PROJECT DEVELOPMENT & OPERATIONS MANUAL

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MINNEHAHA COUNTY

Transportation Excellence

HIGHWAY DEPARTMENT

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PROJECT DEVELOPMENT MANUAL

OVERVIEW

This Project Development Manual has been created to serve as a reference which guides both County Highway employees and Consulting Engineers on the policies and procedures surrounding general department operations, project development and the administration of design and construction projects.

The intent of this manual is to:

- offer context that informs internal staff and the consulting community as to why and how business is conducted within the Highway Department
- provide direction and guidance
- establish a minimum level of expectation,
- be instructive and informative, and
- establish and provide standards through which consistency can be achieved.

To the extent that is practical, standardized forms have been created to be used by both County and Consulting Engineer staff in order to streamline and standardize our work products. Where appropriate, policies, procedures, engineering guidelines, recommended products, some specifications, standard forms, etc., are included.

Throughout this document, the terms "Project Manager", "Project Inspector" and "Consulting Engineer" are used frequently. The term Project Manager refers to a County engineer or technician assigned to the project. The phrase "Consulting Engineer" may refer to anyone employed by a consultant hired as our agent such as the project manager, design engineer, inspector, etc. A "Project Inspector" refers to anyone providing oversite during construction serving in this role.

This manual is not intended to provide a full suite of engineering and design standards related to transportation, traffic, structural, hydraulics and hydrology, and safety design. Common standards such as the *AASHTO* green book, *MUTCD*, and the *SDDOT Standard Specifications for Roads and Bridges* as well as other SDDOT design standards including the *Local Roads Plan*, among others, should be used during the development and preparation of projects. In no way does this manual over-ride federal, state, and/or local laws, policies, requirements, and/or rules and regulations.

Furthermore, we operate in a dynamic and ever-changing profession so some sections may be out of date. Highway staff will share such new information with our colleagues during the normal course of operations and project development. As always, any suggested enhancements are welcome.

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SECTION 1 - PROJECT DEVELOPMENT

1.1 ANNUAL BUDGET PROCESS

Each year, the Commission sets a schedule for the budgeting process. This typically begins in April and the final budget is adopted in September. By May, the Minnehaha County Highway Department should have a fairly complete preliminary plan of expenses and revenues which includes projects, engineering cost estimates, and equipment purchases. Also, staffing needs are identified and planned for.

A. Annual Revenues

There are three primary sources of revenue into the Highway Fund: Motor Vehicle Fees, State Pooled Motor Vehicle Fee, and Wheel Tax. These three sources of funds account for about 90% of the total revenues into the Highway Fund, or about $12M in 2019.

In addition, the State provides about $750,000 per year as their share of federal funds allocated to Minnehaha County through the federal Surface Transportation Program (STP). The state takes the federal allocation and keeps it for their use on federal-aid eligible routes while swapping the same amount and giving that to the Counties. In this way, the annual STP allocation to the counties is state money instead of federal funds which reduces some bureaucratic processes associated with spending federal-aid funds.

Another source of revenue (approximately $400,000 annually) into the Highway Fund is Minnehaha County's share of Port of Entry fees collected by South Dakota Motor Carrier Services. Other minor sources of revenue include: sale of County property, weed and pest grants, invested interest, metro transportation, permit fees, mobile home tax, and motor fuel tax.

Overall, total revenues in 2019 are estimated to be $13.1M.

Minnehaha County is unique in that we are the only county in the state that is 100% funded by the Highway Fund. The Highway Fund receives no subsidy from other county revenues streams such as property tax (general fund).

B. Annual Expenses

There are three expenditure departments used by the Highway Department:

- Highway Administration
- Highway Construction, and
- Wheel Tax Distributions.

Highway Administration and Highway Construction expenses include personnel, capital outlay, and other expenses. Contracted construction costs are included under Highway Construction.

Wheel Tax Distributions are dispersals of county-collected Wheel Tax to the Townships.

On average, about $7M is spent yearly on contracted construction projects and about 15% of that is spent on engineering services such as preliminary and final designs, and project inspection and observation.

C. Project Selection and Scoping

As stated above, project selection begins essentially after that year's construction projects are completed. The Engineering staff will update the Pavement Management System (PvMS) with that year's projects and re-run the project recommendations for the following year. Asphalt surfaces are generally forgiving in that there is about a two-year window where the recommended targeted treatment remains the same for preservation projects.

In addition to updating pavement preservation projects, there are long-term plans for reconstruction projects. Generally speaking, the Highway Department has between one and three reconstruction projects going in any given year. Some may be in the design phase while others may be in the Right-of-way acquisition phase or construction. It is our practice to conduct grading in one year and pave it the following year. In other instances, a reconstruction project may be in the preliminary engineering phase (with no commitment for the year of construction) in hopes of securing a grant in order to fund construction.

Rarely will a reconstruction project be warranted due to pavement distress (PCI score < 30) because our in-house maintenance personnel performs between 6,000 and 15,000 tons per year of asphalt patching (thin lift over-lays usually short in length).

Regarding how bridge work is planned, the bridge inspection reports form the basis of how bridge work is prioritized. It is desirable to have no posted structures on the paved County Highway System. Secondly, it is desirable to avoid having any bridge posted at less than 12 tons GVW. This represents a bridge that has been de-rated to less than one-half of its original design carrying capacity.

A third consideration in selecting bridge projects is the Sufficiency Rating combined with how much the repair would cost versus how much remaining life would be gained. As a rule of thumb, if the cost of rehabilitation exceeds 30% of its replacement cost with no less than a 20 year life extension, the bridge should probably be replaced instead of rehabilitated. Similar cost/benefit analyses should be performed as needed.

Further discussions are contained elsewhere in this document under project selection and scoping topics. In general, structural engineers should be relied on for the best advice regarding the cost/benefit of rehabilitating structures.

1.2 PAVEMENT

A. Pavement Management System

At the end of construction season each fall, Engineering staff update the Pavement Management System (PvMS) and re-run a variety of funding scenarios. Typically, about $3.1 million is allocated annually to pavement preservation projects. This number may be hard to track because of the other scopes of work such as reconstruction or in-house paving/patching (thin asphalt overlays) but, our pavement management consultant indicates that if we spend between $3.1 and $3.4 million per year on pavement preservation, our existing PCI score of 77 is sustainable with minimal to no increase in the backlog.

Internally, we believe a preferred minimum PCI score of 74 (with 69 being the lowest acceptable minimum) with less than 4% backlog is a more practical and sustainable goal while still being a very good rating that is substantially above the national average of 64 on secondary paved highways. In 2014, our PCI score was a 69. In 2020, our roads will re-sampled.

Highway project planning begins during the previous fall. As an example, we need to know which roads will receive pavement preservation in two years so they can be crack sealed in year one.

i. PCI Score (Pavement Condition Index)

Roads are surveyed by a pavement management consultant every three years. The analysis methodologies and data collection technologies are based on the latest version of *ASTM D6433 Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys* (hereinafter ASTM D6433) for assessment of pavement surface distresses and the International Roughness Index (IRI) for quantification of pavement roughness on all County streets.

These measurements of pavement quality are combined to form an overall 0 to 100 Pavement Condition Index (PCI) as follows:

PCI = 33% Roughness Index + 67% Surface Distress Index

Figure 1 and Figure 2 shown below illustrate the importance of adopting a pavement preservation program and how PCI score relates to recommended pavement improvements. These two charts illustrate the cost savings over time by picking the right treatment at the right time. This approach to pavement management minimizes life-cycle costs.

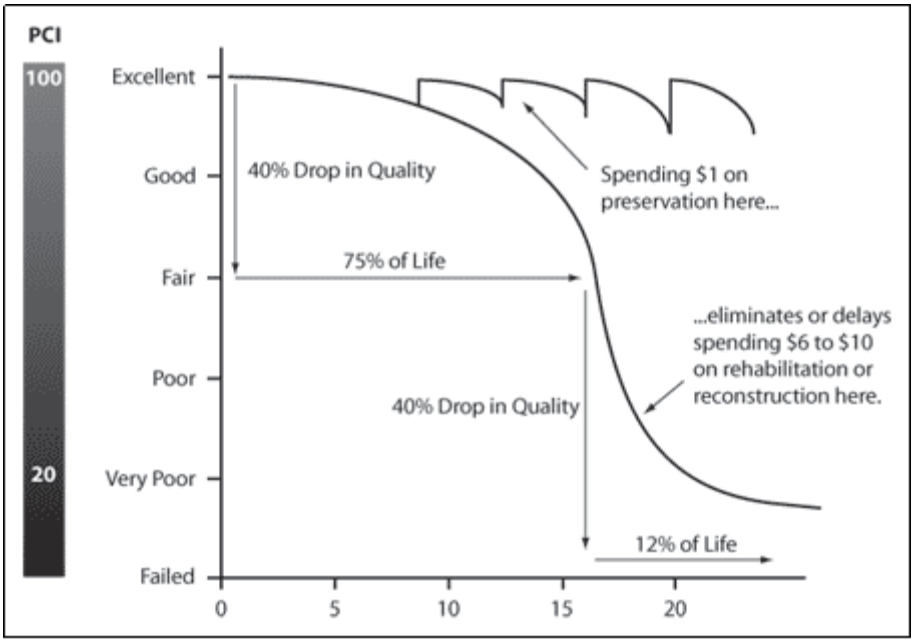


Figure 1 – Pavement Deterioration Curve and Preservation

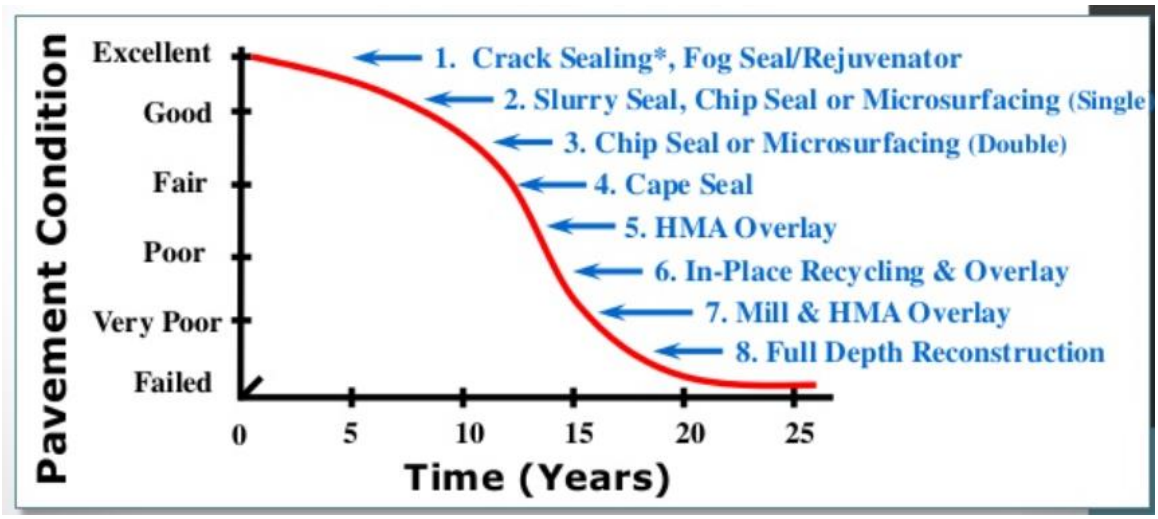


Figure 2 - Recommended Treatment vs. PCI Score

A third chart, see Figure 3 below, illustrates Minnehaha County's approach to pavement preservation in terms of idealized pavement treatment sequencing. This is the general hierarchy of treatment progression built into the PvMS. However, it should be noted that the PvMS always chooses a recommended treatment based on the Pavement Condition Index (PCI) score which may or may not follow the progression shown in Figure 3. This is why the roadways are re-sampled every three years.

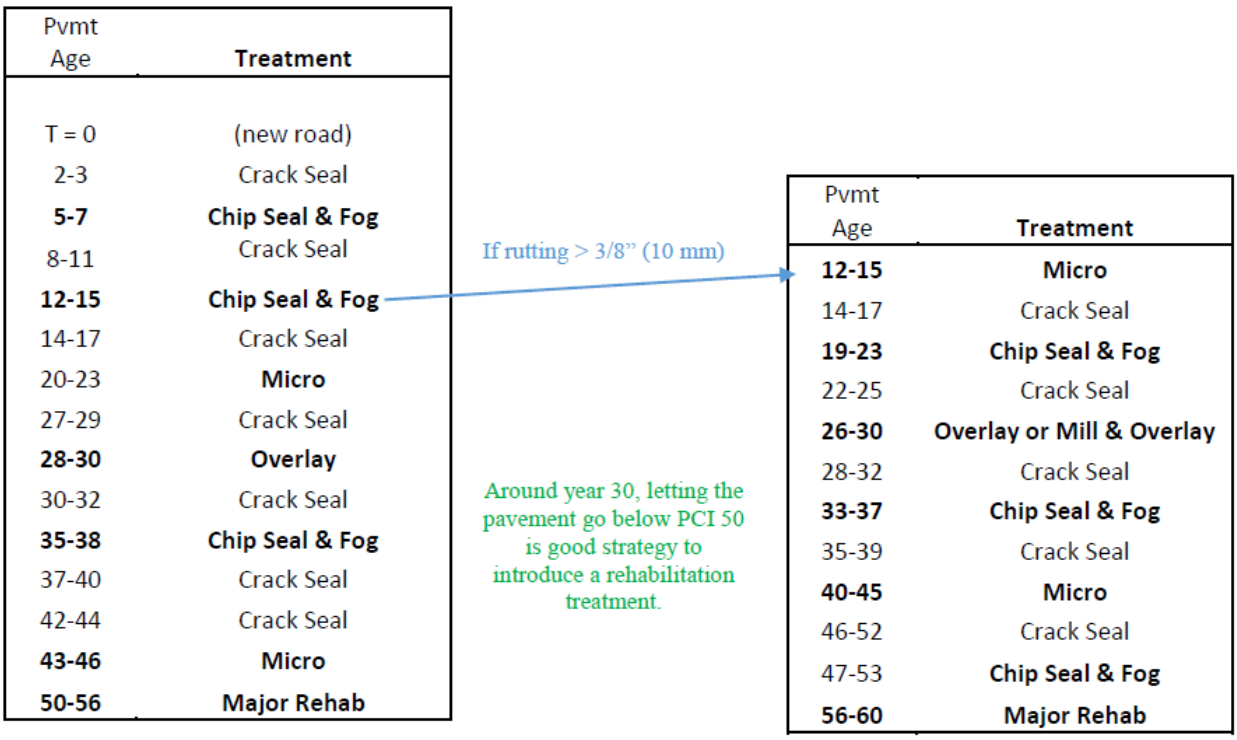


Figure 3 – Pavement Treatment Sequencing

Engineering Staff may over-ride the recommended treatments in order to ensure that project termini are logical. This is an important analysis to conduct because the recommended treatments do not always line up with logical termini. For example, on a four-mile segment, if the recommended treatment is microsurfacing on 87% of the route and a chip-seal on the remaining 13%, staff will over-ride the recommended treatment to be microsurfacing on the entire four miles. Over-time, our project selection process will create logical 3-5 mile long segments of pavements needing similar treatments which terminate at common-sense points such as the intersection of two county highways.

A few more comments about Figure 3:

- It is important to seal cracks the year prior to performing a preservation treatment. Microsurfacing is compromised if preceded by a crack seal the same year because the sealant can peel or shred and get caught up in the microsurfacing paving machine. This includes mastic; although, less trouble has been identified with mastic when applied the same year.

- A chip seal always includes a fog treatment. In the event that a chip seal occurs without crack sealing the previous year, we would follow up the chip seal with a slurry seal the following year and skip the fog.

- Microsurfacing adheres very well to a chip seal. Normal pavement marking paint does not need to be removed despite early recommendations made by ISSA.

- Mastic must be in place at least one year before an overlay can be installed; otherwise, the mastic bubbles up from the heat of the overlay.

- Note that rehabilitation is not part of the selection process until the pavement is quite aged. This is because the focus of preservation is to keep good pavements in good condition. The strategy of letting a pavement fall below a PCI score of less than 50 (when a Mill and Overlay would be the recommended treatment) should seriously be considered because the cost of cold-in-place-recycling with an engineered emulsion (a minor rehabilitation treatment) is competitive when the additional pavement life is taken into account.

> Stated another way - *The preferred basis of rehabilitation candidate selection is to examine the cost of deferral of a highway, against increased life expectancy.*

- With an ideal pavement life of over 50 years for a new road, the importance of having a strong foundation under the asphalt surfacing cannot be overstated. Therefore, it is very important to get geotechnical design recommendations on gravel thickness and sub-base treatments such as cement treated bases.

ii. PvMS Goals

Minnehaha County has approximately 347 center-line miles of 2-lane rural highways. Current network conditions and goals are:

	2020	Goals	National Averages
PCI Score	78	74	60-65
Backlog	0%	2-6%	10%
% Excellent (PCI >85)	35%	>15%	15-20%

Backlog is the percentage of roads with a PCI score of 40 or less (Poor to Very Poor). Backlog can also be thought of as those roadways that have a recommended rehabilitation/reconstruction treatment that could not afforded to be install that year.

Local jurisdictions should be contacted when any preservation work is being conducted adjacent or near their boundaries. It is common for Minnehaha County to coordinate with other local jurisdictions to include some segments of their roadways within our projects. In these cases, formal agreements with local jurisdictions are in order to recuperate costs.

B. Preservation (PCI > 50)

The category of preservation can be thought of as that range of pavement treatments up to and including a mill and overlay. Once a mill and overlay starts getting to be

more than 2 inches of treatment, it is considered to be more of a rehabilitation of the existing pavement rather than preserving it.

i. Crack Sealing ($1,500 to $8,000/mile)

Crack sealing is a method in which hot sealant is applied to working cracks to prevent water intrusion. Crack sealants are rubberized (latex modified) and have the ability to seal the crack while staying flexible with the pavement's movement. Beneficial for active cracks that continue to extend in size and severity over time, crack sealants stop water and debris from entering the crack, protecting the longevity of the pavement.

Crack Sealing can really be done anytime joints start to open up beyond 1/8 inch (3 mm) and also, anytime of year as long as the crack is dry. Crack Sealing is one the best returns on investment in the pavement management world because it keeps moisture out of the roadway structure thus minimizing the negative impacts of freeze/thaw cycles and weakening the subgrade allowing fines to be either pumped or otherwise migrate out of the highway structure creating weak spots, depressions, and eventually pot-holes and/or joint faulting.

A useful rule-of-thumb is that one pound of sealant will fill about 2.0 to 2.4 feet of crack.

On a newly reconstructed roadway, crack sealing would not be needed until approximately year 6 or 7. Crack Sealing after an overlay should generally occur 2 to 3 years later because cracks generally migrate one inch per year (two seasons for a 2-inch overlay) and will need to be resealed.

As mentioned earlier, it is important to crack seal all roads receiving a preservation treatment the year before the preservation treatment is applied. It is also acceptable to seal cracks the year after the preservation treatment is installed, more so for microsurfacing, less so for chip sealing. Crack sealing is not part of the Pavement Management System (PvMS) so Highway Staff need to administer the crack sealing program separate from other pavement preservation efforts.

One important inspection/design item to note is that when cracks are wider than 1.5″ (38 mm), the joint should be filled with mastic and not crack sealer.

In general, Minnehaha County's practices generally align with SDDOT Standard Specification 350-Asphalt Concrete Crack Sealing and Crack Leveling procedures and pre-approved products.
At this time, Minnehaha County does not perform crack sealing using in-house forces. The Engineering staff prepares plans yearly for formal public bidding. A typical crack seal project will cover 30 to 60 miles of roadway and cost between $6,000 to $7,000 per mile (2019) on a total

cost basis which includes mobilization, traffic control, edge rumbles, pavement markings, etc.

ii. Crack Filling (Mastic - $5,000 to $30,000+ per mile)

Crack filling is the placement of asphalt emulsion into non-working cracks to reduce water infiltration and to reinforce the adjacent pavement. The application of mastic is much like crack sealing but the joints are wider and rarely is backer rod used. The application of mastic is sometimes called joint filling, joint leveling, joint repair, or crack filling or crack leveling. *Any joint or crack wider than* ***1.5″ (38 mm) should be treated with mastic.***

An asphalt overlay will bubble over a joint where new mastic has been placed. Therefore, it is very important to apply mastic the year before the overlay is applied. Cracks must be completely dry before adding mastic.

One key difference between applying mastic on a joint versus crack sealing is the tool used to deliver the product onto the crack. A shovel box or "squeegee" is filled with the product and then is drug over the crack. These shovel boxes can be customized to individual preferences and crack types but generally range between 8″ to 18″ wide and 4″ to 12″ high. Also, the bottom striking face sometimes includes a slight concave curve in the middle which accounts for a little settlement in the joint. In large depressions, there has been some success experimenting with sand as filler.

Minnehaha County prefers Mastic One by Crafco but there are other acceptable brands. Brock-White Construction Materials is a local distributor and also sells to MnDOT and the SDDOT through a state bidding process; therefore, counties are able to purchase directly off their bids. Primarily, Minnehaha County uses in-house forces to install mastic but we do include some mastic within the crack-seal project which bids annually.

iii. Chip Seals ($21,000 to $25,000 per mile) PCI = 76-88

Chip Seals (or seal coating) is the application of a special protective wearing surface to an existing pavement. A thin layer of liquid asphalt is sprayed down in front of the chip spreader.

Chip sealing has been a mainstay in preserving asphalt pavements for many years because of the many benefits which include:

- Keeping water from penetrating the road structure
- Filling and sealing cracks and raveled surfaces of old pavement
- Provides an anti-glare surface during wet weather
- Sealing the pavement surface thus minimizing the effects of aging
- Improves skid-resistance

Typically rated as being in *Good* to *Very Good* condition, a road needing a Chip Seal displays minor amounts of cracking that are localized and in good condition. The ride is smooth, the surface is non-weathered, and the base is strong. The goal is to keep the road healthy and waterproof.

It is Minnehaha County's practice to place a chip-seal one to two years after a new structural surface is installed such as an overlay, rehabilitation, or reconstruction – anywhere a fresh mat is exposed. We expect to get 7-9 years of service from a chip-seal before another treatment is needed. Cracks should be sealed the year prior and then as needed thereafter. Typically, a microsurfacing treatment follows a crack seal when the next treatment becomes due.

In general, Minnehaha County's practices generally align with SDDOT Standard Specification 360-Asphalt Surface Treatment, and material specification 881-Aggregates for Asphalt Surface Treatments, Type 2B aggregate, applied at the following rates:

Aggregate:	Type 2B @ 20 pounds per square yard
Emulsified Asphalt Binder:	CRS-2P @ 0.34 gallons per square yard
Fog Seal:	SS-1h or CSS-1h @ 0.10 gallons per square yard (1:1 dilution)

We have found that the addition of the fog seal offers several benefits: it minimizes the risk of loose rocks being picked up and flung into traffic; it adds contrast to pavement markings; and, with the new standard practice of adding rumble strips, the fog seal adds an additional measure of protection. When

applying pavement marking paint to a new chip seal, the application rate of pavement marking paint is increased 20-33%.

iv. Microsurfacing ($34,000 to $40,000 per mile) PCI = 70-82

Where pavement preservation is concerned, microsurfacing is quickly becoming a popular option due to the many benefits it offers. By simply mixing aggregate, mineral filler (cement), water, and a polymer-modified asphalt emulsion, it creates a uniquely durable result. When coated on a road surface, it can accept traffic in as little as an hour.

Similar to a chip seal, typically rated as being in *Good* to *Very Good* condition, a road that is ready for a microsurfacing treatment displays minor amounts of cracking that are localized and in good condition. The ride is smooth, the surface is non-weathered, and the base is strong. The goal is to keep the road healthy and waterproof. If a chip seal has already been placed on a road exhibiting these characteristics, the next logical treatment is microsurfacing. Also, because microsurfacing is a bit more robust than chip-sealing, it is the better application for those roadways having PCI scores in the lower 70's.

A microsurfacing treatment can be thought of as a courser version of a slurry seal. However, slurry seals usually take 24 hours to cure whereas a micro can be opened to traffic in as little as 20 minutes if conditions are right but more typically about an hour. A slurry may last 2-4 years before needing another treatment whereas 8-10 years can be expected from a microsurfacing treatment (using locally sourced quartzite). Both treatments seal the road and fill minor cracking but the microsurfacing is a more stout application.

In 2013, Minnehaha County installed their first microsurfacing treatment. We believe a microsurfacing project should last 7-10 years before needing an additional treatment as long as crack sealing is being performed as needed. As a road maintenance strategy, it is ideal for leveling a road and filling ruts.

However, microsurfacing is a poor choice if the existing cross-slope of the road is 1% or less because it does not do a very good job in re-establishing a desirable crown of 2% on the driving surface.

The traveling public perceives this treatment as an overlay because it is very smooth and black. Also, our plow drivers get more longevity out of their blades versus a freshly chip-sealed road.

For these reasons, the Minnehaha County Highway Department slightly favor microsurfacing over chip sealing. In the past we have done 10-14 miles of microsurfacing per year and want to get closer to 20 miles per year.

It is our common practice to install microsurfacing in two stages. First, a scratch course is put down using a full width spreader box at a rate of 15-23 pounds per square yard followed by a finish course of 15-20 pounds per square yard. These figures refer to the dry-weight of the aggregate. If severe rutting exists, these figures may need to be adjusted accordingly or perhaps a profile milling phase should be considered.

We have used both Type II and Type III aggregate gradations and have come to favor the Type II. The reason for this is the surface appears to seal better and there is less rock dragging on the finish screed. We also believe it seals minor cracks better.

The microsurfacing paving machines can comfortably lay 14 feet of width in one pass. To keep the bids low and production high, the maximum width of treatment is 28 feet. This avoids having to make three passes for one lift. Afterward, using either in-house crews or it can be put into the construction contract, whatever width of shoulder is left untreated receives a simple fog seal.

Adding rumble strips has introduced a little more cost to these projects and also has added another level of coordination that occurs during construction so it is best to include fog spray of shoulders in the bid. Consideration should be given to lay the first course inside the white line if rumble strips exist so then only the finish course will fill the rumbles leaving the rumbles effective before needing to be re-grooved.

When performing a microsurfacing project, specifications should clearly state that bridge decks shall not be treated with the new surfacing.

From an inspection point of view, observing the installation of microsurfacing can be a frustrating because much of the process is controlled by the computers on the paving/mixing machine. Therefore, it is very important to understand the mix design and how the material is specified in the plans and how the machine mixing

works to get to the appropriate production rate. These machines also need to be calibrated prior to beginning the project.

The SDDOT has not formalized specifications and construction requirements for microsurfacing within their *Standard Specifications for Roads and Bridges*. For a good reference to these standards and testing requirements, see *SDDOT Special Provision for Polymer-Modified Micro-surfacing*.

Because the storage and staging area needed by the contractor can be substantial, it is helpful for the contractors when bidding to include a note in the plans which describes where a staging/storage location might be available.

v. Overlays and Milling ($100,000 to $175,000 per mile) PCI = 50-70

An asphalt overlay is a paving method of applying a new layer of asphalt to a deteriorating surface. Rather than tearing up an old asphalt surface entirely, an asphalt overlay project will use the existing layers as a base for the new asphalt pavement. Consequently, the total width of the paved surface narrows over time as layers are added.

Pavement milling (cold planing, asphalt milling, or profiling) is the process of removing at least part of the surface of a paved area such as a road or bridge. Milling removes anywhere from just enough thickness to level and smooth the surface (which is considered a profile milling), to 2 inches or more. Milling can also be used to re-establish a proper cross-slope (crown) of 2%.

Typically rated as *Good* (PCI = 60-70), a roadway that is ready for a thin mill and overlay displays small amounts of distresses that can easily be removed and to restore the road. The ride quality is noticeably rougher. There are localized patches where soft spots either have been repaired or need to be repaired. Cracking is more extensive and some filled cracks continue

to move; however, load associated distresses are low thus the structural integrity is generally good.

Roads with a PCI score in the high 60's provide the greatest opportunity for extending pavement life at the lowest possible cost, thus applying the principles of the perpetual life cycle approach to pavement maintenance.

Typically rated as *Fair* (PCI = 50-60), a roadway that needs a thick mill and overlay exhibits multiple stresses and cracking patterns are present but tend to still be somewhat localized but more severe. Again, the distresses are non-load

rated with a high prominence of longitudinal and transverse cracking, and the cracks are deeper and wider, yet the underlying structure of the road has not failed. Shoulder weakness and edge break-up may be evident.

At the light end, an overlay project could consist of simply adding one inch of new hot mix (PCI score in the high 60's). Whereas a heavy mill and overlay project may consist of milling two inches and replacing with two inches of hot mix (PCI score in the low 50's). Between those two extremes, a medium overlay could be coupled with varying degrees of milling which may include smoothing the road surface, remove ruts, re-establishing a 2% cross-slope, or milling down enough to gain the width needed to install a 2 inch overlay.

Roads rated as Fair tend to receive a lower priority when developing a preservation program. This is appropriate because the cost to cure is only a few dollars less per square yard then if one were to wait 3 to 6 years and then perform a minor rehabilitation strategy - thus the cost of deferral is low.

Overlays are generally applied to add structural capacity; however, they cannot cure weaknesses in the base and sub-base. If soft spots are known to exist, they should be dug out and fixed prior to the overlay being installed. If there are specific areas where depressions are large and irregular and the road suffers from

a high degree of random and alligator cracking, these are signs that the localized supporting structure below the asphalt is weak and needs to be repaired.

