

GUIDELINES FOR RAISING MANHOLE AND INLET HEADS

AND

THE USE OF EXTENSION RINGS AND FRAMES

by

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ABSTRACT

This report presents an analysis of the problems involved in raising the heads of manholes and inlets on resurfacing projects and outlines suggested remedial measures.

The recommended solutions address the method currently used in resetting heads, as well as more recently developed technology involving use of epoxy-bonded cast iron extension rings.

Application of the guidelines presented herein entails an evaluation of the condition of the existing manhole/inlet hardware and use of an empirical procedure for calculating the required "rise" of the head. The latter procedure should be particularly useful on resurfacing projects with abbreviated plans (i.e., those with no profile or grade sheets)

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1.0 INTRODUCTION

raising of manhole and inlet frames in preparation for an asphalt concrete overlay has been a standard highway practice for the last fifty years

seemingly simple operation is usually time-consuming, costly, and disruptive of traffic flow. In some of our urban areas, the number of manhole and inlet castings (heads)* which must be raised prior to resurfacing can exceed 120 units per mile. Depending on the number of units on a particular project, the contractor may begin raising of the heads from four to six weeks before the paving operation, thereby creating a continuing source of annoyance to the motorist as well as a possibly hazardous condition in the travelled way

As a result of a recent Department Study, titled "Second Generation Overlays", an improved procedure for raising manhole and inlet heads has been developed. This improved practice is based on the use of epoxy-bonded cast iron extension units. (A note on terminology The extension unit used to raise manholes is referred to as an "extension ring"; the comparable unit for inlets is an "extension frame"

2.0 SPECIFIC AIM

The objective of this report is to present guidelines for design engineers covering all facets of raising heads. The major topics discussed include the traditional practice for resetting existing manhole and inlet frames, the technique employing extension rings and frames, and a temporary ramping procedure necessary to produce a safe ride.

* "Heads" is the common expression for head castings consisting of cast iron frames, grates and covers used in constructing manholes and inlets.

3.0 BACKGROUND

Past experience with extension rings breaking loose and manhole covers popping out caused the Department to prohibit their use for any application other than raising inlets in shoulder areas.

The successful application of the newly designed extension units and the technique employed was demonstrated in the investigation "Second Generation Overlays" performed by the Division of Research & Demonstration

During this investigation the common cause for most of the problems associated with manholes was wear

4.0 EVALUATION OF EXISTING HARDWARE

Highways are often repaved or rehabilitate with no more than cursory attention being paid to the highway hardware. If a manhole or inlet is tilted or collapsing, more often than not, it will be raised using the same hardware

Manholes located in the travelled way are subjected to spalling (from snow plows) and wear (Photo 1 Sanitary sewer manholes can be subjected to both of the foregoing as well as deterioration by a corrosive atmosphere (photo 2)

4.1 Wear of Manhole Frames and Covers

Manhole wear can lead to popping out of covers [a devastating safety hazard] and a rough riding pavement.

The wear of manhole castings--both the frame and cover, is due to movement under traffic. The degree of wear is dependent mainly on two things: (1 the amount and type of traffic and, (2) the location in the travelled way

Wear is exacerbated by the sand and dirt that enters the space at the peripheral interface between the cover and frame. Under the action of

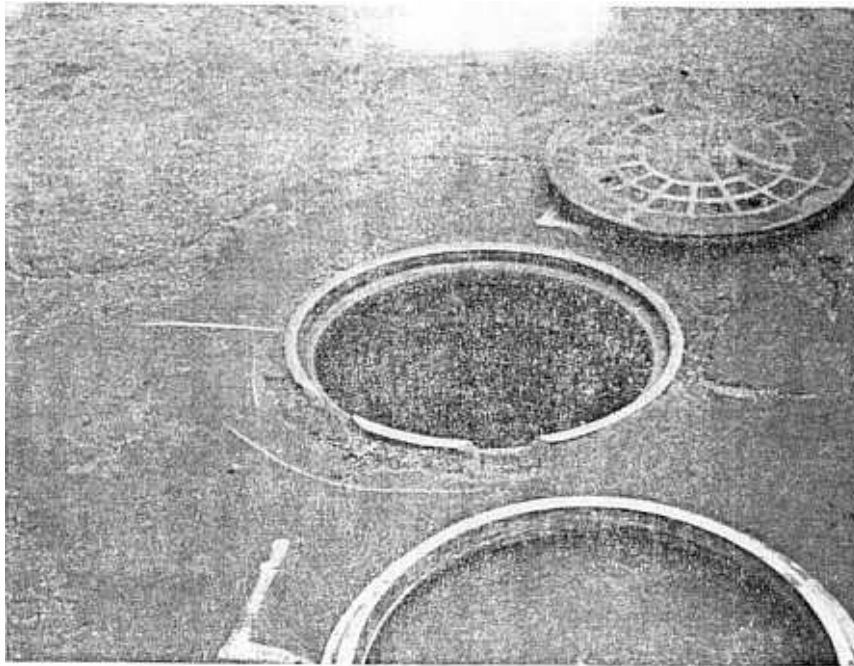


PHOTO 1
SPALLED MANHOLE FRAME

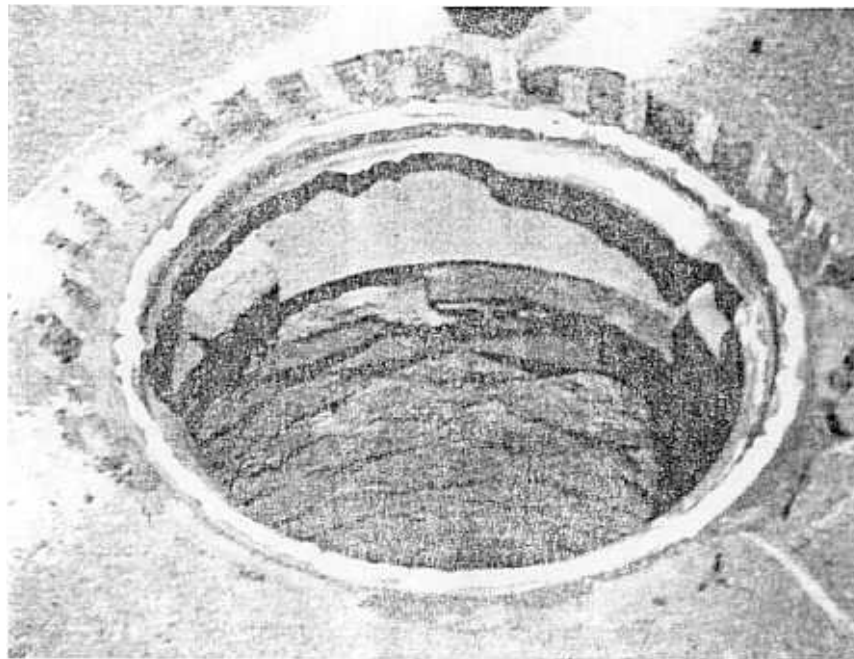


PHOTO 2:
CORRODED SANITARY SEWER MANHOL FRAME

traffic, these abrasive materials can wear both the bottom of the cover and seat of the frame

4.2 Types of Wear

Three types of wear may occur; uniform, generalized non-uniform and localized non-uniform wear.

4.2.1 Uniform Wear

Uniform wear occurs when the cover moves in a circular motion rotating as much as 360° in one to three months (Photos 3 & 4) This type of motion causes the cover to drop below the top of the frame and surface of the roadway (photos 5 & 6).

