by incorporating this moisture into the mix. After scarifying and pre-wetting, the loose soil/aggregate is shaped to crown and grade.

Cement is spread by a mechanical cement spreader; then the mixer picks up the soil/aggregate and cement and mixes them in place. Water, supplied by a tank truck, is usually applied to the mixture by the spray bar mounted in the mixing chamber or water may be applied ahead of the mixer by water pressure distributors. The soil/aggregate and cement must be sufficiently blended when water contacts the

mixture to prevent the formation of cement balls. The number of mixing passes depends on the type of mixer, the soil/aggregate characteristics and its moisture content, and on the forward speed of the mixer.

Section 4.0 Compaction, Finish, and Cure

Compaction starts immediately after the CTB material has been mixed or spread. While vibratory steel-wheel rollers are most common, many types of compaction equipment may be used to obtain adequate densification.

Adequate compaction at the edge of the pavement is extremely important. With plant-mixed and spread CTB, one method that permits proper edge compaction is to blade shoulder material up against the spread CTB to confine it. The shoulder material then provides the support for edge compaction.

If mixing or spreading has been carefully done, the compacted CTB should be smooth and at grade, and minimum finishing should be required, if needed, the surface is shaped, moistened, and re-rolled to tighten the surface. The finished surface should be dense and free of cracks, ridges, and loose material.

When CTB is placed as a subbase layer under a concrete pavement, most contractors use electronically controlled equipment operating from an accurately placed reference wire or string line for grade control. Initially, the CTB is placed slightly high and after compaction is trimmed to grade and finish rolled.

Compacted and finished CTB contains sufficient moisture for adequate cement hydration. The newly constructed base should be kept moist (by lightly watering or misting) for a 7-day period or a moisture-retaining cover or curing compound can be placed over the CTB soon after completion to retain the moisture and permit the cement to hydrate. If the road will have an asphalt surface a bituminous prime coat can be applied at any time as this will act as a curing membrane. The finished CTB surface is kept moist until the curing compound is applied. At the time of application, the CTB surface should be free of all dry, loose, and extraneous material.

Construction joints are formed by cutting back into the completed work to form a true vertical face. Special attention should be given to joint construction to ensure a vertical joint, adequately mixed material, and compaction up against the joint.

Section 5.0 Surfacing

A concrete or bituminous surface should be placed on the completed CTB as soon as practical. Although it is not unusual for several weeks to elapse between completion of the CTB and placement of the wearing course, it can be placed immediately provided the CTB is stable (does not rut or shove) under construction traffic. The time required for this can range from 4 to 48 hours. The type and thickness of surfacing depend on traffic volume, availability of materials, cost, and local practices. Local experience and practice will dictate the specific details of construction. Good construction practices such as thorough cleaning of the base course should always be followed when the surfacing is placed.

Traffic can be placed on the CTB in the same timeframe as along as repeated applications of heavy trucks are not involved. In many cases with low-volume roads, traffic is allowed to run on the compacted base until the project is ready for surfacing. For conditions where heavy truck traffic is involved, up to 7 days may be required to make sure the base has gained sufficient strength for a high volume of heavy trucks.

Section 6.0 Reflective Cracking

CTB will shrink naturally while curing. With properly designed pavements and good construction procedures, the resulting cracks in the base will not significantly affect pavement performance. In some cases, larger cracks in the base layer can result in stress concentrations, and the cracks may reflect from the base into the surface. This does not normally affect pavement roughness but may influence the overall appearance of the pavement.

Usually proper construction procedures, crack minimization strategies and maintenance sealing, if necessary, can eliminate requirements for significant maintenance due to reflective cracking Newer techniques such as microcracking or using a stress absorbing interlayer have been very successful. A well-designed and properly maintained CTB will normally outlast several asphalt overlays providing decades of low maintenance service.

2204 PRIME AND TACK COAT

2204.2 - Liquid Asphalt Material

Section 2204.2 is revised to state that trackless asphalt emulsion shall be used when available. If Trackless tack or prime coat is not available, grade SS-1h or SS-1hP shall be the material designated for application of tack coats on existing asphalt surfaces and between new courses of paving. However, tack coat materials may be adjusted to suit weather conditions or other variables which may be encountered at the time of construction.

2205 ASPHALTIC CONCRETE SURFACE AND BASE

Asphalt concrete materials and construction shall conform to standard specification APWA Section 2205 except as herein amended:

2205.4 Mixing and Proportioning

A. All asphalt pavement shall be type 1 base and type 3 surface. The bas may include recycled asphalt material as described in KC Metro APWA Standards, while the surface shall be virgin material.

Add Section 2205.11 Base Repair with Hot Mix Asphaltic Concrete Base Course

A. Description: This item shall consist of scarifying, loading and disposing of existing asphaltic surface and base materials and the furnishing and placing of hot mix asphaltic concrete base (black base), on the approved subgrade.

B. Materials: The asphaltic concrete mixture for the asphalt base may consist of 15 to 27 percent reclaimed Type 1 asphalt and meet the requirements of subsection 2205.3 Mixing and Proportioning.

C. Construction Methods: The existing asphaltic surface and flexible base material shall be removed for its full depth and to the width and at the locations directed by the Engineer. The surface and base material shall be removed in such a manner as not to disturb the underlying subgrade.

The Contractor shall not excavate more area than he/she is capable of paving within the same working day. At the end of each working day all open street excavations must be either backfilled and compacted to within one inch below existing finish grade, or covered with steel plating in order to allow use by public traffic.

Unless directed by the Engineer, the Contractor shall not consider pitted (small surface failures) areas as base repair. These areas shall be cleaned out and leveled up with the level-up course. This work is considered subsidiary to this item and shall not be paid for separately.

Base repair shall consist of saw-cutting or other approved cutting method, scarifying and disposing of asphalt base material to a depth equal to the existing asphaltic materials depth, but not less than eight inches (8"). The areas of repair shall be cut in square or rectangular shape with faces free of loose material. One pair of faces shall be at right angles to the alignment of the proposed roadway. Repair areas shall extend at least twelve-inches horizontally, into the existing base and/or subgrade.

The black base shall be placed and compacted in lifts not to exceed four (4) inches.

D. Measurement: See section 2205.9

E. Payment: Base repair with hot mix asphaltic concrete base material, furnished and placed, and measured as provided above, shall be paid for at the contract unit bid prices for "**Base Repair Recycled Asphalt Base, APWA, Type 1-01"**. This price shall be full compensation for tack coat, saw-cutting or other approved cutting method, scarifying, removing, disposing of pavement materials, preparation of subgrade, furnishing all materials, placing asphaltic concrete mixture, compaction and finishing and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

2207 COLD MILLING

Cold milling materials, equipment, and construction shall conform to Standard Specification section 2207 except as herein amended:

2207.2 Equipment

Delete paragraph C and replace with the following**:**

Edge milling cutting width shall be a minimum of six (6) feet.

2207.3 Construction details

Add the following to paragraph A.3 in this section:

The Contractor will keep the millings provided they are properly hauled and disposed. All milling piles left on or beside the street will be cleaned up DAILY by the Contractor.

2207.5 Basis of payment

Add the following sentence to the section:

Payment for accepted work shall be paid at the contract total bid prices for Edge Milling or Full Milling.

2208 PORTLAND CEMENT CONCRETE PAVEMENT

2208.2 Materials: **Delete** sections A and B and **replace** with the following:

A. Concrete: Concrete shall conform to the specifications of the Kansas City Metro Materials Board (KCMMB) 4k mix. Mix designs shall be approved KCMMB mixes and shall be submitted to and approved by the City Engineer before placement.

END OF SECTION