Generally speaking, if more than two inches is to be milled, or the project is otherwise concerned with width, and/or the steepness of in-slopes, these items kick the project out of the "preservation" category and into "rehabilitation" because a preservation project is strictly concerned with placing the new material on and within the existing pavements.

Minnehaha County's practices generally comply with SDDOT Standard Specification, 320 - Asphalt Concrete, 880 – Aggregates, and 890 – Asphalt Binder. The following items are specific to Minnehaha County:

- Class G Asphalt
- Class G-2 (toplift) aggregate
- PG64-22 or PG58-28 binder, PG58-34 without RAP.
- Up to 20% recycled asphalt is allowed with the preference to use the more modified PG binder
- NO recycled asphalt shingles are allowed
- Tack Coat can be SS-1H or CSS-1h emulsified asphalt placed at 0.05 to 0.1 gallons per square yard
- If blotting sand is needed, place at 10 pounds per square yard
- New gravel on shoulders should be "Gravel Surfacing" and not Aggregate Base Course.

There are many variables to consider when assessing the scope of work for an overlay project. When assembling plans, the designer should consider the following:

- Vegetation on shoulders and other shoulder work
- Culvert replacements
- Need for dig outs
- Grade of in-slopes
- Need for high-tension rail
- Existing cross slope if less than 2%
- Need for base course where new asphalt is needed such as new approaches and increasing turning radii at intersections
- Milling depth, stock pile of millings for county use, or contractor owned millings
- Application rate of tack coat if milling is needed
- The prevalence of relatively new crack seal material if milling
- Existing pavement markings, especially the locations of No-Passing zones
- Turn-lanes
- Radii at intersections
- General design consideration for all approaches and asphalt quantity
- Existing or proposed rumble stripes
- Adjusting height of guardrail
- Bridge tapers and terminal tapers (transverse joints)
- Safety edge
- Need for shoulder gravel vs. topsoil and seeding

Approaches: Minnehaha County will provide a 2-foot bump out (measured longitudinally along the edge of pavement) as part of the overlay project for farm field and residential accesses. If a home or business has a hard surfaced driveway (asphalt or concrete), we will pave asphalt to the right-of-way line.

C. Rehabilitation (PCI between 30 and 50)

Rehabilitation of a roadway is needed when the pavement conditions are too dilapidated for a pavement preservation strategy to work effectively. This is generally the case when the PCI score is 50 or less. Cost estimates for each are:

- Minor Rehabiliation ($100,000 to $175,000 per mile)
- Major Rehabilitation ($160,000 to $250,000+ per mile)

Typically rated as being *Marginal* (PCI > 40) to *Poor* (PCI > 30), roadways in need of rehabilitation still have some remaining life before becoming critically

in need of reconstruction. Base failure has begun and will begin to accelerate thus spreading quickly to cover the entire width of the road.

Key distresses include transverse cracking, edge cracking, longitudinal cracking and either the presence or need of extensive patches. Ride quality will be noticeably rough in places. Rutting will be present and intermittently excessive near large cracks. The roadway's cross-section will also be inconsistent with changing degrees of high points and low points from edge to edge.

> It sometimes can be of greater value to let a pavement degrade from *marginal* to *poor* because the cost of deferral is minimal.

Roads rated as *poor* are typically selected first for rehabilitation as they provide the greatest cost/benefit – the greatest increase in life per rehabilitation dollar spent. Therefore, it sometimes can be of greater value to let a pavement degrade from *marginal* to *poor* because the cost of deferral is minimal. To understand this point further, consider the equipment required to perform a rehabilitation treatment. Milling 4 inches versus 8 inches introduces only a minimal cost increase, yet the entire

pavement structure is being treated versus leaving the oldest and weakest pavement in place.

The key difference between a Minor Rehabilitation and a Major Rehabilitation is whether or not the entire section of hard surfacing is fully removed or not. A Minor Rehabilitation will not expose the aggregate surfacing located below the pavement. A Major Rehabilitation will expose the aggregate surfacing supporting the pavement and may also include augmenting or improving the structural capacity of the aggregate surfacing without getting deep enough to expose the sub-base material. Although, in relatively small areas, digging-out weak or soft sub-base material may be required.

Choosing between a Minor or Major Rehabilitation strategy is more dependent on analyzing the strength of the existing materials in place versus a PCI score. For this, an in-depth geotechnical analysis is needed.

Also, the designer needs to consider other factors such as safety, site distance, crash-history, turn-lanes, right-of-way width, accesses, culvert and bridge capacity and remaining service life, utility relocation costs, etc., before moving forward with a pure rehabilitation strategy. If 40% or more of the corridor has sub-standard vertical curves, it may be more beneficial to defer construction until sufficient funds are available to perform a reconstruction project.

D. Reconstruction ($800,000+ per mile) PCI < 30

A full reconstruction of a highway corridor is a major undertaking which requires 2 to 3 years to design and up to two years to construct if the length exceeds three miles. In Minnehaha County, *it would be very rare that our traveling public would allow the PCI score to fall below 30* to warrant a reconstruction based purely on ride quality and pavement distresses.

Typically rated as being *very poor*, a road segment in need of reconstruction exhibits extensive base failure made evident by the severe amount of fatigue (alligator)

cracking, transverse and edge cracking, and patching. A mill and overlay of such a road would not be suitable as the base has failed and would not meet an extended service life of at least 12 to 15 years.

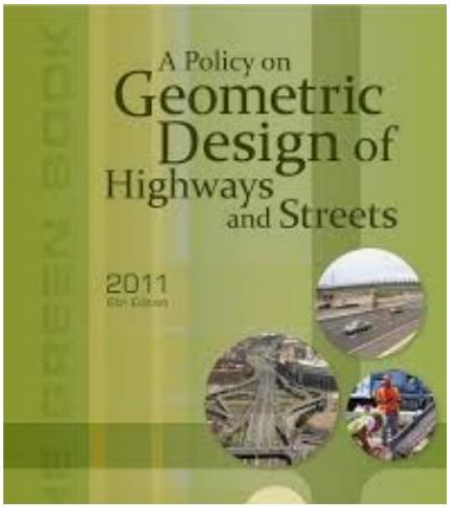
Due to the high cost of reconstruction, *very poor* streets are often deferred until full funding is available in favor of completing more streets that can be rehabilitated at lower costs.

Deferral of reconstruction of streets rated as *very poor* will not cause a substantial decrease in pavement quality as the streets have passed the opportunity for overlay-based strategies. Due to the high cost of reconstruction, *very poor* streets are often deferred until full funding is available in favor of completing more streets that can be rehabilitated at lower costs, resulting in a greater net benefit to the County. However, this strategy must be sensitive to political pressures derived from citizen complaints forcing the street to be selected earlier. In addition, this type of street can pose a safety hazard for motorists because severe potholes, flying debris, and distortions may develop.

Reconstruction of a county highway will more likely be warranted due to safety concerns such as an accident cluster or poor site distance over vertical curves. Other supporting reasons why a road may warrant to be rebuilt is when multiple characteristics fall below modern design standards. Examples of such deficiencies include: roadway width, the steepness of the in-slopes, drainage problems, and the existing width of right-of-way.

Section E below presents modern design criteria and discusses Minnehaha County's preferred practices.

E. Roadway Design Criteria



In 2011, the SDDOT's Local Transportation Programs office published a *Local Roads Plan*. This plan is to be used as a guideline for use in planning, designing, and constructing roads and bridges on the local government highway systems. The *Local Roads Plan* may be viewed as a miniature version of the SDDOT's *Road Design Manual* which is heavily influenced by the national highway standard design publication by AASHTO, *A Policy on the Geometric Design of Highways and Streets* – the most recent version of which has just been released in its 7th Edition, in 2018, hereinafter referred to as the *AASHTO Manual*.

The *Local Roads Plan* contains two separate sections with different design criteria. Beginning on page 11, criteria for Rural Roads begins. On page 27, criteria for Rural Collectors begins. This is the classification of roadways most common on our highway system. However, when we build bridge and culvert projects on township roads, the Rural Roads criteria is relevant. Sections on urban arterials are also contained within the *Local Roads Plan*.

The SDDOT is currently revising the *Local Roads Plan* which should be available in 2019. When in doubt, the designer should consult the *AASHTO Manual* for design guidance and relevant context. The designer should also consider yet a third reference, *Guidelines for Geometric Design of Very Low-Volume Local Roads – 2001*, when the AADT is less than 400. However, it appears that the new *AASHTO Manual* incorporates the aforementioned reference from 2001.

i. Design AADT

Minnehaha County gathers average annual daily traffic counts (AADT) on its entire system in a two-year cycle. On even years, staff takes traffic counts on all bridges on the east side of the county and roads on the west side. On odd years, staff takes traffic counts on all bridges on the west side of the county and roads on the east side.

For pavement preservation projects, knowing the AADT, also known as design volume, plays a small role in design because the focus is concentrated on the paved surface only. However, providing the AADT on the front page of the plans is customary and provides a sense of traffic levels to be expected during construction.

AADT plays a much larger role in the design of rehabilitation projects and is a crucial element when designing reconstruction projects. For such projects, a 20-year projected design volume should be developed. This is done by applying an annual growth factor to an existing AADT.

Typically throughout Minnehaha County, we see mild growth rates of 0.2-3% per year. Closer to urbanized areas, we see annual growth rates in traffic of 3-5%. Heavy truck use can be as high as 12 to 15% during harvest (22% at one location) on certain routes so timing of any traffic data collected needs to be identified.

An example: To determine the design volume after 20 years of growth in traffic at 2% growth per year and starting with existing AADT of 450, the calculation is:

$AADT_D = 450 \times 1.02^{20} =$ 669, which can be rounded to 670.

It should be noted that for Rural Minor and Rural Major Collectors, the *Local Roads Plan* as well as the *AASHTO Manual* (Chapter 6 – Collector Roads and Streets) often group design criteria based on AADT with the ranges of

0	to	400	(Very Low)
400	to	2000	(Low)
and	>	2000.	

Whereas under Chapter 5 – Local Roads in the *AASHTO Manual* groups design criteria based on AADT within finer ranges by comparison:

0	to	50
50	to	250
250	to	400
400	to	2,000
And	>	2,000

ii. Design Speed

The speed limit on all county highways is 55 MPH, unless otherwise specified. Speed zones other than 55 MPH must be approved by resolution to be enforceable. A listing of all county speed zones is contained in the most recent speed zone resolution, most recently adopted in November of 2018.

In general, either the 85th-percentile speed or the speed limit should be used as the design speed for analysis of in-place or current features.

In the cases of major rehabilitation and reconstruction, it is recommended to start with a design speed of 65 MPH. This way, in the event that tolerances need to be decreased due to some constraining design element, the designer can slightly back-off one or two design parameters and still achieve a serviceable highway segment that does not have to be posted at a speed of less than 55 MPH. However, in some cases, the costs to do so becomes exorbitant and creating a speed zone where less than 55 MPH is warranted and becomes the only practical option.

iii. Sight Distance

Stopping Site Distance and Passing Site Distance are a direct function of the design speed. An eye height of 3.5 feet and an object height of 2.0 feet are used to determine stopping site distance. An eye height of 3.5 feet and an object height of 3.5 feet are used to determine passing sight distance. See Tables 6.3 and 6.4 in the *AASHTO Manual* (page 6-5).

As found in the *AASHTO Manual*, At 55 MPH, the minimum design Stopping Site Distance is 495 feet and the minimum design Passing Site Distance is 900 feet. This standard applies to collector routes.

In addition, as found in AASHTO's *Geometric Design of Very Low-Volume Local Roads,* minimum design Stopping Site Distance is 365 feet when AADT is less than 250 vehicles per day, and 405 feet when AADT is between 250 and 400 vehicles per day. These standards apply to local roads only.

iv. Grades

See Table 6-2 on page 6-4 of the *AASHTO Manual* where suggested maximum grades are shown for collectors in rural areas which are a function of terrain and design speed. Note that for 55 MPH in level terrain, 6% grade is suggested as a maximum. In general, the County prefers less than 4% due to our relatively flat

topography. However, we recognize that allowances need to be made when projects occur in areas having more vertical relief.

> It has been observed that stopped or parked vehicles on very icy roads will slide on surfaces greater than 4%.

v. Alignment

The designer should provide the most favorable alignment as practical for rural collectors. Horizontal and vertical alignment should complement each other and should be considered in combination to achieve appropriate safety, capacity, and appearance for the type of improvement proposed. Topography, traffic volume and composition, and right-of-way conditions are controlling features.

Abrupt changes in horizontal alignment should be avoided. Vertical curves should meet the sight distance criteria for the design speed. For further information, see the Section 3.3 – Horizontal Alignment, and Section 3.4 – Vertical Alignment within the *AASHTO Manual*. Also see a detailed discussion about appropriate use of signs around curves later in this manual within Section 1.5.

vi. Cross-slope

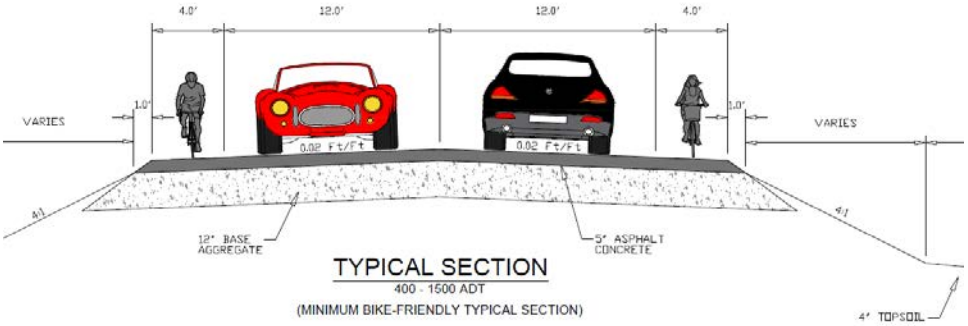
Adequate drainage of roadways is achieved by providing proper cross-slope. On paved county roadways, a cross-slope of 2% +/- 0.5% is required. When designing structures on gravel roads, the Townships are instructed to build 4% cross-slopes; therefore, we design bridge decks on township roads to have a cross-slope of 3%. For more information on cross-slope design, see Section 4.2.2 – Cross Slope in the *AASHTO Manual.*

vii. Superelevation

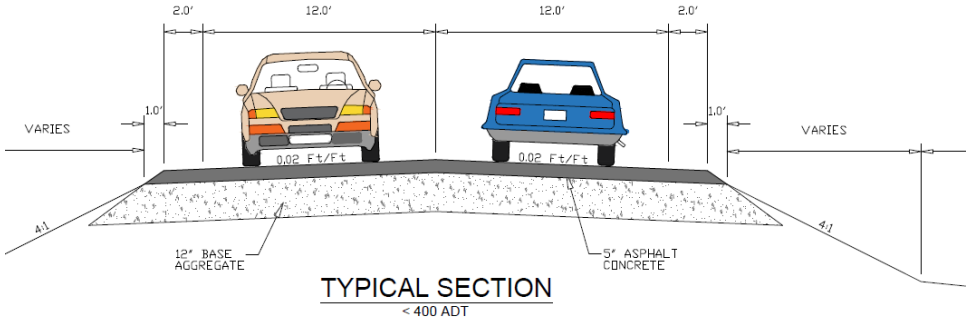
As per the *SDDOT Road Design Guide*, the maximum permissible rate of super-elevation on any highway in South Dakota is 6%. From field observations, we know that a stationary vehicle will slide on ice while resting upon a 6% slope. Therefore, caution should be exercised when designing super-elevations above 4%. Section 3.3 – Horizontal Alignment within the *AASHTO Manual* is available to learn more about super-elevation rates for various design speeds.

viii. Typical Sections

Minnehaha County's highways can be separated into two categories in terms of AADT: roads having more than 400 vehicles per day (vpd) vs. roads having less than 400 vpd. It is always assumed that each travel lane will have a 12-foot lane width. Therefore, the only differences are in the width of the shoulders. The two figures below show these differences in shoulder width.



4.0' Shoulders for roads having AADT > 400



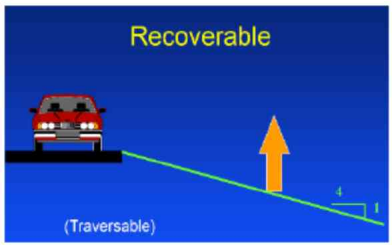
2.0' Shoulders for roads having AADT < 400

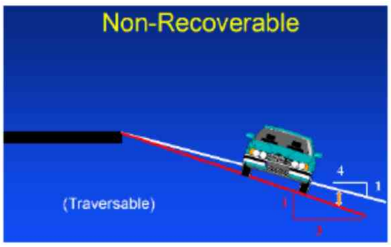
Note that we refer to roads having a 4-foot shoulder as being **"biker**-friendly". In 2015, the state legislature passed a law stating that for roadways where the speed limit is 45 MPH and less, bikers must be given a 3-foot buffer. Where the speed limit is 45 MPH or greater, the biker must be given a 6-foot buffer.

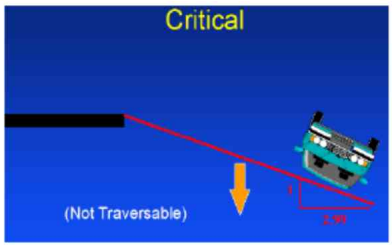
Using the 4-foot shoulder on a 55 MPH roadway, a biker has 3-feet to ride on the shoulder and the passing car would have enough room to hug the center-line without crossing it and still give the biker the required 6-feet of buffer. An added safety feature is a recent addition where edge-line rumble stripes are always part of new paving projects along with a 6-inch wide white shoulder stripe.

When AADT exceeds 2,000 vehicles per day, adding another two feet of shoulder may be justifiable. In some cases, it may be prudent to create 8-foot shoulders in order to create a safe harbor area for vehicles pulled over.

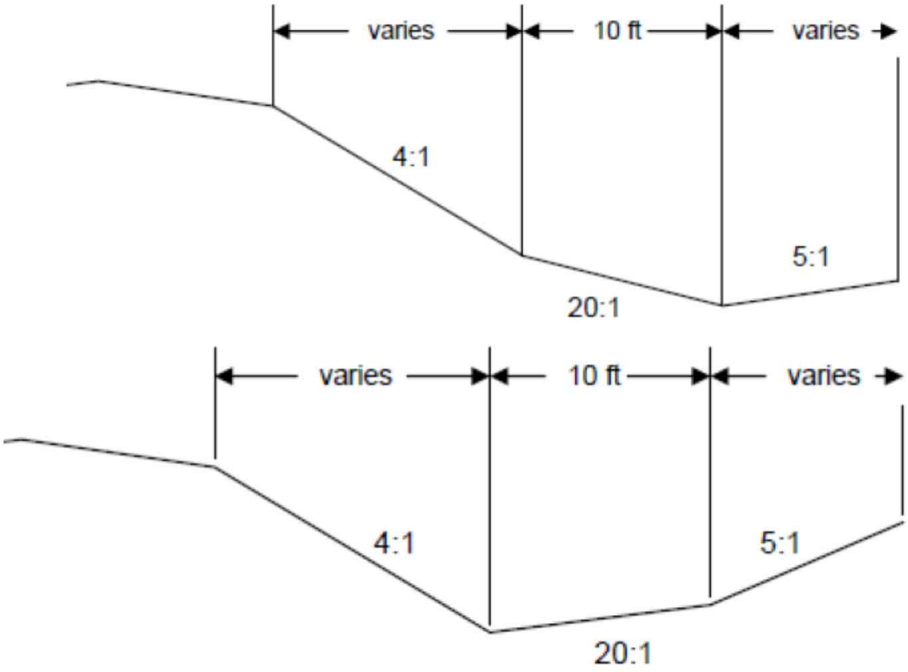
The design standard for in-slopes is 4:1 (H:V) on Minnehaha County's highways because at this incline an errant vehicle can recover safely as illustrated in the three figures below.







There has been much debate about the standard ditch sections shown below as found in the *Local Roads Plan*.



While Minnehaha County agrees with the standard in-slopes and back-slopes being 4:1 (H:V) and 5:1 (H:V), respectively – we do not agree that the ditch bottom width needs to be locked-in at 10 feet. We have tried various ditch bottom widths ranging from 6 feet to 10 feet – and in some locations (crests of hills), v-bottom ditches.

No matter which is specified, the contractors complain about how difficult it is to construct due to the various width of their equipment and types of equipment being used. Typically, the bigger the project, the bigger the equipment is and they have a difficult time installing a 6-foot wide ditch when their dozer has a 10-foot wide blade or a grader with a 12-foot blade. Furthermore, over time, we find that all ditch bottoms end up being rounded at the bottom due to wind deposited sedimentation as well as sediment transport and deposition from run-off. Using modern CAD software, we believe good design embraces a customized approach that is both nimble and appropriate given its context.

There are many factors to weigh when designing a ditch section. The storage created by the two standard ditch sections shown above is important for providing

storage of blowing or plowed snow as well as a safe harbor area for errant vehicles, and therefore, a ditch-bottom width of 8-10 feet is preferred where possible. However, considering a typical right-of-way width is 100 feet (50 feet per side), it is sometimes difficult to get a full typical section constructed inside this constraint.

Another consideration is whether the reconstructed section is in a cut or a fill section. Sometimes, extended temporary easements can be used in lieu of acquiring additional right-of-way. In these cases, when the temporary easement goes into a portion of cropped farmland, we have had success in using tie in slopes at 10:1. In these cases, we end up paying for one year of crop loss. Also, at the crest of a hill, when challenged, the designer may elect to vary the ditch bottom width starting at a 2-foot minimum width as long as the in-slope is at least 8 feet wide which allows for a minimum of 2-feet of depth for snow storage.

One more thing to vary is the back-slope. While a 6:1 (H:V) is preferred to allow the wind to blow across the road and minimize the development of snow drifts, at times, using a 4:1 (H:V) back-slope is chosen in order to minimize impacts on private property. In some extreme cases, the use of retaining walls is warranted.

Minnehaha County has not pursued programmatic installation of living fences such as shelter belts near road segments which are prone to drifting; however, such concepts should be explored during land-owner negotiations. With much of our county farmed, one can expect minimal support to set aside cropland in lieu of shelter belts.

In summary, designing a modern ditch section is not a one-size-fits-all proposition. The designer must take into account land use impacts, drainage concerns, snow drifting, as well as existing and proposed right-of-way widths as well as the size of temporary construction easements.

ix. Clear Zones

A clear zone is the unobstructed, traversable area provided beyond the edge of the traveled way for the recovery of errant vehicles.

The *AASHTO Manual*, defers to the *AASHTO Roadside Design Guide* when it comes to minimum standards for clear zones and lateral offset. In the 4th Edition of the *Roadside Design Guide*, on page 3-3, Table 3-1 shows the appropriate minimum recommended clear zone widths based on design speed, AADT, and steepness of in-slopes (fore-slopes), and back-slopes.

CLEAR ZONE DISTANCES
(IN FEET FROM EDGE OF TRAVEL LANE)

DESIGN SPEED	DESIGN ADT	FORESLOPES			BACKSLOPES		
		1V:6H or flatter	1V:5H to 1V:4h	1V:3H	1V:3H	1V:5H to 1V:4H	1V:6H or flatter
40 mph or less	UNDER 750	7-10	7 – 10	**	7 – 10	7 – 10	7 – 10
	750 – 1500	10 – 12	12 – 14	**	10 – 12	10 – 12	10 – 12
	1500 – 6000	12 – 14	14 – 16	**	12 – 14	12 – 14	12 – 14
	OVER 6000	14 – 16	16 – 18	**	14 – 16	14 – 16	14 – 16
45 – 50 mph	UNDER 750	10 – 12	12 – 14	**	8 – 10	8 – 10	10 – 12
	750 – 1500	14 – 16	16 – 20	**	10 – 12	12 – 14	14 – 16
	1500 – 6000	16 – 18	20 – 26	**	12 – 14	14 – 16	16 – 18
	OVER 6000	20 – 22	24 – 28	**	14 – 16	18 – 20	20 – 22
55 mph	UNDER 750	12 – 14	14 – 18	**	8 – 10	10 – 12	10 – 12
	750 – 1500	16 – 18	20 – 24	**	10 – 12	14 – 16	16 – 18
	1500 – 6000	20 – 22	24 – 30	**	14 – 16	16 – 18	20 – 22
	OVER 6000	22 – 24*	26 – 32*	**	16 – 18	20 – 22	22 – 24
60 mph	UNDER 750	16 – 18	20 – 24	**	10 – 12	12 – 14	14 – 16
	750 – 1500	20 – 24	26 – 32*	**	12 – 14	16 – 18	20 – 22
	1500 – 6000	26 – 30	32 – 40*	**	14 – 18	18 – 22	24 – 26
	OVER 6000	30 – 32*	36 – 44*	**	20 – 22	24 – 26	26 – 28
65 – 70 mph	UNDER 750	18 – 20	20 – 26	**	10 – 12	14 – 16	14 – 16
	750 – 1500	24 – 26	28 – 36*	**	12 – 16	18 – 20	20 – 22
	1500 – 6000	28 – 32*	34 – 42*	**	16 – 20	22 – 24	26 – 28
	OVER 6000	30 – 34*	38 – 46*	**	22 – 24	26 – 30	28 – 30

The recommended clear zones shown in this table are noticeably conservative. This is especially evident within the statement provided on page 6-8 of the *AASHTO Manual* under Section 6.2.4.1 where it is stated: "*For low-speed, rural-collectors, a clear-zone width of 7 to 10 feet is desirable.*"

Moreover, AASHTO recognizes their lack of observed and realistic field data to support the figures in Table 3-1 of the *Roadside Design Guide* as apparent in the following excerpt from page 3-2:

> "*Table 3-1 can be used to determine the suggested clear-zone distance for selected traffic volumes and speeds. However, Table 3-1 provides only a general approximation of the needed clear-zone distance. These data are based on limited empirical data that were extrapolated to provide information for a wide range of conditions. The designer should keep in mind site-specific conditions, design speeds, rural versus urban locations, and practicality. The distances obtained from Table 3-1 should suggest only the approximate center of a range to be considered and not a precise distance to be held as absolute. For roadways with low traffic volumes, it may not be practical to apply even the minimum values found in Table 3-1.*" (The underlining and colored text above have been added for emphasis.)

Also of particular interest on this topic is sub-note "c" from page 3-3 of *AASHTO Manual*, which reads:

> *"For roadways with low volumes it may not be practical to apply even the minimum values found in Table 3-1…"*

As transportation engineers, highway designers, and a governing body who is given authority to responsibly own and operate a local highway system as safely and as efficiently as possible, what does the above information mean to us?

It means, we need to think critically and make practical decisions. We need to analyze the context. These quotes do not mean that we look up some data in a table and go with it as the golden rule.

We know that "very low volume roads" refers to roads having less than 400 vehicles per day (vpd). And through a literature review, we can deduce that the term "low volume roads" most commonly refers to roads carrying less than either 1,500 or 2,000 vehicles per day (vpd). Therefore, when a highway carries less than 400 vpd, the designer is free to assume that applying a clear zone standard to their design that is substantially less than what is shown in Table 3-1 should be acceptable.

Similarly, but to a lesser degree, using a clear zone width that is slightly less than what is shown in Table 3-1 when AADT is less than 1,500 is allowable. On page 10-8 of the *SDDOT Road Design Manual*, Table 10-2 lists recommended clear zones appropriate for county highways and is reproduced here for convenience.

Traffic Volume (AADT)	Clear Zone (feet)
< 551	10
551 to 1500	15
> 1500	20

Below this table in the SDDOT Road Design Manual, the following text is found:

> *"The designer should calculate the clear zone based on speed, ADT, and the slopes using Table 3.1 of the current AASHTO publication of the* Roadside Design Guide. *The clear zone should not be greater than what is shown in Table 10-2 for the same ADT."*

The underlining has been added to emphasize the point that the SDDOT recognizes the conservative nature of AASHTO's recommendations. Moreover, the SDDOT directs designers to override those values found in AASHTO and to use the information from Table 10-2 instead.

And to round out this discussion, the designer is perhaps well advised to use the lower ranges of those "suggested" values for clear zone width found in AASHTO's Table 3-1 (from page 1-27) when the AADT is greater than 1,500 vpd.

To explore what is practical AND good engineering practice, the following example is presented: Imagine a vehicle traveling at the 55 MPH speed limit and losing control and ending up in the ditch. The ditch bottom where the errant vehicle comes to rest should be safe and free of obstructions and should be included within the clear zone width. With 4:1 (H:V) in-slopes, that vehicle will likely not roll but rather come to rest safely in the bottom of the ditch where they may be able to drive out under dry conditions or perhaps need to be retrieved (towed) in wet or snowy conditions.

However, in the case of culverts, the proper clear zone width becomes less clear. If the ditch is 4 feet deep, the end of a culvert would be located approximately 18 feet horizontally from the edge of the traveled way. This makes sense and, in fact, complies with Table 3-1 in the *Roadside Design Guide*, as long as the AADT is less than 750 vehicles per day.

However, if the ditch were only 2 feet deep, the end of a culvert could be located as close as 10 feet horizontally from the edge of the traveled way, which does not comply with Table 3-1 for the same traffic volume because the table shows that 14 feet of clear zone is "suggested" for traffic volumes less than 750 per day.