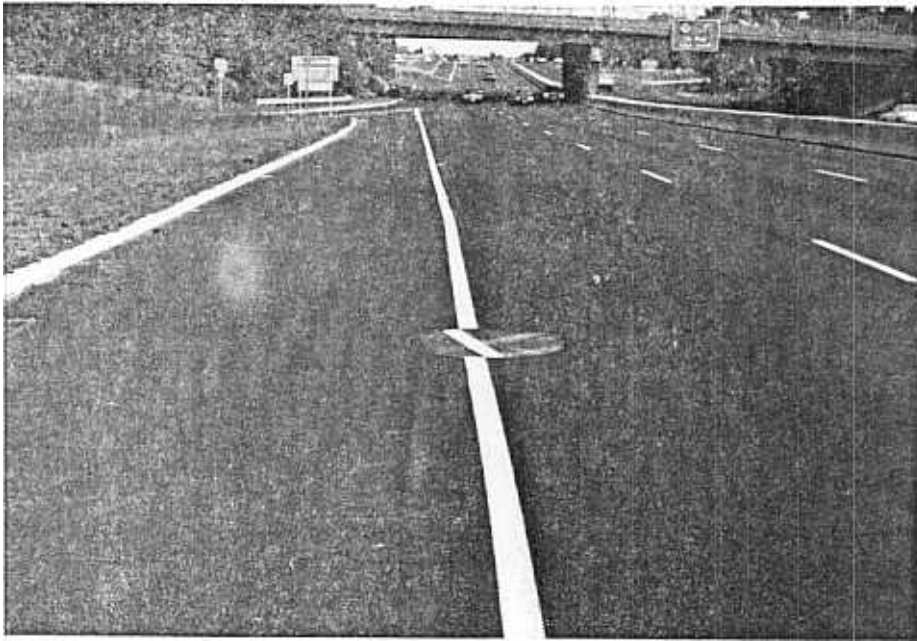
4.2.2 Generalized Non-Uniform Wear

In some cases the cover moves in a to and fro motion with minimal rotation. This causes both the cover and seat of the frame to establish a mating concave-convex configuration, usually tapering to the leave edge of the manhole (photos 7 & 8)

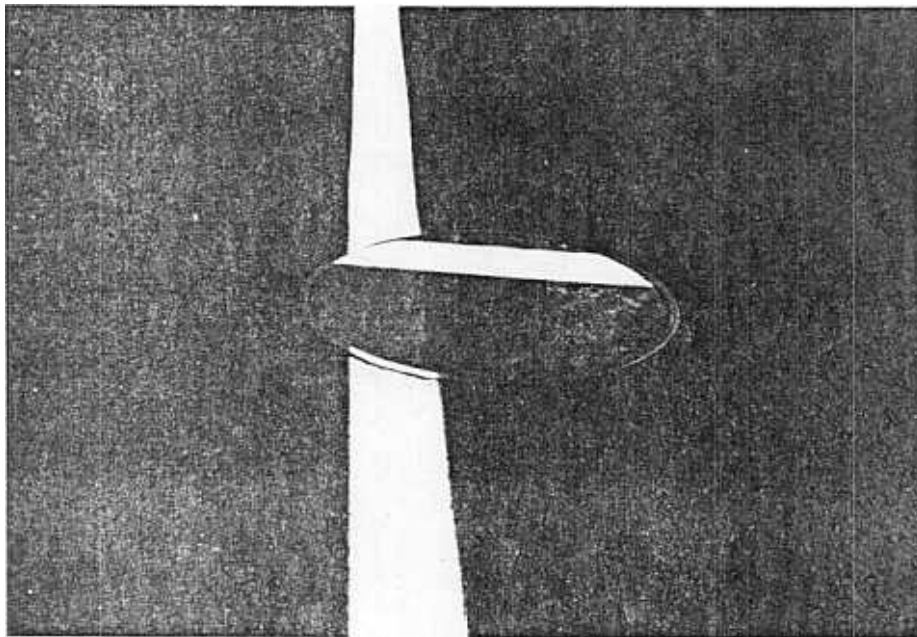
4.2.3 Localized Non-Uniform Wear

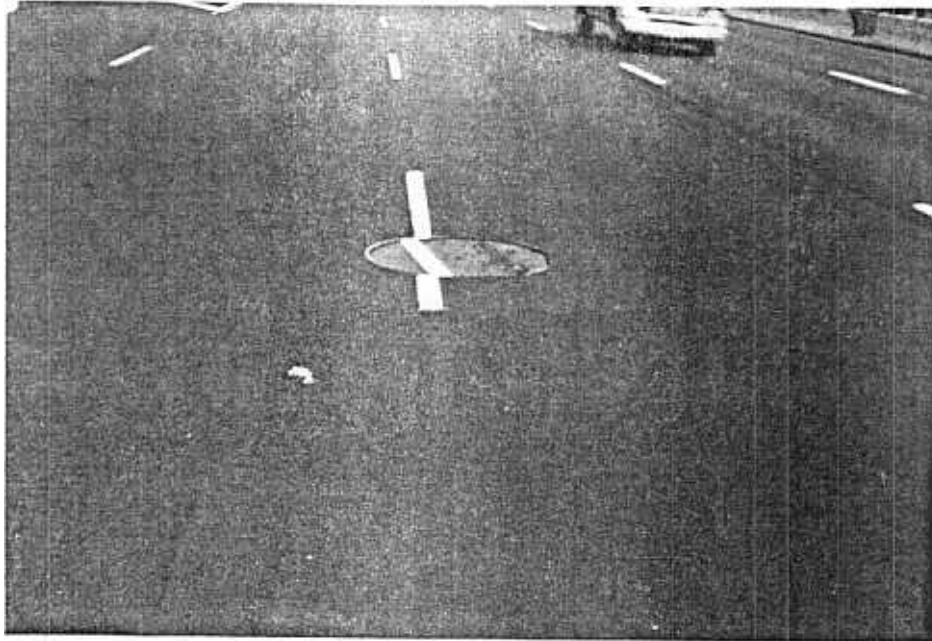
Localized non-uniform wear also occurs when the cover moves in a to and fro motion with no rotation. In this case however, the wear is fairly uniform across the seat except the area under the pick holes of the cover. Here the seat maintains its original height as the rest of the seat is worn away. The result is a 3/16" to 1/4" high, 1" long plateau with rounded edges. (see photos 9 & 10)

If the proper corrective action is not taken, continued wear of the frames and cover will create a variety of safety problems and effect the rideability as well



