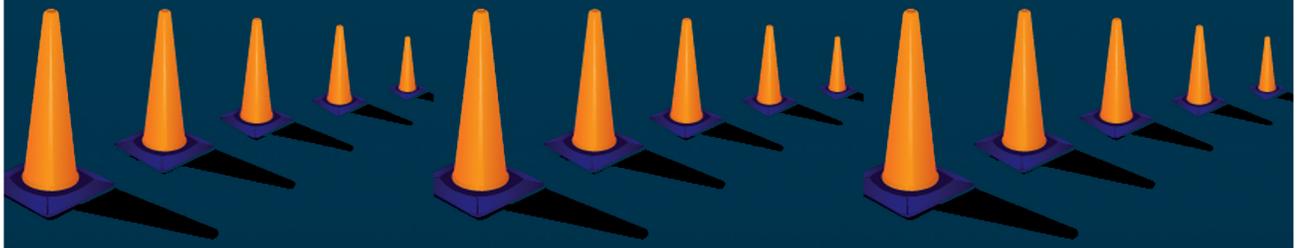




2016 Highway Maintenance Manual





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KANSAS DEPARTMENT OF TRANSPORTATION

BUREAU OF MAINTENANCE HIGHWAY MAINTENANCE MANUAL

INTRODUCTION

The care and upkeep of Kansas highways is assigned to the Director of Operations of the Kansas Department of Transportation, in order to protect the highway investment and continue maximum transportation benefits to the traveling public.

This Highway Maintenance Manual has been prepared to help meet such a challenge by providing information and guidance to those concerned and responsible for highway maintenance. Also, it will be helpful in training new employees by outlining the procedures for performing the actual maintenance operations.

This Manual is a guide to help standardize methods and procedures of performing various maintenance activities, and for the preparation of records and reports. Written memoranda, design standards, illustrations and Department of Transportation forms have been incorporated to provide a convenient reference for maintenance operations.

It should be remembered that the contents herein serve as a manual of reference and instructions for use in the administration and operation of highway maintenance activities. Should situations arise which are not specifically covered or if adherence to instructions is not feasible due to the many and varied field conditions encountered, then experience and sound judgment must be relied on.

This Manual is designed as a loose-leaf notebook to be used both in the field and in the office. Revisions or additions when adopted are to be inserted into the appropriate sections to keep the Manual current and up to date.

Each employee needs to realize the necessity of both efficient, quality job performance and good relations with the public.

In this Manual the words “shall,” “should” and “may” are used to describe specific conditions. To clarify the meanings intended by the use of these words, the following definitions apply:

1. **SHALL** - A mandatory condition. Where certain requirements are described with the “shall” stipulation, it is mandatory that these requirements be met.
2. **SHOULD OR MAY** - A permissive condition

Record of Revisions to KDOT Maintenance Manual

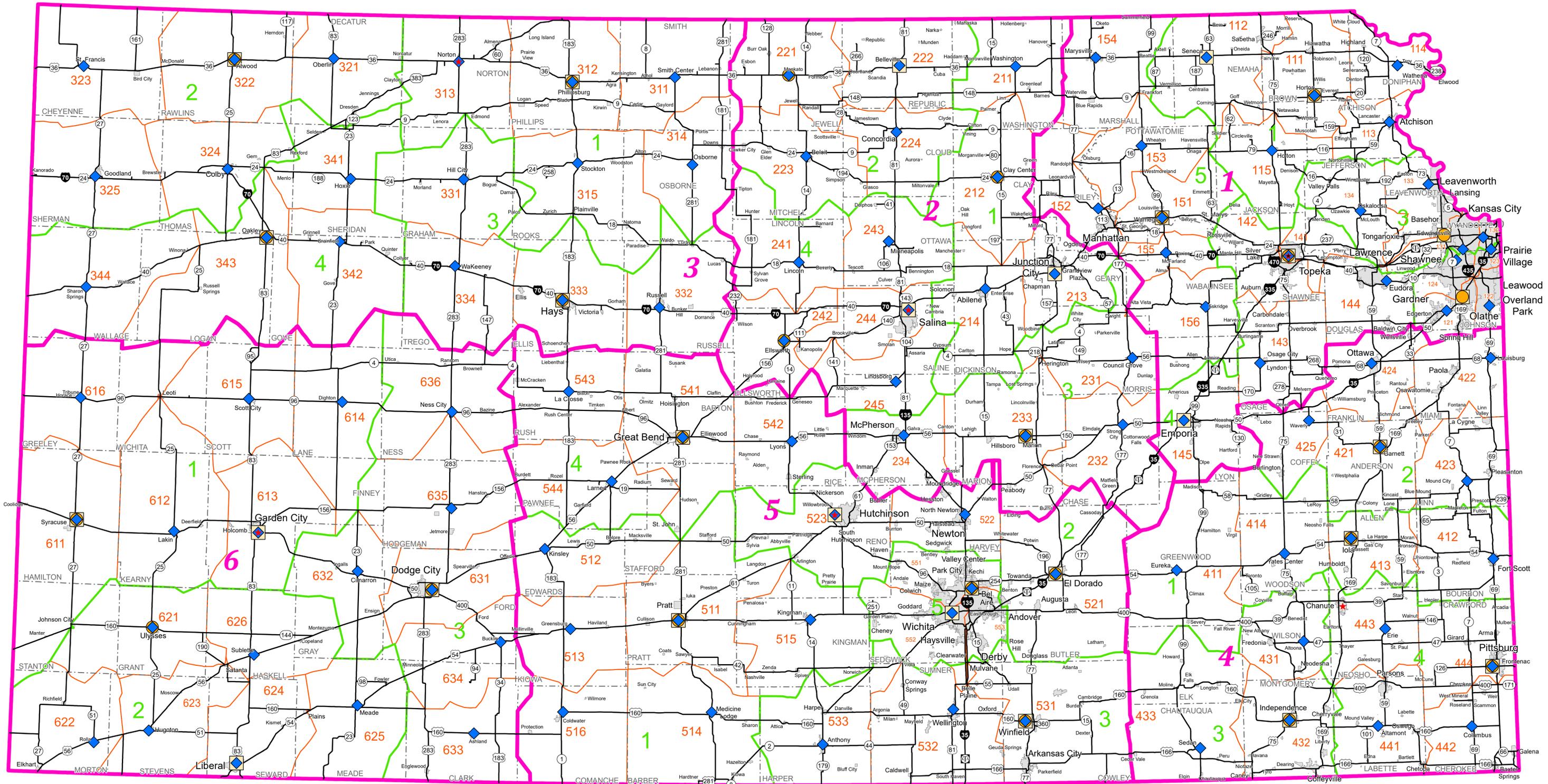
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KDOT Maintenance Districts, Areas, and Subareas



- * Headquarters
- ★ District Office
- Area Office
- ◆ Subarea Office
- Construction Office
- ▭ District Boundary
- ▭ Area Boundary
- ▭ Subarea Boundary

PREPARED BY THE
KANSAS DEPARTMENT OF TRANSPORTATION
BUREAU OF TRANSPORTATION PLANNING

Map Created Tuesday, May 07, 2019

KDOT makes no warranties, guarantees, or representations for accuracy of this information and assumes no liability for errors or omissions.

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ORGANIZATION AND OPERATION

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CHAPTER ONE

ORGANIZATION AND OPERATION

- Section 1.10 - ORGANIZATION AND RESPONSIBILITIES

1.11 – BUREAU OF MAINTENANCE

The Bureau of Maintenance is located in Topeka. This office is generally referred to as “Headquarters”.

Administration of the maintenance function is under the direction of the Chief of the Bureau of Maintenance who reports to the Director of Field Operations.

The Bureau of Maintenance is responsible for establishing and implementing statewide policies and procedures for highway maintenance.

The Bureau of Maintenance coordinates the activities of the various agency bureaus in matters pertaining to maintenance of state highway and associated property.

1.12 – DISTRICTS

The State is divided into six districts as depicted on the Maintenance Facilities Map included in the Maintenance Manual Introduction.

The District Engineer is responsible for budgetary control and KDOT Operations of the District and reports to the Director of Field Operations.

The District Maintenance Engineer assists and makes recommendations to the District Engineer in matters pertaining to maintenance.

The District directs the planning of maintenance operations within the District based on procedures established by the Bureau of Maintenance and approved by the Director of Operations.

The general administration of the various employee training and progression programs is the responsibility of the District.

The District is responsible for initiating contract maintenance projects.

DOT Form No. 402, Project Request, is normally used to initiate contract maintenance projects.

An “**R**” **Project** may be created to *capture costs* for preliminary engineering before the 402 document is prepared and submitted.

The District is responsible for the specialized highway maintenance performed by the District Bridge, Paint, and Heavy Equipment crews, if the crew exist.

1.13 – AREAS

Each District is sub-divided into three to five Areas.

The **Area Engineer** is responsible for construction and maintenance operations within the area.

The **Area Superintendent** assists and makes recommendations to the Area Engineer in matters pertaining to maintenance.

The Area is responsible for directing the maintenance of state highways and associated facilities located within the Area.

The Area implements the overall maintenance plan of the District by coordinating the work of each Subarea and planning the advance purchases and delivery of materials and supplies.

The Area delegates the responsibility for On-the-Job Training for Equipment Operators to the subareas.

The **Area Weekly Report** is the responsibility of the Area Maintenance Superintendent. This information is entered through Crew Card where a Form 303 report can be produced as needed.

- A. This report should accurately and completely document work performed each day.
- B. This report is to show the daily activities and locations of work crews and equipment. It also shows highway openings and closures, unusual highway and structure conditions.

1.14 – SUBAREAS

Subareas are the smallest geographical unit of highway maintenance.

Each Area is sub-divided into three to six Subareas.

Each Subarea maintains an equivalent of about 150 to 300 lane miles.

The Subarea is responsible for the physical maintenance of state highway roadsides, roadways, structures and associated facilities located within the Subarea.

A ***Highway Maintenance Supervisor*** is responsible for each Subarea, including the On-the-Job Training for Equipment Operators.

An ***EO Specialist*** is designated and trained to act in the absence of the Subarea Maintenance Supervisor.

1.15 – PUBLIC RELATIONS

Using reasonable efforts to establish and maintain good public relations is the responsibility of KDOT employees:

- A. Keep personal appearance neat and equipment, property and facilities as clean as practical.
- B. Obey applicable traffic laws when practical. When operating a vehicle that is moving slower than the prevailing traffic or speed limit, be mindful of traffic backing up behind the vehicle and take opportunities to let traffic pass.

The public should be given only information that you know to be true and accurate.

For information regarding contact with the media review SOM 1.3.1

- Section 1.20 -
HIGHWAY MAINTENANCE

1.21 – DEFINITION

Highway Maintenance is the Preservation, Upkeep, and Restoration of Highway Elements.

Highway Elements Include: Roadways, Roadsides, Structures, Buildings and Associated Facilities of KDOT.

The specific maintenance of each element is contained in an individual chapter of this Manual.

1.22 – PURPOSE

Highway maintenance provides for the operation of a reasonably safe and efficient highway transportation system.

Highway maintenance is intended to give the maximum protection to the original investment with a minimum of cost.

1.23 – CITY CONNECTING LINKS

Streets carrying highway markers, which are within the city limits, are known as City Connecting Links.

Cities have statutory responsibility to maintain the connecting links. The Secretary of Transportation reimburses cities for such maintenance, based on the lane mile rate established by statutes. The Secretary may assume maintenance responsibilities in lieu of reimbursement to a city. Such action requires a ***City Connecting Link Maintenance Agreement, DOT Form No. 329*** (conventional highways) and/or ***DOT Form No. 330*** (access controlled), with the individual city.

Generally when a city maintains the connecting link, KDOT's only responsibility is to provide, install and maintain route marker signs. Field personnel directing maintenance operations should be familiar with the requirements of individual City Connecting Link Maintenance Agreements within their jurisdiction so that maintenance required to be performed by KDOT under the agreement is provided. The agreements can be found through the Bureau of Maintenance website.

City Connecting Link Maintenance Agreements can be found in the Forms Warehouse on the KDOT intranet.

**- Section 1.30 -
FISCAL CONTROL**

1.31 – BUDGET

Maintenance operations of the Agency are controlled by an annual appropriation provided by the State Legislature.

The Bureau Chief of Maintenance and District Engineers are responsible for preparing an annual budget for their work units. Estimated expenditures are classified by account codes as follows:

- A. **5100s, Salary and Wages:** Classification of employment, number of employees provided in each classification, and the estimated salary of each classification.
- B. **5200s, Contractual Services:** The Expenditure for services performed by contract.
- C. **5300s, Commodities:** The expenditure for materials, parts and supplies, and PPE.
- D. **5400s, Capital Outlay:** The expenditure for equipment, shop tools, furniture and fixtures.

The budget is an estimate of the financial expenditures for one fiscal year (July 1 to June 30).

1.32 – PURCHASING

Purchases can be made locally against established contracts, from Kansas Correctional Industries or from State Use Facilities with no dollar limitation. Items NOT generally stocked, yet needed for immediate use, may be purchased locally using a KDOT Procurement card or requesting a purchase requisition through **SMART**. When applicable for those KDOT offices not active in **SMART**, a hardcopy of purchase requisition **DOT Form No. 455-A**, found in the KDOT Forms Warehouse, is used and submitted through the district or bureau's normal approval process. Purchases from other sources are limited by the delegated authority amount of \$5,000 in a fiscal year. Purchases not on contract or in excess of delegated authority should be initiated using a **SMART Requisition** or **DOT Form No. 455-A**.

Open End Contracts specify Kansas Standard Specifications and:

- A. Contracts are awarded following formal competitive bids.
- B. Contracts are let for specified time periods to furnish such items as aggregate, asphalt, tires, salt, petroleum products, batteries, and other items.
- C. Contract items may be obtained directly from the contract holder by following instructions in the KDOT “Procurement and Inventory Control Manual”.

Districts with NAPA-IBS managing stockrooms: NAPA-IBS provides consumable goods for agency use under their open-ended contract. Excluded items include: Services, Fuel, Highway Paint/Glass Beads, Highway Signs, and Highway Materials (i.e. Asphalt, Aggregate, Salt and Sand). Request of items from NAPA-IBS require the completion of a **DOT Form No. 496**. If the item(s) is not in NAPA-IBS stock, their personnel will coordinate acquisition of item(s) with the requesting KDOT person. There is no dollar limitation spend from NAPA-IBS.

1.33 – ACCOUNTING

All labor hours, equipment hours, materials, repair parts and accomplishments shall be coded to specific units of equipment, buildings or bridges using project and activity numbers. Specific guidance can be found in the Maintenance Activity Guidelines manual.

- Section 1.40 - WORK WEEK

1.41 – WORK WEEK

The *Calendar Work Week* begins at 12:01 AM Sunday and ends at 12:00 Midnight Saturday.

A *Work Week* consists of 40 hours. The schedule of these hours may vary as needed for necessary maintenance operations. (See SOM 2.3.1.)

1.42 – OVERTIME WORK AND OTHER COMPENSATION

Supervisors may authorize overtime for the following activities:

Emergency work such as snow and ice control, extraordinary work necessitated by natural disasters such as floods or fires, emergency surface or structural repair, emergency traffic control and other work deemed emergency work by the proper authority.

Eligible employees will be compensated for work in excess of 40 hours a week.

For more information on overtime and other compensation, see SOM 2.2.3 – “Overtime and Other Compensation” along with the Division of Field Operations and the Bureau of Maintenance websites.

1.43 – OFFICE AND SHOP HOURS

The District Engineer may revise the normal shop or office hours to accommodate particular circumstances. (See SOM 2.3.1.)

DISTRICT OFFICE – 8:00 AM – 4:30 PM

AREA OFFICE – 8:00 AM - 4:30 PM

DISTRICT AND AREA OFFICES should be open for public business during lunch breaks as deemed necessary by the District Engineer. Staggered lunch breaks may be used as needed.

**- Section 1.50 -
TRAINING**

Training of maintenance personnel consists primarily of an “On-the-Job” training program. This includes passing a standard knowledge test and performance test. For more details, see **SOM 2.1.11 Trainee, Progression, and Training Programs**.

1.51 – EQUIPMENT OPERATORS

Each new hire to the Equipment Operator classification, EO Trainee or EO/CA is required to successfully complete an on-the-job training program which includes passing a standard knowledge test and performance skills checklist and is documented on **DOT Form No. 0032 EO Trainee/EO CA Agreement**.

*** KDOT shall be excused from promoting, even if all relevant requirements are met, in the event that promotion is prevented or delayed, retarded or hindered by causes beyond the reasonable control of KDOT including, an epidemic, pandemic, quarantine, governmental action or inaction, and orders of government. Approval of promotion shall be dependent upon available funding.*

1.52 – EQUIPMENT OPERATOR SENIOR

Participation in this program is strictly voluntary. Equipment operators have the opportunity to choose whether they are interested in participating, however, they may change their mind at anytime by submitting a **DOT Form No. 067 EO Senior Participation Form**. Participants in the Equipment Operator Senior program will be required to fulfill the mandatory requirements and all the requirements in one of the optional categories. The Highway Maintenance Option is for subarea and area equipment operators while the other options are for district crews. Information on the EO Senior program can be found on the Bureau of Maintenance website

<http://kdotweb.ksdot.org/Bureaus/BurMaint/manuals.asp>

Refer to SOM 2.2.2 for information on salary increases** for completing the midpoint and complete program requirements.

*** KDOT shall be excused from promoting, even if all relevant requirements are met, in the event that promotion is prevented or delayed, retarded or hindered by causes beyond the reasonable control of KDOT including, an epidemic, pandemic, quarantine, governmental action or inaction, and orders of government. Approval of promotion shall be dependent upon available funding.*

1.53 – EQUIPMENT MECHANIC PROGRESSION

This program is currently suspended and will be revamped in the future.

1.54 – EQUIPMENT MECHANIC SENIOR PROGRESSION

Participation in this program is strictly voluntary. Equipment Mechanics have the opportunity to choose whether they are interested in participating, however, they may change their mind at anytime by submitting a **DOT Form No. 0093, EM Senior Program Participation Form**. Information on the EM Senior program can be found on the Bureau of Maintenance website

<http://kdotweb.ksdot.org/Bureaus/BurMaint/manuals.asp>

Refer to SOM 2.2.2 for information on salary increases** for completing the midpoint and complete program requirements.

*** KDOT shall be excused from promoting, even if all relevant requirements are met, in the event that promotion is prevented or delayed, retarded or hindered by causes beyond the reasonable control of KDOT including, an epidemic, pandemic, quarantine, governmental action or inaction, and orders of government. Approval of promotion shall be dependent upon available funding.*

- Section 1.60 - PERSONNEL

1.61 – POLICIES

The Area Office Manager or the District Human Resources Professional can provide information concerning personnel policies and should be referred to for details concerning employment, benefits, pay, promotions, retirement, and items concerning employment with KDOT.

Personnel policies are compiled in the “Kansas Department of Transportation *Standard Operating Manual*” (SOM) *Volume 2, Personnel Management*, and are available for reference.

The Kansas Organization of State Employees (KOSE) *Memoranda of Agreement* provides information on personnel related matters for KOSE covered employees and any supplements therefor.

- Section 1.70 -
REPORTING INFORMATION

1.71 – SURVEILLANCE – HIGHWAY CONDITIONS

Routes within each Subarea should be inspected each week, generally at driving speeds, by the Highway Maintenance Supervisor or a designated employee. Primary emphasis is to be on roadway features such as travelway and shoulder surface, signs, guardrail, and delineators.

- A. A **Weekly Surveillance Report** is to be completed to document the conditions observed. Use **DOT Form No. 302** for this weekly report and submit to the Area Office as per instructions on the form.
- B. Document both normal and abnormal conditions.
- C. Make entry for route(s) that cannot be reviewed during the week, with appropriate explanations.
- D. Note corrective action needed and record any corrective action taken.

Record information received regarding a highway condition requiring maintenance. Also, record any corrective action taken. **DOT Form No. 319, Highway Condition/Maintenance Request Log**, is available for recording such information.

1.72 – VEHICLE ACCIDENTS

The following actions shall be performed by operators of KDOT vehicles or equipment involved in a collision or other accident/incident. This also applies to State-leased and rented vehicles and equipment as well as private vehicles used for official State business. **SOM 1.10.1** contains complete details regarding accidents.

- A. **Stop at the scene of the accident and exchange names**, addresses, and registration (license plate) numbers of the vehicles involved, if practical.
- B. Notify the KDOT immediate supervisor **as soon as practical**.
- C. Notify law enforcement when motor vehicle or motorized equipment accidents involve second parties. (Highway Patrol preferred).
- D. Notify law enforcement when damages estimated to be in excess of \$1000.00 except for accidents occurring in a KDOT yard or facility.
- E. Contact the Risk Management section in the Office of Chief Counsel if the accident/incident involves a fatality, serious injury, and/or high-dollar damage to non-KDOT property.
- F. **Do not make any statement except to a law enforcement officer**. Do not sign any statement, except one given to law enforcement, unless directed to do so by the Office of Chief Counsel.
- G. If a rental vehicle is being operated, make notification as indicated on the rental agreement documents, and **notify the Bureau of Fiscal Services**.
- H. Complete and submit the appropriate portions of the **DOT Form No. 0026** “Accident, Damage, and Loss Reporting” workflow form located in the KDOT Forms Warehouse **within five working days** of the accident/incident.

1.73 – PROPERTY DAMAGE REPORT

DOT Form No. 1612 “Property Damage Report” is used to report repair cost for KDOT property damaged by accident or vandalism involving a second or unknown party.

- A. This form should be processed after repair work is completed.
- B. ***Do Not Use Estimated Costs unless asked to do so by the Office of Chief Counsel.*** Your data of actual repair costs is used to collect for the property damage from individuals and insurance companies.
- C. Accident, vandalism, or hit-and-run damages, regardless of amount should be reported on **DOT Form No. 1612**

DOT Form No. 1612 is also used to report:

- A. Water, fire or vehicle damage to bridges as in Section 5.22.
- B. Cost of removing illegal signs as covered in Section 14.94.

1.74 – ADVERSE ROAD CONDITIONS

Adverse Road Conditions are to be reported to the appropriate management level. **Such conditions include, snow or ice covered roads, dense smoke, dense dust, flooded roads and some traffic accidents.** KDOT Maintenance Personnel at the Districts, Areas, and Subareas share the responsibility for observing and reporting adverse road conditions.

Each *Area* should report *adverse road conditions* using *K-CARS or TG-Segment*, a KDOT Intranet-based mapping system that records road conditions. At a minimum, adverse conditions should be reported at the following times: ***4:30am, 10:30am, 2:30pm and 8:30pm. Report Conditions as those conditions change***, during regular hours. If shifts are working a 24-hour period, road condition changes should be reported during the 24-hour period. The return to seasonally normal road conditions should be reported to the appropriate management level.

1.75 – ROAD CLOSURES

Storm-related road closings are a decision of the District Engineer after consultation with the KHP Troop Commander. Authority to close a highway is delegated to the District Engineer in accordance with SOM 1.14.3 - Temporary Highway Closures.

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CHAPTER TWO

TRAVELWAY

- Section 2.00 - DEFINITIONS

2.01– ROADWAY

Roadway surfaces include the travelway and shoulders.

2.02– TRAVELWAY

That portion of the roadway for the movement of vehicles, exclusive of shoulders.

A divided highway has two separate travelways.

Travelways consist of components of the pavement structure, which includes subgrade, sub-base, base course and surface course.

City connecting link travelway maintenance, when undertaken by KDOT does not include certain items such as parking lanes, curb and gutter, parallel storm sewers, sidewalks, lighting, traffic control devices, and snow removal from parking lanes. For other KDOT maintenance exceptions see, “City Connection Link Maintenance Agreement” DOT form 329.

2.03– PAVEMENT STRUCTURE

Pavement structure is a combination of sub-base, base course, and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed.

SUBGRADE

The subgrade is the top surface of a roadbed, usually soil, upon which the pavement structure and shoulders (including curbs) are constructed.

SUBGRADE TREATMENT

This is the chemical or mechanical modification of roadbed for stabilization.

SUB-BASE

A sub-base is the layer of specified material, usually crushed rock, of designed thickness placed on a subgrade to support a base course.

{TRAVELWAY}

BASE COURSE

This is the layer or layers of material of designed thickness on a sub-base or subgrade, which supports the surface course.

SURFACE COURSE

The surface course is one or more layers of a pavement structure designed to accommodate the traffic load. The top layer is sometimes called “Wearing Course.”

- Section 2.10 - TRAVELWAY MAINTENANCE

Travelway maintenance includes both the preservation and repair of pavement surfaces and bases. The Area Engineer should determine the cause of major surface and base failures, and take steps to implement appropriate corrective measures.

2.11– SURFACE MAINTENANCE

Refer to:

“Section 2.20 – ASPHALT SURFACES”

AND

“Section 2.30 – CONCRETE SURFACES”

2.12– BASE MAINTENANCE

The stability of the base is essential to the satisfactory life of the wearing surface.

Base types and thicknesses vary according to various traffic and soil conditions. The base under lightly traveled pavements may consist of subgrade only. It may consist of a base course, sub-base, and subgrade under a heavy-duty pavement.

In areas of major base failures, the unstable material should be removed and replaced with select material.

Minor base failures may, under some conditions, be corrected by overlaying the affected area with asphalt material. In some cases, they should be repaired by removing the failed areas.

{TRAVELWAY}

Unsealed surfaces and/or poor subsurface drainage leads to most base failures. Draining roadway ditches will help prevent base failures in some cases.

**- Section 2.20 -
ASPHALT SURFACES**

This includes all pavements with an asphalt wearing surface, including concrete pavements with asphalt overlays.

2.21– SURFACE FAILURES

Surface Failures are usually caused by moisture in the base or subgrade due to:

- A. Inadequate surface drainage or traffic ruts near the pavement edge.
- B. Porous shoulders and inadequate ditch drainage.
- C. Edge line joints that are not filled or sealed.

They may also be traffic related.

Surface failures may be classified as follows:

TRANSVERSE CRACKS

These cracks extend across pavements approximately perpendicular to centerline. Usually, they are caused by shrinkage of the asphalt pavement or reflection of the cracks and joints in a concrete pavement, which has been overlaid.

LONGITUDINAL CRACKS

They are fairly straight cracks parallel to centerline of roadway.

FATIGUE CRACKS

These are commonly called alligator cracks; they are caused by traffic and normally occur in the wheel path areas. The first sign of fatigue cracking is usually one or more longitudinal parallel cracks in the wheel path. After repeated traffic loading the cracks connect, forming many sided, sharp-angled pieces that develop a pattern resembling the skin of an alligator (see Figure 2-1). The pieces are usually less than one foot on the longest side. Advance stages include pumping and shoving of the cracks.

{TRAVELWAY}

BLOCK (map) CRACKS

Block or map cracks are a series of interconnected transverse and longitudinal cracks that divide the pavement into rectangular pieces with sides ranging from approximately one to twelve feet. The cracks generally intersect at approximately right angles and are caused by aging and hardening of pavement rather than loading. (See Figure 2-2)

SHOVING and CORRUGATIONS

These are irregularities of the pavement surface resulting from lateral movement or shoving of pavement materials by traffic. They are usually found in areas of accelerating, and/or braking traffic. (See Figure 2-3)

RUTTING

These longitudinal depressions develop in the wheel paths of asphalt pavements. Rutting may result from consolidation or lateral movement under traffic in one or more of the underlying courses, or by displacement in the asphaltic layer itself. (See Figure 2-4)

RAVELING

Raveling is usually due to a dry mix or oxidation. However, an excessive amount of moisture will contribute to raveling by washing away the asphaltic concrete particles. Freeze-thaw cycles also contribute to raveling.

FLUSHING or BLEEDING

This can cause a slippery surface and is often caused by excess asphalt combined with dense surface texture.

2.22 – REPAIR AND MAINTENANCE

CRACKS and JOINTS

The timely sealing or filling of cracks and joints to prevent moisture infiltration into the subgrade is one of the most important activities in asphalt surface maintenance. (See “Crack Maintenance, Sealing Cracks and Filling Cracks below.”)

RAISED DISTORTIONS

Raised distortions can be leveled by blading during hot weather. Such blading in other seasons may require the use of heaters or burners to heat the pavement. Several light cuts are more effective than a fewer number of heavy cuts. Milling is also a good method for removing distortions.

SETTLED SURFACES

Depressions can be filled as follows:

{TRAVELWAY}

- A. Apply a tack coat at the rate of 0.03 to 0.10 gallons per square yard residual asphalt, depending on condition of the old surface and the type of overlay being applied.
- B. Then apply a thin leveling overlay of asphalt cold or hot mix.
- C. Blade and roll thoroughly with a pneumatic and/or flat-faced roller. The final surface should be smooth and trimmed to a neat line.
- D. To complete the repair work, apply a dilute seal. (See following Section 2.23, Sealing Asphalt Surfaces)

In some instances, small patches may be laid directly on top of an asphalt surface. In this type of patching, the surface to be patched must be clean and free of any foreign substances. A liquid asphalt tack coat should be applied to the area to be patched prior to applying the patch material. Small patches may be placed using hand methods. For larger patches, it may be more effective to use a motor grader or a tow paver. All patches should be thoroughly compacted. They should have squared ends and neat lines to provide a finished appearance.

POTHOLES

They should be repaired by shaping the area evenly with vertical sides to the depth of the patch and removing all loose material. The bottom and sides should then be tacked with a liquid asphalt.

Place an asphalt mix in the hole (maximum 4" lifts) and compact. An allowance should be made for compaction that will allow the finished surface of the patch to be flush or just slightly above the surrounding surface. As a general rule, the asphalt material will compact 1/4" for each inch in loosely placed thickness.

Under some weather conditions, temporary patching not utilizing the suggested procedures may be required.

SWEEPING

The Surface maintenance operations include sweeping, with special emphasis on keeping the gutters, intersections, and bridge decks clear of foreign matter.

ANTI-SKID SURFACE TREATMENT

The application of anti-skid surface treatment may be warranted when experience indicates additional surface treatment is necessary.



FIGURE 2-1 FATIGUE (ALLIGATOR) CRACKS

Interconnected cracks forming a series of small polygons that resemble an alligators hide.



FIGURE 2-2 BLOCK (MAP) CRACKING

Interconnected cracks forming a series of large polygons usually with sharp corners or angles.



FIGURE 2-3 SHOVING

Displacement or bulging of paving material in direction of loading or pressure.

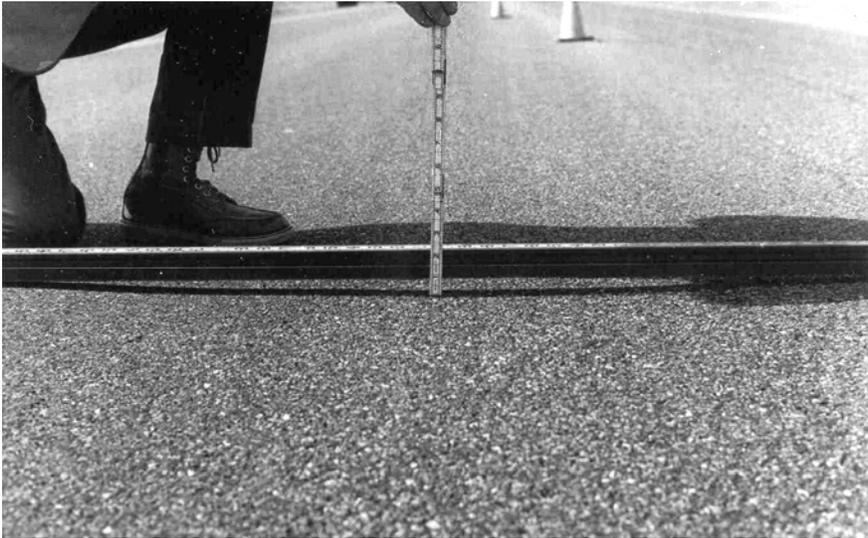


FIGURE 2-4 RUTTING

Longitudinal depression in wheel-paths of traffic, which may cause consolidation or displacement in the base course and/or surface layer.

2.23 – SEALING ASPHALT SURFACES

Most conventional and machine sealing operations are by contract and usually involve KDOT forces only in the preparation and signing functions.

Preparation involving crack sealing/ filling and surface repair should be done far enough in advance of the seal to allow the repair material to properly cure. Repair eight months to one year prior to the seal would be a good target time.

Seal areas shall be marked with - **DO NOT PASS** and **PASS WITH CARE** signs at the beginning and ending of “No Passing Zones”, and remain in place until the center line is restored.

DILUTE SEAL

The application of a mixture of emulsified asphalt and water to the roadway surface using a distributor. This seal is used to reduce water infiltration, raveling, break-up, and to fill hairline cracking.

This treatment is not appropriate for low friction pavement surfaces. If experience suggests that the area to be sealed has low skid resistance, consult with the Bureau of Materials and Research to determine if skid testing is necessary.

The normal proportion for a dilute seal mixture is one part emulsified asphalt (contains two parts asphalt and one part water as received from supplier) and two parts water.

The dilute seal is to be applied at a rate to produce 0.02 - 0.03 gallons per square yard of residual asphalt. The application rate and/or mixture may vary according to the condition of the travelway surface being sealed.

When an asphalt emulsion is applied, it is brown in color because it contains both asphalt binder and water. After a short period of time, usually in 30 to 45 minutes, the emulsion will break - change color from brown to black - and the water will begin to evaporate. The rate of evaporation will depend on the type and grade of the emulsion used, the application rate, the temperature of the existing pavement surface, and environmental conditions. After the emulsified asphalt has broken, the entire sealed area shall be blotted with ice control aggregate to improve skid resistance. When sealing shoulders, only areas of excess asphalt need to be blotted.

{TRAVELWAY}

SLURRY SEAL

A slurry seal is the application of a mortar-like mixture of emulsified asphalt, aggregate, cement and water to the travelway surface. This seal is used to reduce water infiltration and to provide an improved wearing surface with good skid resistance.

Since most slurry seals are by contract the KDOT equipment is used primarily for patches, crack filling, filling wheel ruts, etc.

Slurry mixes will be designed by District Materials personnel. This design should be followed as accurately as practical. Separate designs should be requested for slurry patches, crack filling and filling wheel ruts as mixes may vary for different conditions.

Calibration of the slurry equipment should be made in accordance with the manufacturer's specification or as directed by the district. Calibration should be checked during periods of extended equipment operation.

SPOT (CONVENTIONAL) SEAL

Sometimes called chip seal, this is the application of a liquid asphalt to the road surface followed by 3/8" to 1/2" cover aggregate. KDOT forces should apply spot seals as necessary to extend the life of short distressed areas.

Traffic shall be maintained at a reduced speed until the asphalt has set and the excess aggregate has been swept off the surface.

2.24 – ASPHALT HANDLING AND STORAGE

ORDERING and DELIVERY

When ordering asphalt materials, comply with Special Provisions in the Asphaltic Materials Contract.

Asphalt materials should be ordered 24 hours prior to delivery time.

Delivery shall be made during normal KDOT working hours. Delivery during other hours must be approved by the District.

The Supplier should notify District if delivery is to be late.

Asphalt orders may be cancelled using the following procedures:

- A. The District should notify the Supplier of the cancellation no later than 12 hours prior to the delivery time.
- B. The Supplier should notify the District no later than 12 hours prior to the delivery time in the event the Supplier cancels.

A representative of KDOT must be at the point of unloading to:

- A. Verify that the transport tank was completely empty.
- B. Sign the bill of lading when unloading is complete. Retain a copy for payment and also for the District to check material certification.

HANDLING and STORAGE

Asphalt Emulsions should generally not be stored over 90 days and they must not be allowed to freeze.

Exercise care when handling emulsion asphalt to prevent separation or contamination from addition of water or other types of asphalt. Separation can result from fast heating or from overheating. Heat and circulate cautiously. Do not heat emulsions above 180° F.

{TRAVELWAY}

Cutback Asphalt should be heated according to the following table.

| TYPE | GRADE | MIN. | MAX. |
|------------------|--------------|-------------|-------------|
| | | (Degrees F) | |
| MC | 30 | 88 | 125 |
| MC&RC | 70&250 | 125 | 200 |
| MC&RC | 800&3000 | 150 | 250 |

Use an *Antifoam Silicone* to reduce foaming and possibility of overflow.

These antifoam silicones are highly concentrated and must be diluted as follows:

- A. Use 1 pint or 1 pound of silicone to mix with 5 gallons of diesel fuel.
- B. Add 1 pint of the silicone and diesel fuel mixture to 600 gallons of asphalt.

The following checks or precautions should be observed *when a distributor is used* for applying the asphalt:

- A. Check to see if the truck tachometer, pump tachometer or pressure gauges are working.
- B. Check to see if pump pressure is satisfactory and if the by-pass system is working properly.
- C. Determine if the thermometer is accurate.
- D. Check nozzles for size and type. Are all nozzles set at the proper angle? Is the spray bar at the height recommended by the manufacturer and does the bar shut off without excessive dripping?
- E. The distributor must be thoroughly cleaned by flushing with kerosene or diesel fuel when changing from emulsion to AC or MC.
- F. Before heating, have fire extinguisher ready for immediate use. Park the distributor so the front of the distributor is slightly elevated above the rear.
- G. Be certain the flues are covered with asphalt before lighting the burners.
- H. The manhole cover on the distributor tank must be closed prior to lighting the burners and shall remain closed during all heating operations.

{TRAVELWAY}

- I. When Practical, position the distributor so that the wind moves across the distributor from the side.
- J. Heat slowly and do not overheat.

2.25 – MIXING ASPHALT & AGGREGATE

PUGMILL MIXING

A portable pugmill is used to produce an asphalt mix.

The recommended procedures are:

- A. Stockpile aggregate. (Peak-up to minimize moisture from entering)
- B. Request a recommended asphalt content from the District. (An Aggregate sample or the aggregate acceptance tests may be used.)
- C. Prepare site, set up pugmill, and calibrate.
- D. Order asphalt as needed.
- E. Start pugmill operation using recommended asphalt content.
- F. Send sample of final mix to District Materials Laboratory to verify the actual asphalt content.
- G. Dry the mixed material and complete final mixing. This procedure is similar to blade mixing.
- H. Stockpile the mixed material in large windrows if the mix will not be used soon.

BLADE MIXING

This is usually done on permanent “mixing strips”. **The Recommended Procedures are:**

- A. Request a recommended asphalt content from the District (an Aggregate sample or the aggregate acceptance tests may be used).
- B. Place aggregate in a uniform windrow and aerate until uniform recommended moisture content is obtained.
- C. Apply the recommended amount of asphalt.

{TRAVELWAY}

- D. Blend material and aerate by blading and/or using a ROTOVATOR or springtooth.
- E. Blade completed asphalt mix into windrow stockpile.
- F. Send sample of final mix to District Materials Laboratory to verify the actual asphalt content.

PLANT MIXING

This utilizes a hot mix plant to produce a uniform asphalt mix.

When a plant is to be relocated, the new location must be reported to the Bureau of Construction and Maintenance ten days prior to beginning of mixing operations. This is necessary to allow the Department of Health and Environment time to schedule testing for air quality.

Recommended Production Procedures for Hot Mix are:

- A. Stockpile aggregate. (Peak-up to minimize moisture entry.)
- B. Request a recommended asphalt content from the District (an Aggregate sample or the aggregate acceptance tests may be used).
- C. Prepare site and set up plant.
- D. Order asphalt.
- E. Pre-dry aggregate, if necessary.
- F. Start plant operation using recommended asphalt content.
- G. Notify the District if asphalt content seems inappropriate.
- H. Send sample of asphalt mix from the end of the first days run to District Materials Laboratory for possible revisions in asphalt content.
- I. Stockpile mixed material if required. (Peak-up to minimize moisture from entering stockpile)

2.26– CRACK MAINTENANCE

The Area Engineer is responsible for coordinating a program of crack sealing and filling.

It is very important that cracks be sealed before moisture has damaged the pavement, base, or subgrade.

A **PROPOSED WORK SCHEDULE** should be developed by March 1 of each year. Projects that cannot be scheduled for in-house sealing or filling should be listed and submitted to the District for possible contract work.

The **UNSEALED CRACK DATA** report form Number 390 may be used to inventory existing crack problems and conditions.

The “NOS Condition Survey Report” from the PMS system has “Crack” listed under T₂-T₃ when the transverse cracks reach a width of 1/4” and associated depressions are very small. This is usually a good indication crack sealing is needed.

All Cracks Which Are Under 3/8 Inch Wide with little or no associated depression are to be considered as **First Priority** for sealing. The idea behind this is to seal the cracks early, when they can be properly routed, the sealant can be most effective, and problems are most likely to be prevented.

Still important but of lower priority is **Filling All Other Cracks** to minimize water entry and to improve ride.

Previous crack sealing and filling ***Projects Should Be Monitored*** to determine effectiveness of the methods and materials which have been used.

The ***Cost and Effectiveness*** of maintenance crack sealing work should be compared to contract work. This information can help to improve future decisions.

2.27– SEALING CRACKS

Sealing Cracks involves the placement of *Low Modulus Sealing Materials* in or on cracks to stop water and debris from entering. Preparation may include routing, sawing and/or cleaning.

All Open Cracks which are Under 3/8 Wide, that do not have a Noticeable Depression, should be sealed by the following method.

- A. **Rout or Saw** 3/8” to 1/2” deep and 1/2” to 3/4” wide.
- B. **Clean Reservoir Area** with a heat lance or compressed air. (Air compressors must have a water filter and must furnish oil-free and water-free compressed air.)
- C. **Seal** with KDOT Specification sealant (TS 109.6). The cracks should be filled to a level slightly recessed from the pavement surface.

Follow Equipment and Sealant Manufacturer instructions closely.

Apply sealant with a wand and, when necessary, use a squeegee or applicator head to control surface material. **Sealant left on the pavement surface can cause problems on future resurfacing projects and should be avoided.**

Air and pavement temperature should be above 40° F. when applying sealant.

Do Not Allow Traffic on the new sealant until it will not track. (Ramps, intersections or other areas that must carry traffic may require that the sealant be covered with fine sand/powder or toilet paper).

If a **Heat Lance** is used, the sealant application should follow it closely to take advantage of the adhesive quality of the softened pavement. The softening is indicated by a color change. Burning, which is indicated by smoke, or other apparent degradation of asphalt must not be allowed.

The above **Rout and Seal Process** has been used successfully for many years, but it is recommended that each District promote a limited amount of **Experimentation** with new methods. The effectiveness should be compared to a control section where the rout and seal process was placed under the same conditions. This work should be properly documented.

2.28 – FILLING CRACKS

Filling cracks involves the placement of asphaltic material in or on cracks to ***Decrease Entry of Water***. Preparation may require compressed air or a heat lance if the area is dirty.

All Cracks that are Over 3/8 inch Wide that cannot be scheduled for sealing should be filled with one of the following materials:

- A. MC (medium cure asphalt)
- B. AC (use soft grades with or without fibers)
- C. Slurry Crack Pour
- D. Cold mix
- E. Hot mix

Deep Cracks can be filled to within about 1/2" from the surface with sand or other aggregate before filling with a liquid asphalt.

Small ***Areas with Heavy Cracking and Light Distortion*** can usually be stabilized by covering the area with a liquid asphalt material and covering that with sand. Skid resistance may be a problem if this is used on large areas.

Emulsion or Slurry Mixes should be used cautiously in wide or deep cracks, as they will not set up if the water cannot evaporate. (When slurry is to be used over 1" deep it should be tested prior to use).

2.29 – DEPRESSION ASSOCIATED WITH CRACKS

ALL DEPRESSIONS WHICH ADVERSELY AFFECT RIDE should be filled by one of the following methods:

COLD OR HOT MIX ASPHALT

Cold or hot mix asphalt can be used to fill depressions after the cracks have been filled. (See Sect. 2.22 “Settled Surfaces” for more information).

SLURRY LEVELING MIX

This mix *will improve the Ride* and furnish a stable surface. It can be leveled with a squeegee and does not require rolling. However, it cannot be placed in deep lifts, in rain, or in cold weather. In addition, it may cause problems if placed less than one year prior to overlays.

The District Materials Department will furnish Mix Designs with general instructions and acceptable pour depths for the mix.

Excess Water in the mix may cause flushing on the surface. A *Deficiency of Water* in the mix will produce material that is too stiff. Some conditions or mixes may require dampening the surface lightly prior to slurry placement.

The mix should not be used if the emulsion breaks before it is placed.

Slurry should not be placed deeper than will *Cure in 24 Hours*. Depths over 1 inch should be tested prior to use.

Slurry materials should be squeegeed a little high in the center to account for settlement. This height will vary depending on the mix and depth of pour.

Cracks that reappear in the slurry materials should be filled when they are large enough to take a liquid filler.

**- Section 2.30 –
CONCRETE SURFACES**

2.31 SURFACE FAILURES

Concrete pavements may fail due to:

- A. Unstable subgrades.
- B. Overweight loads.
- C. Large temperature changes.
- D. Relatively low tensile strength.

CONCRETE PAVEMENT FAILURE may be classified as follows:

“D” CRACKS

These are a series of fine crescent-shaped hairline cracks, which usually parallel a joint or major crack. “D” cracks are generally observed in pavements in the eastern half of the state or where limestone has been used for one-half or more of the total aggregate.

PATTERN CRACKING

On otherwise good pavements, these cracks will show a fine pattern, which usually can be seen only during drying after a rain. No repair procedure is practical until further deterioration develops.

JOINT DISTRESS

This is a deterioration of the pavement at contraction or construction joints *due to D-cracks*, frozen dowels, spalling or other related distresses. Initial signs of this distress are the discoloration of the pavement near the joint and/or very minor cracking adjacent to the joint. As distress progresses, hairline cracks increase adjacent to the joint and the deterioration continues until pieces of the pavement loosen and spall due to traffic action (see Figure 2-5).

TRANSVERSE CRACKS

Two or three per panel are normal where 61’ - 6 joint spacing is used (see Figure 2-6).

{TRAVELWAY}

BLOCK (MAP) CRACKING

This shows as a roughly rectangular pattern 2" to 4" apart. It develops in pavements utilizing the sand-gravel aggregate from some streams; including the Kaw, Republican, part of the Arkansas and others. It is seldom found where 30% limestone aggregate or Type II cement has been used.

FAULTING

This is a condition where two adjacent slabs have moved vertically with respect to each other. It is caused by repeated deflection of the joint under heavy loads. Faulted joints are common in older pavements where no sub-bases or joint dowels were used (20 ft. and 30 ft. joints). Mud-jacking can often improve the situation (see Figure 2-7).

BLOW—UPS

They are created by internal pressure causing localized upward movement of the slab. They generally occur on hot days following wet periods (see Figure 2-8).

SPALLING

Spalling is cracking and breaking or chipping of the pavement usually along joints, edges, or cracks. Spalls may also develop where joints were sawed too green or where solid material has entered the crack during cold weather. Partial depth patching can result in an effective repair (see Figure 2-9).

2.32 – REPAIR AND MAINTENANCE

CONCRETE PAVEMENT FAILURES & BLOW-UPS

These should be repaired the same as *Full Depth Patches*.

Use a concrete diamond or carborundum saw to square up the area for repair if an overlay is not scheduled. Repair areas should be rectangular in shape with a minimum length of 6 foot by full lane width. Cut patch full depth, being careful not to damage the subgrade. Removal of slabs in one piece is recommended if feasible.

If the pavement is to receive an overlay, a rock cutter or rock saw may be used to saw the patch.

Remove ALL Concrete within the patch area. Using compressed air, blow dust and loose concrete from the existing pavement at the patch edge; or wash with water. Wet edges of the patch and the subgrade with water, but not to the extent, the subgrade will be muddy or have freestanding water. This is to prevent absorption of moisture from the new concrete.

Where **Pavement Condition** is unsound, underpin all full depth patches in accordance with KDOT Design Std. #720.2, Conc. Pavement-Patching Details”.

Where **Pavement Condition** is sound, full depth concrete patches will be doweled or undoweled in accordance with KDOT Design Standard #721A or #721B (see Chap 15 - Standard Plans). Dowel bars will be 1 1/4” in diameter with a minimum spacing of 13.5 inches.

Use **Ready Mixed Concrete** whenever possible. Specify 8-sacks mixes for Type I & II cement and a 7-sack mix for Type III cement. **Maximum slump** at the point of delivery should be 1 3/4”.

Place Portland Cement Concrete, thoroughly vibrate, strike off, float, texturize surface and cure with a curing membrane.

The following **Cure Times** at the indicated air temperatures should be considered as minimum, however the time may vary with size of repair area. Lower temperatures will require extra precaution or time. Hot weather precautions should be observed when temperatures are 90° F. and above.

1. When curing time is a **Minimum of 24 Hours** and the air temperature is 60° F. or above, use Type I or II cement.

{TRAVELWAY}

2. When curing time needs to be *Accelerated, and Air Temperature is 60°* or above add Calcium Chloride to cement as follows: (by weight)

| <u>CURING TIME</u> | <u>CALCIUM CHLORIDE</u> |
|--------------------|-------------------------|
| 6 hour minimum | add 1% |
| 4 hour minimum | add 2% |

The use of Calcium Chloride as an accelerant can shorten the life of patching concrete. Where the patch is to remain in service for a period of 5 years or longer, consult with the Bureau of Materials and Research for alternative methods for accelerating cure times.

If pavement is not to be overlaid the perimeter of the patch is to be *Grooved and Sealed* as follows: Edges of the patch shall be sawed or formed to provide a reservoir for the sealant material. Prior to sealing, the groove will be cleaned by high pressure sand blasting and air cleaning. See Sealing Cracks and Joints on the following page for additional information.

Traffic will be routed around the concrete patch whenever possible, see the Highway Signing Manual for appropriate traffic control.

Steel Plates may be placed over the patch to carry traffic if traffic control cannot be maintained throughout the required cure time.

1. Steel plates should not be placed until the concrete patch has its initial set.
2. Steel plates will be secured to the pavement with lag bolts and expansion shields.

SEALING CRACKS AND JOINTS

The *Timely Sealing* of most cracks and joints to prevent moisture infiltration into the subgrade is a very important activity in concrete pavement maintenance.

Area engineers should monitor the “*Crack and Joint Problems*” on their PC Concrete roads.

“*Open Cracks/Joints*” that are allowing water to cause premature pavement failure must be sealed. Existing sealants should be repaired, as necessary when complete resealing is not feasible.

{TRAVELWAY}

Sealing operations should be limited to pavements and shoulders that are in good condition.

Consider the Following on Sealants and Methods of Application:

- A. The “Type of Sealant” should be determined after an evaluation of the problems, pavement condition, and in place cost.
- B. “Reservoir Type and Size” should be designed according to movement involved and type of sealant used.
- C. The tied longitudinal centerline joints normally do not allow water movement.
- D. Backer rod or adhesive backed tape should be used when feasible.
- E. Air Compressors must be equipped with traps capable of removing all measurable moisture and oil from the air. (Check them daily)
- F. When resealing joints it is generally necessary to remove all of the existing sealant and other material which is adhering to the walls of the sealant reservoir.
- G. All loose material must be removed from the pavement surface to prevent recontamination of the joint.
- H. The slurry caused by sawing must be washed away before it has a chance to harden.
- I. Immediately prior to placement of the backup material and sealant, both joint faces must be cleaned by sandblasting. The loose material must then be blown out with air.
- J. Pavement and air temperatures must be above 40° F. and the reservoir must be dry when placing sealant.
- K. Sealant and other materials must be handled and placed according to manufacturers instructions.

A ***Sawed Reservoir with Backer Rod*** is a common method of Sealing Joints in PC concrete paving. However, problems with following a crack that is not fairly straight might be sufficient reason to consider an inverted or a surface band aide when sealing Cracks.

{TRAVELWAY}

The Districts should promote some small *Experimental Projects* within each of their large projects. This may help solve future problems that occasionally occur on sealing projects. It would also increase local experience with new methods and materials.

FILLING CRACKS AND JOINTS

Crack/Joint Filling usually involves the placement of asphaltic material in or on the crack or joint to decrease entry of water.

Cracks and joints should be filled when it is not considered feasible to seal them and they are allowing an excessive amount of water to pass through to the subgrade.

Crack Filling may be done with any of the following materials:

- A. MC (Medium Cure Asphalt)
- B. AC (Use soft grades with or without rubber or fibers)
- C. Slurry Crack Pour (See Sec. 2.29)
- D. Cold Mix
- E. Hot Mix

The bottom of deep cracks can often be filled with sand to decrease sealant or filler thickness.

Slurry Mixes should not be placed over one inch thick without prior testing (water may not evaporate from the mix).

2.33 – HAND PATCHING

Periodic inspections may indicate temporary repairs are warranted due to small-localized areas of surface failure affecting the ride of the pavement.

Small areas of spalled or scaled concrete may be repaired by squaring up the area to be repaired with a concrete saw, removing all loose & deteriorated concrete, and filling the hole with appropriate material.

2.34 – RELIEF SLOTS

Relief slots are provided by cutting full depth transverse slots (approximately four inches wide) in the pavement and installing pressure relief joint filler material.

They are necessary at most bridge approaches to prevent structural damage from the concrete pavement expansion.

Locations for new relief slots will be provided by the Bureau of Design, Bridge Section on a case-by-case basis.

They should normally be cut in the Spring or Fall when pavement is not under pressure due to temperature.

It has been determined that cutting relief slots is not an economically effective method for preventing blow-ups. Therefore, they should not be used for this purpose.

Relief slots should be cut when excessive horizontal pavement pressure is suspected, and indicated by:

- A. Closed expansion devices (at 90°) on bridges that will not withstand pavement expansion forces
- B. Bridge movement that indicates a problem due to pavement expansion.
- C. Existing relief slots that are almost closed.

In all cases the transverse joints which are adjacent to existing relief slots should be inspected prior to re-cutting slots. Open joints indicate that relief slot openings should not be re-cut. These openings should be checked during warm weather.

All relief slots shall be filled with appropriate filler.



FIGURE 2-5 “D” CRACKING

A series of cracks which usually parallel a joint and curve across slab corners.



FIGURE 2-6 TRANSVERSE CRACKING

A crack that runs at approximately right angles to the pavement centerline.



FIGURE 2-7 FAULTED JOINT

Differential vertical displacement of abutting slabs at joints or cracks creating a “step” deformation in the pavement surface.



FIGURE 2-8 PAVEMENT BLOW – UP

Localized upward buckling of the slab (usually occurs at a transverse crack or joint)

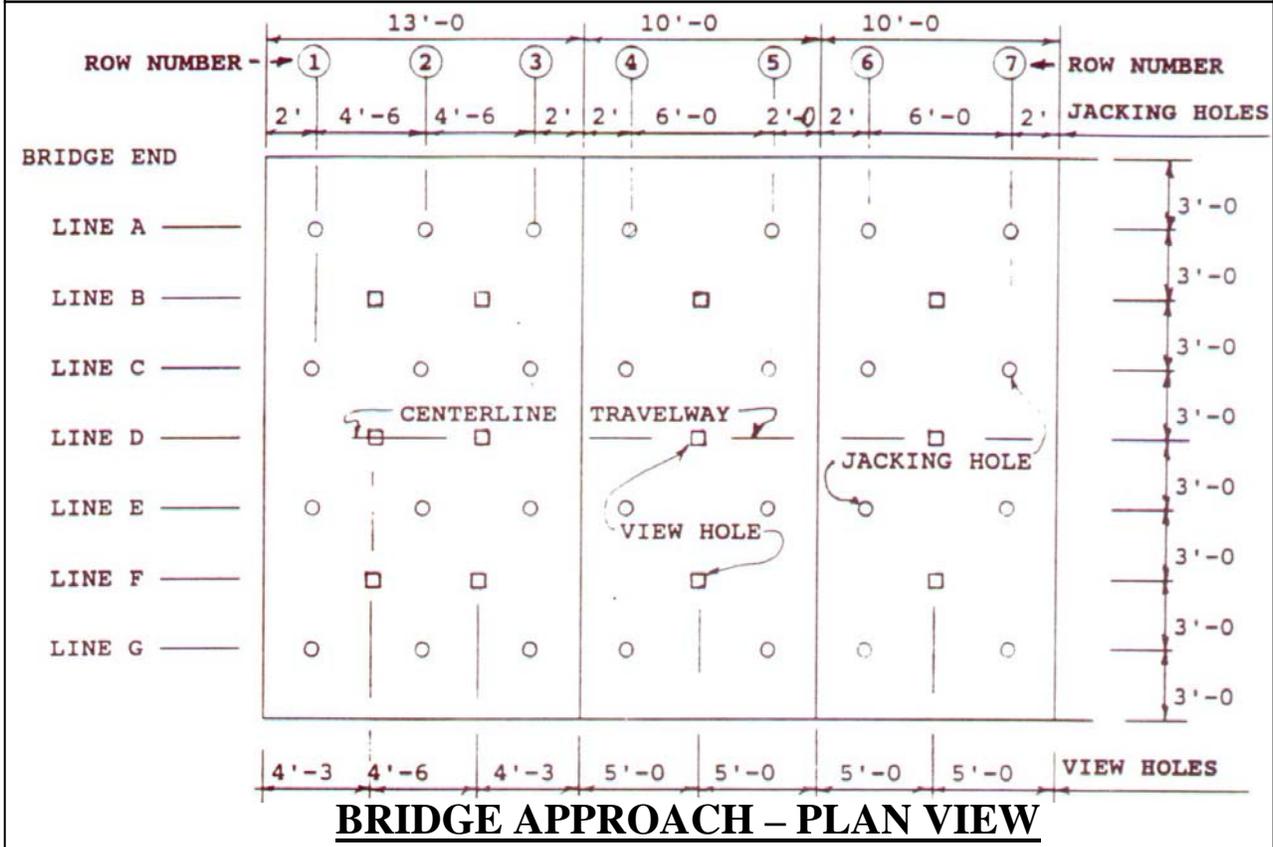
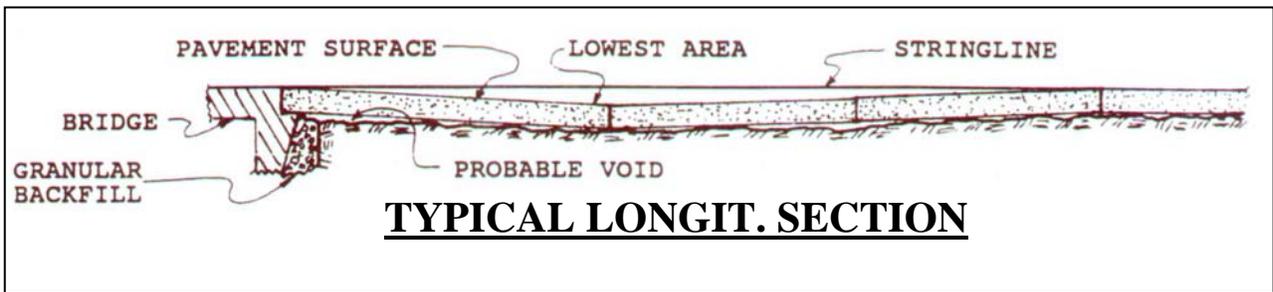
{TRAVELWAY}



FIGURE 2-9 JOINT SPALLING

Breakdown or disintegration of slab edges at joints or cracks or directly over reinforcing steel, usually resulting in the removal of sound concrete.

{TRAVELWAY}



- Step 1. - Pump a medium to stiff grout with low pressure through all Row 1 holes.
(To seal granular material and fill voids that may exist near backwall)
- Step 2. - Raise the lowest areas first. (Do not pump high holes until low areas have raised)
Pump stiff grout in low Row 3 and Row 4 holes to bring the surface above other low areas.
- Step 3. - Pump Line A, then Line C, then Line E holes. Repeat until the surface along Line A is at proposed grade.
- Step 4. - Pump lines C, E and G to proposed grade.
- Step 5. - Pump all holes in lines B, D and F to fill voids and equalize pressure.

MUDJACKING A LOW BRIDGE APPROACH

2.35 – MUDJACKING

Mudjacking is the process of raising PC concrete slabs or parts of slabs to improve ride and subgrade support.

Slabs are raised with fluid pressure, which is obtained by pumping a grout slurry through holes in the slab.

Bridge approaches and areas over culverts with differential settlement problems can usually be improved by mudjacking.

Use 50' stringlines to locate low areas and to monitor vertical movement during jacking.

Slab joints must be open to allow vertical movement. Late fall is usually a good time to jack areas that may be locked up in warm weather.

Slurry Grout mixes are very unpredictable. They must be designed by trial and should be monitored during use.

MATERIAL

Cement - Type III should be used if a high early strength is required.

Flyash - Use Type C, F or un-graded. Availability, cost and initial set time are determining factors. Initial set time will vary depending on source.

Limestone Dust - Should have a crystalline structure, which approaches a spherical shape.

Water - potable water is acceptable.

Additives - Flow-EZ, Sodium Silicate or bentonite may be used to alter the strength, shrinkage, pump-ability, or other properties of grouts.