Under the same conditions but with up to 1,500 vehicles per day, the minimum "suggested" clear zone becomes 20 feet according to Table 3-1. When the traffic volume exceeds 1,500 vehicles per day, the "suggested" clear zone goes up to 24 feet. In the case when the ditch is 2 feet deep, which option makes it safer for the errant vehicle? Yet the cost ramifications for extending culverts and extra grading are substantial, not to mention potential further complication being introduced because of the need to seek additional easement area or perhaps additional right-of-way.

Therefore, practical design dictates that the clear zone distances shown in Table 3-1 in the *Roadside Design Guide* are mere conservative suggestions but not to be taken as absolute values. When designing culvert lengths, the use of appropriately designed flared end sections on culverts and grading that is well blended with adjacent slopes may dictate design more so than Table 3-1. This allows the designer to match a safe clear zone as presented by the standard in-slope and ditch bottoms without extending the culvert end too far beyond the normal toe of the in-slope where a vehicle would normally come to rest prior to recovering. This distance will be less than what is shown in Table 3-1 with little to no impact on safety.

When culverts are large, and/or when ditches are deep, the use of guardrail may be the safer and more practical solution. In these cases (see picture at left), a cost/benefit analysis should be conducted.

In the case where "barn-roof" sections are designed to minimize fill sections on very long in-slopes, it is recommended to use 6:1 (H:V) fore-slopes inside the clear zone, then break to a 3:1 (H:V) or steeper outside the clear zone. At this critical break, it may be warranted to install guardrail above the critical slope where recovery is impossible and consequences would be severe.

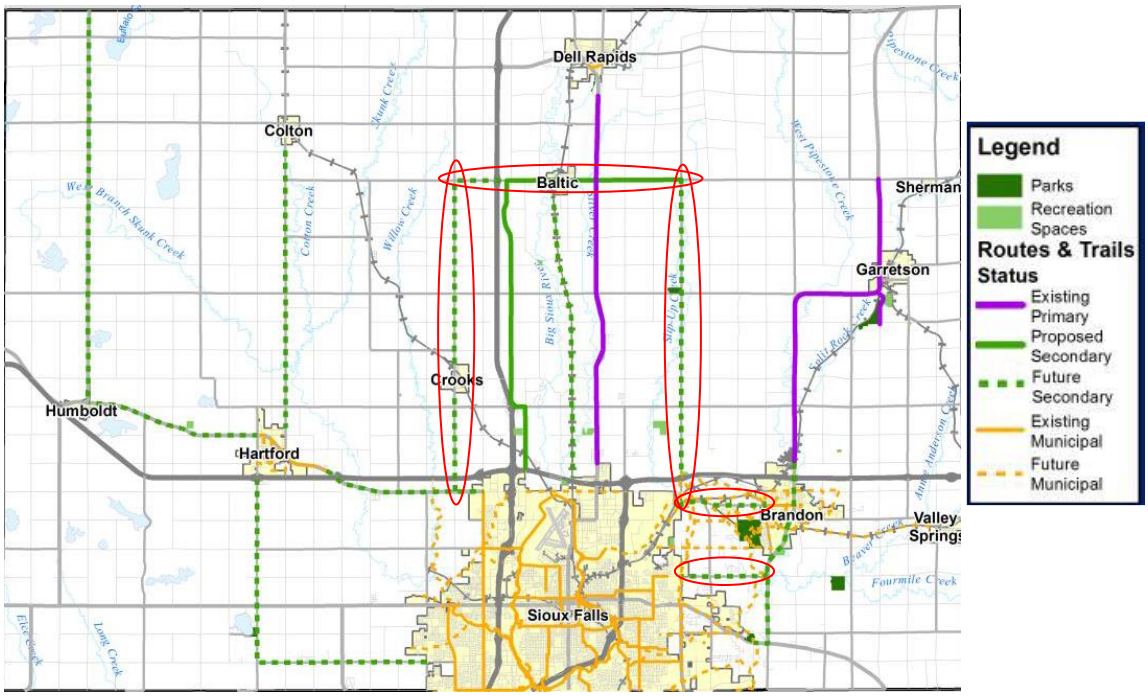
In summary, where constraints of cost, terrain, right-of-way, or potential environmental impacts make the suggested clear zone widths found in Table 3-1 of AASHTO's *Roadside Design Guide* impractical, clear recovery areas less than suggested may comfortably be used. Designers should consider a tailored approach to the roadside design to fit site-specific conditions while considering cost-effectiveness. Other factors such as crash history trends, expected growth, and the frequency of wide loads should be considered in determining an appropriate width of clear zones.

x. Surfacing

In general, surfacing depths on new construction consists of 5 inches of asphalt pavement over 12 inches of new aggregate base course. Recycling existing asphalt into the gravel layer is always encouraged. Also, the strength of sub-grades should be an important consideration. Therefore, Minnehaha County relies on geotechnical investigative reports for recommendations on surfacing design.

xi. Bicycle Considerations

The only "bike-friendly" routes recognized by the Highway Department are shown circled in red in the following figure.



These routes will be built having 4-feet of paved shoulders when opportunities arise – such as when a rehabilitation or reconstruction is to occur.

Note that we refer to roads having a 4-foot minimum shoulder as being **"biker-friendly".** In 2015, the state legislature passed a law stating that for roadways where the speed limit is 45 MPH and less, bikers must be given a 3-foot buffer. Where the speed limit is 45 MPH or greater, the biker must be given a 6-foot buffer. Using the 4-foot shoulder on a 55 MPH roadway, a biker has 3-feet to ride on the shoulder and the passing car would have enough room to hug the center-line without crossing it and still give the biker the required 6-feet of buffer.

An added safety feature is a recent addition where edge-line rumble stripes are always part of new paving projects along with a 6-inch wide white shoulder stripe. See Section H below for more discussion on edge-line rumbles.

F. Intersections

Intersections should be located to avoid steep profile grades and to provide adequate approach sight distance. An intersection should not be situated near a sharp crest vertical curve or on a sharp horizontal curve. In cases where this cannot be achieved, a site-triangle analysis should be conducted and back-slopes should be flattened accordingly. See Section 9.5 – Intersection Site Distance in the *AASHTO Manual* for more information.

Minnehaha County prefers 50-foot radii at junctions where two county highways intersect and where a county highway crosses a township road.

Where county highways cross state highways, the design of the state highway governs.

Radii for approaches and driveway accesses shall be 25 feet.

When using AutoTurn to customize the design of an intersection, the standard design vehicle is a WB-67. This is a standard, 5-axle truck- trailer combination with a 53-foot trailer. This vehicle should be able to complete a turn while staying in their lane without crossing over the yellow centerline on the highway with minimal over-steer. If it is desirable to analyze the turning movement of trucks with extra trailers, the design vehicle is a WB-110.

Minnehaha County requires approval of an approach permit when adding or changing an existing approach. We also have an *Access Management Plan*. The *Access Management Plan* addresses permitting, traffic impact studies, access spacing, and access control.

G. In-house Road Maintenance

Minnehaha County's road maintenance team is led by an Operations Manager who supervises maintenance team leaders and 15 team members. During the summer, we hire an additional 4 to 10 temporary employees.

The primary duties of the maintenance team include:

i. Patching

Roadway patching is achieved using an asphalt paver and hot-mix. This is essentially performing thin lift overlays on areas that are experiencing localized distress and are in need of treatment before the next programmed project can be performed. The depth of patching ranges between 1/2 of inch to 2 inches. Material specifications for the asphalt concrete to be used for patching is presented under Section 1.2.B.v of this document.

When placing deeper lifts, care must be given to maintain a safety edge (see right) to maintain safe driving conditions. Annually, county forces place between 6,000 to 14,000 tons. In those years when higher quantities are installed by county forces, it is usually associated with conducting an in-house overlay on 1 to 4 miles of road.

ii. Pot-hole Repairs

The repair of pot-holes is an inevitable part of roadway maintenance. Our staff uses a variety of treatments including hot mix asphalt, mastic, and cold patching material when it is too cold to use hot mix asphalt.

iii. Mastic

Applying mastic material to joints is another form of pavement preservation. County forces use a Patcher II which holds 500 pounds of mastic which usually takes about 4 hours to apply an entire load. A more in depth discussion on the benefits and application of mastic is presented in Section 1.2.B.ii of this document.

iv. Obstruction Removal

Keeping the right-of-way free from obstruction is a primary duty of our maintenance staff. This includes anything projecting 4 inches or more from the ground -- such as trees, stumps, mailboxes, hay bales, kitchen appliances, etc. Any feature that is taller than 4 inches has to be either removed, or if located inside the clear zone, it must be mounted on an approved break-away device.

v. Culvert Cleaning and Repairs

Formal culvert inspections occur every three years. From these inspections, culverts that appear to be in good condition but are more than 50% full of sediment are flagged for cleanout. Some of this work can be accomplished with in-house forces and some of it is contracted out. Either way, the removed debris needs to be disposed of in an environmentally responsible manner. Often times, this material makes for very good topsoil and can be repurposed; however, it may also carry an abundance of dormant weed seeds.

Another item that is flagged for in-house repair are culvert end sections. When the end sections have failed, and even pipe sections located under the in-slope, our in-house forces perform these repairs by drilling and tieing the sections together and replacing eroded pipe bedding material. If the work requires replacement or repair of pipe segments under the roadway, these projects are contracted out to a consultant for more formal design which includes signing for a detour and preparing a schedule of bid items.

vi. Ditch Cleaning

Ditch cleaning is performed by county personnel on a somewhat regular basis. However, this work is done on a more reactive basis rather than being programmed. This is often done in conjunction with culvert cleaning. The removed debris needs to be disposed of in an environmentally responsible manner. Often times, this material makes for very good topsoil and can be repurposed as such.

The increasing use of drain-tile is putting pressure on local governments to maintain a ditch and culvert system that drains well. Virtually every ditch in our county could have sediment removed to restore the ditch section to originally designed finish grade contours. Sediment from fields is transported through wind and runoff and ends up in our ditch system. As long as the highway ditch is functioning properly and not causing harm to adjacent property or the roadway, the need for ditch maintenance is not required.

H. Striping and Rumbles

Having visually prominent pavement markings is long proven to be one of the most cost effective solutions to improving driver safety.

i. Pavement Markings

Minnehaha County participates in a program with the SDDOT whereby the state plans and administers a contract for county-wide paint striping. Personnel from the County engineering staff coordinate this process including construction oversite.

Minnehaha County elects to repaint all striping and pavement markings every year, including turn lanes and railroad crossings. We have tried painting all yellow striping one year and white markings in opposite years but we have found this to be ineffective. Little to no beads are left after plowing our roads over the winter which makes the markings barely visible at night and even less so when it rains.

Also note that our new standard for center-line dashed pavement markings where passing is allowed in both directions is 6 inches wide, while the standard yellow constant lines or when one direction is allowed to pass remains at 4 inches wide each.

We have also adopted a new paint for all pavement markings which shall be equivalent to SDDOT Standard Bid Item No. 633E1200 and 633E1205, "Waterborne Pavement Marking Paint with High Grade Polymer, White/Yellow". This type of paint features a durable high build, low VOC, fast drying, waterborne traffic paint with a 100% acrylic polymer. At this time the two pre-approved products are:

- Diamond Vogel's Waterborne High Build Polymer Marking Paint, and
- Ennis-Flint's High Build Polymer Marking Paint

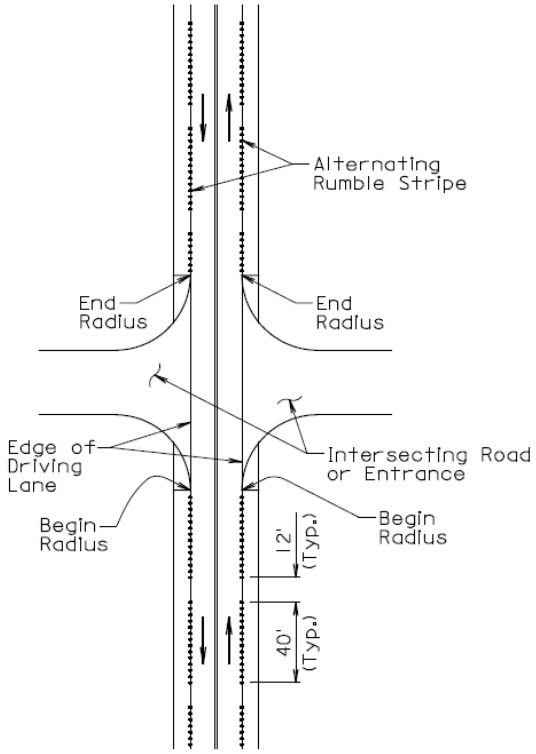
Updated standard notes and standard plates shall be included in all projects which include pavement markings. When applying pavement marking paint to a new chip seal, the application rate of pavement marking paint is increased 20-33%.

ii. Edge-line Rumbles

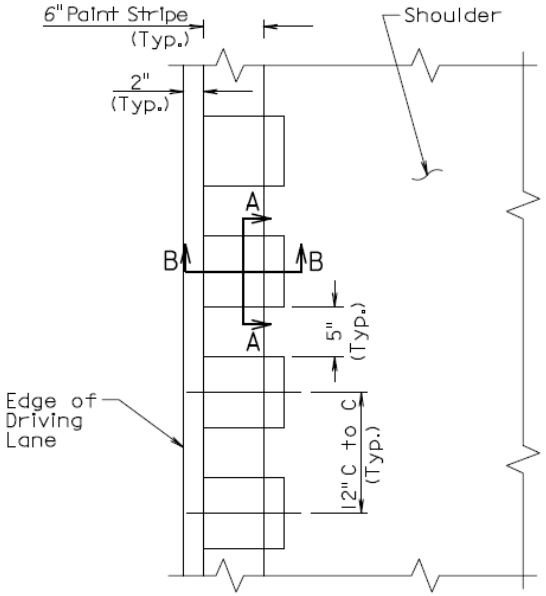
A recent addition to all projects is edge line rumble stripes. Minnehaha County has slightly modified standard rumble striping details put out by the SDDOT. We prefer an 8 inch wide *edgeline rumble stripe* to be placed directly below a 6-inch wide white stripe (as shown in the picture at right) in areas where speed limits are 45 MPH and higher.

On corridors where shoulder widths are greater than 4 feet, *shoulder rumble strips* may be considered, shown at left. It is preferred to allow a potential biker at least 3 feet of shoulder width to ride on, whereas providing at least 4 feet of width is more ideal in support of providing "biker friendly" routes.

The figures below provide additional details showing how Minnehaha County has customized edgeline rumble stripes located at the outside of the travel lane.



PLAN VIEW



PLAN VIEW
TYPICAL RUMBLE STRIPE
IN ASPHALT CONCRETE

These and other details can be found on Minnehaha County's Standard Plate 320.10 – 8" Rumble Stripe in Asphalt Concrete.

The benefits of installing rumble strips are many:

- Shoulder or edge line rumble strips are one of the proven countermeasures that reduce the risks of run-off-road crashes due to in-attentive and distracted drivers.
- Rumble strips are placed as a countermeasure for driver error, rather than roadway deficiencies.
- Designed primarily to assist distracted, drowsy, or otherwise inattentive drivers who may unintentionally drift over the edge line.
- The audible and vibratory warning produced by rumble strips *greatly improves the opportunity for a safe recovery*.
- Run-off-road crashes account for approximately one-third of the deaths and serious injuries each year on the Nation's highways.
    - Drift-off crashes, caused by drowsy, distracted, or otherwise inattentive driving, are a subset of run-off-road crashes.

- This subset contains the specific crash types that are most likely to be reduced by shoulder or edge line rumble strips.

  Milled rumble strips are among the most cost-effective countermeasures available for this type of crash, since they directly address driver risk factors.

- In a study of 1,800 run-off-road freeway crashes, one state found that drift-off-road crashes (due to inattentive driving) resulted in death or serious injury at a rate three to five times higher than other categories of run-off-road crashes.

- The warning created by rumble strips often improves driver reaction, thereby reducing crash severity.

- The practice of placing the edge line pavement markings over the rumble strip improves nighttime marking visibility, particularly in wet conditions.

- Snow plow operators have indicated a positive effect of rumble strips – they associate the rumble strip pattern with their ability to discern the limits of their travel lane.

- Rumble strips are not affected by freeze/thaw cycles any more than the surrounding pavement.

- Field observations refute concerns about the effects of the freeze-thaw cycle as water collects in the grooves. These observations show that wind and the action of wheels passing over the rumble strips in fact knock debris, ice, and water out of the grooves.

- Ironically, snow plow drivers have come to depend on shoulder rumble strips to help them find the edge of the travel lane during heavy snow and other low visibility situations.

2018 was the first year a substantial amount of the highway system received edgeline rumble stripes. To date, county staff have not received one complaint.

iii. Center-line Rumbles

Beginning in 2019, the SDDOT is supporting (through funding) the addition of center-line rumbles on corridors carrying 2,500 vehicles per day or more. Minnehaha County has about 23 miles of such routes but not all of which have speed limits of 45 MPH and greater. Going forward, these are the criteria for including center-line rumbles within projects.

iv. Pavement Marking Updates

Starting in 2019, our new standard for center-line dashed pavement markings where passing is allowed in both directions (single standard centerline skips or dashes) is 6 inches wide.

We have also adopted a new paint for all pavement markings which shall be equivalent to SDDOT Standard Bid Item No.s 633E1200 and 633E1205 - "Waterborne pavement Marking Paint with High Grade Polymer, White/Yellow".

v. Other Rumbles

Minnehaha County uses rumbles to provide haptic feedback to roadway users in two other ways besides edge-line and center-line rumbles – both provide advance warnings for railroad crossings and stop signs and both have the characteristics as shown on MCHD Standard Plate 320.40. Note that the installation locations are 350 feet in advance of the rail crossing or stop sign, and also at 600 to 750 feet in advance of the first location.

The reason we do not place full-width rumbles across the driving lane is by request from the motorcycle community.

vi. No-Passing Zones

The highway department completed an extensive study on our highway system analyzing the passing sight distance for all horizontal and vertical curves. Other state standards were also investigated. From the results of these efforts, the following standards have been adopted:

Roadway design begins 10 mph above the posted speed limit. However, we place pavement markings (centerline striping) at the appropriate distances for the *posted* speed limit. All horizontal and vertical curves shall be analyzed for minimum passing sight distance. Refer to current *AASHTO* standards for the minimum passing sight distances.

- If any portion of the roadway fails the minimum passing sight distance, it shall receive solid yellow paint indicating no passing is allowed.
- No passing zones less than 500' shall receive a minimum of 500' of paint.
- For zones under 500', add the additional paint at the beginning of the no passing zone.

- If the length of the no passing zone exceeds 500', the paint shall match.
- If no-passing zones on the same side of the road are spaced less than 800' apart, combine them into a single no-passing.

Note that these standards need to be analyzed and applied for ***both*** directions of the road.

1.3 BRIDGES

Some interesting facts from 2018 about our structures are:

- Minnehaha County has 195 structures vs. 3,641 statewide.
- Minnehaha County has the most structures of any county in the state.
- 0 structures are closed versus 75 statewide
- The average age of our County bridges is 39 years old
- The typical design life for most of those bridges was 50 years
- 58 structures are older than 50 yrs
    - Of these, the average age is 71 years
- 25 bridges currently have weight limit postings less than legal loads
- An average of 3-5 structures are replaced every year
- The average Sufficiency Rating is 81.6 vs. 74 statewide.

A. Bridge Inventory System

The National Bridge Inventory (NBI) is a database, compiled by the Federal Highway Administration, with information on all bridges and tunnels in the United States that have roads passing above or below. This bridge information includes the design of the bridge and the dimensions of the usable portion. The data is often used to analyze bridges and judge their conditions.

The inventory is developed with the purpose of having a unified database for bridges to ensure the safety of the traveling public as required by the Federal-Aid Highway Act of 1968. It includes identification information, age, bridge types and specifications, operational conditions, bridge data including geometric data and functional description, and inspection data. Any bridge more than 20 feet long used for vehicular traffic is included.

The National Bridge Inventory includes a structural evaluation of deck, superstructure, substructure, and culvert on a 0-9 scale as presented below.

Description	Code
NOT APPLICABLE	N
EXCELLENT CONDITION	9
VERY GOOD CONDITION - no problems noted.	8
GOOD CONDITION - some minor problems.	7

SATISFACTORY CONDITION - structural elements show some minor deterioration.	6
FAIR CONDITION - all primary structural elements are sound but may have minor section loss, cracking, spalling or scour.	5
POOR CONDITION - advanced section loss, deterioration, spalling or scour.	4
SERIOUS CONDITION - loss of section, deterioration, spalling or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.	3
CRITICAL CONDITION - advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.	2
"IMMINENT" FAILURE CONDITION - major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put back in light service.	1
FAILED CONDITION - out of service - beyond corrective action.	0

Code "N" (NOT APPLICABLE) is used for item 62 (Culvert Rating) when the structure is a bridge or for items 58, 59, and 60 (Deck, Superstructure Rating, Substructure Rating, respectively) when the structure is a culvert.

The term "Functionally Obsolete" has been removed from published NBI data, as it is no longer tracked.

The NBI can classify bridges as "Structurally Deficient", which means that the condition of the bridge includes a significant defect, often meaning that speed or weight limits must be put on the bridge to ensure safety; a rating of 4 or lower on any of items 58, 59, 60, or 62 (Deck, Superstructure, Substructure, and Culverts, respectively) qualifies a bridge as "structurally deficient".

Some bridges are also identified as "fracture critical", which means that the failure of a single major tension member or member element will cause a significant portion or the entire bridge to collapse due to a lack of redundancy.

A bridge's Sufficiency Rating is a quick way to gain a sense of the overall health of the structure. The sufficiency rating formula provides a method of evaluating highway bridge data by calculating four separate factors to obtain a numeric value which is indicative of bridge sufficiency to remain in service. The result of this method is a percentage in which 100 percent would represent an entirely sufficient bridge and zero percent would represent an entirely insufficient or deficient bridge. The formula considers the structural adequacy; functional obsolescence and level of service; and essentiality for public use. The SR formula is described in Appendix B of FHWA's *Recording and Coding Guide for the Structure, Inventory and Appraisal of the Nation's Bridges*.

Minnehaha County conducts bridge inspections on all bridges every other year except those bridges that have been identified as being either "scour critical", or "fracture critical" which get inspected every year. The inspections are coordinated through a contract with the SDDOT and conducted by a consultant.

B. Bridge Preservation

A successful bridge program seeks a balanced approach to preservation and replacement. Focusing only on replacing deficient bridges while ignoring preservation needs will be inefficient and cost-prohibitive in the long term. Adopting a "worst first" approach to managing bridge assets may also yield ineffective results that allows bridges in good condition to deteriorate into the deficient category which generally is associated with higher costs and other challenges.

The objective of a good bridge preservation program is to employ cost effective strategies and actions to maximize the useful life of bridges. Applying the appropriate bridge preservation treatments and activities at the appropriate time can extend bridge useful life at lower lifetime cost.
Preservation activities often cost much less than major reconstruction or replacement activities. Delaying or forgoing warranted preservation treatments will result in worsening condition and can escalate the feasible treatment or activity from preservation to replacement. The latter will result in extensive work and higher cost. A viable alternative is timely and effective bridge preservation of sound bridges to assure their structural integrity.

The operations described below describe some of the most effective bridge preservation and preventative maintenance techniques, the majority of which are performed by Minnehaha County staff.

i. Washing

Bridge cleaning and/or washing is the cleaning of decks, joints, drains, superstructure, and substructure horizontal elements. This slows the deterioration of concrete and steel elements since debris, bird droppings, and contaminants in conjunction with water will accelerate the deterioration of concrete and steel elements.

> While somewhat time consuming, bridge washing is the most cost effective way to extend the life of a structure.

Furthermore, washing bridges is a preventative maintenance task performed on a recurring basis in order to protect bridges against corrosive effects of chlorides, de-icing chemicals and the accumulation of material on bridge surfaces throughout the winter. It is important that the process of removing of the sand and debris is accomplished early in the year and in a manner that does not harm the environment or violate state or federal regulations. This includes pressure

washing beam seats, beam ends, girders and diaphragms, and bearing devices. Minnehaha County washes all bridges on the paved system every year.

For bridges on the township road system (gravel roads), those structures get washed every two years. It almost goes without saying that prior to washing bridge decks, they should be swept. The accumulated debris should be disposed of in an environmentally responsible manner.
A good work plan includes:

- Appropriate traffic controls
- Appropriate erosion and sediment prevention controls
- Fall protection
- Working over water plan
- Protection of birds and other species in compliance with SD DENR guidelines and requirements. For example, due to nesting habits of swallows and other migratory species, Minnehaha County has been instructed by SDDOT Environmental office to avoid removing nests between April 30 and Sept. 15.
- Identify appropriate water source
- Testing equipment such as pumps, hoses, nozzles, etc. prior to mobilizing.

For those bridges located on gravel roads or near active work sites that have open joints, a good tip is to retrieve the gravel that has fallen through the open joint prior to deck washing. The process may need to be repeated a second time after the deck has been washed.

ii. Bearing Lubrication

After a thorough washing, if moveable bearings exist, it is highly recommended to further clean and lubricate each bearing. When bearings do not function as designed, unintended forces develop on the superstructure, substructure, and the bearing itself.

Lack of or inadequate bearing maintenance can also lead to reduced service life. Issues typically relate to lack of cleaning which results in debris buildup below deck expansion joints, and steel element corrosion. Dirt and debris buildup prevents proper bearing movement and rotation. Debris buildup also retains and holds moisture and salt against exposed steel elements, which leads to corrosion if the elements are not cleaned.

Silicone greases are recommended because they are effective at low temperatures and do not attack the sliding materials such as neoprene, butyl-rubber and other latex-based types of pads.

iii. Erosion Control

Erosion control practices, often referred to as streambank stabilization, around structures primarily focuses on permanently minimizing local erosion of the stream embankments located immediately adjacent to the structure. This is done by creating or restoring streambanks and roadside in-slopes to a stable state. To perform this work, temporary erosion controls may be needed along with consultation with the US Army Corps of Engineers.

Examples of stabilizing banks around structures includes:

- Removal of steep embankments by cutting them back to a 4:1 (H:V) slope or flatter and establishing permanent turf.
- Using geogrids and erosion control blankets to assist in establishing permanent turf on slopes 3:1 (H:V) and steeper.
- Tree and foliage removal
- In extreme cases, gabion baskets may be required.
- See Section iv-Scour Protection below for additional considerations.

iv. Scour Protection

Scour protection differs slightly than Section iii-Erosion Controls above in that this work primarily occurs under the structure itself and not adjacent to it. Whereas erosion control measures are taken to stabilize streambanks, scour protection measures are taken to prevent or minimize material losses in and around the supporting foundations of the structure. Picture at right shows rip-rap that has been grouted in.

Primarily, scour protection consists of re-establishing the original cross-section of the channel through the structure which includes native materials as well as rip-rap aprons. *It is highly recommended to review as-built drawings and photos of the completed structure prior to installing new rip-rap in order to match the hydraulic capacity as well as other design intentions of the structure and rip-rap as originally designed.*

Other important considerations involved with protecting the foundations of bridge abutments and interior bents include:

- Always placing erosion control fabric under the rip-rap and installed as per manufacturer's recommendations.
- Key-in the toes of the rip-rap and around all but the upper edges.
- Consider the appropriate size of rip-rap. This may require consulting with an engineer to determine the design velocity and shear strength and matching the rock size appropriately.
- Remove or add enough material prior to placing rip-rap such that the finished grade surface elevation of the top of the rip-rap is as intended.
- Consult a structural engineer if foundations are exposed and damaged.
- Planning material storage and staging prior to placing including access and platform building.
- Place proper erosion and sediment controls prior to beginning work.
- Plan to restore site to stable conditions including topsoil and seeding.
- Consult with the US Army Corps of Engineers anytime work is planned to occur within the ordinary high-water boundaries. A Section 404 permit may be required.
- Watch out for over-head power lines and other utilities in the area. Coordination with utility companies may be required.
- Research permanent easements or H-lots associated with the structure.
- Visit with adjacent landowners if potential trespassing may occur.

v. Channel Clearing

Removing debris such as timber and clearing accumulating sediment are both considered ordinary preventative maintenance for bridges and culverts. As this work occurs within the ordinary high water of the waterway, consultation with the US Army of Corps of Engineers is required. In general, a nationwide Section 404 permit may be issued when the total length of temporary disturbance along the channel is less than 350 feet.

When performing channel maintenance by removing accumulated sediments, it is very helpful to review as-built drawings and the photos contained within bridge reports to gain a sense of normal channel shape and/or to perhaps trouble shoot areas causing the sediment accumulations. There may be a hidden scour hole near an abutment or bent which may be revealed within the bridge reports. Also, reviewing the list of items that should be considered when planning for a channel clearing project is similar to preparing for a scour repair project. See Section iv-Scour Protection above.

vi. Deck Joint Repair

Seals: Bridge joint seals take on a variety of types and methods of installation. When joints need to be repaired or replaced, it is advisable to review the as-built drawings to gain an understanding of joint details and functions.

The technology of sealing bridge joints is ever-evolving and many times a better product is available versus what was originally installed. Therefore, Minnehaha County prefers to consult with an independent expert before deciding on which type of repair to perform and whether or not it will be done using in-house forces or outside contractors.