PHOTOS 3 & 4
ROTATING COVERS





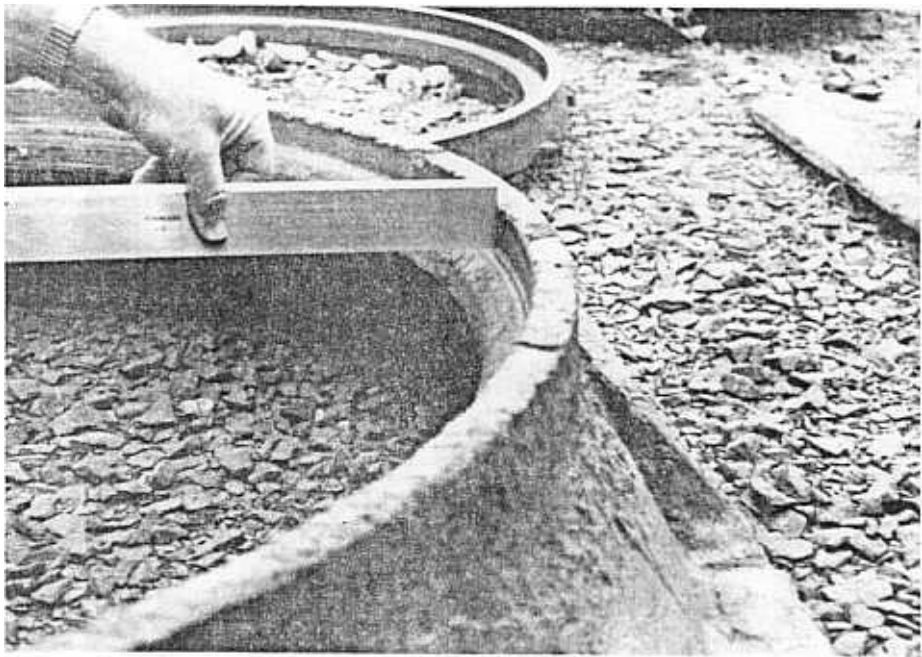
PHOTOS 5 & 6 (UNIFORM WEAR)
COVER DEPRESSED DUE TO WEAR OF COVER SEAT





PHOTO 7 & 8

GENERALIZED NON-UNIFORM WEAR OF MANHOLE FRAME



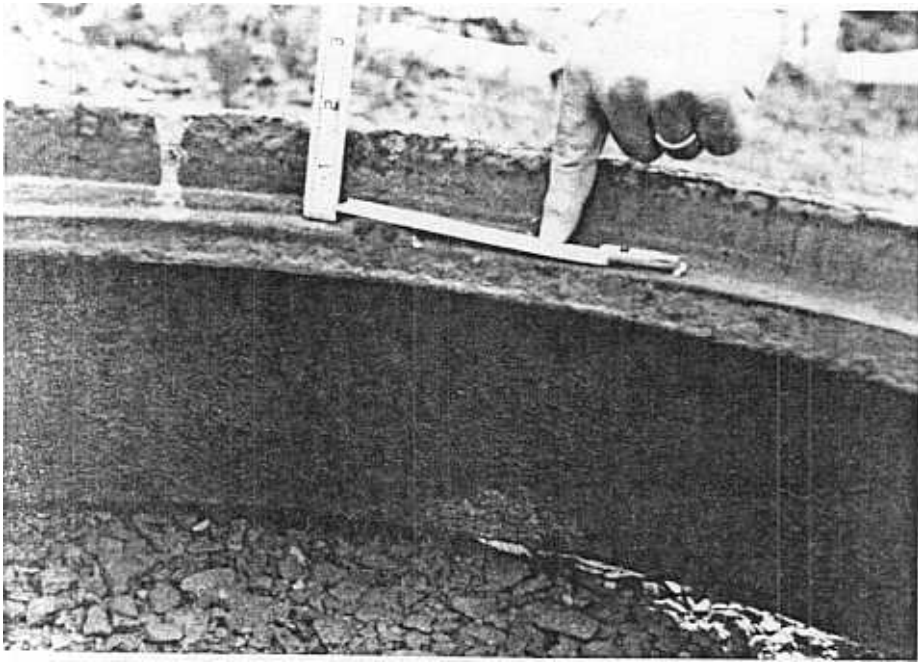
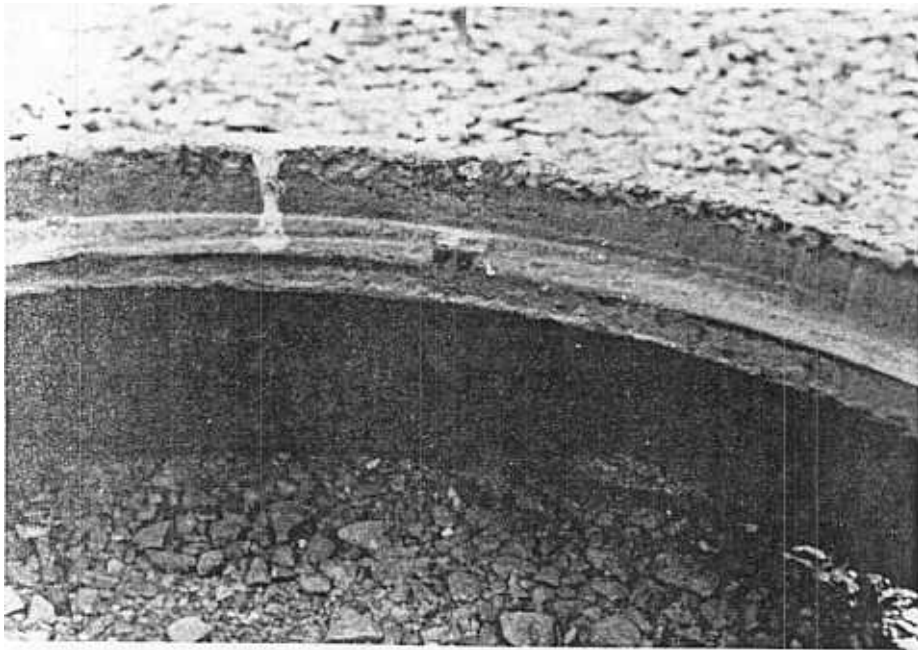


PHOTO 9 & 10
LOCALIZED NON-UNIFORM WEAR



4.3 Effects of Wear

Uniform wear of the frame and cover will effect the riding quality of the pavement as the cover progressively moves down. As continues, the interface of the cover and frame will round, with the possibility of the cover sliding out or the seat collaping under the impact of traffic.

If a frame and cover wear non-uniformly and the cover is removed and then replaced indiscriminantly on the manhole frame, the cover becomes an ideal candidate for being flipped out by a vehicle riding over it. The way to eliminate this problem is to mark the frame and cover with a lumber crayon (keel) to insure its exact replacement. Note: marking procedure should be followed anytime a cover is disturbed since the type of wear wouldn't be apparent until the cover is removed.

4.4 Corrective Action for worn frames and covers

When a manhole is to be raised using the traditional resetting procedures and the existing hardware is excessively worn or in other-wise poor condition, a new frame and cover should be used. While such new hardware can be expensive, when one considers safety and poor rideability consequences of using worn hardware, of a new frame and cover is obviously the prudent course of action. As outlined below, one of the advantages of the extension technique is that it is relatively more "forgiving" of wear and corrosion of the existing hardware. If the choice is made to raise the head using traditional procedures, field forces must make judgmental evaluations of the condition of the existing hardware and the effects of that wear upon the subsequent performance of the raised manhole. While this would require a case-by-case evaluation,

general guideline is that if wear causes the cover to be depressed more than 1/4" below the top of the frame, this degree of wear should be considered excessive and a new frame and cover should be specified

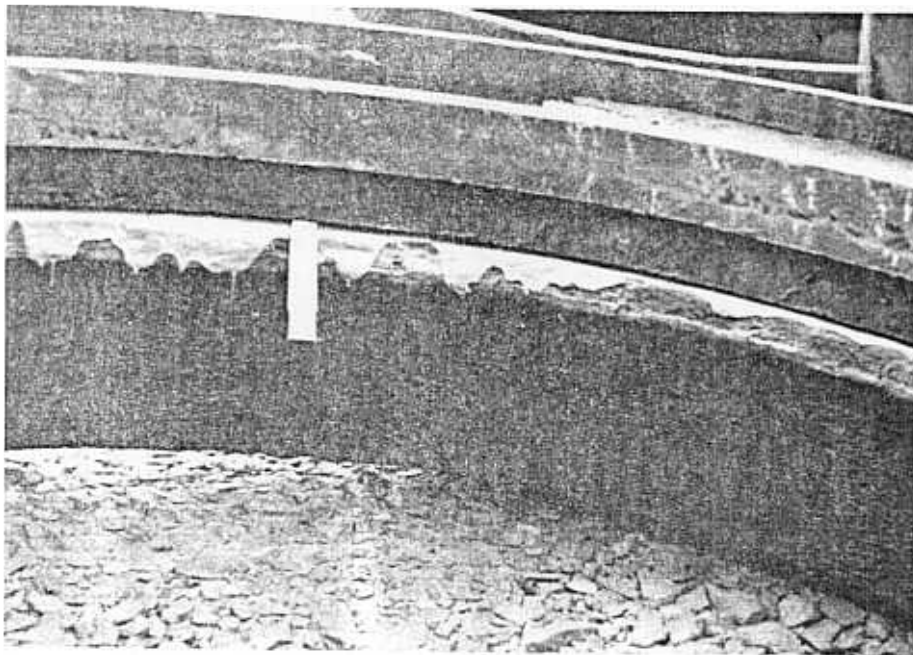
4.5 Effect of wear on the use of extension rings

Extension rings can be used on spalled frames with good seats or on frames with a good top and badly corroded seat. An extension essentially renews the condition of the frame and saves the cost of excavating and replacing the frame.

When an extension ring is placed on a manhole frame which exhibits uniform wear or generalized non-uniform wear as described in 4

4.2.2, there may be little or no bearing of the lower surface of the extension ring on the seat of the manhole frame and no bedding or bonding of the epoxy as shown in photo 11. An epoxy which does not have the ability to leave a bead and make contact with both of the surfaces suffers a loss of approximately 40% of the intended bonding power. This problem is resolved through the use of a non-sag, rapid setting epoxy gel.