MIX DESIGN

Time of Efflux = Time required for standard flow cone to go from full to empty. This should vary from 16 to 32 seconds without causing problems with initial set time. A more fluid mix of 9 to 15 seconds is sometimes necessary to start the slab moving when no void exists under the slab. The mix should be stiffened as necessary to control vertical movements. The resulting voids should be filled with a more fluid mix.

{TRAVELWAY}

The **Time of Initial Set** should be between 30 minutes and 1 hour. Slow initial set times cause large liquid areas under the slab, which results in less control of vertical movement. Traffic should not be allowed on raised slabs until the grout has taken its initial set.

The **Final Grout Strength** is not as important as stability in water except when used to raise and stabilize badly broken slabs.

The Mix should have 1 part cement with 0 to 3 parts flyash and/or 0 to 9 parts limestone dust; with water as necessary to obtain desired fluidity. Retarders or accelerators should be considered if desired initial set time cannot be obtained by varying amounts and/or types of the above materials.

MIXING EQUIPMENT

High Speed Colloidal Mixers create a shearing action and subsequent pressure release to make a homogeneous mixture.

Paddle Type Mixers may require more water to obtain similar flowability.

Dry material should be accurately measured by weight or volume. Water should be measured to achieve desired flowability.

DRILLING HOLES

Holes should not be larger than 2 1/2" diameter. They should be drilled round, vertical and with minimum bottom breakout.

Holes should be drilled 3" into the subgrade when no void exists under the slab. (In some cases a mirror can be used to direct light to the bottom of the hole to show conditions).

Holes should be at least 2' from pavement edges. Spacing and location will vary depending on fluidity of the grout and size of area being jacked.

View holes are drilled to monitor grout coverage. They should be used as final jacking holes to fill voids and help equalize pressures.

JACKING

A stringline should be established in each wheel line to monitor slab movement during jacking.

{TRAVELWAY}

When bottom of slab to subgrade is over 1” the void should be filled with grout prior to jacking. This will reduce liquid grout thickness and give better control over vertical movement.

Raise the slab gradually, working from lowest area to lowest area. Do not jack the high holes in a line until they become the lowest hole.

Use view holes to determine coverage and flowability. When grout does not flow to these holes, the mix may be too stiff.

Work from one edge across to the other. When low areas must be raised over 3” it may be necessary to move across and back. The slab will only bend about 1/4” in 12’ so it is not possible to raise one lane without affecting the other.

Heavy trucks can cause liquid grout slurry to move if allowed on the slab too soon. Use a faster setting grout to solve timing problems.

Use a faster setting mix and start on the downhill end on steep grades.

Use tapered wood plugs for stoppers to keep grout in holes. Seal holes with a sand-cement grout when finished.

See “Mudjacking a Low Bridge Approach” for hole layout and jacking sequence on page 2-18.

2.36 – UNDERSEALING

Undersealing a pavement involves filling voids without raising the slab. The purpose is to re-establish uniform and complete support for the concrete pavement.

VERTICAL DEFLECTION

Pavements which show vertical movement (as pumping or faulting) should be considered for undersealing. Vertical deflection can be measured by the following methods:

- A. Dynamic deflections are measured with units that simulate an 18,000 lb. load. Kansas DOT Materials and Research has a crew available with one of these units. The loading plate should be positioned 1 foot in from shoulder joint and 1 foot from transverse joint or crack. Readings should be taken both on approach and leave side. Consider undersealing areas with readings that indicate over 0.025” deflection.

{TRAVELWAY}

- B. A single axle truck loaded to 18,000 lb. on the rear axle and two mounted dial indicator gauges can be used as follows:

Position the mount with one gauge referenced to the corner of each slab on both sides of the joint near the pavement edge. The gauges are then zeroed with no load on the slab. A loaded truck is then moved into position with the center of the 18,000 lb. axle 1 foot behind the joint and the outside test wheel 1 foot from the pavement edge. Read both gauges. The 18,000 lb. axle should then be moved to 1 foot past the joint and both gauges read again. Areas with over 0.025" deflection should be considered for undersealing.

- C. Proof rolling is the procedure of slowly driving an 18,000 lb. axle load over a transverse joint while observing deflection of the slabs. When any deflection can be visually observed, the joint should probably be undersealed.

All deflection testing should be performed when the slabs are not experiencing curl or joint closure. This will normally occur between midnight and 10 AM. It may also occur on cloudy days. The temperature difference for air and pavement should be under 5° F. if curl is suspected.

Excessive Vertical Slab Movement at joints can usually be detected by observing conditions at the shoulder to pavement joint. Open areas near joints indicate excessive movement.

The P.C. Concrete Pavement Survey Reports have dynaflect readings listed as "vertical deflections" which should be reviewed. Vertical movements over 0.025" should be considered for undersealing.

MATERIALS

Cement - use Type I or III

Flyash - use Type C, F or ungraded

Water - potable water is acceptable

MIX DESIGN

Flow cone **time of efflux** should be between 9 and 15 seconds.

The **time of initial set** should be between 30 min. and 1 hour.

{TRAVELWAY}

The mix should have 1 part cement and 3 parts flyash with amount of water necessary to obtain desired flowability. These mixes are unpredictable and must be tested prior to use. The flyash source and type will vary initial set times. All mixes should be monitored during use.

Additional **water** should not be added after initial mixing.

EQUIPMENT

Colloidal mixers are considered preferable to paddle mixers.

All material should be measured to achieve dependability and quality.

A gauge must be used to monitor grout pressure.

DRILLING HOLES

Holes should be drilled round vertical and with minimum bottom breakout. (Maximum diameter = 2")

They may be drilled 3" into the subgrade and washed to create a small cavity when necessary to allow initial spread of grout.

Some experimentation is necessary to determine an effective hole pattern. Three to five holes will usually be required for each 12' of joint or crack. The void under the outside wheel line on the leave side of the joint will probably be the largest.

Keep holes a minimum of 2' from shoulder edges and 18" from joint edges.

SUBSEALING

Mounted dial indicators must be used. No part of the slab should raise more than 0.125"

Each hole should be pumped to a maximum pressure of 60 psi or until grout is flowing from an adjacent hole or until movement is detected.

The grout must be given time to flow when working with thin voids (they are often only 1/8" in height). High early pressures will drive water off which causes the grout to thicken so it will not flow into thin voids.

Grout will effectively displace some water from the void area if it can be worked toward an opening. Water should normally be moved towards the outside and downhill.

{TRAVELWAY}

Use Caution while undersealing areas, which may have underdrains, edgedrains or large unexplained voids

Vertical deflection should be re-measured after undersealing. Readings over 0.025" indicate a need to underseal a second time.

Holes should be capped with a sand/cement mix after undersealing is completed.

**- Section 2.40 –
CRACK & JOINT SEALING EQUIPMENT**

2.41 – CRACK & JOINT SEALING MACHINE

Solid Asphalt Sealer material should be handled as follows:

- A. Material is to be lowered into machine through top filler door. Temporarily disengage the agitator while door is open.
- B. Extreme care must be exercised in loading the machine so hot sealant does not splash. Machines should be modified as necessary to prevent direct loading of the material.
- C. Solid material is to be added at intervals and in sizes, which will not slow rotation of agitator.
- D. Material may be added while machine is heating; hot sealant level is to be maintained above the agitator.
- E. Heat all sealant materials to the placement temperature, which is recommended by the manufacturer.
- F. When sealant begins to liquefy start agitation action.
- G. When sealant becomes liquid throughout recalculation and/or pumping action may begin.
- H. Applicator hose can be kept warm and ready for use by storing it in the heating chamber of the machine.

{TRAVELWAY}

- I. When sealant reaches recommended temperature pumping through the nozzle may begin.
- J. Material should be reheated only in accordance with manufacturer's recommendations.

For detailed information in operating and using the Joint and Crack Sealing Machine, review the following:

- 1. Manufacturer Instruction Manual.
- 2. KDOT Operators Training Manual.

2.42 – SAFETY CONSIDERATIONS

Recommended:

EXERCISE EXTREME CAUTION when mixing or pouring sealant materials due to the high temperatures encountered.

The Supervisor should check that all personnel are well trained in handling, mixing, and pouring rubber asphalt, asphalt cement and other hot pour sealers and fillers.

The Supervisor must ascertain that equipment is in proper condition.

Distributors used for asphalt or other hot pour sealers shall be equipped with a high pressure/high temperature hand hose.

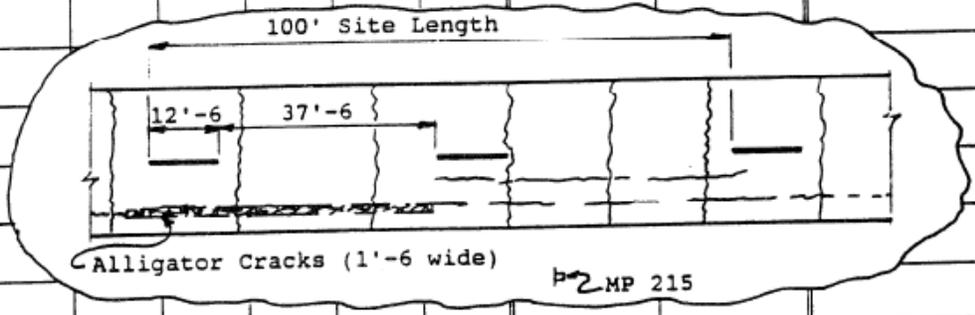
Distributors should be equipped with molasses valves for filling pour pots.

{TRAVELWAY}

KANSAS DEPARTMENT OF TRANSPORTATION
BUREAU OF CONSTRUCTION AND MAINTENANCE
UNSEALED CRACK DATA REPORT

DATE 1-27-92 HIGHWAY US xx MP 214 to MP 226 NEAR No. of xxxxx
TEMP. 37° SITE LENGTH 100 FT. ROAD WIDTH 24 FT. ROAD LENGTH 12 MILES

| MILE POST | UNSEALED CRACKS / SITE | | | | | | | NORMAL CRACK WIDTH | NORMAL DEPRESS. DEPTH | CONDITION |
|-----------|------------------------|--------------------|--------------------|--------------------|-------|-------|-------|--------------------|-----------------------|-------------|
| | TU ⁻ ft | TU ⁺ ft | TO ⁻ ft | TO ⁺ ft | LU ft | LO ft | AL SF | | | |
| 215 | 48 | | 24 | 48 | 100 | | 75 | 1/2" | 1/4" | OPEN ~ DEEP |
| 220 | 72 | 24 | 24 | | 75 | | | 1/2" | 1/4" | " " |
| 225 | 96 | | 24 | | 50 | | | 1/4" | 1/8" | " |



| | | | | | | | | | | |
|-------------|--------|-------|--------|--------|--------|--|--------|------------------|-------------------|--|
| SITE TOTAL | 216 | 24 | 72 | 48 | 225 | | 75 | RECOMMENDATIONS: | | |
| TOTAL /mile | 3800 | 420 | 1270 | 840 | 3960 | | 1320 | SEAL | _____ | |
| ROAD TOTAL | 45,620 | 5,070 | 15,210 | 10,140 | 47,520 | | 15,840 | FILL | <u>ALL CRACKS</u> | |
| | | | | | | | | LEVEL | _____ | |

CODE:
 TU⁻ = Transverse - UNDER 3/8" wide - UNDER 3/8" Depression above crack
 TU⁺ = " " " " - OVER " " " "
 TO⁻ = " " - OVER 3/8" " - UNDER 3/8" " " "
 TO⁺ = " " = " " " " - OVER " " " "
 LU = Longitudinal Cracks UNDER 3/8" wide - (Includes edge joint if applicable)
 LO = " " " OVER " " - (" " " " ")
 AL = All Alligator Crack Areas - (Measured in square feet)

{TRAVELWAY}

INSTRUCTIONS FOR DOT FORM NO. 390

UNSEALED CRACK DATA REPORT

This form may be used to inventory length, size, and condition of all unsealed cracks. It is not intended as an inventory for all cracks.

This report should furnish an economical method of obtaining a yearly inventory of various *unsealed crack problems*.

Roads with uniform crack patterns can be inventoried by using 100 ft. test sites at 5-mile intervals. Roads with non-uniform patterns may require longer and/or more sites. The road length covered by each report sheet should have similar surface and crack problems.

Mile Posts and Centerline Markings can be used to locate sites as follows:

1. Use South or West ends of 12'-6" centerline markings as FIXED POINTS.
2. Use First Fixed Point North or East of "Designated Mile Post" as the Northerly or Easterly end of INVENTORY SITE.
3. The total length of three lines and three skip spaces equals approximately 100 ft., which makes a convenient site length.

The centerline marking locations will change after seal coat or resurfacing projects. However, the crack status will also change.

The *UNSEALED CRACK/SITE* columns should include the actual unsealed length of the various types of cracks. This includes those which have been sealed or filled but have failed to where they should be repaired.

Cracks, which are listed in alligator areas, are not to be measured as a transverse or longitudinal crack.

The *NORMAL CRACK WIDTH* and *DEPRESSION DEPTH data* should describe the most common crack widths and depression depths in fractions of an inch.

CONDITION data should indicate general crack problems.

RECOMMENDATIONS should state possible solutions and/or needs.

$$\text{TOTAL/MILE} = \frac{(\text{site total}) (5.280)}{(\text{No. of sites}) (\text{length of one site})}$$

$$\text{TOTAL/ROAD} = (\text{total/mile}) (\text{number of miles})$$

{TRAVELWAY}

INSTRUCTIONS FOR DOT FORM NO. 390

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1. Use South or West ends of 12'-6 centerline markings as FIXED POINTS.
2. Use First Fixed Point North or East of "Designated Mile Post" as the Northerly or Easterly end of INVENTORY SITE.
3. The total length of two lines and two skip spaces equals 100 ft., which makes a convenient site length.

The centerline marking locations will change after seal coat or resurfacing projects. However, the crack status will also change.

The *UNSEALED CRACK/SITE* columns should include the actual unsealed length of the various types of cracks. This includes those which have been sealed or filled but have failed to where they should be repaired.

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CHAPTER THREE

SHOULDERS AND APPROACHES

- Section 3.10 - DESCRIPTION

3.11– SHOULDERS AND APPROACHES DEFINED

A **SHOULDER** is that portion of the roadway, which extends from the outside edge of the traveled lane to where the shoulder slope meets the sideslope.

APPROACHES for maintenance purposes include sideroad & entrance approaches, crossovers and turnouts.

- A. Sideroads provide access for the other public roads and streets.
- B. Entrances provide access for roadside amenities such as historical markers, roadside tables, private properties and commercial properties.
- C. Crossovers are connections that run through a median, between the opposing lanes of divided highways.
- D. Turnouts are the extra width area, which runs along the pavement or shoulder typically for access to mailboxes.

3.12 – FUNCTION

Shoulders are areas parallel and contiguous to the travelway to which they provide lateral support. Proper shaping of shoulders promotes good drainage of surface water from the pavement edge. Shoulders of sufficient width and surface type should be suitable to provide emergency parking for disabled vehicles, and serve as deceleration lanes where necessary.

Sideroads and Entrances provide ingress and egress to traffic lanes.

Crossovers may be provided on major multilane facilities at important sideroad and entrance locations. On freeway type facilities, they are for emergency and maintenance use only.

Turnouts typically provide access to mail boxes.

**- SECTION 3.20 -
SHOULDER MAINTENANCE**

3.21 – GENERAL MAINTENANCE

Maintain cross section of shoulders and approaches along with grade line as originally constructed, reconstructed or improved; or to a line, grade and cross-section which has resulted from normal maintenance activities and deterioration due to the natural elements of weather and time.

CURRENT SHOULDER CROSS SLOPE design, for all type of shoulders, is one-half inch per foot.

Repair shoulder surfaces by applying a surface coarse material equal to or better than the existing shoulder surface material. The finished shoulder surface slopes should approximate the existing shoulder surface slopes.

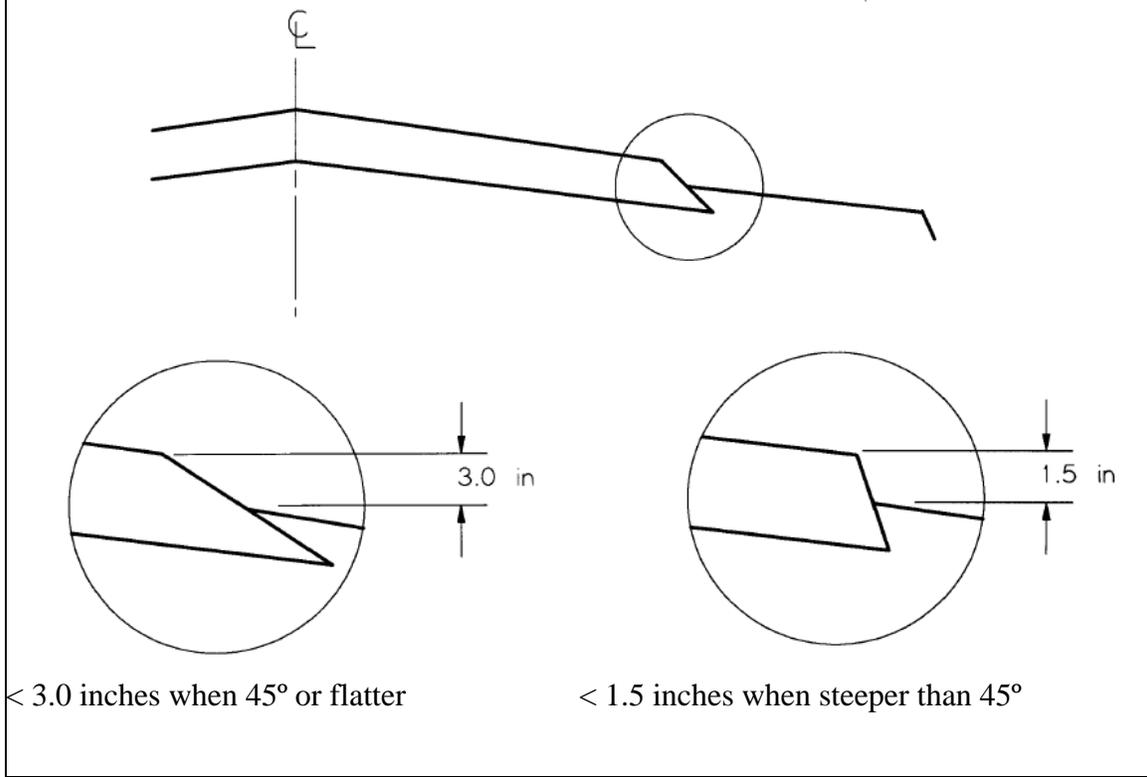
The outside edge of shoulder should be trimmed to a neat line, which follows alignment of the existing shoulder.

High shoulders may cause water to pond, which can result in sub-grade water problems.

“DROP-OFF” OR “RUTTING” between travelway and shoulder may be caused by travelway overlays or continuous wear and deterioration of unpaved shoulder due to traffic and weather.

- A. When shoulder maintenance on unpaved shoulders is performed, adjust the shoulder to within ½ inch of pavement surface, adding shoulder material where necessary. Shoulder maintenance should be done when 75 foot or longer edge ruts or drop-offs which are 3 inches or greater in depth exist along travelway pavements that have a 45 degree or flatter sloped edge or 1 ½ inches or greater in depth along travelway pavements with edges more vertical than 45 degrees. To the extent that resources allow, maintenance may be scheduled when ruts or drop-offs are of lesser depths or lengths. See figure 3-1.
- B. Raise shoulders by adding material equivalent to existing material.
- C. The line, grade and cross section should approximate those of the existing shoulder.

FIGURE 3-1 EDGE DROP-OFF / RUTTING



“Drop-offs” or “Rutting” may also develop at the outside edge of paved and unpaved shoulders or along the edge of the travelway on roads without shoulders. Reasonable steps should be taken to maintain these edges as described in the preceding paragraph. It is recognized that under some circumstances material cannot be placed or maintained to that criteria given existing roadway, shoulder and slope configuration. Any questions concerning this should be directed to the Area Engineer.

JOINTS BETWEEN TRAVELWAY AND SHOULDER should be sealed or filled to decrease water entry.

3.22 – ASPHALT SHOULDERS

(Plant Mix, Road Mix, or Surface Treated)

CHAPTER TWO – TRAVELWAY, SECTION 2.20 “ASPHALT SURFACES”, covers policies practices, and procedures which recognize design features, traffic volumes, climate, age, finances, and other considerations. ***This should be followed for Maintenance of Asphalt Shoulders as follows:***

- A. See “Surface Failures” Sect. 2.21, for information, terminology and figures on cracks and other surface failures.
- B. See Section 2.22, “Repair and Maintenance” for repair information on cracks, joints and surface distortion problems.
- C. See “Sealing Asphalt Surfaces” and “Asphalt Handling and storage” in Sections 2.23 and 2.24 for information on sealing AC surfaces.

3.23 – CONCRETE SHOULDERS

Concrete shoulders require maintenance similar to concrete pavements.

The longitudinal pavement to shoulder joint may allow surface water to cause sub-grade damage if it is not sealed.

Design Features, Condition, Climate, Age, Cost and Traffic Volume should be considered when making decisions on concrete shoulder maintenance.

Policies, procedures and practices outlined in Section 2.30 “***Concrete Surfaces***”, are applicable for maintenance of concrete shoulders.

3.24 – AGGREGATE SHOULDERS

Blade lightly when needed, preferably after a rain. Limestone screenings may be needed if there has been an excessive loss of fines. Finish to a uniform cross slope with no ridges or ruts to trap water.

Chlorides, or brine, may be added to aggregate shoulders to help retain moisture in the binder.

3.25 – TURF SHOULDERS

CORRECT SHOULDER BUILD-UP BY LIGHT BLADING. Cut the shoulder down to edge of payment elevation and provide slope for drainage.

Light blading will usually allow the re-establishment of remaining sod and roots. Spot reseeding and fertilizing will be needed in some cases.

Where traffic or erosion continues to produce rutting along the pavement edge, consideration should be given to stabilizing a two or three foot width. A six-inch minimum depth of aggregate (or asphaltic material) should be used for this type of repair. **(Note that all changes should be consistent with the shoulder policy, contained in Section 8.5 of the Road Design Manual, and that District Engineer approval is necessary.)**

**- SECTION 3.30 -
APPROACHES**

3.31 – GENERAL MAINTENANCE

SIDEROAD AND ENTRANCE APPROACHES extend from the edge of the travelway to the normal right-of-way line, and are to be maintained by KDOT.

Approaches covered by special agreement will be maintained in accordance with specific information provided in the agreement filed in the District Office. Unique differences may exist from agreement to agreement.

Maintenance Is To Be In Accordance With Procedures Established for Roadways of the Same Surface Type And:

- A. It is desirable that approach grades be maintained so surface water does not flow onto the roadway.

Approaches May Be Upgraded to Higher Surface Type With District Approval, As Outlined Below:

- A. Extend drainage structures when required and widen the approaches to meet current standards before placing asphalt material.
- B. Slope the approach down and away from the roadway surface to a point over the ditch line.
- C. Cut out the approach to a six-inch depth and replace with an asphalt or other approved material.
- D. See “Detail for Surfacing of Side Roads and House Entrances” contained in Design Standard No. RD051. Road Design standards can be found on the KDOT Intranet under Bureau of Design, Documents.

{ SHOULDERS AND APPROACHES }

3.32 – CROSSOVERS

Maintain these in the same manner as described for sideroad and entrance approaches of similar surface type.

CROSSOVER SURFACING shall be of sufficient thickness to support the heavy maintenance vehicles.

3.33 – TURNOUTS

Maintain turnouts in the same manner described for sideroads and entrances.

TURNOUTS MAY BE UPGRADED TO A HIGHER SURFACE TYPE, WITH DISTRICT. APPROVAL. See “Detail for Surfacing of Mail Box Turnouts” contained in Design Standard No. RD051. Road Design standards can be found on the KDOT Intranet under Bureau of Design, Documents.

CHAPTER FOUR

ROADSIDE AND DRAINAGE

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CHAPTER FOUR

ROADSIDE AND DRAINAGE

- Section 4.10 - DEFINITIONS

4.11 – ROADSIDE

This includes the area between the outside edge of the shoulder and the right-of-way line. The roadside also includes interchange areas, medians on divided highways and the channeling islands at intersections.

4.12 – ROADSIDE MAINTENANCE

Includes all activities necessary to keep the roadside clean, neat, attractive, and reasonably safe for the motoring public.

Major Activities include drainage, mowing, pesticide/herbicide spraying, erosion control and landscape maintenance.

The maintenance of rest areas, litter and trash pick up and the removal of abandoned vehicles are included in Chapter Seven “Motorist Services”.

- SECTION 4.20 -
DRAINAGE

4.21 – SYSTEMS

1. ***DRAINAGE SYSTEM POLICY***

- A. Highway drainage systems include the ditches, culverts, underdrains, edge drains, storm sewers, and other miscellaneous drainage structures.
- B. Drainage & maintenance **easements** are usually obtained when the road is constructed. Limits of such easements are on file at the District Office.
- C. Notify the District Engineer of **obstructions** to natural drainage when caused by adjacent property owners.
- D. All proposed **drainage revisions** should be reviewed to prevent natural watercourses from being diverted to other property.
- E. Report all **drainage deficiencies** to the District Engineer.
- F. Use Highway Permit Agreement, DOT Form No. 304 for all **Requests for Revisions** to the waterways and terraces that drain into right-of-way.
- G. Maintenance of storm sewer systems **along city connecting links** is generally performed by cities. Review the individual city maintenance agreements to determine KDOT's responsibility.

2. ***NEW CONNECTIONS TO SYSTEM***

- A. The District Engineer shall approve new drainage system connections.
- B. Use DOT Form No. 304, Highway Permit Agreement, for drainage connection requests. Bureau of Design approval may be requested.
- C. Connection requests must meet KDOT requirements.
- D. The connection must not damage the system, alter natural drainage, or affect adjacent property adversely unless approved by District Engineer.
- E. Connections to the system are allowed only if the applicant pays the cost of such alteration work, and if the system can handle the additional drainage satisfactorily.

3. ***DISCHARGES INTO DRAINAGE SYSTEM***

- A. Only storm water is allowed to discharge into the drainage system.

{ROADSIDE AND DRAINAGE}

- B. Discharge into the system, which may present a maintenance problem, should be referred to the District Engineer.

4. ***DRAINAGE EASEMENTS***

- A. The District Office obtains permanent drainage easements when required.
- B. The Area offices may obtain temporary easements using DOT Form No. 344, Agreement for Highway Maintenance Easement.

5. ***DRAINAGE SYSTEM INSPECTION***

- A. Inspections should be performed periodically in each subarea.
- B. The inspection is made by the Area Superintendent and/or his designee.
- C. Refer problems to the District Engineer when major repairs are required or when extensive deterioration is found.

4.22 – DITCH AND GUTTER MAINTENANCE

1. ***GENERAL***

- A. Maintain to line, grade, depth and cross-section as originally constructed, reconstructed, or improved, or to a line, grade and cross section which has resulted from normal maintenance activities and deterioration due to the natural elements of weather and time.
- B. Clean periodically by removing rocks, dirt, debris, weeds and brush, which may restrict the normal flow of water.
- C. A continuing program for the inspection of all ditches should be established in each sub-area.

2. ***UNLINED DITCHES*** (Roadside, Outlet and Intercepting)

- A. Ditch Grading
 - (1) Light ditch grading should be performed as needed in each sub-area.
 - (2) Heavy grading activities should have approval of the District Engineer.
- B. Place excavated material on shoulder slopes, shoulders, and backslopes as needed. Excess material should be disposed of each day as directed by the Area Engineer. The dumping of excess material into streams is not permitted.

{ROADSIDE AND DRAINAGE}

- C. Seed, fertilize and mulch the disturbed areas when natural vegetation is removed due to ditch cleaning.
- D. Mow or spray only as necessary to control the growth and spread of noxious weeds or control growth which will adversely affect stream flow or traffic operations. (See Sections 4.40, 4.50 and 4.60)

3. ***LINED DITCHES AND SPILLWAYS***

- A. Repair ditch lining with proper size aggregate as needed.
- B. Check for breaks, voids, cracks, erosion, and washouts.
- C. Correct side erosion by backfilling, widening the lining or strip sodding.
- D. Correct settlement or fill voids under paved ditches by using mudjacking equipment.
- E. Correct end scour and erosion by using grouted rock or concrete.
- F. Extend paved length of ditch lining if necessary.
- G. Fill open cracks and joints in ditches with approved filler.
- H. Maintain ditch lining free of trees, brush, weeds and debris.

4. ***CURB AND GUTTER***

- A. Maintain curb and gutter sections to original line, grade and type of construction.
- B. Cleaning of gutters is largely dependent on conditions. It may be necessary to clean them several times each year in urban areas.
- C. Remove excessive accumulation of debris when discovered or as soon as reasonable.
- D. Damage to curbs or settling that could affect the efficiency of the gutter should be repaired.

4.23 – BANK PROTECTION

1. ***GENERAL***

- A. Bank protection is necessary to protect roadway or stream embankments and bridge berms from erosion, scouring, undermining, and washing.

{ROADSIDE AND DRAINAGE}

- B. Growth of native trees is encouraged where it does not adversely affect stream flow or traffic operations.
- C. Inspect and repair bank protection in a reasonable timeframe following heavy rains and floods.
- D. The District Maintenance Engineer shall approve major repair work.

2. ***PAVED SLOPES (Concrete or Asphalt)***

- A. Fill joints and cracks on paved slopes with approved material.
- B. Use mudjacking equipment to fill voids under paved slopes.
- C. Keep the surface free of trees, brush, weeds and debris.

3. ***FIBERGLASS MATS OR MESH***

- A. Use for highway or railroad overpass berms.
- B. Remove small weeds from fiberglass mats.
- C. Asphaltic seal coats applied to fiberglass mats may be necessary every four or five years.

{ROADSIDE AND DRAINAGE}

4. ***RIPRAP AND GROUTED RIPRAP***

- A. Riprap or rock blankets may be of quarry run stone, boulders or broken concrete.
- B. The size of riprap or grouted riprap depends on stream velocity and expected scouring action.
- C. High stream velocity may require the riprap to be grouted depending on the nature of the stream and the size of the riprap.
- D. When laying riprap, cut a trench to the depth of the anticipated scour or a minimum of 2 feet deep at the toe of the slope.
- E. Place large rocks with the flat sides in contact with the slope.
- F. Fill voids with smaller rocks.
- G. Where a grouted riprap is necessary, use material at least 0.25 cu. ft. or more in size.
 - (1) The normal grout mix consists of one part portland cement and three parts sand.
 - (2) Sweep with a stiff broom to remove excess grout from the surface.

4.24 – CULVERTS

1. ***TYPES AND DEFINITION***

- A. Culverts are drainage structures for lateral or transverse drainage, which are 20 feet and less in roadway length, measured as spans in direction of traffic. (see Figure 5-7 “How to Determine a Bridge or Culvert”)
- B. Culverts consist of many types which include:
 - Corrugated Metal Pipe
 - Metal Arch
 - Multiplate
 - Plastic Pipe
 - Timber
 - Reinforced Concrete Pipe
 - Concrete Box Culverts

2. ***CULVERT MAINTENANCE***

- A. General
 - (1) Maintain culverts and their end area free of trash & silt.
 - (2) Remove the brush and debris from around hubguards, wing walls, and flow lines.
 - (3) Clean outlet ditch to assure the proper flow.
 - (4) Clean small culverts with cable drawn scoop cleaner or other applicable means.
 - (5) Clean box culverts with front-end loaders, dragline, and cable drawn slip scrapers, or scoop cleaners.
 - (6) If a culvert silts up repeatedly, check for cause, and instigate necessary corrective action.
 - (7) Culvert ends should be marked as per Sections 3 and 5 of the KDOT Sign Manual.
- B. The lower ends of **Erosion Pipes** are subject to extensive scour action and should be inspected.
- C. **Concrete Box Culverts** should be repaired in kind.
 - (1) Repair damage in accordance with design and construction standards.

{ROADSIDE AND DRAINAGE}

- (2) Make concrete repairs with new concrete tied into the original reinforcing steel.

D. **Concrete Pipe Culverts** are subject to settlement.

- (1) Joint openings may require repair by grouting.
- (2) If settlement is large the pipe may need to be reset.
- (3) Check end sections for settlement periodically.

E. The ends of **Corrugated Metal Culverts** are subject to damage during routine ditch maintenance operations.

- (1) The bent pipe ends should be straightened.
- (2) Damaged end sections should be replaced as needed.

3. ***CULVERT INSTALLATION***

- A. The Area Engineer should determine when the installation of a new culvert is necessary.
- B. Culverts should be installed in accordance with present access permit regulations and standard material and construction specs.
- C. Replacement culverts should conform to the original culvert size unless design requirements have changed or a scour area exists near the outlet of the existing culvert.
- D. Size changes should be approved by the Area Engineer as determined from the following Drainage Tables.

DRAINAGE TABLE – AREAS DRAINED

ROUND CONCRETE PIPE

| DIAMETER (inches) | OPENING AREA (sq. ft.) | ACRES DRAINED | |
|----------------------|---------------------------|--------------------|------------------|
| | | Rolling Country | Level Country |
| *12 | 0.7 | 3 | 6 |
| *15 | 1.2 | 6 | 11 |
| 18 | 1.7 | 9 | 18 |
| 21 | 2.4 | 14 | 28 |
| 24 | 3.1 | 20 | 39 |
| 30 | 4.9 | 36 | 71 |
| 36 | 7.0 | 59 | 116 |
| 42 | 9.6 | 89 | 175 |
| 48 | 12.5 | 126 | 250 |
| 54 | 15.9 | 174 | 345 |
| 60 | 19.6 | 229 | 453 |
| 66 | 23.7 | 295 | 584 |
| 72 | 28.2 | 373 | 737 |
| 78 | 33.1 | 461 | 912 |
| 84 | 38.4 | 562 | 1111 |

NOTE: This table reflects averages of numerous variables and should not be relied on when overflow and flooding are a recurring problem. Major drainage structures should be reviewed by the Bureau of Design.

* Pipe sizes less than 18” diameter are not permitted, except for median drains.

ROUND CORRUGATED METAL PIPE

| DIAMETER (inches) | *GAUGE | OPENING AREA (sq. ft.) |
|----------------------|-------------|---------------------------|
| 18 | 16-14-12 | 1.7 |
| 21 | 16-14-12 | 2.4 |
| 24 | 16-14-12-10 | 3.1 |
| 30 | 14-12-10-8 | 4.9 |
| 36 | 14-12-10-8 | 7.0 |
| 42 | 12-10-8 | 9.6 |
| 48 | 12-10-8 | 12.5 |
| 54 | 12-10-8 | 15.9 |
| 60 | 10-8 | 19.6 |
| 72 | 10-8 | 28.2 |
| 78 | 8 | 33.1 |
| 84 | 8 | 38.4 |

*Different gauges for design of various heights of fill.
The lightest gauge will be for normal use.

{ROADSIDE AND DRAINAGE}

CORRUGATED METAL PIPE ARCH

| DIAMETER OF EQUIVELENT ROUND PIPE | SIZE (inches) | | GAUGE | OPENING AREA (sq. ft.) |
|-----------------------------------|---------------|------|-------|------------------------|
| | Span | Rise | | |
| 18" | 22 | 13 | 16 | 1.6 |
| 21" | 25 | 16 | 16 | 2.2 |
| 24" | 29 | 18 | 14 | 2.8 |
| 30" | 36 | 22 | 12 | 4.4 |
| 36" | 43 | 27 | 12 | 6.3 |
| 42" | 50 | 31 | 12 | 8.3 |
| 48" | 58 | 36 | 12 | 10.8 |
| 54" | 65 | 40 | 12 | 13.5 |
| 60" | 72 | 44 | 10 | 16.6 |
| 72" | 85 | 54 | 8 | 23.9 |

3. **CULVERT INSTALLATION** (Continued)

- A. Required Culvert Length should be determined by measurement in the field or by computation.
 - (1) Corrugated metal pipe is available in multiples of two-foot lengths, and reinforced concrete pipe in 4-foot, 6-foot and 8-foot sections.
 - (2) Follow access permit regulations and design standards for determining the correct lengths of entrance, approach road, and sideroad culverts.
- B. Pipe culverts should be installed following normal construction procedures and requirements. See Section 207.03 of the KDOT Standard Specifications.
- C. The excavation width for culvert pipes is usually two times the diameter of the pipe.
 - (1) Grade the bed to provide a uniform and firm area, which conforms to the shape of the pipe.
 - (2) Undesirable bedding material should be replaced with suitable material, which can be thoroughly compacted.
- D. Culverts should be aligned to fit stream flow (outlet alignment is most critical)
- E. The flowline of the pipe should be slightly lower than natural grade of the stream as determined by the Area Engineer.
- F. When installing corrugated metal pipe culverts:
 - (1) Outside laps of circumferential joints shall be pointed upstream with the longitudinal laps on the side.

{ROADSIDE AND DRAINAGE}

- (2) For pipe sections jointed on the site, ends are butted as close as feasible and connected with a band.
- G. **Suitable backfill material shall be placed in six inch lifts** and tamped to at least the height of the pipe or the original ground level. Compaction is most important to prevent settlement and damage to the road surface.

4.25 – UNDERDRAINS

TYPES AND FUNCTION

The *District Maintenance Engineer* should approve all locations for underdrains placed by maintenance forces (based on KDOT Geologist recommendations). Underdrains are installed to remove excess groundwater from the sub-grade.

UNDERDRAIN INSTALLATIONS

- A. KDOT geologists will design the more complex underdrain systems.
- B. ***NORMAL trenching procedures will be followed.***
 - (1) A “V” shaped or a shored-up trench shall be used in unstable soils.
 - (2) The trench should be excavated to a width that will allow a 4” minimum granular backfill on each side of the pipe and a 2” bedding below the pipe.
 - (3) The trench should be graded so the drain outlet is at least 6 inches above the bottom of the highway ditch.
- C. The perforated underdrain pipe must be installed with the perforations down.
- D. Plain underdrain pipe is used outside the limits of the granular backfill.
- E. All ***Trench Backfills*** should be made in accordance with section 207 of the Standard Specifications, “Backfilling for Structures”.
 - (1) Use coarse graded sand for backfill material to at least one foot above the top of the perforated pipe.
 - (2) Use gravel with a high percent of fines to fill remainder of the trench.
 - (3) The trench should be capped with impervious material.
- F. ***Underdrains should be marked*** with a steel or wood guidepost thirty inches above ground with the top 6 inches painted red.

{ROADSIDE AND DRAINAGE}

- G. See Design Standard No. 650, for underdrain installation details.
- H. *Existing underdrain outlets should be cleaned* each spring and fall. Hail screen should be maintained in the outlets to keep all rodents out.

4.26 – EDGE DRAINS

FUNCTION

Edge drains are used to drain excess water from along the bottom outside edge of pavement or base. The District Maintenance Engineer should approve new locations prior to construction.

INSTALLATION

- A. Some edge drains are constructed with a filter fabric around the granular material and perforated pipe. They are usually outleted into the ditch with plain pipe and a concrete flume.
- B. See Design Standard No. 654 for edge drain construction details.
- C. The trench should be graded so the drain outlet is at least 6 inches above bottom of the highway ditch.

MAINTENANCE

- A. *Edge drain outlets should be checked twice each year* and should be cleaned or flushed when determined necessary by the inspection. Rodent guards must be kept in good repair.
- B. *The guideposts which were placed during construction should be removed* if the outlet is protected by a concrete flume. When a flume does not exist, one should be added and the post should then be removed.
- C. *Edge drain locations shall be identified as follows:*
 - (1) Paint a 1 ft. x 4-inch stripe, perpendicular to roadway centerline near the outside edge of shoulder.
 - (2) Use white paint on asphalt and black on concrete.
 - (3) These stripes are to be painted on the edge of pavement when the shoulders are rock or dirt.

4.27 – MISCELLANEOUS DRAINAGE STRUCTURES

**DROP INLETS, CATCH BASINS,
DRAIN BASINS AND MANHOLES**

{ROADSIDE AND DRAINAGE}

Inspect and clean these at regular intervals.

Keep grates free of debris and sweep gutters regularly to maintain proper drainage.

Keep approach gutters free of sand, gravel, and dirt that would cause the underground system to become clogged.

Structural steel grates, frames, and covers should be painted as necessary.

STORM SEWERS

Review the individual city connecting link maintenance agreements to determine KDOT's area of responsibility.

Repair structural damage as soon as practical.

Maintain a reasonably tight fit on the manhole covers.

- SECTION 4.30 -
LANDSCAPE

4.31 – GENERAL

Landscape Maintenance Operations are necessary to maintain the growth and appearance of vegetation such as shrubs, evergreens, shade and flowering trees.

Keep *New Landscape Plantings* watered and weed-free until plantings are established.

Report Plant Losses and order replacement plantings to maintain the original design as approved by the Area and District Engineer.

The Area Engineer and/or District personnel may recommend proper methods of fertilizing plants.

Area and/or District personnel determine the method, location, material type, and application rate for all herbicides within applicable guidelines. See Section 4.50 “Spraying”.

Cultivate plant beds as necessary to control weeds.

Trees and plantings located in fence rows or on the right-of-way line are considered property of adjacent landowner. If pruning and/or removal are necessary, the Area Superintendent must obtain *approval from the landowner* or the lessee.

When pruning is required around KDOT safety features on other’s right-of-way, such as for Stop Ahead signs, the Area Engineer should work with the local governmental authority to resolve the issue in a timely manner, documenting progress as appropriate. If the problem cannot be resolved in a timely fashion or the trees and plantings are an immediate safety concern, the trees and plantings should be pruned by KDOT, billing the responsible party, if possible.

All trees and plantings on highway right-of-way belong to the Department of Transportation unless title has been retained by the landowner specifically in the deed or condemnation petition through which the right-of-way was secured.

4.32 – PLANTING

Plant *bare root deciduous trees* between November 15 and April 15.

- A. Subject all bare root trees to a hard killing frost before digging.
- B. Bare root plants which cannot be immediately planted should be heeled in the ground and watered down until planting;

Plant *balled and burlapped plants* between October 1 and April 20.

- A. Balled and burlapped plants should be kept moist or stored inside a cool building until they are planted.

4.33 – SELECTIVE THINNING

Selective thinning should be performed under direction of District personnel.

Selective thinning will encourage the growth of desired native vegetation.

When thinning, attempt to *protect native shrubs* such as sand plum, sumac, dogwood, and redbud.

4.34 – PRUNING

General Pruning of Plants, Shrubs, and Trees should be performed as shown in Figures 4-1, 4-2 and 4-3 utilizing standard procedures.

- A. Retain the natural shape of the plant if possible.
- B. Prune hedges only upon the recommendation of the Area Engineer or District personnel.
- C. Tools used for pruning or trimming of trees are provided by KDOT.
- D. Keep all cutting tools sharp and clean.

The Proper Methods for Trimming and Pruning Trees are as follows:

- A. Cut the branches back to their respective parent branches, limbs, or trunks with a cut just outside of the branch collar (see illustration), to avoid stubs or horns that will result in decay. To remove larger limbs, undercut a foot or less from the main limb or trunk sufficiently to prevent stripping of the bark or splintering and remove by a top cut slightly farther out from the first cut. Cut the remaining stub just outside of the branch collar and bark ridge, for the least decay and fastest healing (See Figure 4-2)

{ROADSIDE AND DRAINAGE}

- B. For safety, remove large limbs in sections. When the space below a limb is not clear, lower it by rope. Undercut large upright limbs in the direction to be felled. If trimming is required to such an extent that the native form of the tree is ruined, remove the tree.
- C. Train trees by pruning and removing dead or broken branches, crossing or rubbing branches, as well as narrow and weak crotches, which are easily split during storms.
- D. When making final cut, exercise care to prevent injury to the bark or cambium (greenwood) surrounding the wound. Avoid flush cuts or any other sculpting of the cut face. The cut should be made in the proper place and left at that.

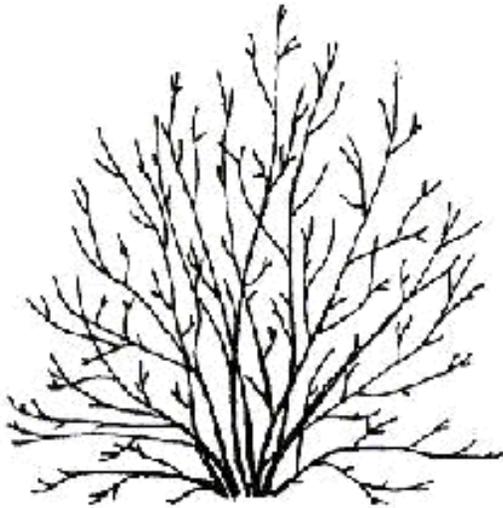
Tree Pruning for Utility Lines and Tree Removal should be performed as shown in Figure 4-3 and should be in accordance with established policies.

- A. The Area Engineer and/or District personnel are responsible for recommending the pruning or removal of trees for utility line clearance.
- B. The Area Engineer is responsible for authorizing tree trimming for utility line clearance.
 - (1) DOT Form No. 304 Highway Permit Agreement, is used to grant authority to utility companies for tree trimming. The location of the pruning will be made a part of the permit. (See Section 11.20 Highway Permit Agreements)
 - (2) Before authority is granted for major limb or tree removal, consideration should be given to using armored cable or other means of supporting and protecting the trees.
 - (3) Pruning should conform to standards of the Kansas DOT.
- C. Dispose of cut material properly. In the event open burning is necessary, conditions outlined in Chapter Twelve - Environmental Protection and Safety, "Burning" must be complied with.

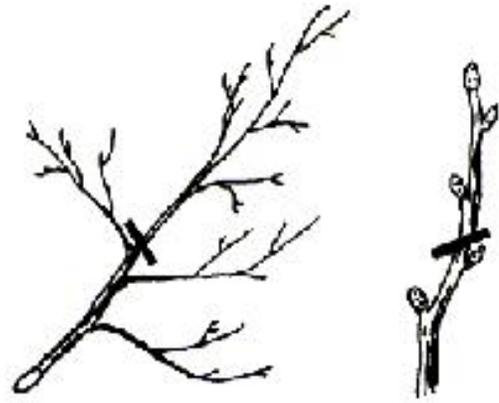
To prevent damage, corrective pruning should be performed as shown in Figure 4-2.

- A. Cut, smooth, and shape the edges of the bark injury, which disturbs the greenwood's ability to allow proper drainage and sap movement.
- B. Clean any cavities of rotten wood and shape to drain.
- C. Trim the cavity and the bark at the edges of the cavity.
- D. Repair weakened crotches with a lag screw tree rod or lag screws and cable.

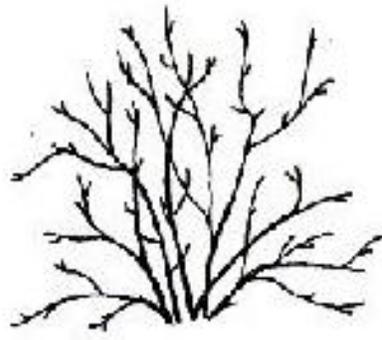
PRUNING SHRUBS



PRUNE BY REMOVING DEADWOOD, AND THINNING OUT UP TO ¼ OF THE OLDER CANES AT GROUND LEVEL.



PROPER WAY OF REMOVING BRANCHES AT A LOWER BUD OR FORK.



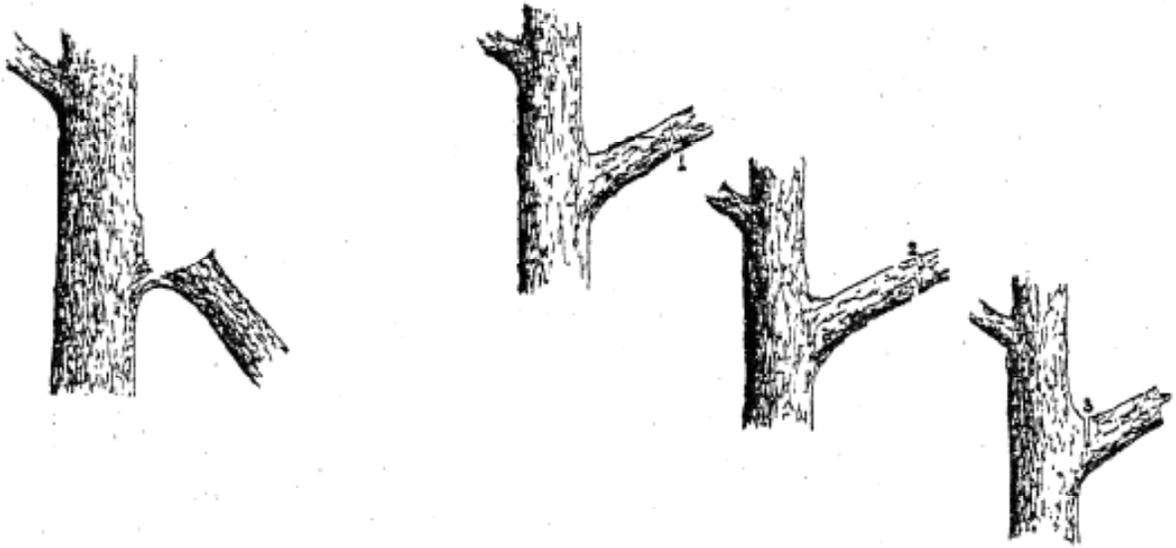
REDUCE SIZE BY SELECTIVE REMOVAL OF BRANCHES AT A LOWER BUD OR FORK TO RETAIN A UNIFORM SHAPE.



REMOVE LONGER BRANCHES AT A HEALTHY SIDE BUD AND RETAIN ITS NATURALISTIC SHAPE. THE SHEARED BOXY SHAPE AT RIGHT IS UNDESIRABLE, UNLESS IN A HEDGE FORM.

FIGURE 4-1 PRUNING SHRUBS

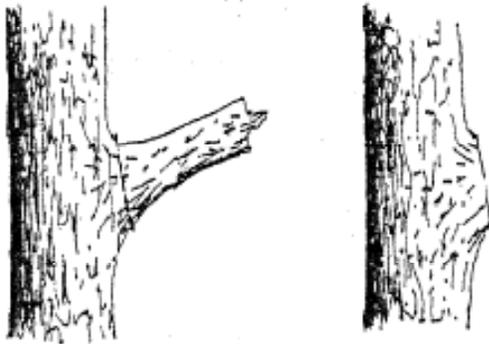
PRUNING TREES



Bark stripping is the result of improper pruning when removing a large branch

LARGE LIMBS: Correct removal of large branches takes three cuts.

- 1) Cut to prevent bark stripping
- 2) Cut of limb a few inches above cut #1
- 3) Final cut (see below left)



Make last cut (#3) so that the lower cut is slightly out from the tree trunk. This results in a smaller wound and faster healing.

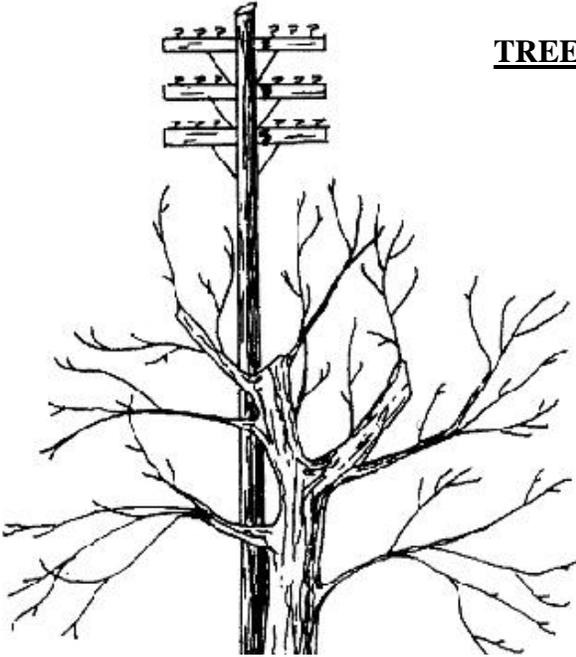


SMALL BRANCHES:

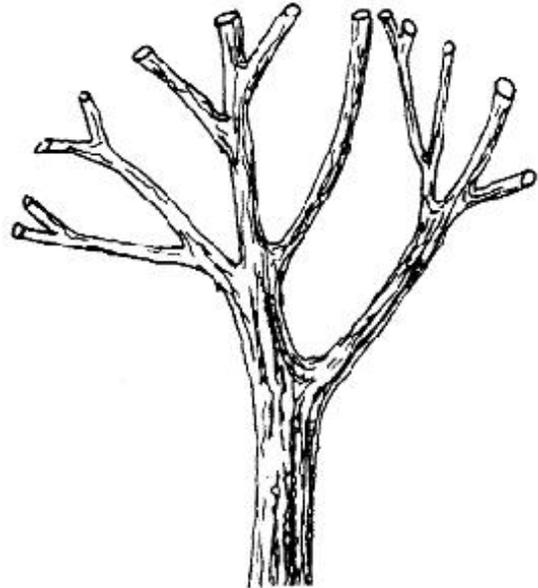
One clean cut should be close to a large limb or trunk, but slightly angled out as with cut #3

FIGURE 4-2 PRUNING TREES

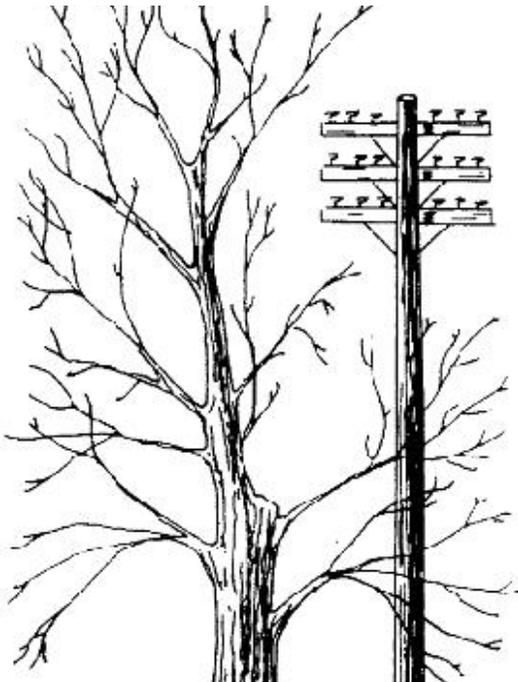
TREE PRUNING FOR UTILITY LINES



DROPCROTCH PRUNING – REMOVE UPPER INTERFERING LIMBS BACK TO SECONDARY BRANCHES, PRUNE TO RETAIN NATURAL SHAPE. REMOVE WITH A CLEAN FINAL CUT.



**- UNACCEPTABLE-
TOPPING PREVENTS
HEALING AND THE STUB
REMAINS OPEN TO DISEASE.**



SIDE AND DIRECTIONAL PRUNING MAY BE DONE BY SELECTIVE REMOVAL OF LIMBS AND BRANCHES DIRECTLY AROUND THE PATH OF THE WIRES.

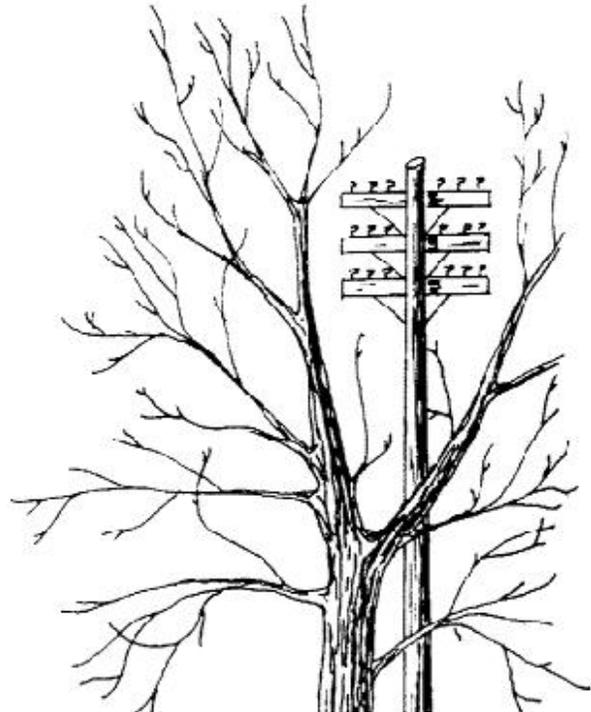


FIGURE 4-3 TREE PRUNING FOR UTILITY LINES

4.35 – TREE REMOVAL

Authority for tree removal is granted only if the tree is Diseased, Dead, Deformed, Damaged, Creates a Traffic Hazard, or Restricts Sight Distance from driveways or approach roads. District Engineer approval is required.

Trees too close to traffic may be removed if not properly protected with guardrail.

The Area Engineer shall contact utility companies before removing trees near utility lines for possible assistance or removal by their crews.

The Area Superintendent will contact the landowner when removal of trees not on the right-of-way is necessary.

The following should be considered when planning a ***Tree Removal***:

- A. Confirm ownership of the tree. (See Section 4.31)
- B. Consult with District Office.
- C. To protect adjacent trees and property, cut and remove the limbs of larger trees before the trunk is felled.
- D. Cut a notch to a depth less than one-half the diameter of the tree on the side, which is in the direction of the desired fall.
- E. Make a second cut on the opposite side and 2 inches to 4 inches above the bottom saw cut. Wedges can be used in “throwing” the tree.
- F. Cut the remaining stump flush or below ground level.
- G. Spray freshly cut stumps with herbicides to prevent re-growth.

Destruction or Unauthorized Removal of Trees or Plantings on the right-of-way shall be stopped immediately and referred to the Office of Chief Counsel for proper action and collection of damages.

**- SECTION 4.40 -
MOWING**

4.41- GENERAL

The following policy is intended to provide uniform statewide mowing practices with appropriate considerations for safety, appearance, economy and wildlife habitat.

Each maintenance section should be visually evaluated in order to determine the amount of acreage to be mowed and the schedule by which it should be mowed.

Cutting heights are prescribed to improve vegetation, increase equipment capacity, reduce flying objects and avoid exposing small litter to view.

4.42 - POLICY

1. ALL ROADSIDE MOWING

- A. The **MOWING SEASON** shall be determined by the District Engineer based on the requirements of each maintenance area as directed below.

Areas outside the shoulder and shoulder slopes **should not be mowed between April 15 and October 1** due to the sustainability of native grasses and wildflowers and the protection of ground nesting wildlife. Exception #1: Urban area mowing is acceptable in developed areas. Exception #2: Specific problem areas such as noxious weeds or woody infestations of undesirable growth may be mowed as required for control. Exception #3: Newly seeded areas during a 1-3 year establishment period may be mowed as required for the control of weeds.

- B. The **MINIMUM MOWING HEIGHT** should be 6 inches with the following exceptions. These areas may be mowed at 4 inches as needed:

- 1) Urban Areas.
- 2) Turf Shoulders.
- 3) Areas designated by the District.

- C. **MOW THE FOLLOWING AS NECESSARY** to maintain a safe and neat appearance or to accomplish specific requirements:

- 1) **Shoulder Strip Mowing Area** – This includes one mower width (about 10-15 feet) adjacent to the edge of the roadway. A second pass is optional for roads without shoulders.

{ROADSIDE AND DRAINAGE}

- 2) Medians – All medians should consist of Shoulder Strip Mowing only, unless required for safety considerations or in preparation for winter weather. One or two swaths may be mowed across the median, as necessary, to provide KHP and other emergency vehicles an identified location to cross the median. Medians in urban areas, or those less than 60 feet in width may be mowed out as required for appearance. The width of the median shall be measured between the yellow lines. (See figures 4-4)
- 3) Safety Mowing for sight distance at intersections, inside curves, ramps and entrances. (See figures 4-10, 11 and 12)
- 4) Newly Seeded Areas – Mow at an 8” height to control weeds and promote growth of germinating seed.
- 5) Brushy Areas – Except for desirable plants as noted in D (4) below.
- 6) Excessively Weedy Areas as required for control. Crown Vetch may be mowed prior to blooming, where proliferation or invasiveness onto adjacent property is causing concern.
- 7) Urban and Developed Areas adjacent to residences or cemeteries. (See also Section 2)
- 8) Areas where mowing will reduce or eliminate a known fire hazard.

D. **LIMITED MOWING** for the following areas except as noted:

- 1) Rural Right-of-Way outside the shoulder and shoulder slopes should be mowed on a 4-year cycle except as required for the control of weeds, brush, trees or other concerns. Exception: Two-lane roads with narrow R/W (<30 Ft. of grassy area) MAY be mowed out on an annual basis.