By sealing or replacing leaking joints (or eliminating deck joints altogether), the deterioration of superstructure and substructure elements beneath the joints is minimized.

vii. Deck Sealants

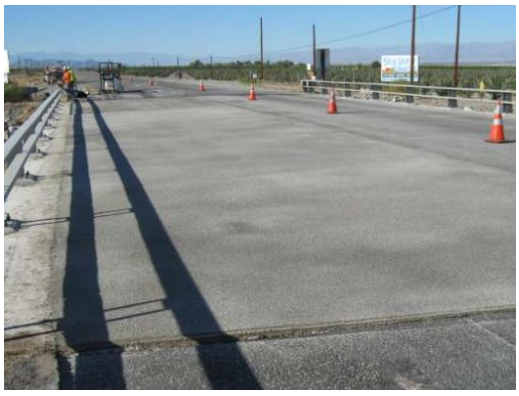
Application of concrete sealants, coatings, and membranes for surface protection of the concrete are important because they protect the reinforcing steel from corrosion by stopping or minimizing the intrusion of water and chloride through the concrete.

Not long ago, it was common practice to assume thin asphalt overlays provided such protection. This is absolutely not true and this practice is highly discouraged. The asphalt is actually quite porous and holds moisture which induces increasing chloride contamination over time. In fact, it is recommended to remove all such prior placements of asphalt overlays on bridge decks and take remediate actions as soon as possible. However, sometimes removing the asphalt from a bridge deck reveals some surprises so be prepared. A structural evaluation may be needed.

Recommended desk seals treatments are discussed below.

a. Silane

Silane is a clear, penetrating, breathable water repellent for use on exterior above-grade concrete, masonry, and some natural stones. It penetrates the surface and bonds chemically to the host substrate resulting in a permanent attachment. It is not a coating and will not discolor or change the surface appearance in any way, which includes friction properties. It is also easy to apply.



Minnehaha County's preferred product is Chem-Trete BSM 40 VOC. It is our practice to apply this product according to its manufacturer's recommendations 30 days after a new deck has been poured. We choose to re-apply this product every 5-10 years thereafter. In addition, we have been systematically applying this product on bridge decks we know to be less than 10 years old

and will again re-apply on a 5-10 year cycle. We believe using Silane in this way to be the most effective and cost-beneficial solution in minimizing the penetration of chlorides into our newer bridge decks. We also believe it adequately seals hairline cracks.

b. Epoxy Flood Coating

Penetrating epoxies deeply infiltrate cracked concrete and structurally seal cracks keeping moisture and chlorides out.

Minnehaha County prefers to use Unitex Bridge Seal 75% by Dayton Superior. This is a two-part epoxy so it is crucial to closely follow the manufacturer's recommendations include surface preparation, mixing, and placing requirements. It rapidly cures and is usually allowed to be opened to traffic in about 4 hours. It can also be used on concrete columns and beams.

For those structures located on a paved routes (not on township roads), an epoxy flood coating is applied the following year after new installation (year 2) and every 5 years thereafter because the epoxy wears over time. The reason we do not apply this product on bridges located on gravel roads is due to the lack of road salt applied.

c. Epoxy Chip Seal

The SDDOT has been performing similar applications with the addition of a very specific gradation and type of granite which is called an Epoxy Chip Seal. This combination has proven to be very effective in sealing bridge decks as well as increasing the surface friction. Because of the specific types of equipment needed and tight quality controls necessary to achieve success, Minnehaha County has elected not to perform this type of work in-house. Long term adhesion to the deck surface can be problematic. Plus the granite/basalt is quite expensive. However, we will consider using contractors when and if the need arises.

d. Other Sealants

Pro-Epoxy 300 is another type of sealant used in deck repairs when the concrete of a new patch is cured. The product is applied to the saw-cuts.

viii. Column Jacketing

Placing a secondary outer surface on bridge columns is a relatively simple process requiring similar cleaning and concrete removal techniques described below under

bridge deck repairs. The major difference is the columns are oriented vertically so the grout needs to be contained when poured.

The need to perform column jacketing arises from damaged concrete either from ice and debris collisions and/or spalling and delamination of the concrete due to rust building upon the reinforcing steel.

When repairs are simple and do not include adding or removing reinforcing steel, county forces are capable of performing this work. When repairs become structural in nature, we rely on consultants to design and inspect these more complicated projects. The US Army Corps of Engineers should be consulted for necessary permitting.

ix. FRP Wraps

FRP is an acronym for Fiber Reinforced Polymer. An FRP wrap combines lightweight, high-strength fibers (glass or carbon) with premium resins to create an externally bonded reinforcing system that is ideal for applications on existing structure elements.

FRP wrap is extremely flexible in its application and can be used on nearly any type of structural member in order to harden and increase structural capacity and protect against uplift, progressive collapse, and spalling. Because of its ability to harden a structural member without significantly increasing its size, FRP wraps can be used in confined space applications and on irregular member geometries.

Minnehaha County relies on outside expertise in the design and application of FRP wrap.

C. Bridge Overlays

Overlays significantly increase the life of the deck by sealing the deck surface from chlorides and reducing the impact of aging and weathering. Overlay systems include

waterproofing membranes with asphaltic concrete, concrete overlays, and methyl methacrylate and polymer-system overlays.

Some localized patching can be performed by in-house forces as Concrete Surfacing Repair. When the repair required is more substantial and involves concrete forming or steel reinforcement replacements and additions, we call this Structure Concrete Repair and leave to consultants to design and contractors to build. Because bridge deck overlays are commonly needed and widely performed, extra detail is included herein to assist bridge managers and maintenance personnel.

Concrete Surface Repair is defined as repair of concrete surface deterioration using low slump concrete or Portland Cement Concrete (P.C.C.) mix when no forming or placing of reinforcing steel is required. Structural Concrete Repair is defined as repairing structural concrete deterioration or damage where forming or steel reinforcement placement is required.

The two are closely related and use the same materials and methods for the most part. One of the differing variables is in how much material needs to be removed. Several types of concrete removal are required to properly prepare the surface and to remove delaminated concrete. The bond between the bridge deck and the overlay is critical. Therefore, special attention needs to be given to properly prepare the surface prior to applying the concrete patch or overlay.

The most common types of equipment required include:

- Scarifier or Milling Machine
- Power Hand tools such as 30-pound jack hammers and 15-pound chipping hammers
- Concrete Saws
- Abrasive Blasting Equipment including media and large air-compressor

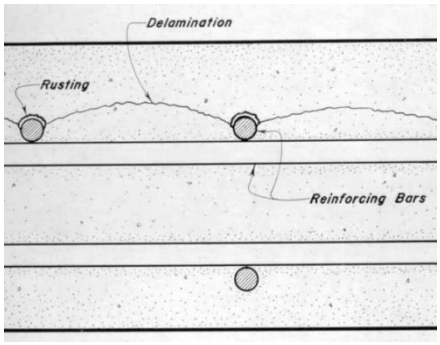
Type 1A Removal is intended to remove surface contaminants and to provide a sound bonding surface. This consists primarily of removal through scarifying the top 0.25 inches of the entire deck surface (and possibly approach slabs). Additional depth of scarification may be specified in some areas to improve the profile or ride quality. Accurate grade control during scarification is essential.

Type 2A Removal is intended to be used when removing an existing overlay is required. This requires additional passes with scarification equipment to remove thin unsound areas of the previous overlay.

These areas should be approved by an engineer or somebody experienced in the use of sounding hammers. Extreme care must be used to assure no damage to reinforcing steel occurs. Type 2A Removal stops (depth) the moment steel is encountered.

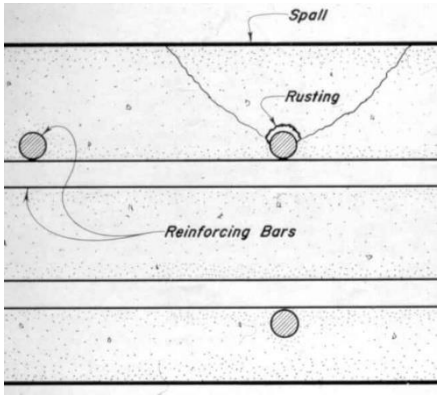
Often encountered while doing this type of work is the need to remove extra concrete because of *delamination* of the bond between concrete and steel or *spalls*. Both of these result from internal pressure caused by the buildup of rust corrosion on the reinforcing steel.

<u>*Delamination*</u> are areas where the concrete has not properly bonded with the reinforcing steel. The resulting planar cracks (running parallel to the surface) are due to corrosion of rebar near the top surface or below embedments.



By tapping the concrete with a hammer (sounding) or by chain-dragging, delaminations can often be detected. A hollow sound indicates a delaminated area.

<u>*Spall*</u> are areas where concrete has become broken. Small spalls, or pop-outs, can occur at edges where bar ends terminate near the concrete surface or at other localized areas of shallow concrete cover. However, larger spalls occur near embedments and where long sections of reinforcing steel, with insufficient cover, run parallel to the concrete's surface.



Type 1B Removal consists of removal only of the areas determined to be delaminated or spalled that have been marked out after hammer sounding or chain dragging. The depth of this type of removal is from the top deck surface down to the top of the top mat of reinforcing steel.

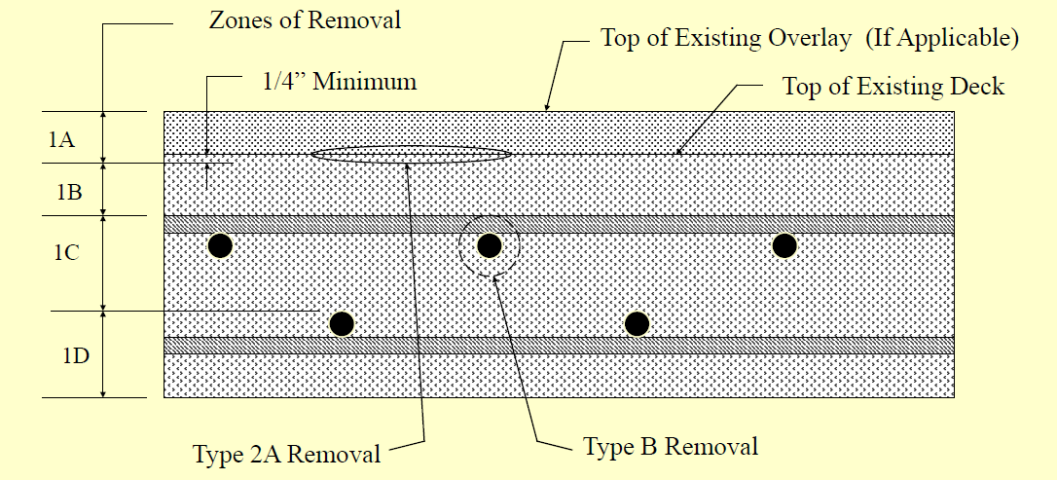
After Type 1B Removal is complete, the areas are re-sounded to determine if additional depth of removal is required.

Type 1C Removal consists of removing the additional areas that have delaminated or spalled after completing the Type 1B Removal. These areas will go deeper than the top mat of reinforcing steel. The bottom limit of Type 1C Removal will vary but must stop at the top of the bottom mat of reinforcing steel. During the removal operation, the areas should continually be re-sounded until the area of good concrete is encountered.

Type 1D Removal occurs when removing delaminated concrete is found to be deeper than the top of the bottom mat of reinforcing steel. Areas of Type 1C Removal are resounded and if more delamination is discovered, they are removed full-depth.

Type B Removal consists of removal of concrete around the periphery of reinforcing steel. This is generally performed on isolated bars that have de-bonded around the bar for more than one-half the circumference. The difference between this and Type 1C is subtle and either can be used but Type B Removal is generally used over a length following one or more specific locations following a bar. Specific to Type B removal is the requirement to remove enough material to ensure a clearance of 0.75 inches around the bar.

The various removal types are illustrated in the graphic below.



Inspectors and installers need to be keenly aware for the level of care required on concrete deck repair projects -- some highlights of which include:

- Scarified surface shall continuously kept clean
- Upon completion of Type 1A Removal (Scarification)
  - Traffic is NOT permitted on the scarified surface

        - Construction equipment on the scarified surface should be minimized
        - Equipment that is allowed on deck shall be equipped with diapers to prevent oil or grease from contaminating the surface.
        - If grease or oil contamination does occur, additional scarification, removal, or detergent cleaning must be done.
    - Jack hammers no heavier than 30 pounds are allowed for Type 1B removal (down to top mat of reinforcing steel)
    - Jack hammers no heavier than 15 pounds are required when working around reinforcing steel.
    - Extreme care shall be taken to prevent damage to reinforcing steel in all cases.
    - The edges of removal areas shall be kept as near to vertical as possible or left to be slightly tapering inward. No reverse tapers shall be left within removal areas.
    - No more than 24 hours prior to concrete placement, the deck shall be cleaned using abrasive blasting. This removed contaminants and enhances the bond of the new concrete to the in-place concrete.
    - Re-blasting is required when delays result in exceeding 24-hour limitation or when rain or high winds cause contamination to occur after initial blasting.
    - After abrasive blasting is complete, the entire deck shall be thoroughly blown clean using compressed air.
    - Full depth holes (Type 1C/1D Removal) require shoring from bottom side of deck and shall be filled up to the level of the scarified surface prior to placing the low slump overlay.
    - Carefully review the Section 550 and Section 460.3E of *Standard Specifications for Roads and Bridges*.
    - When more than 30% of longitudinal bars on a continuous concrete bridge OR 30% of the transverse bars on a steel girder bridge are freed up in any area that is 10 feet wide, a structural engineer needs to be consulted immediately. See picture below.

The picture at left is a good example when a structural engineer needs to be consulted.

When placing the low slump overlay, some key points to remember include:

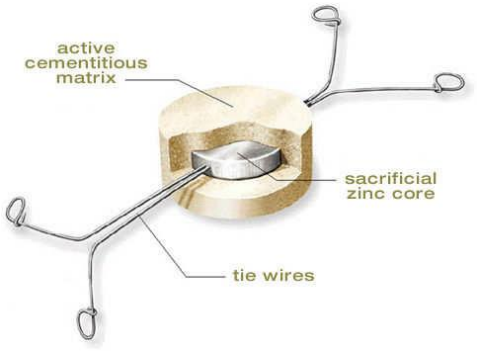
- Paver shall achieve a minimum pour rate of 40 feet per hour.
- Maximum placement width is 24 feet.
- Surface temperature shall be greater than 40 degrees and the ambient temperature shall be between 45 and 80 degrees.

- Fresh concrete shall be maintained at 45 degrees or more for 72 hours after placement.
- No placement allowed when air temperature exceeds 85 degrees. Fogging equipment is required when above 80 degrees.
- Slump must be 1 inch maximum.
- Air content between 5% and 7%.
- Required testing includes slump, concrete temperature, air content, and unit weight.
- Wet burlap or other system to maintain wet cure for at least 72 hours is required.
- No traffic for 72 hours after placement.

D. Corrosion Protection

When performing concrete deck repairs, it is inevitable that rust on the reinforcing steel will be encountered. The continuous build-up of this rust has a negative impact on the structural integrity of the deck and leads to weakening the strength of the concrete thus leading to lower posting requirements and eventually failure if not proactively treated.
The chlorides used in road salts eventually seep into the deck and accelerate the formation of rust on the reinforcing steel. This action is much like a battery where the chlorides ionize and react with the iron in the re-bar which oxidizes the steel and creates rust. This is the major source of corrosion around the re-bar that causes delaminations and spall; however, normal concrete contains a variety of chlorides, chlorates, and other ionizing chemicals that would eventually react with the iron in the steel rebar but road salt greatly speeds up this process.

To counteract the galvanic reaction that occurs between chlorides and iron, another material is introduced into the deck that the chloride ions are more attracted to than the iron in the re-bar. Galvanic protection systems utilize sacrificial anodes that naturally generate an electrical current to mitigate corrosion of the reinforcing steel.



In concrete structures, zinc anodes are typically used. Galvanic protection for concrete can be classified into two categories: targeted protection for concrete repair, and distributed systems for blanket protection.

Discrete anodes are used to provide targeted protection around concrete patches, and can also be placed into drilled holes on a grid pattern in sound concrete to provide distributed protection. Vector, BASF, Euclid, and Sika Corp, all offer zinc anodes that are used to provide targeted protection for concrete patch repair.

The Federal Highway Administration has stated *that "cathodic protection is the only rehabilitation technique that has proven to stop corrosion in salt contaminated bridge decks regardless of the chloride content in concrete" (NCHRP Report 558, page 34).*

Discrete zinc anodes are normally intended to provide corrosion protection for only the top mat of reinforcing steel; since the top mat is usually where concrete is chloride contaminated and where corrosion takes place.

The number and spacing of anodes is determined by the steel density ratio which is a calculation of the surface area of the reinforcing steel to the area of repair. Product manufacturers supply spacing tables based on the steel density ratio for each anode type. Anodes are estimated to provide 5 to 15 years of corrosion protection.

The protective current supplied by sacrificial anodes will decrease slowly with time as zinc corrosion products accumulate. The recommended anode spacing provided by the manufacturers provides a balance between desired service life and reasonable cost. Altering the anode spacing will change the service life, but the relationship between the spacing and the service life is not linear. Doubling the anode spacing (therefore halving the anode cost) will reduce the expected service life by much more than half. Halving the anode spacing will extend the expected service life by more than double, but at greatly increased cost.

Since the corrosion products of zinc occupy more volume than the original zinc, means must be provided to accommodate this expansion. Vector encapsulates the zinc in a high alkaline environment to chemically control expansion. Euclid allows for the expansion of the zinc corrosion by-products by using compressible materials within the encasement. This information and more can be found within the *NCHRP Report 558* Chapter 5, "Extension of Service Life with repair and Corrosion Mitigation Options".

Minnehaha County uses one Vector Galvashield XP zinc puck per two square feet of area when performing minor deck repairs similar to the picture shown above. However, for larger repairs, a professional specialist should be consulted.

We are open to using a product called Z-bar which is a rebar that has zinc integrated into its production; however, historically when bid as an alternate, this product's cost has been prohibitive. Perhaps in the future supply and availability will improve the bidding environment surrounding this product.

E. Bridge Rehabilitation

Rehabilitation involves major work required to restore the structural integrity of a bridge as well as work necessary to correct major safety defects.

Rehabilitation work can be done on one or multiple elements and/or components. Bridge rehabilitation projects are often intended to restore the structural integrity of a bridge and correct major safety defects.

Bridge rehabilitation activities are considered bridge preservation. However functional improvements such as adding a travel lane or raising vertical under-clearance, while often is considered as rehabilitation are not considered preservation.

Bridge rehabilitation projects provide complete or nearly complete restoration of bridge elements or components. These projects typically require significant engineering resources for design, a lengthy completion schedule, and considerable costs. Most rehabilitation projects include repairs to several bridge components but can be limited to bridge deck replacement.

Examples of bridge rehabilitation include but are not limited to:

- Partial or complete deck replacement
- Superstructure replacement
- Strengthening.

Incidental widening is often associated with some of these activities.

Minnehaha County relies on recommended improvements as outlined in bridge inspection reports. We use expertise within the consultant community to design and inspect bridge rehabilitation projects.

F. Bridge Replacement

Bridge Replacement is defined as the total replacement of a structurally deficient or functionally obsolete bridge with a new facility constructed in the same general traffic corridor. A nominal amount of approach work, sufficient to connect the new facility to the existing roadway or to return the gradeline to unachievable touchdown point in accordance with good design practice is also eligible. The replacement structure must meet the current geometric, construction and structural standards required for the types and volume of projected traffic on the facility over its design life.

Similar to bridge rehabilitation, bridge replacement projects require engineering resources for design, a substantial and complex completion schedule, and considerable costs. Life cycle costs and other economic factors are usually considered when weighing rehabilitation versus replacement costs.

i. Structurally Deficient

Bridges are considered structurally deficient if significant load carrying elements are found to be in poor condition due to deterioration and/or damage, or the adequacy of the waterway opening provided by the bridge is determined to be extremely insufficient to the point of causing overtopping with intolerable traffic interruptions.

To be considered structurally deficient one of the two following conditions must be met:

- A bridge component (deck, superstructure, substructure or culvert) having an NBI general condition rating of a 4 or less (poor condition), OR
- Structural Evaluation or Water Adequacy rated a 2 or less (a bridge with a very low load rating capacity, or a bridge that is subject to overtopping with significant or severe traffic delays or presents significant impacts to adjacent properties).

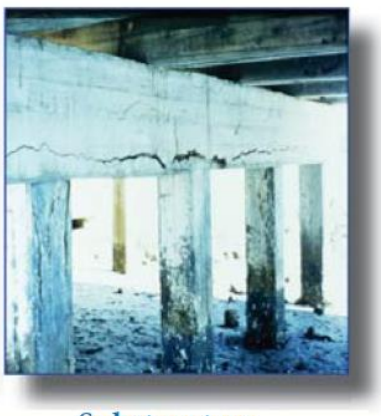
In addition, for a structure to be considered structurally deficient, one of the following items must be true:

	NBI GENERAL CONDITION RATINGS				APPRAISAL RATINGS	
NBI Item#	58	59	60	62	67	71
	Deck	Superstructure	Substructure	Culvert	Structural Evaluation	Waterway Adequacy
Code	<= 4	<= 4	<= 4	<= 4	<= 2	<= 2

The following pictures show three different bridges that are considered structurally deficient for different reasons:

Deck

Superstructure



Substructure

ii. Functionally Obsolete

Bridges are considered functionally obsolete when the deck geometry, load carrying capacity (comparison of the original design load to the current State legal load), clearance, or approach roadway alignment no longer meet the usual criteria for the system of which it is an integral part. In general, functionally obsolete means that the bridge was built to standards that are not used today.

Examples of characteristics leading to a functionally obsolete classification include:

- Low load carrying capacity
- Low waterway adequacy
- Insufficient deck roadway width
- Insufficient horizontal and vertical clearances
- Poor approach roadway alignment

For a structure to be considered functionally obsolete, one of the following items must be true:

	APPRAISAL RATINGS				
NBI Item #	67	71	68	69	72
	Structural Evaluation	Waterway Adequacy	Deck Geometry	Underclearances	Approach Roadway Alignment
Code	= 3	= 3	<= 3	<= 3	<= 3

G. STRUCTURAL DESIGN CRITERIA

i. AADT

The minimum traffic volume, average annual daily traffic (AADT), to be used in the design of new structure is the projected volume 20 years after construction. An average annual increase in traffic can be applied based on either the previous five years, taken from a regional traffic model, or confirmed with county staff.

Because structures are designed to have a useable life of 50 to 75 years, the normal 20-year traffic volume projection may not be inadequate. This is especially true when the project is located within the projected growth area of a community.

ii. Speed

Posted speed limits are generally used as the design criteria for speed. In some cases, when vertical curves, stop signs, or other factors influencing travel speeds are present near a structure, it may be warranted to conduct a speed study. In those cases, the 85th percentile speed is generally used as the speed criteria for design purposes.

iii. Clear-width

The minimum distance of clear width for structures is defined as the free, unobstructed distance of the traveled way which includes driving lanes plus shoulders. Since guardrail is placed on bridges, the easiest way to think of the

clear-width is the distance between the inside face of rail from one side to the other.

Table 6-6 in the *AASHTO Manual* shows the minimum roadway widths and design loadings for new and reconstructed bridges and is shown below.

Design Volume (veh/day)	Min. Clear Roadway Width for Bridges [a]	Design Loading Structural Capacity
< 400	Traveled way + 2'	HL-93
400 to 2,000	[b] Traveled way + 4'	HL-93
>2000	[b] Approach roadway (width)	HL-93

a – Where the approach roadway width (traveled way plus shoulders) is surfaced, that surface width should be carried across the structures.

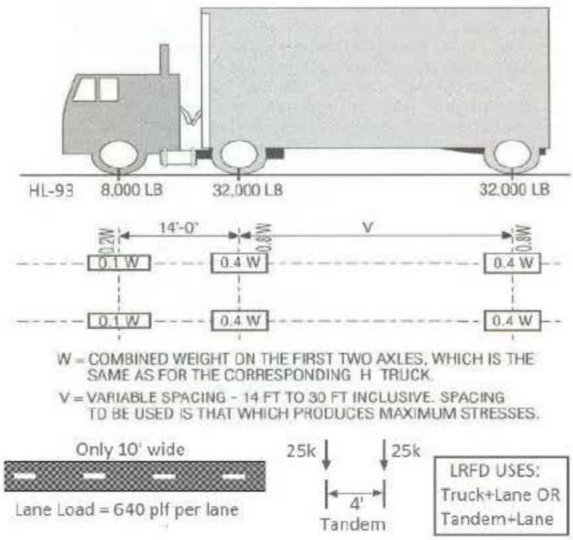
b - For bridges in excess of 100 feet in length, the minimum width of the traveled way plus 3 feet on each side is acceptable.

Supplemental to the above information, it is Minnehaha County's practice to design bridges with clear widths as follows:

- 32 feet (minimum) on any paved road
- 28 feet on any township (gravel) road

iv. Design Load

The design of bridges, culverts, and other structures shall be in accordance with the current *AASHTO LRFD Bridge Design Specifications*. As shown above from Table 6-6 in the AASHTO Manual, all structures shall be designed using HL-93 design vehicle live loading (shown at right).



The HL93 designation consists of a "design truck plus design lane load" or "design tandem plus design lane load," whichever produces the worst case. A "design truck" is identical to the older HS20 load configuration. The "design tandem" is the same also except that the axle load is 25,000 pounds rather than 24,000 pounds. The term "lane load" is relatively new and applies to design of above grade bridge decks. It does not apply to below ground structures. This is confirmed in ASTM C1577, which states

that the tables were created using the AASHTO HL 93 live load without the lane load as permitted by AASHTO.

In addition, when designing new structures, Special Haul Vehicles (SHVs) should be considered because it is very poor practice to place reduced load signs on newly constructed bridges.

For more information on how to incorporate SHV's into the design and analysis of a new structure, consult the SDDOT Bridge Office or the Local Government Assistance Office. Also for more information on SHV's, see the following website: Department if Transportation Bridge Inspection Information

v. Beam and Deck Types

Early in the design of bridge, usually during the Type, Size, and Location Study (TS&L), an evaluation of alternatives for the types of beams and bridge decks is conducted. This includes cost. The most reasonable practicable alternative should be preferred which includes consideration of

- Cost (initial and life-cycle)
- Landowner and environmental impacts
- Long-term maintenance needs
- Flow capacity
- Low beam elevation (existing vs. proposed)
- Finished roadway elevation (existing vs. proposed)
- utilities

Based on a large variety of projects, Minnehaha County has come across the following general trends:

- Pre-cast Double-Tee's and Bulb-T beams bridges do not last 50 years. While they have an attractive initial cost, the weld plates connecting the beams break which allows an individual beam to act independently which often leads to posting the structure for reduced loading and/or accelerated deterioration of the structure. Another primary mode of failure for these precast units is the stem of the beam where loads are transferred onto the beam-seat. The narrow sections begin to crumble. Another issue that leads designers away from choosing this option is due to the amount of camber required, they are not conducive where a 55-mph design speed is desirable.

- Bridges less than 100 feet in length should not require approach spans. An exception can be made if the design includes steel stringers and the amount of thermal expansion/contraction justifies including approach spans and/or sleeper slabs.

- Standard concrete I-beam construction is usually the least structural cost; however, due to their depth, the roadway's finished grade elevation needs

to be raised a significant amount – sometimes rendering this choice as not being the preferred alternative.

- Steel beams usually are not the preferred alternative unless the bridge's length is 200 feet or longer. Even then, due to the high cost of maintenance, other options are typically preferred.

- Soil conditions are rarely conducive for spread-footing foundations.

- Driven H-pile and round pipe pile are preferred. Common sizes range between 10 and 14 inches. The use of pile driving tips is strongly encouraged.

vi. Vertical Clearance

Vertical clearance at underpasses should be at least 14 feet (16 feet preferred) over the entire roadway width, with an additional allowance for future resurfacing.

vii. Horizontal Clearance

See Chapter 1.2.E.ix of this manual for a discussion on Clear Zones and Section 6.2.4.2 of the *AASHTO Manual* on Lateral Offset.

viii. Hydraulics

Hydrologic and hydraulic analyses for structural elements shall be conducted by a person specializing in such disciplines. Furthermore, it is expected that if any change, modifications, or certifications involving either the floodplain or elevation of objects near the floodplain be conducted by a Certified Floodplain Manager in conjunction with a Registered Land Surveyor, as appropriate.

For a complete understanding of how the SDDOT conducts drainage investigations and hydraulic designs, consult the *South Dakota Drainage Manual*.

Some important highlights from this manual and how it relates to Minnehaha County, the following points are provided for convenience:

- Flood plain evaluation will be in accordance with 23 CFR 650A.

- Hydraulic design will normally be for the 25 year storm (Q_{25}) on the paved county system and the 10 year storm (Q_{10})on the township gravel system. These design storm events assume no back-water affect is created. In other words, the hydraulic grade line matches the slope of the thalwag of the stream. If ample vertical space is available, an ideal design would allow for 1 foot of freeboard to accommodate ice flow.

  Furthermore, this assumes there is an over-flow section within close proximity of the structure. If an overflow section does not exist within the approach

grade, the proposed design solution shall not create a rise in the water surface elevation from the 100-year storm.

- Low water crossings will be designed using report #FHWA/RD-83/015, Design and Construction of Low Water Stream Crossings, as a guide. Typically the low water crossings are designed using a 2 year design frequency with 1.5 feet of overtopping depth.