In placing an extension ring on a casting exhibiting localized non-uniform wear as described in 4.2.3, the projection of the non-worn part of the seat in the vicinity of the pick holes also prevents the proper bedding and bonding of the extension ring. This unworn segment of the seat can in certain cases (such as wear at the top of the old manhole frame) cause rocking of the ring and cover and failure by cracking of the extension ring (photo 12). This cracking may occur as follows: as vehicles strike the approach side, the ring is pressed down striking the seat; milliseconds later, the ring is violently depressed on the trailing side with a resounding impact. Repeated impacts can cause failure of the cast iron ring. The way to alleviate



PHO POOR INSTALI ION PRACTICES;
CONTAC ENSION RING EPOXY

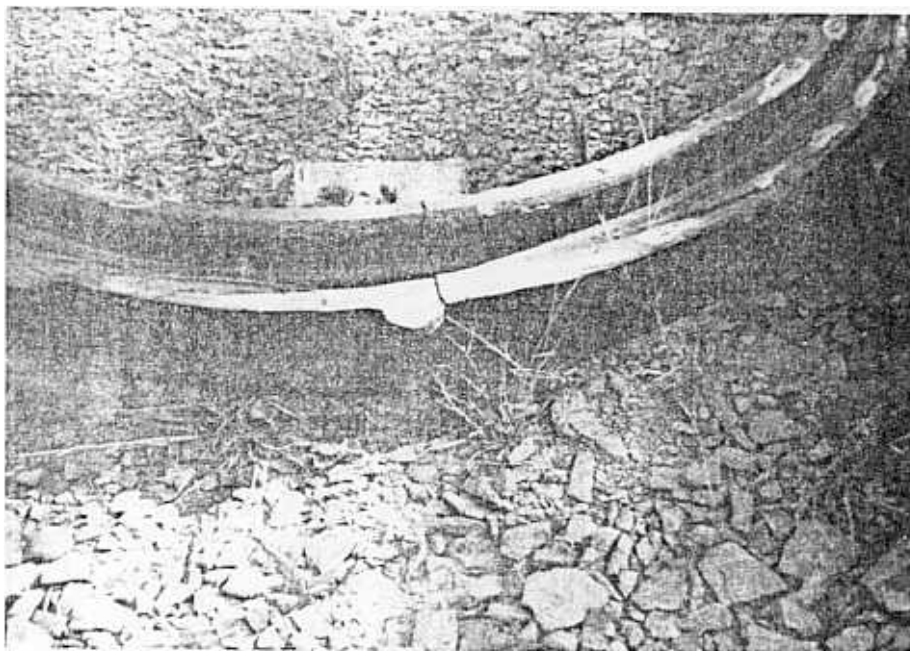


PHOTO
RACKING EXTEP RING DUE UNEVEN SEA ING

this situation is to grind off this small plateau and place the normal amount of epoxy on the top of the frame and a heavier amount on the seat of the existing casting.

4.6 Preparation of Castings for Application of Epoxy

In order to assure proper bonding of the extension unit to the casting by the epoxy, the surfaces must be clean and free of any rust encrustation. [Sanitary sewer hardware is usually the oldest in the field and the hardest to clean due to deterioration by the corrosive sewer gas atmosphere.

The best method to prepare the surfaces would be by sandblasting. Brushing with a wire wheel in an electric or pneumatically driven drill has given satisfactory results. As a word of caution: A wire wheel after an hour or so of use has the tendency to bend the wire away from the direction of rotation. This bending of the wire tends to burnish the rust rather than remove it. The useful life of the wire wheel can be extended by alternately reversing the wire wheel on its mandrel.

Hand brushing is a slow, tedious, process when done properly and is not adequate for the cleaning of all castings. Accordingly, use of a hand wire brush is not to be permitted.

5.0 OTHER FACTORS FOR THE SUCCESSFUL APPLICATION OF EXTENSION UNITS

The use of epoxy bonded extension rings and frames for raising heads is a fairly new technology. Most contractors and inspectors are seeing this application for the first time. The degree of success will be dependent on several things:

- 1 A clear knowledge of what is expected
- 2 The integrity of the contractor's workers in doing what is expected.

3. The diligence of the state inspector in seeing what is expected is carried out
- 4 Selection of the proper size and height of the extension ring or frame.
5. The physical condition of the units to be raised

6.0 PROBLEMS ASSOCIATED WITH RESETTING

The major problems associated with resetting heads are failure to bring them to the proper elevation and the use of faulty existing hardware. Heads set at the improper elevation result in excessive feathering. Faulty hardware results in depressed covers.

6.1 Feathering

Feathering of the bituminous mat is commonly used as a method of matching the elevation of a manhole. This is especially true where a thin cosmetic overlay has been applied without the benefit of raising the head.

Excess feathering around manholes and inlets can cause poor rideability, segregation of the mix due to over-raking and premature failure of the pavement due to stripping (photo 13, & 14)

In some cases, even less care is taken around inlets. Some grates have been observed to be 2 to 3 1/2 inches below the surrounding pavement (see photo 15 & 16). This creates a hazardous condition as well as a litter trap.

Normally, manhole frames are reset to the thickness of the proposed overlay, with no adjustment to correct for any existing feathered condition. The result is a low manhole head in the new overlay and the consequent need for additional feathering.