It is suggested that a 4-year cycle of mowing be scheduled as follows:

- Year 1 – East side of all north/south roadways
- Year 2 – North side of all east/west roadways
- Year 3 – West side of all north/south roadways
- Year 4 – South side of all east/west roadways

- 2) Slopes should not be mowed if the operator will be endangered or if the slope might be damaged by spinning or sliding tires. Do not mow 3:1 or steeper slopes without special equipment.
- 3) Wet or Sandy Soils which cannot support equipment without rutting or damage to the area.
- 4) Native Sumac, Sand Plum, Grey Dogwood, Choke Cherry, Elderberry, or Redbud shall not be mowed unless it is a potential safety hazard or will cause snow to drift onto the roadway. (See Figure 4-8)

- E. A more pleasing and acceptable visual impact will be accomplished by transitioning from one pattern to another. Abrupt changes in mowing patterns should be avoided (See Figure 4-6).

{ROADSIDE AND DRAINAGE}

- F. Development of Trees and Shrubs should be encouraged in areas where they will not be detrimental to the reasonable safety or economical maintenance of the highway.
- G. Four-inch high mowing patterns to delineate the surface features for Aerial Photo-mapping is allowed. This mowing will be coordinated between the District and the Bureau of Design.
- H. **WILDFLOWER ENHANCEMENT AREAS** developed by KDOT or others through local partnerships should be marked with the standard wildflower logo sign to prevent accidental mowing, and the areas maintained as follows:
 - 1) Mowing and chemical treatment should be avoided except as noted below.
 - 2) Monitor areas annually for invasion by noxious or other weeds, including smooth brome and tall fescue, and treat in accordance with the latest recommendations by the KDOT Environmental Section, the Kansas State Extension Service, NRCS, or other qualified Agronomy Specialist. Spot spray only. No general spraying should be allowed.
 - 3) Where practicable, prescribe burn the area every three to four years between March 15 and April 15. If not feasible, mowing every four years after heavy freeze (November 15) is acceptable.
 - 4) No haying of enhancement areas should be allowed.
 - 5) Evaluate enhancement areas every fifth year to determine renovation needs

2. URBAN AND DEVELOPED AREA MOWING

The above “Mowing Policy” (1A through 1H) also applies to the urban and the highly developed rural areas except as follows:

- A. Urban and highly developed rural areas (as designated by the District Engineer) may to be mowed on a schedule that will maintain a neat appearance.
- B. Large urban interchange areas may be designed for limited mowing. (See Figure 4-13 for additional information.) All median and interchange areas may be mowed except those parts of wide medians and large interchange quadrants which are designated for limited mowing.
- C. Established native grass and wildflower areas, including enhancement areas by KDOT or others through local partnerships may be mowed as needed between November 15 and April 15.

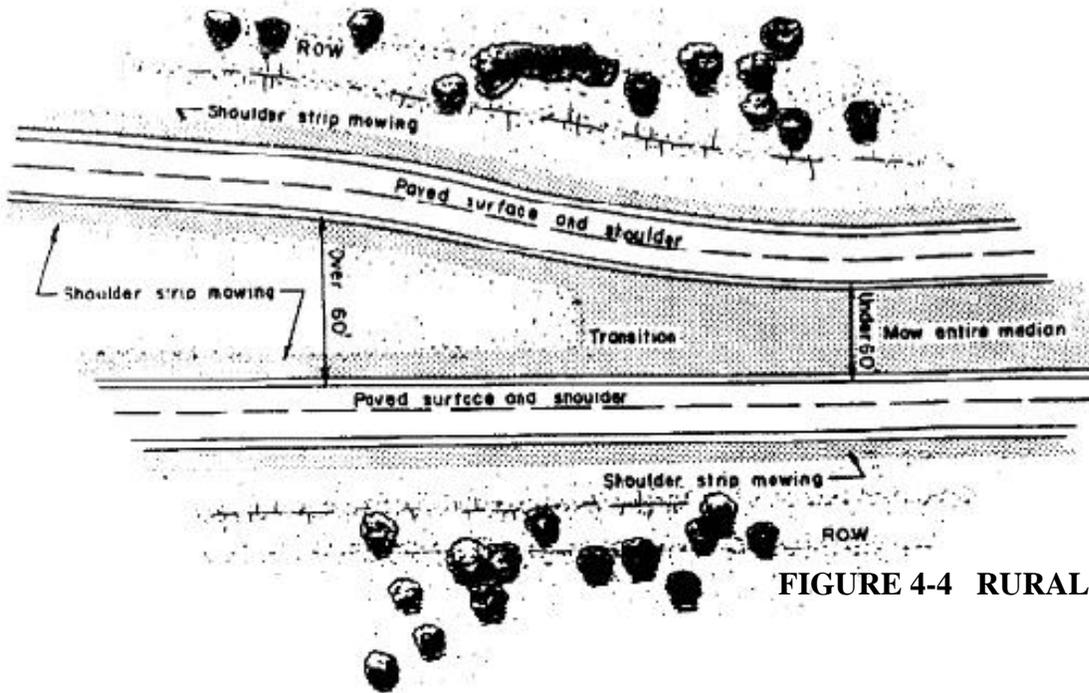


FIGURE 4-4 RURAL MEDIANS

THE ENTIRE AREA OF MEDIANS, WHICH ARE LESS THAN 60 FEET IN WIDTH, SHOULD BE MOWED. ON MEDIANS, WHICH ARE MORE THAN 60 FEET IN WIDTH, ONLY TRANSITION AND SHOULDER STRIP MOWING SHOULD BE PERFORMED. THIS APPLIES TO ALL DIVIDED HIGHWAYS, INCLUDING STATE, U.S. AND INTERSTATE HIGHWAYS. THE 60 FEET SHALL BE MEASURED FROM THE EDGE OF THE TRAFFIC LANE.

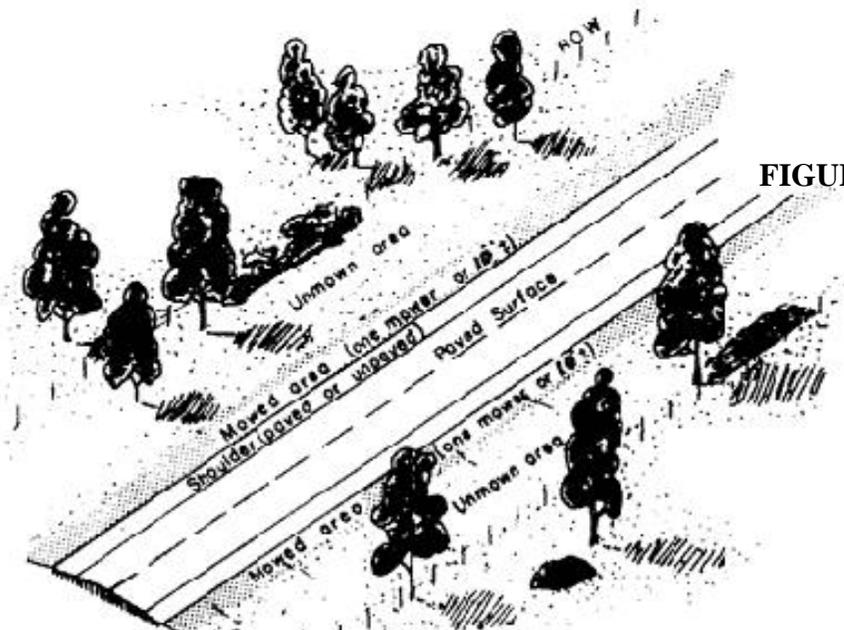


FIGURE 4-5 SHOULDERSTRIP MOWING

SHOULDER STRIP MOWING IS DEFINED AS THE AREA INCLUDING THE SHOULDER PLUS ONE MOWER WIDTH OR APPROXIMATELY 10 FEET DOWN THE SHOULDER SLOPE. THIS AREA SHOULD BE MOWED AS OFTEN AS NECESSARY FOR REASONABLE SAFETY AND CONFORMANCE WITH HEIGHT STANDARDS.

MOWING (POLICY)

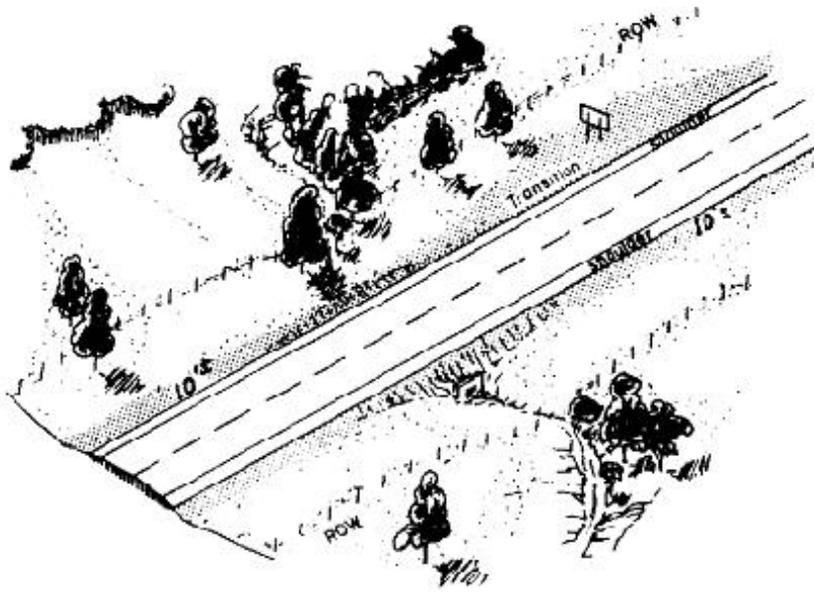


FIGURE 4-6 TRANSITION MOWING

TRANSITION OR CONTOUR MOWING SHOULD BE PERFORMED TO PROVIDE ADEQUATE SIGHT DISTANCE FOR SIGNS OR FIXTURES NEAR THE EDGE OF THE SHOULDER. ABRUPT CHANGES IN THE MOWING PATTERNS SHOULD BE AVOIDED TO LESSEN VISUAL IMPACT. AREAS OF TRANSITION MOWING MAY INCLUDE CULVERT ENDS, RESIDENTIAL AREAS, CEMETERIES OR OTHER LOCATIONS WHERE MOWING WIDTH VARIES FROM THE NORMAL SHOULDER STRIP WIDTH.

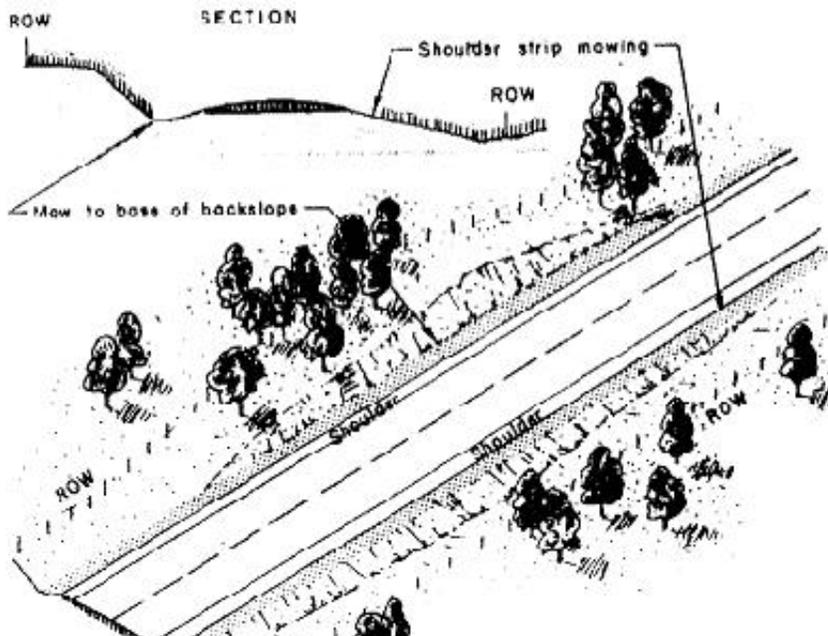


FIGURE 4-7 CUT AND FILL SECTIONS

ON BACKSLOPES OR FILLSLOPES WITH A VERTICAL HEIGHT GREATER THAN FIVE (5) FEET ABOVE OR BELOW THE ROADWAY AND SLOPES 3:1 OR STEEPER, MOW ONLY ONE (1) CUT UP OR DOWN THE SLOPE IF NECESSARY FOR DRAINAGE.

MOWING (POLICY)

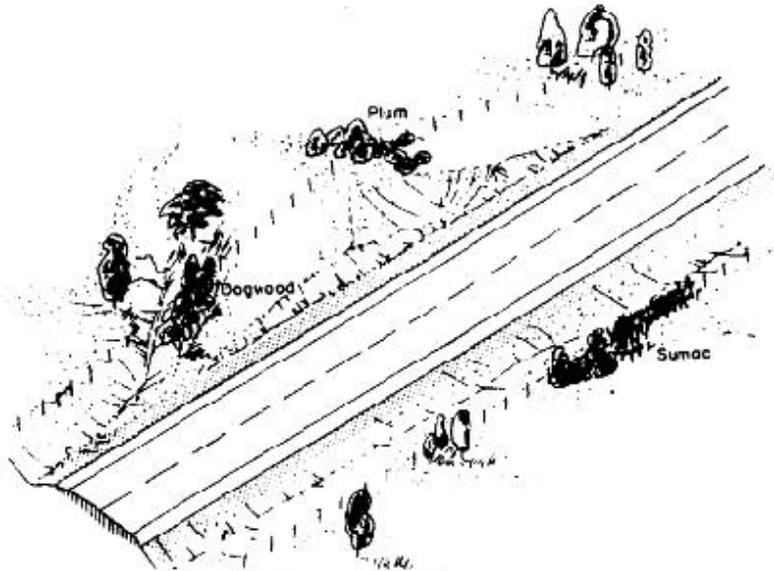


FIGURE 4-8 SPECIAL AREAS

BRIDGE BERMS AND OTHER SLOPES WITH CROWN VETCH, HONEYSUCKLE OR OTHER GROUND COVER SHALL NOT BE MOWED OR DISTURBED. WILDFLOWER PLANTINGS SHALL NOT BE MOWED OR DISTURBED (THEY MAY BE MOWED IN LATE FALL TO REMOVE DEAD TOPS AFTER GROWTH HAS CEASED). AREAS OF NATIVE SUMAC, SAND PLUM, GREY DOGWOOD, CHOKE CHERRY, ETC., SHALL NOT BE MOWED. (THIS VEGETATION PROVIDES WILDLIFE HABITAT THROUGHOUT THE YEAR.) TRANSITION MOWING SHALL BE PERFORMED TO AVOID ABRUPT CHANGES IN THE MOWING PATTERNS AND TO PRESENT A PLEASING VISUAL IMPACT.

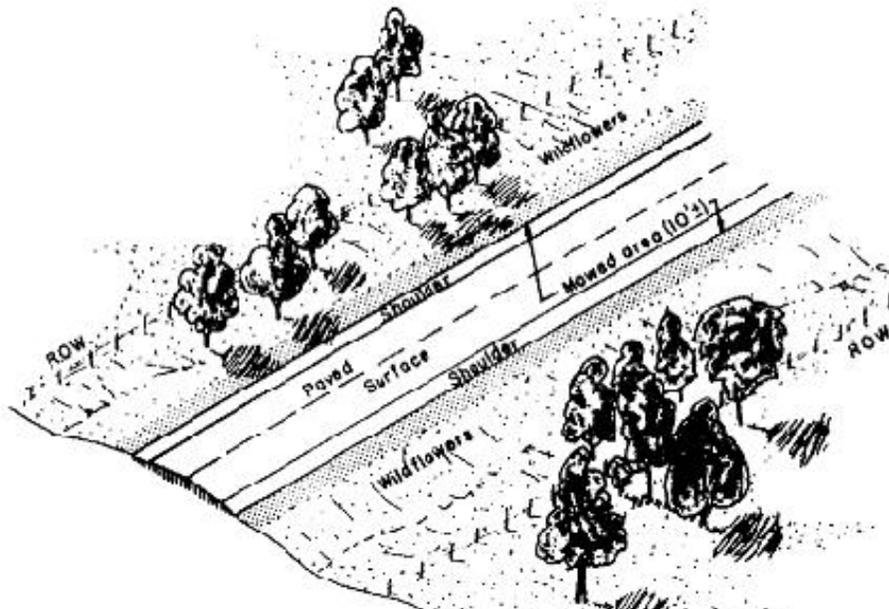


FIGURE 4-9 WILDFLOWER PRESERVATION

IN AREAS WHERE FULL-WIDTH MOWING WILL BE NECESSARY SUCH AS URBAN AREAS, IT SHALL BE DEFERRED UNTIL WILDFLOWERS HAVE MATURED SEEDS. DURING THE PERIOD OF WILDFLOWER PRESERVATION, MOWING SHOULD BE LIMITED TO A SINGLE PASS OF A SINGLE ROTARY OR SICKLE MOWER ADJACENT TO THE PAVEMENT FOR SAFETY. WILDFLOWER AREAS SHOULD HAVE ONE FULL-WIDTH MOWING IN THE FALL.

MOWING (POLICY)

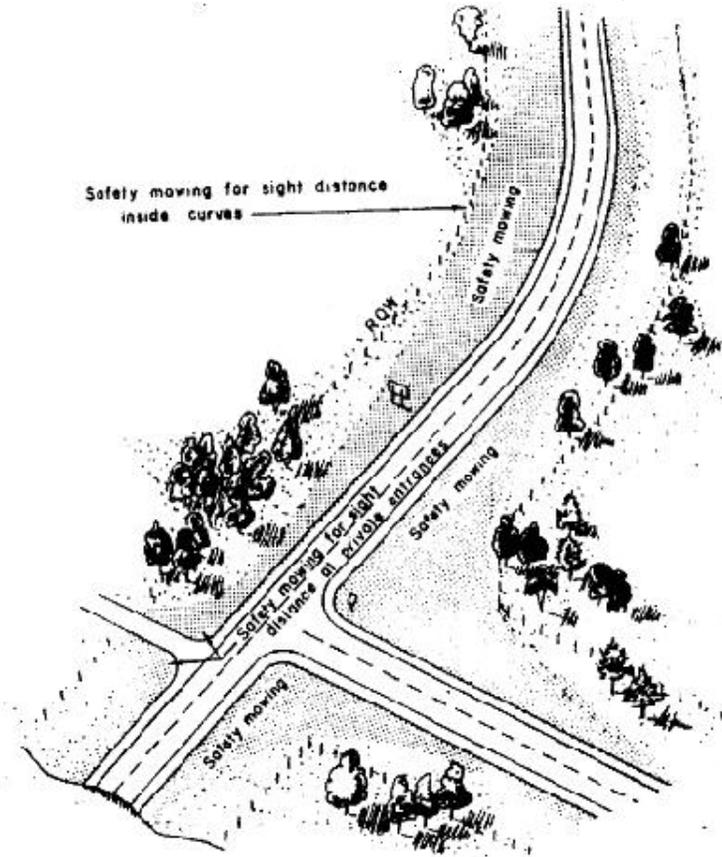


FIGURE 4-10 SAFETY MOWING

SAFETY MOWING WILL BE PERFORMED WHEN AND WHERE NECESSARY TO MAINTAIN SIGHT DISTANCES; SUCH AS INSIDE CURVES, OFF RAMPS, ON RAMPS, INTERSECTIONS, AND PRIVATE ENTRANCES

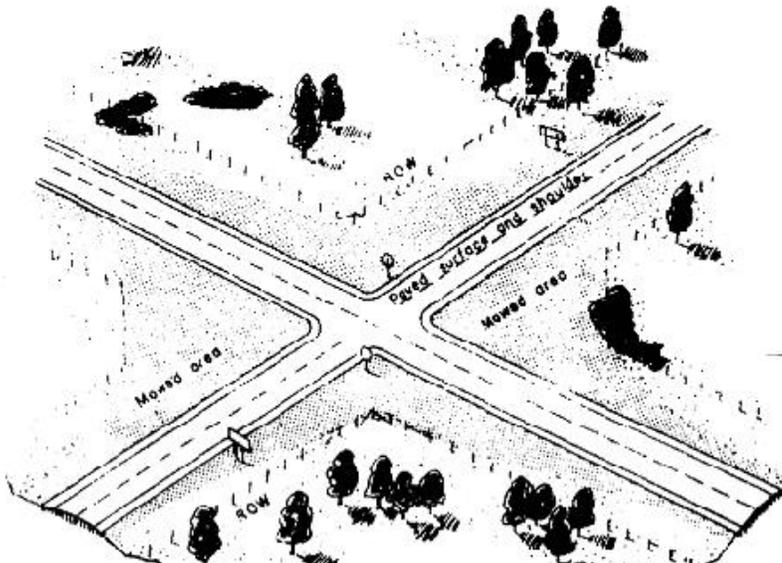


FIG. 4-11 RURAL INTERSECTIONS

MOWING SHOULD BE PERFORMED OVER RURAL INTERSECTION OR INTERCHANGE AREAS AS NECESSARY TO PROVIDE ADEQUATE SIGHT DISTANCES

MOWING (POLICY)

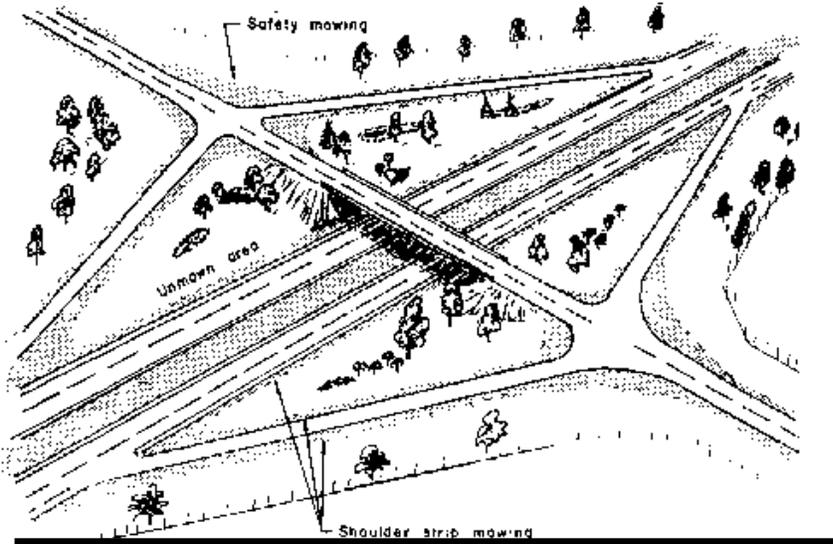


FIGURE 4-12 RURAL INTERCHANGE

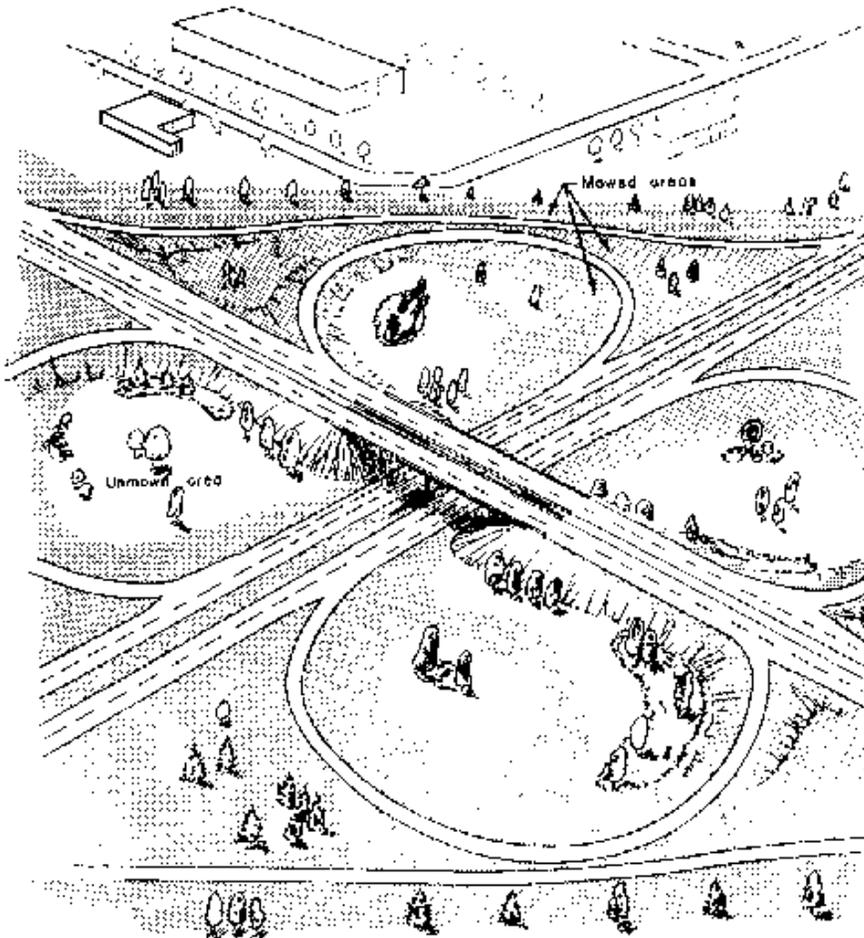


FIGURE 4-13 URBAN INTERCHANGE

LARGE URBAN INTERCHANGE AREAS MAY BE DESIGNED FOR LIMITED MOWING. THE SHOULDER, SHOULDER SLOPE AND PORTIONS OF THE INTERCHANGE QUADRANTS MAY BE MOWED. THE QUADRANT MOWING WILL BE DONE ON CONTOURS TO ESTABLISH A PATTERN COMPLIMENTARY TO THE SITE. DEVELOPMENT OF WOODY SPECIES IN THESE AREAS SHALL BE ENCOURAGED.

4.43 – SAFETY

Operators should be made aware that Roadside Mowing has resulted in accidental deaths and injuries.

Use Flashing or Revolving Lights when operating a tractor on, or adjacent to the travelway. Use your headlights if available.

Wear your seatbelt.

Be Alert for Holes or Soft Spots which may cause the tractor to roll when operating on slopes.

Mow in such a manner that cuttings and debris are ejected away from the travelway, when practical. Mowers may be operated against the direction of traffic when necessary to accomplish this.

Keep red top mower markers in good condition. Use higher markers as needed for high surrounding grasses or plant.

Study the following applicable rules and guidelines in the **KDOT SAFETY MANUAL**.

1. Chap. 6, Sect. 3, Tractors
2. Chap. 7, Sect. 4, Slow-Moving Vehicle Emblem
3. Chap. 7, Sect. 5, Warning Lights
4. Chap. 8, Sect. 1, Roadside Mowing

4.44 – HAYING

Harvesting of hay may be permitted along the right-of-way. The ***Adjacent Landowner*** will be given first consideration until March 31 of any given year.

Permits will be required for harvesting hay on the ROW in accordance with Sect. 11.20 “Highway Permit Agreements”.

Complete and process Form No. 304-A upon acceptance of the project.

Specific requirements and guidelines are listed on ***Form No. 317*** “Harvesting Hay on Highway ROW”.

Noxious Weeds are not to be baled or removed from the ROW.

**- SECTION 4.5-
SPRAYING**

4.51- INSTRUCTIONS

All spraying must be accomplished under the general direction of a Certified Sprayer.

Appropriate care should be taken when spraying insecticides and herbicides.

The Area and/or District personnel shall recommend the best procedure for insect and disease control on roadside plantings.

Notify the District Office if insect disease damage to plants is suspected.

Herbicide spray application must be accomplished in a manner that will prevent the chemical residue from harming trees and shrubs.

Personnel in spraying operations should be reasonably knowledgeable of the materials, hazards, methods and purpose of the particular operation with which they are involved.

The *Equipment*, including hoses and spray wands or guns, should be **clean** and checked for safe and proper operation prior to beginning work.

Pesticides must be measured accurately to assure correct rate of use.

Speed of travel, together with nozzle output should be calibrated to attain desired rate of application. The walking speed of an average man is about three miles/hour. Nozzle output should be calibrated at least twice each day. (See Figure 4-14 "Travel Speeds for Application of Chemicals").

{ROADSIDE AND DRAINAGE}

INSERT TRAVEL SPEEDS FOR APPLICATION OF CHEMICALS

4.52 – SAFETY

Safety Rules for the use of Pesticides are as follows:

- A. Review the Material Safety Data Sheet (MSDS) for each chemical being used and follow the safety requirements.
- B. Blow out clogged sprayer lines & nozzle tips, and siphon pesticides from containers in a manner that will avoid body contact.
- C. It is desirable to wear protective clothing, especially when handling chemicals in the concentrate form.
- D. Smoking is prohibited when handling pesticides.
- E. Spraying or dusting is authorized only on calm days to prevent drift.
- F. Pesticides are not to be applied in areas near wells, to avoid contamination of drinking water.
- G. Mix pesticides in a well-ventilated area, preferably outdoors.
- H. Wettable powders should be premixed into a slurry form before adding to the main spray tank.
- I. Avoid prolonged contact with the pesticides.
- J. Wash hands thoroughly after handling a pesticide.
- K. Dispose of used containers as directed by the manufacturer and/or as per environmental regulations.

4.53 – CHEMICAL SPRAYING

Spraying with selected chemicals is the most effective method of controlling noxious weeds. The following weeds are classified as Kansas Noxious Weeds:

| | |
|--------------------------|------------------|
| Johnsongrass | Field Bindweed |
| Musk Thistle | Bur Ragweed |
| Canada Thistle | Hoary Cress |
| Sericea Lespedeza | Leafy Spurge |
| Quackgrass | Russian Knapweed |
| Indian Rush Pea (Pignut) | Kudzu |

Multi-flora Rose & Bull Thistle may be designated noxious weeds on a county option.

The use of herbicides is limited. All chemical spraying operations by KDOT forces to control vegetation should be under direction of a certified sprayer.

Typical examples of locations where spraying is effective include:

- A. Channels, culverts or bridge ends.
- B. Guard fence and sign posts.
- C. Areas “Chemical Mowing” is desired to suppress vegetation growth.

4.54 – NOXIOUS WEED – CONTRACT SPRAYING

Most chemical spraying operations are performed by counties or individuals through a contractual arrangement using DOT Form No. 322, “Agreement to Treat Noxious Weeds” or DOT Form No. 325 “Contract to Treat Noxious Weeds”.

Chemical Spraying Contractors and Operations must have Dept. of Agriculture approval.

Accurate records should be kept by the Contractor or person on the job in charge of the spraying operation, using either DOT Form 322A or a suitable county or contractor-supplied form. The following data should be included:

- A. Purpose of treatment.
- B. Actual Location (include County, Route, Reference Point to 1/10 mi., application width, Description of Area as shoulder, median, etc.)
- C. Name of chemical(s) used (Include percent of active ingredient and, if stated on label the formulation, i.e.: “W”, “E.C.”, etc.)
- D. Rate of chemical(s) per acre.

{ROADSIDE AND DRAINAGE}

- E. Total gallons sprayed.
- F. Estimated acres treated.
- G. Actual time of spraying.
- H. The approximate wind speed and direction (every 2 hours)
- I. Approximate temperature (every 2 hours)
- J. Personnel and equipment involved.
- K. Applicator's license number
- L. Remarks - (clarify any unusual circumstances or happenings related to the use of chemicals).

4.55 – BRUSH KILLER MIX

There are several chemicals available for the control of brush. A mixture of the following ingredients has proven to be *an Effective Brush Killer*.

| | |
|----------|--------------------|
| 100 gal. | water |
| 4 oz. | sodium gluconate |
| 2 gal. | krenite |
| 1 qt. | non-phytotoxic oil |

Non-phytotoxic oil is optional.

Add sodium gluconate to water prior to adding the krenite.

This brush killer is suitable for most uses and should be applied to the foliage in *Late August*. The treated brush is not to be cut through the winter or the next growing season.

**- SECTION 4.60 -
EROSION CONTROL**

4.61 – NEW GRADED SLOPES

Preventive maintenance is an essential part of erosion control.

- A. *Keep equipment off slopes if sliding or rutting occurs.*

{ROADSIDE AND DRAINAGE}

B. Reseed, mulch, and fertilize as necessary to obtain a complete ground cover.

The repair of erosion problems may be accomplished by the use of hay mulch or excelsior blankets when necessary.

Erosion will normally require some grading before reseeding operations can begin.

4.62 – OLD ESTABLISHED SLOPES

Backfill with successive (compacted) layers of soil until the original grade is attained when repairing deep washes.

Additional backfill may be required annually to stabilize the slopes.

Reseed or sod, fertilize, and mulch as necessary.

All seeding operations shall conform to Section 903 of the Standard Specification.

4.63 – GROUND COVER

Ground cover is necessary for a good appearance and for the control of wind and water erosion.

The most common ground covers include all native grasses, honeysuckle, crown vetch, etc.

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- Section 5.10 -
BRIDGES GENERAL

5.11 – STRUCTURE TYPES

Various *Bridge Types* are as shown in Figures 5-1 through 5-4.

Standard *Bridge Nomenclature* is shown in Figure 5-5.

Impact Attenuators, Luminaire Supports and Sign Support Structures are shown in Figure 5-6.

5.12 – IDENTIFICATION

Structures over 20 feet in length are bridges.

- A. The length is measured parallel to the centerline of the highway.
- B. The length of reinforced concrete boxes is measured as shown in figure 5-7.
- C. The length of contiguous pipes is measured as shown in Figure 5-7.

Pedestrian overpasses are bridges.

Reference to a specific bridge, culvert, impact attenuator, sign support structure, or luminaire support structure should include the following:

- A. ***Route and County Number***
- B. ***The State Reference Point Number*** is the number on the reference post that is west or south of the bridge plus the distance from that post to the center of the bridge.
- C. ***Bridge Serial Numbers*** are unique in each county and new bridges are assigned new numbers. They may be obtained as follows:
 - (1) Serial number plate located at the bridge as shown in Fig. 5-8.
 - (2) Bridge location maps & listings.
 - (3) Area Bridge Maint. Form #307.

{BRIDGES}

(4) The Bureau of Design, Bridge Management Section bridge log.

Impact Attenuators, Sign Support Structures (overhead and cantilever sign trusses) and *Luminaire Support Structures* (tower lights) are assigned *Serial Numbers*, which are unique on a statewide basis.

D. *Structure Types* are BR = bridge, CV =culvert, IA =impact attenuator, ST =sign truss and TL =tower light.

5.13 – PERMITS

For information on special permits for movement of *Oversize or Overweight Loads*, see Section 11.30.

For *Utility Attachment to Structures*, use DOT Form No. 310. (see Sections 11.10, 11.20, and the current Utility Accommodation Policy)

{BRIDGES}



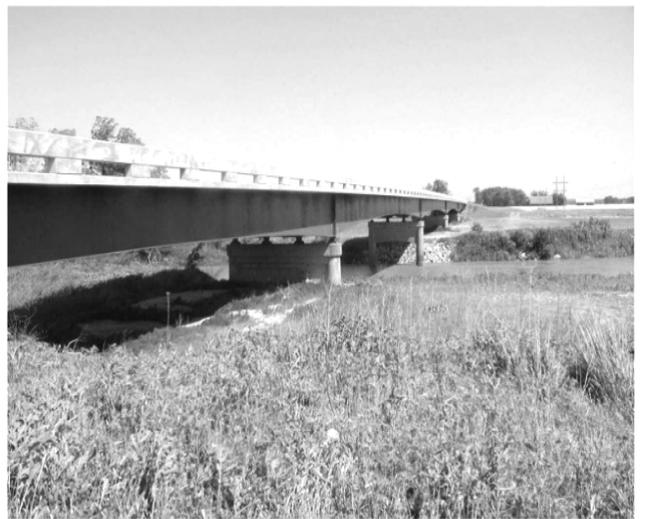
Post-tension Box Girder Continuous (XBGC)



Weathering Steel Box Girder Continuous (WBGC)



Weathering Steel Welded Plate Girder Continuous (WWGC)



Steel Welded Plate Girder Haunched (SWG H)

FIGURE 5-1 GENERAL BRIDGE TYPES

{BRIDGES}



Steel Beam Continuous (SBMC)



Steel Beam Simple (SBMS)



Reinforced Concrete Illinois Bulletin Slab
Continuous (RISC)



Reinforced Concrete Deck Girder Simple
(RDGS)

FIGURE 5-2 GENERAL BRIDGE TYPES

{BRIDGES}



Reinforced Concrete Through Arch Fixed (RTAF)



Steel Through Arch Tied (STAT)



Steel Deck Truss Continuous and Haunched (SDTH)



Steel High Truss Continuous (SHTC)

FIGURE 5-3 GENERAL BRIDGE TYPES

{BRIDGES}



Reinforced Concrete Deck Girder Haunched (RDGH)



Reinforced Concrete Slab Haunched (RCSH)



Reinforced Concrete Box Girder Continuous (RBGC)



RBGC view inside

FIGURE 5-4 GENERAL BRIDGE TYPES

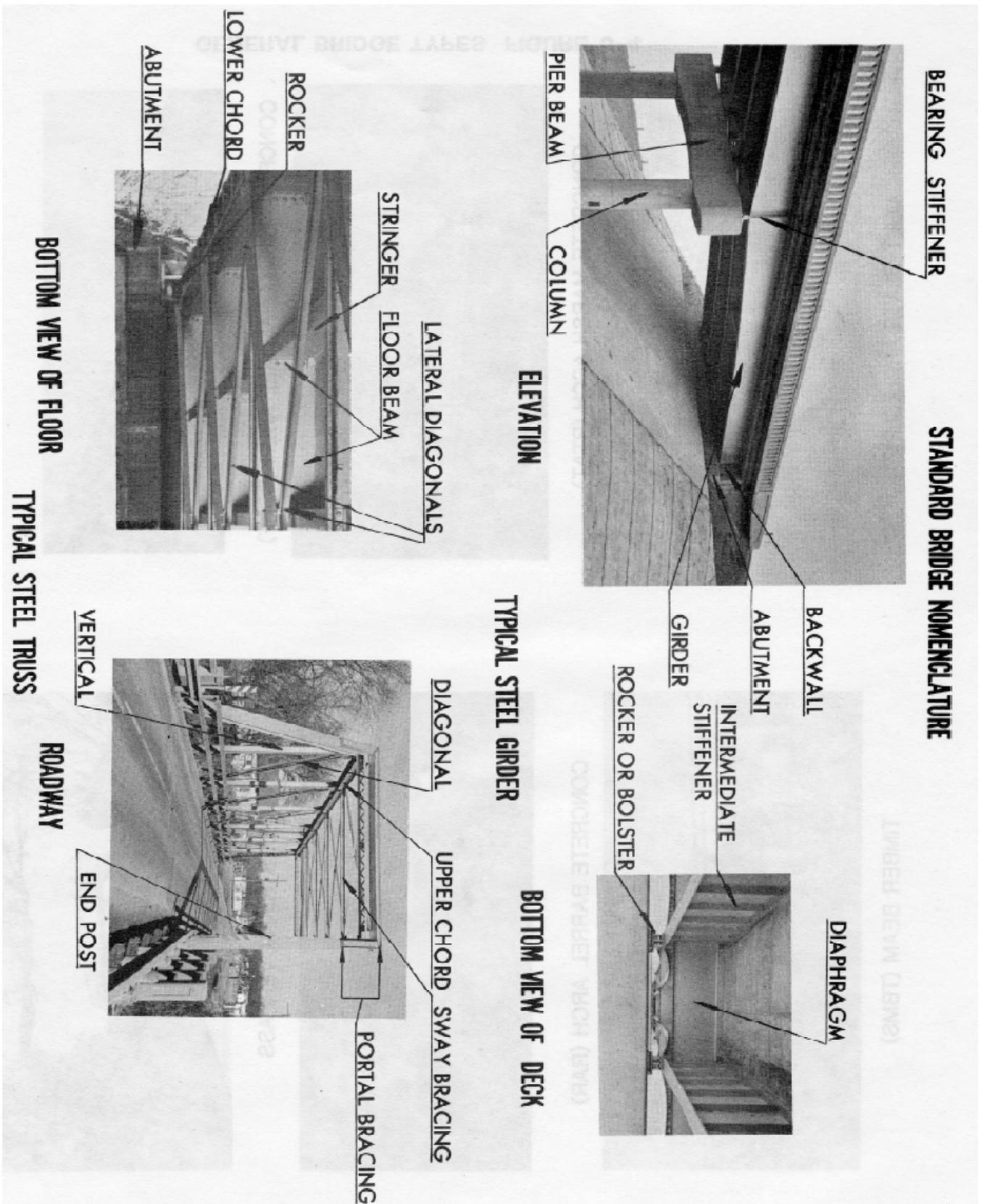


FIGURE 5-5 STANDARD BRIDGE NOMENCLATURE

{BRIDGES}



Reinforced Concrete Box Culvert (RCB)



Reinforced Concrete Rigid Frame Box (RFB)



Corrugated Metal Arch (CAR)



Reinforced Concrete Arch (RAR)

FIGURE 5-6 TYPICAL STRUCTURES

{BRIDGES}



Impact Attenuator - Great



Sign Support - Overhead

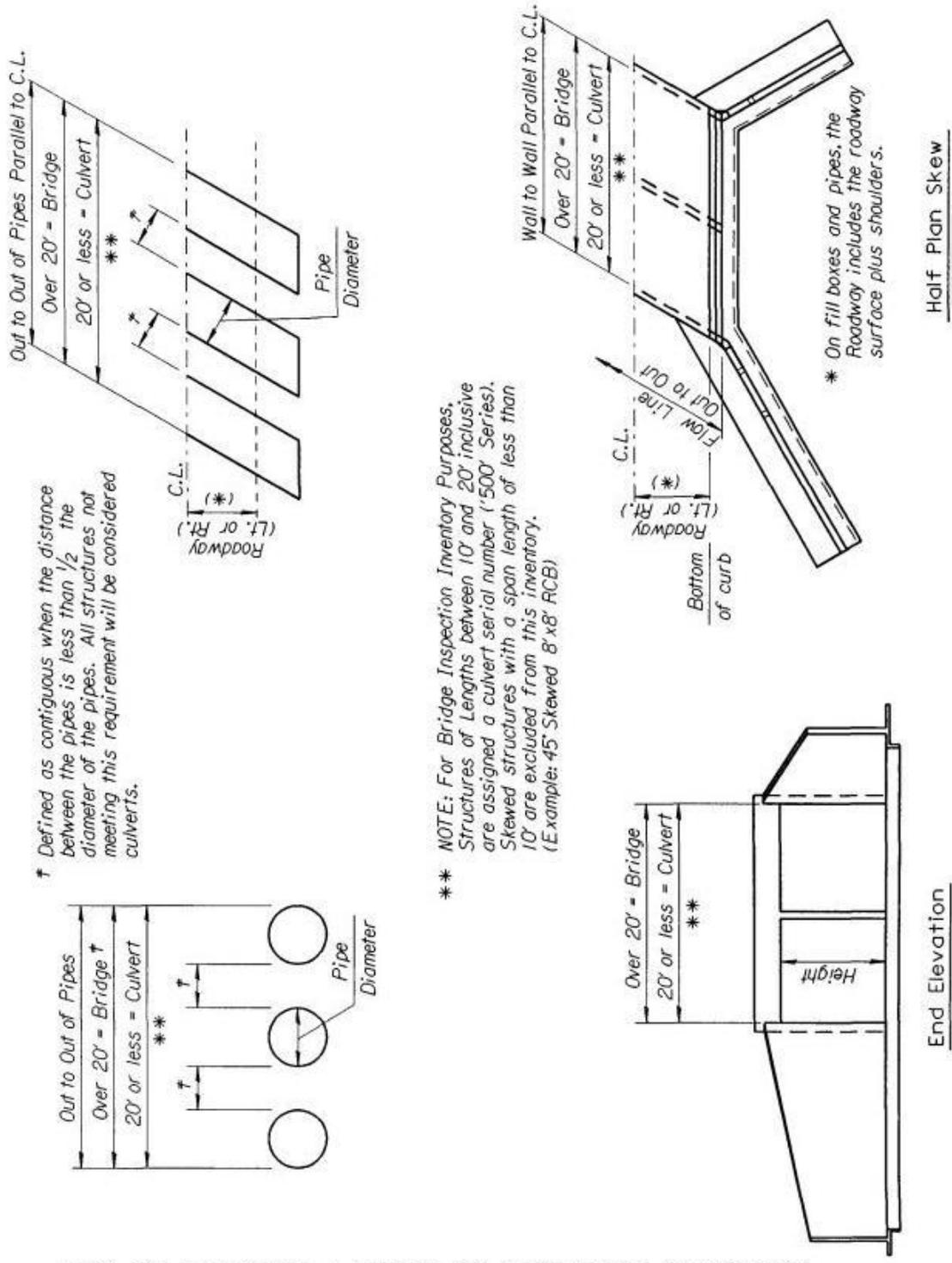


Impact Attenuator - Inertial Barrel



Sign Support - Cantilever

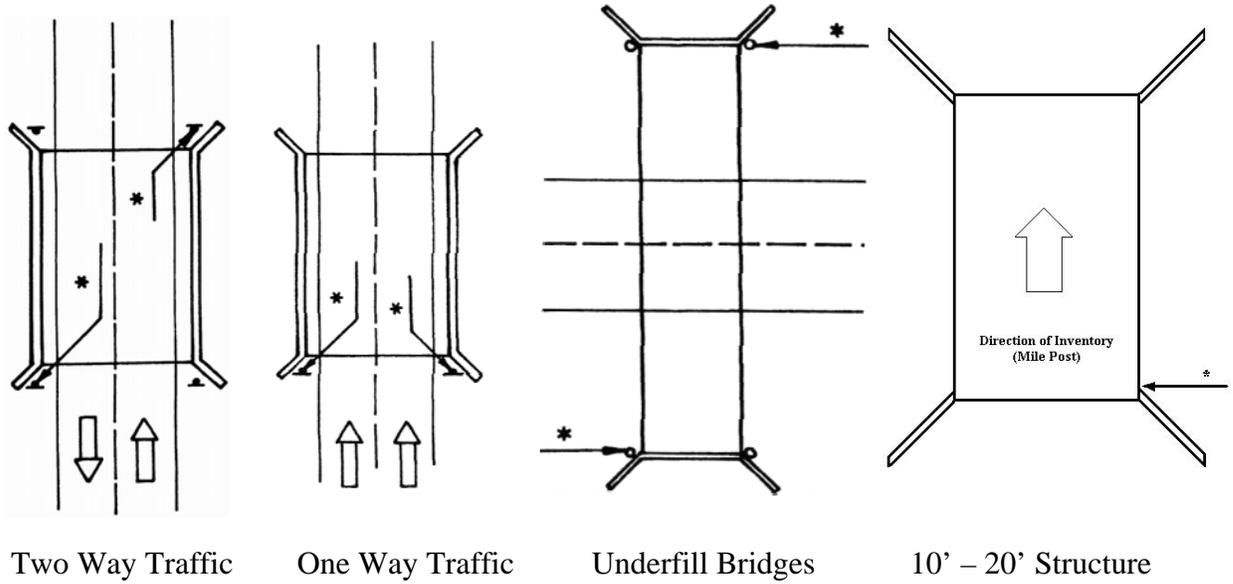
FIGURE 5-7 TYPICAL STRUCTURES



HOW TO DETERMINE A BRIDGE OR '500' SERIES STRUCTURE

Figure 5-8

{BRIDGES}

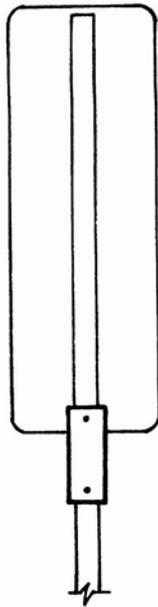


Two Way Traffic

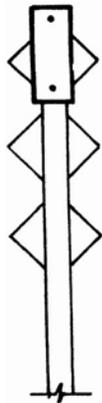
One Way Traffic

Underfill Bridges

10' - 20' Structure



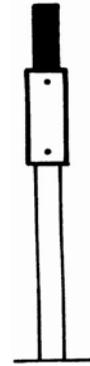
Type III Object Marker



Diamond

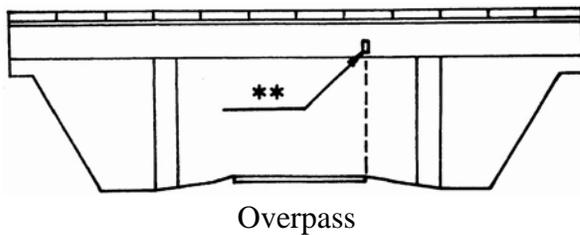


Button



Mowing Marker

Type II Object Markers



Overpass

* Serial Number Plate

** Serial Number Plate
Conformable Sheeting Mounted
6" Above Bottom of Superstructure

Figure 5-9 Typical Locations for Bridge Serial Numbers

5.14 – INSPECTION PROCEDURES

The Bureau of Design, Bridge Management Section establishes the periodic bridge inspection program to meet the requirements set out in the National Bridge Inspection Standards.

An ***In-Depth Bridge Inspection*** is required for all new or rebuilt bridges and 500 series structures. All contract repair work on bridges and 500 series culverts also requires a new in-depth report.

In-depth inspections must be completed within 90 days after the Notice of Acceptance is issued or the structure is open to traffic, whichever comes first.

Bridge and structure inspections are to be performed by the Bureau of Design, Bridge Management Section or District staff. See the Bridge Inspection Manual for details.

Supplementary or Routine Bridge Inspection Reports are required at the following intervals to update the In-depth reports:

1 Year Inspections (Annual) - are required when one of the following conditions is found:

1. Problem Structures (Cribbed, Pin & Hanger, Etc.)
2. All Posted Structures.
3. All Fracture Critical Structures.
4. Open Span Structures and with at least one of the following Condition Rating: Deck, Superstructure or Substructure ≤ 4 .
5. All Culvert Structures with a condition rating ≤ 4 .
6. All Culvert Structures with a Channel rating ≤ 4 .
7. All Structurally Deficient structures.

Note: All of the above conditions apply to both bridge length and “500 Series” structures.

2-Year Inspections - are required when one of the following conditions is found:

1. All Remaining Bridge Length Structures.
2. All “500 Series” structures with at least one of the following Condition Ratings: Deck, Superstructure, Substructure, or a Culvert Rating of 5. Channel Rating ≤ 5 .

4-Year Inspections:

1. All Remaining “500 Series” Structures (structures between 10 feet and 20 feet, inclusive.)

{BRIDGES}

The ***Damage Inspection*** is an unscheduled inspection to assess structural damage resulting from environmental or man-inflicted causes. The scope of the inspection must be sufficient to determine the need for emergency load restriction or closure of the bridge to traffic. The amount of effort expended on this type of inspection will vary significantly depending upon the extent of the damage.

A ***Special Inspection*** may be one of several types. ***Fracture Critical, Pin and Hanger,*** and ***Underwater*** are all special inspection types. The interval and magnitude of special inspections varies with different design features and deterioration of the structure.

A systematic and regular inspection of bridges is the preliminary step for programmed preventive bridge maintenance. All completed field inspection reports are to be sent to the office of The Bridge Inspection Unit for review and completion of necessary maintenance recommendations.

A ***Letter of Summary*** with the following attachments must accompany each review:

A. ***Area Bridge Maintenance Form #307:***

This form provides a list (in order of route-reference point) of each bridge that was inspected as well as the recommended maintenance that is desired and in most cases can be performed by Area personnel (some assistance by the District may be required). Each Area is responsible for listing each completed maintenance action on DOT Form 303, "Area Weekly Report" so that the Bridge Management section can track these activities.

B. ***Special Summary Lists A, B, C, & D:***

"A" List includes structures that are programmed or recommended for contract repair or replacement.

The "A" List will contain only those structures, which are programmed or recommended for contract work. Structures, which are BR or BH eligible and in good condition will not be included. This list will be extremely helpful for each Area when making their list of Bridge Set-Aside repair candidates.

"B" List includes structures that require painting. This will inform each Area of their bridges, which need contract paint. All structures with 10 ton of steel or less are considered too small for contract painting. Therefore, they will be the District's a responsibility.

"C" List includes locations, which require signing corrections. This lists structures, which do not meet minimum signing requirements as set by the current version of the Highway Sign Manual.

{BRIDGES}

“D” List includes the bridges and culverts, which require more than routine maintenance. This list contains the structures with condition ratings less than 7 for the deck, superstructure or substructure. Refer to the inspection report for actual condition and recommended maintenance.

Representatives from the states of Missouri and Kansas make an annual joint inspection of the bridges which cross the Missouri River.

5.15 – SIGNING

Load Posting for bridges will be recommended by the Bureau of Design and transmitted to the District. See the current version of the Highway Sign Manual for typical signing for bridge weight limits.

Bridges with a **Minimum Overhead or an Under Clearance** of less than 15 feet 9 inches are signed with W12-2 (symbol) and W12-2p (overhead) LOW CLEARANCE signs. The Bureau of Design, Bridge Management Section, will provide minimum vertical clearance for bridges.

Bridges having a clear **Roadway Width of 20 feet to Less than 24 feet** should be posted with a W5-2 NARROW BRIDGE sign.

Bridges having a **Clear Roadway Width of Less Than 20 feet** should be posted with a W5-3 ONE LANE BRIDGE sign.

Changes in Clearances either vertical or horizontal should be reported to the Bureau of Design, Bridge Management Section.

For **Signing & Delineation** at bridges, refer to the current version of the Highway Sign Manual.

For **Paint Striping through Bridges**, see the current version of the Highway Sign Manual.

Stream Name Signs should be erected at bridges having lengths over 200 feet and at bridges with historical significance. Refer to the current version of the Highway Sign Manual for the location of stream name signs.

The Bureau of Design will provide **Bridge Serial Numbers** for new or replacement bridges upon request.

**- SECTION 5.20 -
BRIDGE DAMAGE**

This Section also includes damage to *Impact Attenuators, Sign Trusses, Tower Lights,* and *Other Structures*. If in doubt regarding the extent of any damage to a structure, contact the District Office for guidance.

5.21 – TYPES

High Water — Check for scour, settlement, drift or other obstruction of the waterway.

Vehicle Collision — Check for misaligned or broken members and/or connection failures.

Fire — Check timber structures for depth of char, steel structures for excess deflection, and concrete structures for spalling.

5.22 – REPORTING

Report all Structural Damage to the District Office as soon as practicable. The District shall then notify the Chief of Construction/Maintenance and the Bureau of Design, Bridge Management Section.

Crib or Close the Bridge if any doubt exists as to the safe Load Capacity. The District Office should arrange for a temporary detour when needed.

The Bureau of Design will initiate DOT Form No. 883, “Construction Project Authorization” if emergency contract repairs are needed.

Obtain a police report if damage is caused by a vehicle or vandalism.

Documentation and color photos must be sent to Bureau of Design, Bridge Management Section within two weeks of cribbing or other repair work of a critical nature.

Accurate Records of all repair costs must be maintained. Report the repair of all minor and major damage in detail using DOT Form No. 1612 Property Damage Report and DOT Form No. 303 Area Weekly Report. (See Section 1.73)

Use bridge identification as outlined in Section 5.12, for reporting damages.

5.23 – INSPECTION AFTER DAMAGE

Channel and *Berms* should be cleared of drift and debris.

{BRIDGES}

- A. Stream flow should be through the center of channel.
- B. Scour may have undermined footings, piles, and toe walls of riprap.
- C. Look for erosion of berms, roadway shoulders, roadway slopes, and around wings.

The **Substructure** (abutments, piers and piles) transmits loads from the superstructure to the ground.

- A. Stream scour may have caused settlement or lateral movement, note any element that appears out of plumb.
- B. Pile bents should be inspected for damage to the piles and diagonal bracing.
- C. Check for deterioration of all substructure elements.

The **Superstructure** is made up of the main load carrying members. (girders, stringers and floor beams)

- A. The **Girders** must be inspected thoroughly.
 - (1) Timber Girders may be cracked, broken, or charred by fire.
 - (2) Concrete Girders are subject to deterioration, spalling, scaling, and cracking. Note all cracks larger than hairline.
 - (3) Steel Girders may be punctured or buckled. Cracks may develop around rivets or from welds. Note condition of paint; peeling may indicate the location of an area with excessive bending.
- B. Inspect all **Bearing Devices**. Check rollers, rockers, and bearing shoes for proper position.
- C. General alignment of **Steel Trusses** will indicate whether end posts, portal bracing, bottom chords or top chords are buckled or out of line.
 - (1) Inspect truss members of pin connected trusses for small kinks and unequal tension in eyebar pairs.
 - (2) Inspect all connections.

Decks Should be Inspected Thoroughly.

- A. All bolted connections and deck planks shall be securely fastened.

{BRIDGES}

- B. Inspect for broken welds between the stringers and steel grids or planks.
- C. The concrete may be cracked or spalled.

Additional Items to be Inspected:

- A. Curb and handrail alignment may reveal settlement or lateral movement of the bridge.
- B. Observe the bridge during passage of a heavy load. Note any excessive deflection, bowing, or buckling of members.

Damaged Impact Attenuators require prompt replacement to promote uninterrupted service.

- A. Inventory all damaged parts.
- B. Order required replacement parts as soon as practical. See Section 1.32 of this manual for information on use of DOT Form 455 “Purchase Authority or Purchase Request”.

Check Overhead Sign Trusses for misalignment of diagonal, vertical, or horizontal members.

- A. Inspect all connections.
- B. Anchor bolts in footings are to be secure.
- C. Signs are to be mounted securely.
- D. Sign lighting should be operating correctly.

5.24 – REPAIR

Contact the District Office for guidance in determining the extent of damage. Repair of ***Minor Structural Damage*** will be done by maintenance forces. All repairs should conform to original plans, unless otherwise authorized by the Bureau of Design.

Report all minor repairs on DOT Form 303 “Area Weekly Report”.

Repair of ***Major Structural Damage*** will usually be done by contract. The Bureau of Design will assist the District in assessing damage and planning repairs.

An In-depth bridge inspection report, with photos of the repairs, is required following completion of major repairs.

**- SECTION 5.30 -
BRIDGE MAINTENANCE**

5.31 – PURPOSE

The primary concern is to promote the safe and uninterrupted flow of traffic.

Preventive maintenance is performed to protect the original investment with minimum cost.

5.32 – RESPONSIBILITY

Structures built jointly or by other agencies such as the Kansas Turnpike Authority, railroads, Bureau of Reclamation, or U.S. Army Corps of Engineers or adjacent states are maintained according to existing maintenance agreements.

The *Area Maintenance Personnel* are responsible for maintenance of items, which do not require structural repair.

- A. Crews working on structures should inspect, clean, and report on the condition of the bridge.
- B. Subarea crews will make repairs within their capability. District Bridge Maintenance Crews will be used for larger projects.

Utilities are maintained by the owner. Notify the owner of any required maintenance.

Bridge lighting is ordinarily maintained by agreement or contract. Report outage, vandalism, etc., to the proper authority as soon as practicable.

The *Major Bridge Repairs* will be contracted.

- A. Bridges requiring contract work will be assigned a priority number by Program Management and listed in the KDOT Improvement Program.
- B. These projects are executed by contract and administered by KDOT personnel.

5.33 – CHANNEL AND BERM

Waterways should be kept clean within the right-of-way. This includes waterways where easement agreements have been secured.

{BRIDGES}

An *Ideal Waterway* is cleared, shaped, and sodded, to enable complete mowing. (See Sections 4.22, 4.23, 4.24-2a and 4.55)

Corrective action should be taken *After Piling has been Exposed by Scour* around bridge footings. One of the following may be appropriate:

- A. Extend the footings a minimum of 3 feet below bottom of channel when feasible.
- B. Fill scour holes to the stream flowline with rock (grout in place if necessary).

The following steps may be taken to *Obtain Additional Channel Control*.

- A. Spur dikes or jetties should be considered. Obtain a plan from the Bridge Management Section for this type of repair.
- B. Rock riprap should be considered. The Bridge Management Section may recommend riprap for bank protection when appropriate.

Well-maintained *Bridge Berms* are important for protection of approach pavements and bridge abutments.

- A. Water should be drained away from the bridge berms to prevent erosion.
- B. Bridge drains, which are causing berm slope erosion, may be plugged, provided good deck drainage can be maintained.
- C. Berm slopes should be protected with rock, concrete, or fiberglass riprap where erosion persists.
- D. *Bridge Berm Slopes Protected by Concrete Slabs* should be maintained as follows:
 - (1) Fill voids under the concrete slab with flowable mortar, sand, or a mudjack mix. Use gravity flow when feasible.
 - (2) Leave room for movement at columns.
 - (3) Seal or fill cracks in concrete with approved sealant or filler.
 - (4) Seal or fill the joints between berm concrete and abutment back-wall with approved material.
 - (5) Construct mat dikes on the berm slopes under bridge drip grooves to

{BRIDGES}

deflect water down berm slope.