- Scour design will be in accordance with Hydraulic Engineering Circular No. 18 (HEC-18).

- Riprap design will be in accordance with Hydraulic Engineering Circular No. 11 (HEC-11.)

At locations where the current structure functions hydraulically at a storm event less than those noted above, and extensive grading would be required to make the new structure meet these criteria, the designer may request a design exception to maintain the BFE only, on a project by project basis.

Some more helpful information to be considered while conducting the preliminary and final hydraulic design of a structure is as follows:

- Always show the elevation of the 2-year storm (Q_2) in both plan and profile views. This elevation is used to establish jurisdiction by the Corps of Engineers. The area of impact is also defined by the area of the channel inundated by the Q_2. This information is helpful when divulging temporary and permanent cut and fill volumes, as well as temporary and permanent material types, as required on ENG FORM 4345 for the Section 404 permit of the *Clean Water Act* application.

Minnehaha County recommends the use of 2D modeling while conducting the TS&L. Currently three programs are capable of modeling the floodway in 2D:

- SRH-2D developed by the Bureau of Reclamation and sponsored by FHWA.
- HEC-RAS developed by the US Army Corps of Engineers
- XPSWMM/XPSTORM by Innovyze

At this time, one-dimensional modeling is allowed. Minnehaha County prefers SRH-2D because it is soon becoming the standard for departments of transportation across the country and is well supported by FHWA.

ix. Floodplains

The discussion above regarding the 100-year storm centers on the Base Flood Elevation, or BFE. BFE's are provided on FEMA/FIRM maps when a detailed study has been performed as noted be Zone AE. If only Zone A floodplains exist on a FEMA/FIRM map, this means no formal study has been done and no formal BFE is published.

During the modeling of existing conditions, the designer will establish a BFE. This value is not to be exceeded by the proposed solution. The TS&L, or other hydraulic analyses, shall contain a discussion of existing and proposed conditions which shall contain a copy of the FEMA/FIRM map and panel number.

With the use of modern modeling software such as HEC-RAS 2D and SRH-2D, it is very easy to create flood inundation mapping for the proposed solution. This information has proven to be very valuable during landowner negotiations and is also often requested by regulating agencies.

x. No-Rise Certification

No replacement structure shall create a rise in the flood elevation produced by the 100-year storm (1%-chance storm), or Base Flood Elevation (BFE). To this end, whenever a hydrologic and hydraulic (H&H) analysis is done, including a TS&L, the engineer of record shall certify that their design does not create rise in the BFE.

xi. Section 404 Permit

Any project with a contributing watershed area larger than 0.5 acres, and/or occurs on a "blue-line" stream as shown on a traditional USGA quadrangle map, and/or may impact "waters of the United States", requires consultation with the US Army Corps of Engineers in compliance with the *Clean Water Act*. In many such cases, a Section 404 Permit will be required using ENG FORM 4345 as published by the US Army Corps of Engineers.

The South Dakota Regulatory Office can be reached by calling 605-224-8531, or by mail at 28563 Powerhouse Road; Room 118; Pierre, SD 57501.

In addition to the standard information required when applying for a Section 404 Permit using ENG FORM 4345, Minnehaha County has found it helpful to include the following:

- Show the Q_2 in both plan view and profile view for existing and proposed conditions
- Highlight or hatch the area inundated by the Q_2 and also show this area's callout in acres or square feet.
- In a table or in paragraph form, show the volume of cuts and fills including temporary and permanent impacts.
- At about 60% design completion, include within the application:
    - TS&L including appropriate graphics
    - Cover sheet, Plan and Profile sheets, erosion control plans
    - Other information as necessary such as cofferdam construction, temporary construction platforms, by-pass channel design, etc.
    - Pictures of the structure looking up and down stream, pictures from upstream and downstream looking at the structure

For those projects where wetlands other than those typically located adjacent to a streambank, it is a good idea to conduct a wetland investigation by a qualified person and submit a formal request for Jurisdictional Determination (JD) to the US Army Corps of Engineers two to four months prior to submitting the Section 404 Permit application and ENG FORM 4345.

A straightforward project which temporarily impacts less than 350 linear feet of stream channel, and/or permanently impacts less than 0.1 acres of wetland or other waters of the United States will take about 90 days or less to get an approved Section 404 permit from the US Army Corps of Engineers. If formal consultation with the US Wildlife Service is required because of threatened or endangered species (T&E), one can expect that time to at least double and may take up to six months.

Similarly, if the structure being removed is greater than 50 years old and/or may present some loss to an archeological or historical resource, additional coordination and paperwork may be required in compliance with the *National Historic Preservation Act* as directed by the State Historic Preservation Office (SHPO).

The US Army Corps of Engineers, Regulatory Office, will provide information and guidance about what to do for T&E as well as SHPO ***after*** the ENG FORM 4345 and Section 404 Permit application has been submitted.

Regional Conditions for Nationwide Permits: The Omaha District of the US Army Corps of Engineers promulgated Regional Conditions for all Nationwide Permits. Their most recent update is dated from 2017. Nationwide permits are generally the simplest authorization for categories of activities that are similar in nature and that have minor environmental impacts. These permits are valid only if the proposed activities comply with all the terms and conditions of the permit. If the conditions cannot be met, a regional or individual permit is required. To review all the Regional Conditions, go to:
Nationwide Permits Regional Conditions Information

Some useful highlights from Omaha District's Regional Conditions include the following:

> Minimum Culvert Width: In stream channels the culvert opening width of a stream crossing shall not be less than the mean bank to bank width as measured from the ordinary high water mark in the affected stream reach. In stable stream channels, the ordinary high water mark (OHWM) is often found at the point where over-bank flow begins during a flood event. In incised stream channels that do not frequently access a floodplain or upper terrace, the OHWM is generally located within the entrenched channel. The OHWM may be identified by observing indicators such as a distinct change in slope, a change in vegetation characteristics, or a change in sediment characteristics. Common practice is to use the elevation of the stream resulting from the 2-year storm (Q_2) to establish OHWM.

Common practice is to use the elevation of the stream resulting from the 2-year storm (Q_2) to establish the OHWM.

Note that the South Dakota Drainage Manual recommends using a factor of 1.2 times the "normal" stream width for both culverts and bridges as the minimum recommended open structural width. In Minnehaha County's experience, using the Q_2 width at a location near the structure where the streambanks are stable has been accepted by the USCoE-Regulatory Office.

Culvert Counter-sink Depth: In streams with intermittent or perennial flow and a stable stream bed, culvert stream crossings shall be installed with the culvert invert set below the natural flow line of the stream channel according to the table below. This regional condition does not apply in instances where the lowering of the culvert invert would allow a head-cut to migrate upstream of the project into an unaffected stream reach.

CULVERT TYPE	DRAINAGE AREA	Minimum Distance Culvert Invert Shall be Lowered Below Stream Flow Line
All culvert types	$\leq$ 100 acres	Not Required
Pipe diam. < 8.0 feet	100 to 640 acres	0.5 feet
Pipe diam. < 8.0 feet	> 640	1.0 feet
Pipe diam. $\geq$ 8.0 feet	All drainage sizes	20% of pipe diameter
Box Culvert	All drainage sizes	1.0 feet

- The stream flow line shall be defined as the longitudinal average of the low flow stream channel.
- The slope of the culvert should be parallel to the slope of the stream flow line.
- The culvert invert depression depth shall be measured at the culvert inlet for culverts installed at a slope less than the slope of the stream flow line.
- Riprap inlet and outlet protection shall be placed to match the height of the culvert invert.

There are many other conditions placed on Nationwide Permits. Designers, inspectors, and the party performing the installation should thoroughly understand these conditions as well as other special provisions that may be associated with the Section 404 Permit issued by the US Army Corps of Engineers.

xii. Bridge Rail

Bridge rail design is an evolving practice among the DOT's around the country. In Minnehaha County, for bridges on the paved highway system, concrete bridge rail (jersey-barrier) is preferred.

For those structures located on the township system of gravel roads, surface mounted box-beam rail (T101) is preferred.

The reason side-mounted box beam rail (SL-1 and T115) is not preferred is, when maintenance needs to be performed on this rail, county staff has an easier time working from the top down versus working from the side of the deck. Special consideration should be given to the desired clear-width through the structure.

In addition, there are a variety of standards and guidance governing the use of thrie-beam bridge rail as well as rail termination types and styles. The designer should evaluate which is most appropriate per each location given the traffic volumes, speeds, functional classification of the roadway, associated grading, pavement cost, and other variables.

As stated on page 20, under the design criteria for local rural roads, within the *SDDOT Local Roads Plan* (2011), it is stated:

> "*Bridge rail end protection and bridge rail systems that have been crash tested in accordance with NCHRP 350 will be provided on Rural Collectors and Local Rural Roads with ADT's greater than 150. Rural Collectors and Local Rural Roads with ADT's less than 150 may have rail end treatments turned down 15° or flatter and rail systems designed in accordance with NCHRP 350 Test Level 2 or better design criteria. The {Local Government Assistance} Section maintains details for several rail systems that meet the criteria noted. These details also address the type and length of approach rail if applicable.*
>
> *Rail designs that may be needed for special conditions (i.e. an approach or intersection located within such close proximity to a structure as to interfere with the standard rail placement, rehabilitation of existing rail, etc.) will be in accordance with current SDDOT guidelines.*"

xiii. Typical Signing

Properly designed bridges will have Type 2 object markers (stickers) located at the leading face of all approach rail located on all four corners.

In the case where the bridge deck clear width is narrower than the traveled way (lane width plus shoulder width), then Type 3 object markers are used instead of the Type 2's, with the Type 3 markers located at the bridge ends on all four corners (single sided, facing the approach direction). In addition to the Type 3 markers, there shall also be a series of 4 double-sided delineators spaced every

50 feet starting at the beginning of the narrowed section for a total of 200 feet each at the four corners.

xiv. Right of Way and Easements

Minnehaha County has taken a unique approach regarding right-of-way around county structures located on the paved highway system. Horizontally, 25 additional feet of right-of-way is acquired beyond the typical 50 feet per side. The length this extra area extends is 25 additional feet measured longitudinally from each bridge end. This H-lot (highway use re-plat) is done on both sides of the structure.

The reasons this extra area is acquired is,

1) This is a typical area needed for temporary construction and/or permanent easement anyway, for which the county usually pays for, and

2) In the future, when maintenance is required that forces county personnel to access the abutments, bents, and/or adjacent channel, a trespassing issue is avoided.

However, in the cases where the project is located on a township road, in lieu of acquiring an H-lot, permanent storm water easements are acquired. This is because no public right-of-way exists on township roads as landowners actually own to the center of the section-line road (typically). See Section 6 for more information.

xv. Other Considerations

- High-tension cable rail is gaining favor within the transportation community. Minnehaha County prefers to use high-tension cable rail when conditions are suitable. The reason for this is due to its lesser footprint in terms of grading requirements and lesser area of asphalt required. One caution about high-tension cable rail is that when repairs are needed, specific training is required. Therefore, when repairs are required Minnehaha County does not do this work using in-house personnel.

- In the event that bikes or pedestrians need to be accommodated across a bridge, the standard rail height is 42 inches. This and other design considerations can be found in the *Guide for the Development of Bicycle Facilities*, 2012, 4th Edition by AASHTO.

- When painting box-beam rail, the products shall be the following, or approved equals:

- For bridge field paint in the color of BRIDGE ORANGE, use Devguard 4308 by ICI/Devoe, Interlac 665 by International Paint, or Interthane 870 by International Paint.

- For primers, use Amercoat 5105 by PPG Industrial Coatings, Devguard 4160 by ICI/Devo, or Interlac 573 by International Paint.

- Standard cross-slope on any structure shall be 2% on paved county highways and 3% on township roads.

- Minimum longitudinal slope on any bridge deck is preferred to be 1% minimum.

- For all transverse culverts:

  - these will always be reinforced concrete pipe (RCP)
  - all sections are to be bolted together with tie bars.
  - if it is a box culvert (RCBC), each end-section shall include a parapet.

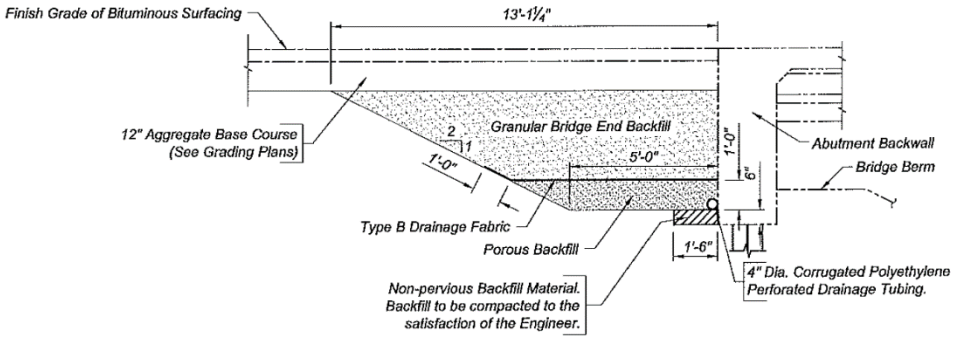
- Bridge deck drains are encouraged and shall be placed near the quarter points for any three-span structure at a minimum. For other bridge types and lengths, the designer shall consult with the SDDOT Bridge office, the LGA Office, and county management.
- The location of the date stamp (the year the structure was constructed) shall be on a vertical face on the left side visible upon entering the structure in both directions. For box culverts, the locations will be determined in the field.

- Survey markers shall be installed on the southwest and northeast corners of the structure on a horizontal concrete face that is easily accessed from above using standard survey equipment. These markers will be provided by Minnehaha County and shall be stamped by a Registered Land Surveyor no later than when the initial inspection is to take place, or within 30 days of substantial completion, whichever comes first. The datum, coordinate, and elevation data of these markers shall be recorded on the as-built drawings.

- Minnehaha County's preferred geometry at the top of the rip-rap located inside the abutments is a 2-foot wide bench instead of the SDDOT's standard 5-foot wide bench.

- Liquefied spray mulch and seed are preferred over punched straw mulch and drilled seed because of the limited areas and challenging terrain often associated with stand-alone bridge projects.

- Minnehaha County has developed a unique standard for granular bridge end backfill located behind abutments and adjacent to larger culverts. An example of which is shown below.



In the example above, the length and depth will vary as a function of the height of Abutment Backwall. The granular bridge end backfill shall consist of ¾ inch crushed quartzite rock meeting the following gradation:

SIEVE DESIGNATION	PERCENT PASSING
1 INCH	100
3/4 INCH	91–100
1/2 INCH	68–89
3/8 INCH	57–80
NO. 4	37–66
NO. 8	25–48
NO. 16	18–40
NO. 30	14–35
NO. 40	13–31
NO. 50	10–27
NO. 100	6.1–20
NO. 200	3.3–12

H. Type, Size, and Location Studies (PE)

Most consultants, bridge engineers, and water resource specialists working in and around Minnehaha County have experience in working with the SDDOT Bridge office and have done so for over a period of time. As such, they have become personally familiar with the South Dakota Drainage Manual -- in particular, Chapter 4-Planning and Location, Chapter 5-Data Collection, Chapter 6-Documentation of Hydraulic studies, and Chapter 14-Bridge Hydraulics. A keen understanding of the South Dakota Drainage Manual is paramount to performing good hydraulic and hydrologic design, similar to how important understanding LRFD is for structural engineers.

In addition, the Local Government Assistance Office has promulgated rules and guidance for the Bridge Improvement Grant (BIG) Fund program. Of which, there are sections outlining what is expected in terms of preliminary and final design, which includes Type, Size and Location Studies, commonly referred to as TS&Ls. The guidance also includes minimum geotechnical testing and boring requirements.

When questions arise during the design of a bridge or culvert, the designer is encouraged to seek answers from these references, as well as Section G of this document, under Chapter 1.3-Bridges, prior to contacting the county.

Rather than regurgitate those standards and guidance, the following section briefly introduces what is expected from our consultants when preparing a TS&L.

The following chapters are usually presented in a report format:

- Cover Page
- Table of Contents
- Introduction
- Existing Conditions including geotechnical information
- Bridge Hydraulics and Scour Potential
- Bridge Alternatives Considered (no less than two)
- Roadway Design, including grading and utilities, and potential landowner impacts
- References
- A list of figures
- An Appendix which contains preliminary cost estimates, results from modeling, other interesting graphics and information, hydraulics data sheet for the preferred option, and a No Rise Certification.

Minnehaha County expects to be contacted early in the TS&L process to gain an understanding of existing conditions. At that point, bridge types and other design issues can be discussed such as landowner impacts, utilities, grading, etc.

A second formal meeting should be held after preliminary modeling and design is complete for the various design alternatives, including cost estimates. Other informational meetings may be held as the need arises.

Once all preliminary information is known and all preliminary issues have been fully vetted and discussed, a final TS&L meeting will be held where the preferred alternative will be selected. At this point any final remaining issues can be discussed and decided upon prior to submitting the Final TS&L and then proceeding to final design preparation.

Arrangements for geotechnical investigations should be made prior to commencing with bridge design alternatives. This includes a D_{50} / D_{90} analysis of the streambed materials in order to analyze scour potential. The county will also send out landowner notification letters prior to commencing with survey.

1.4 SIGNS

A. Inventory

In 2015 and 2016, all roadside signs within Minnehaha County were replaced with new High Intensity Prismatic reflective faces through a grant from the SDDOT.

STOP signs and NO PASSING ZONE signs use Super High Intensity reflective faces. From this project, a complete inventory for county wide signs was created. This inventory is stored within the mapping portion of the Planning Department.

The inventory system manages the following sign components separately:

- Sign Text/Symbol
- MUTCD standard sign number
- size of sign
- post type, size, and length
- T-post locations
- Condition (Reflectivity)
- Inspection and Repair Dates

B. Maintenance

i. Mailboxes

Standard policy for Minnehaha County is to replace any downed mailbox caused by county forces with a 2-inch square post inside a 2.25 inch base and either a medium or large steel mailbox, no matter what existed previously. In those cases where the landowner prefers something different than what we provide, it is our practice to dig the hole for their post and the landowner completes the installation in accordance with provided US Postal Service guidance.

If climactic conditions prevent the installation of a new permanent mailbox and post, county forces will provide a temporary mailbox within 24-hours of notice (or the next business day) until such time that a permanent installation can be completed.

ii. Downed STOP Signs

As soon as Minnehaha County highway staff receive notification that a STOP sign has been damaged or downed from a collision, we make reparations as soon as possible – usually well within 24 hours.

iii. Franklin Posts

Though not solely a maintenance item, the use of non-heavy duty u-channel posts, commonly referred to as "Franklin posts", occurs weekly. These Franklin posts weigh 1.12 pounds per linear foot and are usually seven feet long. Minnehaha County uses them frequently when installing or repairing:

- Delineators
- Rural address signs
- Type 2 object markers

iv. Flexible Object Markers

In areas where vertical clearance of Type 3 object markers is an issue, Minnehaha County uses flexible object markers. More specifically, a square to round

breakaway insert is placed between the vertical and base assembly. This hard to find part number is XKBSMA42520-G, Surface Mount Klein Break.

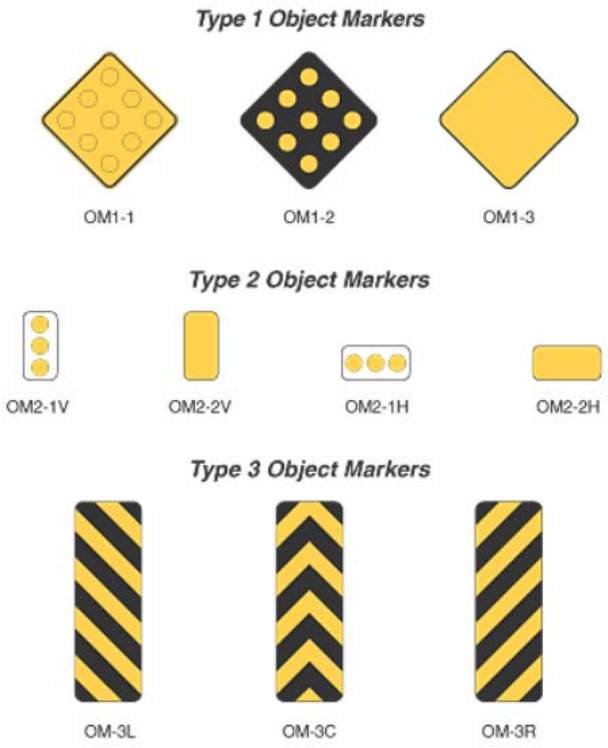
C. County Practices

Minnehaha fully complies with the *Manual of Uniform Traffic Control Devices* (*MUTCD*). However, there are some unique aspects how Minnehaha County achieves this accordance.

i. Object Markers

Chapter 3C of the *Manual of Uniform Traffic Control Devices* (MUTCD) addressed object marker design and placement height. Object markers are used to mark obstructions within or adjacent to the roadway. Images of the three types of object markers are shown on the following page.

Type 1 objects are either a marker consisting of nine yellow retroreflectors, each with a minimum diameter of 3 inches, mounted symmetrically on a yellow (OM1-1) or black (OM1-2) diamond panel that is 18 inches or more on a side; or on an all-yellow retroreflective diamond panel (OM1-3) of the same size. *Type 1 object markers are not used by our maintenance staff*.



Type 2 object markers are either a marker (OM2-1V or OM2-1H) consisting of three yellow retroreflectors, each with a minimum diameter of 3 inches, arranged either horizontally or vertically on a white panel measuring at least 6 inches by 12 inches, or on an all-yellow horizontal or vertical retroreflective panel (OM2-2V or OM2-2H), measuring at least 6 inches by 12 inches.

In Minnehaha County Type 2 object markers are used in the following instances:

- At all four corners of box culverts located adjacent to both sides of the culvert ends at all four corners of inlets and outlets.

- At culverts larger than 24 inches in diameter (or equivalent). For these, each receive a single post that is double-sided with Type 2 object markers located adjacent to the culvert end on the traffic approach side.

- Some bridge ends that have not had their guardrail updated to meet current AASHTO guardrail standards.

- Any obstacle within the clear zone not mounted on approved break-away devices that project 4 inches or higher than the ground surface. This does not include guy wire tie-downs.

Type 3 object markers are a striped marker measuring 12 inches by 36 inches, consisting of a vertical rectangle with alternating black and retroreflective yellow stripes sloping downward at an angle of 45 degrees toward the side of the obstruction on which traffic is to pass. The minimum width of the yellow and black stripes is 3 inches. In Minnehaha County, Type 3 object markers are used when:

- Approaching a structure that is narrower than the roadway (includes shoulder width). The mounting location is visually in-line with the structure opening as close to the structure as possible and sometimes actually gets mounted on the structure.

- Anytime an obstruction is narrower than the roadway. Often times, these applications are used in conjunction with approach delineators.

  Culverts located inside county right-of-way that service private property (ie., approach culverts) do not receive the standard Type II object markers. Instead, they receive an inverted T-post. This is discussed in more detail a little further along in this section.

  Other unique applications for delineation in Minnehaha County include:

- Steel T-posts with a yellow reflective cylinder are used to designate the presence of transverse culverts located under county highways when the culvert diameter is 24 inches and less.

ii. Delineators

Chapter 3F of the MUTCD addressed delineators. Delineators are particularly beneficial at locations where the alignment might be confusing or unexpected, such as at lane-reduction transitions and curves.

Delineators are effective guidance devices at night and during adverse weather. An important advantage of delineators in certain locations is that they remain visible when the roadway is wet or snow covered. Delineators are considered guidance devices rather than warning devices. Delineators may be used on long continuous sections of highway or through short stretches where there are

changes in horizontal alignment. Delineators are mostly used around structures and to designate areas where it would be hazardous to depart from the roadway.

They are used at box culverts when the end of the culvert terminates inside the clear zone. They are also used at all county highway structures except for when a box culvert is located outside of the clear zone.

The delineating of curves is presented in the MUTCD; although, it can be complicated. The following guidance is offered to assist the sign specialist or roadway designer.

Delineators are installed on ALL curves that

- have a radius of less than 2,300 feet,
- a degree of curvature greater than 2.5 degrees, or,
- an obstruction that blocks the line of sight along a curve less than 1,584 feet long.

The Spacing along the outside radius of horizontal curves and the leading and trailing delineators are determined by the following table:

Spacing (S) for specific radii not shown in the table may be interpolated from the table or computed using the following formula:

$$S = 3 \times (R-50)^{0.5}$$

		Spacing in Advance & Beyond Curve (in feet)		
Radius Of Curve	Spacing On Curve	1st	2nd	3rd
50	20	40	65	125
150	30	60	90	180
250	40	85	125	250
300	50	95	145	290
400	55	110	170	300
500	65	125	190	300
600	70	140	210	300
700	75	150	230	300
800	80	165	245	300
900	85	175	260	300
1000	90	185	275	300

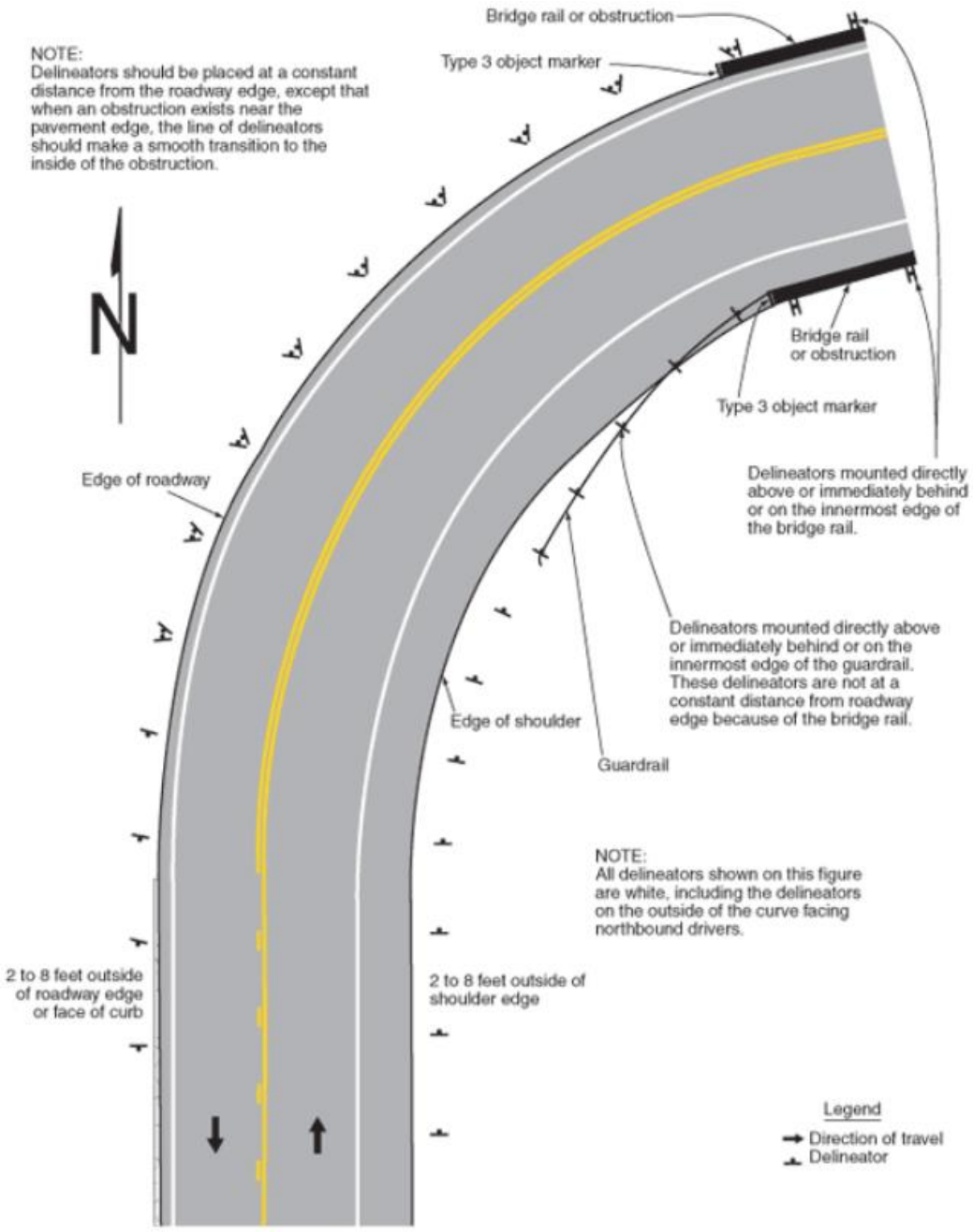
The minimum spacing should be 20 feet and the maximum shall not exceed 300 feet. The leading and trailing delineators are to be spaced 2xS from the curve tangent then 3xS from the first delineator, then 6xS from the second delineator.

Some other major pointers to remember are:

- Delineators are not required on the outside radius' of curves when W1-8 signs are present. In ALL other instances, they are required.

- Leading and trailing delineators are recommended but not required by the MUTCD.

The following figure is Figure 3F-1 - Examples of Delineator Placement.



Often times, delineation on curves is used in conjunction with chevron warning signs (W1-8). Geometry and design speed (or comfort speed in those cases where signs need to be retrofitted to an existing curve that has been ball-banked) govern the installation delineators and chevrons around curves.