PHOTO 13
POOR RESET - POOR RIDEABILITY



PHOTO 14
EXCESSIVE FEATHERING AND MIX SEGREGATION

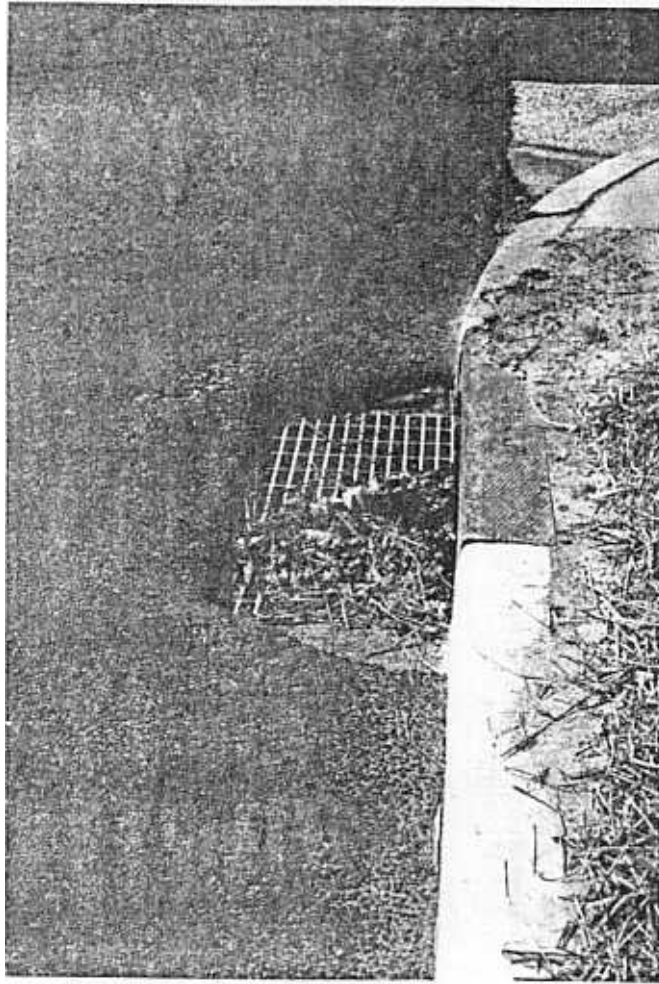


PHOTO 15
FEATHERED INLET, LITTER TRAP

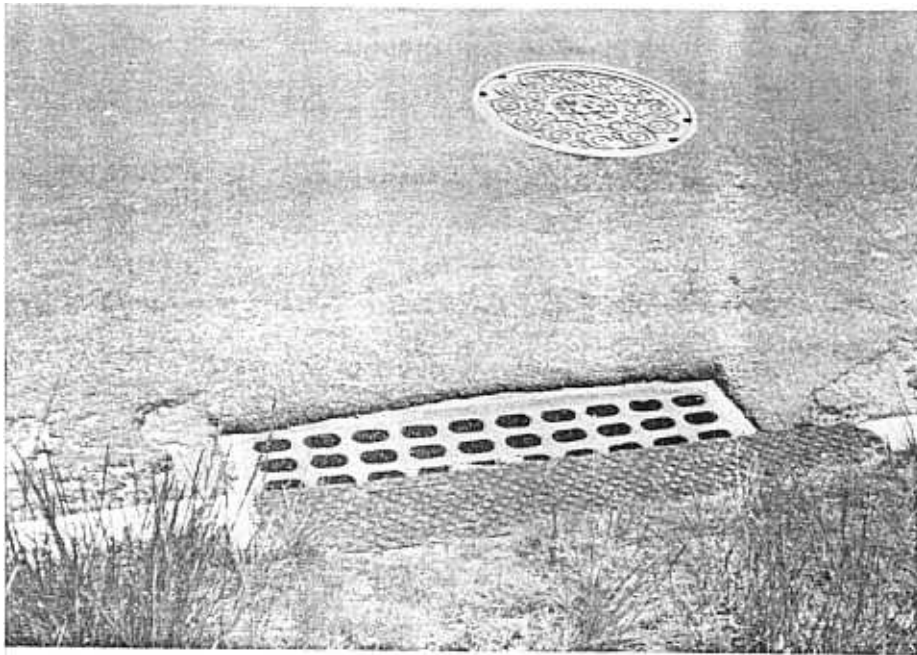


PHOTO 16
DEPRESSED INLETS

The problem of low heads requiring feathering has been exacerbated by the Department policy changing the method of payment for paving from square yards to tonnage. Payment by tonnage typically results in an overrun of material, causing a lift thickness greater than specified. This increase in thickness was verified by pavement cores taken from various projects during the 1983-84 paving season. On 1-1/2 inch and variable overlay projects, the average thickness was 1.82 inches. On nominal 3 inch (two course) surfacing projects, the average core thickness was 3.55 inches. Given these typical overruns, it is obvious that if a unit is raised only to the design thickness, feathering will be necessary.

6.2 Depressed Covers and Associated Problems

The use of worn frames and covers creates a depressed cover associated rideability and safety problems. The following example illustrates the magnitude of the problem which can occur from such a situation.

On two recent overlay projects, utility companies raised manhole frames which had been in service for decades. The covers were depressed from 1/2 to 1-3/16 of inch below the frame and surface of the roadway (Photo 17). This condition of depressed covers caused an otherwise smooth pavement to be considered a rough riding pavement by the motorist (Photo 18).

To provide a specific indication of the roughness imparted by the poor resetting practice, the pavement was tested with a "Mays Ride Meter". The Mays Ride Meter consists of an instrument package mounted in a standard passenger car which measures road smoothness in terms relative movement between the car body and the differential housing.

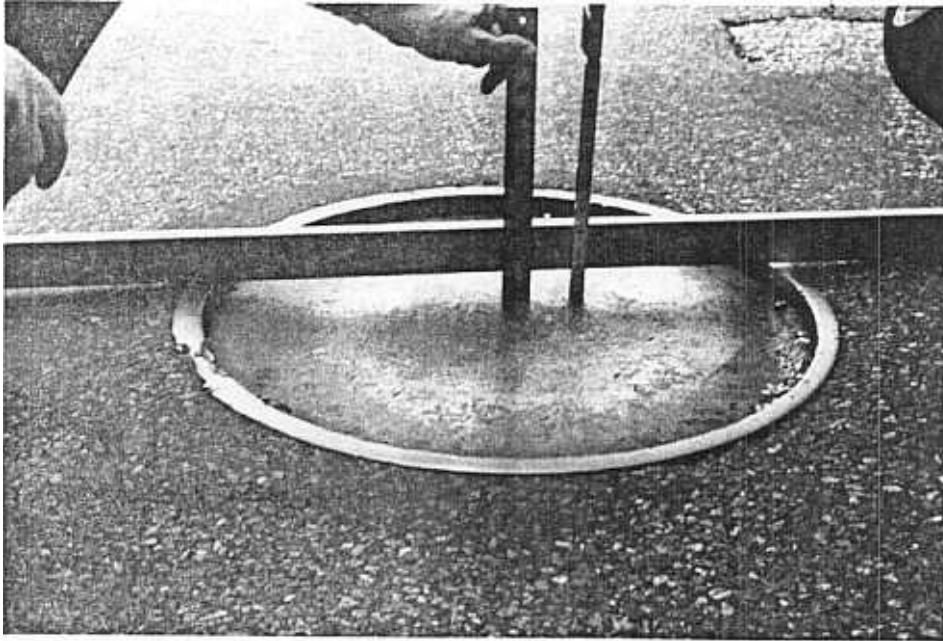


PHOTO 17
HAZARDOUSLY DEPRESSED COVER

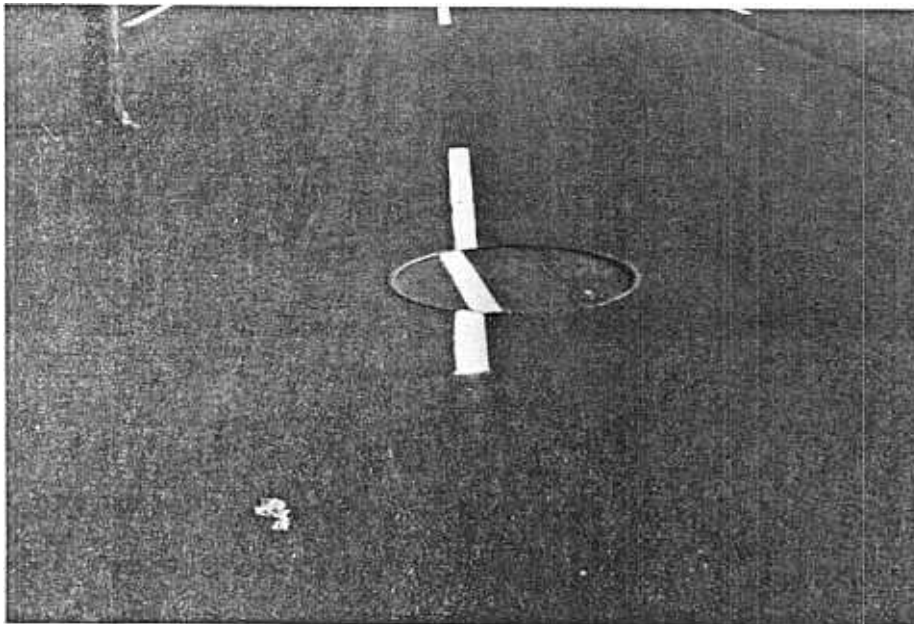


PHOTO 18
DEPRESSED COVER; POOR RIDEABILITY

The amount of travel between the differential and body of the car give a specific indication of roughness caused by a depressed manhole cover. Mays Ride Meter readings on this particular project showed

the roughness in the vicinity of the depressed manhole covers was as much as 8.5 times that of the surrounding pavement.

Besides producing a rough ride, worn covers present a safety hazard. Photo 19 shows an old frame with a badly worn cover that was reset without the benefit of a bituminous ramp about the head. This condition imparted dynamic jump to the wheels of the truck which landed on the cover, breaking it. (Photo 20). Trucks riding over worn covers in the finished surface or unramped resets during construction create a source of annoyance to residents in the form of irksome noise (Photo 21).

A dynamic jump can also result from a depressed cover, i.e., as the wheels pass over the cover, they drop down momentarily, then strike

higher manhole frame and impart dynamic jump to the vehicle. As the wheels land on the newly-placed pavement, the impact can shove the material ahead of the wheel, causing a bump to form (Photo 22). This pavement distortion not only effects the riding quality, but could also cause vehicle handling problems or problems in snow removal.

6.3 Resolution of Problems

6.3.1 Feathering

Feathering can be eliminated by paving to an engineered elevation and cross slope. Since many resurfacing projects are not fully engineered, a correction for prior feathering and expected thickness overruns often must be made.