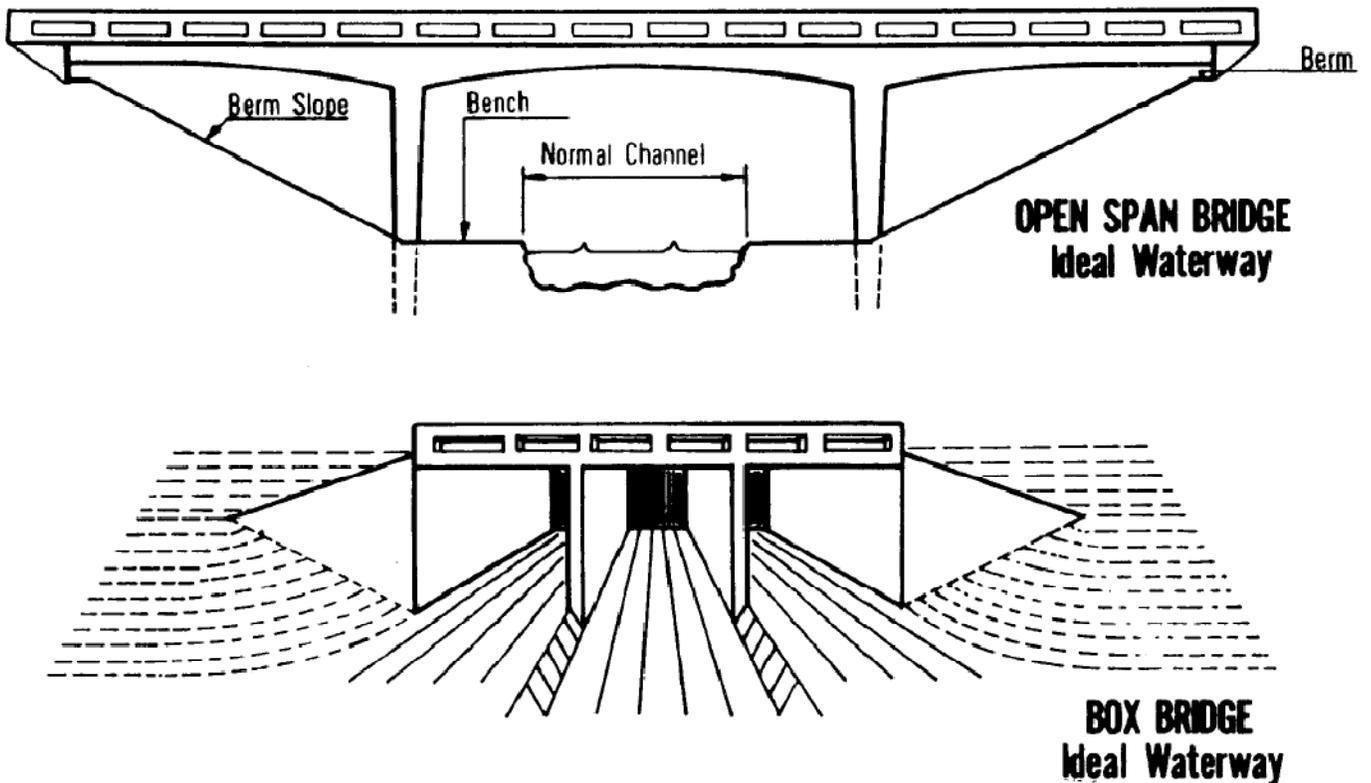
- (6) To prevent erosion along the berm slope edge, extend some fill material a minimum of 6 inches onto the berm concrete.

Box Type Structures should have proper fill around wings for protection of wing and box. A constant flowline slope should be maintained from R/W line to R/W line. Remove any attachment such as cattle gates that may collect debris and obstruct flow of water.

The District is responsible for channel maintenance where permanent channel easements exist. Permission from the property owner is desirable for maintenance of these channels.

The District has no control of stream conditions off right-of-way unless secured by separate easement agreements using DOT Form No. 344, "Agreement for Highway Maintenance Construction Easement".

Plans for major stream control are prepared by the Bureau of Design. Then right-of-way is secured, and a contract is let for the project.



5.34 – SUBSTRUCTURE

The substructure is that portion of the bridge below the bearings, including backwalls.

Timber Structures are subject to damage by rot, fire, and impact.

- A. Replace damaged piling, caps, bulkheads, and bracing as soon as practicable after the damage is reported.
- B. Bolted connections should be tight; caps centered over pile bents and exposed piling tops covered with sheet metal.
- C. Timber pile caps should be anchored to timber piling with metal splice bars.

Steel Pile Bents are subject to damage by corrosion and impact.

- A. Damaged or weakened sections are repaired by replacing, straightening, welding additional metal along the section, or by reinforcing with a concrete collar. Request a plan from the Bridge Management Section for this type of repair.
- B. Where stream scour has occurred or vertical height over 12 feet is without “X” bracing, additional cross bracing will be necessary on steel piling. Request a plan from the Bridge Management Section for this type of repair.
- C. Corrosion is best eliminated by cleaning and painting. All painting should be in accordance with Section 5.36, Bridge Painting.

Concrete Structures may be damaged by fire, collision, deicing chemicals, and soil pressures.

- A. Waterproof the bridge seats which are below open expansion joints. Seal open expansion joints where possible.
- B. Clean all bridge seats.
- C. Repair concrete spalls by removing delaminated concrete, clean the reinforcing steel by sandblasting, apply epoxy-bonding agent to existing concrete and place concrete.
- D. Repair concrete deteriorated by deicing chemicals and cracking. (See Section 5.53 for pier cap end repair.)

{BRIDGES}

Backwalls and Wings can be damaged by pavement pressures, binding expansion devices, or both.

- A. The pavement pressure must first be relieved before repairs can be made. Current design of an open span bridge with concrete approach pavement provides 4” relief slots located 33 feet from the end of the bridge.
- B. Where older designs did not provide such relief slots, it will be necessary to cut a four-inch wide relief slot in the approach pavement. Location of the relief slot will depend on the pavement design and as directed by Bureau of Design. (See Section 2.34.)
- C. Relief slots should be cut when the pavement is not under pressure.
- D. At skewed bridges with concrete approach pavement, the concrete gutter section between the pavement and bridge wing must be removed and replaced with hot mix.
- E. For repair of backwalls and wings, request a plan from the Bureau of Design.

5.35 – SUPERSTRUCTURE

The superstructure is that portion of the bridge above and including the bearing device.

Timber Superstructures are subject to damage by rot, fire, and impact.

- A. Repair the stringers if they are crushed, cracked or decayed.
- B. Bridging between stringers should be tight and working properly.

Steel Superstructures are subject to corrosion and impact.

- A. Structural steel should be painted. Inspect for corrosion along lower flanges, beneath the deck joints and near drains. All painting should be in accordance with Section 5.36, Bridge Painting.
- B. Diaphragms and stiffeners should be securely fastened. Loose rivets should be replaced by high strength bolts. Re-weld broken welds.
- C. If girders are out of alignment, contact Bureau of Design, Bridge Management Section as soon as practicable.

Concrete Superstructures are subject to fire, collision, & deicing chemicals.

{BRIDGES}

- A. Repair concrete spalls by removing delaminated concrete, clean reinforcing steel by sandblasting, apply epoxy-bonding agent to existing concrete and place concrete.
- B. Repair major (45° shear) cracks at girder ends. (See Section 5.52 for girder end repair).

Trusses are subject to corrosion and collision damage.

- A. All connections at joints should be free and clean.
- B. Repair of all damaged truss members should be made immediately. Contact Bureau of Design, Bridge Management Section for plan.

Concrete Box Type Structures are subject to settlement and general deterioration.

- A. See “Concrete Superstructures” above for repair of concrete.
- B. For wing failure, request a plan for the repair from the Bureau of Design Bridge Management Section.
- C. Soil savers and energy dissipaters should be kept clean for proper operation.

Maintenance of Bearing Devices is important to the proper functioning of the bridge.

- A. All rockers, bearing shoes, plates and rollers should be clean and free of rust and corrosion.
- B. Rockers should be reset if they are tipped to maximum or if the pin is out of its socket.
- C. Rollers should be centered on bearing plates.
- D. All bearing devices should be adjusted so they are either centered on bearing plates or are vertical (plumb) at a temperature of 60 degrees F (25.6 degrees C).
- E. Contact the Bureau of Design, Bridge Management Section for assistance in resetting bearing devices. The Bureau of Design may prepare plans for the resetting of these devices.

Maintenance of Expansion Devices is important to the proper functioning of the bridge.

- A. These devices allow for expansion and contraction of the bridge due to temperature and should be cleaned at least once each spring.

{BRIDGES}

- B. ***Finger Type*** - may have a trough below that will need to be cleaned periodically.
- C. ***Sliding Plate*** – should be kept clean and free of debris that could impede proper operation.
- D. ***Elastromeric*** – should be free of dirt and sand, keep hole plugs filled. Contact Bridge Management Section if failure occurs.
- E. ***Strip Seal Assembly*** – should be kept clean and free of debris. Contact Bridge Management Section if strip seals are loose or damaged.
- F. Expansion devices should be reset if they are closed and tight. The ***pavement pressure*** must be relieved before repairs are made.
- G. All of the above expansion joints may be reset. Contact the Bureau of Design, Bridge Management Section for a plan prior to resetting these devices.
- H. The open joints on all structures should be cleaned and sealed. Consult the Bridge Management for type and size of compression seal to be used at a particular location. (See Section 5.54 for installation procedures).

5.36 – BRIDGE PAINTING

Steel bridges should be programmed to be cleaned and painted every twenty years. Bridges with less than 10 tons of structural steel should be painted by KDOT Maintenance personnel. The remaining structures will be painted by contract.

Maintenance Personnel should Spot Paint the problem areas as needed using these preferred procedures:

- A. All surfaces to be painted must be thoroughly cleaned by sandblasting.
- B. ***Spot Painting of Basic Lead Silica Chromate Dark Green Painted bridges*** requires three coats.
 - (1) One coat of Barium Metaborate primer is to be applied to all exposed bare metal.
 - (2) The second coat is Silicone Alkyd gray paint.
 - (3) The final coat is Silicone Alkyd dark green paint.

{BRIDGES}

- C. ***Spot Painting of Aluminum Painted Bridges*** requires three coats.
- (1) One coat of Barium Metaborate primer is to be applied to all exposed bare metal.
 - (2) The second coat is Tinted Aluminum paint.
 - (3) The final coat is Untinted Aluminum paint.
- D. ***Spot Painting of Inorganic Zinc-vinyl Painted Bridges*** requires two coats. Prior to such spot painting, contact Bridge Management Section for procedures and preparation.
- (1) One coat (3.0 mils minimum dry film thickness) of Organic Zinc paint is to be applied to all exposed bare metal and then continued at least one inch onto the existing vinyl coating.
 - (2) A final vinyl finish coat (3.0 mils minimum dry film thickness) completes the painting.

Bridges Requiring Total Repainting should be painted with materials and procedure as recommended by the Bridge Management Section. Containment and proper disposal of sandblast sand may be required.

5.37 – DECK

Traffic is carried on the bridge deck or wearing surface.

Deck repairs are important and should not be delayed until time of bridge inspection. All bridge decks should, to the greatest extent possible, be maintained and repaired as built.

Timber Decks are subject to decay and excessive wear and roughness. Replace all loose, cracked or broken planks.

Concrete Decks are subject to concrete spall, scale, and full depth deterioration, as evidenced by chlorides and moisture through the deck.

- A. Repair all concrete decks with portland cement concrete or high early strength concrete. (See section 5.51 for deck repair).
- B. Temporary patches may be made with quick set cements or asphalt if weather is inclement.
- C. A slurry seal may be applied if warranted. Consult the Bridge Management Section for recommendation.

{BRIDGES}

The *Bituminous Wearing Surface* should be removed from open span bridges with concrete decks when it appears the surface is allowing water penetration.

- A. Be prepared to patch the concrete deck when bituminous material is removed.
- B. Cut down approach grades instead of overlaying the deck to maintain the proper riding surface.
- C. Badly deteriorated deck surfaces may be resurfaced with approval of the District Engineer and Bridge Management Section. An allowable load analysis may be necessary.
- D. ***Do Not Remove Experimental Asphalt Surfaces.*** Contact Bureau of Materials and Research for locations of experimental surfaces.

Bridge decks and gutters should be swept after storms (during the winter season) to remove chemicals & abrasives. All ice control abrasives should be removed from the gutter areas soon after the winter storm season.

Water should not be allowed to pond on decks, as it can shorten the useful life of the deck. The Bridge Management Section will furnish help for draining these ponds when needed.

Steel Decks are subject to broken connections with supporting stringers and girders. Re-weld these connections.

5.38 – HANDRAILS AND GUARDRAIL

Bridge Handrails are to be repaired as soon as practicable after the damage has been reported.

- A. The Districts should stock various types of metal posts and rails for bridge repair.
- B. Handrail on narrow bridges should be replaced with three beam guardrail.
- C. Replace the handrail on truss type bridges with guardrail through the structure.

Bridge Approach Guardrail installation should be in accordance with the following:

- A. Guardrail should be attached to the bridge.
- B. Guardrail should be installed in accordance with current Road Design drawings.

{BRIDGES}

- C. The traffic side of the guardrail should be flush with the inside of the curb.
- D. Contact Bureau of Design for the latest methods and practices prior to designing guardrail installations. All modifications should be approved by Bureau of Design.
- E. On interstate routes, the entire installation should be replaced when over 50% needs replacement due to damage.

See Section 6.60 of this manual for additional information on installation and maintenance of guardrail.

5.39 – ADDITIONAL ITEMS

Bridge Approaches should be kept in a condition that will furnish a smooth ride at speeds which are common for the area.

- A. Concrete approach pavement, which has settled, may be mudjacked. See Section 2.35 Mudjacking.
- B. Bituminous approaches should be leveled with the same material as the adjacent roadway.

Seal Joints at Bridge Ends. Remove the redwood board if loose and seal the joint.

Concrete or bituminous curbs, flumes, and or slope drains may be constructed on the approaches to protect shoulders and bridge berms.

Proper Disposal of Waste Material may alleviate future maintenance problems and make the site more attractive.

- A. The debris from decks and gutters should be disposed of in such a manner that it will not lodge on trusses, pier caps or abutments.
- B. Broken concrete from bridge repair work may be placed around bridge wings or in washes on berms.
- C. Brush, drift, old form lumber, cement sacks, etc. should be removed from the bridge site.

**- SECTION 5.40 -
BRIDGE REPAIR EQUIPMENT**

5.41 – EQUIPMENT

Major repair equipment consists of two Bridge Inspection Units. See Section 9.23 “Operation of Equipment” for scheduling and operating information.

**- SECTION 5.50 -
BRIDGE REPAIR TECHNIQUE**

5.51 – DECK

Concrete bridge decks are repaired with low slump high early strength concrete.

Use the Following Mixture for Repairing Concrete:

| MATERIALS | 1 Sack Batch | 1 cu. ft. Batch |
|----------------------------|---------------------|------------------------|
| Type III High Early Cement | 94 lbs. | 24 lbs. |
| Water | *4 gal. | *1 gal. |
| Sand | 220 lbs. | 55 lbs. |
| Gravel or Chat Sized Rock | 220 lbs. | 55 lbs. |

* This amount of water assumes dry or nearly dry aggregate.

Since this is a “rich” concrete mix and the percentage of gravel or rock is small, the mix will need to be kept very dry to avoid excessive shrinkage during drying.

Concrete Repairs require the following *Cure Times for Warm Weather*.

- A. Bridge Deck Spalls — Place in morning - Protect until evening.
- B. Full Depth Repairs of one to five square feet - Protect until second evening.
- C. Larger Full Depth Repairs- Protect until third evening.

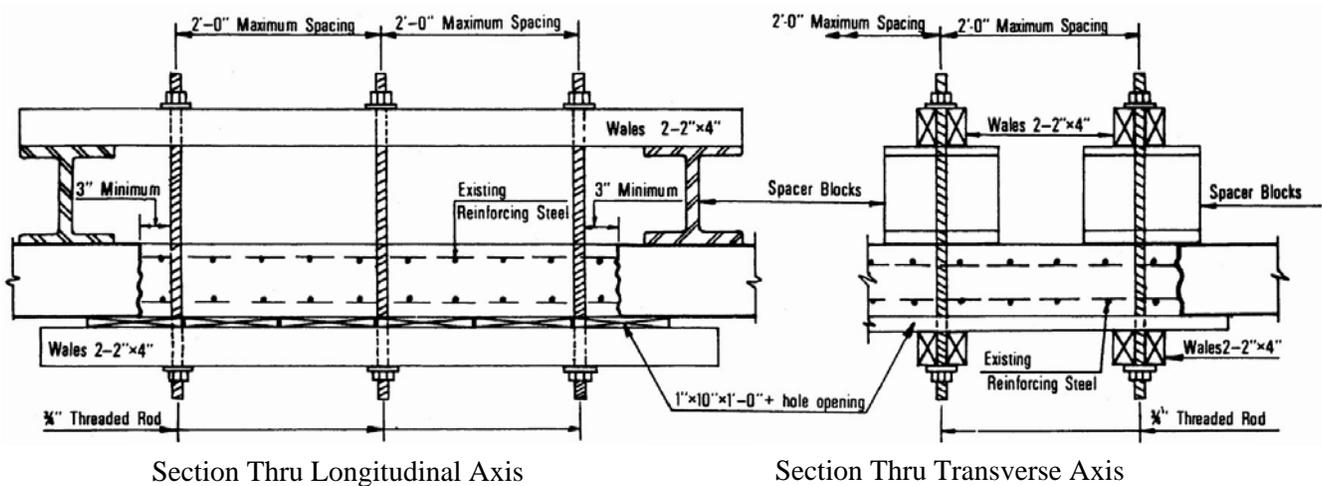
Longer Cure Time Will Be Required For Cool Weather.

Steel Plates may be placed over repairs while curing concrete, to save flagging traffic.

Partial Depth Repair Procedures are as follows:

- A. Make a saw Cut approximately six inches beyond the perimeter of deck deterioration to a depth of one-quarter inch above top layer of reinforcing steel.
- B. For spalls, chip out to a uniform depth of two inches.
 - (1) This will require chipping below the top layer of reinforcing steel.
 - (2) Remove all unsound concrete and clean reinforcing steel before placing concrete.
 - (3) A slurry of portland cement grout or epoxy must be applied to the surface to be overlaid just before placing the concrete. (See Section 5.58 "Epoxy - Bonding system for Concrete")

Full Depth Repair



C. *Full Depth Concrete Repair Procedure.*

- (1) Remove all unsound concrete and clean reinforcing steel. When reinforcing steel corrosion or loss of cross-sectional area is encountered, Additional-reinforcing Steel may have to be placed. Consult the Area Engineer or the Bridge Management Section for recommendations.
- (2) The above sketch shows a method of forming, Use this when forming can only be accomplished from above the bridge deck.

- (3) Epoxy should be applied to exposed concrete surfaces to help bond the new concrete to the old concrete. (See Section 5.58 “Epoxy Bonding Systems”)
- D. Place concrete as per instructions in the preceding paragraphs.
- E. Strike off and broom the concrete surface.
- F. ***The New Concrete Surfaces Should Be Covered*** with wet burlap or other approved impermeable material during the curing period.

5.52 – GIRDER ENDS

Repair Concrete girder ends with the same low slump high early strength concrete as used on deck repairs.

Repair Cracked or Broken Girder Ends that have less than 50% of their bearing left.

See the “***Typical Girder End Repair***” sketch for additional steel and limits of concrete removal.

Before removing concrete, ***Support the Girder End*** so it is not bearing on the pier.

Use controlled drilling to establish limits of concrete removal.

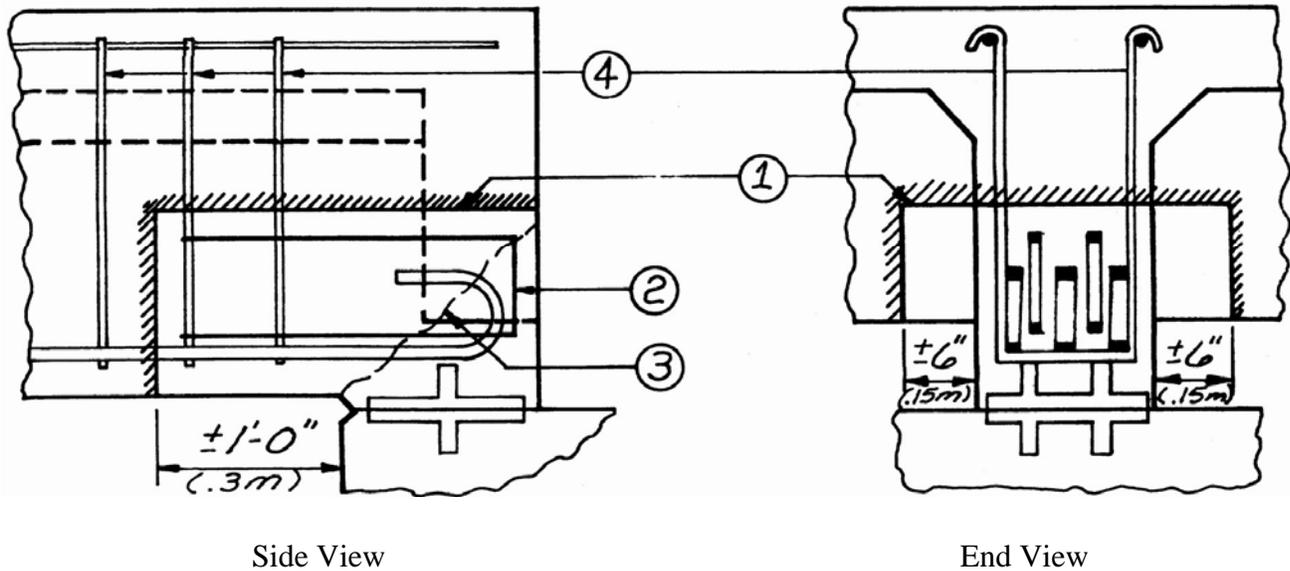
Remove all unsound concrete and clean exposed reinforcing steel.

Apply epoxy to all areas of concrete that are to be bonded to new concrete. (See Section 5.58 “Epoxy Bonding Sys.”)

Use steam fitters packing or neoprene pads as bearing plates for expansion ends of girders. Pour a cold joint on fixed ends.

The sketch below shows limits for concrete removal and steel to be added.

Typical Girder End Repair



1) **Minimum Concrete Removal Lines** – Drill holes along concrete removal line to control breakage of concrete. The contact surface between old and new concrete shall be painted with epoxy adhesive. (See Section 5.58 “Epoxy Bonding Systems”)

2) **Additional Reinforcing Bars** – Use #5 stirrups.

3) **Approximate Location of Crack in Concrete**

4) **Existing Reinforcing Steel**

5.53 – PIER CAP ENDS

Concrete *Pier Cap End Repair* should be repaired with the same low slump high early strength concrete as used on deck repairs. (See Section 5.51)

Use this method when the extent of deterioration will not allow the use of epoxy for repair.

See the following “Typical Pier Cap End Repair” sketch for limits of concrete removal. Use controlled drilling to establish limits of the concrete removal.

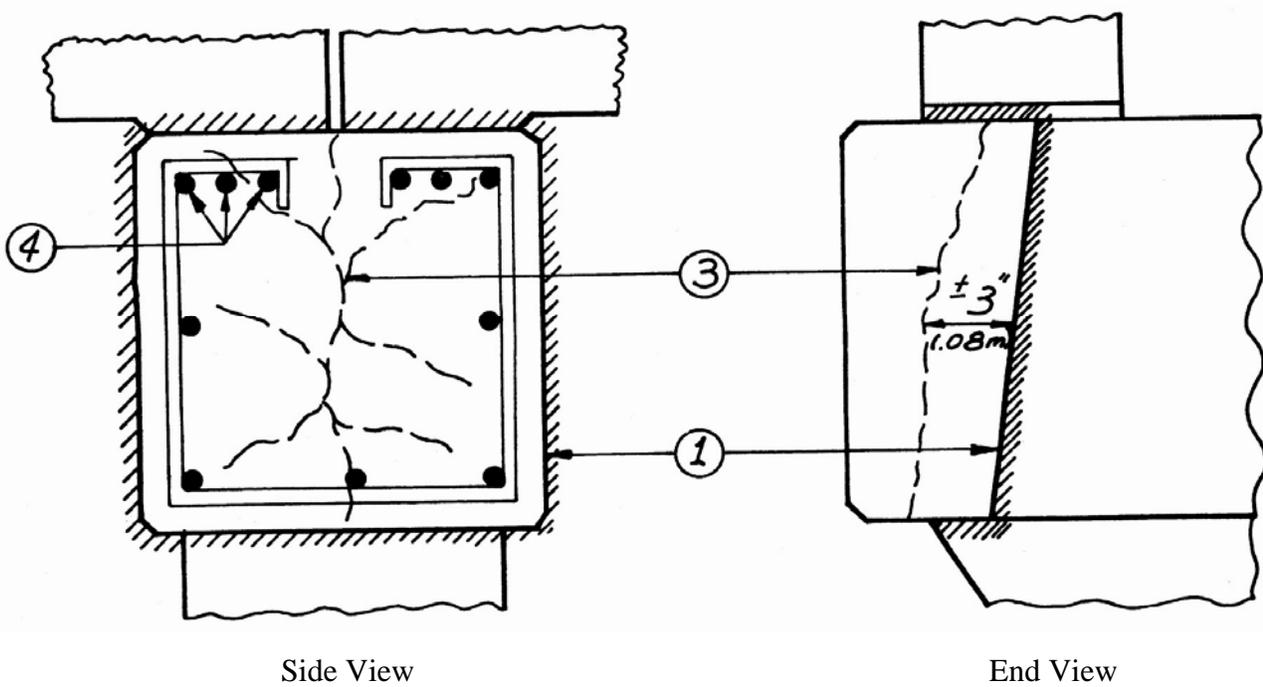
Remove all unsound concrete and clean exposed reinforcing steel.

{BRIDGES}

Apply epoxy to all areas of concrete that are to be bonded to new concrete. (See Section 5.58 "Epoxy Bonding Sys.")

Partial or full independent girder support may be necessary. Contact the District Office for guidance.

Typical Pier Cap End Repair



1) **Minimum Concrete Removal Lines** – Drill holes along concrete removal line to control breakage of concrete. The contact surface between old and new concrete shall be painted with epoxy adhesive. (See Section 5.58 "Epoxy Bonding Systems")

3) **Approximate Location of Crack in Concrete**

4) **Existing Reinforcing Steel**

5.54 – COMPRESSION SEALS

All Open Joints Should be Sealed with a Compression Seal, Polytite or equivalent should be used.

- A. Thoroughly clean joint faces, by sandblasting, until the necessary depth of clean concrete is reached.
- B. Install compression seal as per Manufacturer's recommendations.
- C. Seal joints completely across the bridge deck, along the front face of curbs, and across the top of the curbs.
- D. Recess seal 1/4 inch below deck surface.
- E. Program installation of seals for 50 degrees F (10 degrees C). The Bridge Management Section will furnish joint opening data on request.

5.55 – BRIDGE SEAT WATERPROOFING

Clean all dirt, loose particles, and other foreign matter from bridge seat surfaces at locations with Finger and Sliding Plate Expansion Joints.

Compressed air and/or sandblasting may be required to obtain a clean and dry surface.

Apply waterproof membrane sealant in accordance with manufacturer's recommendations. Contact Bureau of Materials and Research for available products.

5.56 – EPOXY PUMPING

KDOT Maintenance is no longer using this repair technique.

5.57 – GIRDER REPAIR – POST REINFORCEMENT

KDOT Maintenance is no longer using this repair technique.

5.58 – EPOXY – BONDING SYSTEM FOR CONCRETE

An *Epoxy - Resin- Base Bonding System* should be used when repairing areas, which require a good structural bond between the old and new concrete.

Refer to ASTM C881-10 for *Type, Grade* and *Class* of epoxy-resin bonding system needed. This is a material specification, which defines type, grade and class of epoxy needed for various applications. (Type V, Grade 2, Class C is a medium viscosity material used to bond freshly mixed concrete to hardened concrete at temperatures above 60° F.)

{BRIDGES}

This ASTM describes applicable terms as Contact Time and Working Pot Life. The mixed epoxy and the new concrete must not be applied too soon or too late.

Information on safety hazards, sampling, and test methods are also covered in this ASTM.

Use correct type of epoxy and ***Follow Manufacturers Instructions*** for mixing, handling and placing of the materials.

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CHAPTER SIX

TRAFFIC CONTROL AND OTHER MARKINGS

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Section 6.10
GENERAL

6.11 TRAFFIC CONTROL DEVICES

The Highway Sign Manual should be referred to as needed for guidance on temporary traffic control and permanent signing details.

Traffic Control Devices include signals, signs, pavement markings, variable message boards, channelizing devices and the use of flaggers.

Traffic control devices should be properly maintained.

6.12 ROAD CLOSURES

When a road must be closed for extended periods of time:

Information and warning signs (reflectorized for night visibility) should be erected.

The District Office will notify the Highway Patrol and local media of the closure.

Road closure and detour signs should be placed at the nearest town, highway junction or other convenient location.

When a road must be closed in emergency situations or for a short duration, the provisions above should be followed to the extent reasonable under the circumstances.

For additional information on Storm Related Road Closures see section 1.74, and section 8.30 for detours.

SECTION 6.20 TEMPORARY SIGNS AND FLAGGERS

6.21 SIGNING

Traffic Control is part of operations where traffic must be carried through or around routine or emergency work areas. The purpose of traffic control for a work area is to guide traffic through or around work areas.

Traffic control should command attention, be visible, and convey a clear (simple) message.

The KDOT Highway Sign Manual provides information on signing and marking. Refer to this manual for:

- A. Sign placement and traffic control procedures.
- B. Breakaway signpost and proper bolt torque.
- C. Sign Identification and use.
- D. Pavement Markings.

The *Statewide Dynamic Message Sign (DMS) and Closed-Circuit Television (CCTV) Camera Operations Procedures* document provides guidance for the use of these devices on Kansas Highways. This document can be accessed on the KDOT Intranet through the Bureau of Transportation Safety and Technology, ITS section. <http://kdotweb.ksdot.org/Bureaus/BurTransSafety/ITShome.asp>

6.22 FLAGGING

Flagging may be used to provide information and to help guide and control traffic through work zones, detours and unusual road conditions. Refer to the Highway Sign Manual for information on where flaggers should be used. Certain road conditions may warrant flagging on a 24- hour basis.

Guidelines for flagging are provided in the current version of the *Flagger Handbook*. Each flagger should be familiar with the Flagger Handbook.

SECTION 6.30 STRIPING

6.31 TRAFFIC LINES

The Highway sign manual provides information on striping and rates for paint and bead application.

6.32 TEMPORARY PAVEMENT MARKING

When permanent *centerline markings or lane lines* on multi-lane facilities are eliminated due to patching or resurfacing, temporary markings should be placed the same day, if practicable.

Place four-inch wide temporary pavement marking tape approximately 4 feet in length at the same cycle length as permanent marking (32.8'). This may be varied if deemed necessary due to existing conditions. See Part G of the Highway Sign Manual for additional details.

SECTION 6.40 PERMANENT PAVEMENT MARKINGS

6.41 AIRCRAFT MARKERS

The Kansas Department of Transportation (KDOT) will cooperate with the Kansas Highway Patrol (KHP) in providing accurate speed check markings on roadway surfaces for observation from aircraft.

- A. The Districts should be notified annually, by the KHP Troop Captain in charge of the air patrol or local Troop Commander, of the proposed aircraft markers locations for their enforcement program.
- B. Locations for such markings will be determined cooperatively by the KHP and KDOT District Engineer.

- C. It is anticipated that the marking program will be similar from year to year.

See Part G of the Highway Sign Manual for additional aircraft marking information.

6.42 RAILROAD CROSSINGS

Markings are to be placed at grade crossings controlled with signals or automatic gates, and at other crossings where prevailing speeds are 40 MPH or greater.

See part G of the Highway Sign Manual for marking information.
See chapter 8 section 8.43 for additional information on traffic control requirements.

SECTION 6.50 MARKERS (Signs)

6.51 HISTORICAL MARKERS

Historical markers are set at locations established by the State Historical Society.

The Environmental Services Section of the Bureau of Right of Way will provide special instructions and information on the location and installation of historical markers.

- A. Historical markers should be neat and attractive. All graffiti or minor defacing should be painted out and/or repaired.
- B. If major repairs are necessary, contact the Environmental Services Section.
- C. See Part C of the Highway Sign Manual for typical sign layout.

6.52 REFERENCE POINTS (MILE MARKERS)

Reference Point Markers are set at approximately one-mile intervals to provide a means of identifying the location of accidents, emergencies and highway maintenance activities including features inventory.

- A. Numbering will begin at the *South* or *West* state line, or at the point of route origin.
- B. Alternate routes will be marked from point of separation.
- C. The system is based on the 1976 Route Mileage Log.

The **INSTALLATION OF REFERENCE POINT MARKERS** requires consideration of the following items:

- A. On routes carrying two or more route designations, the reference point should carry mileage based on route precedence; I, US, K; then the lowest numbered route of precedence.
- B. On routes with *Two Lane pavement*, reference point markers are erected back to back on right-hand shoulder when moving in the direction of the numbering.
- C. On roadways of *Four or More Lanes*, reference point markers are erected on the right-hand shoulder in each direction of travel.
- D. To augment the reference point system in metro areas, intermediate reference point markers which show the tenth of a mile may be installed at an interval of 0.2 miles. See “Intermediate Reference Markers” in the Highway Sign Manual for details.
- E. Reference point markers should be erected at approximate mile intervals on all rural routes. They are not required on city connecting links.
- F. Individual marker locations may be varied a maximum of 50 feet from the official log mileage point. Markers, which cannot be placed within this 50-foot distance, should be omitted.
- G. Reference point marker locations are to be re-established with the use of Distance Measurement Instruments (DMI).

- H. See the Highway Sign Manual for additional reference point marker placement data.

6.53 RIGHT – OF – WAY MARKERS

Right-of-Way Markers, either red 4”x4” concrete or U-post with sign, should be located at breaks in the highway right-of-way. These markers are set by field construction personnel during construction of the highway.

Maintain the markers as originally installed.

Markers, when damaged or destroyed, are to be reset by field construction personnel as established by a survey.

6.54 TRAIL MARKERS

Trail Markers are erected to show the location of early day wagon and cattle trails.

They are erected in rest areas and other historical, scenic or picnic pullouts along routes, which are designated by the Legislature.

6.55 MEMORIAL HIGHWAY SIGNS

Memorial Highway signs are erected to show the location of Memorial Highways.

They may be erected in rest areas and other historical, scenic or picnic pullouts or on highways.

Sign identification information can be found in Part J of the Highway Sign Manual and the designated route locations can be obtained from the Bureau of Traffic Engineering.

They are to be maintained in a similar manner as route markers.

6.56 MOWING MARKERS

The use of *Red Topped Mowing Markers* is described in Part H of the Highway Sign Manual.

The Purpose of red topped markers is to Warn Equipment Operators of:

- A. Objects that may interfere with safe operation of the mower.
- B. Small culverts, underdrain outlets or other items that may be damaged by the mower or other equipment.

These markers should be placed and maintained in appropriate locations. They are not to be used at edge drains which are marked with 12"x3" paint stripes on pavement or paved shoulder.

The recommended height of 30"-36" above ground may be increased as necessary to accomplish the intended purpose of these markers.

SECTION 6.60 GUARDRAIL

6.61 GENERAL INSTALLATION

Guardrail installations or removals will be under the Area Engineer's direction.

Installations, to the extent reasonably possible, will be in accordance with Current Design Standards for guardrail. See Section 5.38 for guardrail attached to bridges.

Contact the Bureau of Road Design for current design standards and/or bridge attachment information as needed.

6.62 MAINTENANCE

Repair damaged guardrail in accordance with existing Guardrail

Repair/Design Manual. Keep a supply of cables, posts, blocks, rails, and end sections in District or Area stock to replace damaged guard rail according to the policy.

When notified of damaged guardrail, place appropriate devices, such as a trimline channelize, around Non-Functional guardrail as soon as reasonably practical.

Check cable tension and springs on cable guardrail seasonally and adjust, as necessary, to prevent sagging or excessive tension.

Tension for Breakaway Cable Terminals (BCT) at End Sections is to be maintained in accordance with Design Standard 606 B and 606 C.

Reference the “Barrier Systems” pocket guide for more information on Installation, Inspection and Maintenance of commonly used barrier systems in KDOT. This printed pocket guide is available through the Bureau of Maintenance.

SECTION 6.70 IMPACT ATTENUATORS

6.71 GENERAL DESCRIPTION

Impact attenuators are designed to absorb energy and reduce the crash impact in case of a motorized vehicle striking the attenuator.

Impact Attenuators are positioned at certain overhead sign supports, bridge ends, barrier wall ends and pier locations. Some common types of impact attenuators used by KDOT include:

- A. Sand Filled Plastic Barrels (Energite & Fitch Systems).
- B. Great
- C. QuadGuard
- D. SCI
- E. Tau-II

6.72 MAINTENANCE

Impact Attenuator installations should be inspected and inventoried annually. Records should be maintained at both the Area and District offices.

When notified of a damaged impact attenuator installation, place appropriate devices, such as a trimline channelizer, around the Non-Functional device as soon as reasonably practical.

Barrel systems are designed for specific sites and the location of each barrel is to be in accordance with its individual plan.

Check the plastic barrel systems for weathering and cracking.

Provide adequate drainage to prevent trapping of water and deicing chemicals, which accelerate corrosion of metal components.

Reference the “Barrier Systems” pocket guide for more information on Installation, Inspection and Maintenance of commonly used barrier systems in KDOT. This printed pocket guide is available through the Bureau of Maintenance.

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Section 7.10 POLICY

The Highway System is divided into three classifications for snow and ice control as shown on the “*Kansas Snow and Ice Control Classifications*” maps (see Figures 7.2, 7.3, and 7.4) with some adjustment for route continuity. Classifications are:

Class I Routes - Multi-lane highways and two-lane highways with traffic volumes over 3000 Annual Average Daily Traffic (AADT).

Class II Routes - Two-lane highways with traffic volumes from 1,000 to 3,000 AADT.

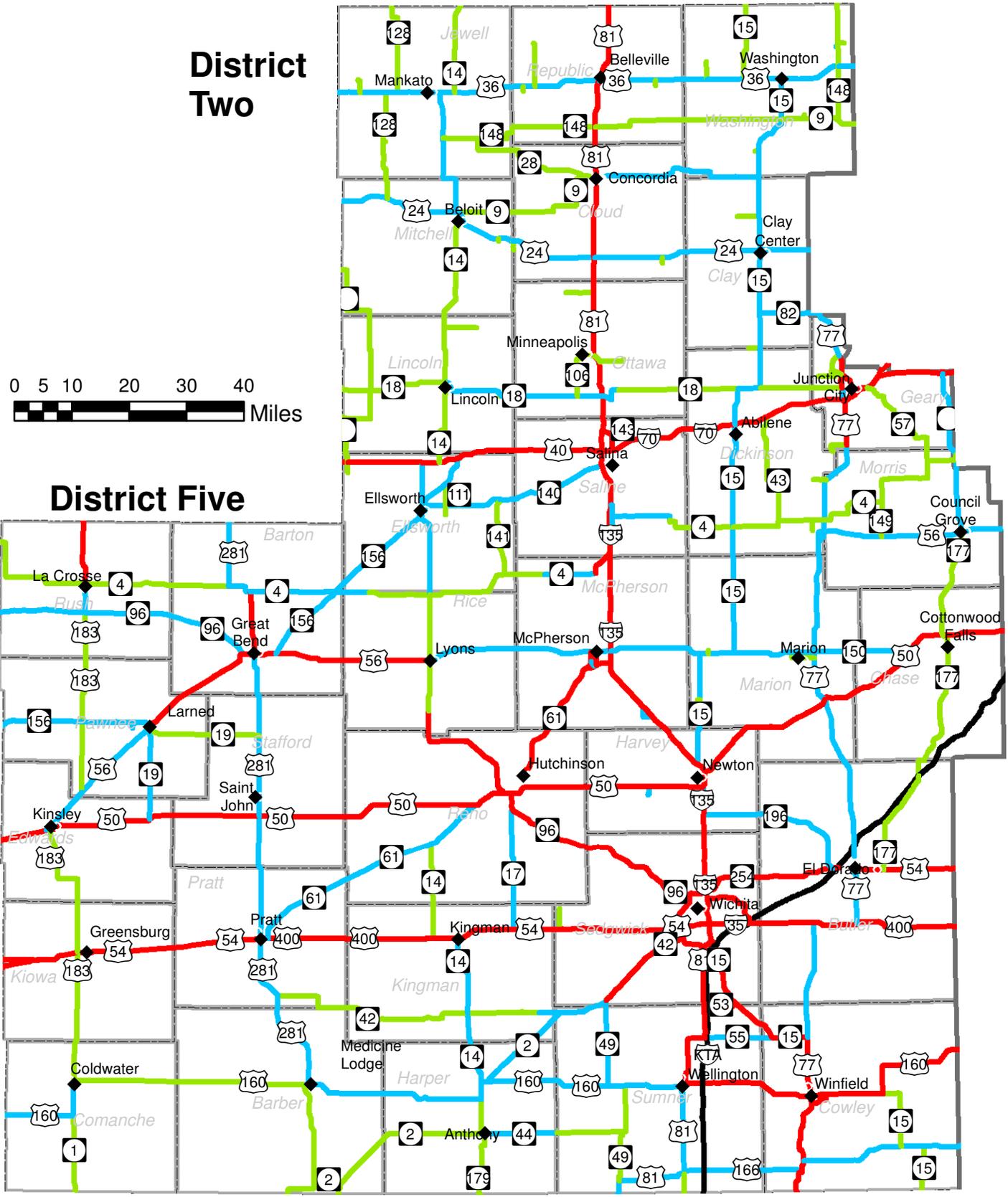
Class III Routes - Two-lane highways with traffic volumes under 1,000 AADT.

The category descriptions, level of service and priorities for each classification are outlined in the following “Snow and Ice Control Policy/Level of Service Chart”.

| SNOW AND ICE CONTROL – POLICY/LEVEL OF SERVICE | | |
|--|---|---|
| CLASSIFICATION | LEVEL OF SERVICE | PRIORITIES |
| <u>Category I Routes</u> | | |
| Multi-lane highways and two-lane highways with traffic volumes over 3,000 Annual Average Daily Traffic (AADT). | All through lanes on divided roadways and both lanes on two-lane roads will have bare/ wet wheel paths with intermittent bare pavement. | <ol style="list-style-type: none"> 1. Aid for emergency vehicles responding to calls (if requested) 2. Interstate 3. Freeways and Expressways 4. Higher AADT highways, or as storm conditions dictate |
| <u>Category II Routes</u> | | |
| Two-lane highways with traffic volumes from 1,000 to 3,000 AADT. | Both lanes on two-lane roads will have intermittent bare/wet wheel paths. | <ol style="list-style-type: none"> 1. Aid for emergency vehicles responding to calls (if requested) 2. Problem areas that may be on (hills, curves, bridges, stop signs) 3. Higher AADT highways, or as storm conditions dictate |
| <u>Category III Routes</u> | | |
| Two-lane highways with traffic volumes under 1,000 AADT. | One wheel path in each lane on two-lane roads will have intermittent bare/wet wheel paths. | <ol style="list-style-type: none"> 1. Aid for emergency vehicles responding to calls (if requested) 2. Problem areas that may be on (hills, curves, bridges, stop signs) 3. Higher AADT highways, or as storm conditions dictate |

Central Kansas Snow and Ice Control Classification

(Changes made October 23, 2013)



— Class I — Class II — Class III — KTA

Fig. 7-2

PREPARED BY
 KANSAS DEPARTMENT OF TRANSPORTATION
 BUREAU OF TRANSPORTATION PLANNING
 MAP CREATED THURSDAY, OCTOBER 13, 2016
 KDOT makes no warranties, guarantees, or representations for accuracy of this information
 and assumes no liability for errors or omissions.

Eastern Kansas Snow and Ice Control Classification

(Changes made October 23, 2013)

District One

- Class I
- Class II
- Class III
- KTA

District Four

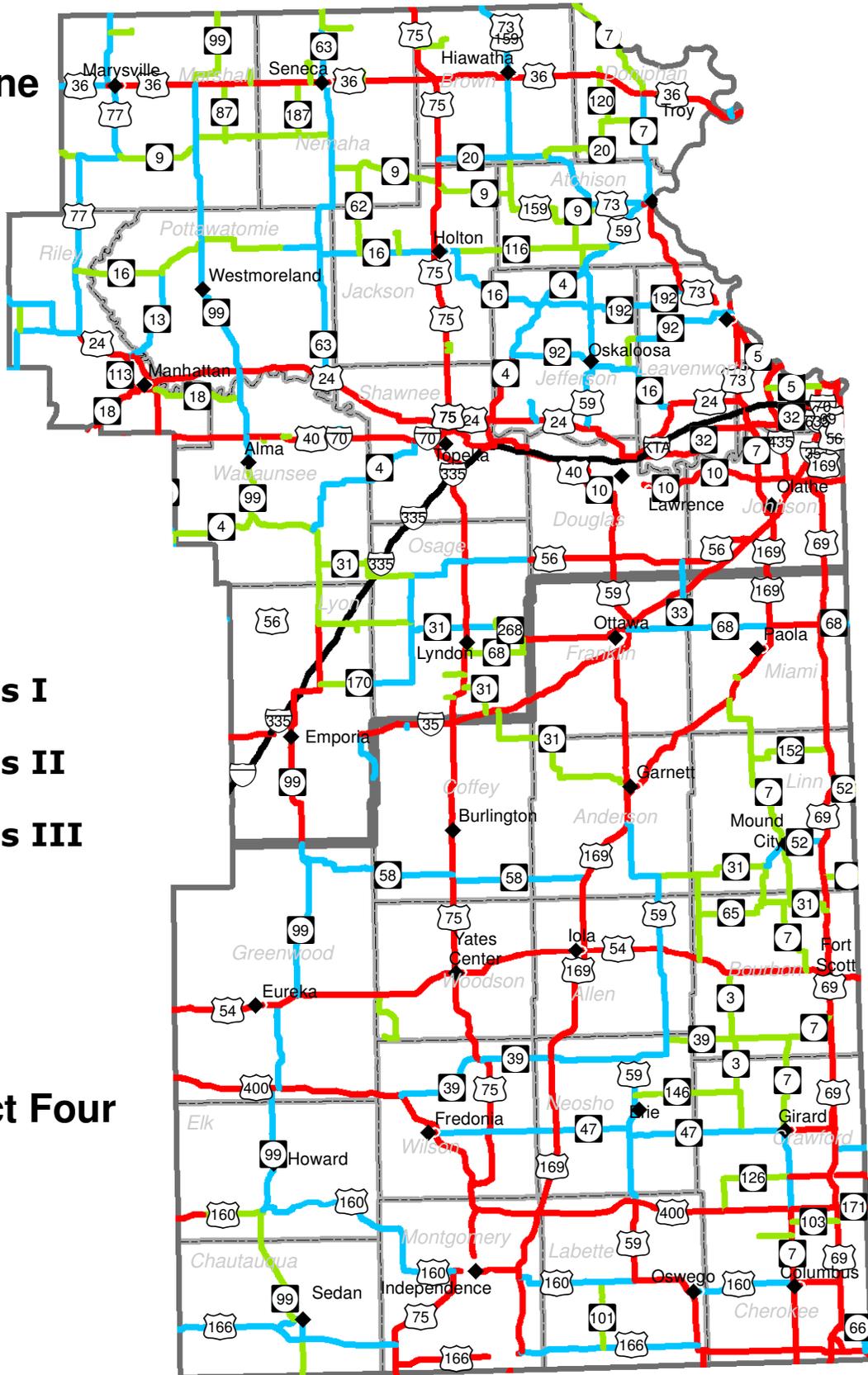
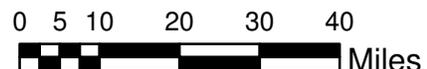


Fig. 7-3



7.11 PERSONNEL AND EQUIPMENT PLAN

Each district should have a *Storm Coverage Plan* for implementing the Snow and Ice Control Policy. The plan should consider the following:

- A. The plan should consider such factors as personnel available, differences in geography, equipment available, and special requirements for night operations.
- B. Route length and cycle times should reflect the priorities of the following table.

| ROADWAY CLASSIFICATION | CYCLES PER SHIFT | ROUTE LENGTH (lane miles/truck) |
|-------------------------------|-------------------------|--|
| Category I Routes | 4 | 30 – 34** |
| Category II Routes | 3 | 50 – 60** |
| Category III Routes | 2 | 76 – 90** |

**Each truck is responsible for a route or section of highway at an approximate average speed of 12 – 18 mph.

- C. Predetermined turnarounds for snow and ice control boundaries should fall at, or within city limits, or at highway junctions. This may require the crossing of existing subarea, area, and/or district lines. Each of the Districts should set up a snow plan to provide the necessary coordination between subareas and, areas, and work with adjacent districts on district boundaries.
- D. It is to be expected that local situations and circumstances may occasionally create needs, which are not addressed by the general snow and ice control policy. These needs may be addressed on a case-by-case basis, but the District Engineer must approve all exceptions to the basic snow and ice control policy.
- E. The Area should allocate manpower to distribute workload.
- F. Supervisors should communicate with employees; what shift they will be working, the truck they will be assigned to, and the routes they will be working on, prior to a snow and ice event.
- G. Personnel should be assigned to shifts that will allow 24 hour coverage. The beginning and duration of each shift may vary. Employees may be called due to an emergency with instructions to report at a specific time. Reporting times may be changed if employees are given reasonable notice.
- H. See Section 1.40 “Work Periods,” and KDOT SOM 2.2.3 – Overtime and Other Compensation for additional information on overtime.

7.12 PREPARATION

Preparations for snow and ice control should be completed by **October 15th** of each year. Preparation timing should be taken into consideration prior to October 15th. Supervisors should review the Maintenance Manual and applicable district instructions regarding winter operations with their personnel. Operators should become familiar with their assigned highway sections.

Training Guidelines for snow and ice control personnel should include:

A. Equipment preparation and preventive maintenance

1. Winterizing
2. Mount and inspect attachments
3. Pre-start inspections
4. Post storm cleanup and servicing

B. Safety

1. Operator condition
2. First-aid
3. Clothing
4. Accident procedures
5. Winter travel safety bag
6. Radio Communications during shifts (keeping in contact)

C. Equipment operation

1. Truck
2. Loader
3. Motor Grader
4. Plowing procedures
5. Material Spreaders controls & procedures
6. Brine Maker
7. Weather information access and use

D. Policy

1. Route classification
2. Road closures

Salt, Chemicals and Abrasives should be ordered in late summer or early fall for delivery before October 15th and then as needed to maintain supply.

Snow Fence should be considered for locations which have a history of significant drifting and:

- A. Permission must be obtained before entering private property.
- B. Snow fences should be erected prior to October 15th or as soon as practical thereafter.
- C. Snow fence should be erected on the predominate windward side of the highway, approximately 35 times the height of the fence from the road shoulder as recommended in SHRP-H 320, "Snow Fence Guide".
- D. After the fields are sufficiently dry in the spring, the snow fences should be removed where necessary.

Snow gates/barricades

- Place portable snow closure barricades such as, Type III barricades or Conical Cones prior to winter season in the vicinity.
- Check permanently mounted snow closure gates to make sure they are in good working condition.
- Place portable message boards prior to winter season.
- Check the working condition of message boards prior to the expected storm. Inspect solar panels for excessive dust, and clean if necessary. Inspect batteries for proper charge. If batteries are serviceable check for proper fluid level.

EQUIPMENT PREAPERATION

Equipment (loaders, motor graders, trucks, plows, spreaders, saddle tanks, brine tanks/pumps, anti/ice brine applicator) *Should Be Readied* for winter storm coverage *By October 15th*. (Refer to **Equipment Users Handbook for more in-depth procedures**).

- A. Attachments should be fitted to trucks and test runs made to check proper operations.
- B. Check spreader and liquid applicator calibrations yearly.
- C. Check pavement temperature sensor calibrations yearly.

7.13 SNICE TOOLS

The following *Snow and Ice tools* should be used to anticipate the storm and proactively maintain the specified level of service. During blizzard conditions, snow and ice removal operations may be suspended.

Forecasts – Maintenance personnel should monitor forecasts and pavement conditions and make direct observations to anticipate when to deploy equipment and personnel. The use of forecasts available over the Internet and from other sources is encouraged.

Eight pieces of information that are valuable:

1. When and where will event start?
2. What type of event will occur?
3. How much snow/ice is expected?
4. What will the air/pavement temperature be?
5. What speed(s) and direction(s) will the wind blow?
6. What will the traffic conditions be?
7. When will the event end?
8. What is the forecast following the storm?

RWIS – KDOT-specific pavement temperatures and weather forecasts are available through the KDOT Road Weather Information System (RWIS), which can be accessed through the KDOT Intranet homepage under “Road Conditions” or over the Internet at <http://kdotweb.ksdot.org/>. This site provides users with **current pavement conditions, radar and satellite images, as well as graphical forecasts for many KDOT pavements** throughout the state. To access this same data over the Internet from home computers, users should talk to their supervisor or the district computer support technician.

Infrared Pavement Temperature Sensors – KDOT maintenance vehicles equipped with these sensors can help maintenance personnel monitor the pavement temperature throughout the subarea.

KanDrive – KDOT specific mapping system that allows employees and the public to view road conditions, cameras and statewide information technology devices. The use of KanDrive can be a useful tool to maintenance personnel to view camera images and road conditions across the state to monitor approaching weather.

BEFORE THE STORM

Communication should be encouraged between Subarea Supervisors and Area Superintendents of adjoining facilities, especially across Area and District boundaries, to promote cooperation and provide assistance, when needed.

The supervisor should, with appropriate Area input, consider the pavement forecast in deciding the proper storm-fighting strategy. The supervisor should consider options such as pre-treating pavements with anti-icing liquids to preserve a higher level of service early in the storm. This may assist in preventing ice and snow from bonding to the pavement. Snow and Ice personnel should be alerted upon a forecast of inclement weather if the temperature is expected to drop below freezing.

ANTI-ICING

Anti-icing can be a cost-effective strategy that optimizes chemical usage. It is a proactive approach that should be the first in a series of strategies considered for most winter storms. By applying chemical freeze-point-depressant materials, such as salt or salt brine before a storm, you can prevent snow and ice from bonding to the pavement. This can help you get more work done with less effort during the storm and after the storm during cleanup. Guidance for initial and subsequent application rates are given in Figures 7.8 through 7.12.

GUIDELINES FOR ANTI-ICING

- Anti-icing may be effective for heavy frosts.
- Accurate road weather information allows for the proper use of anti-icing agents.
- Application of anti-icing agents should be made prior to a weather related event.
- Liquids are the most efficient and may be applied days in advance of an event. Among other considerations, the amount of lost material due to traffic and with should be considered when deciding when to apply anti-icing agents prior to a forecasted event.
- Similar applications of pretreated salts may also be used as an anti-icing agent. Use the lowest possible setting and apply as close to the start of event as reasonably possible. See the Application Rate Guidelines in Fig 7.9 & 7.10

What to do

- Apply liquids with stream nozzles to minimize nozzle plugging. Fan spray is not recommended.
- Consider scheduled applications on bridge decks if temperature and moisture conditions are predicted to produce frost or black ice.
- Apply anti-icing agents during non-rush-hour traffic periods if possible.

Things to Consider

- Applying anti-icing agents to dry roads in windy conditions may allow snow to collect to the road. Relevant factors should be considered before using anti-ice material when wind speeds are predicted to exceed 15 mph. Monitor road conditions for pavement changes that would warrant applying chemical.
- Reapplication isn't always necessary if there is still residual on the pavement surface from previous applications. The residual effect can remain for days after application if precipitation does not completely dilute or traffic does not remove the application. A wet surface can refreeze when temperature drops and/or additional moisture dilutes the chemical.
- **Don't apply** before predicted rain.

PRE-WETTING SALT AND SAND

- Pre-wetting is adding salt brine to the salt/salt sand as it is being applied to the road.
- Depending on the liquid used, it may lower salt's effective working temperature.
- Pre-wetting salt may help the salt stay on the road surface.
- Pre-wetting salt may increase its effectiveness by decreasing the time after application when melting of the snow and ice begins.

GUIDELINES FOR PRE-WETTING

- The usual application rate is 8 to 14 gallons to a ton of salt.
- Below 15° F, salt brine becomes less effective; below 0° F, it may freeze hoses and valves.
- Salt brine should be mixed at 23% by weight or 88 to 91% by saturation. Know which type of hydrometer you will be using for correct mixing of salt brine. This range provides the lowest optimal freezing point and cost effectiveness.

DURING THE STORM

DEICING

Deicing is an operation in which a deicer is applied to the top of an accumulation of snow, ice, or frost that is already bonded to the pavement surface.

Removing ice that has already bonded to the pavement can be difficult. Generally, enough ice must be melted chemically to break the bond between the ice and the pavement, which requires larger quantities of chemical than anti-icing.

- Use an appropriate amount of salt. Prevent over-salting by using good judgment, selecting appropriate rates and truck speed.
- It's not practical to melt all the snow or ice by using salt without the aid of plowing. Apply enough salt to loosen the bond between the ice and the road, so it can be plowed off.
- See the Application Rate Guidelines in Figs 7.8 thru 7.12
- **Dilution of Solution** also applies to deicing.

USING ABRASIVES

Attempt to remove snow/ice from roadway prior to the point when dilution of brine solution loses its ability to melt snow/ice.

- Use sand and other abrasives when temperatures are below 15° F.

- Sand does not melt snow or ice.
- Sand may provide temporary traction.
- When determining the amount of sand to use in any given condition, it should be considered that sand can clog sewers, drains, ditches and streams, and may build up on bridge decks.
- A salt/sand mix may be helpful when freezing rain is occurring.
- A 50% salt/sand mix is effective in increasing friction by causing the sand to remain on the surface.
- Use abrasives in slow-moving traffic areas such as intersections and curves.
- If your purpose is **only** melting, do not use sand.
- Salt becomes less effective when temperatures begin decreasing.
- Sand is not cheap when you consider the handling, cleanup, and disposal costs.

STANDARD PRACTICES

- Know the pavement temperatures and which direction they are trending, to help you use the right application at the right time. Generally use less chemical when temperatures are rising and more when they are falling.
- When temperatures reach 15 degrees F or below, a plan of action between the operator and supervisor should be discussed to consider all variables of whether to apply or not to apply chemicals/abrasives. Things to consider but not limited to:
 - Wind speed (will the wind blow chemicals or abrasives off the road?)
 - When is sunny weather predicted (radiant heat from the sun warming the pavement helps in the melting of snow and ice)
 - Cost effectiveness
 - The amount of traffic using the road (moving traffic helps distribute chemical and helps in the melting of snow and ice)
 - Duration of storm (future forecasted conditions)
 - Availability of chemicals (Salt/Brine)
- Adjust your spinner speed to the lowest setting possible, except at intersections.
- Drive slowly—recommended, not to exceed 25 mph—to keep material on the road.
- On multi lane roads, apply deicers in the center of the road or high side of the curve.
- In rural areas, the chemicals and abrasives should be spread by confining the **Width of Spread** toward center line of a two-lane road. The concentrated material will melt the snow and ice over the middle section and work out to each side of the road with very little wasted material.
- Ramps, widenings and interchanges should have the same level of service as the accompanying traveled way.
- KDOT will not be responsible for removing windrowed snow from driveways and side roads, which may result from winter operations. However, a reasonable effort should be made to not block driveways and side roads.
- Once the level of service for a given route has been achieved and is likely to sustain itself, equipment and resources may be reduced or reassigned to assist on other routes.

LOADING/HAULING

- The chemical loading area should be maintained without piles of debris or material on the surface of the loading area.
- Avoid spilling on units or overloading units.
- Watch for co-workers in or near the loading area.
- Observe good housekeeping and material storage recommendations.

EFFECTIVE USE OF PLOWS

Plow to remove loose snow and slush before deicing applications. If snow accumulates before or after deicing applications, plowing before the next application will minimize deicing agent dilution.

- Plow before applying deicers to avoid dilution of the salt.
- Coordinate plowing activities to eliminate windrows at intersections and prevent plowing off salt or sand placed by another operator.
- Adjust the blade angle to maximize cutting efficiency or snow throwing capabilities.
- Plowing intermittent to bare pavement will wear down the plow bit faster on the plow
- **CHECK PLOW BITS TO AVOID DAMAGE TO THE MOLDBOARD.**
(It is the operator's responsibility to routinely check plow blades to avoid plow damage)

PUBLIC SAFETY/OPERATOR SAFETY

- Perform your required CDL pre-trip and post-trip inspections.
- Be mentally and physically prepared to drive.
- **Use of Seat Belts is required by State Law.**
- Clean lights and windows as needed.
- Demonstrate courtesy toward other drivers and pedestrians.
- Effort should be made **not to** plow snow over bridge rails and onto roads, trails or railroads below.
- Be alert to downed power poles, stop lights, overhead structures, and power lines.
- Be aware of changed braking abilities given the load or lack of load on the vehicle being operated.
- Keep management informed of changing road conditions.
- Report hazards such as low-hanging branches, raised utilities, downed power lines or other potential problems.