Also, during reconstruction projects and major rehabilitation projects, tube-type delineators, also referred to as edge-line delineators, are being installed at major intersections. This application is currently in vogue by the SDDOT and is slowly

becoming more standard in counties; however, most plow drivers do not like them.

iii. Curves

Part 2c of the MUTCD contains detailed information regarding the appropriate use and placement of signs around curves. For convenience, some helpful information follows.

When designing curve signage there are two variables that are used in determining the need and the type of curve signage:

1) curve radius, and
2) the comfort speed of the curve.

The radius can be determined by measurements of CAD designs or taken from scaled aerial photographs or measurements in the field. The comfort speed can be determined by the CAD design of the roadway or by in the field measurements while driving the curve utilizing a Ball Bank Indicator. When such measurements are not available, using the 85th percentile speed located at the 2/3 point around the curve can be used.

The facilities that are utilized when signing a horizontal curve include but are not limited to:

- Advance Warning Signs
- Supplement Speed Plaques
- Turn Arrows
- Chevrons
- Delineators

Advance Warning Signs: The placement of the signs in advance of the curve to warn drivers is outlined in Table 2C-4 in the MUTCD which is included below for convenience.

The type of warning sign selected should match as closely as possible to the configuration of the curve. Simple curves and turns are easy. W1-1's and W1-2's are going to be the vast majority. However, there are instances when it may be necessary to install a warning sign like a W1-10b when curves have tangent roads. Custom signs can also be manufactured to represent the existing geometry of a curve to better inform drivers.


W1-1


W1-2


W1-10b

Section 2C.05 Placement of Warning Signs

Support:

01 For information on placement of warning signs, see Sections 2A.16 to 2A.21.

02 The time needed for detection, recognition, decision, and reaction is called the Perception-Response Time (PRT). Table 2C-4 is provided as an aid for determining warning sign location. The distances shown in Table 2C-4 can be adjusted for roadway features, other signing, and to improve visibility.

Table 2C-4. Guidelines for Advance Placement of Warning Signs

Posted or 85th-Percentile Speed	Advance Placement Distance[1]								
	Condition A: Speed reduction and lane changing in heavy traffic[2]	Condition B: Deceleration to the listed advisory speed (mph) for the condition							
		0[3]	10[4]	20[4]	30[4]	40[4]	50[4]	60[4]	70[4]
20 mph	225 ft	100 ft[6]	N/A[5]	—	—	—	—	—	—
25 mph	325 ft	100 ft[6]	N/A[5]	N/A[5]	—	—	—	—	—
30 mph	460 ft	100 ft[6]	N/A[5]	N/A[5]	—	—	—	—	—
35 mph	565 ft	100 ft[6]	N/A[5]	N/A[5]	N/A[5]	—	—	—	—
40 mph	670 ft	125 ft	100 ft[6]	100 ft[6]	N/A[5]	—	—	—	—
45 mph	775 ft	175 ft	125 ft	100 ft[6]	100 ft[6]	N/A[5]	—	—	—
50 mph	885 ft	250 ft	200 ft	175 ft	125 ft	100 ft[6]	—	—	—
55 mph	990 ft	325 ft	275 ft	225 ft	200 ft	125 ft	N/A[5]	—	—
60 mph	1,100 ft	400 ft	350 ft	325 ft	275 ft	200 ft	100 ft[6]	—	—
65 mph	1,200 ft	475 ft	450 ft	400 ft	350 ft	275 ft	200 ft	100 ft[6]	—
70 mph	1,250 ft	550 ft	525 ft	500 ft	450 ft	375 ft	275 ft	150 ft	—
75 mph	1,350 ft	650 ft	625 ft	600 ft	550 ft	475 ft	375 ft	250 ft	100 ft[6]

1. The distances are adjusted for a sign legibility distance of 180 feet for Condition A. The distances for Condition B have been adjusted for a sign legibility distance of 250 feet, which is appropriate for an alignment warning symbol sign. For Conditions A and B, warning signs with less than 6-inch legend or more than four words, a minimum of 100 feet should be added to the advance placement distance to provide adequate legibility of the warning sign.
2. Typical conditions are locations where the road user must use extra time to adjust speed and change lanes in heavy traffic because of a complex driving situation. Typical signs are Merge and Right Lane Ends. The distances are determined by providing the driver a PRT of 14.0 to 14.5 seconds for vehicle maneuvers (2005 AASHTO Policy, Exhibit 3-3, Decision Sight Distance, Avoidance Maneuver E) minus the legibility distance of 180 feet for the appropriate sign.
3. Typical condition is the warning of a potential stop situation. Typical signs are Stop Ahead, Yield Ahead, Signal Ahead, and Intersection Warning signs. The distances are based on the 2005 AASHTO Policy, Exhibit 3-1, Stopping Sight Distance, providing a PRT of 2.5 seconds, a deceleration rate of 11.2 feet/second2, minus the sign legibility distance of 180 feet.
4. Typical conditions are locations where the road user must decrease speed to maneuver through the warned condition. Typical signs are Turn, Curve, Reverse Turn, or Reverse Curve. The distance is determined by providing a 2.5 second PRT, a vehicle deceleration rate of 10 feet/second^2, minus the sign legibility distance of 250 feet.
5. No suggested distances are provided for these speeds, as the placement location is dependent on site conditions and other signing. An alignment warning sign may be placed anywhere from the point of curvature up to 100 feet in advance of the curve. However, the alignment warning sign should be installed in advance of the curve and at least 100 feet from any other signs.
6. The minimum advance placement distance is listed as 100 feet to provide adequate spacing between signs.

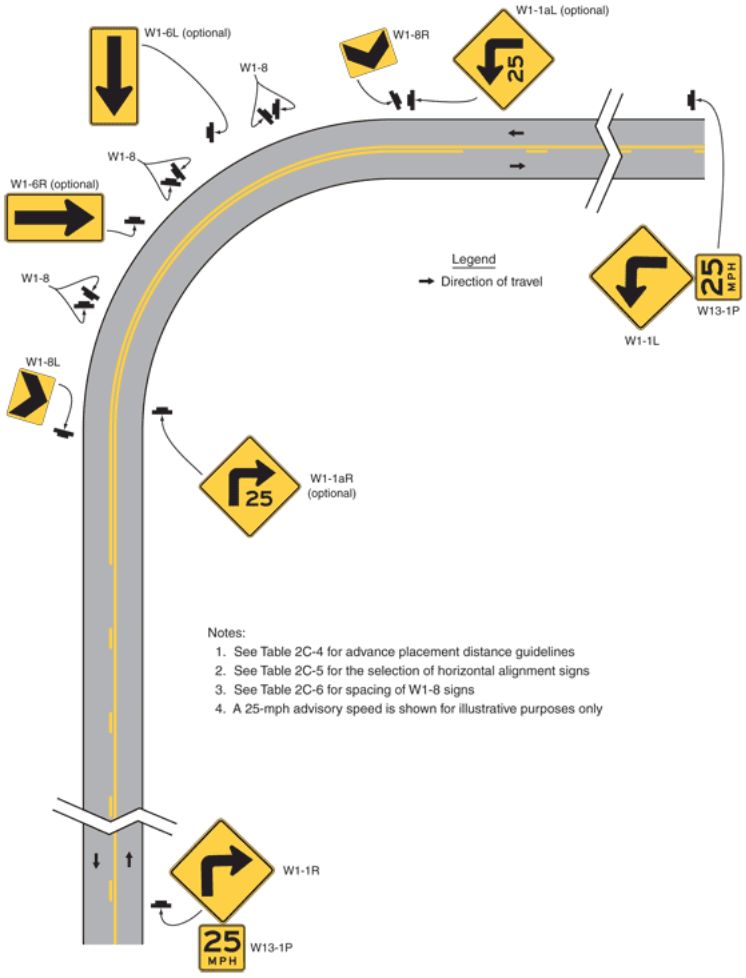
The placement distance will be determined by the difference in speed from the posted speed limit and the calculated or measured comfort curve speed determined by CAD analysis or ball banking in Table 2C- 4. That distance is measured from the approaching tangent point of the curve.

The need for a supplemental speed plaque should follow Table 2C-5 of the MUTCD. *In general supplemental plaques are not required unless the measured supplemental speed deviates from the posted speed limit by ten (10) mph or more*. The comfort curve supplemental speed sign (W13-1P) will also be determined by the analysis or ball banking.

W13-1P

Turn vs. Curve: Unless otherwise outlined in Section 2C-07 of the MUTCD, a Turn Sign (W1-1) shall be used when the curves *supplemental speed is 30 mph or less*. A Turn Sign (W1-2) is used for supplemental speeds greater than 30 mph.

Figure 2C-2. Example of Warning Signs for a Turn



If there is 600 feet or less distance between the tangents of curves they should be signed as one. That means that a winding road sign (W1-5) placed at each end of the combination curve should be used instead which minimizes roadside clutter.

Turn Arrows: Turn arrows are used in conjunction with Turn Signs (W1-1), Single Arrows (W1-6) and curve delineators.

W1-1

W1-6

Chevrons (Curve): Chevrons and delineators should be used at locations where Curve Signs are needed. Spacing of the chevrons shall follow the spacing outlined in Table 2C-6 in the MUTCD as shown below.


W1-8

Table 2C-6. Typical Spacing of Chevron Alignment Signs on Horizontal Curves

Advisory Speed	Curve Radius	Sign Spacing
15 mph or less	Less than 200 feet	40 feet
20 to 30 mph	200 to 400 feet	80 feet
35 to 45 mph	401 to 700 feet	120 feet
50 to 60 mph	701 to 1,250 feet	160 feet
More than 60 mph	More than 1,250 feet	200 feet

Note: The relationship between the curve radius and the advisory speed shown in this table should not be used to determine the advisory speed. See Section 2C.09 Chevron Alignment Signs (W1-8) in the MUTCD for additional guidance.

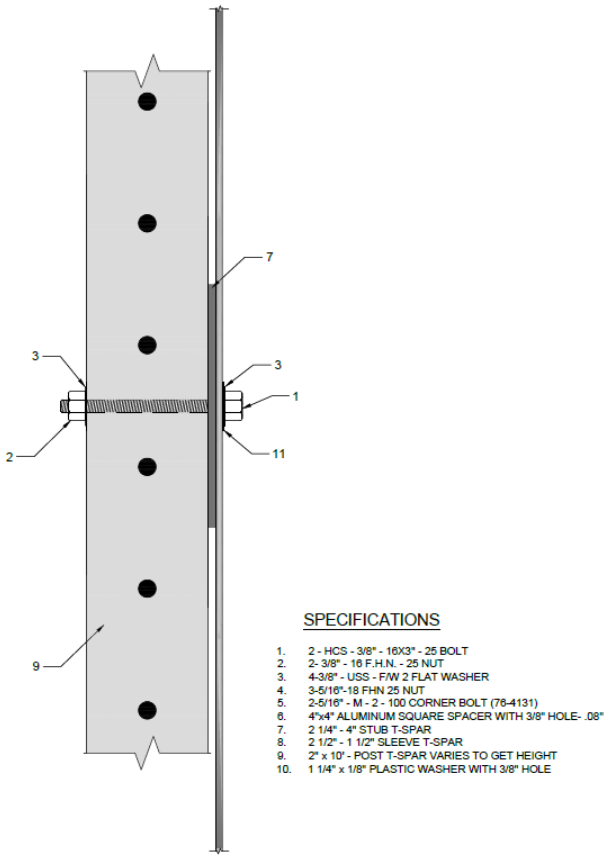
iv. Slip-plate Base Anchor:

Slip-plate base anchors, also referred to as slip-plate bases, are used with larger signs when the post is too strong to perform a normal breakaway function through shear action when struck. These units allow the base to slip instead of shear when impacted in compliance with NCHRP Report 350 and/or MASH crash testing.

Minnehaha County ALWAYS uses slip-base anchors on stop signs when street signs are also mounted above the stop sign. This is considered a combination sign. Here, the sign posts are 2.5 inches square instead of the normal 2 inches square perforated posts in order to resist the larger wind loads from the extra signs above the stop signs. A two-post installation may also be used with 2-inch perforated posts which would not require the use of the slip-base. Minnehaha County uses *Redi-Torque* Model 280 – Omni Directional Slip Base (combination anchor with lower slip plate: RT280U-SQ1) which receives a square sign post.

v. Backer-plate Installation

Unique to Minnehaha County is the use of a 4 inch by 4 inch aluminum backer plates (see image at left) on all traffic signs.



The use of this plate stiffens the structure of the standard aluminum sheeting of the signs.

Also, sometimes powered nut drivers or impact wrenches impart too much torque. This over-tightening weakens the aluminum behind the nut which leads to punching failure as well as early fatigue failure from resonating vibrations induced by wind.

All projects that include new or resetting of existing signs shall include standard plate "MCHD 634.10 – Sign Installation Typical Sign Detail". This applies to all signs but for object markers and delineators. Payment for furnishing and installing the backer plate and associated fasteners is always incidental to the sign installation as new or when re-set.

vi. Route Signs

As stated in Chapter 2D.10 of the MUTCD, "*All numbered highway routes shall be identified by route signs and auxiliary signs*". Minnehaha County uses the standard sign M1-6, 24 inches x 24 inches.

We also use advance warning signs indicating intersecting routes ahead which are located 350 feet in advance of the intersection. The "on" route markers are placed 200 feet beyond the intersection which always appears prior to the posted speed limit signs which are located 500 feet from the intersection.

County Route Sign
M1-6

vii. Sign Post Reflector Strips

Critical traffic signs can go unseen until the last minute in inclement weather or when partially obscured by landscaping or other obstacles. Aging drivers can benefit from an extra 150 to 200 feet of viewing distance when approaching traffic signs when using sign post reflector strips.

All of these factors illustrate the importance of increasing the reflectivity of a sign to seize a driver's attention. Minnehaha County chooses to include red reflective sign post strips on *all* STOP (R1-1) signs and yellow reflective post strips on *all* advance warning STOP AHEAD (W3-1) signs.

viii. Blinker Signs

Blinker-signs, also referred to as "solar lighted LED road signs", have embedded light emitting diodes (LED) in the sign face. This improves safety by enhancing driver awareness. Blinker-signs also improve driver compliance with regulatory signs through improved conspicuity and enhance visibility recognition of regulatory and/or warning signs, especially under low-light or low-visibility conditions.

This treatment is applicable for regulatory and warning signs at unsignalized intersections with the intended purpose of improving the visual conspicuity of the signs.

Typical locations where LED-embedded signs can be implemented include:

- Locations with sight visibility limitations (horizontal curves, dusk/dawn glare, etc.)
- Locations with documented problems of drivers failing to recognize an intersection; and

- At STOP signs – this treatment may help to increase the rate of vehicles stopping and to avoid drivers failing to detect the STOP sign.

At a cost of roughly $1,500 to $2,300 each (which includes the solar panel and battery), consideration is given to the appropriateness of this application. However, when evaluating the cost of even one minor crash, the benefit of these signs far exceeds their cost. These signs can be used as an upgrade to safety where crash clusters occur and can also be used proactively when significant changes in roadway operations occur.

It is Minnehaha County's practice to use these signs on high-volume routes where low compliance is known to occur. Only two locations in Minnehaha County are currently utilizing blinker-signs.

ix. Sign Placement

Specific guidance for locating and placing all traffic signs can be found throughout the MUTCD. The following information is presented to address general cases for placing common signs as practiced by Minnehaha County:

Stop Sign	As close as practical to intersection it regulates. As of 2019, these will always be done in pairs when two county roads intersect. All sign posts receive reflective post strips as well.
Street Sign	Always in the northeast corner, except on dead-end roads which then defaults to being located on top of stop sign.
Advance Warning	Generally placed 350 feet in advance of actual sign. For "Stop Ahead" (W3-1) warning signs, yellow reflective post strips are always used.
Route Marking	Placed around 200 feet of intersection. For advance route ahead sign, placed 350 feet in advance of the intersection.
Bridge Postings	Four signs total needed. Two placed immediately adjacent to bridge ends in both directions. The other two are placed within 50 to 75 feet of the nearest intersection which offers an alternate route. These should be visible from all three legs of the intersection. Also, the advance warning bridge posting sign is supplemented with a placard indicating bridge and distance ahead.

1.5 ENGINEERING AGREEMENTS

A. County Procedures

Depending on the scope and scale of a given project, Minnehaha County will solicit proposals from a variety of firms who are known to be competent, or, a solicitation notice will be sent out requesting interest in receiving a "Request for Proposal" (RFP). To assist staff and consultants with understanding project parameters and various design elements, a Project Information Sheet has been developed.

If the project is small (less than $25,000 in estimated design fee), one to three firms will be solicited. If the project is medium size (between $25,000 and $100,000 in estimated fee), two or more firms will be solicited. For larger projects (estimated fee > $100,000), a RFP process will usually be initiated.

Furthermore, some projects are conducive to soliciting Preliminary Engineering (PE) and Final Design (FD) together in one proposal while others require more preliminary analysis and planning before going to Final Design. In such cases, separate agreements are negotiated for PE and FD. In the case of bridges, the Type Size and Location Study (TS&L) serves as the PE portion of project development, in which case a FD agreement will need to be negotiated after the preferred build option has been identified through the TS&L.

Achieving a 60% complete design typically constitutes the end of PE and the beginning of FD. This milestone is important because at the 60% complete stage, the following elements are established and should not change:

- Horizontal alignment
- Vertical alignment
- Grading limits (day-light lines)
- Drainage and Culvert/Structure Sizing
- Utility and Landowner impacts, both permanent and temporary
- Environmental impacts

Knowing this information is imperative prior to beginning landowner negotiations and pursuing environmental permitting. Thus, the emphasis and exploratory design and development of concepts must occur prior to achieving a 60% complete design. This is primarily for main-line grading and alignment. It is common for minor changes to be made to ancillary design elements such as private approaches and fencing during landowner negotiations.

In addition, from a 60% complete design, a reasonable cost estimate is provided which is another important deliverable for staff to assess budget impacts and plan accordingly as well assess timeliness of acquiring needed permitting and right-of-way.

Commonly, the engineering firm who performed the design will also be asked to perform Construction Administration (CA) services to act as the County's agent in the field during construction.

All proposals from consultants shall contain the following:

- A written description of project understanding and scope of services to be performed under said agreement. This would include a listing of major milestones, deliverables, and schedule.
- A listing of items not included within the scope of services
- A listing of items to be provided by the County
- A brief description of project team members and their roles
- A schedule of hourly rates per position description/classification and/or per employee
- A detailed table of tasks and hours per employee/team member to accomplish each task
- A time schedule of interim and final delivery dates including a date by which the contract completion date is identified.
- The total hourly-not-to-exceed contract fee.

All sub-consultants needed to accomplish the work shall provide similar information and be listed separately.

Minnehaha County reserves the right to reject contributions from individuals who are not listed in the proposal. Therefore, any additions or substitutions need to be approved prior to the new personnel working on the project and including the changed personnel prior to having any new personnels' time appear on a pay request.

B. Preliminary Engineering

To assist staff and consultants with understanding project parameters and various design elements, a Project Information Sheet has been developed. In addition, Chapter 3 of the SDDOT Road Design Manual contains specific direction on what shall be included as part of Preliminary and Final Design plan preparation.

Preliminary design is the stage in which general project location and design concepts are determined. It includes all that is necessary to conduct an alternatives analysis and review process properly, but good preliminary design goes beyond that. Preliminary design can also include additional activities which do not materially affect the objective consideration of alternatives.

Final design clearly includes the preparation of construction plans and detailed specifications for construction work to be performed. To ensure that those plans and specifications will be time-effective and cost-effective with minimal changes, the right steps need to be taken to ensure focused preliminary design.

Preliminary design can include a wide range of preliminary engineering and other activities and analyses, including but not limited to:

- Environmental assessments
- Topographic surveys
- Boundary surveys
- Geotechnical investigations/Soil borings
- Hydrologic & Hydraulic analysis
- Preliminary geometric alignment
- Typical Sections
- Pavement Design
- Bridge/structural layouts
- Right-of-way, Utility and Railroad Coordination
- Traffic studies/Level of Service
- Access Management
- Public Involvement/Public Meetings/Land Owner Meetings
- Preliminary Detour plans
- General cost estimates

For a road project, the following list of tasks are provided as an example scope of services to be included for a Preliminary Engineering proposal:

Project Management Owner Meetings & Coordination Monthly Billing **Survey** Research Control Boundary Topo Utility Prepare Base Map Property Identification Plat design and document preparation **Drainage Analysis** Inventory existing ID Drainage basins Model existing conditions Develop and Model needed conditions No-Rise Analysis and Certification Draft Drainage Report **Pavement Design/Typical Section** Geotechnical Review **30% Plan & Profile Development** Prelim. Grade Line Review Grade Lines at Intersections Review Site Distances at Approaches Review ditch grading Review daylight lines Review drainage needs Review utility conflicts Review Environmental Impacts Review cut/fill balances P&P Alternatives Analysis Prepare 30% P&P, X-sections Submittal Prepare Cost Estim. Owner Review/Meeting(s) P&P Revisions	**Environmental Coordination** Coordinate with Wetland Specialist Coordinate with Hist. and Arch. Coordinate with US Army CoE Coordinate with other agency(s) Evaluate Section 404 Permit impacts **Meetings – Public Involvement** Prepare for Open House Attend Open House Prepare and Submit Meetings Summary **60% Design** Final Grade Lines including intersections Final Site Distances at Approaches Final ditch grading Final daylight lines Final drainage needs & Report Final utility conflicts Final Environmental Impacts Prepare CoE Section 404 Permit (option) Final cut/fill balances Preliminary Detour Layout Prepare H-lot and Easement Exh bits Prepare H-lot Exhibits Prepare 60% Plan Submittal Prepare Cost Estim. Owner Review/Meeting(s)

On smaller projects, including TS&L's for structures, many of the above items would be grouped together. Similarly, on very complex projects, additional tasks may be required.

C. Final Design

Final Design (FD) plans cover the design of all phases of the project to be built or bid. They contain more detailed refinement of those items to be carried forward from PE such as material types, specifications, and special provisions. FD plans ultimately will be used to solicit bids from contractors as well used by the project inspectors. As a general rule, one should not need a calculator or a scale to interpret plans because all the information should be called out by notes or annotations.

Chapter 3 of the SDDOT Road Design Manual lists and describes activities necessary to conduct final design and prepare Final Design plans. While Chapter 3 of the Road Design Manual is useful in terms of logical progression of final design development and reviewing tasks and checklists on road projects for completeness, Minnehaha County *requires the following order of plan sheet layout*:

Section A: Title Sheet, Legend, Control Data
Section B: Estimate of Quantities and General Notes
Section C: Typical Sections
Section D: Right of Way & Easements
Section E: Traffic Control
Section F: SWPPP & Erosions Control
Section H: Existing Conditions & Removals
Section L: Plan & Profile
Section M: Permanent Signing, Pavement Markings, & Fencing
Section S: Structures
Section X: Cross Sections
Section Z: Pipe Sections

Note that it is preferred to place the appropriate Standard Plates within the relevant sections as shown above.

For a road project, the following list of tasks are provided as an example scope of services to be included for a Final Design proposal. You will see that a phase for Bidding the project is included. The Bidding Phase is usually attached to Final Design but it can also be part of Construction Administration.

Final Grade Line Establish Final Grade Line Typical Sections & Tie Ins Final P&P Sheets & Callouts Final Cross-Sections Removals Temp & Final Easements Final Limits and Notes Final Exhibits RoW & Easements Plans Meet with Landowners Revisions & Resubmit Culvert Design Final Plans P&P Details & Special Provisions Storm Drainage Easements Retaining Walls Plans and Notes Details and Special Provisions Erosion Control Prepare Plan Sheets SWPPP Details and Standard Plates Private Utilities Meet with Utilities Prepare Exhibits Dvlp Private Utility Work Plans Update Plans and Notes as needed Coordinate with Owner Traffic Control Plans Define Work Constraints/Sequencing Layout Phases Prepare Plan Sheets, Notes, QTO Permanent Signing and Pvmt Markings Existing Inventory Traffic Sign Design Traffic Layout Sheets Tables and Notes Standard Plates & Details	Meetings/Public Involvement Prepare for Open House Attend Open House Prepare and Submit Meetings Summary Final Plan Production-Grading Title Sheet Estimate of Quantities Typical Sections Survey Control & Map General Notes Misc. Quantity Tables Easements Traffic Control Erosions Control & SWPPP Drainage Structures Surfacing Plan Pavement Marking Plans Permanent Sign Plans Cross-Sections/Culverts/Walls Compile 95% Design Plans-Grading Prepare Plan Sheets Prepare Bid Book Prepare Final Cost Estimate Misc. Coordination Internal Plan Review Final Owner Review Plan Revisions 100% Complete Submittal Print and Seal Final Plans Print and Seal Bid Book Prepare Project Cost Estimate Bidding Respond to Contractor's questions Organize Pre-Bid Meeting (option) Attend Pre-Bid Meeting Circulate Meetings Minutes to Plan Holders Address Addenda Attend Bid Opening Review Bid Tabulation Provide Award Recommendations

On smaller projects, many of the above items would be grouped together. Similarly, on very complex projects, additional tasks may be required.

D. Construction Administration

In the simplest of terms, the project Inspector is defined as the Owner/Engineer's authorized representative assigned to make detailed inspections of contract performance.

The Minnehaha County Highway Department does not have enough staff to inspect all the work being performed under contract and bid each year. Therefore, we rely on qualified and experienced consultants to serve as the project inspector to observe, record, and advise us on the quality and progress of the work being performed.

As such, the duties of the Inspector include examining all work done and materials furnished in compliance with the contract requirements. This inspection may extend to any part of the work, preparation, fabrication, or manufacture of the materials and methods to be used. The Inspector will not alter or waive the provisions of the contract. The Inspector will not issue instructions contrary to the contract, or act as a foreman for the Contractor. The Inspector may reject work or materials until any issues can be referred to and decided by the Owner/Engineer.

Neither the County's authority to inspect all work nor any actual inspections performed by the County during the course of construction will constitute an acceptance of work performed or operate to relieve the Contractor of the Contractor's obligation to construct the project in compliance with the plans and specifications.

Moreover, and beyond project inspection, Minnehaha County relies on consultants to coordinate with the contractors and assist in processing the paperwork as well as setting grade controls and staking involved with administering the construction contract.

Collectively, the consultant's roles of

- Inspection
- Observation
- Grade control and field staking
- Documentation
- Coordination with utility companies
- Coordination with geotechnical & field testing
- Coordination with landowners, and
- Administrative assistance

of the construction contract is referred to as the Construction Administration phase.

Typical tasks included in a proposal for Construction Administration include the following.

Project Management Owner Coordination Prepaying Billing Coordination with Testing Agency Pre-Construction Meeting Prepare for PreCon Notice, Agenda Attend Meeting PreCon Minutes Pre-Construction Video Mailing to Area Residents Construction Staking Office Prep Set Control and Turning Points Erosion Controls Removals Grading limits and Easements Base Course Blue-Tops Approaches Culverts, Structures, and Guardrail Pavement Markings Permanent Signs Set Sections Corners & Property Pins	Project Inspection Pay Requests Primary Inspection & Daily Reporting Bi-Weekly Progress Report Post 0.5" Rain Inspection Project Administration Review Shop Drawings Review Soils and Materials Testing Bi-Weekly Progress Mtgs & Documentation Site Visits Misc. Coordination Meetings Bi-Weekly Pay Requests Change Orders Project Finals Substantial Completion Warranty Inspections & Letters Final Quantities and Pay Request Compile Construction Reports As-built/Final Record Drawings Courthouse Filings Project Close-out Checklist

E. Geotechnical & Field Testing

From testing glass beads in paint to measuring air entrainment in concrete to measuring pile capacity, just about every project will require some kind of geotechnical evaluation during design or construction. During the design phase, geotechnical recommendations are paramount and influence decision making. Similarly, in the field during construction, just about every project will benefit from having geotechnical field testing conducted which assures that minimum standards are being achieved.

A good contractor will want good geotechnical field testing done because it validates they are performing well. In addition, from an owner's perspective, having a field testing program in place prior to construction is cheap insurance that we are achieving a quality installation. This minimizes maintenance in the long run and benefits our users over a longer time period.

The SDDOT has a *Materials Manual* which includes minimum certification, sampling and testing requirements and the testing procedures used by it's employees when testing construction materials. A hard copy of the manual may be purchased from the Office of Materials & Surfacing at a cost of $100. Sections of the manual area available on-line at South Dakota Department of Transportation Materials Certification Forms and Manuals.

It is expected that geotechnical consultants working for Minnehaha County be very familiar with this manual. In addition, the SDDOT *Standard Specifications for Roads and Bridges* contains copious amounts of testing and specification minimum

standards. It is expected that consultants performing project construction administration and inspection services for Minnehaha County be very familiar with this manual as well.

In all cases, the design team -- which consists of the design consultant, county staff, and the geotechnical engineer, need to coordinate early in the project's phase and agree upon the appropriate level of geotechnical investigation and testing that will be required to meet the project needs.

iii. Road Projects – Design

On the design side for a road project, Minnehaha County typically solicits a proposal from one or more geotechnical consultants. The work involved includes adequate test borings to captures pavement, base course, and sub-base material qualities and strengths so that a pavement design can be performed using the California Bearing Ratio (CBR) method. In addition, samples are gathered to determine shrink/swell factors as well as Proctor testing. Test boring logs are produced to be put in the project's bidding documents to inform the contractors. Soil tests are performed to classify the soil using the Unified Soils Classification System. Further soil tests include Atterberg limits, moisture content, dry density, and grain size analysis.