PHOTO 19

DEPRESSED COVER ON RESET MANHOLE FRAME

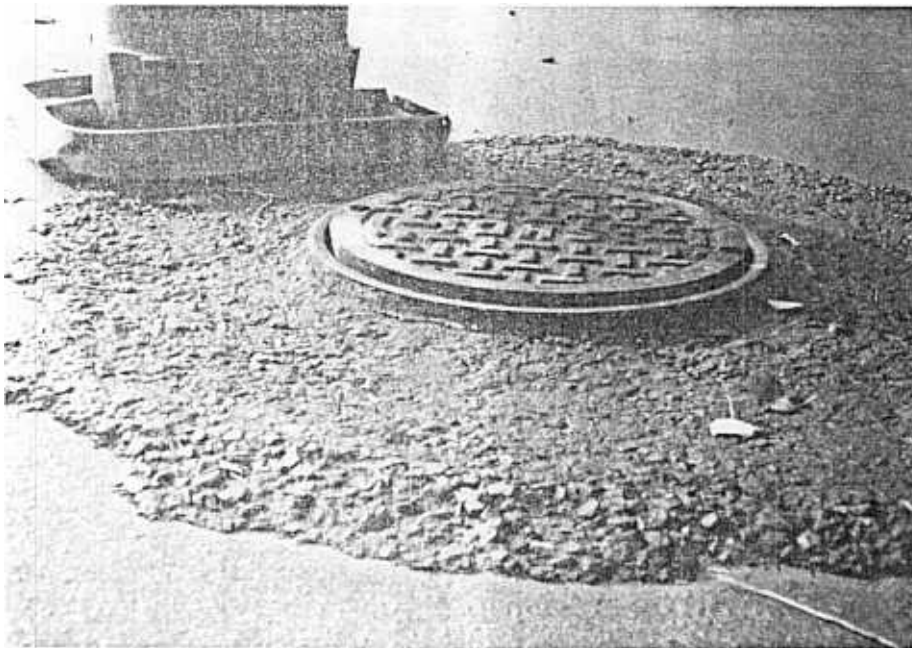
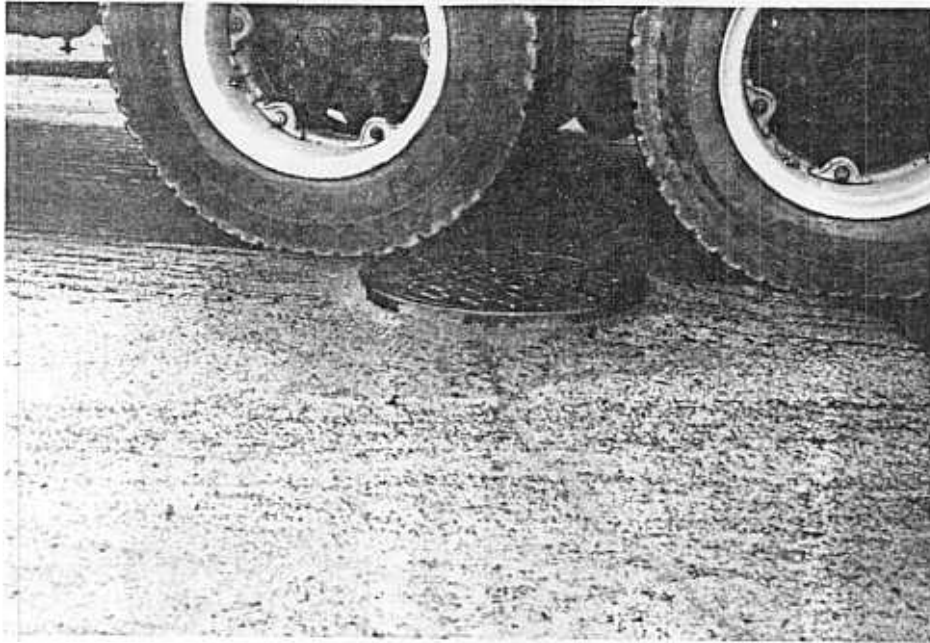


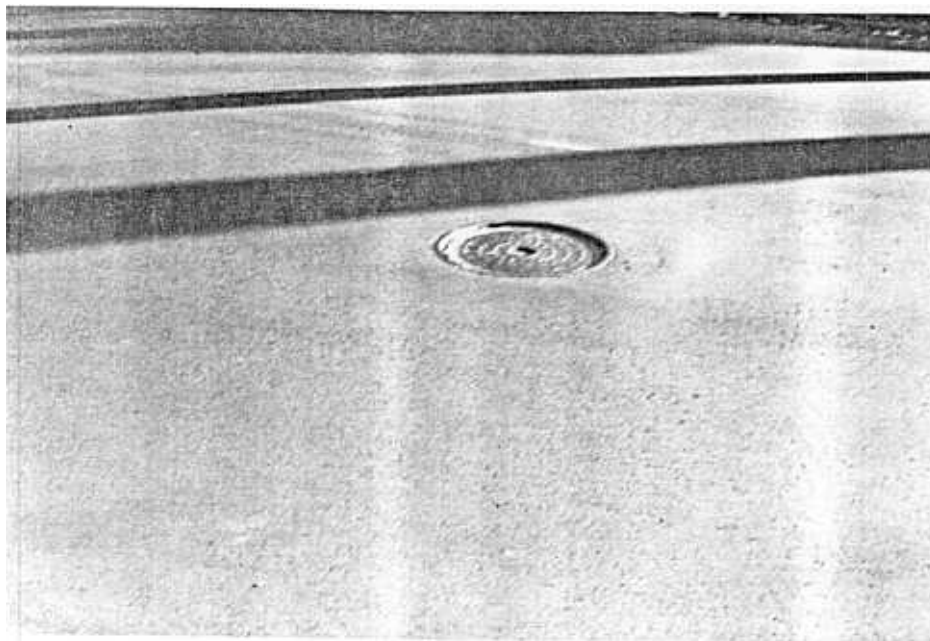
PHOTO 20

DEPRESSED RESET SANITARY HEAD - NO RAMP
COVER BROKEN BY DYNAMIC JUMP OF TRUCK



PHOTO

UNRAMPED RESET HEAD AS A SOURCE ANNOYING NOISE



PHOTO

WORN HEAD CAN CAUSE DYNAMIC JUMP AND PAVEMENT DISTORTION

This correction, when added to the specified nominal overlay thickness, will provide a satisfactory estimate of the height the head must be raised to bring it to the proper elevation.

6.3.2 Depressed Covers

As shown previously, excessive wear will result in a depressed cover. Based both a safety standpoint and smoothness of ride, if a manhole cover is more than 1/4 inch below the frame, it should not be reset; the condition will only worsen. A new frame and cover (or an extension ring and cover) should be specified.

7.0 Responsibilities of Design Engineer and the Contractor

7.1 Design Engineer

Design Engineer will be responsible for determining the general method to be used in raising the heads on a particular project: i.e., resetting or extension rings. The criteria to be employed in making that decision are outlined in Section 8 of guide. As outlined in that report subsection, the primary factor affecting the decision as to the choice of methods for raising manhole heads is the height to which the head should be raised. In particular, if the new elevation is less than 1-1/2" or more than 3-1/2", resetting will be employed. If the new elevation is in the range of 1-1/2 to 3-1/2", an extension ring will be specified.

Design Engineer or his representative will make an initial determination of whether the existing hardware is adequate; specifically whether a new manhole cover is required. The designer will make a "windshield" survey of a proposed project if a particular cover appears to be more than 1/4" below the frame, a replacement cover will be specified (see Section 6.3.2).

Whether such new cover will be used in conjunction with a new frame (i.e., resetting), or with an extension ring, will be dependent on the height to which the head should be raised, (i.e., the "rise") as computed in Section 8.1

7.2 Contractor

The contractor of course bears the ultimate responsibility for insuring that heads are brought to the proper elevation

On fully engineered projects (i.e., those with profiles and cross slopes), determination of the elevation of the heads should not be a particular problem since the amount the head should be raised can be easily calculated. On projects with abbreviated plans, --those with no profile or cross section sheets-- the contractor must take into account the present elevation and cross slope of the manhole/inlet hardware.

To assist the contractor in calculating the proper rise for a resetting or extension ring, the procedure outlined in Section 8.1 is offered as a guide. This empirical procedure -- which takes into account existing "feathering" around the manhole frame and expected thickness overruns, as well as the nominal overlay thickness -- should be of particular use on those projects with abbreviated plans.

Regardless of the procedure used for raising the heads, it is essential that the contractor inspect the existing manhole masonry and frames to determine whether the unit must be reconstructed or if a cracked frame should be replaced, etc. When proposed overlay work contemplates a change from the existing cross slope and an extension ring is specified, the

contractor should order a ring with the necessary slope change built in.