SNOW CLOUD

Snow clouds can form during any plowing operation. A snow cloud may decrease your visibility to motorists. Things to consider:

- Reduce your speed to reduce the chance of snow clouds.
- **Don't plow just to plow** if shoulder plowing isn't necessary.

AFTER THE STORM

Roadway Clean-up operations should usually be performed during regular working hours once the roads are clear to the prescribed level of service. During clean up, snow will be removed from shoulders, gores and in front of longitudinal barriers (bridge hubguard, guard fence, concrete safety barriers, attenuators, and bridge walkways).

Clearing storage space for later snowfall or to keep drifting snow off the roadway should be done during regular business hours, unless more immediate action is needed for the level of service.

- Remove snow from barriers and bridge walls.
- Accurately record your material use at the end of your shift.
- After action meetings can help to evaluate and learn from the event.
What worked and what didn't – what would you have done differently and why?
- Look for opportunities to try new practices while maintaining the appropriate level of service.
- Clean and check all equipment.
- Chemicals that are not stored in covered facilities should be tarped. This includes salt & salt/sand mixes.

STANDARD PRACTICES

Documenting and charting

Good documentation and charting helps KDOT use less material, reduce costs and environmental impacts, and run a more effective snow and ice control program.

- Record material use for reporting purposes (crew card)
- Record midnight miles/hours for reporting purposes (crew card)
- Understand the storm conditions and the target level of service for each route.
- Refine procedures and material use based on observations.
- Share observations to improve operations and learn from each other.
- Complete forms at the end of the shift.
- Turn in forms to the supervisor.

Application Rates for Salt and/or Mixtures are important because of effectiveness and cost. Many variations in conditions can and will occur during snow and ice storms. The "best" procedure for applying chemicals or mixtures and plowing for particular conditions are determined to some extent by experience, however, the application rates listed in figures 7.6 thru 7.10 can be used as general guidelines.

END OF SEASON

- Trucks, loaders, spreaders and plows should be washed thoroughly to remove any residual salt/sand residue.
- Plows should be inspected for cracked or frayed hydraulic hoses. Sand down areas where paint is missing and repaint. Block up plows to keep the blade off ground.
- Spreaders should be inspected for bent slats, cracked or frayed hydraulic hoses. Spreader chain should be tightened and sprayed with lubra seal or other approved coating.
- Saddle tanks and anti-ice tanks should be drained and thoroughly rinsed with fresh water.
(See Equipment Users Handbook for more info on proper end of season cleanup)

ASSIST TRAVELING MOTORISTS

- A. Stalled vehicles should be checked for occupants before a road closure.
- B. KDOT equipment should not be used to pull a privately owned vehicle that has run off the roadway.
- C. Managers should discuss with their employees on how to handle stalled or slide off vehicles in their area.

KDOT personnel should interrupt snow removal activities to move Abandoned Vehicles only if they interfere with snow and ice removal operations. (See Section 14.80)

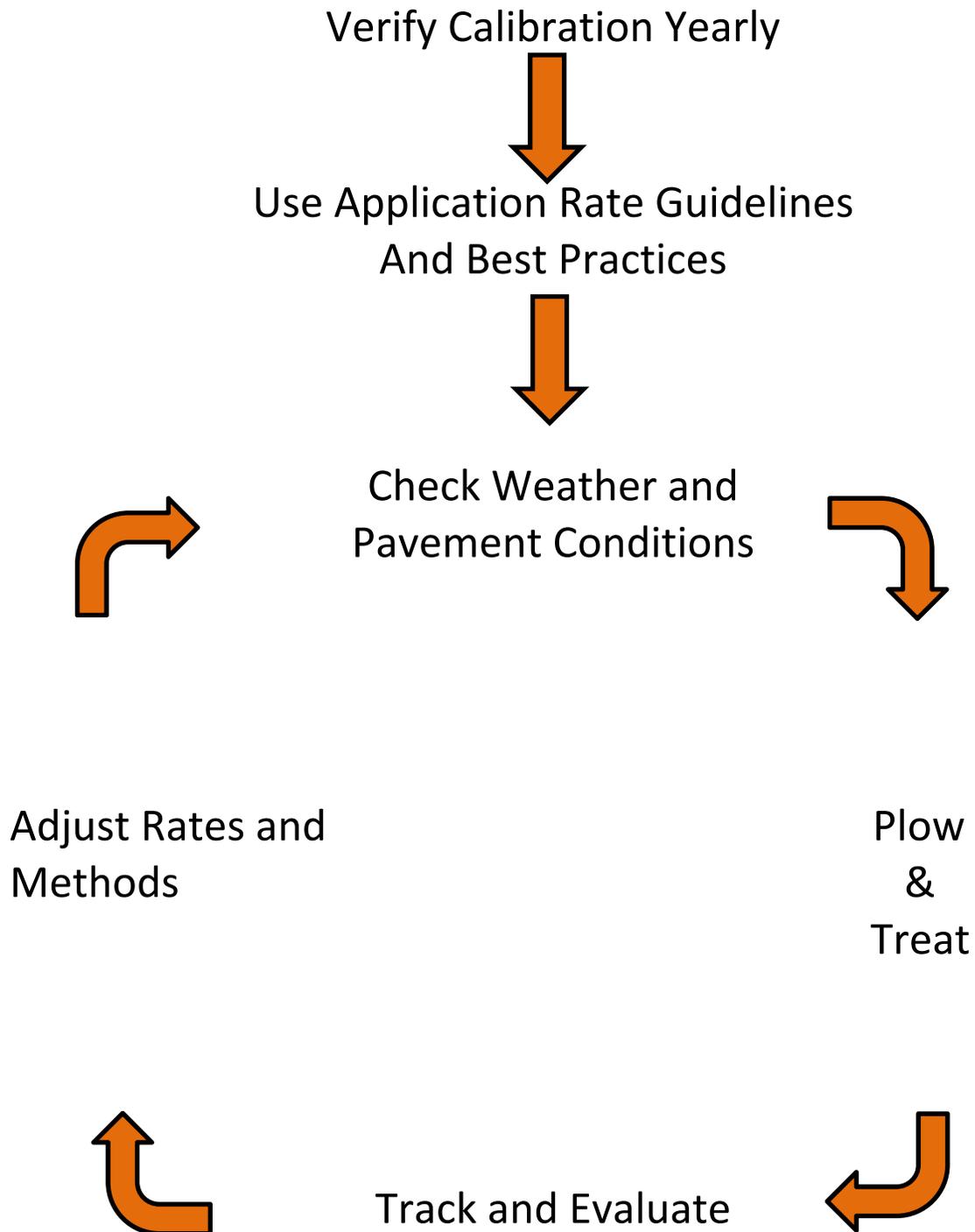
When KDOT maintains City *Connecting Links*, each city should be consulted as to their preference for plowing procedures and use of chemicals and abrasives. KDOT does not pick up and remove snow or plow parking areas.

7.14 ROAD CONDITION REPORTS

Adverse Road and Weather Conditions of any nature are to be reported to the appropriate management level. KDOT Maintenance Personnel at the Districts, Areas, and Subareas share the responsibility for observing and reporting adverse road/weather conditions.

Each *Area* should report *adverse road conditions* using *KanRoad*, a KDOT Intranet-based mapping system that records road conditions. At a minimum, adverse conditions should be reported at the following times: **4:30am, 10:30am, 2:30pm and 8:30pm. Report Conditions as those conditions change**, during regular hours. If shifts are working a 24 hour period, road condition changes should be reported during the 24 hour period. Report blowing snow or dust, flash flooding or other road conditions. The return to seasonally normal road conditions should be reported to the appropriate management level.

- Section 7.20 -
CHARTS/BEST PRACTICES



**APPROXIMATE LANE MILES A LOADED HOPPER OF
SALT IS CALCULATED TO TRAVEL BEFORE BECOMING EMPTY**

STRAIGHT SALT

| Pounds per lane mile Of straight salt | 10 yard hopper | 12 yard hopper |
|--|----------------|----------------|
| | Straight salt | Straight salt |
| 100 | 200 lane miles | 240 lane miles |
| 200 | 100 lane miles | 120 lane miles |
| 300 | 67 lane miles | 80 lane miles |
| 400 | 50 lane miles | 60 lane miles |

**Pre-Wetting of Material with Saddle Tanks
At least 10 gallons of brine applied
Per 1 ton of material distributed from Hopper**

**APPROXIMATE LANE MILES A LOADED HOPPER OF
50/50 MIX IS CALCULATED TO TRAVEL BEFORE BECOMING EMPTY**

50/50 MIX SALT/SAND

| Pounds per lane mile Of salt/sand mix | 10 yard hopper | 12 yard hopper |
|--|----------------|----------------|
| | 50/50 mix | 50/50 mix |
| 200 | 115 lane miles | 138 lane miles |
| 300 | 77 lane miles | 92 lane miles |
| 400 | 58 lane miles | 69 lane miles |
| 500 | 46 lane miles | 55 lane miles |
| 600 | 38 lane miles | 46 lane miles |
| 700 | 33 lane miles | 39 lane miles |
| 800 | 29 lane miles | 35 lane miles |
| 900 | 26 lane miles | 31 lane miles |
| 1000 | 23 lane miles | 28 lane miles |
| 1200 | 19 lane miles | 23 lane miles |

**Pre-Wetting of Material with Saddle Tanks
At least 10 gallons of brine applied
Per 1 ton of material distributed from Hopper**

**THIS CHART SHOW THE APPROXIMATE LANE MILES A FULL
LIQUID APPLICATION TANK
IS CALCULATED TO TRAVEL BEFORE BECOMING EMPTY**

| Gallons Per Lane Mile | 1500 Gallon Application Tank | 1800 Gallon Application Tank |
|------------------------------|-------------------------------------|-------------------------------------|
| 60 | 25 Lane Miles | 30 Lane Miles |
| 55 | 27 Lane Miles | 33 Lane Miles |
| 50 | 30 Lane Miles | 36 Lane Miles |
| 45 | 33 Lane Miles | 40 Lane Miles |
| 40 | 38 Lane Miles | 45 Lane Miles |
| 35 | 43 Lane Miles | 51 Lane Miles |
| 30 | 50 Lane Miles | 60 Lane Miles |
| 25 | 60 Lane Miles | 72 Lane Miles |
| 20 | 75 Lane Miles | 90 Lane Miles |

**THIS CHART SHOWS THE APPROXIMATE SALT QUANTITY IT
TAKES TO MAKE SALT BRINE AT
23% BY WEIGHT OR 88-91% BY SATURATION**

| Gallons of Brine | Tons of Salt |
|-------------------------|---------------------|
| 10,000 | 11.5 |
| 9,000 | 10.35 |
| 8,000 | 9.2 |
| 7,000 | 8.05 |
| 6,000 | 6.9 |
| 5,000 | 5.75 |
| 4,000 | 4.6 |
| 3,000 | 3.45 |
| 2,000 | 2.3 |
| 1,000 | 1.15 |
| 500 | 0.58 |
| 250 | 0.29 |

1 YARD OF COARSE SALT = 1 TON

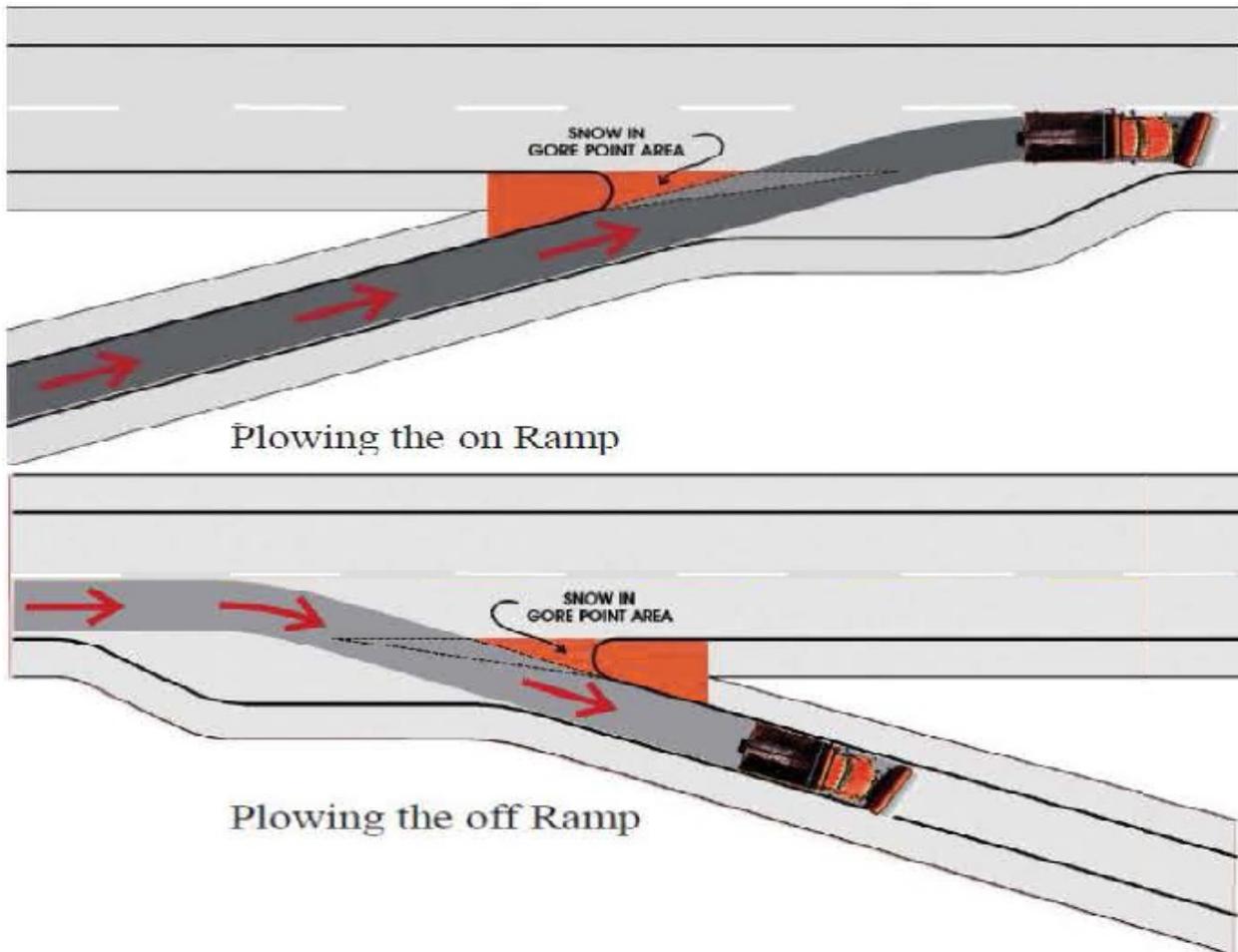
THIS CHART SHOWS APPROXIMATELY HOW MUCH ICE CAN BE MELTED PER POUND OF SALT AT DIFFERENT TEMPERATURES

| Pounds of Ice Melted Per Pound of Salt | |
|---|---|
| Pavement Temperature | Pounds of Ice Melted Per Pound of Salt |
| 30 degrees | 46.3 lbs of ice |
| 25 degrees | 14.4 lbs of ice |
| 20 degrees | 8.6 lbs of ice |
| 15 degrees | 6.3 lbs of ice |
| 10 degrees | 4.9 lbs of ice |
| 5 degrees | 4.1 lbs of ice |
| 0 degrees | 3.7 lbs of ice |
| -6 degrees | 3.2 lbs of ice |

PLOWING RAMPS

When plowing ramps, the snow can be pushed to either side of the ramp until you reach the gore point. This is the area where the ramp contacts the main roadway. At this point, all of the snow should be moved toward the outside shoulder.

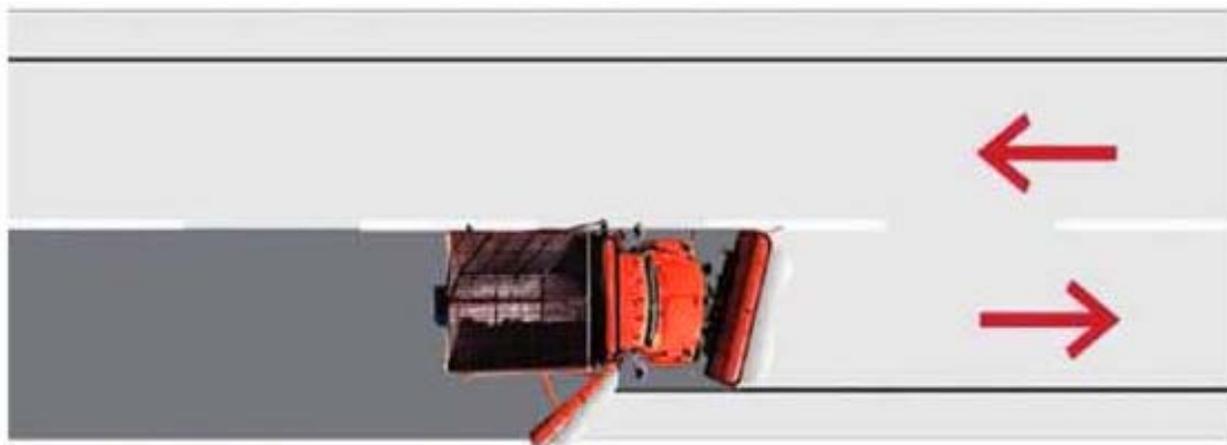
As snow is removed from the roadway, it is cast toward and sometimes onto the ramp area. Plow the portion of the ramp that is closest to the lane of the main roadway first. Using this method to plow ramps also keeps you from having to push the remaining snow into a pile at the end of the quadrant. See illustration for more details.



PLOWING TWO LANE HIGHWAY

The plow should “hug” the centerline **but not cross the centerline**. Subsequent passes should work towards the shoulder. It is important to keep the centerline clear so you will know where you are in relation to the road.

It is important not to over plow. If roads are “spotty” with patches of cover, the operator may want to pick up the plow slightly to avoid “sparking” or engage the blade saver option to reduce extensive wear on the plow blades. Do not carry the plow too high to avoid overheating of the truck. “See illustration below”



Two-lane Highway (one-way traffic)

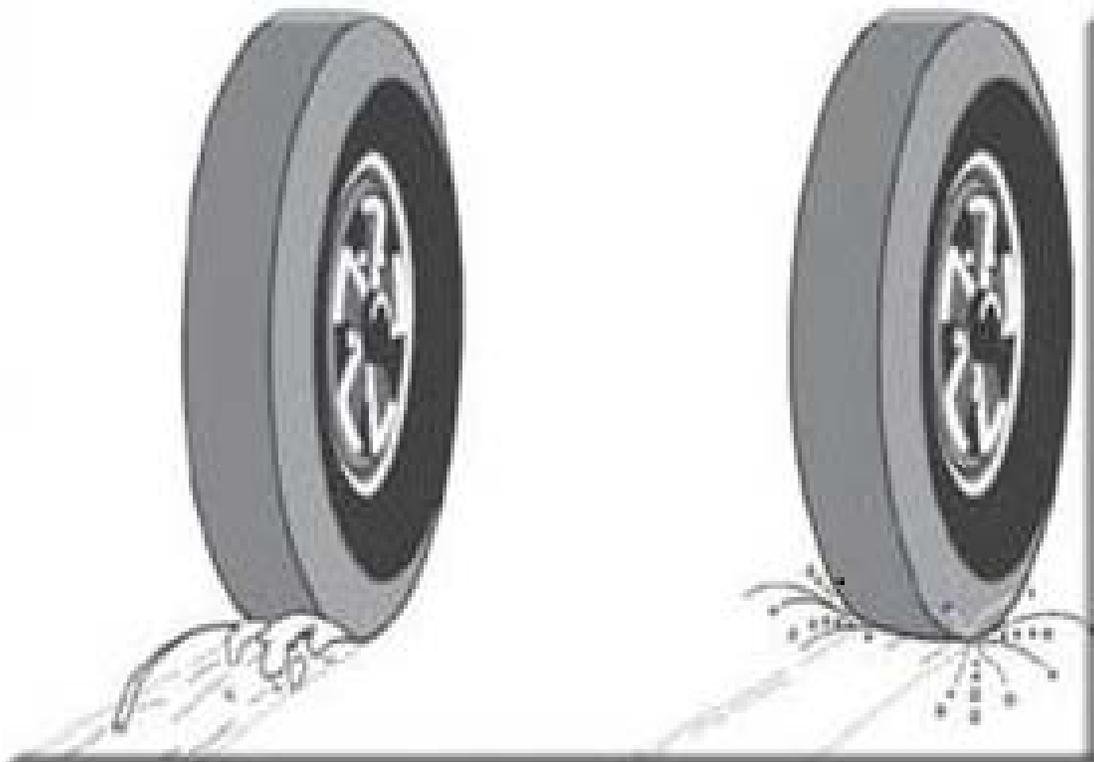
KNOW WHEN TO PLOW AND WHEN TO RE-APPLY SALT

If slush is fanning out from the tires of other vehicles, another salt application is not needed

Apply salt application when snow is being kicked out behind the tires of other vehicles

Temperature drops can cause conditions to change quickly resulting in fanning slush to turn to snow being kicked out.

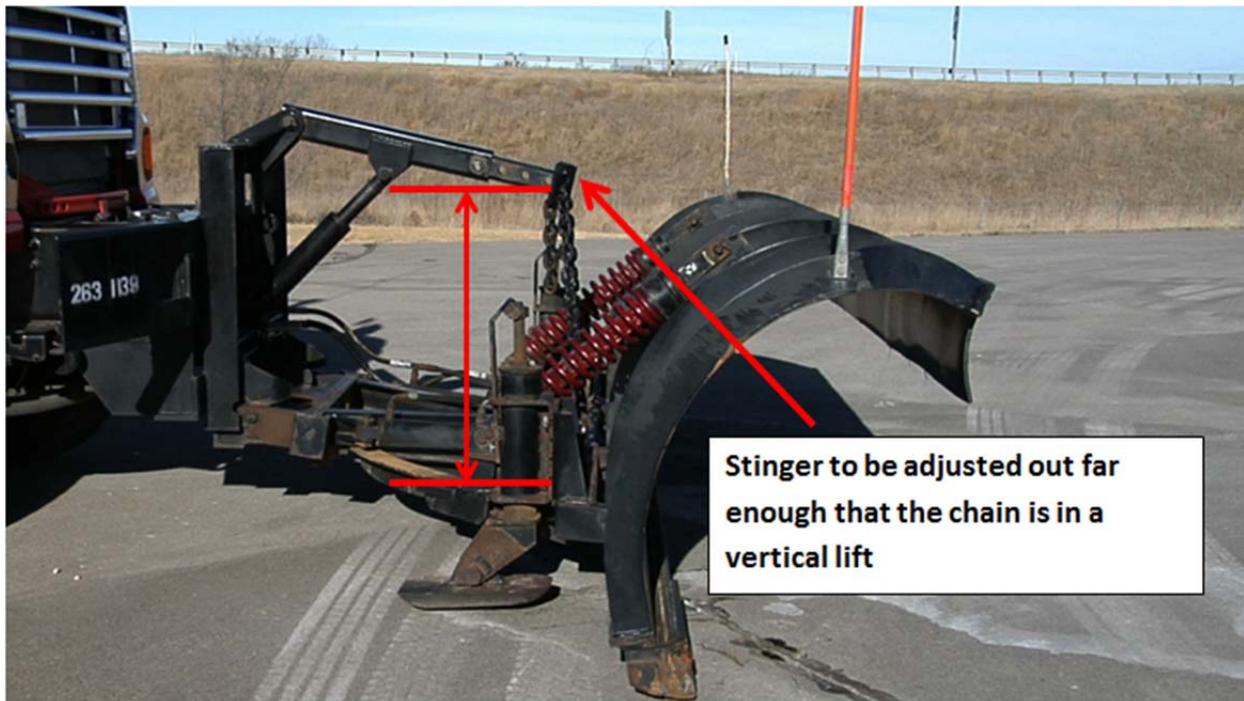
Keep an eye on your onboard temperature gauge to stay informed of temperature drops.



**Plow and apply
more salt**

**Salt is still
working**

LIFT CHAIN POSITIONING FOR PLOW



BLADE SAVER OPTION ON PLOW TRUCKS

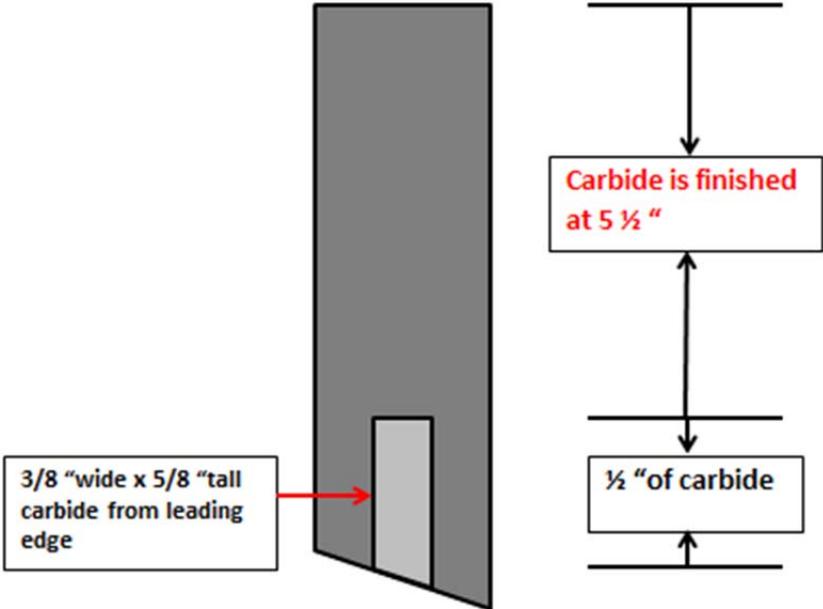
Blade Saver Option: Plow trucks with the Blade Saver option are calibrated with the stinger out over the lift eyes in a vertical position. If the position of the stinger is changed from what the plow was calibrated at it will change the amount of pounds the plow is distributing to the road surface.

When plowing and the blade saver is engaged, if the plow is skipping, or bouncing on the road discontinue use of the blade saver option until a mechanic can check the calibrations.

Single and Double Carbide are calibrated at 500 lbs. to the ground

High performance blades are calibrated at 1000 lbs. to the ground

TYPICAL DIAGRAM OF A STANDARD CARBIDE BLADE



TYPICAL MEASUREMENT OF CARBIDE BLADE

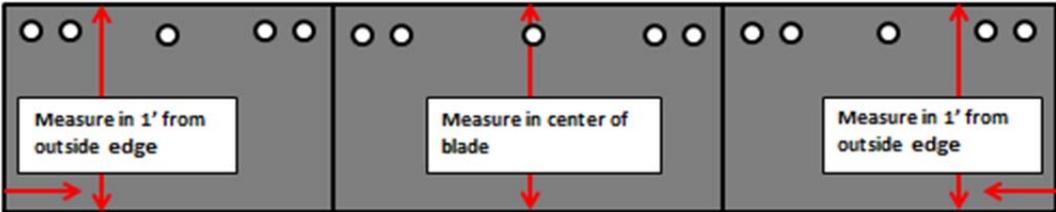
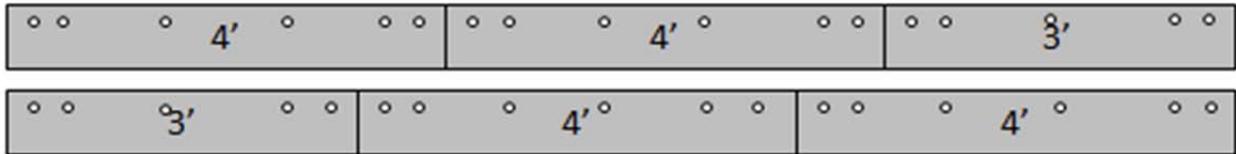


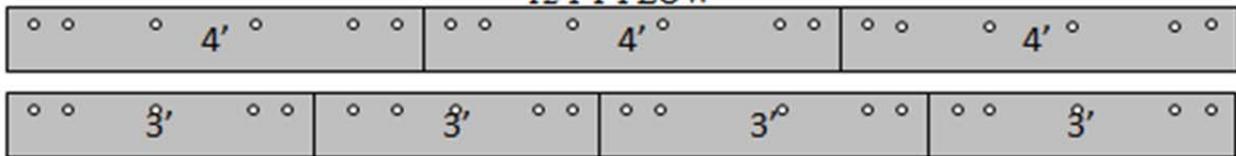
Fig 7.4

TYPICAL INSTALLATION FOR DOUBLE CARBIDE

11 FT PLOW

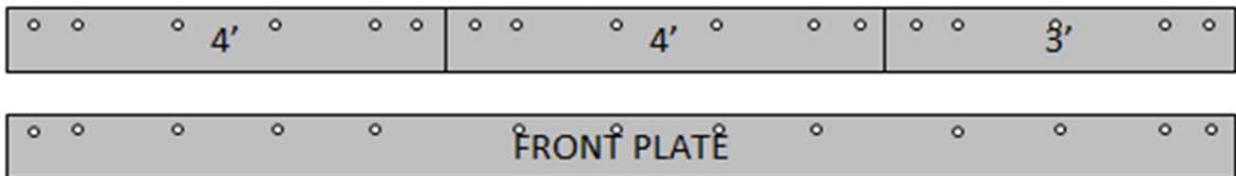


12 FT PLOW



TYPICAL INSTALLATION FOR SINGLE CARBIDE

11 FT PLOW



12 FT PLOW

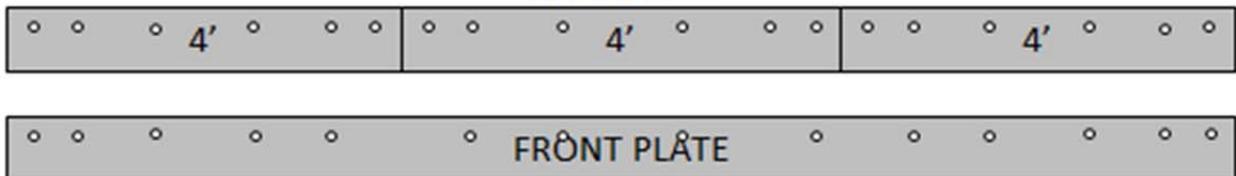


Fig 7.5

SPREAD CHAIN TENSION AND COMPONENT CARE

Steps to tighten Spreader Chain:

1. Loosen bearing plate lock nuts on both sides of spreader (Fig 7.6)
2. Loosen lock nut for adjustment bolt on both sides of spreader (Fig 7.6)
3. Measure from center of bearing shaft back to where chain is touching spreader frame/sill (needs to be 20" to 30") see Fig 7.7
4. Turn adjustment bolt until desired measurement is reached equally on both sides (Fig 7.6)
5. Tighten bearing plate nuts then tighten lock nut for adjustment bolt (Fig 7.6)

TYPICAL DIAGRAM OF SPREADER CHAIN TIGHTENING EXTERNAL VIEW

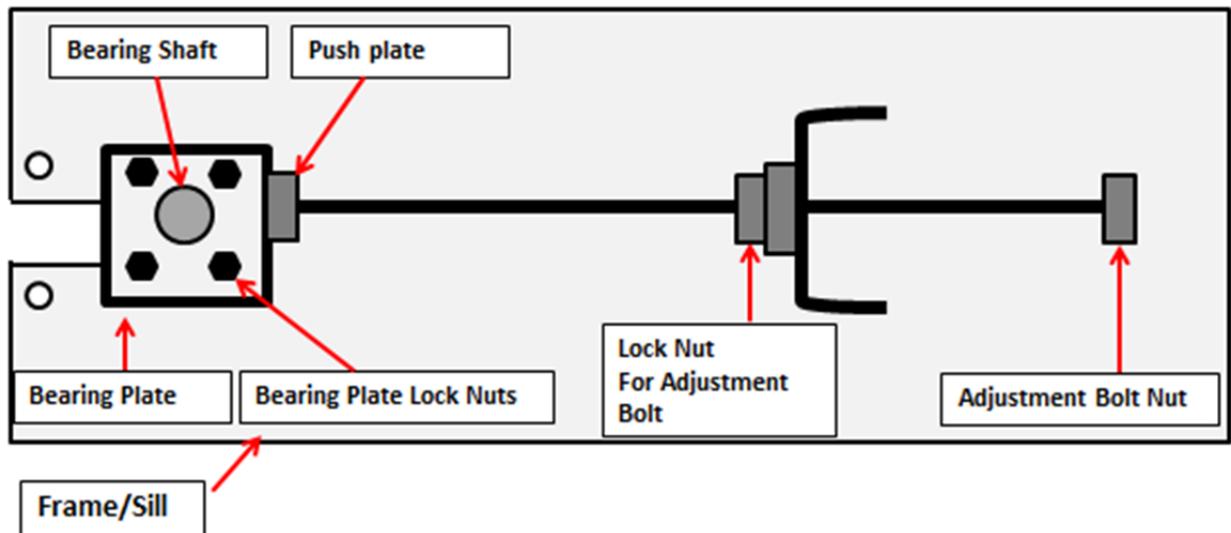


Fig 7.6

SPREADER CHAIN TENSION AND COMPONENT CARE

Chain Tension to be measured from center of shaft to where chain comes into contact with the frame/sill. Proper Tension 20" to 30" (see illustration Fig 7.7)

Checklist:

- Inspect spreader chain tension by October 15th, then after every storm for proper tension
- If chain tension is too tight or loose adjust to proper tension
- If adjustment bolt runs out of threads to adjust tension contact Supervisor so the proper personnel can take out a link
- Measure chain adjusters for equal distance
- Grease bearings after each storm or power washing
- Check gear box for proper oil level
 - Verify vent cap rotates freely
 - Verify no water contamination in gear box
- Verify spreader chain bars are not bent or damaged
- Listen for abnormal sounds (i.e. clunking or knocking)
- Chain links should be coated with an approved material for summer storage

TYPICAL DIAGRAM OF SPREADER CHAIN TIGHTENING INTERNAL VIEW

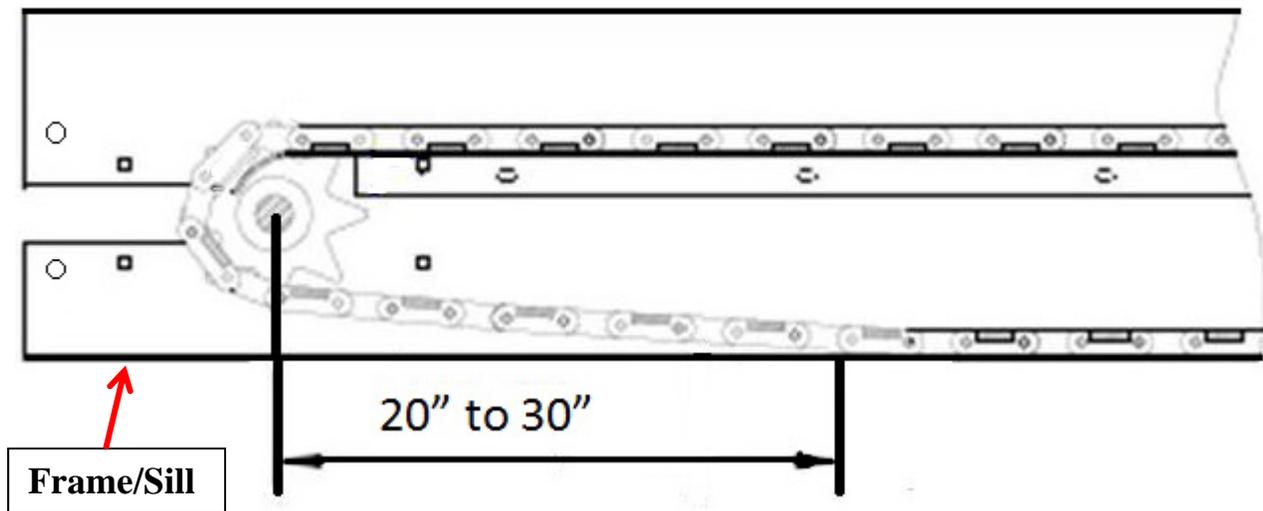


Fig 7.7

| Application Rate Guidelines | | | | | |
|--|--|----------------------|------------------------------------|------------------------------------|------------------------------------|
| LIQUID SALT BRINE - 23% by Weight or 88-91% by Saturation | | | | | |
| Gallons of Brine Per Lane Mile | Surface Temp (F) | Pre-Treatment | 32 -27 | 26 -21 | 20 – 15 |
| | Heavy Frost, Black Ice | 40 – 50 | 50 | 60 | *60 |
| | Light to Medium Snow | *40 – 50 | *50 | *60 | *60 |
| | **Heavy Snow | *50 – 60 | *50 | *60 | *60 |
| | **Freezing Rain, Drizzle, Sleet | <u>NR</u> | <u>Liquid: 60</u> Salt: 150-200 | <u>Liquid: 60</u> Salt: 250-300 | <u>Liquid: 60</u> Salt: 350-400 |

NR = Not Recommended

* = Pre-Treatment / Treatment not recommended when forecast calls for winds exceeding 15 mph. Treatment with liquids may cause snow to stick to road.

** = Not Recommended to shoot Salt Brine during these events unless you have the resources to follow up with a dry chemical application using a spreader truck due to the quick dilution of liquid by itself. **(CAUTION: DILUTION OF SOLUTION)**

Fig 7.8

| Application Rate Guidelines | | | | | | |
|---|--------------------------------------|-----------------|----------------|----------------|----------------|-------------------------|
| PRE-WETTED SALT 1-2 hour turn around | | | | | | |
| Pounds of Salt Per Lane Mile | Surface Temp (F) | Above 32 | 32 – 27 | 26 – 21 | 20 – 15 | 15 & Falling |
| | Heavy Frost, Black Ice | * | 50 – 100 | 100 – 150 | 150 – 200 | ** |
| | Light to Medium Snow | * | ***100 – 150 | ***150 – 200 | ***200 – 250 | ** |
| | Heavy Snow | * | ***100 – 150 | ***200 – 250 | ***300 – 350 | ** |
| | Freezing Rain, Drizzle, Sleet | * | 150 – 200 | 250 – 300 | 350 – 400 | ** |

* = Treat icy patches if needed with chemical at 100 lbs. / lane mile.

**= It is recommended that before applying chemicals in this temperature range you discuss with your supervisor the appropriate quantities of chemicals to use.

***= Applying anti-icing agents to dry roads in windy conditions may allow the snow to collect to the road. Because of this, use caution before using anti-ice material when wind speeds are predicted to exceed 15 mph. Closely monitor road conditions for pavement changes that would warrant applying chemical.

Fig 7.9

| Application Rate Guidelines | | | | | | |
|---|--------------------------------------|-----------------|----------------|----------------|----------------|-------------------------|
| PRE-WETTED SALT 2-4 hour turn around | | | | | | |
| Pounds of Salt Per Lane Mile | Surface Temp (F) | Above 32 | 32 – 27 | 26 – 21 | 20 – 15 | 15 & Falling |
| | Heavy Frost, Black Ice | * | 100 – 150 | 150 – 200 | 200 – 250 | ** |
| | Light to Medium Snow | * | ***100 – 150 | ***200 – 250 | ***250 – 300 | ** |
| | Heavy Snow | * | ***150 – 200 | ***250 – 350 | ***450 – 500 | ** |
| | Freezing Rain, Drizzle, Sleet | * | 200 – 300 | 350 – 450 | 500 – 600 | ** |

* = Treat icy patches if needed with chemical at 100 lbs. / lane mile.

**= It is recommended that before applying chemicals in this temperature range you discuss with your supervisor the appropriate quantities of chemicals to use.

***= Applying anti-icing agents to dry roads in windy conditions may allow the snow to collect to the road. Because of this, use caution before using anti-ice material when wind speeds are predicted to exceed 15 mph. Closely monitor road conditions for pavement changes that would warrant applying chemical.

Fig 7.10

| Application Rate Guidelines | | | | | | |
|--|--------------------------------------|-----------------|----------------|----------------|----------------|-------------------------|
| PRE-WETTED 50/50 SALT/SAND MIX 1-2 hour turn around | | | | | | |
| Pounds of Salt/Sand Mix Per Lane Mile | Surface Temp (F) | Above 32 | 32 – 27 | 26 – 21 | 20 – 15 | 15 & Falling |
| | Heavy Frost, Black Ice | * | 100 – 200 | 200 – 300 | 300 – 400 | ** |
| | Light to Medium Snow | * | ***200 – 300 | ***300 – 400 | ***400 – 500 | ** |
| | Heavy Snow | * | ***200 – 300 | ***400 – 500 | ***600 – 700 | ** |
| | Freezing Rain, Drizzle, Sleet | * | 300 – 400 | 500 – 300 | 700 – 800 | ** |

* = Treat icy patches if needed with chemical at 100 lbs. / lane mile.

**= It is recommended that before applying chemicals in this temperature range you discuss with your supervisor the appropriate quantities of chemicals to use.

***= Applying anti-icing agents to dry roads in windy conditions may allow the snow to collect to the road. Because of this, use caution before using anti-ice material when wind speeds are predicted to exceed 15 mph. Closely monitor road conditions for pavement changes that would warrant applying chemical.

Fig 7.11

| Application Rate Guidelines | | | | | | |
|--|--------------------------------------|-----------------|----------------|----------------|----------------|-------------------------|
| PRE-WETTED 50/50 SALT/SAND MIX 2-4 hour turn around | | | | | | |
| Pounds of Salt/Sand Mix Per Lane Mile | Surface Temp (F) | Above 32 | 32 – 27 | 26 – 21 | 20 – 15 | 15 & Falling |
| | Heavy Frost, Black Ice | * | 200 – 300 | 300 – 400 | 400 – 500 | ** |
| | Light to Medium Snow | * | ***200 – 300 | ***400 -500 | ***500 – 600 | ** |
| | Heavy Snow | * | ***300 – 400 | ***500 – 700 | ***900 – 1000 | ** |
| | Freezing Rain, Drizzle, Sleet | * | 400 – 600 | 700 – 900 | 1000 – 1200 | ** |

* = Treat icy patches if needed with chemical at 100 lbs. / lane mile.

**= It is recommended that before applying chemicals in this temperature range you discuss with your supervisor the appropriate quantities of chemicals to use.

***= Applying anti-icing agents to dry roads in windy conditions may allow the snow to collect to the road. Because of this, use caution before using anti-ice material when wind speeds are predicted to exceed 15 mph. Closely monitor road conditions for pavement changes that would warrant applying chemical.

Fig.7.12

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Section 8.10
INTERCHANGES & GRADE SEPARATIONS

8.11 INTERSTATE

ON THE RURAL INTERSTATE SYSTEM

Separate agreements are made with some counties detailing the maintenance obligations of both the county and KDOT for interchanges and grade separations.

It is the responsibility of the Area Engineer and Area Maintenance Superintendent to be knowledgeable of maintenance agreements applicable to their Area and to follow the agreement.

Interchanges between Interstate and Local Roads shall generally be maintained as follows:

- A. **KDOT Maintains** the entire interchange including separation structures, connecting ramps, and the local road to the outermost ramp terminal.
- B. **The County Maintains** all of the local roads, modified, or relocated, and not provided for in (A) above.

Grade Separations Between Interstate and Local Roads (no interchange) shall generally be maintained as follows:

- A. **KDOT maintains** all of the separation structure, bridge berm, berm protection, drainage system, signing, guardrail that is part of the structure, and fencing.

The County Maintains the local roadway when over or under the Interstate and the local roadside beyond the structures. They remove snow and debris from structures carrying local traffic over the Interstate.

CITY CONNECTING LINKS ON THE INTERSTATE SYSTEM

These links are covered by separate maintenance agreements with cities, in accordance with SOM - 1.14.9 “City connecting Links”.

In general, specific city connecting link agreements should be followed for maintenance in each city. Copies of current agreements should be on file in the District and Area Offices. The agreements can be found on the KDOT intranet at the following link:

<https://dmsweb.ksdot.org/resolutions/>

8.12 TURNPIKE

KDOT Maintains the roadside within the limits of the KDOT right-of-way and outside fenced portions of the Kansas Turnpike Authority (KTA) right-of-way.

At structures carrying a ***highway over the turnpike***, KDOT maintains the superstructure, guardrail, and signs.

At structures carrying ***turnpike over a highway***, KDOT maintains the substructure, drainage structures, bridge berms, and berm protections within the right-of-way limits mentioned above.

At ***access grade intersections with the turnpike***, KDOT maintains all highway elements and appurtenances within limits of the KDOT right-of-way **except** the KTA signs. This includes the pavement, shoulders, turnouts, and drainage structures.

Section 8.20 PARK ROADS

8.21 JURISDICTION

State park roads are under the jurisdiction of ***The Department of Wildlife, Parks and Tourism***. These roads are not part of the State Highway System.

By statute, the Secretary of Transportation may use state highway funds for “. . . maintenance of roads located in a state park that are not maintained by a federal agency.”

8.22 KDOT INVOLVEMENT

The Area Engineers and maintenance superintendents will conduct *Periodic Inspections* with each park manager to determine needed park road maintenance.

KDOT's work involvement with park roads will be limited to the surfaces of **bituminous roadways**. This does not include parking areas, drives, ramps, or any area not part of the actual roadway used for vehicle traffic movement. Activities are limited to **patching** and **crack sealing**.

Section 8.30 DETOURS

8.31 DETOUR INFORMATION

Road closures affect the highway user. *Reasonable efforts should be made* to keep the public informed of road closures. The area office should keep local law enforcement and the news media informed of road closures.

KCARS, the KDOT Internet-based mapping system that records detour and road conditions, shall be used to report all road closures and detours. The detour removal should also be entered into KCARS when the time for detour removal is not shown on the original entry.

8.32 PLANNED, TEMPORARY, NON-EMERGENCY ROAD CLOSURES

The Secretary of Transportation may authorize the temporary closing of any part of a highway for any purpose, which is in the best interest of the State.

The Secretary has delegated this authority to the District Engineers, in accordance with SOM 1.14.3 "Temporary Highway Closures".

Every Non-emergency Authorized Closure is Subject to the Following Conditions:

- A. A Detour Plan is in place, where appropriate, and has been approved by the District. If a non-highway location is involved, the local governing body must also give approval.
- B. A Traffic Control Plan is in place and approved by the District.

- C. Timing which will not unreasonably inconvenience the traveling public.
- D. The Request for Closures are to be submitted to the District from five to thirty days prior to the requested closing date. The required lead-time depends on detour requirements.
- E. Required traffic control will be installed and removed by and at the expense of those requesting temporary closing.
- F. Information on the Closure and resulting detour will be entered into KCARS. The news media, Highway Patrol and local enforcement agencies should be kept informed.

8.33 EMERGENCY CLOSURES AND DETOURS

In emergencies when a road must be closed for an extended period of time, a detour should be established and signed as soon as practical.

If a detour is not available, signs advising of the closure, which are visible at night, should be placed at the nearest town and/or other appropriate locations as soon as practical.

The Bridge Management Section should be notified if the road closure is bridge related.

The District Office will notify the Highway Patrol, local law enforcement and local news media of emergency road closures.

8.34 CHANGE IN TRAFFIC ROUTING AND HIGHWAY STATUS

Changes in traffic routing that result from construction or maintenance projects or an emergency situation should be entered into **KCARS**, the KDOT Internet-based mapping system that records detour and road conditions. KCARS is accessible through the Intranet homepage under “Road Conditions”. <http://kdotweb/Documents/roadconditions.asp>

KCARS training and instructions are available at the above link or through the Bureau of Maintenance.

The KCARS system shall be used to report the actual dates and locations (beginning and ending points) of road closures, route changes and restrictions, detours, and rest area closures. Descriptions of detour alignments should also be included in the KCARS system.

KCARS entries will need to be updated periodically to show changes in restrictions; and when a highway, bridge, or rest area is reopened to unrestricted traffic.

KCARS will be used by the responsible KDOT office, to enter Road or Bridge Closures, Route Changes and Rest Area Closures including those emergency situations where the FHWA must be notified.

The following occurrences require ***FHWA Notification*** and are to be processed by the area office.

1. Road closures due to snow, ice and high water, natural disasters such as floods, earthquakes, and tornadoes.
2. A terrorist incident impacting highway operations.
3. Incidents that cause a major highway (K, US & I-routes) to be closed for more than **8** hours except where the public has been notified in advance via newspapers, radio, or television announcements.
4. Incidents that cause major damage (in excess of one million dollars) to the highway network.
5. Bridge failures or emergency closures. Indicate if the closure is related to a bridge inspection.
6. Incidents involving hazardous materials, fire, explosion, or release of hazardous materials that impact highway operations.
7. Incidents that create national media attention and impact highway operations.
8. Chain reaction highway crashes where more than **20** vehicles are involved, regardless of the number of injuries.
9. Highway crashes involving the deaths of **10 or more** people or any highway crash involving a school bus resulting in serious injuries or deaths to school children.

FHWA Notification can either be accomplished by entering the information into KCARS and selecting the FHWA for email notification or by calling the FHWA regional office at 1-785-213-1840.

If KCARS is not available, notification of an incident can be made either through the use of the fax or telephone to relevant parties. The occurrence should be entered into the KCARS as soon as reasonable, even after the fact, for historical documentation.

Section 8.40
8.40 RAILROAD GRADE CROSSING

8.41 MAINTENANCE RESPONSIBILITIES

The **KANSAS DEPARTMENT OF TRANSPORTATION** is responsible for the following items except when the crossing is located on a city-maintained connecting link:

- A. The roadway approaches to a line two feet outside the outside rails. (Take care when working around railroad crossings to avoid dragging foreign material into the flangeways.)
- B. Pavement markings.
- C. Advance warning signs.

The **RAILROAD COMPANY** is responsible for:

- A. The area, which lies between the rails and two feet outside each rail.
- B. Traffic control devices at the crossing, including the crossbucks, signals, gates, and other control equipment.
- C. The installation and maintenance of guardrail at crossing warning devices.

THE FOLLOWING APPLIES - When Railroad Crossing Repairs are Performed by the Railroad Company or their contractors:

- A. When Highway Remains Open (Under Traffic)
 - (1) KDOT, if requested, may loan signs and barricades to the railroad company for traffic control use.
 - (2) If requested, and the crossing is not located on a city maintained connecting link, KDOT may install signs and barricades and bill the railroad company for actual equipment rental and labor costs.

(3) Flag persons shall be furnished by the railroad company.

B. **When Highway is Closed** a detour will be provided at the expense of the railroad company.

(1) The closure must be authorized, and procedures followed as outlined in Section 8.32 “Planned, Temporary, Non-Emergency Road Closures”.

(2) KDOT, if requested, may loan signs and barricades to the railroad company for traffic control use.

(3) If requested, and the crossing is not located on a city maintained connecting link, KDOT may install signs and barricades and bill the railroad company for actual equipment rental and labor costs.

8.42 CROSSBUCK SIGNS

Crossbuck signs and posts are owned and maintained by the railroad company. Special projects or agreements may result in upgrading work by others, but their condition and maintenance remains the responsibility of the Railroad Company.

The crossbuck assembly shall have high-quality white reflectorized sheeting with the words “RAILROAD CROSSING” in black lettering.

One Crossbuck Sign shall be maintained on the right-hand side of the roadway on each approach to the crossing as follows:

At rural grade crossings, **WITHOUT *Flashing Light Signal Control***, each side of the crossbuck sign (double faced) shall have white reflectorized background, with the words “RAILROAD CROSSING” in black lettering so that two faces are displayed to each highway approach.

At rural grade crossings **WITH *Flashing Light Signal Control***, the single faced crossbucks are permissible, unless an engineering study finds restricted sight distance or unfavorable road geometry. Then the double faced crossbuck signs will be located so that two faces are displayed to each highway approach.

At City Streets Designated as City Connecting Links, single faced crossbuck signs are permissible, unless an engineering study finds restricted sight distance or unfavorable road geometry. Then crossbuck signs shall be placed back-to-back or otherwise located so two faces are displayed to each highway approach.

If there are *Two or More Tracks* between crossbuck signs, the number of tracks shall be indicated on an auxiliary sign mounted below the cross buck. Use of the auxiliary signs is optional at crossings with automatic gates.

8.43 SIGNING AND PAVEMENT MARKINGS

See “*Highway Sign Manual*” for typical signing and pavement markings at railroad grade crossings.

A special “***ROUGH CROSSING***” sign may be used for rough crossings. This sign should be considered when a crossing has tracks with high super elevation or those awaiting maintenance by the railroad company. An *Advisory Speed Sign* is a part of this sign assembly. The advisory speed limit will need to be established for each location where a “ROUGH CROSSING” is marked. Consult with your Area Engineer to establish the advising speed limit.

THE FOLLOWING APPLIES - When Railroad Crossing Pavement Marking Repairs are Performed by KDOT:

KDOT has the authority to maintain the highway up to the railroad crossing, including the painting of the stop bar, and advance warning railroad crossing.

KDOT Maintenance will notify the Railroad Company (Manager of Track Maintenance or Road Master) prior to working with equipment within 25 feet of a railroad crossing. At Crossings controlled by signalized warning devices, such as flashing lights and/or gate arms, the railroad has requested a railroad flagman be present when KDOT is flagging traffic across the signalized railroad crossing. KDOT shall comply with this request for flagging. For maintenance activities that do not require flagging traffic across a signalized railroad crossing, the railroad may want a railroad flagman present when KDOT’s maintenance operations are within 25 feet of the railroad track. KDOT may comply with this request for flagging if possible and if the railroad is responsive to KDOT’s schedule. Depending on the duration of the flagging needed, the Manager of Track Maintenance may need a 2-to-3-week lead time to schedule flagging. Railroad flagging performed by railroad is at railroad’s expense.

Definition:

Railroad Flagman – is a railroad employee with radio communication with the train crew and train dispatch center. The railroad employee will be able to stop highway traffic at the crossing in the event of an oncoming train.

FRA – Federal Railroad Administration (FRA) has the authority to levy fines against the railroad for non-compliance with railroad crossing regulations.

Regulation Requirement:

Traffic Flagging Operation - Traffic routed in the opposite lane of travel, causes the railroad crossing warning signals to be facing away from the approaching traffic. This condition causes

the signals, according to the FRA regulations to be considered to be in failure. A crossing signal considered to be in failure causes the railroad, upon knowledge of such a condition, to take a set of actions that includes stopping the train before entering the crossing according to FRA regulations.

8.44 GUARDRAIL

Guardrail is to be installed *At Flashing Light Signals* on railroad crossings.

Installation and maintenance of such guardrail is the *Responsibility of the Railroad Company*.

8.45 RAILROAD CROSSING INSPECTIONS

All Rural and City Connecting Link railroad-state highway grade crossings should be inspected annually. Inspection data is to be sent to the District, and the Bureau of Maintenance using **DOT Form No. 361 “Condition of Railroad Crossings”**.

- A. If no inadequacies are noted, a copy of the form should be forwarded to the Bureau of Maintenance.
- B. If inadequacies are noted, retain a copy at the Area. When the crossing inadequacies have been remedied, Part V “Completion Notice” shall be filled out and a copy forwarded to the Bureau of Maintenance.

For *Rural Crossings on state highways*, should any of the inadequacies listed on DOT Form No. 361 require repair by the railroad company, **DOT Form No. 332 “Railroad Crossing Repair Order”** shall be completed and sent to the Railroad Company.

- A. If repairs or satisfactory arrangements for repair are not commenced within 30 - 60 days, a second notice is to be issued to the railroad company.
- B. If inspection within 30 to 60 days reveals that repairs or satisfactory arrangements for repairs are not underway following the second issuance of the “Repair Notice”, then a third notice should be completed, and all copies sent to the Bureau of Maintenance for handling.

For Crossings on City Connecting Links inadequacies listed on DOT Form No.361, Condition of Railroad Crossings, are to be referred to the city along with a copy of DOT Form No. 361. The city should inform the railroad of these inadequate conditions when they are the city’s responsibility.

- A. Inadequacies which are designated a part of the maintenance obligation of the city are to be repaired by the city.
- B. If repairs are the responsibility of the railroad company, then such repairs are to be completed by the railroad company. See Section 8.41 for information on the use of KDOT signs.

Section 8.50 TRAFFIC COUNTERS

District personnel have no regular responsibility for these stations. *On occasion, flagging may be requested* for in-road repairs by Planning. City crews are contacted for stations within city limits, county maintenance is contacted for other non-Highway stations but KDOT crews will typically flag for repairs on the state system.

8.51 PERMANENT COUNTERS

The Bureau of Transportation Planning maintains over 100 permanent traffic monitoring stations in continuous operation throughout the state. These stations consist of in-pavement sensors connected to a roadside cabinet via conduit through the shoulder and roadside. Many of these stations also have a buried telephone line. A few stations have AC power, but most are solar powered and have only 12V DC (battery power) on-site.

Traffic and Roadwork may damage the in-pavement sensors, shoulder and roadside work may affect the conduit, and mowing may impact the cabinet; please notify the *Traffic and Field Operations unit of the Bureau of Planning* if roadside operations, roadway work or crashes damage this equipment.

Highway stations are identified in KANPLAN by the 'ATR Station' item. Any questions about these stations may be addressed to the *Field Data Collections Engineer* or *Planning Shop supervisor of the Bureau of Transportation Planning*.

8.52 PORTABLE COUNTERS

The Bureau of Transportation Planning sets over 11,000 short-term counts each year. These counts are conducted county-wide and can be recognized by one or two roadhoses stretched across the travel lanes and connected to a portable box chained to a post at the roadside. These are managed by on-site Planning staff, any questions, or concerns or to

report damage to a portable counter, direct it to the *Field Data Collections Engineer* or *Traffic Counting Coordinator in the Bureau of Transportation Planning*.

Section 8.60 EMERGENCY OPERATIONS

8.61 GENERAL

The *Emergency Mission of KDOT* is to maintain the integrity and usefulness of the transportation system, to restore the transportation system to a useable condition and provide such other support activities as may be required to restore traffic movement and protect citizens' health and safety.

Detailed Emergency Procedures may be found in SOM 1.9.4 "Emergency Operations" A copy of SOM 1.9.4 with attachments should be available in District, Area and Subarea offices.

Priorities will be determined by the Kansas Division of Emergency Management when the Emergency DOT Executive Control Group is operating under provisions of the Kansas Emergency Operations Plan.

8.62 DEFINITIONS

Disaster is the occurrence or imminent threat of widespread or severe damage, injury, or loss of life or property resulting from any natural or man-made cause, including but not limited to fire, flood, earthquake, wind, storm, epidemic, air contamination, blight, drought, infestation, explosion, riot, or hostile military or paramilitary action.

Emergency is any occasion or instance for which assistance is needed to supplement state and local efforts and capabilities to save lives and to protect property and public health and safety.

Hazardous Material is a substance or material, including a hazardous substance, which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated (49 CRF 171.8). For the purposes of ESF #10 and the Oil and Hazardous Materials Annex, the term is intended to mean hazardous substances, pollutants, and contaminants as defined by the National Contingency Plan.

Nuclear Incidents may involve nuclear weapons, nuclear devices, nuclear reactors, fire or explosives in buildings or facilities where radioactive materials are stored or used, or an incident involving the transportation of radioactive materials.

8.63 EMERGENCY RESPONSE PROCEDURES

The following will be observed, for local or state emergency conditions.

Life Safety:

- A. **The State Highway System will usually receive first priority**, by restoring traffic flow to provide access to locations or communities with an emergency situation.
- B. KDOT forces need not wait for an official declaration to begin offering help for stabilization of life safety efforts to local authorities.

Relief Efforts:

- A. Upon request by local authorities for the need of assistance for relief and restoration efforts the following steps should be taken.
 - If a declaration has been issued, then the request is directed through the Kansas Department of Emergency Management (KDEM)
 - If there is no declaration, then the request is directed through the District Engineer.
 -

See Chapter Twelve; Section 12.20 “Hazardous Material Emergencies” for procedures regarding radioactive accidents and cleanup of hazardous material spills.

8.64 DELEGATIONS OF AUTHORITY

KDOT Employees (individuals or crews) in the immediate area of a disaster will take the following actions:

Equipment Operator will take the following actions:

- A. Inform higher KDOT authority of the nature of the disaster and request approval to act as soon as practical.

Supervisor will take the following actions

- A. Upon request or recognition of necessity to act, give assistance (including the use of KDOT operated equipment) to local authorities for stabilization of life safety efforts. It is not necessary to have advance approval to take this action.
- B. Report Emergency support activities to the Area or District as soon as practical.

Area Engineers will take the following actions:

- A. Report emergency support activity to the District as soon as practical.
- B. Determine if additional equipment or personnel is needed and report such requests and action taken to District Headquarters.

District Engineers will take the following actions:

- A. Inform Headquarters “KDOT Emergency Coordinator and or Director of Field Operations” of the emergency event and the actions taken by KDOT.