From these analyses, a report is generated that contains the results and recommendations regarding the following:

- Existing asphalt pavement and aggregate base course materials
- Earthwork and grading for the roadway subgrade
- Retaining walls and recommendations
- Estimated subgrade strength (CBR) and potential corrective measures such as cement treated base or geotextiles
- Shrinkage factors for the soils
- Box culverts;
- Comments regarding factors that may impact the constructability and final performance of the project
- Quality control observations and testing.

iv. Bridge Projects – Design

On the design side for a bridge project, Minnehaha County typically solicits a proposal from one or more geotechnical consultants. The work involved includes drilling at least two test borings. It is preferred to go deep enough to find bedrock but this is not always possible, in which case a friction pile analysis is warranted. Most geotechnical engineers in this area are familiar with bedrock depths and they can advise on appropriate depths of drilling within their proposal. Individual boring logs are prepared. A written report is prepared which contains the results of the field and laboratory testing as well as geotechnical engineering opinions and recommendations regarding the following:

- Subgrade support of the box culvert
- Backfill requirements
- Shrink-swell potential of the subgrade
- Frost action potential
- Quality control observations and testing
- Comments regarding factors that may impact the constructability and final performance of the project
- D_{50}/D_{90} sampling of streambed for scour analysis.

Additional requirements for BIG Fund projects may apply.

v. Road Projects – Construction

It may seem intuitive when the soil or gravel gets "hard" but how hard is hard enough? This can only be answered through standardized testing by qualified individuals. Materials testing and inspection proposals for constructing a road project are generally centered around grading and asphalt testing. Some testing of concrete may be required for cast-in-place structures which is covered below under part iv. Additional materials not gathered during the original investigation during design need to be sampled for material properties, primarily for Proctor testing to establish a minimum acceptable density and moisture content parameters for each material. Considering a typical cost to grade a 5-mile project is around $3 million and it costs about $13,000 to perform materials testing and inspection -- that is about 0.4% of total construction – it is very cheap insurance before putting down hard surfacing.

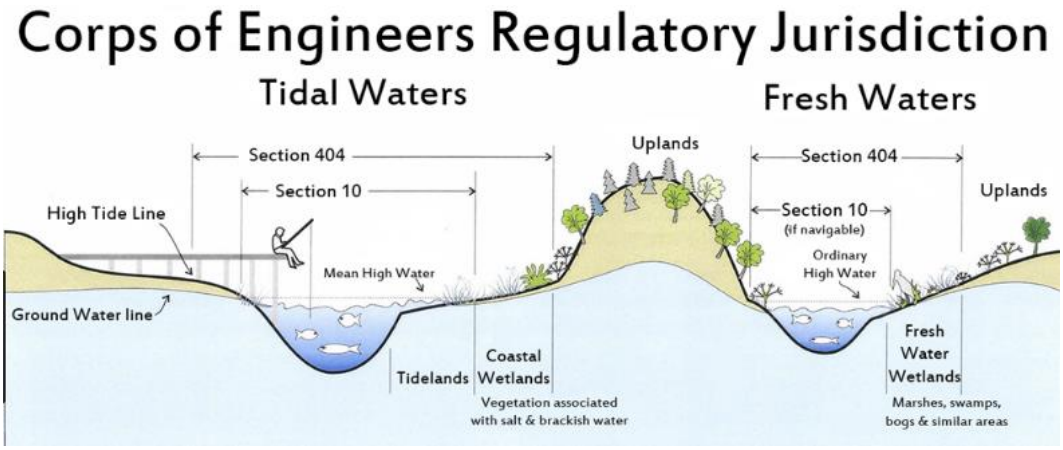
Similarly, to perform materials testing and inspection on a paving project, the costs are about the same. So it takes less than 1% of the price of construction to assure a good quality project by performing good material testing and inspection. The primary focus on a paving project from a materials standpoint is that the aggregate base course is proper. Beyond that, its all about the asphalt which includes, Rice density and nuclear-densometer testing, temperature, rolling pattern, AC extraction tests, as well as gradation. Advanced testing can be performed on the asphalt and its additives but generally Minnehaha County accepts certification from the materials' suppliers.

vi. Bridge Projects – Construction

Materials testing for bridges during construction is centered around backfill requirements, material compliance, and concrete testing. Due to the nature of bridge building, a little more materials testing and inspection is required versus a standard road project. Material samples are needed for the backfill and bedding in order to take Proctor tests. Gradations are also taken for specified gravels, sand, and other materials. Concrete cylinders are gathered for structural strength tests at days 4, 7, 14, and 28. Also, compliance with slump, air entrainment, and temperature levels are vital factors when pouring bridge components.

F. Wetland Delineations & Mitigation

This section is intended to provide the reader with a working knowledge of what one needs to be aware of when a project impacts wetlands and other water resources. It is not intended to provide a comprehensive review of the *Clean Water Act* and Section 404 permitting.



When a project permanently impairs a "waters of the United States", mitigating those impacts can sometimes be required by the US Army Corps of Engineers as part of their responsibilities to comply with Section 404 of the *Clean Waters Act*. This can happen when impacts to a protected water resource are as little as 0.1 acres. In recent history, Minnehaha County has had to do this twice. Therefore, when it is known that any project potentially could impact a protected water resource, it is imperative to conduct a wetland delineation.

In the recent past, Minnehaha County performed wetland delineations on all their bridge projects. We were instructed by the Corps that this was not necessary for "ordinary" bridge projects. They have biologists on staff and have reviewed enough bridge projects to gain a comfort level that stream impacts due to bridge construction were mostly temporary in nature and would not permanently impact the water-way. Therefore, in most cases, the Corps assumes that all areas within the construction limits and under the ordinary high-water elevation will be temporarily disturbed during construction but not permanently damaging to the water-way. In addition, these temporary impacts usually resulted in less than 0.1 acres of land below ordinary high-water elevation so permitting was streamlined under the Nationwide permitting program.

Road projects are somewhat different because there are often many culverts being replaced. The Corps looks at these impacts individually and not cumulatively, therefore, individual impacts are less than 0.1 acres also. However, delineations are required to determine these impacts.

Upon completion of the delineation, a Jurisdictional Determination will be made to the US Army Corps of Engineers and they will inform whether or not the water resource is a

protected water of the United States. If it is and the impacts are greater than 0.1 acres, it could trigger the need for mitigation. If impacts are greater than 0.5 acres, it is likely that mitigation will be required and also likely that a Nationwide Permit will not apply which means an Individual Permit will be necessary. This process could take up to a year to complete. It is essential that a dialogue with the US Army Corps of Engineers be started as soon as possible.

More often, for linear transportation projects and isolated bridge projects, impacts will be less than 0.5 acres and mitigation will not be required.

When mitigation is required, there are two options: 1) Mitigate on-site, or 2) purchase wetland credits through a certified wetland bank.

Mitigating on-site is not Minnehaha County's preferred practice because we are not in the business of creating, owning, and maintaining wetlands. It is very difficult to create in two to three years what mother nature has established over a much longer period of time. Some bogs take hundreds of years to form. In addition, this often requires the purchase of additional land which can be expensive, difficult, and adds time to the preliminary and final design phases. Moreover, there are yearly reporting requirements for the first five years, and then additional requirements every five years thereafter.

Mitigation through the purchase of wetland credits is the preferred option since we essentially write a check and somebody else is responsible to maintain the wetland in perpetuity. There is a lot more to it than that, but from a transactional standpoint, that is what happens. At this time, three certified wetland banks are approved by the US Army Corps of Engineers; Tetonka, Goeden Properties, and Duck Unlimited.

The process to purchase wetland credits is facilitated by the bank owner and the US Army Corps of Engineers but it takes a significant amount of paperwork and coordination to get through it. Part of the paper work involves additional study of the impacted wetland which involves calculating FCU's (facultative credit units) based on a hydrogeomorphic model (HGM) analysis. FCU's are established by a certified wetland specialist and agreed upon by the US Army Corps of Engineers. These credits are used as a unit of trade to offset ecological losses that occur within the impacts water resource. Not all wetlands are created equal so the more pristine or unique the water resource is, the higher the credit unit of impacts need to be mitigated. To conduct this work, additional consultant contracts are needed.

In Minnehaha County's experience, when mitigation is required, the wetland specialist's fees will be between $6,000 and $10,000 over and above their cost to perform the initial wetland delineation survey. Also, the cost to purchase the mitigation is roughly $40,000 per acre.

G. Historic and Archeologic Investigations

When federal-aid is part of the project's funding, formal historical and archeological investigations are required. Since Minnehaha County rarely receives any federal-aid, we are exempt from having to perform this work -- with one exception: when applying for a Section 404 permit from the US Army Corps of Engineers. Receiving a grant from the BIG Fund program is state money and not federal-aid; however, the discussion below would apply to projects using BIG Fund dollars.

Because the Corps must issue permits in compliance with national laws, such as the *Clean Water Act*, *Threatened and Endangered Species Act*, and the *Historic Preservation Act*, there are times when they ask for additional information. When agencies apply for any permit, the Corps conducts coordination behind the scenes with other sister agencies such as the US Fish and Wildlife Service and the State Historic Preservation Office. In the case of historic and archeological resources, the requirements outlined within the *Historic Preservation Act* are carried out by the State Historic Preservation Office (SHPO).

If a structure is 50 years or older, it is eligible to be listed on the National Register of Historic Places. This does not mean that registration is automatic. But, because it is eligible, further analysis by qualified people is required and the SHPO must concur prior to actually being registered.

The majority of structures on a highway system that are older than 50 years old will not be declared as being of significant historic value to be listed on the National Register. However, SHPO still may require documentation. This entails taking photographs "of" the structure and "from" the structure at specific vantage points. Also, a records search is often requested to accompany the photo documentation. For example, if there was an article from the 1930's with a picture of the President of U.S. and the structure was in the picture, this is the kind of information that would be significant to the SHPO. Another example would be if there were only two structures left designed by a significant historic figure.

When historic and archeological investigations are needed, Minnehaha County hires people from Augustana College or from a list of approved specialists from the SDDOT. The Corps of Engineers is also available to provide guidance as to what kinds of documentation and field study is being requested by the SHPO office.

1.6 COMMISSION REQUESTS AND APPROVALS

A. Legal Review by SAO

At the time of this writing, legal review of all consulting agreements and construction contracts is required by the State Attorney's Office (SAO). The Project Manager will forward said documents to the SAO approximately 10 days prior to the pending Commission meeting where the items will be presented along with a recommendation to approve. The Highway Department has consistently worked to standardize these documents so the review and approval process by the SAO is fairly routine.

B. Commission Requests

While budget authorization for the 5-year spending plan for the Highway Department is adopted by the Commission by end of September of each year, specific Commission approval is required for nearly all major expenditures by the Highway Department in compliance with the Minnehaha County Purchasing Policy Manual. Part K of this manual specifically addresses construction projects.

i. Consulting Agreements

All consulting agreements under $50,000 and amendments to said agreements which would result in a cumulative agreement amount less than $50,000 may be signed by the Highway Superintendent if the project is listed in the currently approved budget and the Long Range Plan. In these cases, approval from the Commission Liaison is required.

All consulting agreements greater than $50,000 and amendments which result in a cumulative agreement amount greater than $50,000 must be signed by the Commission Chairman.

All consulting agreements amendments which result in a cumulative agreement amount of less than $50,000 but result in a significant change in scope must be approved by the Highway Department's Commissioner Liaison.

All consulting agreements for proposed projects that are not in the current approved budget must be signed by the Commission Chairman, regardless of amount.

ii. Construction Contracts

All construction contracts that are in excess of current statutory bid limits (as of January 1 of 2016 - $25,000 for equipment, supplies, and services, and $50,000 for construction) must be signed by the Commission Chairman.

Construction Contracts less than current statutory bid limits may be signed by the Highway Superintendent.

iii. Commission Approval

Commission Approval's are voted on at regularly scheduled Commission Meetings occurring every Tuesday and starting at 9:00 am. To get the information to the Commission, an agenda is prepared by staff and approved by the Highway Superintendent. The due date for the Highway Superintendent's approval is at noon, the Wednesday prior to the Commission Meeting. This way, the Superintendent has time for edits or changes because his due date to the Commission for all Agenda Items is the prior Thursday at noon.

Staff responsibilities in preparing the agenda item include gathering and preparing all pertinent data and putting it in the form of an Agenda Item. Usually a one page cover memo is preferred with more complicated charts and information attached to the cover memo. All information should be complete and accurate, including SAO approvals as required. This information is then assembled into a pdf document and provided to the Highway Superintendent for final review and approval.

In preparing the agenda item, staff should consider the audiences (which includes the public) and avoid overly technical explanations, exhibits and jargon (the shorter the better) while ensuring germane information is adequately covered. Staff may provide supporting and supplemental information to the Superintendent that is not included in the agenda item in case questions arise during the presentation.

SECTION 2.0 - BIDDING, AWARD, and NOTICE TO PROCEED

2.1 BIDDING FOR CONSTRUCTION

A. Bid Calendar

The Project Manager and Consulting Engineer shall agree on the date that the bid opening shall occur. The bid opening date will always be on a Wednesday at 10:30 a.m. with bids due to the Auditor no later than 10:15 a.m. that same day. The Commission Recorder at the Auditor's office typically receives the bids and schedules the room to have the bid opening. If larger groups are anticipated, the Commission Recorder should be informed as soon as possible in order to reserve an appropriately sized room.

See *Exhibit 2.1 - Bid Calendar* for the current year, an example of which is located at the end of Chapter 4. The official newspapers used by Minnehaha County varies from year to year, so it is important to check with the Project Manager to verify the newspapers listed (and their advertising dates) are correct.

Prior to the Notice to Bidders being advertised, the States Attorney's Office (SAO) must review and approve the Instructions To Bidders book including the bid form and contract. This step is currently required because of anomalies occurring between the language in the standardized bidding documents vs. the contract. Also, recent legislative changes may require updated language. The SAO may take up to 10 days to review and approve prior to advertising.

B. Notice to Bidders

Note that first official entry on the Bid Calendar is providing the Notice to Bidders to the Auditor's Office, an example of which is included at the end of this chapter as *Exhibit 2.2 – Notice to Bidders*.

The Project Manager is responsible to deliver a digital copy of the Notice to Bidders (in Microsoft WORD) along with one complete hard copy (printed) set of plans and specifications to the Commission Recorder no later than noon 22 days prior to the bid opening date, which shall always occur on a Tuesday.

The delivery of the Notice to Bidders to the Auditor's Office signifies the beginning of the bidding process.

C. Instructions to Bidders Book

This manual assumes that all construction projects will be built using 100% county funds. Procedures for projects using state or federal funds may be different.

The Instructions To Bidders book, sometime referred to as "Bidding Documents" or "Bid Book" or "front-end documents" is as crucial to the bid process as the plans are to construction. The bid book and the plan set together are collectively referred to as the "bidding documents" and should always be provided together when sharing plans with any party whether they intend to serve as the prime contractor or not.

The County will provide standard front end documents to the Consulting Engineer. Note that the opportunities to alter or edit standard front end documents, including the cover page, are very limited. All changes proposed by the Consulting Engineer need to be reviewed and approved by the Project Manager.

Standard sections within the bid book include the following:

NOTICE TO BIDDERS
INSTRUCTIONS TO BIDDERS
PROPOSAL FORM
NOTICE OF AWARD
CONTRACT
NOTICE TO PROCEED
PERFORMANCE BOND
PAYMENT BOND
WAIVER AND RELEASE OF LIEN
WARRANTY FOR CONSTRUCTION ACTIVITY
SPECIAL PROVISIONS
GEOTECHNICAL REPORT
PERMITS

The County's front-end documents have been standardized to a large extent such that one simply needs to fill in the blanks at specific locations throughout the document. However, there are sections that need to be tailored to the project which include, but are not limited to the following:

- Proposal Form
- Time of Performance (not included above since it is part of the Proposal Form. Also, make sure schedule in plans match)
- any Special Provisions, as well as the
- Geotechnical Report
- Permits

Each of the sections contained within the bid book use specific language and instructions as approved by the Minnehaha County's State's Attorneys' Office and are subject to constant revision. Furthermore, other counties may be subject to other or additional rules and regulations and therefore the use of these front end documents outside of Minnehaha County is not recommended. The County's Project Manager is responsible to assure that the most up to date version is being used.

Note that if the project has a Section 404 Permit issued by the US Army Corps of Engineers, the entire permit shall be included as part of the project's Special Provisions. Any particular and/or specific requirements or procedures included as part of the

Section 404 Permit should be highlighted and covered elsewhere such as within the notes as part of the construction plans.
Note that when the Consulting Engineer provides a draft document for review and comment, a Microsoft WORD version is preferred over an Adobe pdf file.

D. Bid Package Submittal

The Consulting Engineer shall provide two paper copies and one digital copy of the construction plans and the front-end documents to the Project Manager on or before the day the Notice to Bidders is delivered to the Commission Recorder's office. Documents shall be stamped and signed by a registered professional engineer or watermarked with "FOR BIDDING PURPOSES ONLY". In addition, the Consulting Engineer shall provide one paper copy and one digital copy of their Preliminary Opinion of Cost to the Project Manager at the same time.

E. Bidding and Addenda

During the time the project is being advertised, questions from contractors should be directed to the Consulting Engineer. The Consulting Engineer shall keep a log of questions asked and responses. It is preferable to receive all questions in writing (emails and letters of inquire are acceptable, phone texts are not).

Starting on the Monday prior to the bid opening, the Consulting Engineer and the Project Manager are encouraged to make themselves available due to the many phone calls and emails that seem to cluster around this time. Also, the party administering the bidding process and maintaining the plan holders list can expect many requests during this time just before the bid opening date.

Addenda: In the event that a common stream of questions emerges and/or the Consulting Engineer needs to publish a correction and/or clarifications to the plans, specifications, and/or front-end documents, an amendment to the contract documents is needed in the form of an Addendum. This Addendum shall go out no later than the Monday prior to bidding and is preferred to be published at least five days prior to the bid opening date.

The Consulting Engineer shall prepare the Addendum using a form provided by the Project Manager and submit to Project Manager for review and approval. See *Exhibit 2.3 – Bidding Addenda* located at the end of this chapter.
The Consulting Engineer shall clearly and concisely explain the exact nature of the amended items, what is changed within the contract documents, and how the amendment changes the bid items and bid proposal. In some cases, new plan sheets may be required as well as a new bid proposal form. All new forms and plan sheets associated with a specific addendum shall be clearly labeled as Addendum #X along with the date they are published.

The Addendum shall be marked in a manner consistent with the bidding documents and shall be sealed by a Professional Engineer since they are part of original contract documents.

F. Plan Holders List

The Project Manager will maintain the list of all plan holders. The County does not let a diverse amount of project work types to bid and therefore has a respectable list of contractors who consistently show interest on our projects. The County solicits bids directly to contractors using Dropbox. We also provide the bidding documents to the two local builder's exchanges. In the rare case when a contractor requests a paper copy of the plans and front-end documents, the County will print and provide said documents (including Addenda).

The County reserves the right to negotiate that the Consulting Engineer will administer the bidding process but this is more the exception than the rule.

No plans may be distributed prior to the first day of advertising.

G. Pre-Bid Meetings

Typically, the County does not require pre-bid meetings. Should the need arise, the Pre-bid meeting must be held at least ten days prior to the opening date of the bid. The Consulting Engineer and Project Manager will jointly decide on the details of the pre-bid well in advance of providing the Notice to Bidders to the Auditors Office.

H. Bid Opening Day

The Project Manager and the Consulting Engineer should attend the bid opening. The Consulting Engineer is responsible for preparing a bid tabulation summary for use by those attending the bid letting. An example of the Bid Tabulation is located at the end of this chapter. See Exhibit 2.4 – Bid Tabulation.

Bid Tabulation: The Project Manager is responsible for preparing the bid tabulation and providing it to the County's website manager in order to get the bid prices, *as read*, published. The bid tabulations are typically posted to the County Highway Department's website no later than the end of the day following the day of the bid opening. The Project Manager will also provide a digital copy of the bid tabulation to all those contained on the plan holders list.

Publishing the bids "as read" signifies the end of the public bidding process and the beginning of the award process.

Also occurring right after the bids are opened and publicly read, the Commission Recorder will provide copies of the submitted bid documents to the Project Manager. The Project Manager will then in turn share this information with the Consulting Engineer who will begin to review the bids for accuracy, preparing the bid abstract (sometimes erroneously referred to as the "certified bid tabulation") and their letter of recommendation to award the project.

2.2 BID AWARD AND CONTRACT

A. Bid Abstract

The bids, "as read", are not necessarily the final bid amount by any contractor. The Consulting Engineer shall receive copies of the submitted bids from the Project Manager and begin their review of individual bid item costs versus the calculated extended bid item costs and then compare that to what the contractors submitted. This is done in Microsoft Excel. The Project Manager will provide an example template for the Consulting Engineer to use in preparing the bid abstract.

Upon the Consulting Engineer's review and approval of the bid abstract, he/she shall sign and certify its completeness. At this point, the document is referred to as the "certified bid abstract". Using the term, certified bid tabulation should be avoided. Also, County staff as well as the Consulting Engineer will review the bonds and other submittal requirements to make sure that the submitted bids fully comply with the Instructions To Bidders as described in the Bidding Documents.

This process of checking for accuracy and completeness must be done prior to determining who is the *lowest responsive and responsible bidder*. It is not uncommon to find minor discrepancies (math errors) in the contractor's bid submittal. These are called minor anomalies. However, it *is* uncommon when the discrepancy is significant enough to change who the apparent low bidder is based on the bids "as read" during the bid opening.

It is important to note that the *unit cost per bid item governs over what is listed as the extended cost for the total quantity of said bid item*.

If the apparent low bidder "as read" changes due to the correction of math errors, the Project Manager will consult with the County's States Attorneys' Office. Specific language needs to be included within the Commission Agenda item when the bid is either awarded or rejected. By statute[1], the Commission needs to be informed of any bid irregularities.

B. Recommendation Letter

Assuming only minor anomalies exist, the Consulting Engineer shall complete their preparation of the Certified Bid Abstract and then prepare a letter recommending the construction contract be awarded to the *lowest responsive and responsible bidder*. They should also verify the correctness of the bid abstract by signing and dating that document which is to be attached to the recommendation letter to award. By statute,

[1] SDCL 5-18A-5(6)

the County has 30[2] days from the bid opening date to officially award or not award the contract.

It is the current practice of the Highway Department to not publish the Certified Bid Abstracts; however, they are available by request.

C. Award and Contract

Within the book of Bidding Documents, there exist examples of the Notice of Award, the construction Contract. We recently removed the Notice to Proceed from the bid book as it simply requires a short letter which the Project Manager will provide to the Contractor after all the appropriate documents have been submitted, reviewed, and approved.

It is important to include the Notice of Award and construction Contract example documents within the Instructions To Bidders book because it gives the contractors an opportunity to review their content and it also sets an expectation of what is to come so they may bid accordingly. Furthermore, it provides the bidders an opportunity to seek clarification should they have questions during bidding. These items should have been reviewed and approved by the SAO prior to advertising.

To this end, it is also important for the Consulting Engineer to provide to the Project Manager a final version of the Instructions To Bidders document in Microsoft WORD for ease of editing later.

SAO Review: Prior to the Notice to Bidders being advertised, the States Attorney's Office (SAO) must review and approve the Instruction To Bidders book including the bid form and construction Contract.

Based on the Consulting Engineers' letter of recommendation, the Project Manager will prepare the Contract for final legal review by the States Attorney's Office (SAO). This is usually sent to the SAO during the same week bids are opened. The SAO may take up to 10 days to review based on their workload; however, the Project Manager should request their review and approval be complete no later than the following Wednesday from the bid opening date. By statute[3], the County is allowed up to 30 days to either award or reject a bid after bids are opened.

Preparing the Commission Agenda Item: During the time the SAO is reviewing the contract, the Project Manager will prepare the Notice of Award along with a Commission Agenda Item requesting the award of the contract. The SAO does not need to review and approve the Notice of Award. The complete agenda item includes:

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[2] SDCL 5-18A-5(7): *The contract for services or public improvement shall be awarded within thirty days and the contract for supplies shall be awarded within forty-five days of the bid opening by written notice to the lowest responsible and responsive bidder whose bid meets the requirements and criteria set forth in the invitation for bids.*

For more information on Highway Department procedures as related to A/E Agreements and Construction Contracts, see the *Minnehaha County Purchasing Manual*, Chapter 4: Guidelines for County Department Heads, part K.

[3] SDCL 5-18A-5(7)

- Agenda Item cover memorandum (language must be included describing bid irregularities, if any)
- Bid Tabulation (as-read)
- Consulting Engineer's Letter of Recommendation
- Certified Bid Abstract
- Notice of Award
- Construction Contract (first page of contract to have the approval block from the SAO office filled out)

This package must be provided to the Highway Superintendent no later than 12:00 pm (noon) on the Wednesday prior to the Commission Meeting. The email to him/her shall include a pdf of the complete agenda item followed up with a paper copy delivered to his/her desk. The final deadline from the Highway Superintendent to the Commission Office is Thursday by noon.

Then, no later than the Monday before the Commission meeting, the Project Manager will provide to the Commission Recorder two paper copies of the Notice of Award and construction Contract. These will be the actual copies signed by the Chairperson.

The Commission Recorder will then send two paper copies each to the contractor for signature with instructions to return one signed original copy and also provide a digital copy to the Highway Department's Project Manager. This is a good time to also remind the Contractor to provide a copy of their W-9 and their performance bond along with the fully executed contract as they will be required prior to issuing the Notice to Proceed.

The return of the fully executed contract, performance bond, and W-9 from the contractor signifies the end of the award process.

2.3 NOTICE TO PROCEED

No work may begin on a project until a Notice to Proceed has been issued. A Notice to Proceed is only issued after the contract has been fully executed, the performance bond has been provided along with the W-9 and within 10 days prior to beginning construction. The Project Manager will issue the Notice to Proceed after a pre-construction meeting based on the contractor's schedule provided at the preconstruction meeting. The Notice to Proceed must be signed and returned to the Project Manager. The Project Manager shall share a copy of the notice with the Consulting Engineer providing construction administration.

The issuance of the Notice to Proceed marks the beginning of the Construction phase.

2021 Bid Calendar

Monday	Tuesday	Wednesday	Thursday	Friday
	Send *Notice to Bidders* to Auditor's Office		(Argus deadline at noon)	(Brandon deadline at noon) (Garretson deadline at 5 pm)
Advertise in Argus Leader		Advertise in Brandon Valley Journal (Messenger deadline at noon)	Advertise in Garretson Gazette	Advertise in Minnehaha Messenger
Advertise in Argus Leader				
		Open Bids at 10:30a.m.		
Submit Briefing memo to Attorneys Office to Review and Approve Contract		**Submit briefing memo to Commission Office by 12:00 noon**		
	Present request to award bid at Commission Meeting			

Exhibit 2.1 – Bid Calendar

Notice to Bidders

Minnehaha County Highway Department requests bids for "Redwood Blvd Bridge Replacement".

Replace the existing 286.5' four span continuous steel girder structure with a new 300' four span prestressed concrete deck girder bridge structure.

Sealed bids shall be received by Minnehaha County Auditor's Office, 415 N Dakota Avenue, Sioux Falls, SD 57104, not later than **10:15 a.m. Wednesday, April 13, 2016. Bids shall be publicly opened and read at the Auditor's Office at 10:30am**.

Specifications and proposal forms that must be used are available at Minnehaha County Highway Department located at 2124 E 60th Street North, Sioux Falls, SD 57103. Bids submitted on forms other than the proposal supplied by the Minnehaha County Highway Department will be irregular and will not be considered.

Minnehaha County reserves the right to reject any or all bids, waive technicalities, and make award(s) as deemed to be in the best interest of the county.

Publish:
Argus Leader on March 28, 2016 and April 4, 2016
Garretson Gazette on March 31, 2016
Minnehaha Messenger March 31, 2016

Exhibit 2.2 – Notice to Bidders (example)

ADDENDUM NO. 1 - March 28, 2016
TO
BIDDING DOCUMENTS, DRAWINGS, AND SPECIFICATIONS
FOR
MINNEHAHA COUNTY
COUNTY HIGHWAY 149 RECONSTRUCTION
(Grading, Interim Surfacing, and Pipe Culverts)
From SD Hwy 38 to 254th Street

Project # MC-149-Reconstruct

Bid Letting: March 30, 2016

TO: **PROSPECTIVE BIDDERS AND OTHER INTERESTED PARTIES**

ADDENDUM NO. 1 is being sent out VIA E-MAIL to all plan holders. The bidder shall note receipt and make acknowledgement of the addendum on their proposal form, incorporating its provisions into their bid. The revised pages/sheets are attached to this cover sheet and are considered part of the addendum.

THE BIDDING DOCUMENTS AND SPECIFICATIONS, INCLUDING CONTRACT DRAWINGS ARE HEREBY MODIFIED BY THE FOLLOWING ITEMS:

DRAWINGS

1. **Plan Sheet B6:**
   a. Add the following line item to the table for Incidental Work, Grading:

Station	L/R	Remarks
305+75 TO 310+00	L	Contractor shall remove and dispose of existing abandoned Minnehaha Community Water Corporation rural water mains. Contractor shall plug (with concrete) the ends of the abandoned mains that are to remain in place.