In urban areas a variety of manhole frame cover designs and sizes may be encountered. The contractor will be responsible for measuring the existing units and ordering all the proper size rings, frames, and/or covers. When a manhole is other than a standard Department of Transportation unit and a new cover is required, such cover will be replaced in kind, i.e., if the manhole has a solid (vented) cover, it will be replaced with a solid (vented) cover.

8.0 CALCULATING THE RISE

1) In calculating the rise of a head to the new elevation, a correction for prior feathering must be made. This will be accomplished by placing a minimum eight-foot straightedge across the pavement spanning the manhole and measuring the distance to the top of the frame.

2) A correction must also be made for the expected thickness overruns. This overrun correction factor will be

1/4 inch for 1-1/2 and 2 inch resurfacing projects

3/8 inch for 3 inch resurfacing projects

Cumulatively, the height or rise a particular head must be raised to bring it to the proper elevation will be calculated as: the distance from the straightedge to the frame plus the specified overlay thickness plus the expected overrun thickness equal the rise. Succinctly it would be

Distance from	Specified Overlay	Expected Thickness	
	+	+	= Rise
Straightedge to Frame	Thickness	overrun	

9.0 Criteria for Selecting the Method of Raising Heads

9.1 General

decision as to whether a particular head will be raised using traditional resetting procedures or, alternatively, through use of an extension frame, requires analysis of a number of variables. These include

- 1) The height to which the head is to be raised.
- 2) The maximum height of the casting above the roadway surface when open to traffic
- 3) The prevailing traffic speed and volume.
- 4) The location of the head (e.g., traveled way versus shoulder)
- 5 Expected interference with traffic flow.
6. The condition of the head to be raised
7. The relative cost of raising a head (e.g., resetting in concrete pavement are generally more expensive)

well: The foregoing factors are to be analyzed in light of the that out of concern for motorists safety and comfort, the Department has adopted the policy that not more than 1-1/2 inches of a head may protrude above the roadway surface for more than 48 hours on mainline pavements. On low speed, low volume roads, residential streets, or in the shoulders of state highways, the 48 hour limit on the 1-1/2 inch rise may be extended at the discretion of the engineer While some case-by-case analyses of the above listed seven factors need to be made, the general rule will be that if the rise of head is in the range of 1-1/2 to 3-1/2", an extension unit will be specified. If the rise to the new elevation is less than 1-1/2" or more than 3-1/2", the head will be reset.

The raising of heads in advance of the paving operation disrupts and/or slows the flow of traffic. The degree of disruption will be

dependent primarily on the number of units to be raised and the size of the work force engaged in this operation. Normally, the work commences after the heavy flow of morning traffic and ceases before the heavy flow of evening traffic, producing a shortened work day. A reset in a concrete pavement is much more labor intensive than a reset in a bituminous pavement section. This typically results in the resetting of 2 to 3 units per day in concrete and 4 to 5 units per day in bituminous pavement. In contrast, 14 to 18 extension units can be placed in a day regardless of the type of pavement.

9.1.1 Resets

In keeping with Department policy, new elevations exceeding 3 1/2 inches will be reset according to the following procedure. On multi-course resurfacing projects, the base and/or binder course will be placed before a manhole frame is raised. This increases the degree of accuracy in bringing the manhole to the proper grade and cross slope and leaves no more than 1-1/2 inches of casting exposed to traffic; thus providing a greater measure of safety and comfort to the motorist. With only 1-1/2 inches exposed the roadway can be safely opened to traffic.

In opening the roadway to traffic, a word of caution must be noted. The use of ordinary mortar used in laying the brickwork on rebuilt or reset manholes can result in bond failure due to impact loading. Therefore, a fast setting, non-shrink mortar developing a one hour compression strength of 2500 psi should be specified.

On some multi-course resurfacing projects, a contractor may for the sake of expediency elect to stack two rings rather than reset the manhole frame. This has been successfully demonstrated in

the field and is permissible. It may be more economical as well. By way of comparison, on a 4 to 6 inch resurfacing, a manhole would have to be covered over with the first two courses and then reset prior to placement of the surface course. This would require locating the head, excavating a 45 inch or greater diameter circle 12 to 14 inches deep, resetting the head brickwork, fill the excavation with hot mix and tamping, provide a ramp around the exposed portion of the head. If it was a manhole head that required replacement there would be the additional cost of a new frame and cover.

With the placement of two rings, the worse case scenario would be one ramp with no excavation. If the plans call for a change in cross slope; a ring with the proper cross slope can be ordered. It should be noted that 1-3/4 inches is the minimum thickness for a ring with a built in cross slope.

9.1.2 Extension Rings (Manholes)

Except in unusual cases, on single or two course resurfacing projects not exceeding 3-1/2 inches on mainline pavement, an extension ring will be used to raise heads in line with departmental policy.

When installing the extension ring, any rise above 1-1/2 inches must be paved over and reset before the surface course is placed unless the binder course is placed before opening to traffic. It should be noted that minimum thickness for a manhole extension ring is 1-1/2 inches. Any height adjustments in the range of 1-1/2 to 2-1/4 inches will require a new 1 inch cover. Since the standard cover is 2 inches thick, any salvageable cover in good

condition can only be used in an extension ring 2-1/2 inches or more in height

9.1.3 Extension Frames (Inlets)

The minimum height of an inlet extension frame is 1-3/4 inches. A great many inquiries have been made by consultants and design engineers as to how a 1-3/4 inch extension frame can be used with an 1-1/2 inch overlay. Experience has dictated that most inlets are already dished or depressed and it is not uncommon to use a 2, 2-1/2 or 3 inch extension frame to match the elevation of a new 1-1/2" overlay.

When used on combination inlets, extension frames present no problem with blocking off the curb opening on 8, 10, and 12 inch curb pieces. On a 6 inch curb piece, the opening would be virtually blocked off. This, however, presents no problem since hydraulic tests have shown the curb opening has little effect on the hydraulic capacity of a combination inlet except when in a sump condition or on an extremely flat grade with a severe cross slope.

The savings of not having to remove and replace the curb and raise the head could be substantial, especially when in a barrier curb.

By virtue of a recent statute (Chapter 283 of the Laws of 1983), the utility companies will be reimbursed for all relocations needed to accommodate any project administered through the Department of Transportation. Accordingly these utility companies will be required to conform to Department Standards (e.g., with respect to resetting heads)

9.2 FLOW CHART FOR DECISION MAKING ON RAISING HEADS

The flow chart presented as Figure 1 was developed to aid the engineer (NJ DOT, consultant or contractor) select the method for raising heads in several types of overlays:

- 1) A fully engineered design project paving to a planned profile and cross slope
- 2) A project where no profile or cross slope is given and a uniform design thickness (3 inches) is being placed, subject to the profile as picked up by a ski grade follower

A modification of this would be a determined thickness (i.e. 1-1/2 inches and variable) with a given cross slope

- 3) An abbreviated plans project with little or no engineering, where no profile or cross slope is given (i.e., match existing cross slope) and the Departments thickness provisions do not apply.

In the latter case, the selection is straightforward--an extension ring and new 1 inch cover for overlays between 1-1/2 and 2-1/4 inches. For overlays 2-1/2 to 3-1/2 inches thick an extension ring and standard 2 inch cover should be used. For inlet extension frames, the minimum rise is 2 inches with an 1-1/2 inch overlay as explained in section 9.1.3.

9.2.1 Estimated Quantities for "If and Where Directed" Items

If a survey crew is not going to be used to collect the necessary data as to the condition of all the highway hardware (state & utilities) then provision for reconstructed inlets, reconstructed manholes, new manhole castings, new manhole covers and cast iron curb pieces should be included as "if and where" directed items. The following table provides some guidance as to the number of units to included

	# of units on project	
	100	50
reconstructed inlets type	5	2
reconstructed manholes	5	2
new manhole castings	5	2
new manhole covers	5	2
cast iron curb pieces	10	5

10.0 RAMPING OF HEADS

At present, raised heads are left protruding above the old pavement (Photo 22) or at best may have a skimpy 6 to 8 inch ring of hot or cold mix material placed around the casting. This creates not only a rough ride, but can be hazardous to cyclists and pedestrians. Another problem is the noise created by an empty truck passing over a raised head. In order to alleviate these problems and encourage good public relations, Department policy dictates that the ramping around the heads will be constructed as follows

- 1) On single course (1-1/2" & variable) projects a 36 inch circular ramp of hot mix will be placed about the periphery of the manhole leaving 1/2 inch of the extension ring exposed. Leaving the 1/2 inch exposed should avoid under-compacted, shoddy appearing areas (due to feathering) when the surface course is placed. In those cases where cold mix is used for convenience by the contractor, it will be removed prior to placing the hot mix surface course.
- 2) For multi-course resurfacing projects the base and/or binder course should be placed before the head is raised. This increases the degree of accuracy in raising the head to the proposed elevation and is a way

of achieving the policy of having not more than 1-1/2 inches of exposure for more than 48 hours.