- B. Direct the use of KDOT personnel and equipment as may be necessary for cleanup and restoration efforts. Such actions will involve Headquarters Bureau of Maintenance, Topeka.

8.65 RECORDS

Records Are to Be Maintained of All Expenditures for labor, equipment, and materials utilized during emergency or disaster operations. Purchases that are a direct result of disaster operations should also be tracked, such as flat tire repairs during storm clean-up.

Charges for emergency work will be accounted for under ***Special Project Numbers and or Activity 611*** which may be assigned after the fact by the Bureau of Maintenance.

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CHAPTER NINE

EQUIPMENT

- Section 9.10 - GENERAL

9.11–EQUIPMENT MANAGEMENT SYSTEM

Usage and Cost Reports are available from the Equipment Management System. These are useful when considering the usage, replacement and repair of KDOT equipment units.

Reports are available statewide - to the subarea level. Standard reports can be generated through the reports portal on the KDOT intranet.

9.12–BUDGETING

Budgets are submitted annually to replace worn or obsolete equipment.

The approved budget specifies the number of equipment units which may be purchased each year. The individual units are not identified in the budget document.

Current Replacement Criteria for KDOT equipment may be found in the Equipment Policies and Menu document posted on the Bureau of Maintenance Website. It is recognized that these replacement criteria can be superseded by:

- A. Exceedingly high operating costs
- B. Unavailability of repair parts
- C. A repair that is uneconomical due to the age of the equipment
- D. The cost of repair.
- E. The lack of available funds to meet replacement needs

The *Replacement Criteria (Minimum Usage and/or Age)* is based upon a determination of the optimal time to minimize total cost of ownership. This determination considers multiple factors such as purchase price, salvage value and rising maintenance costs.

9.13–NEW EQUIPMENT

The districts shall communicate their equipment requests to the Equipment Section in the Bureau of Maintenance. If there are special considerations or options required, that should also be included in the request

The Bureau of Maintenance approves the requests and prepares specifications for new road equipment.

Approved requisitions and specifications are forwarded to the Bureau of Fiscal Services for procurement of items.

The new equipment is delivered to the destination specified on the purchase request.

The Following Procedures Should be Used Upon Receipt of New Equipment:

- A. The District Equipment Shop Superintendent and/or Equipment Engineer inspects the unit as to condition and compliance with specifications. The acceptance or rejection of equipment is based on this inspection. Within 7 days of receipt of the equipment, the Equipment Shop Superintendent should notify the Equipment Section for acceptance or reasons for rejection.
- B. Accepted KDOT equipment is serviced, assigned and activated in inventory. **FORM 314, "SERVICE Manual"** should be prepared according KDOT's service recommendations (see Section 9.17). **Service Reminder Stickers** can be installed as an aid for obtaining service when the unit is not equipped with an automated service reminder.
- C. **KDOT Form 348, New Equipment Evaluation**, should be completed by the operator and/or supervisor after a new unit of equipment has been used for a season. A second form should be processed in another year or as problems occur.

9.14–REGISTRATION AND MARKING OF KDOT EQUIPMENT

KDOT Vehicles Shall be Titled and Registered as required by law, and they should be marked in a uniform manner.

Vehicles shall be registered at the same weight rating as the Manufacturer's GVW Rating except for the following:

- Dump trucks and other tandem axle trucks equipped with a pintle hitch for towing tandem axle trailers shall be registered at 74,000 pounds.
- Tandem axle semi tractors equipped with a fifth wheel shall be registered at 85,500 pounds

KDOT equipment must have the DOT number permanently marked on the unit. Light and medium duty vehicles (cars, pickups, vans, and sport utility vehicles) shall be marked on the inside of the fuel door and/or under the hood. Heavy duty vehicles (heavy trucks, tractors, trailers, loaders, motorgraders) should be marked in a way to be legible from either side of the unit.

Equipment purchased as Buyback Equipment, or heavy equipment not painted orange should have an appropriate sized Kansas Department of Transportation seal affixed to both sides of the equipment which are visible to passing motorists.

Red and White conspicuity tape should be applied to the sides and tailgate of dump beds and on the rear of spreaders. Alternating 6" red and 6" white reflective tape should be used to outline the perimeter of the dump body sides, tailgate, and rear of the spreader.

License tag request and registration: The District Equipment Shop Superintendent shall submit the tag request information to the Department of Administration upon receipt of any district or headquarters' vehicle required to display a license tag. At the time of tag request, the applicant must list the Registration Weight on the application.

Kansas Certificate of Title: The District Equipment Shop Superintendent shall make application for a Kansas Certificate of Title upon receipt of any district vehicle requiring a license tag and delivered with a Manufacturer's Statement of Origin. The district shall store titles in a secure location for each vehicle assigned to any inventory location within the district.

Trailers: Trailers with a gross weight (the weight of the trailer and the maximum expected load) that is over 2,000 pounds shall be titled and registered. Trailers are defined as units whose purpose is to transport loads. This includes sign trailers, utility trailers, lowboy and tilt top trailers.

Units such as air compressors, arrow boards, crash attenuators, crack sealers, and pothole patchers are not tagged or registered.

9.15– EQUIPMENT RENTAL

KDOT has established Equipment Rental Contracts with multiple vendors. The contracts are available on the Department of Administration website and must be used to rent equipment. If the needed equipment is not available on contract, please contact the KDOT Equipment Section and/or the Chief Procurement Officer of the Bureau of Fiscal Services to either modify the contract or to deviate from the rental contract.

Prior to the rental of equipment, reasonable effort should be made to obtain the needed equipment from within KDOT's current equipment inventory. The Equipment Section in Headquarters can aid in identifying potential units to borrow. If the equipment is not available within KDOT's current inventory, approval **MUST** be obtained from the District Maintenance Engineer to verify the availability of funds necessary to rent the equipment throughout the expected duration.

The Equipment Rental Contracts establish terms and conditions including daily, weekly and monthly rates along with Delivery, Insurance and Usage provisions. KDOT employees should not sign any agreement provided by the equipment vendor that would change the terms and conditions found in the Equipment Rental Contracts. If there is any question about whether a document should be signed, please contact the Chief Procurement Officer of the Bureau of Fiscal Services for assistance.

9.16 –INSPECTIONS

Annual Equipment Inspections

KDOT equipment, except for those items listed on the Maintenance Website as *Equipment Not Requiring Inspection*, shall be inspected on an annual basis by a mechanic or equipment inspector to see that it is being properly maintained. This inspection will confirm that scheduled maintenance has been performed. The mechanic/inspector will look for items that need repair or replacement.

A form 351, Annual Equipment Inspection, will be completed by the District Equipment Inspector or an Equipment Mechanic. When deficiencies are found that require repairs to be performed by an Equipment Mechanic, a form 359, Equipment Service and Repair Order, will be used to document repairs that were completed. The repair order number shall be written on the bottom of the Inspection form for auditing purposes. If the Annual Equipment Inspection is done in the field as part of a Preventive Maintenance day, the 351 should be completed in lieu of Form 363, Equipment Preventive Maintenance Check. The 359 with a copy of the 351 attached will be filed in the equipment folder at both the Area and District shop for equipment assigned to an Area, and in the District equipment folder for equipment assigned to the District.

Entry of information into the Equipment Management System (EMS)

The following information from the 351 will be entered into EMS at the District and should be entered within 30 days from the inspection: Inspection number (use the calendar year of the inspection followed by the number of times that unit has been inspected that year. e.g. 20161 the first time the unit was inspected in 2016), equipment number, inspection date, inspection rating, and unit condition. For guidelines on inspection rating and unit condition, see the Maintenance Website.

The information from the 359 will be entered into EMS at the Area or District.

The District Equipment Shop Superintendent shall run reports to confirm that all appropriate equipment assigned to the District is being inspected on an annual basis.

Equipment assigned to Divisions other than Operations

It will be the responsibility of the individual assigned to a piece of equipment to schedule an Annual Inspection of the equipment. This inspection may be done at a District or Area shop with the 351 submitted to the District Equipment Shop Superintendent. The Equipment Section will run reports to confirm that equipment not assigned to Operations is being inspected on an annual basis.

Inspections of Cranes and Man-Lifts

An annual inspection is required to be performed by a certified inspector of powered (air or electric) Shop Overhead Cranes and Man-Lift equipment (Sign Bucket Trucks, Derrick Trucks, Bridge Inspection Truck, Scissor Lift and Boom Lift units). A monthly visual inspection is required to be done by KDOT personnel for powered overhead cranes. This monthly inspection should be documented on a KDOT Form #364.

Public Transportation Vehicles

Public Transportation (PT) Vehicles shall be inspected yearly as directed by the District Shop Superintendent or Equipment Inspector from information furnished by the Public Transportation Section of the Bureau of Transportation Planning. PT vehicles are inspected and documented on a DOT Form #853.

Equipment Preventive Maintenance Day

Proper maintenance is essential for the efficient operation of equipment owned or leased by the Kansas Department of Transportation. Equipment needs to be maintained in good operating condition. It has been shown that a regularly scheduled preventive maintenance day will improve the availability and reliability of equipment.

Each Sub-Area, Area and District Crews will have an equipment preventive maintenance day on a 4 to 6-week schedule. This day will primarily be used to complete a form 363, Equipment Preventive Maintenance Checklist, on equipment assigned to the location and to perform any preventive maintenance identified. For Sub-Area and Area equipment, forms shall be sent to the Area Shop to be filed and stored. District equipment forms shall be sent to the District Shop to be filed and stored. It is suggested that the forms be filed by month and location. Forms shall be kept for the previous calendar year. (Example: on 1/1/2020 you may dispose of the 363's from calendar year 2018)

Districts are encouraged to have a mechanic present at the preventive maintenance day if staffing allows. District, Area and Sub-Area crew supervisors and Equipment Operator Specialists shall take an active role in the equipment preventive maintenance day by assigning tasks and assisting in inspections.

Equipment listed on the "Equipment not Requiring Inspection" list as posted on the Bureau of Maintenance website is not required to be inspected or to have a Form 363 completed. All other equipment should follow the schedule below for frequency of maintenance day inspections:

Non-seasonal, self-propelled equipment

Form 363 will be filled out on active, non-seasonal, self-propelled equipment at each maintenance day.

Seasonal and non-self-propelled equipment

Form 363 shall be filled out on maintenance days during the season the equipment is being used. One inspection should be scheduled as a preseason review to confirm that the equipment is in "ready to use" condition.

Vehicles assigned to Construction and Materials field offices

The individual assigned a vehicle will be required to fill out a form 363, Equipment Preventive Maintenance Checklist, every 2 months and submit the form to the Area Shop or District Equipment Shop Superintendent.

Equipment on loan from another maintenance crew

Equipment on loan from another maintenance crew will be inspected by the crew that has borrowed the equipment. The 363 will be forwarded to the shop (lender) that the equipment is assigned to.

Equipment not currently located in the yard

To minimize travel and hauling costs on PM days, equipment that is not easily accessible during the scheduled preventive maintenance day should either be inspected and serviced in the field by an operator on a day that they are assigned to operate the equipment or during a time the equipment is scheduled to return to the yard.

Daily Pre-Trip Equipment Inspection:

A ***Daily Equipment Inspection*** (walk around before operation) shall be completed prior to putting the medium or heavy-duty equipment into operation. This check shall include the following items and be documented on form 306, Activity Daily Report:

- Fluid levels
- Wheels, tires, rims and lug nuts
- Hoses and belts
- Lights and reflectors
- Windows, wipers and mirrors,
- Fire extinguishers and first aid kits.
- Leaks
- Items in cab secured
- Trailer connection
- Load secured
- Seasonal items (Plow/Spreader)

After Engine Start-up

- Gauges
- Horn
- Wipers and washers
- Clutch and brakes
- Normal engine temperature

9.17 – SCHEDULED EQUIPMENT MAINTENANCE

Service Intervals:

Oil Change Intervals can be found at the Bureau of Maintenance Website. The intervals are based on miles/engine hours and time (whichever occurs first). The Service Intervals shall be documented in the Form 314, Equipment Manual, kept with the vehicle. The Equipment Shop Superintendent may deviate from the guidance based on legitimate factors such as manufacturer's recommendation and prior experience with premature failures for a particular engine. Deviations from the standard must be approved by the Equipment Section.

Scheduled Equipment Maintenance:

Equipment will be serviced as per the manufacturer's guidelines and/or the form 314, Equipment Manual, kept with each unit. Scheduled maintenance of equipment, completed by the operator, shall be recorded to Maintenance Activity 751 and the proper KDOT number. The maintenance service performed should be entered in the unit's 314 manual. Mechanics performing preventive maintenance should code their time on the Form 359, Repair Order, to Activity 764.

- Section 9.20

EQUIPMENT OPERATION AND OPERATOR MAINTENANCE

9.21 – USE OF EQUIPMENT

Equipment shall be used only for work on state highways and their associated facilities and to assist governmental entities in time of disaster (See SOM 1.9.1 "Use of KDOT Equipment" and SOM 1.9.4 "Emergency Operations").

Specialized Equipment should be shared between districts to provide the most service to the Agency.

9.22 – OVERNIGHT PARKING OF EQUIPMENT

KDOT equipment may be parked overnight on highway right-of-way provided a minimum clearance of 30 feet from the edge of the pavement is maintained.

No overnight parking of KDOT equipment shall be allowed within median areas.

KDOT equipment may be parked on private property only upon consent of the property owner or tenant.

9.23 – OPERATION OF EQUIPMENT

KDOT equipment shall be operated in accordance with the current KDOT SOM 1.10.3 “Operation of State-Owned Vehicles and equipment” and KDOT SOM 2.1.9 “Commercial Driver’s License”.

Operators should receive equipment training for the equipment being operated prior to being assigned operation responsibilities.

- A. Equipment specifications provide for training by the vendor on many new equipment units. The personnel attending this training should be prepared to conduct training sessions for other operators.
- B. Construction personnel and other personnel needed to operate equipment in an emergency or during snow and ice operations should be trained as an equipment operator and given hands-on experience in anticipation of emergency needs.

Equipment is not to be left unattended with the engine running. Engines should not be left to idle for over a couple minutes even during warm up or cool down periods. Modern engines no longer require longer warm up or cool down periods. Excessive idling can result in premature failure of emission systems, higher fuel costs, greater engine wear, and increased air pollution.

Unattended idling of loaders and motorgraders, even during snow and ice operations, is not necessary or recommended.

If a piece of KDOT equipment is operated under conditions other than for which it was designed, the manufacturer warranty may become void. Overloading, use of improper lubricants and mistreatment are some typical reasons for a voided warranty.

Vehicle High Intensity LED/Strobe (Amber) and 4-Way Hazard Lamps (Red) should be activated whenever a truck 80 inches or more in overall width is stopped upon a roadway or adjacent shoulder.

Operators should be familiar with KDOT Form #314, ***Manual for Care and Operation of Motor Equipment***, as it relates to the proper servicing of equipment.

The operator of KDOT equipment should perform daily maintenance to help prevent costly repairs and time lost due to breakdown as a part of the operation of equipment. Proper servicing and repair are an integral part of the operation of the equipment.

Slow moving emblems should be removed or hooded when the vehicle is moved by trailer or by itself at speeds more than 25 MPH.

If equipped with a manual battery disconnect switch, the switch should be turned to the disconnect position when the equipment is parked.

Any requested repairs, service or painting should be submitted by Form 350, *Request for Service and Repairs*.

Equipment should be kept reasonably clean and neat.

- A. Exteriors should be washed periodically.
- B. The interior should be kept clean. Hosing out interiors of cabs promotes corrosion and is discouraged.
- C. Items in the cab that could injure occupants in a crash should be secured or stored outside of the cab.

9.24 – COLD WEATHER EQUIPMENT MAINTENANCE/OPERATION

The **FOLLOWING GUIDELINES SHOULD BE FOLLOWED:** (to promote winter readiness and reduce equipment damage)

- A. Winter equipment should be hooked up and tested by October 15.
- B. Spreader controllers should be tested for proper operation, the calibration verified and re-calibrated if necessary, prior to October 15.
- C. **Cooling System:** Check for proper concentration of antifreeze and adjust if needed.
- D. **Battery:** Check and clean battery connections when needed.
- E. **Tarps:** Non-integrated tarps should be removed from dump bodies for winter operations.
- F. **Fueling:** Fill fuel tanks prior to overnight parking to reduce water contamination due to condensation in the tank.

- G. **Starting Techniques:** Units with block heaters should be plugged in if cold weather is anticipated. Check manufacturer's recommendations for cold weather starts especially units with intake air heaters and glow plugs. **Aerosol ether should not be used.**
- H. **Air Tanks** should be drained to prevent cold-weather freezing.
- I. **Air Dryer and Fuel Filters:** Air dryers with replaceable cartridges and fuel filters should be serviced at least annually and preferably prior to cold weather season.

WINTER STORAGE CHECKLIST:

- A. Equipment should be cleaned, inspected and the needed repairs scheduled prior to service in the spring.
- B. A dry, clean and protected storage area should be used when available to lengthen the life of the equipment.
- C. Lubricate all points inside and out to prevent corrosion and the drying out of protective seals.
- D. If the cooling system will be exposed to freezing temperatures, be sure it is filled with a permanent type antifreeze mixture. After filling, idle the engine for complete distribution of the antifreeze and/or additive.
- E. **Fuel System:** Fill the tank with fuel. Drain off water from tank(s), filter(s), and water separators and close the drain valve.

SUMMER STORAGE CHECKLIST:

- A. Snowplows, material spreaders and anti-ice tanks should be thoroughly cleaned, inspected, and scheduled for needed repairs prior to next service.
- B. Clean and spot paint exposed mild steel surfaces (tailgate latch bars on hoppers and anti-ice tanks).
- C. Keep conveyor chains and augers coated with Lubra-Seal or other rust inhibitors (applied to chains and not to the slats).
- D. Re-paint snowplow moldboards as necessary to cover exposed metal.
- E. **Retract Hydraulic Cylinders** as much as possible. Protect exposed piston rods from weather elements with plastic or other appropriate material.

BULK FUEL PURCHASE AND STORAGE:

Diesel fuel received between October 1st and March 15th shall have a minimum cold filter plug point (CFPP) of -20 degrees Fahrenheit.

Lower cold filter plug points are achieved by blending #2 diesel with #1 diesel and/or additives that affect the CFPP. Higher percentages of #1 diesel fuel raises the price of the fuel and lowers the lubricity and amount of energy per gallon of fuel. Because of this, it is preferable to keep the amount of #1 diesel blended in the fuel to no more than 20% #1 diesel to 80% #2 diesel. The quality of the fuel available to suppliers varies greatly. While one supplier may need to blend 20% #1 diesel into #2 diesel, another supplier may be able to achieve -20 degree CFPP with additives only. Using too high content #1 fuel will cause engine power loss and engine fuel system damage

Blending of fuel and/or additives should be done 10 degrees above Cloud point of the fuel(s) being blended. This includes the fuel already in KDOT storage tank. Attempting to add or blend products at or below its cloud point can result in the two products not mixing in the tank.

KDOT personnel should take a sample of the fuel being delivered before any fuel is put in KDOT storage tanks. This will allow an opportunity to check fuel for clarity. If there are visual abnormalities with the fuel, do not allow the vendor to put the fuel in the KDOT storage tank. After delivery of fuel into the KDOT storage tank, the sample should be dated and retained until the next delivery in case any issues arise over the fuel quality.

Diesel storage tanks shall be checked for water content in the fall before colder temperatures arrive.

Gasoline and diesel fuel should never be mixed, as the gasoline vapors make the mixture an explosion hazard and cause extensive damage to the engine.

9.25–LEGAL WEIGHTS AND DIMENSIONS

State Equipment will be loaded to comply with the maximum weight and dimension requirements of the state statutes.

The *Maximum Allowed Legal Weight* on any group of axles is limited by the manufacturer's weight ratings of each component including tires, suspension and axles and the Bridge Formula. Generally, allowable axle weight limits are 20,000 pounds on a single axle position and 34,000 pounds on a tandem axle position. The maximum gross weight in Kansas is 85,500 pounds (80,000 pounds on interstate highways). The gross weight is defined as the total weight of the vehicle (with trailer) and the load. Any questions about the Bridge Formula restrictions can be answered by contacting the KDOT Equipment Section.

Maximum Legal Width is 8.5 feet.

Maximum height is 14 feet.

Oversize and Overweight Permits can be obtained as explained in Section 11.30, "Special Permits (Oversize and Overweight Vehicles)".

The Equipment Section will work with the KDOT Central Permitting Office to obtain an annual Over Dimension Permit for District Tractor Trucks.

- Section 9.30 - SHOP MANAGEMENT

9.31–SHOP EQUIPMENT BUDGETING

Purchase and replacement of shop equipment should be approved by the District Equipment Shop Superintendent. Shop needs should be communicated to the District Equipment Shop Superintendent so that the needs may be reviewed and reflected in future budgets.

9.32–SHOP SAFETY

Shop Safety guidelines are contained in Chapters 11 and 12 of the General Safety Program section of the KDOT Safety Manual.

9.33– SERVICE AND REPAIRS

GUIDANCE FOR MECHANICS AT REPAIR FACILITIES

AT THE DISTRICT: The District Shop Superintendent and/or Shop Supervisor should schedule work in the shops.

All-inclusive equipment repairs with an estimated cost of \$10,000 or more in parts or outside services shall be pre-approved by the Equipment Engineer or designee. This is not limited to purchases from a single vendor. Repairs that exceed \$10,000 and are sourced from multiple vendors still require approval. The district may request verbal approval but must follow with a Repair Authorization Form, Form 396. If the repairs exceed the initial authorized amount, the district must revise the Repair Authorization Form for final approval. Purchases for parts or services must comply with the relevant purchasing requirements found in the KDOT Procurement Manual.

AT THE AREA: The Area Mechanic should schedule work in the shops.

Equipment repairs performed at an area repair facility with an estimated cost of \$3,000 or more in parts or outside services shall be pre-approved by the District Equipment Shop Superintendent or designee. The area mechanic may request verbal approval but must follow with a Repair Authorization Form, Form 396. Purchases for parts or services must comply with the relevant purchasing requirements found in the KDOT Procurement Manual. The only exception to this policy is replacement of tires. A Form 396 is not required to replace tires.

Repair parts or labor for equipment, other than preventive maintenance items or emergency repairs, shall only be purchased at the direction of the Shop Supervisor or Area Mechanic.

Repairs performed on equipment items must be documented on an “Equipment Service and Repair Order”, Form 359. A copy of all invoices for parts or service should be attached to the Form 359 and kept in the equipment jacket that is maintained at the District Office. For repairs or service that is contracted to an outside entity, a Form 359 should be completed with the invoice for the service attached.

Procurement card purchases for repair parts (other than preventive maintenance items such as oil, filters, antifreeze, wiper blades, and other preventive maintenance items) shall have the purchase receipt signed by the purchaser and approved by the supervisor, attached to the Form 359 and kept in the equipment jacket maintained at the district.

Purchases for parts or service must comply with the KDOT Procurement AND Inventory Manual. Purchases made from any “non-contract” supplier must be communicated to the KDOT Procurement Officer for guidance and direction prior to the purchase.

Transfer of Equipment. Whenever an equipment unit is transferred between Districts, the Repair History Jacket maintained at the District Shop should also be transferred.

GUIDANCE FOR EQUIPMENT USERS

Malfunctions of Equipment should be reported by the operator to the supervisor when they occur. The supervisor will report malfunctions using DOT Form #350, Request for Service and Repairs.

Repairs needed on headquarters’ vehicles or equipment located outside it’s assigned district should be coordinated at the closest Area or District shop.

Equipment Service and Repair Orders will be generated from the 350 form or the Annual Service Inspection Form 351.

The following information will be furnished on the DOT Form #350 when service and/or repairs are requested:

- A. Equipment Number
- B. Assigned Location
- C. Miles/Hours
- D. Date of request
- E. Description of service or repair requested. NOTE: Operators should describe the symptoms they observe to help mechanics make the correct diagnosis.

Accident, Damage and Loss Reporting: Damage to, loss of, or accidents involving KDOT vehicles and equipment shall be reported in a timely manner following the procedures laid out in SOM 1.10.1 including submitting the DOT Form 26, KDOT Report of Accident/Incident.

Each ***District Stockroom*** is either managed by an outside contractor or by a District Storekeeper and each ***Area Stockroom*** by an Area Office Manager. Both stockrooms will coordinate with the Shop Superintendent on what items should be kept in stock for equipment maintenance.

- A. Items such as small parts, filters, tires, grease, lubricating oil, antifreeze and standard replacement parts should be readily available.
- B. Items not available from stock shall be purchased locally within the limits established by KDOT’s Procurement and Inventory Control Manual.

Modification of Equipment. Extras, alterations, or modifications of equipment shall receive prior approval from the Bureau of Maintenance by submitting **DOT Form No. 315, "Equipment Authority - Construction or Modification"**.

Truck Tires, which have been recapped, re-grooved, or retreaded, should not be used on steer wheels.

Front Truck Tires should be replaced before the tread depth, as measured in the shallowest groove, wears to 4/32 inch or before the tire is 10 years old, whichever occurs first. The tread depth shall not be measured at tie bars, humps or fillets. Manufacture tire date is stamped on each tire in a four-digit format: XXXX where the first two digits are the week of manufacture and the last two digits are the year (example 1512 was manufactured during the 15 week of 2012). **Other Tires** should not be used with less than 2/32-inch tread depth. The above is required by current Federal Motor Carrier Safety Regulations (Section 393.75)

9.34– PREPARATION OF EQUIPMENT FOR SERVICE

MANUALS - The Manufacturer's Operator's Manual and the completed Form #314, Service Manual should always be placed with the vehicle.

INSURANCE AND FUEL - Current Insurance Carrier Information, KDOT Credit Card and KDOT Fuel Key should also be placed with the vehicle when applicable.

BACK-UP ALARM - An *Electric Back-Up Alarm* shall be installed on medium and heavy-duty trucks and on all off-road self-propelled equipment. The alarm shall be installed in a protected location near the rear of the unit. Sound should begin when the transmission is shifted into reverse with no equipment motion necessary to activate it.

Back up alarms are not required on rollers and riding lawn mowers where the operator has good visibility to the ground close to the machine in each direction of travel.

SLOW-MOVING VEHICLE EMBLEM – Off-road equipment traveling at less than 25 MPH in the travel way must have a Slow-Moving Vehicle Emblem centrally mounted with the triangle pointed up and located on the rear of the vehicle and visible to motorists traveling behind the slow-moving equipment. They are to be mounted to have between 2 ft. and 6 ft. from bottom of emblem to ground.

FIRE EXTINGUISHERS, REFLECTIVE TRIANGLES AND FIRST AID KITS

Fire extinguishers and first aid kits shall be provided on the following equipment as described below:

5 lb. Rechargeable Fire Extinguisher

- Commercial Motor Vehicles (a licensed vehicle with a Gross Vehicle Rating of 26,001 lbs. or more)
– example: Dump trucks, Truck tractors, Core Drills, Digger Derrick trucks

2 ½ lb. Disposable Fire Extinguisher

- Maintenance Supervisor's Pickup
- Maintenance Crew Pickup
- Equipment exposed to overhead or buried electrical/gas hazards – sign trucks, backhoe, excavator
- Tractor/mower combination (either mounted on the tractor or the mower)

10 lb. Rechargeable Fire Extinguisher (may be a combination of two 5 lb. rechargeable)

- Distributor Trucks
- Crack Sealers (5 lb. on crack sealer in combination with 5 lb. on truck allowed)
- Pothole patchers (5 lb. on pothole patcher in combination with 5 lb. on truck allowed)

First Aid Kits

- Self-propelled licensed vehicles
- Mowing Tractors.

Emergency Road Hazard Reflective Triangle Kit

- Commercial Motor Vehicles (a licensed vehicle with a Gross Vehicle Rating of 26,001 lbs. or more)
– example: Dump trucks, Truck tractors, Core Drills, Digger Derrick trucks

EQUIPMENT WARNING LIGHT CONFIGURATIONS:

Lighting on KDOT equipment shall comply with State of Kansas Motor Vehicle laws.

THE FOLLOWING ARE TYPICAL LIGHTING CONFIGURATIONS

MAINTENANCE PICKUPS – Supervisor and Crew Pickups (mounted to headache rack)

MAINT SUPERINTENDENT - PICKUP (mount to headache rack) or Compact SUV (roof mount)

FULL SIZE SUV (Suburban) – Roof mount – may need 50” to 56” lightbar for proper mount

44” lightbar with traffic advisor (includes secondary white flashing light to rear)



CONSTRUCTION PICKUPS – Mounted on 3rd Brake Light Bracket

TRACTORS – KDOT Owned

16” Mini Light Bar



AUTOMOBILES, MINIVANS AND MIDSIZE SUVs (Traverse) – Rear Deck Mounted/ Back Glass – Visor Mount/Windshield

8 Lamp Light Stick – Rear



Single Amber Light - Front



OFF ROAD EQUIPMENT – Example: Loaders, Motor Graders, Rollers 12 volt and 24 volt



9.35 PREPARATION OF EQUIPMENT TO BE SOLD OR TRADED

ITEMS TO BE REMOVED FROM EQUIPMENT being sold or traded:

- A. **KDOT identification** such as decals and numbers
- B. KDOT radios
- C. Serviceable fire extinguisher, first aid kits, reflector kits

ITEMS TO REMAIN ON EQUIPMENT being sold or traded are as follows:

- A. The Form 314, which lists “Care of Motor Equipment”, should go with the units when they are sold. Equipment Jackets are to be retained for 3 years after the unit is sold.
- B. ***Repair Parts***, which cannot be used on other KDOT equipment, are to be listed as part of the unit that is being sold or traded.

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{BUILDINGS AND LAND MANAGEMENT}

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BUILDINGS AND LAND MANAGEMENT

**- Section 10.10 -
DESCRIPTION**

10.11 – DEFINITION

Buildings and grounds include all KDOT buildings and land other than highway right-of-way. KDOT has defined a “building” as a structure with 100 sq ft or greater and at least three sides and a roof.

Maintenance includes the janitorial services, repairs, painting, landscape upkeep, mowing, and proper storage of equipment and materials.

Buildings and grounds should be maintained to originally constructed, reconstructed or improved condition with consideration for normal maintenance activities and deterioration due to age and usage. This may be accomplished by either KDOT or contract within the agency building maintenance and capital improvement guidelines. See Section 10.72.

10.12 – PURPOSE

The purpose of this chapter is to outline general maintenance of building and grounds and to outline general procedures for the administration of capital improvement (buildings) projects.

**- Section 10.15 -
BUILDING INSPECTIONS**

10.16 – INTENT

Periodic uniform building inspections are the important first step of a preventive maintenance program.

Building inspections also aid in the budgeting process for contractual repairs and capital improvement projects.

10.17 – INSPECTOR

Each District Engineer will designate a building inspector.

The building inspector is responsible for scheduling and making the periodic inspections.

10.18 – INSPECTION CHECK LIST

Building conditions are reported on DOT Form No. 355, *Building Inspection Check List*.

The completed checklist shows the general condition of the building while noting any defects or items which require attention or replacement. Information relating to items not provided for on the form should be explained under the “remarks” section.

The Area Engineer should review those “Building Inspection Check Lists” (DOT Form No. 355), which have items that need attention or replacement and note the corrective action to be taken.

- Section 10.20 -
BUILDING AND YARD MAINTENANCE

10.21 – RESPONSIBILITY

The maintenance of all KDOT buildings and grounds, except the district headquarters facilities, is the responsibility of the appropriate Area Engineer, unless the District Engineer advises differently.

When required building maintenance cannot be accomplished by the Area, it should be reported to the District Maintenance Engineer who will determine how such work is to be accomplished.

Janitorial service normally will be performed by KDOT personnel. However, Districts have the option to hire janitorial services for District, Area, and Construction office complexes.

Maintenance responsibilities for the Weigh Stations and Inspection Stations are outlined in Chapter Seven – under “Motor Carrier Inspection Stations”.

10.22 – PROCEDURES

Overhead doors on storage stalls are to be kept closed when not in use.

Doors between rooms, which are heated by different heating systems, are to be kept closed. Doors between air conditioned and non-air conditioned rooms are to be kept closed.

Use good judgment in setting other thermostats during working and non-working hours.

Always be aware of the need to *Conserve Energy*.

Heated Equipment Storage Areas should be heated only as necessary to obtain comfortable working conditions. Thermostats should be turned down to 55° or below when feasible.

Inspect and Maintain the fan motors, belts, and blowers in all heating and ventilation systems. *Replace Filters As Needed*. Follow the manufacturer’s instructions when replacing filters.

Tanks on air compressors and hot water heaters should be drained, as per manufacturer’s instructions, at periodic intervals.

- Section 10.25 -
STANDARD PAINT COLORS

10.26 – HIGHWAY BUILDINGS

When selecting **EXTERIOR PAINT** use neutral colors which are complimentary to other buildings in the complex.

Do Not Paint prefabricated galvanized buildings, natural stone, aluminum, or copper items.

Posts, brick, stone masonry, aluminum windows, storm doors, copper guttering, downspouts, gravel stops, corrugated fiberglass panels and composition roofing *are to remain unpainted.*

- Section 10.30 -
FIRE PREVENTION MEASURES

10.31 – PREVENTION

SOME IMPORTANT PREVENTIVE MEASURES: (See KDOT Safety Manual for further details)

- A. *Clear Passageways* shall be maintained to electric panel boxes, fire extinguishers, hydrants and exits.
- B. Spontaneous combustion hazards, such as oil and grease rags, shall be disposed of in approved disposal containers.
- C. Smoking is prohibited within 50 feet of fuel pumps or other flammable liquids and storage areas.
- D. Portable containers of liquefied petroleum gas (e.g. propane) *Should Not* be taken into buildings.

10.32 – FIRE EXTINGUISHERS

Guidance for the proper use and maintenance of fire extinguishers can be found in the KDOT Safety Manual.

Use and maintenance of fire extinguishers includes, but is not limited to the following:

- A. Maintain fire extinguishers in a fully charged and operable condition and keep in a designated place at all times when not in use.
- B. Do not obstruct fire extinguishers from view.
- C. Equip dry chemical extinguishers with a pressure gauge or an indicator which is easily visible without removing the extinguisher from its bracket. To maintain these extinguishers, remove from the bracket at least once a month, turn upside down, and tap with a rubber mallet.
- D. Extinguishers will have a durable tag securely attached to show the inspection date and signature (or initials) of the person who performed this service. Each shop or office should designate a person to perform monthly extinguisher checks.

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- E. Check extinguishers monthly to determine that they are in their designated place, that they have not been actuated or tampered with, and to detect any obvious damage, corrosion, or other impairments. An extinguisher showing defects will receive a complete maintenance check.
- F. Extinguishers will be thoroughly inspected annually by a certified technician and, if necessary, recharged, repaired, or replaced.
- G. Immediately replace extinguishers removed for recharging or maintenance by spare extinguishers of the same type and size.
- H. Fire extinguishers must be recharged or filled after each use.
- I. Employees should be trained in the use of fire extinguishers and their locations.
- J. Dry chemical (BC/ABC) extinguishers should be emptied and inspected every six years and hydrostatically tested every 12 years.

**- Section 10.35 -
SIGNS AT BUILDINGS**

10.36 – INFORMATION SIGN

A six-foot by four-foot information sign should be erected at Area and Sub-Area buildings. See KDOT Highway Sign Manual for location details.

Sign information is provided on removable plates, which bolt to the larger sign.

10.37 – GUIDE SIGN

On conventional roads, a guide sign showing direction and distance to buildings not adjacent to the highway should be erected to inform drivers of nearby highway facilities.

See the KDOT Highway Sign Manual for additional information.

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**- Section 10.40 -
SECURITY LIGHTS AND NIGHT LIGHTS**

10.41 – SECURITY LIGHTS

Security lights are designed to provide perimeter lighting around the buildings.

Security lights are controlled by a photoelectric cell.

10.42 – NIGHT LIGHTS

Shops and offices without security lights should have the porch or other exterior lights on at night.

Shops and offices should have selected interior lights on at night.

**- Section 10.45
KEY SYSTEM**

10.46 – LOCKS AND KEYS

A *Best Lock, Grand Master Locking System* is used in all KDOT districts.

All keys are keyed under a standardized system, which generally limits access to those with a need to enter.

Policies and procedures governing distribution and use of keys are outlined in KDOT SOM - 1.9.6 under Distribution and Use of Locks and Keys.

Unauthorized possession of these keys will be considered grounds for disciplinary action.

- Section 10.50 -
CARE AND DISPLAY OF AMERICAN AND KANSAS FLAGS

10.51 – POLICY AND RESPONSIBILITY

The United States and the Kansas Flag should be displayed at KDOT offices when appropriate.

10.52 – REGULATIONS CONCERNING FLAG DISPLAY

It is the universal custom to display the Flag from sunrise to sunset on buildings and on stationary flagstaffs in the open. However, the flag may be displayed twenty-four hours a day if illuminated such that it is recognizable by the casual observer.

A six foot by four foot United States Flag will be flown over a five foot by three foot Kansas Flag where flag poles have been erected.

The Flag should be hoisted briskly.

The Flag should be displayed daily (working days), weather permitting. All weather flags, nylon or other non-absorbent material, may be flown during inclement weather.

No other flag or pennant shall be placed above or to the right of the Flag of the United States of America.

The Flag, when flown at half-staff (one-half the distance between the top and the bottom of the staff), should be first hoisted to the top of the pole for an instant and then lowered to the half-staff position. The Flag should again be raised to the peak before it is lowered for the day. The Kansas Flag will not be flown when the United States Flag is flown at half-staff.

The Flag should never touch anything beneath it, such as the ground, floor, or water.

The Flag should never be fastened, displayed, used or stored in such a manner as will permit it to be easily torn, soiled or damaged in any way.

The Flag, when it is in such condition that it is no longer a fitting emblem for display, should be destroyed in a dignified way, preferably by burning.

**- Section 10.60 -
DISPOSITION OF EXCESS BUILDINGS AND LAND**

10.61 – BUILDING OR LAND SALE REQUEST

When existing buildings or land, other than highway right of way, are no longer required, the District Engineer should send a written request for sale of such buildings or land to the Bureau of Construction and Maintenance.

A complete description of grounds, buildings and appurtenances must be shown.

If approved, the request is submitted to the Bureau of Right of Way for sale or disposition.

In those situations where this method is not appropriate then the process sanctioned by State Surplus Property should be followed and includes the initiation of a DA-110 form.

**- Section 10.70 -
BUDGET**

10.71 – BUILDING MAINTENANCE

All routine maintenance services and stock supplies for buildings shall be addressed in the Districts maintenance budget.

All contractual services are budgeted in Object Code 240.

Materials and supplies for building maintenance are budgeted in the appropriate 300 Object Code series.

All rehabilitation, repair, routine, preventative maintenance and replacement of existing items will be addressed through the district apportioned Capital Improvement Rehabilitation and Repair budget. See section 10.72 for further details.

10.72 – CAPITAL IMPROVEMENTS

The Capital Improvements programs and budgets are prepared by the Bureau of Construction and Maintenance in accordance with the Division of Budget guidelines and are divided into four main categories.

New Building Construction or Addition Projects – Includes ALL new construction and building addition projects and land for building sites. It may also include fixed equipment necessary to equip such new buildings or facilities. These projects must be appropriated in the agency Capital Improvement Plan.

Examples: new salt dome, new Subarea, new equipment storage building, etc.

Major Improvement, Remodeling, or Renovation Projects - Includes all major improvement, remodel, or renovation projects that substantially change the existing structure and/or its use. This includes the conversion of old facilities to new uses, major modernization projects, or major new items of equipment needed in connection with such remodeling to make the affected facility ready for use. These projects must be appropriated in the agency Capital Improvement Plan.

Examples: remodel or renovation of District material lab, or Area office space.

Major Maintenance, Rehabilitation, and Repair Projects – Includes extensive maintenance, specialized maintenance, or repair projects that extend the expected life, but DO NOT increase the value of the building. These projects are done only once in several years or are of a special nature and simply maintain existing facilities in sound condition, without materially increasing the value of the facility.

These projects must be appropriated in the agency Capital Improvement Plan.

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Examples: complete re-roof, complete replumbing or rewiring of a building, tuckpoint/waterproof of building.

Building Rehabilitation and Repair Projects - Includes routine maintenance, major maintenance, emergency maintenance, restoration, replacement of fixed equipment, energy conservation, requests related to compliance with the Americans with Disabilities Act (ADA), and code compliance projects. These projects occur to existing items; do not increase the value of the land or building. This includes the purchase of materials and supplies for a specific building repair.

These projects use the district appropriated rehab/repair monies from the agency Capital Improvement Plan.

Examples: repair or replace furnace/AC, replace doors or windows, replace sidewalk, resurface parking lot, small repairs to Safety Rest Areas, SRAs.

**- Section 10.80 -
BUILDING CONSTRUCTION**

10.81 – “A” PROJECT NUMBERS

Upon appropriation of the agency Capital Improvement Plan, Districts will assign and submit building or land numbers for new projects to the Bureau of Construction and Maintenance. Headquarters will submit the information to Fiscal Services who write the “*Purchase Requisition*” for the project.

The Division of Facilities Management, DFM, will issue an “*A Project Number*” only upon receipt of a Purchase Requisition.

The *Purchase Requisition with the Project Number* is the work authorization document for the Division of Facilities Management.

- A. It specifies the limits of the project.
- B. The architect is not authorized to prepare plans beyond the limits specified.

10.82 – TOPOGRAPHY MAP

As necessary, the District will prepare a scale, topographic and contour map of the proposed building location.

All utilities must be included on the map.

10.83 – DESIGN

Working drawings, plans, and specifications and other contract documents for Capital Improvement building projects may either be prepared by Div. of Facilities Management or by an outside Project Architect. Generally, an outside architect will be selected when the total cost of a project is expected to exceed \$500,000 (engineering services) and \$750,000 (architectural services).

The District Engineer will appoint a person to serve as liaison to the architects during plan development.

10.84 – LETTING

Building Projects are advertised, let and awarded by the Department of Administration.

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The Bureau of Construction and Maintenance reviews the project bid tabs and with district concurrence will make a recommendation as to accept or reject the base and alternate bids

The Bureau of Fiscal Services will distribute copies of the signed contract approximately six weeks after the letting.

10.85 – CONSTRUCTION (FACILITIES MANAGEMENT PLANS)

The Division of Facilities Management, DFM, provides professional design and construction related services to state agencies. The Design section within DFM provides services which include design, construction documents, bid analysis, and construction administration. KDOT, through the Division of Facilities Management acts as the agent for the Director of Administration, and may assist with on site project inspection.

Final inspection and administration of the contract will be the responsibility of the Division of Facilities Management. Department of Administration Forms, provided by the Division of Facilities Management will be used for contract administration.

GUIDELINES:

- A. A ***Preconstruction Conference*** will be held prior to the commencement of work. A member of Facilities Management will be present as well as representatives of KDOT, the General Contractor and all major Subcontractors. Facilities Management will set up, conduct the meeting, and take the minutes.
- B. Facilities Management will issue the ***Notice to Proceed*** in concurrence with a KDOT District Representative and the Contractor.
- C. All projects shall have “one point of contact” supplied by KDOT. At no time should the Contractor be given direction from anyone other than this one designee or the architect.
- D. All changes in the contract work shall be duly recorded and a ***Change Order*** issued for the change. Regardless of the size, scope and dollar value of the change, the Contractor shall submit a written request for a change to Facilities Management. A change order is still necessary even for those changes that do not result in a change in the contract price. The Bureau of Construction and Maintenance will provide agency approval of all **Change Orders** with district concurrence.
- E. All **Change Orders** greater than \$75,000 shall be reported to the Joint Committee on State Building Construction (JCSBC) by the Secretary of Administration through the Division of Facilities Management. K.S.A. 75-1264. Division of Facilities Management will sign these change orders after they have been review by the JCSBC.

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- F. All changes that involve a *Design Change* must be approved by the designer (architect/engineer) of record.
- G. *Periodic Inspections* will continue to be performed by KDOT personnel. Facilities Management will conduct inspections on an as needed basis or as requested.
- H. *All final inspections* will be conducted by the Facilities Management Designer(s) and the KDOT contact engineer/inspector. Substantial completion will be determined by these two representatives for each agency.
- I. The *Certificate of Project Completion* will be signed by the district and issued by Facilities Management.

10.86 – CONSTRUCTION (OUTSIDE PROJECT ARCHITECT PLANS)

The Outside Project Architect acts as the agent for Director of Administration.

Inspection and administration of the contract will be the responsibility of the Outside Project Architect. Department of Administration Forms, provided by the Division of Facilities Management will be used for contract administration.

10.87 – K.S.A. 75-374LC. (EXEMPTION FROM LOCAL BUILDING CODES, PERMITS...)

(a) No state capital improvement project for the construction, reconstruction, remodeling, improvement, repair or maintenance of any building or facility for use by one or more state agencies, shall be subject to any building permit requirement or building code of any county, township, district, city or other political subdivision of this state or fees charged there for. No project shall be subject to any inspection requirement or any requirement to obtain any permit, license or other instrument of approval for the project which is imposed by any county, township, district, city or other political subdivision of this state, except that such project shall be subject to reasonable inspections for the sole purpose of allowing members of the police and fire departments and other public emergency services personnel to become familiar with the project. As used in this section “building code” means any building code and includes any plumbing code, electrical wiring code, gas piping code or similar code. This act shall apply to all capital improvement projects in existence prior to the effective date of this act and to those commenced on or after the effective date.

(b) State capital improvement projects shall be exempt from the payment of fees relating to local zoning ordinances and resolutions, but the state shall reimburse a political subdivision for any related publication expenses incurred by the political subdivision.

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HIGHWAY PERMITS

- Section 11.10 - KDOT POLICY

11.11 – UTILITY ACCOMMODATION POLICY

Public Utilities are, by statute, permitted to use state highway right-of-way. However, such use must be in compliance with KDOT regulation and policy.

KDOT has adopted a *Utility Accommodation Policy* which establishes KDOT policy for highway right-of-way use by contractors, utility companies, or others working in the KDOT right-of-way. This policy is available online at <http://www.ksdot.org/public/kdot/> under doing business and information for highway contractors.

KDOT supervisory employees should be knowledgeable of this policy.

A provision of this policy, as well as Kansas law, requires contractors, utility companies, or others to obtain a Highway Permit from KDOT prior to doing any work on highway right-of-way.

11.12 -- UNDERGROUND UTILITIES (DIG SAFE)

Underground damage prevention is a shared responsibility. The Kansas Underground Utility Damage Prevention Act requires excavators to *call Dig Safe for utility locates before excavation*.

Excavation includes, but is not limited to, post driving, setting sign posts, digging, drilling, trenching, bull dozing and other activities that disturb soil or rock below the surface.

Contact Dig Safe to mark privately owned facilities *and* the KDOT District/Area office to request marking of KDOT owned facilities in the work area. After the required notification period has lapsed and prior to excavation, check the site for utility markings or the all clear markings before beginning any excavation. If none are found, do not excavate and contact your supervisor.

Who to contact:

Dig Safe - call (811) or 1-800-344-7233

KDOT - call the Area Office; contact the Area Engineer or Area Utility Coordinator

KC Scout - (816) 622-6500

Water One- Johnson County www.waterone.org (913) 895-1806 in the Kansas City Metro area

{HIGHWAY PERMITS}

Lead time required:

Dig Safe requires 2 working days notice and KDOT requires 5 working days notice to mark utilities.

A wide variety of types of utilities either parallel or cross KDOT highways.

Utilities in the KDOT right-of-way include, but are not limited to, high pressure lines carrying natural gas, petroleum, carbon dioxide, salt water, water and waste water; and high voltage power lines cross underground as well as communication lines and fiber optic cables.

KDOT owned utilities include, but are not limited to: high voltage power lines for highway lighting and fiber optic communication lines. KDOT fiber optic lines are used to connect the ITS equipment, such as cameras, digital message signs (DMS) and traffic signals as well as computer systems to District and Area office buildings.

11.13 – CORRIDOR MANAGEMENT POLICY

Access (egress and ingress driveways) *to the State Highway System* is regulated by KDOT as permitted by law. The petitioner must obtain a Highway Permit from KDOT **Prior to Doing Any Work** on the highway right-of-way.

KDOT has adopted a *Corridor Management Policy* which establishes procedures and policy for obtaining permits to construct or alter driveways. Contact the Bureau of Transportation Planning, Corridor Management for information on this policy. This policy is also available online at <http://www.ksdot.org/public/kdot/> behind the link publications and maps.

The purpose of the policy is to provide reasonable access to abutting properties on the State Highway System while preserving the traffic service function of the highway for the traveling public.

All *Requests for Commercial and Industrial Driveways* should be reviewed by the Bureau of Transportation Planning, Corridor Management for geometrics, location and number of driveways to be permitted. This centralized reviewing procedure provides for uniform application of the policy across the state.

- Section 11.20 -
HIGHWAY PERMIT AGREEMENTS

11.21 – UTILITY AND/OR ACCESS PERMITS

A *Highway Permit* is required for use of right-of-way, attachments to bridges or structures and to obtain access to the State Highway System.

- A. All permits for utility use of right-of-way and attachments to bridges & structures must comply with the KDOT Utility Accommodation Policy.
- B. All Access permits must comply with the KDOT Corridor Management Policy or have a documented and approved Variance Report.
- C. Tree trimming by utility companies or private contractors on highway right-of-way will be authorized by a Highway Permit. See Chapter Four, Section 4.34, Pruning, for tree pruning methods.
- D. Trimming of vegetation for outdoor advertising must follow the policy on Vegetation Management for Outdoor Advertising Signs.

Permitted work on highway right-of-way must conform to provisions of the Highway Permit and applicable KDOT standards.

Permit requests shall be accompanied by a plan or a neatly drawn sketch to show pertinent information.

All permits must be signed by the property or utility owner, their agent or contractor. Permits issued within city limits shall also be signed by a city official prior to KDOT approval.

11.22 – FORMS

DOT Form No. 304, *Highway Permit - Use of Right-of-Way*, shall be submitted for all **activities involving use of highway right-of-way** located in both rural and urban areas.

DOT Form No. 304A, *Highway Permit Completion or Revocation Notice*, shall be issued upon satisfactory **completion of the work**, or shall be issued upon **cancellation of the permit** by either party.

{HIGHWAY PERMITS}

DOT Form No. 304S, *Standing Permit for Vegetation Management*, is issued for reoccurring vegetation management within the right-of-way.

Dot Form No. 304VM, *Vegetation Management*, is issued for vegetation management within the right-of-way.

DOT Form No. 309, *Highway Permit for Highway Access*, shall be submitted for all **new entrances and/or entrance improvements**.

DOT Form No. 310, *Highway Permit – Attachments to Bridges and Other Structures* shall be submitted for all **attachments to bridges and structures**.

DOT Forms No. 317 *Harvesting Hay on Highway Right-of-Way*, shall be submitted for all **haying** activities on the right-of-way. (See Sec. 4.44 Haying)

DOT Form No. 334, *Access Application Information Sheet*, should be submitted with DOT Form No. 309 when the construction of a **commercial/industrial driveway** is requested.

DOT Form No. E1404, **Variance Report**, shall be submitted with DOT Form No. 309 or 304A when no option exists to provide the petitioner reasonable access other than varying from the policy and provided sufficient documentation accompanies the variance.

11.23 – APPROVAL

The District Engineer is responsible for the approval of all permits for their District.

- A. Approval may be made based on recommendations from the various KDOT Headquarters Bureaus.
- B. Access control will be observed when considering requests.

On city connecting links, only permits which have city approval will be considered for District approval.

The Bureau Transportation Planning, Corridor Management should review and approve requests for all commercial and industrial driveway permits for:

- A. geometrics,
- B. location (spacing),
- C. number of driveways, and
- D. safety.

{HIGHWAY PERMITS}

The *Bureau of Design, Bridge Management Section* must review and approve requests involving:

- A. attachments to structures,
- B. revisions to highway drainage systems, or
- C. work near an MSE wall.

Approval by the Secretary is required for permits on Interstate right-of-way when the request varies from the Utility Accommodation Policy. A cost/benefit study and alternate locations are to be provided by the petitioner for such permit reviews.

11.24 – CITY CONNECTING LINK PROCEDURES

The petitioner will contact the city for a permit to accomplish any work on the highway right-of-way within the city. In the case of a city connecting link, the city shall initiate the permit.

The District should furnish the cities a supply of DOT Form No. 304 *Highway Permit - Use of Right-of-Way* and DOT Form No. 309 *Highway Permit for Highway Access* for issuing highway permits.

The city provides the petitioner with DOT Form No. 304 *Highway Permit - Use of Right-of-Way* and obtains the petitioner's signature and necessary form information.

The city obtains the number of detailed plans they require plus five additional sets to accompany the permit.

The city approves, disapproves, or revises the plan and forwards the approved highway permit form and sets of plans to the District Engineer along with a copy of the city's application form when applicable.

KDOT then reviews the plan. When the petitioner, city and KDOT concur on a plan, the District Engineer will sign the permit.

The District Engineer furnishes the city a signed copy of the permit for their records. Copies are distributed to the petitioner, the Bureau of Construction and Maintenance, and the Area office.

With District concurrence, those cities a city with qualified personnel may supervise the construction and administer the terms of the permit.

Upon satisfactory completion of the work and acceptance by the city, KDOT will issue DOT Form No. 304A, *Highway Permit – Completion or Revocation Notice*.

11.25 – SPECIAL USES FOR HIGHWAY PERMITS FORM 304

Highway Permit – Use of Right-of-Way may also be used to keep track of other activities on the right-of-way including but not limited to:

A. Flower Plantings and Landscaping

A DOT Form No. 304, *Highway Permit – Use of Right-of-Way* may be issued to allow for individuals and/or groups to plant wild flowers or to do landscaping along the right-of-way. The following requirements should be placed on the permit:

The Petitioner assumes all risks and liability for injury or damage, which may occur to persons or property arising out of the performance or non-performance of said permit activity. The Petitioner shall instruct their participants in the safety precautions that should be taken during all operations, including the use of approved safety apparel while on the right-of-way.

The Districts may want to add other requirements as they deem necessary, based on their knowledge of the request and the circumstances surrounding the right-of-way that is being requested to be used. KDOT may also supply safety vests and safety brochures from the Adopt-a-Highway program to local individuals and groups requesting access to the right-of-way.

B. Parades

Follow procedures for temporary road closure in Section 8.32 for the closure of a roadway for the purpose of a locally-sponsored event.

C. Banners

The Districts may issue a DOT Form No. 304, *Highway Permit – Use of Right-of-Way* for the placement of a temporary banner to be erected on highway right-of-way for a locally sponsored event. This may also be handled by a letter granting permission with appropriate specific requirements.

D. Cattle Crossing

Districts may issue a DOT Form# 304, *Highway Permit – Use of Right-of-Way* for any livestock crossing.

E. Monitoring Wells

KDOT has a Memorandum of Understanding with the Kansas Department of Health and Environment (KDHE) concerning the placement of monitoring wells on KDOT right-of-way by KDHE or its contractors. All possible locations outside of KDOT right-of-way need to be considered and eliminated before monitoring wells are placed on the right-of-way. A DOT Form No. 304, *Highway Permit – Use of Right-of-Way* needs to be issued and the **Guidelines for KDHE Monitoring Wells on KDOT Right-of-Way** should be attached to the permit. The guidelines are as follows:

GUIDELINES FOR KDHE MONITORING WELLS ON KDOT RIGHT OF WAY

1. When an application, described in the Memorandum of Understanding is submitted to KDOT, the application must include five (5) copies of a drawing of proposed well locations along with property and right of way lines
2. The permit shall be obtained by the petitioner doing the work. The petitioner shall acquire all the necessary signatures on the permit, i.e. "City" approval if necessary, and give KDOT a reasonable amount of time (30 days) to issue the permit.
3. KDOT may issue the permit conceptually authorizing a specific number of wells at proposed locations to be drilled. KDOT reserves the right to deny approval of specific wells that can be located off KDOT right of way. It will then be the petitioner's responsibility to prove that all other possible locations have been exhausted before KDOT approves these sites. Regardless of the issuance of a permit, the petitioner shall contact KDOT (by phone) for approval as to the exact location of each well before installation, and as the contamination pattern is being established. This notification will occur no less than one working day before drilling on KDOT right of way. KDOT will designate a contact representative for each permit when it is issued.
4. The petitioner shall follow the KDOT Utility Accommodation Policy and comply with the Highway Use of Right of Way Permit Agreement.
5. Wells shall be located outside of the highway clear zone, see KDOT Utility Accommodation Policy for chart. Wells shall not be located in the toe of the slope.
6. The District will decide if wells will be flush with the ground or raised, and this shall be stated on the permit. Wells will be installed in accordance with current KDHE standards. Ground markers are to be located at the outer limits of the right of way line. During maintenance/construction activities, the petitioner will locate and mark wells as needed.
7. During installation and monitoring, the petitioner shall use approved traffic control procedures.
8. KDOT shall be notified whenever the petitioner is going to access KDOT right of way, regardless of whether access is for installation or monitoring of a well. The petitioner is also responsible for notifying Dig Safe prior to drilling.
9. During monitoring, the petitioner may park their vehicles on the shoulder and/or roadway only with prior KDOT permission. in some cases they may park their vehicle on the cross road right of way.

10. KDOT shall be notified when a well is to be abandoned. Wells will be plugged using current KDHE approved methods.

F. Surveyors

Surveyors who are subcontractors (contractor construction staking) on construction projects must abide by the contract requirements, but are not required to obtain a permit. KDOT personnel are exempt from the permit requirements.

Surveyors shall obtain a standing permit from each District in which their work is to be performed. Standing permits may be granted, at the discretion of each District Engineer, for a maximum period of one calendar year. No fee will be charged for this permit.

Surveyors shall request a permit by submitting a DOT Form No. 304, *Highway Permit – Use of Right-of-Way*. It is the surveyor's responsibility to keep a signed copy of the permit onsite while working within the Right-of-Way.

All traffic control used within the Right-of-Way shall conform to the current Manual on Uniform Traffic Control Devices (MUTCD) and established State Traffic Control standard drawings. Traffic Control Standard drawings (TE700, TE702, TE704, TE710, TE720, TE722, TE730, TE744, TE746 and TE748 or other applicable standard drawings) are available from the nearest Area Office.

The Surveyor shall notify the appropriate KDOT Area Office prior to commencing any permitted activities AND shall notify the same office upon the completion of work. The location and dates of the beginning and completion of all work will be documented and logged by the Surveyor. This documentation log shall be kept onsite with the signed permit. Approval to proceed may be given by e-mail, fax or in writing. The Surveyor shall record the name of the individual giving authorization and the date authorization was received.

Vehicles within the Right-of-Way and within 30 feet of the travel way shall utilize amber rotating lights or amber strobe lights mounted on the top of the vehicle. Unattended vehicles and equipment should be parked off of State Highway Right-of-Way or at least 30 feet from the travel way.

All personnel working outside of a vehicle and anywhere within the Highway Right-of-Way shall wear appropriate safety apparel that is in compliance with the current edition of the MUTCD.

The permit of any individual or firm who fails to follow these procedures may be revoked. Future requests for a permit may also be denied for demonstrated non-compliance.

G. Fossil and Rock Hunters

A District-wide DOT Form No. 304, *Highway Permit – Use of Right-of-Way* may be issued in each District annually to allow for individuals and/or groups to collect rocks/fossils along the right-of-way. The following requirements should be placed on the permit:

The Petitioner assumes all risks and liability for injury or damage, which may occur to persons or property arising out of the performance or non-performance of said permit activity. The Petitioner shall instruct their participants in the safety precautions that should be taken during all operations, including the use of approved safety apparel while on the right-of-way.

The Districts may want to add other requirements as they deem necessary based on their knowledge of the request and circumstances surrounding the right-of-way being requested. KDOT may also supply safety vests and safety brochures from the Adopt-a-Highway program to local individuals and groups requesting access to the right-of-way.

Individuals and groups are required to notify the local KDOT Area Office by phone prior to each time that they access the right-of-way.

H. Grain Storage on Mixing Strips and Other KDOT Property

The Districts may issue a Highway Permit-Use of Right-of-Way for the storage of private grain on KDOT right-of-way during harvest time when grain elevators cannot handle the volume.

- Section 11.30 -
SPECIAL PERMITS Oversize & Overweight Vehicles

11.31 – REQUIREMENTS

With limited exceptions, a special permit is required for the *Movement of All Oversize or Overweight Loads* upon or across any Interstate, US or K-numbered route within the State.

- A. Such special permits are also required for all city connecting links.
- B. Such special permits are not required for a local road crossing the Interstate, US, or K-numbered route unless approval by permit is requested by the City, County or Township.

Special Permits are issued by the Kansas Trucking Connection in accordance with KDOT regulations for excessive size and weight of vehicles and loads. This office can be reached at (785) 368-6501.