- 3 For a 3 inch resurfacing where 1-1/2 inches are to be milled off, after milling the 36 inch wide bituminous ramp will be placed as for the single course in (1). Then with the placement of the binder course, the head will than be flush with the pavement.

This is an excellent method to be use either in stage construction or at the end of a paving season. Prior to paving of the surface course the proper extension ring and method of ramping will be pursued This procedure is extremely benefical in the case of inlets where it preempts ponding and/or the associated icing conditions around inlets

- 4) For the occassional 2 inch overlays, ramps will be constructed the same as for the 1-1/2 inch course

11.0 SPECIFICATION FOR SELECTING EXTENSION UNITS AND RESETTING HEADS

11.1 Progression of Measurement for Bringing Heads to Grade

The following should be added to the standard specifications under "Methods of Construction" in the sections on the Use of Cast Iron Extension Inlets and "Reset Heads"

1. A minimum eight foot straightedge will be placed across the manhole or inlet
2. Measure down to the frame and record as A
- 3 Measure down to the cover and record measurement as D
4. Record the thickness of proposed overlay as follows:

$$\begin{array}{l} \text{Thickness of overlay } 1\text{-}1/2'' + 1/4'' = B \\ \text{" " " } 2 + 1/4 = B \\ \text{" " " } 3 + 3/8 = B \end{array}$$

5. Select which B is apropos to the proposed thickness.
6. Record rise needed from the formula $A + B = R$

The same method is used to calculate the height for a reset.

11.2 Limits of Rise for determining Method of Bringing Heads to Grade

11.2.1 Rise less than 3 -1/2 inches

- 1) If the rise (R) is less than 3-1/2 use an extension unit.
- 2) If the rise (R) is 1-1/2 or more but less than 2-1/2 use an extension ring and a 1 inch cover.
- 3) If the rise (R) is 2-1/2 or more use a standard 2 inch cover.
- 4) Inlets use a standard 1-1/4 inch grate on all extension frames.

11.2.2 Rise Greater than 3-1/2 inch

- 1) If (R) is greater than 3-1/2 inches reset the head
- 2) If the difference D-A is greater than 1/4 inch, replace the manhole frame and cover
- 3) If the frame is spalled or cracked, replace the frame and cover
- 4) Do not reset the head until the bottom course or courses has/have been placed and not more than 1-1/2 inches will be exposed for a period exceeding 48 hours before bringing the pavement to grade
- 5) The brickwork will be set with a high early strength, non-shrink mortar developing a 1 hour compressive strength of 2500 PSI at 70°F. The mortar should not contain any gypsum, iron particles or chlorides e.g., Fosroc Pike-Patch as produced by Preco Industries Ltd. Plainview, NY 11803

11.3 Instructions for Non Standard Manhole Castings

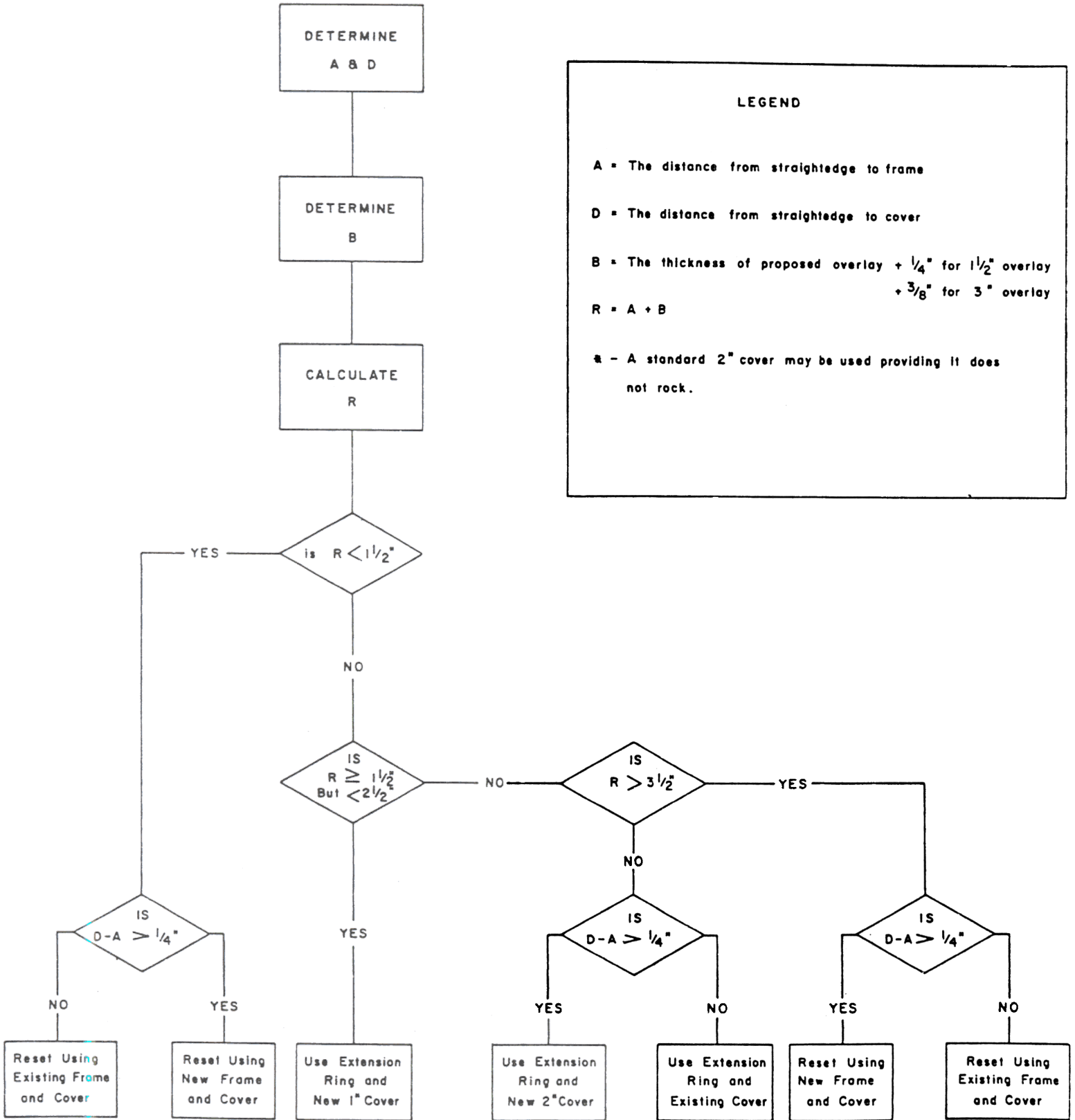
If the existing frame is not a NJDOT standard unit, the following procedure will be followed:

- 1) Mark the existing manhole frame and cover with a piece of lumber crayon (keel) to insure the exact location when the cover is repositioned
- 2) Remove the cover and measure diameter of frame in two directions, record the smaller figure.
- 3) Measure depth from top of frame to the seat in 4 quadrants, record the smallest figure

When ordering specify the following:

- a. Original casting pattern number, if available
- b. Height of Rise (R)
- c. Diameter of existing manhole
- d. Depth of seat from top of frame

MANHOLE RESET DESIGN



LEGEND

A = The distance from straightedge to frame

D = The distance from straightedge to cover

B = The thickness of proposed overlay + 1/4" for 1 1/2" overlay
+ 3/8" for 3" overlay

R = A + B

* - A standard 2" cover may be used providing it does not rock.