The following listings and maps can be used regarding special permits:

- A. ***Bridge Load Posting Lists*** prepared biannually by the Bureau of Design.
- B. ***Narrow Bridge Width List*** prepared annually by the Bureau of Design.
- C. ***Minimum Overhead Clearance and Minimum Under-Clearance*** lists for structures prepared annually by the Bureau of Design.
- D. ***Detour and Construction Activity Maps*** prepared monthly by the Bureau of Construction and Maintenance.
- E. **Construction Detour Reporting System (CDRS)** an electronic web-based listing, updated by District personnel as changes occur.

11.32 – FORMS

The Kansas Department of Transportation “Fax-in Worksheet” shall be used to apply for approval to transport oversize or overweight loads.

The Kansas Department of Transportation “Large Structure Worksheet” shall be used to apply for a special permit to move any load ***wider than 16 feet 6 inches and/or 18 feet in height***. This permit is issued only from the Kansas Trucking Connection.

11.33 – APPROVAL

With limited exceptions, all loads ***Greater Than 8 Feet Six Inches Wide, 14 Feet High And/Or 85 Feet In Length*** require a permit from the Kansas Trucking Connection.

Permits for loads having a width ***Greater Than Eight Feet Six Inches, Up To and Including Ten Feet***, may be issued by the offices listed below:

- A. Highway Patrol
- B. Motor Carrier Inspection Station

Movers of large structures shall have the approval of the District Engineer or his designated representative. Movers shall give notice at least 24 hours before moving. All applicable railroad and electrical companies shall be notified prior to moving. In the event of an accident at a railroad crossing, the emergency telephone number as well as the location reference number, should be listed on the railroad crossing sign or on the railroad equipment shelter at that crossing. Also contact the local sheriff’s office.

11.34 – SUPERLOADS

All Vehicles and Loads Exceeding 150,000 pounds in Gross Vehicle Weight or exceeding axle weight allowed by Kansas Administrative Regulation (Superloads) shall be supervised by a certified escort service while traveling on state-maintained highways.

The mover shall make contact with the designated KDOT official(s) a minimum of 24 hours in advance of the move. Further information regarding superloads may be obtained by contacting the KDOT Bridge Evaluation section, located in the Headquarters Bridge Office.

If it becomes necessary to detain, halt or alter the superload, contact the ***Kansas Highway Patrol*** (KHP) to request assistance. Any of these troop headquarters may be contacted:

| | |
|-------------|----------------|
| Olathe | (913) 782-8100 |
| Topeka | (785) 296-3102 |
| Salina | (785) 827-3065 |
| Hays | (785) 625-3518 |
| Garden City | (620) 276-3201 |
| Wichita | (316) 744-0451 |
| Chanute | (620) 431-2100 |

General questions regarding Oversize or Overweight Special Permits should be directed to the Bureau of Transportation Planning, Rail/Freight Unit (785) 296-3219.

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ENVIRONMENTAL PROTECTION & SAFETY

**- Section 12.10 -
ENVIRONMENTAL PROTECTION**

12.11 – ASPHALT PLANT POLLUTION CONTROLS

KDOT does not own or operate an asphalt plants at this time.

12.12 – STORAGE TANK POLLUTION CONTROLS

Each site with KDHE-permitted tanks must have a Spill Prevention Control & Countermeasures (SPCC) plan which details pollution controls for each site. A copy of the plan must be kept at the nearest KDOT Maintenance facility.

A monthly inspection shall be done on all tanks that contain product and found in the SPCC plan for each facility.

12.13 – BURNING

Open burning, in general, is prohibited.

Open burning, when required, shall comply with local, city, county and state ordinances and laws.

Although open burning is prohibited by Kansas Administrative Regulation (KAR 28-19-45) the KDHE may authorize exemptions when considered necessary and in the public interest.

- A. An exemption to burning regulations must be requested in writing from the KDHE. All requests must state reasons and justification for open burning.
- B. When open burning is authorized, certain stipulations will be required and may include such items as:
 - (1) Maintain proper records of the burning activity including the material burnt locations, date, etc.
 - (2) Only tree brush will be burned.
 - (3) Tires and other heavy smoke producing materials shall not be used as combustion enhancers.
 - (4) Appropriate traffic control should be provided.
 - (5) All fires will be attended until completely extinguished.

A report listing open burning locations should be submitted to your local KDHE office at the end of each month that open burning took place.

12.14 – SALT POLLUTION CONTROLS

All Sub-Areas have covered salt storage facilities. Unmixed and mixed salt should remain -under cover.

Salt-Sand Mixing Areas should be located and constructed to prevent runoff from entering streambeds (wet or dry), private property, or roadside ditches.

Store Salt-Sand Mixtures in Accordance with plan shown in Spill Control and Counter Measures Plan.” Salt-sand mixtures may be stored in covered/enclosed structures.

12.16 – CHEMICALS

Sub-Area buildings have designated storage areas for certain chemicals. The intended chemical should be stored inside these areas.

- A. Care must be used in storage to prevent damage to the building.
- B. Damaged containers should be re-removed and disposed of according to label instructions.
- C. Arrange storage to allow usage of older stock first.
- D. Never use more chemicals than needed.
- E. Labeling and storage of all chemicals shall be in accordance with instructions in the ***“KDOT Hazardous Communication Program”***
- F. All chemicals not in their original containers shall meet the labeling requirements of the ***“KDOT Hazardous Communication Program”***

12.17 Stabilization Pond and Waste Treatment Facility Safety

Stabilization ponds and other waste water treatment facilities must be treated with caution and respect from a safety and public health standpoint by operators and the general public alike. This means that stabilization ponds must be used for their designed purpose only, not for public recreation.

When working near stabilization ponds:

1. Refrain from smoking when hands may become contaminated, such as when working in manholes, on pumps or other parts of the operation.
2. Remove contaminated overalls or rubber boots before getting in your car.
3. Always clean equipment such as safety belts, harness, face masks, or gloves, after using. You or someone else may want to use them again.

4. Keep your fingernails clean and trimmed, as they are excellent carriers of dirt and germs.
5. See a doctor for all injuries.
6. Employees designated to work in these areas should complete training every two years and may be vaccinated for Hepatitis A B. For further information contact district human resource professional or safety specialist.

The principal hazards associated with wastewater treatment are accumulations of sewer gas and its mixture with air or other gases. "Sewer gas" contains high percentages of carbon dioxide; varying amounts of methane, ammonia, nitrous oxides, hydrogen, hydrogen sulfide; and a low percentage of oxygen. Sewer gas can accumulate in sewers or manholes where organic matter has been deposited and has decomposed.

**- Section 12.20 -
HAZARDOUS MATERIAL EMERGENCIES**

12.21 – ACCIDENTS

Determine the Type of Material and if container is damaged

- A. This information may be determined from the driver or person responsible for the material.
- B. Other information sources: check for signs, labels, or other postings for type of material.
- C. The attempt to retrieve shipping papers or name of the commodity from containers should only be attempted if it can be accomplished safely.
- D. Emergency Response Guide can be used to determine placards, vehicle type, safe isolation distance and other needed information.

KDOT personnel may provide the following types of *Emergency Assistance*:

- a. Assisting in the containment of a spill.
- b. Establishing and maintaining traffic control.

12.22 – GENERAL EMERGENCY PROCEDURES

Hazardous material containers should have *Labels* (placards) to identify the material and its hazard rating. *The Safety Data Sheet (SDS) File* should have specific information on the characteristics of materials.

Do not smoke or use flares if flammable materials are involved. Inform others as appropriate.

Keep Away and Upwind from Material 500 yards or more and refer to the Emergency Response Guidebook, which would provide more information.

Stay out of Smoke, Mist, Dust, etc

Avoid inhaling fumes, smoke and vapors even if no hazardous materials are involved. Contaminated persons should be examined by first responders & emergency medical service personnel. As a general rule, fire fighting should be left to the fire fighters.

If you observe bystanders handling debris or taking any item from the scene, direct them to not handle debris if you can reasonably do so.

Emergency procedures for KDOT employees:

- A. Assist in the containment of a spill if trained to do so and if directed by emergency personnel.
- B. Establish and maintain traffic control
- C. Follow procedures set forth by the ERG (Emergency Response Guidebook)
- D. Evacuate the area. Do not start vehicles in close proximity to the spillage, as an ignition spark may start a fire. Personnel should leave on foot.
- E. Rescue people involved in the accident if you can do so safely.
- F. Keep well away from the accident area, container, or other material involved. If a tank is heavily exposed to fire, evacuate the area and let the fire burn.
- G. Report the incident to the nearest authority as quickly as possible. If possible, leave someone in charge at the scene of the accident. Inform the authorities what materials, if known, are involved.
- H. DO NOT eat, drink, or smoke in the incident area. DO NOT use food or drinking water that may have been in contact with material from the incident area.
- I. Personnel who may have become contaminated should be examined by rescue personnel. Remove the contaminating agent as soon as possible.
- J. Leave fire fighting to the firefighters.
- K. Take reasonable steps to prohibit people handling debris or taking souvenirs from the accident scene.
- L. Turn over control at the accident scene to **properly identified** authorities.

12.23 – CLEANUP: HAZARDOUS MATERIAL SPILLS

Cleanup is the responsibility of the carrier, who should undertake all actions necessary to properly contain, collect, control, cleanup, treat, disperse, remove or dispose of the hazardous material.

The *Department of Health and Environment* provides for coordination and supervision of the cleanup. For assistance call (785) 296-1679 anytime; day, night, or weekends.

12.24 – REPORTING PROCEDURES

If a Radioactive or Hazardous Materials Incidents/Accidents/Continuous Releases or accident occurs, notify the Kansas Division of Emergency Management immediately:

24 Hour Emergency - 785-296-8013 or 800-275-0297

- A. ***Identify The Call*** as a Hazardous Material Emergency, and give the operator the following information:
- Your name
 - Location of accident
 - Type of material involved
 - Damage to container or material
 - Telephone number from which you are calling
- B. Remain at the telephone until you are called back. The Division of Emergency Management will give you special instructions relating to flagging, traffic control, detouring traffic, etc..

Spillage of materials having a water pollution potential are to be reported to the Department of Health and Environment by calling (785-296-1679) anytime; day, night, or weekend.

**- Section 12.30 -
EMERGENCIES**

12.31 Medical Emergencies

KDOT employees are offered a First Aid/CPR course. This course provides guidelines for essential care of persons injured in an accident or who suddenly become ill. In accordance with SOM 2.6.2, “Safety”, the First Aid/CPR course is available for KDOT employees when approved by the KDOT Senior Manager. Senior KDOT Managers may require employees to take first aid courses.

Employees currently certified at higher levels of training (i.e., first responders, EMT’s, paramedics, etc.) need only provide a copy of their up-to-date certification.

Know how to get emergency help in your area!! With KDOT employees in locations throughout the State of Kansas, emergency response procedures may vary from area to area. Employees who travel among job sites need to check each area for the proper emergency response procedures. Know the emergency response systems in your job site location.

If you are there when an accident or sudden illness occurs, or if you are one of the first persons on the scene, follow these guidelines:

Carefully survey the scene. Look things over very carefully. Your own safety comes first. If you do not have proper protective equipment and training, call for properly trained assistance (e.g., radio your base or go to a nearby home).

Call for advanced medical care if needed. Call 9-1-1 or the local emergency worksite phone number.

1. Once you have addressed site safety, you may choose to begin patient care for ill or injured persons.
2. Once the primary assessment (assessing the safety of the scene) has been completed, if the patient is conscious, you may choose to do a secondary assessment (to help determine the type and/or extent of injury or illness). At a minimum, continue primary assessment and provide any care (which you are trained to perform) for the patient until Emergency Medical Service (EMS) personnel arrive.
3. Once EMS personnel arrive, tell them briefly as much as you can about what happened and the care you have provided.
4. ***Do not discuss details*** about the incident and any illness or injury involved with anyone except with properly identified EMS personnel, police, or other authorities (e.g., supervisors, accident investigators, etc.).

Employees' Medical Conditions

If you have a medical condition that may result in an emergency situation (e.g., allergic reactions to bee stings, asthma, heart conditions, diabetes, etc.), you should notify your supervisor so that appropriate actions may be taken in the event of an emergency.

12.32 First Aid Kits

First aid kits must be in each KDOT vehicle and must be easily accessible. Each person assigned to a vehicle is responsible for checking monthly or after each use, that the first aid kit is complete and up-to-date.

Kits for office areas and shop areas will be labeled and wall-mounted in an accessible location. Supervisors will inform all employees of the location of the office/shop first aid kit. Supervisors will check the first aid kits on a weekly basis and requisition replacement supplies through their stock room.

The first aid kit must be contained in a waterproof, dust-proof container. Each kit, as a minimum, will contain the following supplies in individually sealed packets:

- 2 pkg. 1"x3" adhesive bandages (16 ea.)
- 1 pkg. 3" bandage compresses (2 ea.)
- 1 pkg. triangular bandage w/safety pins (1 ea.)
- 1 pkg. 3"x3" gauze pads (4 ea.)
- 1 pkg. antiseptic swabs (10 ea.)
- 1 pkg. eye bandage kit (1 eye wash, 2 eye "cup" bandage pads, 4 strips of tape)
- 2 ea. barrier packs (1 pr. Latex gloves and 1 CPR barrier)
- 2 ea. 2"x6' sterile gauze roller gauze
- 1 pkg. "Sting Kill" wipes (10 ea.)
- 2 pr. latex gloves
- 1 ea. cold pack
- 1 pkg. fingertip bandages (10 ea.)

A *Pocket Reference Manual* should also be included in each kit. These manuals should be available from suppliers, trainers, or various other resources.

**- Section 12.40 -
HAZARDOUS WASTE AND SPECIAL ENVIRONMENTAL NEEDS**

This section is intended as general guidance to aid in determining, collecting and disposing of hazardous materials that may be generated at various facilities. It will help assist you in Proper Management of Hazardous Waste and Universal Waste at your facility. It will help you determine your generator status and help you address the common issues like; classification of waste type, storage, labeling, site management, disposal options as well as identifying opportunities to prevent waste generation altogether, also known as waste minimization.

12.41 Chemical and Environmental Safety

SOM 2.6.5, “Hazard Communication Program” states that KDOT “shall have a hazard materials communication program which shall include procedures and guidelines to promote safe use, transporting, and storage of hazardous materials.” The Hazard Communication Program (Right-To-Know) shall be referenced in this manual as the KDOT HAZCOM Manual and Program. Part of this program shall be the collection and maintenance of Material Safety Data Sheets (SDS) for chemicals that KDOT employees use or can be exposed to. SDS’s shall be maintained in an easily accessible location (supervisor’s office, shop area, etc.) for employees to view at any time.

12.42 Hazard Materials Communication Program

The “*Hazard Materials Communication Program*” (Right To Know) includes procedures and guidelines to promote safe use, transportation, and storage of the materials. (See SOM 2.6.5)

Employees who perform job duties which expose them to Hazardous Chemicals shall be trained in the safe and proper use, transportation and storage. The online Hazardous Communication Training will be the means of such training and their supervisor should advise them of the hazardous substances that they work with or around.

The program discusses the following policies:

- A. Hazard Determination Policy
- B. Labeling Policy
- C. Material Safety Data Sheets
- D. Information and Training policy

12.43 Environmental Compliance

A. Compliance Monitoring

Compliance monitoring is a commonly practiced form of environmental monitoring. The purpose of compliance monitoring is to ensure that the quality or quantity of an environmental component is not

altered by a human activity beyond a specified standard of regulation level. An example of compliance monitoring is a sampling program conducted to ensure that concentrations of a contaminant do not exceed a specified level. Implicit in compliance monitoring is the assumption that if the characteristic being monitored is within acceptable limits, then the effects will be within acceptable limits.

Areas that we currently monitor include:

- Mud Pit Waste
- Solvents in Paint Waste
- Paint Waste from Highway Striping Removal Operation
- Oil Burner
- Waste Water Stabilization
- Waste Determination
- Lead Based Paint Content

Types of Waste:

A. Special Waste

Special waste is a waste that requires special handling, trained people, and/or special disposal methods. A waste may be a special waste because of its quantity, concentration, or physical, chemical, or biological characteristics.

1. Mud Trap Waste from Wash Bays
2. Dried Paint mixed with dirt or an absorbent
3. Oil filters not drained
4. Highway paint that has been removed (paint chips)
5. Antifreeze not recycled or reclaimed
6. Oil not recycled or reclaimed or has continuous use (burners)
7. Solvent rags not properly dried

B. Universal Waste

Universal Waste is a category of waste materials not designated as "hazardous waste", but containing materials that can become hazardous waste if not managed properly. These wastes commonly generated by business and industry would be:

1. Spent lamps recycled or reclaimed
2. Oil collected for recycling or for burning
3. Spent batteries being recycled
4. Used tires being recycled
5. Antifreeze being recycled or reclaimed
6. Devices containing elemental mercury; thermostats, switches thermometers, etc
7. Pesticide and herbicides that are recalled or unusable
8. Solvent tanks that are in the continuous use program and collected by a contractor
9. Orphaned waste that is found on the Right of Way; tires, oil batteries etc.???

C. Orphaned Waste

Is a waste that is potentially hazardous or unidentified waste in containers (a drum, box or other container(s)) that have been abandoned or illegally dumped at a site other than the generation point with no identifiable responsible party or owner. This waste may also have special disposal needs.

Types of waste:

1. Hazardous materials that need special assistance from outside Agencies
 - a) Drums or containers of unknowns
 - b) Meth Lab in the production stages
 - c) Transformers

2. Materials that do not need special assistance but have special disposal needs
 - a) Paint
 - b) Tires (store so the water doesn't accumulate)
 - c) Automotive liquids; antifreeze or oil

D. Hazardous Waste

Waste that poses substantial or potential threats to public health or the environment. They have characteristics that make them flammable, reactive, corrosive, toxic, or chemicals that appear on one of the four RCRA hazardous wastes lists (the F-list, K-list, P-list, or U-list). These wastes can be found in different physical states such as gaseous, liquids, or solids.

1. Solvent tanks (parts cleaners) not in the continuous use program or collected by a contractor
2. Solvent rags (ignitable)
3. Spray cans that had a regulated solvent in them (Brake Cleaner)
4. Lamps not recycled or reclaimed (highway lighting HID lamps 10 or greater (*some lamps may contain more or less of mercury arsenic or sodium*))
5. Pesticide/herbicide containers not triple rinsed
6. Pesticide/herbicide not taken to HHW or County Noxious Weed Program
7. Used oil mixed with a solvent, antifreeze or fuel (mixed waste)
8. Paint solvents, solvent from cleaning gun or paint cut with solvent (isocyanates and toluene)
9. Auto paints and the containers they came in
10. Orphaned Hazardous Waste that is found on the Right of Way that is hazardous; Transformers, unknown drums and operating meth lab trash

12.44 KDOT FORMS AND LETTERS

For guidance documents listed below please see **Safety Staff:**

- KDOT Guidance to Determining Hazardous Waste
- KDOT Wash Bay Checklist for Handling Mud Trap

- KDOT Wash Bay Checklist for Water Removal
- KDOT Checklist for Handling Orphaned Waste
- KDOT Guidance for Universal Waste
- KDHE Special Waste Disposal Request Form (Instructions and Completed Form)
- Letter to Request Special Waste Authorization

**- Section 12.50 -
MISCELLANOUS SAFETY**

12.51 Fire Protection

The risk of fire can threaten safety and destroy property. However at KDOT personnel are not trained to fight fires and should rely on outside services to assist with fires and firefighting equipment such as fire extinguishers in buildings should be used for escape purposes only.

All personnel should be trained in:

- The various classes of fires which can occur.
- Their local emergency number.
- The various fire extinguishers, how they are operated, and how they are applied to the fire.
- The physical locations of fire protection equipment in vehicles as well as buildings and sheds.

Building and shop fire safety

Spontaneous combustion hazards such as oil and grease rags need to be disposed of in approved disposal containers.

Never lock or block exit doors. Exit doors must be operative while the building is occupied.

Maintain a clearance of at least 36 inches between the top level of the stored material and the sprinkler deflectors.

Avoid accumulation of trash.

Open containers of flammable liquids are prohibited.

Avoid flammable materials near ignition sources.

Welding areas need to have portable fire extinguishers that meet NFPA requirements.

Avoid overloading electrical circuits.

Do not misuse flammable and combustible liquids.

Where flammable liquids are openly handled, post "NO SMOKING" signs (gasoline pump areas, certain areas of laboratories, etc.).

{ENVIRONMENTAL PROTECTION & SAFETY}

Do not place a Class ABC fire extinguisher closer than 25 feet nor farther than 50 feet from fuel dispensing equipment, underground fill pipe opening, and lubrication or service area.

While filling vehicle fuel tanks, turn off motors.

When filling fuel tanks, prevent overflow and/or spills.

Never use gasoline as a cleaning agent.

A spark arrester with self-closing cap should be used on all gas cans.

Equipment fire safety

Equip all equipment carrying large amounts of flammable liquids with appropriate fire extinguishers (paint striping vehicles, oil distributors, etc.).

Keep all cab areas on vehicles clean and free of waste materials and non-essential items.

Use ventilation systems, where provided, to prevent accumulation of gases or vapors sufficient to cause flash fire and/or explosion.

Install two five-pound type ABC fire extinguishers on each oil distributor.

Location of fire protection equipment

Travel distance to a Class A fire extinguisher should not exceed 75 feet.

Travel distance to a Class B or BC fire extinguisher should not exceed 50 feet.

Maintain fire extinguishers in a fully charged and operable condition and keep in a designated place at all times when not in use.

Do not obstruct fire extinguishers from view. Shop areas should be painted or signed to indicate the necessity for a clear area around extinguisher. In locations where obstruction cannot be completely avoided, provide a means to indicate the location of the extinguisher.

Inspection and Maintenance

Equip dry chemical extinguishers, including those in vehicles, with a pressure gauge or an indicator which is easily visible without removing the extinguisher from its bracket. To maintain these extinguishers, remove from the bracket at least once a month, turn upside down, and tap with a rubber mallet.

Extinguishers will have a durable tag securely attached to show the inspection date and signature (or initials) of the person who performed this service. Each shop or office should designate a person to perform monthly extinguisher checks. The monthly inspection should determine that they are in their designated place, that they have not been actuated or tampered with, and to detect any obvious

damage, corrosion, or other impairments. An extinguisher showing defects will receive a complete maintenance check.

Extinguishers will be thoroughly inspected annually by a certified technician and, if necessary, recharged, repaired, or replaced.

Immediately replace extinguishers removed for recharging or maintenance by spare extinguishers of the same type and size.

12.52 Traffic Control

Reasonable precaution should be taken to protect employees and the driving public during maintenance operations within the right of way.

Traffic control should be provided in accordance with the KDOT Sign Manual before work is in progress and will be used throughout the time work is in progress. Discuss special problems in traffic control with your supervisor.

Unauthorized persons are not permitted near the work area.

Discuss internal traffic control procedure with affected employees including parking and placement of equipment and materials. Discuss movement routes of equipment when entering and exiting work zone.

Whenever practical, stop and park vehicles and equipment beyond the roadway and off the should.

Guidelines for warning lights:

Use amber rotating beacons/strobes and four way hazard lights when stopping on pavement surface, driving slower than 40 M.P.H. on interstates driving and slower than 35 M.P.H. highways.

Use amber rotating beacons/strobes and four way hazard lights when parking on the pavement, shoulder or median (see details in KDOT Sign Manual).

Hazard lights cannot be used to replace a beacon/strobe light (see details in KDOT Sign Manual).

12.53 Misc Safety

A. Work Safety

Work, generally, should proceed with traffic, except where it is apparent that working against traffic affords more protection.

All KDOT vehicles working against traffic should have headlights turned on.

Driving laws and rules are to be followed. KDOT workers do not have special driving privileges.

B. Tarping of Trucks

The need for *tarping loads* can be controlled by managing the size of the load. Problems usually can be traced to trucks hauling during windy weather that are loaded with material running over the tailgate.

Loads should be covered when the material being hauled can be blown out of the truck causing possible damage to other vehicles. Considerations also include type of load, driving speed, and weather conditions. In general tarps should be used when hauling trash and debris and for temperature control when hauling hot mix.

**- Section 12.60 -
SAFETY PROGRAMS**

**ALL REFERENCED PROGRAMS AND PLANS LISTED BELOW CAN BE FOUND
ONLINE AT THE KDOT SAFETY STAFF WEB PAGE.**

**General Safety Program
Hazardous Communication Program
Fall Protection Program
Respiratory Program
Trenching and Excavating Program
Confined Space Program
Personnel Protection (PPE) Program
Spill Control and Counter Measures Plan**

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- Section 13.10 -
RESPONSIBILITY AND PROCEDURES

13.11 – HEADQUARTERS

System Design and Procedures for the maintenance and operation of KDOT communication equipment are established by the Bureau of Maintenance.

Federal Communications Commission licensing of KDOT; and Kansas Highway Patrol (KHP) equipment is the responsibility of the Bureau of Maintenance.

The Bureau of Maintenance prepares the *Annual Budget* for KDOT communications equipment, which includes radio communication equipment used by Kansas Highway Patrol and other county and public service users throughout the state. The budget is based on replacement criteria and information provided to the Communications System Administrator by the Network Service Technician III (NST III) located in each district.

Purchase requests involving communication capital improvements are prepared by the Bureau of Maintenance.

Construction or Modification of radio communication facilities and/or equipment is approved by the Communications System Administrator in the Bureau of Maintenance.

- A. Alteration of radio equipment requires prior approval by the Communications System Administrator.
 - (1) Requests for alterations are to be submitted in writing to the Communications System Administrator.
 - (2) Approval from the Communications System Administrator shall be received prior to construction of new facilities, or the modification of existing facilities or equipment.
- B. Only KDOT-owned communication equipment is authorized for installation in KDOT vehicles.

13.12 – DISTRICTS

The estimated ***Budget Requirements*** for servicing communications equipment within each district is to be submitted by the NST III to the Communications System Administrator in accordance with the “Annual Schedule of Maintenance Events”.

A Supply of radio communication ***Repair Parts*** should be maintained by the NST III located in each District.

13.13 – RADIO COMMUNICATION PERSONNEL

KDOT Communications System Administrator:

- A. Administers KDOT radio communication programs.
- B. Is responsible for system design.
- C. Develops communications equipment operating/maintenance procedures.
- D. Supervises the NST III in each district.
- E. Supervises the statewide NST IIIs.
- F. Supervises the statewide RWIS Technician.

Network Service Technician III (NST III):

- A. Responsible for system operation within an assigned district, and:
 - (1) Participates in the installation, maintenance, and repair of communications facilities and equipment in the district.
 - (2) May be requested to assist other districts and/or the tower and antenna technicians.
- B. Supervises additional NST IIs and/or NST Is assigned within a district.

Network Service Technician II (NST II):

- A. Installs, maintains and repairs communication facilities and equipment in the district.
- B. Installs and/or replaces communication equipment and other electronic equipment in Highway Patrol vehicles.
- C. Performs routine maintenance and inspection on equipment being installed.

RWIS Technician:

- A. Inspects and maintains RWIS sites statewide.
- B. Assists in installation and maintenance of road surface sensors.
- C. Installs, inspects and maintains sensors installed on RWIS towers.

**- Section 13.20 -
COMMUNICATION SYSTEM**

13.21 – SYSTEM DESIGN

The Design of each communications facility is based on requirements of both the Kansas Highway Patrol and KDOT.

Each facility is located and designed to provide adequate local coverage.

13.22 – LOCATION OF KDOT RADIO UNITS

Fixed Station Locations are determined by the radio system design requirements.

Mobile and Handheld Unit Distribution is determined by the “***Statewide Master Radio Hardware Plan.***”

Other Specialized Equipment needs are requested by district and approved by the Bureau of Maintenance.

13.23 – TOWER COMPLEXES

Tower Complexes are identified by a single KDOT capital inventory number. There are five categories as follows:

1. Tower and appurtenances which are KDOT owned, and used ***exclusively for a communications facility:***
 - A. Antennas and cables installed at the complex.
 - B. Equipment shelters which provide for communication equipment housing only.
 - C. Emergency power plants, including fuel storage systems for powering communication equipment only.
 - D. Fences, when provided for protection of radio facilities only.
2. Tower and appurtenances which are KDOT owned and located where ***the site and facilities are also used for purposes other than communications.***
3. Tower complexes in which ***only the appurtenances are owned by the State.***
4. Antenna system only ***on a tower not owned by KDOT.***
5. ***Rooftop tower and antenna.***

**- Section 13.30 -
INSTALLATION**

13.31 – FIXED STATIONS

Repeaters and Fixed Station Equipment should be installed in a competent and neat manner.

Leads, Cords, and Cables, should be dressed, tied down, and secured to enhance the appearance of the facility.

Antennas and Coaxial Cables should be securely attached to the supporting structure in accordance with the manufacturer's and the Bureau of Maintenance recommendations.

13.32 – MOBILE UNITS

Mobile radio equipment for special applications should be installed in accordance with instructions issued for each new model.

New vehicles used by the Highway Patrol should have mobile radio equipment and other electronic equipment installed at the Topeka KHP Fleet Operations facility.

KDOT mobile radio equipment should be installed by the appropriate Bureau of Maintenance radio personnel in each district's radio communication facility.

Some "replacement" Highway Patrol mobile radio equipment can be exchanged (remove old, install new) in the district.

- Section 13.40 -
MAINTENANCE AND INSPECTION

13.41 – SERVICE PRIORITIES

Under normal conditions, *Highway Patrol mobile radio equipment* (including Capitol Area Security Division and Patrol equipment in Governor’s vehicles) **will receive First Priority** for service.

KDOT mobile radio equipment will receive Second Priority with the exception that during emergencies including snowstorms, icing conditions, and floods. KDOT mobile radio equipment will have first priority. The district headquarters consoles and/or control stations should be operative and available.

The following order of priority is suggested for other agencies with whom KDOT has agreements/leases, or for whom KDOT has historically provided service:

- A. Kansas Bureau of Investigation
- B. Kansas Department of Corrections
- C. Kansas Department of Wildlife, Parks and Tourism
- D. Kansas Department of Revenue-Alcohol Beverage Control Division
- E. Kansas State Fire Marshall and other agencies on a first-come, first-served basis, as time is available.

Other agencies requesting service at any facility must obtain authorization from the Bureau of Maintenance before such service is performed.

13.42 – PREVENTIVE MAINTENANCE

Preventive maintenance is performed to increase the overall economy and reliability of the radio communication system and allow radio personnel to more effectively utilize their time.

Repeater and Fixed Station Equipment should be inspected and maintained on a regular schedule as listed below. Use DOT Form No. 360 “*Radio Repair Order*” and/or “*Tower Site Service Log*” to report radio equipment maintenance.

- A. The following should be performed at twelve-month intervals:
- (1) Check and record meter readings for which test points, jacks or meter switch positions, or software readings are provided.
 - (2) Measure and record receiver sensitivity level and receiver quieting level.
 - (3) Measure and record transmitter frequency, transmitter deviation level, transmitter forward RF power, and transmitter reflected RF power.
 - (4) Locate and correct causes of appreciable loss in performance.
 - (5) If a loss of performance indicated the possibility of antenna or transmission line failure, check the transmission line resistance, and inspect visually to determine nature of trouble.
- B. The following should be performed at ninety-day intervals:
- (1) Observe and record operation of the tower lighting equipment.
 - (2) Locate and correct (if possible) causes of failures.
 - (3) If failure exists with equipment attached to the tower contact the Communications System Administrator.

Mobile Radio Equipment should be inspected and maintained on a regular schedule in accordance with established procedures. Use DOT Form No. 360, "Radio Repair Order" to record radio equipment maintenance.

The following should be performed at twelve-month intervals:

- (1) Visually inspect mobile units for evidence of damage or mistreatment.
- (2) Measure and record any reading for which test points, jacks, meter switch positions or software reading are provided.
- (3) Measure and record receiver sensitivity level and receiver quieting level.

- (4) Measure and record transmitter frequency, transmitter deviation level, transmitter forward RF power and transmitter reflected RF power (where applicable).
- (5) Locate and correct causes of appreciable loss in performance.

Tower Sites should be kept neat and orderly and be inspected at six-month intervals. Use “***Tower Site Service Log***” to record inspection details and maintenance.

- A. Dispose of litter in an appropriate manner.
- B. NST IIIs should make minor tower site repairs, if practical.
- C. Mowing or major tower site repairs should be referred to the local area maintenance superintendent.
- D. Towers, transmission lines, and antenna installations are to be inspected by and approved contractor.
- E. Qualified Bureau of Maintenance personnel or approved contractor will periodically check transmission lines with either a time domain reflectometer and/or other specialized equipment while performing inspections.
- F. Emergency power plants (generators), heaters and air-conditioners are to be inspected, tested and have preventive maintenance performed on a semi-annual basis by the appropriate Bureau of Maintenance personnel.

Each radio shop should maintain a current file on each unit serviced.

- A. Records for towers within a district should include current copies of DOT Form No. 342, “***Radio Tower Inspection***”, and DOT Form No. 336 “***Tower Light Observation***”, if applicable.
- B. Service records are to be kept on equipment using DOT Form No. 360, “***Radio Repair Order***”.

- C. The radio inspection and maintenance service records shall bear the signature and address of the NST responsible for repairs and maintenance performed.
- D. Electronic tower light observation data will be maintained by a monitoring contractor and made available to the Bureau of Maintenance.

**- Section 13.50-
EQUIPMENT REPLACEMENT**

13.51 – GENERAL

Microwave Radio Units and associated support equipment are scheduled for replacement as technology and budget allows.

Repeaters and Fixed Stations are scheduled for replacement as technology and budget allows.

Mobile Radio Units are scheduled for replacement as technology and budget allows.

Portable Radio Units and Mobile Vehicle Adapters are scheduled for replacement as technology and budget allows.

Test Equipment is to remain in service as long as it is adequate.

Special Equipment will remain in service as long as it's adequate and not technically obsolete.

Dispatching Equipment will be scheduled for replacement as technology and budget allows.

Generators are to remain in service as long as they are adequate.

13.52 – UNSCHEDULED EQUIPMENT REPLACEMENT

Destroyed or Lost Radio Equipment will be replaced by the Bureau of Maintenance upon receiving proper notification from the district.

- A. Districts should notify the Communications System Administrator with the Bureau of Maintenance about any lost or destroyed radios utilizing D.O.T. Form 26, Part I.
- B. Districts should also send a copy of D.O.T. Form 26, Part I to the local Network Service Technician III.

- Section 13.60 - OPERATION OF RADIO UNITS

13.61 – GENERAL

With the utilization of automatic identifiers on station repeaters in the communications system, *fixed station transmissions* shall be identified at the end of each contact by announcing their location, i.e. **Hays Office**, **Wichita Hillside**, **clear**.

Mobile unit transmissions shall sign off at the end of each contact by announcing their mobile call, i.e. **503**, **5121**, **clear**.

- Section 13.70 - SERVICE

13.71 – GENERAL

Normal routine service of radio equipment will be performed during regular working hours.

- A. The installation and removal of equipment in KDOT and KHP vehicles should be scheduled in advanced whenever possible.
- B. Prior arrangements should be made with the district NST III before returning equipment requiring service.

Emergency Service during non-regular working hours will be performed on failed equipment considered critical to system operations.

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- Section 14.10 -
LIGHTING AND TRAFFIC SIGNALS

14.11 – SURVEILLANCE

The Lighting System Should be Inspected Periodically during the hours of darkness to look for potential problems.

Preventive Maintenance of these facilities should be scheduled to correct deficiencies before serious problems develop.

The system should be checked after electrical storms.

14.12 – MAINTENANCE

Maintenance of lighting and signal systems is usually by contract.

Typical *Types of Maintenance* of the system include:

- A. Replacing lamps
- B. Cleaning and replacing glassware
- C. Replace or repair damaged poles
- D. Replace damaged luminaries
- E. Replace defective wiring
- F. Repair and maintain controllers
- G. Repair or replace damaged bases and/or footings

**- Section 14.20 -
TRAFFIC EMERGENCIES**

14.21 – GENERAL

KDOT employees who have been trained to offer assistance during accidents or traffic incidents and travelling in a state vehicle are to offer ***Traffic Assistance*** when confronted with accidents or other traffic emergencies on the roads and highways of the state:

- A. When coming upon an accident KDOT employees should make contact with Local Authority or Highway Patrol if possible.
- B. If requested by Local Authorities or the Highway Patrol, the KDOT Employee is to remain at the scene and provide assistance.

KDOT employees should assist ***Stranded Motorists*** as described in Section 7.13.

**- Section 14.30 -
PUBLIC USE FACILITIES**

14.31 – GENERAL

The ***Basic Purposes*** of safety rest areas, rest areas and park facilities are to provide rest, relaxation, and recreation for travelers.

Public use facilities subject to public use should be maintained in a reasonable ***Clean, Sanitary, and Attractive Condition***, as resources will allow.

Advertising should not be allowed at public use facilities other than tourist information available inside designated visitor centers. This prohibition does not apply to labels on individual items for sale in vending machines or to signs designating responsibility for public use maintenance.

General guidelines governing use of the public use facilities shall be displayed on the bulletin board.

14.32 – USES (CAMPING – PARKING – CIVIC ORGANIZATIONS)

Overnight Camping is permitted in the public use facility for one night only.

Vehicles shall be parked in such a manner as to prevent interference with normal public use facility use.

- A. All day parking is prohibited.
- B. Parking areas for commercial motor vehicles should be marked for that purpose.

The District Engineer has authority to approve or disapprove the use of public use facilities by *Civic and Service Organizations* for the purpose of serving free refreshments to the traveling public.

- A. All refreshments served must be free.
- B. The solicitation of donations is prohibited.
- C. Signs announcing the service are permitted. (See pages E3-3 and F3-2 of the Highway Sign Manual.)
- D. The placement of a stand, serving truck or cart should not interfere with ramp entrances, exits, toilets, camping, picnic facilities and shall not interfere with Accessibility features.

14.33 – MAINTENANCE POLICY

Contracts have been established state wide for the cleaning of the public use facility's and are under the supervision of the Area Engineer and/or designated representative.

Paint Out Drawings and Writings on the walls of rest areas and shelters. (See Chapter 10; Section 10.25 "Standard Paint Colors" for painting information.

The care and maintenance of *Plants and Shrubs* is outlined in Chapter 4, Section 4.30, Landscape.

Report vandalism and mechanical or electrical failures to the area or district office.

14.34 – WATER

Water Samples shall be taken monthly at all locations where water is not furnished by a city or water district as noted below.

- A. Water sampling is scheduled throughout the year. Failure to return all required water sample bottles during the specified sampling period will require that a sign be installed stating that the water supply has not been properly sampled.
- B. Water samples will be taken only during the first three days of the week.
- C. All water samples shall be mailed the same day collected, to the Kansas Department of Health and Environment.
 - 1. The Kansas Department of Health and Environment will furnish the district with containers for this purpose.
 - 2. Periodically return any unused containers.
- D. Maintain 0.2 mg/liter of free residual chlorine throughout the system.

14.35 – SEWAGE DISPOSAL SYSTEMS

SEPTIC TANK DISPOSAL SYSTEM

The septic tank system is a process whereby the sewage is conditioned so that it may be more readily absorbed into the subsoil. (See Figure 14-10.) This is accomplished as follows:

- A. As sewage from a building sewer enters a septic tank, its rate of flow is reduced so that the larger suspended solids sink to the bottom or rise to the surface.
- B. The solids in the tank are subjected to continuous decomposition by bacteria.
- C. Storage for sludge and scum is provided.
 - 1. Sludge is the accumulation of the settled solids at the bottom of the tank.
 - 2. Scum is a partially submerged mat of floating solids that form at the surface of the liquid in the tank.

- D. ***Inspect Tanks at Least Once a Year.*** Actual measurement of sludge and scum accumulations is the only sure method to determine when the tank should be cleaned.
1. The depth of the sludge and scum should be measured in the vicinity of the outlet baffle.
 2. ***Scum*** can be measured with a stick to which a weighted flap is hinged or with any device that can be used to feel out the bottom of the scum mat. (See Figures 14-10 and 14-11.)
 - a. The stick is forced through the mat.
 - b. The hinged flap falls into a horizontal position.
 - c. The stick is raised until resistance from the bottom of the scum is felt.
 3. ***Sludge*** can be measured with a stick wrapped with rough, white toweling.
 - a. The stick should be lowered behind the outlet device to avoid scum particles.
 - b. After several minutes, if the stick is carefully removed, the sludge line can be distinguished.
- E. ***Septic Tanks Should Be Cleaned*** before excessive sludge or scum is allowed to accumulate.
1. The tank will be cleaned if the scum comes within three inches or the sludge comes within one foot of the outlet. (See Figure 14-10.)
 2. If the top of the sludge or bottom of the scum approaches too closely to the bottom of the outlet device, solids will be carried out of the tank and into the tile field.
 3. When this happens, liquid may break through to the surface, and sewage may back up in the plumbing fixture.
 4. When a disposal field becomes clogged in this manner, it is not only necessary to clean the tank, but it may be necessary to construct a new field.
 5. Cleaning is usually accomplished by pumping the contents of the septic tank into a tank truck.
 - a. Septic tanks need not be washed or disinfected after pumping.
 - b. A small amount of sludge may be left in the tank for bacterial seeding purposes.
- F. The ***Methods of Disposal*** shall be in accordance with the Kansas Department of Health and Environment.
1. The material removed from the septic tank should be buried in uninhabited areas, or with permission of the city or service, district, emptied into a sanitary sewer system.

2. Emptying the material into a storm sewer or directly into any stream or watercourse is prohibited.
- G. The functional operation of septic tanks is not improved by addition of disinfectants or other chemicals.
1. Some proprietary products contain sodium hydroxide or potassium hydroxide. These compounds may interfere with the digestion process.
 2. The resulting effluent may damage the field soil structure and cause accelerated clogging.
 3. The harmful effects of ordinary household chemicals are frequently over-emphasized.
 - a. Small quantities of lye or caustics normally used in the home or added to plumbing fixtures will not interfere with the operation of the tank.
 - b. Soaps, detergents, bleaches, and drain cleaners as normally used will have no appreciable adverse effect on the system.

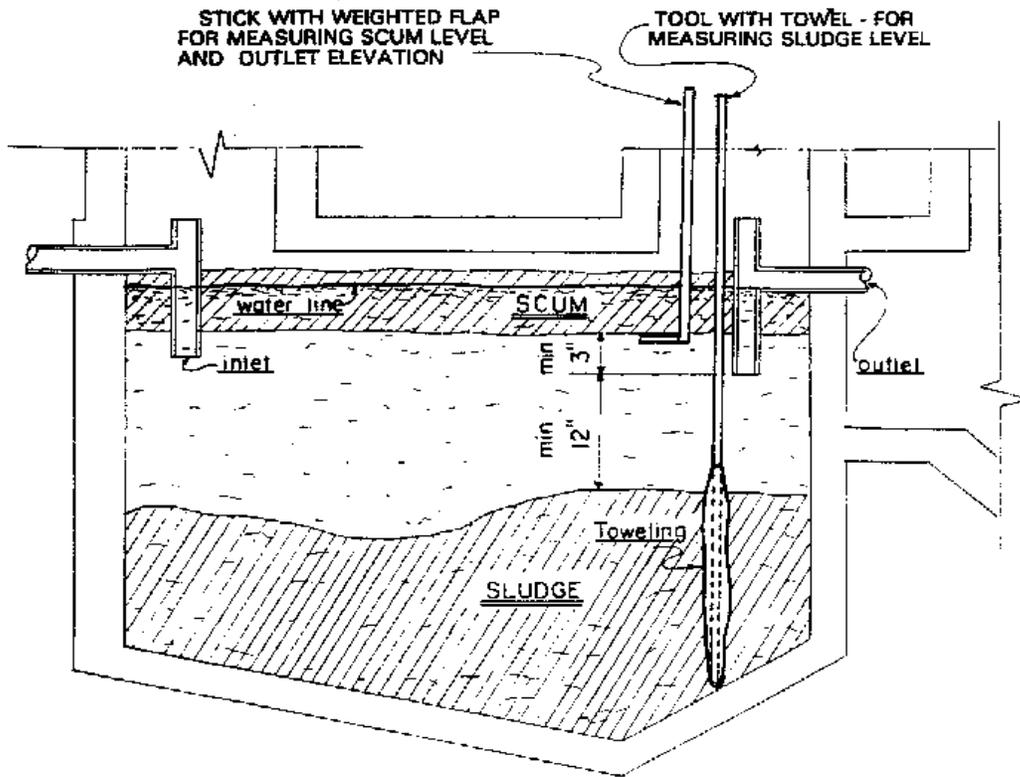


FIGURE 14-10 SEPTIC TANK SECTION

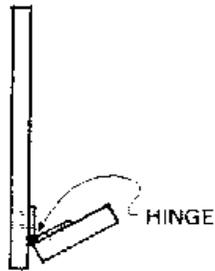


FIGURE 14-11 MEASURING DEVICE FOR SCUM

14.35 – SEWAGE DISPOSAL SYSTEMS (CONTINUED)

- H. ***Observe Lateral Field Areas*** to see that all drain tiles are working.
1. This is determined by color and condition of the vegetation that has grown over the drain tile.
 2. Inspect for effluent rising to the surface of the ground.
 3. Heavy equipment shall not be driven on the lateral field area.

COMPOSTING-TYPE PUBLIC USE FACILITIES

This includes public use facilities with composting-type toilets for waste collection.

- A. Manufacturer's maintenance schedule checklist should be followed. This includes adding bulking agent daily or as necessary, removing finished compost from the compost chamber semiannually or as necessary, as well as following the other manufacturer's recommended maintenance functions.
- B. Compost removed from the storage chamber may be used around shrubs, trees, or in ornamental gardens, or may be used or disposed of by other methods approved by the Kansas Department of Health and Environment.
- C. Emptying the waste material into storm sewers or directly into any stream or watercourse is prohibited.

WASTE STABILIZATION PONDS

These ponds stabilize the raw sewage through a complex natural process that involves sunlight, oxygen, water currents, algae and bacterial action.

- A. GENERAL:
 1. A copy of a manual or document relating to the ***Operation and Maintenance for Waste Stabilization Ponds***, available from the Kansas Department of Health and Environment, should be kept at all applicable public use facilities. This will be in accordance with current accepted practices for operating wastewater facilities.
 2. A copy of the Kansas Pollution Control Permit should be available at the district office for each wastewater facility within the District. This includes specific monitoring and reporting procedures that are to be followed.

3. The Kansas Department of Health and Environment requires that the wastewater facility be operated and maintained under the supervision of a *Certified Operator*.
4. *Monitoring Equipment* has been incorporated into the system to aid in its operation. Reports, including: Non-discharge Summary Monitoring report and Laboratory Analysis Reports should be sent to the Bureau of Design, Environmental Section for review and filing.
5. *Fencing, Warning Signs and Gates* should be maintained in a reasonable condition, with all gates locked when not in use.
6. It is normal for lagoons to experience short periods of *Odors* during spring and early summer months. This situation should be temporary and resolve itself within a few weeks.

B. POOL AND VEGETATION MAINTENANCE.

1. *Pool Levels* should be maintained between two and five feet. The lagoon should gain water depth slightly in the winter and lose in the summer.
2. *General Vegetation* should not be allowed to grow higher than six inches as it provides shelter for rodents and the reduction of wind action on the water surface.
3. Trees and tall weeds should be kept from developing within the fenced enclosure.
4. *Aquatic Weeds* are to be prevented from developing. In each situation where cattails, duckweed or algae becomes a problem, the district is to be contacted for recommended control.

It is generally considered poor practice to use a herbicide for weed control around waste stabilization ponds because of the toxicity of the material and chance of leaving bare dikes that are easily eroded. If it is necessary to use herbicides around waste stabilization ponds, check with the certified operator for an appropriate herbicide

C. MAINTAIN THE DIKES:

1. Dike damage by wave erosion and rodent burrowing should be repaired by reshaping to original plan and reseeded.

2. Surface water should be diverted around the pond to help control erosion.
3. Essential features of the waste stabilization pond such as inlet/outlet piping and fencing should be maintained in original condition.
4. Ponds, which are designed to be non-overflowing, shall be inspected periodically. If waste water level rises to within two feet of the top of the dike, notify your immediate supervisor. (Contact the Department of Health and Environment, District Representative for proper procedures.)

**- Section 14.40 -
MOTOR CARRIER INSPECTION STATIONS**

14.41 – GENERAL

Motor Carrier Inspection Stations are operated by “Kansas Highway Patrol, Motor Carrier Inspection Troop” for inspections and/or weight checks.

KDOT maintenance is limited to state-owned property and buildings.

14.42 – MOTOR CARRIER INSPECTION AND WEIGH STATIONS

KDOT Maintenance should be provided as follows:

- A. ***Maintain and Repair*** entrances, signs, drives, and parking area surfaces.
- B. ***Maintain and Repair*** buildings and facilities, including scale pits.
- C. Landscaping, mowing, and spraying.

14.43 – MOTOR CARRIER PORT OF ENTRY STATIONS

These inspection stations are located near the state borders.

KDOT Will Maintain and Repair the entrance drives, parking area surfaces and signs.

**- Section 14.50 -
FENCING**

14.51 – PURPOSE

Fences are used to “delineate access control” for a highway by serving as a boundary marker. They are used in the same way that right-of-way markers or controlled access signs are used, with or without fence, to identify the access control line.

14.52 – MAINTENANCE AND INSPECTION

The State-Owned Fences are to be maintained as originally configured and in such a condition that they:

- A. Serve their intended purpose of identifying the access control line.
- B. Present a satisfactory appearance.

Fences which have been damaged should be repaired in a reasonable timeframe. A temporary repair may be necessary until permanent repairs can be made.

State-Owned fences should be inspected periodically and repairs made where needed.

**- Section 14.60 -
LITTER PICK UP**

14.61 – LITTER

Litter consists of items and debris which is unsightly and which detracts from the clean and neat appearance of the highway.

Litter along roadsides may be potentially damaging to mowing equipment.

Pick up litter in a systematic manner for removal from an entire area.

The littering of state highways is forbidden by law.

- A. *Signs Prohibiting Highway Littering* should be installed in public use facilities, on routes leaving cities, on routes entering the state, and at

those points where littering is a problem, or at points deemed advisable by the District Engineer.

- B. Enforcement shall be by the proper law enforcement agencies.

14.62 – ADOPT A HIGHWAY PROGRAM

The *Adopt a Highway Program* gives private organizations recognition and responsibility for trash collection, **from right of way outside of the pavement and shoulder areas**, on specified sections of highway. District Adopt a Highway Coordinators administer the program within each district.

The organizations work under agreements, which generally require removal of litter and trash a minimum of three times each year. (See Forms 1210A through 1210G.)

KDOT furnishes trash bags, safety vests, safety literature, and picks up the filled trash bags.

KDOT will continue picking up large, heavy or hazardous materials but will not routinely pick up litter from the adopted sections. Dead animals are still to be disposed of when seen or reported as in Section 14.63

14.63 – DISPOSAL

Open Burning as a method of disposal is, in general, prohibited. In the event this method must be used, it shall comply with the local, city, county and state ordinances and laws. See Chapter Twelve, Section 12.13 – “Burning,” for regulations and exemptions.

Provisions should be made for the *Disposal of Litter* in city or *county* disposal areas.

Cover or Secure load as required by law before *hauling* to the designated disposal site.

Dead or Injured Animals:

- A. Remove dead animals from travelway or shoulders.
- B. Where applicable, notify owner of dead animal’s location.
- C. Local law enforcement should be notified of injured large animals or injured domesticated animals.

**- Section 14.70 -
ENCROACHMENTS**

14.71 – GENERAL

By Law, *All forms of encroachments on Highway Right-of-Way* are prohibited, except public utilities and uses approved by permit. See Chapter Eleven – Highway Permits for permit procedures.

Right-of-Way Encroachments include, but are not limited to, such items as: advertising or unauthorized signs on or overhanging the right-of-way, farming, fences, vehicle parking, storage of materials, unauthorized entrances or excavation.

Keeping encroachments off the right-of-way requires observation of the right-of-way and public relations from field personnel.

Prevention or Prompt Removal of encroachments should be handled in a fair and equal manner.

The signs and other encroachments are private property and should not be unnecessarily damaged.

14.72 – NOTICES AND REMOVAL PROCEDURES

- A. *Immediate Contact with Property Owner* or persons who have installed the encroachment will usually result in an early removal and help prevent further unauthorized use of the right-of-way.
- B. To assist in handling unauthorized encroachments and to provide uniformity in eliminating such violations, *DOT Form No. 0313*, “Notice to Abate Encroachment or Unauthorized Facility or Practice” has been adopted. This written notice should usually be followed by personal contact if the encroachment is not removed within the set time period.
- C. Following issuance of *DOT Form No. 0313*, “Notice to Abate Encroachment or Unauthorized Facility or Practice,” and if the encroachment is not removed within a reasonable time, the second notice should be mailed to the owner allowing at least *an Additional Ten Days* for removal.
- D. *Most Encroachments Not Removed* by the date set should be carefully removed and stored for the owner to pick up. If deemed advisable, the

owner may be required to state in writing that the encroachment will not again be placed on the right-of-way.

- E. If the above procedures do not effect ***Removal of Certain Major Encroachments***, and if deemed appropriate, the matter should be deferred to the Office of Chief Counsel. All notices issued, correspondence, location description and plans or sketches should be submitted to the legal counsel for their review and action.

Temporary Bills, Posters, and Campaign Signs should be removed immediately without notice.

If a personal contact does not affect removal of **portable advertising signs**, they may be removed without further notice.

Signs should be stored for owner to pick up with the understanding that signs will not be placed on the right-of-way again.

14.73 – ROADSIDE MEMORIAL MARKERS

Roadside Memorial Markers are items placed on highway right-of-way in memory of persons who have died while working or traveling on the highway.

When KDOT employees become aware of Roadside Memorial Markers, they should give a description: including size, location, and materials to the Area Superintendent or district-designated KDOT representative. The description should also include any observations of impacts that the marker may have on traffic or pedestrian safety; including but not limited to clear zone issues where the materials would not be “forgiving” to an errant motorist, sight distance obstructions, or the presence of persons stopping vehicles or on foot in the vicinity. The description should also include any significant effect on maintenance activities in the area.

If the Area Superintendent or other district-designated representative determines, based on the information provided or based upon personal observation of the site, that the marker should be removed, he/she should attempt to identify a family member or the person who installed the marker and explain why it must either be removed or modified to address safety concerns for the traveling public, pedestrians, and KDOT workers; or to allow for adequate maintenance of the highway.

If a determination is made that a marker should be removed, KDOT has the authority under K.S.A. 68-413b to remove from highway right of way any objects that are not for highway purposes and for which no permit has been issued.

Markers which fall into disrepair or which present an unsightly appearance should be removed.

If the responsible party cannot be located and the marker needs to be relocated or removed, it should either be carefully moved to a location near the right-of-way line if that will resolve the issue requiring it to be moved; or it should be preserved and stored for a reasonable period of time to allow it to be picked up by the responsible party if they inquire about its removal.

14.74-GUIDELINES FOR CROP ENCROACHMENT ON KDOT RIGHT-OF WAY

Guidelines on dealing with Crops encroaching onto KDOT Right of Way

1. Crops should only be allowed on ROW under a Joint Use Agreement. That is done on a case-by case basis and how far the crops can be planted onto ROW depends on drainage, sight distance, etc. The Districts should work with the Bureau of Right of Way to create and execute the Joint Use Agreement. There is a specific joint use agreement being drafted for crops on ROW.
2. If there isn't a joint use agreement in place and it is simply an encroachment on our ROW, we treat it like any other encroachment: First, identify the ROW line. Determine if the encroachment causes an immediate hazard or other significant safety concern. If so, talk to the landowner and make arrangements for the earliest possible removal of the encroachment/crops. If the landowner won't remove them and it can't wait until harvest, then, **as a last resort**, KDOT can clear the ROW.
3. Form 313, "Notice to Abate Encroachment or Unauthorized Facility or Practice", may be used to document your notifications. (Available in the Forms Warehouse.) However, Area office personnel should talk to the landowner in person before sending any written abatement notice.
4. If it is possible to let the crops remain until harvest without compromising safety, then do so.
5. Make certain a letter is sent to the farmer documenting that they are not to plant future crops on KDOT ROW, absent an executed joint use agreement, or they will be removed by KDOT. If desired, Office of Chief Council(OCC) can assist with wording for such a letter. Copy the District Engineer(DE) as well as OCC on the communications.
6. In the situation where a farmer has removed a berm, soil from ROW, or otherwise damaged or impaired the functionality of the ROW or drainage, this constitutes property damage for which we could make a claim against the landowner. The district should keep records and send to OCC (Sharron Holliday) if you want to pursue.

7. **Please remember that even if the farmer is the encroacher, most legislators will not be sympathetic if KDOT acts with a heavy hand. So, try to work out the current situations and put the farmers on notice to stop further encroachments.** If the situation turns political or the media gets involved, it is preferable if KDOT appears to have taken reasonable steps to work with the landowner and KDOT's actions are justified for reasons relating to safety or the stability/protection of highway structures.

**- Section 14.80 -
ABANDONED VEHICLES**

14.81 – GENERAL

Abandoned Vehicles are those, which have been left unattended on the state highway system for over 48 hours as determined by the Kansas Highway Patrol.

Removal of Abandoned Vehicles will be accomplished as follows:

- A. When the Kansas Highway Patrol determines a vehicle is abandoned, they will make effort to obtain an agreement with a **Commercial Towing Service** or **Salvage Firm**. The “Agreement” will include provisions for hauling, storage, notifications, and disposal of the vehicle.
- B. When KDOT personnel encounter a vehicle, which is interfering with public highway operations or which appears to be abandoned, KDOT personnel should ask the Highway Patrol to have the vehicle removed.

KDOT personnel may move abandoned vehicles **off the roadway** when they are interfering with highway operations (such as plowing snow). Care should be taken to try to avoid damage to the vehicle.

- Section 14.90 -
OUTDOOR ADVERTISING SIGNS

14.91 – RESPONSIBILITY

The District Engineers are responsible for maintaining surveillance over the Federal-Aid Primary and the Interstate highways for *Off-Right-Of-Way Advertising Signs* and for reporting changes to the Bureau of Right-of-Way.

Detailed policy and procedures are outlined in KDOT SOM 1.13.5 – Outdoor Advertising.

14.92 – INVENTORY

The Inventory is a computer listing, by reference markers (mile marker) of advertising signs on primary and Interstate Highway systems. The inventory will be *Maintained by Bureau of Right-of-Way*.

- A. The inventory is based on the “Route Mileage Log”; the date is shown at the top of each sheet.
- B. The rural portion of the inventory lists signs located outside city limits, which are legible from the highway regardless of distance.

The Bureau of Right-of-Way shall periodically update the inventory in conjunction with district personnel, and they will make physical comparisons between inventory and concerned structures.

Maintenance Personnel Shall report the following types of changes to the district engineer who shall notify the Bureau of Right-of-Way.

- A. All Reference Marker corrections.
- B. New signs, modifications (repair or enlargement), storm damage, missing signs, etc.
- C. Accurately report all available information.

14.93 – SURVEILLANCE

The Subarea Supervisor Is To:

- A. Notify the area superintendent of new advertising signs being erected and any old signs being re-erected, repaired, enlarged, legend changed, missing, or removed.
- B. Notify the area superintendent of advertising signs damaged by storms.
 - 1. List individual locations if isolated signs are damaged.
 - 2. Describe general area if damage is widespread and involves several signs.
- C. Keep a copy of inventory available to correct and update routinely.

The Area Superintendent will inform the District Engineer, who in turn will notify the Bureau of Right-of-Way of changes and storm damaged advertising signs.

The Bureau of Right-of-Way will determine status of sign and which type of encroachment notice, if any, to issue, and take necessary action.

The District Engineer, when so requested by the Bureau of Right-of-Way, will:

- A. Remove illegal signs and dispose of the debris as is appropriate.
- B. Restore the ground to a condition similar to that prior to removal of the sign.

14.94 – SIGN REMOVAL COST

The District Engineer shall provide the Bureau of Fiscal Services the following information:

- A. DOT Form No. 1612, Property Damage Report, listing labor and equipment time to remove illegal signs.
- B. The form sets out the name, civil service classification, the hours worked, mileage/hours for equipment and other total cost involved.

The Bureau of Fiscal Services shall compute the cost and bill the owner.

CHAPTER 15

TABLES / CONVERSIONS / STANDARD PLANS / FORMS

FREQUENTLY USED IN HIGHWAY MAINTENANCE

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Reference to DOT forms commonly used in Maintenance

PART ONE: AREAS AND RATES OF APPLICATION

Table 1: ACREAGE – RIGHT-OF-WAY

| Width In Feet | Length In Miles | | | | | | | | | | | | | | | | | | |
|---------------------|-----------------|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|-------|-------|
| | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1' | .0 | .0 | .0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.4 | 0.5 | 0.6 | 0.7 | 0.9 | 1.0 | 1.1 | 1.2 |
| 2' | .0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.5 | 0.7 | 1.0 | 1.2 | 1.5 | 1.7 | 1.9 | 2.2 | 2.4 |
| 3' | .0 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.4 | 0.7 | 1.1 | 1.5 | 1.8 | 2.2 | 2.6 | 2.9 | 3.3 | 3.6 |
| 4' | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 | 0.4 | 0.5 | 1.0 | 1.5 | 1.9 | 2.4 | 2.9 | 3.4 | 3.9 | 4.4 | 4.9 |
| 5' | 0.1 | 0.1 | 0.2 | 0.2 | 0.3 | 0.4 | 0.4 | 0.5 | 0.6 | 0.6 | 1.2 | 1.8 | 2.4 | 3.0 | 3.6 | 4.2 | 4.9 | 5.5 | 6.1 |
| 6' | 0.1 | 0.2 | 0.2 | 0.3 | 0.4 | 0.4 | 0.5 | 0.6 | 0.7 | 0.7 | 1.5 | 2.2 | 2.9 | 3.6 | 4.4 | 5.1 | 5.8 | 6.5 | 7.3 |
| 7' | 0.1 | 0.2 | 0.3 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.7 | 2.6 | 3.4 | 4.2 | 5.1 | 5.9 | 6.8 | 7.6 | 8.5 |
| 8' | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.9 | 2.9 | 3.9 | 4.9 | 5.8 | 6.8 | 7.8 | 8.7 | 9.7 |
| 9' | 0.1 | 0.2 | 0.3 | 0.4 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.1 | 2.2 | 3.3 | 4.4 | 5.5 | 6.5 | 7.6 | 8.7 | 9.8 | 10.9 |
| 10' | 0.1 | 0.2 | 0.4 | 0.5 | 0.6 | 0.7 | 0.9 | 1.0 | 1.1 | 1.2 | 2.4 | 3.6 | 4.9 | 6.1 | 7.3 | 8.5 | 9.7 | 10.9 | 12.1 |
| 20' | 0.2 | 0.5 | 0.7 | 1.0 | 1.2 | 1.5 | 1.7 | 1.9 | 2.2 | 2.4 | 4.9 | 7.3 | 9.7 | 12.1 | 14.6 | 17.0 | 19.4 | 21.8 | 24.2 |
| 30' | 0.4 | 0.7 | 1.1 | 1.5 | 1.8 | 2.2 | 2.6 | 2.9 | 3.3 | 3.6 | 7.3 | 10.9 | 14.6 | 18.2 | 21.8 | 25.5 | 29.1 | 32.7 | 36.4 |
| 40' | 0.5 | 1.0 | 1.5 | 1.9 | 2.4 | 2.9 | 3.4 | 3.9 | 4.4 | 4.9 | 9.7 | 14.6 | 19.4 | 24.2 | 29.1 | 33.9 | 38.8 | 43.6 | 48.5 |
| 50' | 0.6 | 1.2 | 1.8 | 2.4 | 3.0 | 3.6 | 4.2 | 4.9 | 5.5 | 6.1 | 12.1 | 18.2 | 24.2 | 30.3 | 36.4 | 42.2 | 48.5 | 54.6 | 60.6 |
| 60' | 0.7 | 1.5 | 2.2 | 2.9 | 3.6 | 4.4 | 5.1 | 5.8 | 6.6 | 7.3 | 14.6 | 21.8 | 29.1 | 36.4 | 43.6 | 50.9 | 58.2 | 65.5 | 72.7 |
| 70' | 0.9 | 1.7 | 2.6 | 3.4 | 4.2 | 5.1 | 5.9 | 6.8 | 7.6 | 8.5 | 17.0 | 25.5 | 33.9 | 42.4 | 50.9 | 59.4 | 67.9 | 76.4 | 84.9 |
| 80' | 1.0 | 1.9 | 2.9 | 3.9 | 4.9 | 5.8 | 6.8 | 7.8 | 8.7 | 9.7 | 19.4 | 29.1 | 38.8 | 48.5 | 58.2 | 67.9 | 77.6 | 87.3 | 97.0 |
| 90' | 1.1 | 2.2 | 3.3 | 4.4 | 5.5 | 6.8 | 7.6 | 8.7 | 9.8 | 10.9 | 21.8 | 32.7 | 43.6 | 54.6 | 65.5 | 76.4 | 87.3 | 98.2 | 109.1 |
| 100' | 1.2 | 2.4 | 3.6 | 4.9 | 6.1 | 7.3 | 8.5 | 9.7 | 10.9 | 12.1 | 24.2 | 36.4 | 48.5 | 60.6 | 72.7 | 84.9 | 97.2 | 109.1 | 121.2 |

Table 2: ACREAGE – INTERCHANGE

| Width In Feet | Length In Miles | | | | | | | | | | | | | | | | | | |
|---------------------|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1000 |
| 10' | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 |
| 20' | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 | 0.4 |
| 30' | .0 | .0 | .0 | .0 | .0 | .0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 | 0.3 | 0.4 | 0.5 | 0.6 | 0.6 | 0.7 |
| 40' | .0 | .0 | .0 | .0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.6 | 0.7 | 0.8 | 0.9 |
| 50' | .0 | .0 | .0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.2 |
| 60' | .0 | .0 | .0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.3 | 0.4 | 0.6 | 0.7 | 0.8 | 1.0 | 1.1 | 1.2 | 1.4 |
| 70' | .0 | .0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 | 0.5 | 0.6 | 0.8 | 1.0 | 1.1 | 1.3 | 1.5 | 1.6 |
| 80' | .0 | .0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.4 | 0.6 | 0.7 | 0.9 | 1.1 | 1.3 | 1.5 | 1.7 | 1.8 |
| 90' | .0 | .0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.4 | 0.6 | 0.8 | 1.0 | 1.2 | 1.5 | 1.7 | 1.9 | 2.1 |
| 100' | .0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.5 | 0.7 | 0.9 | 1.2 | 1.4 | 1.6 | 1.8 | 2.1 | 2.3 |
| 200' | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 | 0.4 | 0.5 | 0.9 | 1.4 | 1.8 | 2.3 | 2.8 | 3.2 | 3.7 | 4.1 | 4.6 |
| 300' | 0.1 | 0.1 | 0.2 | 0.3 | 0.3 | 0.4 | 0.5 | 0.6 | 0.6 | 0.7 | 1.4 | 2.1 | 2.8 | 3.4 | 4.1 | 4.8 | 5.5 | 6.2 | 6.9 |
| 400' | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.6 | 0.7 | 0.8 | 0.9 | 1.8 | 2.8 | 3.7 | 4.6 | 5.5 | 6.4 | 7.4 | 8.3 | 9.3 |
| 500' | 0.1 | 0.2 | 0.3 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.2 | 2.3 | 3.4 | 4.6 | 5.7 | 6.9 | 8.0 | 9.2 | 10.3 | 11.5 |
| 600' | 0.1 | 0.3 | 0.4 | 0.6 | 0.7 | 0.8 | 1.0 | 1.1 | 1.2 | 1.4 | 2.8 | 4.1 | 5.5 | 6.9 | 8.3 | 9.6 | 11.0 | 12.4 | 13.8 |
| 700' | 0.2 | 0.3 | 0.5 | 0.6 | 0.8 | 1.0 | 1.1 | 1.3 | 1.5 | 1.6 | 3.2 | 4.8 | 6.4 | 8.0 | 9.6 | 11.3 | 12.9 | 14.5 | 16.1 |
| 800' | 0.2 | 0.4 | 0.6 | 0.7 | 0.9 | 1.1 | 1.3 | 1.5 | 1.7 | 1.8 | 3.7 | 5.5 | 7.4 | 9.2 | 11.0 | 12.9 | 14.7 | 16.5 | 18.4 |
| 900' | 0.2 | 0.4 | 0.6 | 0.8 | 1.0 | 1.2 | 1.5 | 1.7 | 1.9 | 2.1 | 4.1 | 6.2 | 8.3 | 10.3 | 12.4 | 14.5 | 16.5 | 18.6 | 20.7 |
| 1000' | 0.2 | 0.5 | 0.7 | 0.9 | 1.2 | 1.4 | 1.6 | 1.8 | 2.1 | 2.3 | 4.6 | 6.9 | 9.2 | 11.5 | 13.8 | 16.1 | 18.4 | 20.7 | 23.0 |

Table 3: SQUARE YARDS OF ROAD SURFACE FOR VARIOUS ROAD WIDTHS

| Road Width | Square Yards of Road Surface | | |
|------------|------------------------------|--------------|----------|
| | Per Lineal Foot | Per 100 Feet | Per Mile |
| 6' | | | 3,520 |
| 7' | | | 4,107 |
| 8' | | | 4,693 |
| 9' | | | 5,280 |
| 10' | | | 5,867 |
| 11' | | | 6,453 |
| 12' | | | 7,040 |
| 13' | | | 7,627 |
| 14' | | | 8,213 |
| 15' | | | 8,800 |
| 16' | | | 9,387 |
| 17' | | | 9,973 |
| 18' | | | 10,560 |
| 20' | | | 11,733 |
| 22' | | | 12,907 |

| Road Width~ | Square Yards of Road Surface | | |
|-------------|------------------------------|--------------|----------|
| | Per Lineal Foot | Per 100 Feet | Per Mile |
| 24' | | | 14,080 |
| 25' | | | 14,667 |
| 26' | | | 15,253 |
| 28' | | | 16,427 |
| 30' | | | 17,600 |
| 32' | | | 18,773 |
| 34' | | | 19,947 |
| 36' | | | 21,120 |
| 38' | | | 22,293 |
| 40' | | | 23,467 |
| 50' | | | 29,333 |
| 60' | | | 35,200 |
| 70' | | | 41,067 |
| 75' | | | 44,000 |
| 80' | | | 46,933 |

Table 4: CIRCLES – LINEAL AND AREA MEASUREMENTS

|  |  |  |  |  |
|---|---|---|---|---|
| Radius | Diameter | Circle Area | Circumference | Fillet Area |
| 1.00 | 2.00 | 3.14 | 6.28 | 0.21 |
| 1.25 | 2.50 | 4.91 | 7.85 | 0.34 |
| 1.50 | 3.00 | 7.07 | 9.42 | 0.48 |
| 1.75 | 3.50 | 9.62 | 11.00 | 0.66 |
| 2.00 | 4.00 | 12.57 | 12.57 | 0.86 |
| 2.25 | 4.50 | 15.91 | 14.14 | 1.09 |
| 2.50 | 5.00 | 19.63 | 15.71 | 1.34 |
| 2.75 | 5.50 | 23.76 | 17.28 | 1.62 |
| 3.00 | 6.00 | 28.27 | 18.85 | 1.93 |
| 3.25 | 6.50 | 33.18 | 20.42 | 2.27 |
| 3.50 | 7.00 | 38.48 | 21.99 | 2.63 |
| 3.75 | 7.50 | 44.18 | 23.56 | 3.02 |
| 4.00 | 8.00 | 50.27 | 25.13 | 3.43 |
| 4.25 | 8.50 | 56.75 | 26.70 | 3.88 |
| 4.50 | 9.00 | 63.62 | 28.27 | 4.35 |
| 4.75 | 9.50 | 70.88 | 29.85 | 4.84 |
| 5.00 | 10.00 | 78.54 | 31.42 | 5.37 |
| 5.25 | 10.50 | 86.59 | 32.99 | 5.91 |

|  |  |  |  |  |
|---|---|---|---|---|
| Radius | Diameter | Circle Area | Circumference | Fillet Area |
| 5.50 | 11.00 | 95.03 | 34.56 | 6.49 |
| 5.75 | 11.50 | 103.87 | 36.13 | 7.09 |
| 6.00 | 12.00 | 113.10 | 37.70 | 7.73 |
| 6.25 | 12.50 | 122.72 | 39.27 | 8.38 |
| 6.50 | 13.00 | 132.73 | 40.84 | 9.07 |
| 6.75 | 13.50 | 143.14 | 42.41 | 9.78 |
| 7.00 | 14.00 | 153.94 | 43.98 | 10.52 |
| 7.25 | 14.50 | 165.13 | 45.55 | 11.28 |
| 7.50 | 15.00 | 176.72 | 47.12 | 12.07 |
| 7.75 | 15.50 | 188.69 | 48.69 | 12.89 |
| 8.00 | 16.00 | 201.06 | 50.27 | 13.73 |
| 8.25 | 16.50 | 213.83 | 51.84 | 14.61 |
| 8.50 | 17.00 | 226.98 | 53.41 | 15.50 |
| 8.75 | 17.50 | 240.53 | 54.98 | 16.43 |
| 9.00 | 18.00 | 254.47 | 56.55 | 17.38 |
| 9.25 | 18.50 | 268.80 | 58.12 | 18.36 |
| 9.50 | 19.00 | 283.53 | 59.69 | 19.37 |
| 9.75 | 19.50 | 298.65 | 61.26 | 20.40 |
| 10.00 | 20.00 | 314.16 | 62.83 | 21.46 |

Table 5: LINEAL FEET COVERED BY 1000-GALLON TANK

| Road Width In Feet | Gallons Per Square Yard | | | | | | | | | | | | | | | | |
|--------------------|-------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|------|
| | 0.10 | 0.15 | 0.20 | 0.25 | 0.30 | 0.33 | 0.35 | 0.40 | 0.50 | 0.60 | 0.70 | 0.80 | 0.90 | 1.00 | 1.25 | 1.50 | 2.00 |
| 8' | 11,250 | 7,500 | 5,625 | 4,500 | 3,750 | 3,375 | 3,214 | 2,813 | 2,250 | 1,875 | 1,607 | 1,406 | 1,250 | 1,125 | 900 | 750 | 563 |
| 9' | 10,000 | 6,667 | 5,000 | 4,000 | 3,333 | 3,000 | 2,857 | 2,500 | 2,000 | 1,667 | 1,429 | 1,250 | 1,111 | 1,000 | 800 | 667 | 500 |
| 10' | 9,000 | 6,000 | 4,500 | 3,600 | 3,000 | 2,700 | 2,571 | 2,250 | 1,800 | 1,500 | 1,286 | 1,125 | 1,000 | 900 | 720 | 600 | 450 |
| 11' | 8,182 | 5,455 | 4,091 | 3,273 | 2,727 | 2,455 | 2,338 | 2,045 | 1,636 | 1,364 | 1,169 | 1,023 | 909 | 818 | 655 | 545 | 409 |
| 12' | 7,500 | 5,000 | 3,750 | 3,000 | 2,500 | 2,250 | 2,143 | 1,875 | 1,500 | 1,250 | 1,071 | 938 | 833 | 750 | 600 | 500 | 375 |
| 14' | 6,429 | 4,286 | 3,214 | 2,571 | 2,143 | 1,929 | 1,837 | 1,607 | 1,286 | 1,071 | 918 | 804 | 714 | 643 | 514 | 429 | 321 |
| 15' | 6,000 | 4,000 | 3,000 | 2,400 | 2,000 | 1,800 | 1,714 | 1,500 | 1,200 | 1,000 | 857 | 750 | 667 | 600 | 480 | 400 | 300 |
| 16' | 5,625 | 3,750 | 2,813 | 2,250 | 1,875 | 1,688 | 1,607 | 1,406 | 1,125 | 938 | 804 | 703 | 625 | 563 | 450 | 375 | 281 |
| 18' | 5,000 | 3,333 | 2,500 | 2,000 | 1,667 | 1,500 | 1,429 | 1,250 | 1,000 | 833 | 714 | 625 | 556 | 500 | 400 | 333 | 250 |
| 20' | 4,500 | 3,000 | 2,250 | 1,800 | 1,500 | 1,350 | 1,286 | 1,125 | 900 | 750 | 643 | 563 | 500 | 450 | 360 | 300 | 225 |
| 22' | 4,091 | 2,727 | 2,045 | 1,636 | 1,364 | 1,227 | 1,169 | 1,023 | 818 | 682 | 584 | 511 | 455 | 409 | 327 | 273 | 205 |
| 24' | 3,750 | 2,500 | 1,875 | 1,500 | 1,250 | 1,125 | 1,071 | 938 | 750 | 625 | 536 | 469 | 417 | 375 | 300 | 250 | 188 |
| 25' | 3,600 | 2,400 | 1,800 | 1,440 | 1,200 | 1,080 | 1,029 | 900 | 720 | 600 | 514 | 450 | 400 | 360 | 288 | 240 | 180 |
| 26' | 3,462 | 2,308 | 1,731 | 1,385 | 1,154 | 1,038 | 989 | 865 | 692 | 577 | 495 | 433 | 385 | 346 | 277 | 231 | 173 |
| 28' | 3,214 | 2,143 | 1,607 | 1,286 | 1,071 | 964 | 918 | 804 | 643 | 536 | 459 | 402 | 357 | 321 | 257 | 214 | 161 |
| 30' | 3,000 | 2,000 | 1,500 | 1,200 | 1,000 | 900 | 857 | 750 | 600 | 500 | 429 | 375 | 333 | 300 | 240 | 200 | 150 |

Table 6: GALLONS OF ASPHALT REQUIRED PER MILE FOR VARIOUS RATES OF APPLICATION

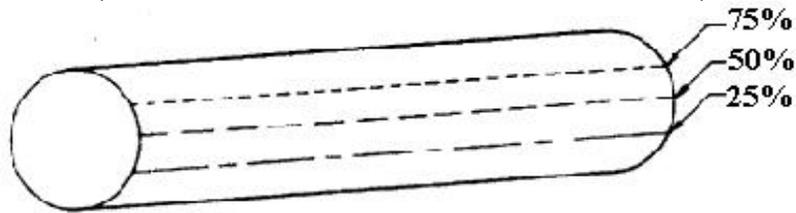
| Road Width In Feet | Gallons Per Square Yard | | | | | | | | | | | | | | | | |
|--------------------|-------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 0.10 | 0.15 | 0.20 | 0.25 | 0.30 | 0.33 | 0.35 | 0.40 | 0.50 | 0.60 | 0.70 | 0.80 | 0.90 | 1.00 | 1.25 | 1.50 | 2.00 |
| 8' | 469 | 704 | 939 | 1173 | 1408 | 1564 | 1643 | 1877 | 2347 | 2816 | 3285 | 3755 | 4224 | 4693 | 5867 | 7040 | 9387 |
| 9' | 528 | 792 | 1056 | 1320 | 1584 | 1760 | 1848 | 2221 | 2640 | 3168 | 3696 | 4224 | 4752 | 5280 | 6600 | 7920 | 10560 |
| 10' | 587 | 880 | 1173 | 1467 | 1760 | 1956 | 2053 | 2347 | 2933 | 3520 | 4107 | 4693 | 5280 | 5867 | 7333 | 8880 | 11733 |
| 11' | 645 | 968 | 1291 | 1613 | 1936 | 2151 | 2259 | 2581 | 3227 | 3872 | 4517 | 5163 | 5808 | 6453 | 8067 | 9680 | 12907 |
| 12' | 704 | 1056 | 1408 | 1760 | 2112 | 2347 | 2464 | 2816 | 3520 | 4224 | 4928 | 5632 | 6336 | 7040 | 8800 | 10560 | 14080 |
| 14' | 821 | 1232 | 1643 | 2053 | 2464 | 2738 | 2875 | 3285 | 4107 | 4928 | 5749 | 6571 | 7392 | 8213 | 10267 | 12320 | 16427 |
| 15' | 880 | 1320 | 1760 | 2200 | 2640 | 2933 | 3080 | 3520 | 4400 | 5280 | 6160 | 7040 | 7920 | 8800 | 11000 | 13200 | 17600 |
| 16' | 939 | 1408 | 1877 | 2347 | 2816 | 3129 | 3285 | 3755 | 4693 | 5632 | 6571 | 7509 | 8448 | 9387 | 11733 | 14080 | 18773 |
| 18' | 1056 | 1584 | 2112 | 2640 | 3168 | 3520 | 3696 | 4224 | 5280 | 6336 | 7392 | 8448 | 9504 | 10560 | 13200 | 15840 | 21120 |
| 20' | 1173 | 1760 | 2347 | 2933 | 3520 | 3911 | 4107 | 4693 | 5867 | 7040 | 8213 | 9387 | 10560 | 11733 | 14667 | 17600 | 23467 |
| 22' | 1291 | 1936 | 2581 | 3227 | 3872 | 4302 | 4517 | 5163 | 6453 | 7744 | 9035 | 10325 | 11616 | 12907 | 16133 | 19360 | 25813 |
| 24' | 1408 | 2112 | 2816 | 3520 | 4224 | 4693 | 4928 | 5632 | 7040 | 8448 | 9856 | 11264 | 12672 | 14080 | 17600 | 21120 | 28160 |
| 25' | 1467 | 2200 | 2933 | 3667 | 4400 | 4889 | 5133 | 5867 | 7333 | 8800 | 10267 | 11733 | 13200 | 14667 | 18333 | 22000 | 29333 |
| 26' | 1525 | 2288 | 3051 | 3813 | 4576 | 5084 | 5339 | 6101 | 7627 | 9152 | 10677 | 12202 | 13728 | 15253 | 19067 | 22880 | 30507 |
| 28' | 1643 | 2464 | 3285 | 4107 | 4928 | 5476 | 5749 | 6571 | 8213 | 9856 | 11499 | 13141 | 14784 | 16427 | 20533 | 24640 | 32853 |
| 30' | 1760 | 2640 | 3520 | 4400 | 5280 | 5867 | 6160 | 7040 | 8800 | 10560 | 12320 | 14080 | 15840 | 17600 | 22000 | 26400 | 35200 |

Table 7: TONS OF AGGREGATE REQUIRED PER MILE FOR VARIOUS RATES OF APPLICATION

| Road Width In Feet | Pounds Per Square Yard | | | | | | | | | | | | | | | |
|--------------------|------------------------|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|--|
| | 3# | 5# | 7# | 8# | 10# | 12# | 15# | 20# | 25# | 30# | 35# | 40# | 45# | 50# | 100# | |
| 8' | 7.0 | 12 | 16 | 19 | 23 | 28 | 35 | 47 | 59 | 70 | 82 | 94 | 106 | 117 | 235 | |
| 9' | 7.9 | 13 | 18 | 21 | 26 | 32 | 40 | 53 | 66 | 79 | 92 | 106 | 119 | 132 | 264 | |
| 10' | 8.8 | 15 | 20 | 23 | 29 | 35 | 44 | 59 | 73 | 88 | 103 | 116 | 132 | 147 | 293 | |
| 11' | 9.7 | 16 | 23 | 26 | 32 | 39 | 48 | 65 | 81 | 97 | 113 | 129 | 145 | 161 | 323 | |
| 12' | 11 | 18 | 25 | 28 | 35 | 42 | 53 | 70 | 88 | 106 | 123 | 141 | 158 | 176 | 352 | |
| 14' | 12 | 20 | 29 | 33 | 41 | 49 | 62 | 82 | 103 | 123 | 144 | 164 | 185 | 205 | 410 | |
| 15' | 13 | 22 | 31 | 35 | 44 | 53 | 66 | 88 | 110 | 132 | 154 | 176 | 198 | 220 | 440 | |
| 16' | 14 | 23 | 33 | 38 | 47 | 56 | 70 | 94 | 117 | 140 | 164 | 188 | 211 | 235 | 469 | |
| 18' | 16 | 26 | 37 | 42 | 53 | 63 | 80 | 106 | 132 | 158 | 185 | 212 | 238 | 264 | 528 | |
| 20' | 18 | 29 | 41 | 47 | 59 | 70 | 88 | 118 | 147 | 176 | 205 | 235 | 264 | 293 | 587 | |
| 22' | 19 | 32 | 45 | 52 | 65 | 77 | 97 | 129 | 131 | 194 | 226 | 258 | 290 | 323 | 645 | |
| 24' | 21 | 35 | 49 | 56 | 70 | 84 | 105 | 141 | 176 | 212 | 246 | 282 | 317 | 352 | 704 | |
| 25' | 22 | 37 | 51 | 59 | 73 | 88 | 110 | 147 | 183 | 220 | 257 | 294 | 330 | 366 | 733 | |
| 26' | 23 | 38 | 53 | 61 | 76 | 92 | 114 | 152 | 191 | 228 | 267 | 305 | 343 | 381 | 762 | |
| 28' | 25 | 41 | 57 | 66 | 82 | 99 | 123 | 164 | 205 | 246 | 287 | 328 | 370 | 410 | 820 | |
| 30' | 26 | 44 | 62 | 70 | 88 | 106 | 132 | 176 | 220 | 264 | 308 | 352 | 396 | 440 | 880 | |

PART TWO: VOLUMES AND WEIGHTS

**Table 8: NUMBER OF GALLONS IN TANKS OF VARIOUS SIZES
(BASED ON PERCENT OF CAPACITY)**



| Percent of Depth | Percent of Capacity | Number of Gallons in Tank | | | | | | |
|------------------|---------------------|---------------------------|-----------------|------------------|------------------|------------------|------------------|------------------|
| | | 600-Gallon Tank | 800-Gallon Tank | 1000-Gallon Tank | 1200-Gallon Tank | 1500-Gallon Tank | 2000-Gallon Tank | 2500-Gallon Tank |
| 1 | 0.2 | 1 | 2 | 2 | 2 | 3 | 4 | 5 |
| 2 | 0.5 | 3 | 4 | 5 | 6 | 8 | 10 | 13 |
| 3 | 0.9 | 5 | 7 | 9 | 11 | 14 | 18 | 23 |
| 4 | 1.3 | 8 | 11 | 13 | 16 | 20 | 27 | 34 |
| 5 | 1.9 | 11 | 15 | 19 | 22 | 28 | 37 | 47 |
| 6 | 2.5 | 15 | 20 | 25 | 29 | 37 | 49 | 61 |
| 7 | 3.1 | 18 | 25 | 31 | 37 | 46 | 61 | 77 |
| 8 | 3.7 | 22 | 30 | 37 | 45 | 56 | 75 | 94 |
| 9 | 4.5 | 27 | 36 | 45 | 53 | 67 | 89 | 111 |
| 10 | 5.2 | 31 | 42 | 52 | 62 | 78 | 104 | 130 |
| 11 | 6.0 | 36 | 48 | 60 | 72 | 90 | 120 | 150 |
| 12 | 6.8 | 41 | 54 | 68 | 82 | 102 | 136 | 170 |
| 13 | 7.6 | 46 | 61 | 76 | 92 | 115 | 153 | 191 |
| 14 | 8.5 | 51 | 68 | 85 | 102 | 128 | 175 | 213 |
| 15 | 9.4 | 56 | 75 | 94 | 113 | 141 | 188 | 235 |
| 16 | 10.3 | 62 | 83 | 103 | 124 | 155 | 206 | 258 |
| 17 | 11.3 | 68 | 90 | 113 | 135 | 169 | 225 | 282 |
| 18 | 12.2 | 73 | 98 | 122 | 147 | 184 | 245 | 306 |
| 19 | 13.2 | 79 | 106 | 132 | 159 | 199 | 265 | 331 |
| 20 | 14.2 | 85 | 114 | 142 | 171 | 214 | 285 | 356 |
| 21 | 15.3 | 92 | 122 | 153 | 183 | 229 | 305 | 382 |
| 22 | 16.3 | 98 | 131 | 163 | 196 | 245 | 326 | 408 |
| 23 | 17.4 | 104 | 139 | 174 | 209 | 261 | 348 | 435 |
| 24 | 18.5 | 111 | 148 | 185 | 222 | 278 | 370 | 463 |
| 25 | 19.6 | 118 | 157 | 196 | 235 | 294 | 392 | 490 |
| 26 | 20.7 | 124 | 166 | 207 | 249 | 311 | 415 | 518 |
| 27 | 21.9 | 131 | 175 | 219 | 262 | 328 | 437 | 547 |
| 28 | 23.0 | 138 | 184 | 230 | 276 | 345 | 460 | 575 |
| 29 | 24.1 | 144 | 193 | 241 | 289 | 361 | 481 | 602 |
| 30 | 25.3 | 152 | 203 | 253 | 304 | 380 | 506 | 633 |
| 31 | 26.5 | 159 | 212 | 265 | 318 | 397 | 530 | 662 |
| 32 | 27.7 | 166 | 221 | 277 | 332 | 415 | 553 | 692 |
| 33 | 28.8 | 173 | 231 | 288 | 346 | 433 | 577 | 721 |
| 34 | 30.0 | 180 | 240 | 300 | 360 | 451 | 601 | 751 |
| 35 | 31.2 | 187 | 250 | 312 | 374 | 468 | 624 | 780 |
| 36 | 32.4 | 195 | 260 | 324 | 389 | 487 | 649 | 811 |
| 37 | 33.7 | 202 | 269 | 337 | 404 | 505 | 673 | 842 |
| 38 | 34.9 | 209 | 279 | 349 | 419 | 524 | 698 | 873 |
| 39 | 36.1 | 217 | 289 | 361 | 434 | 542 | 723 | 904 |
| 40 | 37.4 | 224 | 299 | 374 | 449 | 561 | 748 | 935 |
| 41 | 38.6 | 232 | 309 | 386 | 464 | 580 | 793 | 966 |
| 42 | 39.9 | 239 | 319 | 399 | 479 | 598 | 798 | 997 |
| 43 | 41.1 | 247 | 329 | 411 | 494 | 617 | 823 | 1,029 |
| 44 | 42.4 | 254 | 339 | 424 | 509 | 636 | 848 | 1,060 |
| 45 | 43.7 | 262 | 349 | 437 | 524 | 655 | 873 | 1,092 |
| 46 | 44.9 | 270 | 359 | 449 | 539 | 674 | 898 | 1,123 |
| 47 | 46.2 | 277 | 370 | 462 | 554 | 693 | 924 | 1,155 |
| 48 | 47.5 | 285 | 380 | 475 | 569 | 712 | 949 | 1,186 |
| 49 | 48.7 | 292 | 390 | 487 | 585 | 731 | 975 | 1,218 |
| 50 | 50.0 | 300 | 400 | 500 | 600 | 750 | 1,000 | 1,250 |

Table 9: STORAGE CAPACITY (IN TONS) OF CONE OR TENT-SHAPED STOCKPILES OF SAND OR GRAVEL

| Length of Stockpile in Feet | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 |
|-----------------------------|----|-----|-----|-----|-----|-----|-----|-------|------|------|------|------|------|------|
| 10 | 5 | | | | | | | | | | | | | |
| 12 1/2 | 7 | -- | | | | | | | | | | | | |
| 15 | 10 | 17 | | | | | | | | | | | | |
| 17 1/2 | 12 | 22 | -- | | | | | | | | | | | |
| 20 | 14 | 27 | 39 | | | | | | | | | | | |
| 22 1/2 | 17 | 33 | 49 | -- | | | | | | | | | | |
| 25 | 19 | 38 | 58 | 77 | | | | | | | | | | |
| 27 1/2 | 21 | 43 | 68 | 92 | -- | | | | | | | | | |
| 30 | 24 | 48 | 77 | 110 | 130 | | | | | | | | | |
| 32 1/2 | 26 | 54 | 87 | 120 | 150 | -- | | | | | | | | |
| 35 | 28 | 59 | 96 | 140 | 180 | 210 | | | | | | | | |
| 37 1/2 | 31 | 64 | 110 | 150 | 200 | 240 | -- | | | | | | | |
| 40 | 33 | 70 | 120 | 170 | 220 | 270 | 320 | | | | | | | |
| 42 1/2 | 36 | 75 | 120 | 180 | 240 | 300 | 350 | -- | | | | | | |
| 45 | 38 | 80 | 130 | 200 | 260 | 330 | 390 | 450 | | | | | | |
| 47 1/2 | 40 | 86 | 140 | 210 | 280 | 360 | 430 | 500 | -- | | | | | |
| 50 | 43 | 91 | 150 | 220 | 300 | 380 | 470 | 540 | 620 | | | | | |
| 52 1/2 | 45 | 96 | 160 | 240 | 320 | 410 | 500 | 590 | 670 | -- | | | | |
| 55 | 47 | 100 | 170 | 250 | 340 | 440 | 540 | 640 | 730 | 820 | | | | |
| 57 1/2 | 50 | 110 | 180 | 270 | 370 | 470 | 580 | 690 | 790 | 890 | -- | | | |
| 60 | 52 | 110 | 190 | 280 | 390 | 500 | 620 | 740 | 850 | 960 | 1100 | | | |
| 62 1/2 | 54 | 120 | 200 | 300 | 410 | 530 | 650 | 780 | 910 | 1000 | 1100 | -- | | |
| 65 | 57 | 120 | 210 | 310 | 430 | 560 | 690 | 830 | 970 | 1100 | 1200 | 1400 | | |
| 67 1/2 | 59 | 130 | 220 | 330 | 450 | 590 | 730 | 880 | 1000 | 1200 | 1300 | 1500 | -- | |
| 70 | 61 | 130 | 230 | 340 | 470 | 610 | 770 | 930 | 1100 | 1200 | 1400 | 1600 | 1700 | |
| 72 1/2 | 64 | 140 | 240 | 360 | 490 | 640 | 800 | 970 | 1100 | 1300 | 1500 | 1700 | 1800 | -- |
| 75 | 66 | 140 | 250 | 370 | 510 | 670 | 840 | 1,000 | 1200 | 1400 | 1600 | 1800 | 1900 | 2100 |
| | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55.0 | 60 | 65 | 70 | 75 |

When length and width are equal, the stockpile is cone-shaped.

| For each additional 10 feet beyond the 75-foot length in this table, add the following values. | | | | | | | | | | | | | |
|--|----|----|----|----|-----|-----|-----|-----|-------|-----|-----|-----|-----|
| 9 | 21 | 38 | 59 | 85 | 115 | 150 | 190 | 235 | 285.0 | 340 | 400 | 460 | 530 |

Table 10: STORAGE CAPACITY (IN TONS) OF CONE OR TENT-SHAPED STOCKPILES OF CRUSHED STONE

| Length of Stockpile in Feet | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55.0 | 60 | 65 | 70 | 75 |
|-----------------------------|----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|-----|------|
| 10 | 5 | | | | | | | | | | | | | |
| 12 1/2 | 8 | -- | | | | | | | | | | | | |
| 15 | 11 | 19 | | | | | | | | | | | | |
| 17 1/2 | 13 | 24 | -- | | | | | | | | | | | |
| 20 | 16 | 30 | 44 | | | | | | | | | | | |
| 22 1/2 | 19 | 36 | 54 | -- | | | | | | | | | | |
| 25 | 21 | 42 | 65 | 86 | | | | | | | | | | |
| 27 1/2 | 24 | 48 | 75 | 100 | -- | | | | | | | | | |
| 30 | 26 | 54 | 86 | 120 | 150 | | | | | | | | | |
| 32 1/2 | 29 | 60 | 96 | 130 | 170 | -- | | | | | | | | |
| 35 | 32 | 66 | 110 | 150 | 200 | 240 | | | | | | | | |
| 37 1/2 | 34 | 72 | 120 | 170 | 220 | 270 | -- | | | | | | | |
| 40 | 37 | 78 | 130 | 180 | 240 | 300 | 350 | | | | | | | |
| 42 1/2 | 40 | 83 | 140 | 200 | 270 | 330 | 390 | -- | | | | | | |
| 45 | 42 | 89 | 150 | 220 | 290 | 360 | 440 | 500 | | | | | | |
| 47 1/2 | 45 | 95 | 160 | 230 | 310 | 400 | 480 | 550 | -- | | | | | |
| 50 | 47 | 100 | 170 | 250 | 340 | 430 | 520 | 610 | 690 | | | | | |
| 52 1/2 | 50 | 110 | 180 | 270 | 360 | 460 | 560 | 660 | 750 | -- | | | | |
| 55 | 53 | 110 | 190 | 280 | 380 | 490 | 600 | 710 | 820 | 910 | | | | |
| 57 1/2 | 55 | 120 | 200 | 300 | 400 | 520 | 640 | 770 | 880 | 990 | -- | | | |
| 60 | 58 | 120 | 210 | 320 | 430 | 560 | 690 | 820 | 950 | 1100 | 1200 | | | |
| 62 1/2 | 61 | 130 | 220 | 330 | 450 | 590 | 730 | 870 | 1000 | 1200 | 1300 | -- | | |
| 65 | 63 | 140 | 230 | 350 | 480 | 620 | 770 | 920 | 1100 | 1200 | 1400 | 1500 | | |
| 67 1/2 | 55 | 140 | 240 | 360 | 500 | 650 | 800 | 980 | 1100 | 1300 | 1500 | 1600 | -- | |
| 70 | 68 | 150 | 250 | 380 | 530 | 680 | 850 | 1000 | 1200 | 1400 | 1600 | 1700 | 190 | 0 |
| 72 1/2 | 71 | 150 | 260 | 400 | 550 | 720 | 900 | 1100 | 1300 | 1500 | 1700 | 1800 | 200 | -- |
| 75 | 74 | 160 | 270 | 410 | 570 | 750 | 940 | 1100 | 1300 | 1500 | 1800 | 2000 | 210 | 2300 |
| | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 |

| For each additional 10 feet beyond the 75-foot length in this table, add the following values. | | | | | | | | | | | | | |
|--|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 11 | 24 | 42 | 66 | 94 | 130 | 170 | 210 | 260 | 315 | 375 | 445 | 515 | 590 |

Table 11: LOOSE AND COMPACTED WEIGHTS OF VARIOUS MATERIALS

| Type of Material | Loose | | | Compacted | | |
|----------------------|-----------------------|-----------------------|---|-----------------------|-----------------------|---|
| | Pounds Per Cubic Foot | Pounds Per Cubic Yard | Approximate Pounds Per Square Yard Per 1-Inch Depth | Pounds Per Cubic Foot | Pounds Per Cubic Yard | Approximate Pounds Per Square Yard Per 1-Inch Depth |
| Trap Rock | 96 | 2590 | 72 | 122 | 3300 | 92 |
| | 100 | 2690 | 75 | 127 | 3420 | 95 |
| | 103 | 2780 | 77 | 131 | 3540 | 98 |
| Granite or Limestone | 90 | 2410 | 67 | 113 | 3060 | 85 |
| | 93 | 2500 | 69 | 118 | 3180 | 88 |
| | 96 | 2590 | 72 | 122 | 3300 | 92 |
| Sandstone | 82 | 2220 | 62 | 105 | 2830 | 79 |
| | 86 | 2320 | 64 | 109 | 2950 | 82 |
| | 90 | 2410 | 66 | 113 | 3060 | 85 |
| | 93 | 2500 | 70 | 118 | 3180 | 88 |
| Sand | 97 | 2630 | 73 | 105 | 2830 | 79 |
| | 101 | 2740 | 76 | 109 | 2950 | 82 |
| | 106 | 2850 | 79 | 113 | 3060 | 85 |
| | 110 | 2960 | 82 | 118 | 3180 | 88 |
| Slag | 55 | 1480 | 41 | 70 | 1890 | 53 |
| | 65 | 1760 | 49 | 83 | 2240 | 62 |
| | 76 | 2040 | 57 | 96 | 2590 | 72 |
| | 86 | 2320 | 64 | 109 | 2950 | 82 |
| Asphalt Concrete | 91 | 2480 | 69 | 115 | 3100 | 86 |
| | 100 | 2700 | 75 | 130 | 3510 | 97 |
| | 116 | 3130 | 87 | 145 | 3910 | 109 |
| | 128 | 3460 | 96 | 160 | 4320 | 120 |

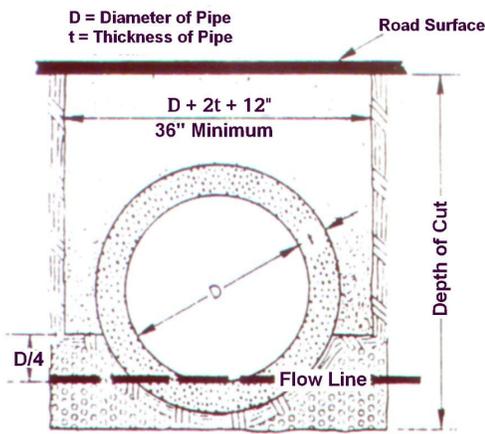
Table 12: POUNDS OF AGGREGATE REQUIRED PER SQUARE YARD FOR VARIOUS CUBIC YARD WEIGHTS

| Pounds of Aggregate Per Cubic Yard | Pounds of Compacted Aggregate Per Square Yard for Various Depths in Inches | | | | | | | | | | | |
|------------------------------------|--|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| | 1" | 2" | 3" | 4" | 5" | 6" | 7" | 8" | 9" | 10" | 11" | 12" |
| 1800 | 50 | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 |
| 1900 | 53 | 106 | 158 | 211 | 264 | 317 | 369 | 422 | 475 | 528 | 581 | 633 |
| 2000 | 56 | 111 | 167 | 222 | 278 | 333 | 389 | 444 | 500 | 556 | 611 | 667 |
| 2100 | 58 | 117 | 175 | 233 | 292 | 350 | 408 | 467 | 525 | 583 | 642 | 700 |
| 2200 | 61 | 122 | 183 | 244 | 306 | 367 | 428 | 489 | 550 | 611 | 672 | 733 |
| 2300 | 64 | 128 | 192 | 256 | 319 | 383 | 447 | 511 | 575 | 639 | 703 | 767 |
| 2400 | 67 | 133 | 200 | 267 | 333 | 400 | 467 | 533 | 600 | 667 | 733 | 800 |
| 2500 | 69 | 139 | 208 | 278 | 347 | 417 | 486 | 556 | 625 | 694 | 764 | 833 |
| 2600 | 72 | 144 | 217 | 289 | 361 | 433 | 506 | 578 | 650 | 722 | 794 | 867 |
| 2700 | 75 | 150 | 225 | 300 | 375 | 450 | 525 | 600 | 675 | 750 | 825 | 900 |
| 2800 | 78 | 156 | 233 | 311 | 389 | 467 | 544 | 622 | 700 | 778 | 856 | 933 |
| 2900 | 81 | 161 | 242 | 322 | 403 | 483 | 564 | 644 | 725 | 806 | 886 | 967 |
| 3000 | 83 | 167 | 250 | 333 | 417 | 500 | 583 | 667 | 750 | 833 | 917 | 1000 |
| 3100 | 86 | 172 | 258 | 344 | 431 | 517 | 603 | 689 | 775 | 861 | 947 | 1033 |
| 3200 | 89 | 178 | 267 | 356 | 444 | 533 | 622 | 711 | 800 | 889 | 978 | 1067 |
| 3300 | 92 | 183 | 275 | 367 | 458 | 550 | 642 | 733 | 825 | 917 | 1008 | 1100 |
| 3400 | 94 | 189 | 283 | 378 | 472 | 567 | 661 | 756 | 850 | 944 | 1039 | 1133 |
| 3500 | 97 | 194 | 292 | 389 | 486 | 583 | 681 | 778 | 875 | 972 | 1069 | 1167 |
| 3600 | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1000 | 1100 | 1200 |

Table 13: POUNDS OF AGGREGATE REQUIRED PER SQUARE YARD FOR VARIOUS CUBIC YARD WEIGHTS

| Width of Area in Feet | Cubic Yards of Loose Aggregate Required for Various Depths in Inches | | | | | | | | | | | | | | |
|-----------------------|--|------|-----|--------|------|--------|------|--------|------|--------|------|------|------|------|-------|
| | 1/2" | 3/4" | 1" | 1 1/2" | 2" | 2 1/2" | 3" | 3 1/2" | 4" | 4 1/2" | 5" | 6" | 8" | 10" | 12" |
| 8' | 1.2 | 1.9 | 2.5 | 3.7 | 4.9 | 6.2 | 7.4 | 8.6 | 9.9 | 11.1 | 12.3 | 14.8 | 19.8 | 24.7 | 29.6 |
| 9' | 1.4 | 2.1 | 2.8 | 4.2 | 5.6 | 6.9 | 8.3 | 9.7 | 11.1 | 12.5 | 13.9 | 16.7 | 22.2 | 27.8 | 33.3 |
| 10' | 1.5 | 2.3 | 3.1 | 4.6 | 6.2 | 7.7 | 9.3 | 10.8 | 12.3 | 13.9 | 15.4 | 18.5 | 24.7 | 30.9 | 37.0 |
| 11' | 1.7 | 2.5 | 3.4 | 5.1 | 6.8 | 8.5 | 10.2 | 11.9 | 13.6 | 15.3 | 17.0 | 20.4 | 27.2 | 34.0 | 40.7 |
| 12' | 1.9 | 2.8 | 3.7 | 5.6 | 7.4 | 9.3 | 11.1 | 13.0 | 14.8 | 16.7 | 18.5 | 22.2 | 29.6 | 37.0 | 44.4 |
| 14' | 2.2 | 3.2 | 4.3 | 6.5 | 8.6 | 10.8 | 13.0 | 15.1 | 17.3 | 19.4 | 21.6 | 25.9 | 34.6 | 43.2 | 51.9 |
| 15' | 2.3 | 3.5 | 4.6 | 6.9 | 9.3 | 11.6 | 13.9 | 16.2 | 18.5 | 20.8 | 23.1 | 27.8 | 37.0 | 46.3 | 55.6 |
| 16' | 2.5 | 3.7 | 4.9 | 7.4 | 9.9 | 12.3 | 14.8 | 17.3 | 19.8 | 22.7 | 24.7 | 29.7 | 39.5 | 49.4 | 59.3 |
| 18' | 2.8 | 4.2 | 5.6 | 8.3 | 11.1 | 13.9 | 16.7 | 19.4 | 22.2 | 25.0 | 27.8 | 33.3 | 44.4 | 55.6 | 66.7 |
| 20' | 3.1 | 4.6 | 6.2 | 9.3 | 12.3 | 15.4 | 18.5 | 21.6 | 24.7 | 27.8 | 30.9 | 37.0 | 49.4 | 61.7 | 74.1 |
| 22' | 3.4 | 5.1 | 6.8 | 10.2 | 13.6 | 17.0 | 20.4 | 23.8 | 27.2 | 30.6 | 34.0 | 40.7 | 54.3 | 67.9 | 81.5 |
| 24' | 3.7 | 5.6 | 7.4 | 11.1 | 14.8 | 18.5 | 22.2 | 25.9 | 29.6 | 33.3 | 37.0 | 44.4 | 59.3 | 74.1 | 88.9 |
| 25' | 3.9 | 5.8 | 7.7 | 11.6 | 15.4 | 19.3 | 23.1 | 27.0 | 30.9 | 34.8 | 38.6 | 46.3 | 61.7 | 77.2 | 92.6 |
| 26' | 4.0 | 6.0 | 8.0 | 12.0 | 16.0 | 20.1 | 24.1 | 28.1 | 32.1 | 36.1 | 40.1 | 48.1 | 64.2 | 80.2 | 96.3 |
| 28' | 4.3 | 6.5 | 8.6 | 13.0 | 17.3 | 21.6 | 26.0 | 30.2 | 34.6 | 38.9 | 43.2 | 51.9 | 69.1 | 86.4 | 103.7 |
| 30' | 4.6 | 6.9 | 9.3 | 13.9 | 18.6 | 23.1 | 27.8 | 32.4 | 37.0 | 41.7 | 46.3 | 55.6 | 74.1 | 92.6 | 111.1 |

Table 14: CUBIC YARDS OF MATERIAL REQUIRED PER FOOT FOR A TYPICAL CULVERT INSTALLATION



| Depth of Cut to Flow Line (In Feet) | D: t: | 12" 2" | 15" 2 1/4" | 18" 2 1/2" | 24" 3" | 30" 3 1/2" | 36" 4" | 42" 4 1/2" | 48" 5" |
|-------------------------------------|-------|--------|------------|------------|--------|------------|--------|------------|--------|
| 2' | | 0.19 | 0.16 | 0.12 | - | - | - | - | - |
| 3' | | 0.32 | 0.29 | 0.25 | 0.23 | 0.18 | - | - | - |
| 4' | | 0.45 | 0.42 | 0.38 | 0.38 | 0.36 | 0.32 | 0.26 | - |
| 5' | | 0.59 | 0.56 | 0.52 | 0.54 | 0.54 | 0.53 | 0.49 | 0.42 |
| 6' | | 0.62 | 0.69 | 0.65 | 0.69 | 0.72 | 0.74 | 0.73 | 0.68 |
| 7' | | 0.85 | 0.82 | 0.78 | 0.85 | 0.90 | 0.95 | 0.96 | 0.94 |
| 8' | | 0.99 | 0.96 | 0.92 | 1.00 | 1.09 | 1.16 | 1.19 | 1.20 |
| 9' | | 1.12 | 1.09 | 1.05 | 1.16 | 1.27 | 1.36 | 1.43 | |
| 10' | | 1.25 | 1.22 | 1.18 | 1.31 | 1.45 | 1.57 | 1.66 | |
| 11' | | 1.39 | 1.36 | 1.32 | 1.47 | 1.63 | 1.78 | 1.90 | 1.98 |
| 12' | | 1.52 | 1.49 | 1.45 | 1.62 | 1.81 | 1.98 | 2.13 | 2.24 |

Table 15: NUMBER OF BOARD FEET PER LINEAL FOOT FOR VARIOUS SIZES OF LUMBER

| Width In Inches | Thickness In Inches | | | | | | | | | |
|--------------------|---------------------|------|------|------|------|-------|-------|-------|-------|-------|
| | 2 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 12 | 14 |
| 4" | 0.67 | 1.33 | - | - | - | - | - | - | - | - |
| 5" | 0.83 | 1.67 | - | - | - | - | - | - | - | - |
| 6" | 1.00 | 2.00 | - | 3.00 | - | - | - | - | - | - |
| 8" | 1.33 | 2.67 | - | 4.00 | - | 5.33 | - | - | - | - |
| 10" | 1.67 | 3.33 | 4.17 | 5.00 | - | 6.67 | - | 8.33 | - | - |
| 12" | 2.00 | 4.00 | 5.00 | 6.00 | - | 8.00 | 9.00 | - | 12.00 | - |
| 13" | - | - | - | - | - | - | - | - | - | 15.17 |
| 14" | 2.33 | 4.67 | 5.83 | 7.00 | 8.17 | 9.33 | - | - | 14.00 | 16.33 |
| 16" | - | 5.33 | - | - | - | 10.67 | - | - | 16.00 | - |
| 18" | - | - | - | - | - | 12.00 | 13.50 | - | 18.00 | - |
| 20" | - | - | - | - | - | 13.33 | - | 16.67 | 20.00 | - |
| 24" | - | - | - | - | - | 16.00 | - | - | 24.00 | - |

PART THREE: CONVERSION FACTORS

Table 16: CONVERSIONS FACTORS – LENGTH MEASUREMENTS

| <u>To Convert</u> | <u>To</u> | <u>Multiply By</u> |
|--------------------------|------------------|---------------------------|
| Inches | Feet | 0.08 |
| Inches | Yards | 0.03 |
| Feet | Inches | 12. |
| Feet | Yards | 0.33 |
| Feet | Rods | 0.06 |
| Yards | Inches | 36. |
| Yards | Feet | 3. |
| Yards | Rods | 0.18 |
| Rods | Inches | 198. |
| Rods | Feet | 16.50 |
| Rods | Yards | 5.50 |
| Miles | Feet | 5,280. |
| Miles | Yards | 1,760. |
| Miles | Rods | 320. |

Table 17: CONVERSIONS FACTORS – AREA MEASUREMENTS

| <u>To Convert</u> | <u>To</u> | <u>Multiply By</u> |
|--------------------------|------------------|---------------------------|
| Square Inches | Square Feet | 0.007 |
| Square Feet | Square Inches | 144. |
| Square Feet | Square Yards | 0.11 |
| Square Yards | Square Inches | 1,296. |
| Square Yards | Square Feet | 9. |
| Square Yards | Square Rods | 0.03 |
| Square Rods | Square Feet | 272.25 |
| Square Rods | Square Yards | 30.25 |
| Acres | Square Feet | 43,560. |
| Acres | Square Yards | 4,840. |
| Acres | Square Rods | 160. |

Table 18: CONVERSIONS FACTORS – VOLUME MEASUREMENTS

| <u>To Convert</u> | <u>To</u> | <u>Multiply By</u> |
|-------------------|--------------|--------------------|
| Cubic Feet | Cubic Inches | 1,728. |
| Cubic Feet | Cubic Yards | 0.04 |
| Cubic Feet | Gallons | 7.48 |
| Cubic Yards | Cubic Feet | 27. |
| Cubic Yards | Gallons | 202. |
| Quarts | Pints | 2. |
| Quarts | Gallons | 0.25 |
| Gallons | Pints | 8. |
| Gallons | Quarts | 4. |
| Gallons | Cubic Feet | 0.13 |

Table 19: CONVERSIONS FACTORS – WEIGHTS AND OTHER MEASUREMENTS

| <u>To Convert</u> | <u>To</u> | <u>Multiply By</u> |
|-------------------|-------------|--------------------|
| Ounces | Pounds | 0.06 |
| Pounds | Ounces | 16. |
| Tons (short) | Pounds | 2000. |
| Tons (long) | Pounds | 2240. |
| Miles/Hour | Feet/Minute | 88. |
| Miles/Hour | Feet/Second | 1.47 |
| Meters | Inches | 39.37 |
| Meters | Feet | 3.28 |
| Meters | Yards | 1.09 |
| Meters | Rods | 0.20 |
| Ounces | Pounds | 0.06 |
| Pounds | Ounces | 16. |

Table 20: CONVERSIONS FACTORS – COMMON FRACTIONS TO DECIMAL NUMBERS

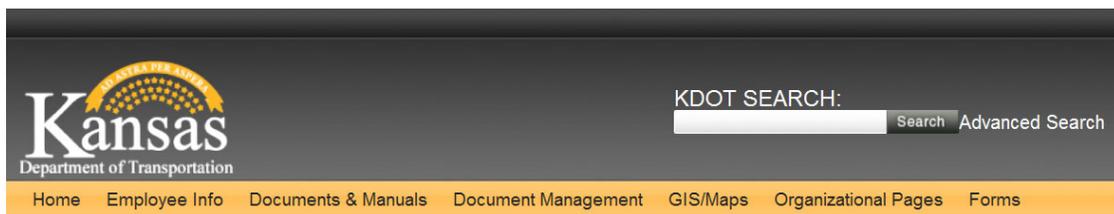
| Fraction | Decimal Equivalent | Fraction | Decimal Equivalent | Fraction | Decimal Equivalent | Fraction | Decimal Equivalent |
|---------------|--------------------|----------------|--------------------|-----------------|--------------------|-----------------|--------------------|
| $\frac{1}{2}$ | .5 | $\frac{1}{7}$ | .14 | $\frac{4}{10}$ | .4 | $\frac{11}{12}$ | .92 |
| $\frac{1}{3}$ | .33 | $\frac{2}{7}$ | .29 | $\frac{5}{10}$ | .5 | $\frac{1}{16}$ | .06 |
| $\frac{2}{3}$ | .67 | $\frac{3}{7}$ | .43 | $\frac{6}{10}$ | .6 | $\frac{2}{16}$ | .13 |
| $\frac{1}{4}$ | .25 | $\frac{4}{7}$ | .57 | $\frac{7}{10}$ | .7 | $\frac{3}{16}$ | .19 |
| $\frac{1}{2}$ | .5 | $\frac{5}{7}$ | .71 | $\frac{8}{10}$ | .8 | $\frac{4}{16}$ | .25 |
| $\frac{3}{4}$ | .75 | $\frac{6}{7}$ | .86 | $\frac{9}{10}$ | .9 | $\frac{5}{16}$ | .31 |
| $\frac{1}{5}$ | .2 | $\frac{1}{8}$ | .13 | $\frac{1}{12}$ | .08 | $\frac{6}{16}$ | .38 |
| $\frac{2}{5}$ | .4 | $\frac{2}{8}$ | .25 | $\frac{1}{12}$ | .17 | $\frac{7}{16}$ | .44 |
| $\frac{3}{5}$ | .6 | $\frac{3}{8}$ | .38 | $\frac{3}{12}$ | .25 | $\frac{8}{16}$ | .5 |
| $\frac{4}{5}$ | .8 | $\frac{4}{8}$ | .5 | $\frac{4}{12}$ | .33 | $\frac{9}{16}$ | .56 |
| $\frac{1}{6}$ | .17 | $\frac{5}{8}$ | .63 | $\frac{5}{12}$ | .42 | $\frac{10}{16}$ | .63 |
| $\frac{2}{6}$ | .33 | $\frac{6}{8}$ | .75 | $\frac{6}{12}$ | .5 | $\frac{11}{16}$ | .69 |
| $\frac{3}{6}$ | .5 | $\frac{7}{8}$ | .88 | $\frac{7}{12}$ | .58 | $\frac{12}{16}$ | .75 |
| $\frac{4}{6}$ | .67 | $\frac{1}{10}$ | .1 | $\frac{8}{12}$ | .67 | $\frac{13}{16}$ | .81 |
| $\frac{5}{6}$ | .83 | $\frac{2}{10}$ | .2 | $\frac{9}{12}$ | .75 | $\frac{14}{16}$ | .88 |
| | | $\frac{3}{10}$ | .3 | $\frac{10}{12}$ | .83 | $\frac{15}{16}$ | .94 |

PART FOUR: STANDARD PLANS

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Standard Plans may be obtained by USING the following page on KDOT Web by selecting Organizational Pages, Engineering & Design, Road Design, and KART. Plans are printed on full size 11” x 17” paper.



Bureau of Road Design - Informational Links

[Divison Home](#) [Coordinating](#) [Road](#) [Pavement](#) [Documents](#)

Road Section Links

BUREAU OF DESIGN MANUALS

[KDOT GUIDELINES & POLICIES](#)

[ROAD MEMORANDUMS](#)

[MEMOS & SQUAD LEADERS](#)

[MEETING MINUTES](#)

[RAINFALL INTENSITY TABLES](#)

[KART \(Standard Drawings, RCB Form, Etc.\)](#)



PART FIVE: DOT FORMS

Forms referenced in the Highway Maintenance Manual are contained in the following two lists. Most forms can be accessed using the Forms Warehouse facility found on the KDOT intranet site. The second list of Forms is available through normal office procurement.

1. Forms Warehouse listing in numerical order

| | |
|------------------------|---|
| DOT 0026/1101A/1612 K2 | Accident Injury Property Damage Loss Workers Comp |
| DOT 0067 | EO Senior Participation Request |
| DOT 0090 | Mechanic Participation Request |
| DOT 0093 | EM Senior Participation Request |
| DOT 0244-A | Facilities Maintenance Work Order |
| DOT 0302 | Weekly Surveillance Report |
| DOT 0303 | Area Weekly Report |
| DOT 0304 | Highway Permit-Use of Right of Way |
| DOT 0304-A | Highway Permit Completion/Revocation Notice |
| DOT 0304S | Use of Right-Of-Way for Vegetation Management |
| DOT 0304VM | Application Permit for Vegetation Management |
| DOT 0309 | Highway Permit for Highway Access (Workflow) |
| DOT 0309C | Highway Access Permit Completion/Revocation Notice |
| DOT 0310 | Highway Permit-Attach to Bridges |
| DOT 0313 | Notice to Abate Encroachment |
| DOT 0317 | Harvesting Hay on Highway Right-Of-Way |
| DOT 0319 | Highway Condition/Maintenance Request Log |
| DOT 0322 | County Agreement to Treat Noxious Weeds |
| DOT 0329 | City Connecting Link Maint. Agreement- 8 routes |
| DOT 0330 | Maint. Agreement-For Access Control City Connect Link 8 Ln. |
| DOT 0332 | Railroad Crossing Repair Order |
| DOT 0344 | Agreement for Highway Maint. Construction Easement |
| DOT 0348 | Equipment Evaluation |
| DOT 0350 | Request for Service and Repairs |
| DOT 0351 | Service Check Worksheet |
| DOT 0353-1 | Equipment Receipt |
| DOT 0355 | Building Inspection Check List |
| DOT 0360 | Radio Repair Order |
| DOT 0361 | Condition of Railroad Crossings-New |
| DOT 0363 | Equipment Preventative Maintenance Check |
| DOT 0383 | Radio Inventory Add/Update |
| DOT 0384 | Capital Inventory Add/Update |
| DOT 0402M | Project Request Form |
| DOT 0455 | KDOT Requisition |
| DOT 0827 | Application for Highway Access |
| DOT 1210A & B | Adopt-A-Highway Application & Agreement |
| DOT 1210C & D | Adopt-A-Highway Release & Consent Form |
| DOT 1210G | Adopt-A-Highway Renewal |

2. Printed Forms available through office procurement

| | |
|---------|--------------------------------------|
| DOT 306 | Individual Daily Report |
| DOT 314 | Service Manual |
| DOT 319 | Highway Condition/Maintenance Report |
| DOT 341 | Equipment Lease Form |
| DOT 354 | Equipment Inspection |
| DOT 359 | Equipment Service and Repair Order |
| DOT 362 | Estimate of Repair for Vehicles |

HIGHWAY MAINTENANCE MANUAL

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(BY CHAPTER SECTION NUMBER)

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