2. **Plan Sheet D1:**
   a. In the SECTION D ESTIMATE OF QUANTITIES table, change the approximate quantity of item D7, Type B Permanent Seed Mixture, from 1113 Lbs to 670 Lbs.
   b. In the SECTION D ESTIMATE OF QUANTITIES table, change the approximate quantity of item D8, Type D Permanent Seed Mixture, from 1360 Lbs to 1020 Lbs.

3. **Plan Sheet D4:**
   a. Delete the final paragraph under the FERTILIZING general note. The deleted paragraph reads "*A commercial fertilizer with a minimum guaranteed analysis of 13-13-13, 18-46-0, 11-52-0, or an approved alternate fertilizer sold for use as a lawn starter fertilizer shall be applied to all areas designated for permanent seeding. The application rate of fertilizer shall be 100 pounds per acre*".

Project # MC-149-Reconstruct: County Highway 149 Reconstruction
(Grading, Interim Surfacing, and Pipe Culverts) From SD Hwy 38 to 254th Street
Addendum #1 March 28, 2016

DRAWINGS (continued)

4. **Plan Sheet F1:**
   a. Under the ASPHALT CONCRETE COMPOSITE general note, add the following sentence:

   Other approved asphalt cements used in the mixture shall be Performance Graded AASHTO designations PG58-26 and PG64-22.

BIDDING DOCUMENTS

1. **PROPOSAL FORM**
   a. Change the approximate quantity of item number 85 Type B Permanent Seed Mixture from 1113 Lbs to 670 Lbs.
   b. Change the approximate quantity of item number 86 Type D Permanent Seed Mixture from 1360 Lbs to 1020 Lbs.
   c. Bidders shall use the revised Proposal Form attached to this addendum for submission of bids.

ALL ITEMS IN CONFLICT WITH THE ADDENDA ARE HEREBY DELETED.

JSA Engineers/Land Surveyors

Myron Adam, PE/LS
Project Manager

March 28, 2016

REGISTERED PROFESSIONAL ENGINEER & LAND SURVEYOR
REG. NO.
6790
MYRON K. ADAM
SOUTH DAKOTA

Attachments:
Revised Proposal Form

Exhibit 2.3 – Addendum (Example)

AS-READ BID TABLULATION

BID: MC18-13

DEPARTMENT: Highway

FOR: MC18-01 Structure Replacement 50-205-060

BIDS RECEIVED AT: Minnehaha County Auditor's Office

BIDS READ ON: June 27, 2018 @ 10:30 a.m.

Bidders	Bid Bond	Total Bid Price
Estimate		$380,592.55
Nolz Dragline & Construction Inc.	x	576,088.36

Exhibit 2.4 – Bid Tabulation (for Bid Opening)

SECTION 3 - CONSTRUCTION ADMINISTRATION

3.1 PRECONSTRUCTION MEETING

A. Requirements and Procedures

The Project Manager shall coordinate the preconstruction meeting date and location with Consulting Engineer and Contractor. The location of this meeting should be coordinated with the consultant and be held preferably at the consultant's office due to limited meeting space at the Minnehaha County Highway Department. If necessary, the second floor multi-purpose room at the main County office building can be scheduled. For small projects, the meeting may also be held on site. The Consulting Engineer will be responsible for distribution of a letter or email notice to the Contractor and affected private utilities. The letter or email shall notify the Contractor of their responsibility to notify their subcontractors about the preconstruction meeting. The notice shall also include any information the Contractor is required to bring to the meeting.

The Consulting Engineer should utilize the Preconstruction Meeting Agenda Template for the preconstruction meeting. The template provides talking points for a variety of projects. Tailor the document for the specific circumstances. Visit with the County's staff prior to finalizing the agenda for the inclusion of the contract date, *etc*., and any current common issues. Further instructions can be found at the beginning of the agenda template.

There may be projects where a formal preconstruction meeting is not necessary. For these types of projects, the relevant details from the informal preconstruction meeting or discussion with the Contractor should be listed in a daily diary.

B. Distribution

Distribute the minutes of the preconstruction meeting to all attendees and make updates as necessary if omittances are noted by attendees. The Preconstruction Meeting Template can be used as the meetings minutes if an associated cover letter is used.

Documents: Preconstruction Meeting Agenda Template

3.2 PRECONSTRUCTION VIDEO AND PHOTOGRAPHY

A. Preconstruction Video

The Consulting Engineer shall make a video (DVD format preferred or Mini DVD is also acceptable) of the jobsite prior to construction as documentation of pre-existing conditions. On small projects, digital photos may be acceptable. This video is critical to help resolve claims or disputes with the Contractor or property owners. A copy of the

DVD or digital photos will be submitted to the County at the completion of a project. Specific items, but not limited to, that should be documented are private property, fences, approaches, adjacent streets, culvert and rip rap locations, up and downstream of channels as appropriate), existing drainage issues, sod conditions, staging areas, or any other items within or adjacent to the construction limits.

B. Construction Photographs

The Consulting Engineer should take digital photos of significant items during the course of the project. The date and time stamp feature should be turned on when taking photos. Copies of the photos should be submitted to the County on a flash drive at the completion of the project as part of normal project close-out procedures. It is not necessary to label each photo file and the Consulting Engineer should use their discretion when it is appropriate or necessary to label a photo file.

Daily photos supporting specific items mentioned within the daily diaries are expected as well as any information supporting a change order or a controversial topic.

3.3 NEWS RELEASES

A. Requirements and Procedures

A news release is issued when there is any impact to traffic caused by the project. This includes any lane closure or partial closure, or a new phase requiring a different detour. It is the policy of the Highway Department to send out a news release a minimum of two working days before installing or modifying traffic control. Road closures require a minimum of five working days. The Consulting Engineer shall coordinate with the Contractor to obtain two weeks' notice prior to any significant traffic impacts. This time is required to give the Highway Department notice for scheduling and setting up their message boards along with issuing news releases. Failure to provide two days' notice will result in project delays. News releases should be submitted earlier on projects where the impact to traffic is significant.

The news release should contain the following information:

- Title (Example: Bridge Replacement over Pipestone Creek located 3.5 miles north of Sherman on HWY 103 (487th Ave)
- Date the impact to traffic begins
- Location
- Type of work
- Impact to traffic and detour routes
- Anticipated completion date or duration of impact
- General note for the traveling public to drive cautiously within the work zone
- Name of the prime contractor

The news release will be developed by the Project Manager and submitted to the Highway Administrative Secretary.

B. Project Completion

A news release should also be issued when a major road project or structure reopens to traffic.

3.4 INSPECTOR'S DAILY REPORTS

The Consulting Engineering is required to keep a project diary during the course of the project. The daily record of a project inspector can be very valuable in determining resolutions to project issues after they have occurred. The more detailed the diary, the easier the resolution. Items which should be documented include, but are not limited to weather, contractors working, work performed, equipment used, tests performed along with their results. All discussions between the inspector and the engineer, contractor, utilities, and landowners should be documented. At the end of the day, the daily record must be signed and dated. A basic template for the project inspector's daily report is attached. However, the Consulting Engineer is encouraged to use their own customized form. Daily Reports should be submitted along with the contractor progress pay applications.

Photo documentation is an important and necessary component of good daily record keeping. Photos of sub-standard work are especially helpful, especially for erosion controls after a rain and when preparing the punch-list.

Documents: Inspector's Daily Report

3.5 BIWEEKLY PROGRESS REPORTS

The Consulting Engineering is required to fill out biweekly progress reports. They can use the form identified below or they can use their own version if it contains the same basic information. A copy of the biweekly progress report must be submitted to the Project Manager in paper or electronic form. A scanned copy of the document in PDF form containing the signature of the inspector is preferred. It is recommended this document be submitted to the Project Manager on the same schedule as the contractor progress pay applications. If the pay applications are submitted monthly, then it will up to the discretion of the Consulting Engineering and Project Manager as to submission schedule.

Documents: Biweekly progress report

3.6 A/E PROGRESS PAYMENTS

The Consulting Engineering is required to submit an architect/engineer progress payment request for services rendered as part of the construction administration agreement. Invoice

documentation must be attached. One copy of the payment request must be submitted to the Project Manager for review and approval. A different form is used for the final payment request. Refer to the project closeout section for information on the architect/engineer final payment request. The County pays bills once a week after every Commission meeting. Commission meetings are every Tuesday and items for the agenda are typically required one week in advance.

Documents: Architect/Engineer Progress Payment Request

3.7 CONTRACTOR PROGRESS PAYMENTS

The Consulting Engineer is required to prepare the progress pay application using the contractor pay application form. A spreadsheet or other supporting documentation of the pay items must also be attached. Typically progress pay applications are submitted biweekly.

One copy of the payment request must be submitted to the Project Manager for review and approval. The Consulting Engineer and Contractor are required to sign each Progress Pay Application. The Project Manager is required to review and sign the Progress Pay Applications. The County pays bills once a week after every Commission meeting. Commission meetings are every Tuesday and items for the agenda are typically required one week in advance.

Documents: Contractor Progress Pay Application Form

3.8 CHANGE ORDERS

Construction Change Orders (CCO) are to be prepared by the Consulting Engineer using the Contract Change Order Form. A draft of the CCO and supporting documentation must be submitted to the Project Manager for review prior to submittal to the Contractor for signatures. The Project Manager will review the CCO and make Consulting Engineer aware of any necessary changes.

All CCOs must comply with SDCL 5-18B-19 which is included below for convenience:

> ***5-18B-19. Amendment or change order to existing contract.*** *Any amendment or change order to an existing contract for construction, reconstruction, or remodeling of a public improvement does not need to be bid if:*
>
> *(1) The contract contains unit prices for the same type or class of work;*
>
> *(2) The change or extra work is necessitated by circumstances related to soils, utilities, or unknown conditions directly affecting the performance of the work that were not reasonably foreseeable at the time the underlying contract was let and the change or extra work is necessary to the completion of the public improvement; or*

(3) The sum of the proposed amendment or change order plus the sum of all other prior unbid amendments or change orders, exclusive of change orders issued under subdivisions (1) and (2) of this section, does not exceed the following:

(a) For contracts not more than five hundred thousand dollars, the greater of twenty-five thousand dollars or fifteen percent of the base contract;

(b) For contracts exceeding five hundred thousand dollars but not more than two million five hundred thousand dollars, the greater of seventy-five thousand dollars or ten percent of the base contract; and

(c) For contracts exceeding two million five hundred thousand dollars, the greater of two hundred fifty thousand dollars or five percent of the base contract.

The County Highway Superintendent can approve all CCOs up to a limit of $25,000 with approval from the Commission's Liaison. The Commission approves all CCOs over $25,000. This amount applies regardless if the net change is an increase or decrease. Work may not begin on CCO work until a CCO has been approved by the County Highway Superintendent or Commission as defined above. In extreme cases, the County Highway Superintendent may verbally approve a CCO.

Documents: Contract Change Order Form

3.9 CULVERTS

Corrugated Metal Pipe (CMP) is allowed under approaches, but only concrete pipe (RCP) is allowed under roadways. Pipe shall comply with the SDDOT specifications as bid in the plans and in accordance with the appropriate standard plates.

A. Tied Joints

Every joint of Reinforced Concrete Pipe (RCP) shall be tied together with appropriate connecting rods.

> Tying the joints prevents separation and infiltration of roadbed material which is a leading cause of roadway failures on our highway system.

B. Installation

Along with tying the joints, the contractor must seal each joint, either with mastic or an appropriately fitting rubber gasket. Ensure backfill material meets the DOT specifications for bedding material based on the installation. Gradations of the material should be taken at regular intervals to guarantee quality. All backfill material shall be installed in compactable lifts and fully compacted in accordance with SDDOT standard specifications prior to adding additional material. Confirm the contractor is knifing bedding material into the haunches of the pipe. Improper bedding of the pipe leads to premature failure. Around the pipe, at the flared ends, clay shall be used to create a watertight barrier in-lieu of the bedding material and typical subgrade. Topsoil shall be

placed on top of the clay uniformly with the rest of the grading. This clay plug shall encompass the pipe and creates a barrier between the waterway and bedding material.

The Contractor is responsible for preventing sediment from entering or exiting the new culverts. This is typically accomplished with wattles or silt fence.

i. Density Tests

Density tests for the backfill should be taken every two feet of fill to ensure the entire trench is properly compacted. Increase and decrease the amount of testing based on the square footage of the trench. Tests should be randomly placed on either side of the pipe as well as over the top of the pipe.

- For Standard Proctor tests, 97% shall be the minimum allowable compaction for the backfill.
- For Modified Proctor tests, 95% shall be the minimum allowable compaction for the backfill.

ii. Roll Tests

After the density requirement has been met, a Roll Test is required prior to placing any granular base. The subgrade must attain density as well as stability. Passing a density test does not guarantee stability. Up to a half inch of deflection is allowed with a fully loaded gravel truck. If there is deflection, it must remain consistent throughout. Areas showing inconsistent deflection or deflection greater than one-half inch must be reworked until passing a roll test.

3.10 RIP RAP

The method in which rip rap is placed depends on the culvert installation. Culverts might be installed level with the typical stream bed elevation or recessed either six inches or one foot. The amount that a pipe is recessed depends on the upstream drainage size. Install to the elevation called out in the plans. Install rip rap to the thickness indicated in the plans, starting with the fabric. Directly abutting the flared ends, rip rap shall NOT protrude above the flowline of the pipe. Ideally the top of the rip rap matches the flowline of the pipe.

Where the rip rap ties into the unexcavated stream bed, the top of the rip rap shall meet the existing elevation of the stream bed. Well placed rip rap completely covers the drainage fabric and leaves minimal spaces between rocks, much like a well-built rock wall. Ensure the placed rip rap matches the class (size) called out in the plans. The majority of rip rap placed with culverts will be class B. Dumping sharp rocks onto the fabric creating tears should be avoided. The fabric should be knifed into the soil on all edges and soil nailed or stapled to its substrate according to the notes and standard plates found in the plans.

3.11 SUBGRADE

A. Scarification

Scarify and Recompact, Fabric, and Soil Cement Treatment are all tools used to bring the subgrade up to an acceptable strength and stability level. Scarify and Recompact works by mixing the different types of soil together creating a homogenous base. Along with unifying the soil strata, moisture is more evenly distributed and can be gradually brought into the optimum moisture range determined by the proctor test.

- For Standard Proctor tests, 97% shall be the minimum allowable compaction for the backfill.
- For Modified Proctor tests, 95% shall be the minimum allowable compaction for the backfill.
- Commonly, the moisture content may be within 4 points of optimum; however, the material remains unstable. To minimize this, the allowable range of the moisture content should fall within the range of -4 to +1 points of optimum.

B. Fabric

Fabric can be used as a separation layer between the subgrade and gravel or as a structural member to the pavement section. Extra depth gravel with a separator fabric is a common solution for frost boils. Ensure the fabric is overlapped and stapled properly prior to gravel placement. Structural fabric should only be used with the recommendation from a geotechnical engineer.

There are many types of fabric offering different performance characteristics. Be sure the correct fabric is specified in the plans and that the correct fabric is being installed.

C. Soil Stabilization

Soil Cement will be considered for projects where a large stretch of road has unsuitable soil making it uneconomical to haul in borrow. Work with a geotechnical firm to determine testing requirements.

- Density tests should be taken at regular intervals along the subgrade to ensure quality work. Areas of fill will require additional tests every one to two feet of fill depending on the project size.
- Roll tests with a fully loaded gravel or borrow truck are required for every section of subgrade prior to placing granular base.

3.12 BASE COURSE

Acceptable base course includes, (from the *SDDOT Standard Specification for Roads and Bridges,* Table 882.2 and Section 884.2.D.1), Aggregate Base Course, Limestone Ledge Rock Base Course, and, Salvaged Material. Base Course shall be laid in lifts and compacted to plan specifications. Maintaining the base course's moisture content within the optimum range is crucial for obtaining passing densities. Common reasons the base might fail are low moisture content, soft subgrade, and too much construction traffic which pulls moisture up from the subgrade and into the base.

- Density tests and gradations should be taken at regular intervals along the base course to ensure quality work.

- Roll tests with a fully loaded gravel truck are required for every section of base course prior to placing surfacing. No deflection is allowed for base course prior to paving. Any deflection in the base course will cause premature failure of the surfacing.

- The 2% crown should be built into the gravel surfacing so that a consistent mat depth can be achieved when placing asphalt. This also helps to minimize over-runs on the quantity of asphalt.

3.13 ASPHALT CONCRETE SURFACING

The Highway Department bids asphalt cement pavements, for large jobs, as Asphalt Concrete and Asphalt Binder separately. This allows the County more control over the oil content used in the mix. Adjustments to the oil content can be made based on an oil burn down test or upon visual inspection of the mat. If in place densities are met and the mat's surface appears open more oil may be required. The Highway Department prefers tack coats prior to adding a lift of asphalt on a freshly laid surface even though SDDOT specs allow for placing subsequent lifts without a tack coat if the mat has not cooled to below a specific temperature. Limit lift thickness to a compacted three inch mat to allow for proper compaction.

- Rice tests must be taken every day asphalt is laid. Without a rice test, the density tests are inaccurate.

- Observe rolling patterns to ensure full coverage and temperature requirements are adhered too.

- Ensure the material tester's nuclear gage is functioning properly, has been calibrated in accordance with the manufacturer's recommendations and that the person operating it is fully skilled in its use including appropriate testing procedures for performing back-scatter testing.

- Same goes for their thermal testing equipment. Most modern thermal guns have a specific emissivity setting for asphalt. Do not rely on the thermal readings from a roller until after you it has been calibrated and checked against a thermal gun known to be functioning properly.

- Minnehaha County requires a safety edge be installed when laying new asphalt mats. These details should appear in the plans and be reviewed during the preconstruction meeting.

3.14 STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES

SDDOT bid items should be used for all applicable work items when possible. The *South Dakota Department of Transportation's Standard Specifications for Roads and Bridges* should be referenced to ensure the contractor properly installs all bid items. It includes specifications for each bid item as well as the proper way to install and inspect each bid item. Any bid items without a SDDOT bid item number should have a special note in the plans that specifically calls out the specifications to follow along with the method of measurement and payment.

3.15 EROSION CONTROL INSPECTION PROCEDURES

The Storm Water Pollution Prevention Plan (SWPPP) in the plans details the posting and inspection requirements. This section expands on those requirements pertaining to the specific inspection requirements and forms to be used. Please note the procedures outlined in this section do not apply to private developments or private site plans as the requirements and procedures for those are different.

A. Required Inspections

These inspections are required as a condition of the General Permit for Storm Water Discharges Associated with Construction Activities. These inspections are to be performed by the Consulting Engineer and the Contractor using the SWPPP Inspection Report form at the following minimum frequencies until the Notice of Termination (N.O.T.) has been submitted:

i. Prior to the removal of any surfacing or topsoil.
ii. Once every seven calendar days (minimum). When runoff is unlikely due to winter conditions, the inspections may be reduced to once a month.
iii. Within 24 hours after every rainfall of 1/4 inch or greater.
iv. After a snow melt that causes erosion.

The language in the SWPPP specifies contract price adjustments if the Contractor fails to comply with the requirements of the SWPPP and the SWPPP Inspection Report form is utilized as part of that process. Therefore, it is critical that the SWPPP Inspection Report is filled out at the frequency identified above and that the Contractor receives a copy of this document in a timely manner in case contract price adjustments have to be

made. The language in the SWPPP also allows inspections to be made at a frequency greater than outline above if obvious items of noncompliance exist.

In cases where the Contractor has not taken corrective or maintenance actions by the next inspection as defined in the SWPPP language, the Consulting Engineer must complete the SWPPP Notice of Contract Price Adjustment form.

B. Maintain Current SWPPP

The Consulting Engineer is also responsible for keeping the SWPPP current as specified in the SWPPP language. Keeping the SWPPP current is a requirement of the General Permit for Storm Water Discharges Associated with Construction Activities. The SWPPP shall be redlined, dated, and initialed by the Consulting Engineer.

C. Visible SWPPP Sign

A posting visible from the right-of-way displaying the permit tracking number, contract name, and phone number for obtaining additional project information is required by the General Permit at the start of the project. It is critical the Engineer keep one original copy of the SWPPP current at all times. The SWPPP must be located on the jobsite.

D. SWPPP Retention

The SWPPP and any modifications made to it must be retained by the Highway Department for a period of three years which is a requirement of the general permit. The SWPPP file must be turned into the Project Manager after the Notice of Termination is submitted.

Documents: SWPPP Inspection Report

3.16 RECORD DRAWINGS

Accurate record drawings are one of the most critical record keeping components of a project. The terms "Record Drawings" and "As-builts" are frequently used interchangeably. For the purpose of this section, the term "Record Drawing" will be used. Record Drawings will be submitted in both hard copy (one paper copy) and PDF. Record drawings must be submitted prior to the completion of the Construction Administration Agreement.

A. Procedures

The title sheet and all other sheets should also clearly state the plans are as-built drawings or record drawings. It is the Consulting Engineer's decision whether to label as as-built or record drawings. It is also the Consulting Engineer's decision as to whether or not the title sheet and all other sheets in the plan are stamped as state law does not specifically indicate that as-built or record drawings need to be stamped.

Significant items that have been changed or altered during construction, including those items included in change orders, should be shown and clearly represented within the record drawings. The use of colored revision clouds (rev-clouds) is highly encouraged.

B. Text and Line-work

The design (original) text shall be crossed out and revised (record) data added and design line work that is not representative of record work shall be erased or crossed out and substituted with the record lines. The use of colored revision clouds (rev-clouds is highly encouraged). Any changes from the original design should be represented with record lines. On the title sheet any sections without record changes should state ORIGINAL (ex. Sheet NO. D1 Typical Sections ORIGINAL). Below are things to look for in specific sections.

Section I. Plan and Profile
The expectation is that any utilities in this section are updated. Minor changes to the actual roadway plan and profile do not need to be noted. Utility design line work that is not representative of as-built line work shall be erased or moved, and substituted with the record drawing line work.

Section J. Pavement Layout (Updated)
The only expectation is to note any significant changes. Examples would include the addition or deletion of turn lanes, addition or deletion of driveways, Minor changes to the tie in or transition locations do not need to be noted.

Section K. Pavement Markings/Permanent Traffic Signing (Updated)
The expectation is to note any significant changes. Specifically, it must be noted if arrows, crosswalks, stop bars, or striping has been added or deleted. It must also be noted if any permanent signage is added, deleted, or changes location more than 50 feet. If no changes are made to this section, it should be labeled as matching original.

In addition, in 2019 highway staff completed a survey on all of our highways at centerline. This survey was then analyzed for passing sight distance, intersection sight distance, and stopping sight distance. With this data, staff can determine where accesses, school bus stop ahead signs, etc. can be placed when assessing existing conditions.

In order to keep this data updated, it is required to submit as-built drawings that identify the locations where passing sight, intersection sight, and stopping sight distances fail to meet minimum standards. It is understood that the permanent striping plan will indicate where NO PASSING ZONES exist, however, please include the areas (zones) where stopping site distance and intersection site distances are compromised. This data should be submitted via AutoCAD and shapefiles offset 5′ on the appropriate side of the roadway. Note that this information is required for each direction of travel.

SECTION 4 - PROJECT CLOSE OUT

4.1 FINAL CONSTRUCTION PAYMENT

The Consulting Engineer is required to prepare a final construction contract payment application on the provided form. This final contract payment is not like the change order format the City of Sioux Falls uses. Rather, it is simply a reflection of any and all final quantities installed. See Section 4.2 below. It is acceptable and somewhat routine to have more or less quantity for any given bid item than what was originally bid and/or as modified through a change order. This final payment is final reconciling of quantities installed. This procedure may be different when federal grants are involved which is not covered in this manual.

The routing and approval process for the final contractor payment is as follows:

1) Consultant to prepare a draft to be reviewed and approved by Project Manager.

2) Consultant to review and gain signature with contractor.

3) The Project Manager will then prepare the final payment paperwork and forward to the Highway Accountant for processing and payment by Commission approval then on to the Auditors' Office. Two paper original copies are preferred.

4.2 CONTRACTOR FINAL PAY REQUEST

A. Final Pay Application

The Consulting Engineer is required to prepare the final pay application using the Contractor Final Pay application form. A spreadsheet or other supporting documentation of the pay items must also be attached. The Contractor must submit a statement of labor compliance with the final pay application on all formally bid projects and the Contractor must sign the final pay application.

B. State and Federal Projects

For state or federally funded projects, other paperwork may be necessary which is not covered in this manual.

C. Additional Procedures

A single digital copy of the final contractor payment request must be submitted to the Project Manager for review and approval prior to being provided to the contractor for review and approval. Special consideration should be given to time of performance, liquidated damages, retainage on punch list items (which would void the final pay request and turn it into a progress payment), etc. The Project Manager is responsible to review and sign the final application after the contractor has reviewed and approved

it. For the final signed payment, two original copies are preferred for circulation and approval.

Documents: Contractor Final Pay Application Form; Contractor Certification Example

4.3 ARCHITECT/ENGINEER FINAL PAY REQUEST

The Consulting Engineering is required to submit a final architect/engineer progress payment request when the project is completed for services rendered as part of the construction administration agreement. Invoice documentation must be attached. These can be handled similarly to all other A/E pay requests; however, the appropriate form shall be used indicating "Final".

Documents: Architect/Engineer Final Payment Request

4.4 NOTICE OF TERMINATION

The Project Manager is responsible to submit the Notice of Termination to the SD DENR. The Notice of Termination must not be submitted until final stabilization, as defined in the general permit, has been achieved.

At this point, if there is a Section 404 Permit issued from the US Army Corps of Engineers, a Certificate of Completion is usually required to be submitted back to the Corps upon project completion.

4.5 FINAL ACCEPTANCE AND WARRANTY LETTER

The Consulting Engineer is responsible to write a final letter of acceptance to the Contractor. This letter should be written when all work has been completed, including punch list items.

The Consulting Engineer is responsible to write a letter to the Contractor outlining the start and ending dates of the one- and two-year warranty time period. Depending on the size and nature of the project, the letter of acceptance and warranty letter may be the same or separate letters.

4.6 PROJECT REPORT

The Consulting Engineer is responsible to provide a project report in electronic format to the County's Project Manager. This final report shall contain the following information:

- Daily reports and field representative's diaries.
- Biweekly reports.
- Material tests reports.
- All correspondence relating to the project including letters and emails.

- All records related to quantity measurements and calculations. This may include copies of handwritten notes and calculations, Excel files, or copies of marked up tables in plan sheets.
- All project videos and photos. These should be submitted on a separate DVD from all other information as these files are very large and multiple DVDs may be needed. If the videos are in Mini DV format, it is not necessary to transfer the video to DVD format and submit to the City. In these cases, the Consulting Engineer is responsible to retain the video tape.
- Other pertinent records and documentation as necessary.
- All construction administrative documentation shall be included no matter if the County has been provided the information previously.

The format should be PDF and the files should be submitted on a DVD or portable thumb drive. A CD may be used if all the information can be submitted on one CD. It is not necessary to create a separate file for each document. Similar items may be grouped together; for example, multiple material test reports may be grouped into one file. Files should be labeled in a systematic format. For example, if the scanning produces two files, each containing 50 material test reports, they could be labeled Material Test Reports 1 and Material Test Reports 2 or they could have a date referenced in the file name. For correspondence or any other data containing signatures, a scanned copy including the signature should be included and should not contain the source word file without signatures.

Project photos do not need to be individually named as these typically already have the date and time on them or the dates are listed in the files properties.

The project report will be subject to review by the County and State auditors. Therefore, the entire report submitted should be organized in a systematic way. On a small project, it may be possible to place all the files in one location. On larger projects, it may be necessary to create folders within the DVD to provide for better organization. Contact the Project Manager for a copy of the County's project file organizational structure as this may help organize large projects in a systematic and standardized way.

The Consulting Engineer is responsible to retain hard copies of all the above documents for a period of three years after project completion.

4.7 PROJECT CLOSEOUT CHECKLIST

A fillable form has been created to assist the consultants with their close-out procedures. County staff use this list as a check-off procedure and consultants are encouraged to do the same. It is recommended that a digital copy of this check list be prominently located when submitting the project final report.

Beyond the obvious, some helpful information regarding the check-list is as follows:

- The Statement of Labor Compliance can be acquired by the contractor by calling

the SD Department of Labor at 605-626-2312.

- The Project Manager shall submit the Notice of Termination to the SD DENR as specified within the Notice of Intent permit (as applicable). Not every project will have an N.O.I and an N.O.T. It is Minnehaha County's practice to always acquire an N.O.I/N.O.T whenever a US Army Corps of Engineers Section 404 Permit is issued. The Notice of Termination must not be submitted until final stabilization, as defined in the general permit, has been achieved.

- The Certificate of Completion is required to be submitted to the US Army Corps of Engineers Office only when there is a COE 404 Permit issued. The Project Manager is responsible to submit the Certificate of Completion. The Certificate of Completion must not be submitted until final stabilization.

- The No-Rise Certification for any significant hydraulic projects is required when a significant culvert is replaced on a linear project or when a structure is replaced. The Consulting Engineer is responsible to prepare a No-Rise Certification letter and submit to the Project Manager.

  This is typically included within the TS&L Study or the Preliminary Engineering/Design phase but the final report shall include as-built conditions which includes field verification and survey that the structural opening as designed and constructed complies with the modeling inputs associated with the preliminary analysis. Any changes from planned conditions versus field conditions "as built" shall be prominently noted. The Project Manager shall then provide a copy to the Floodplain Administrator within the Planning Department.

- The Consulting Engineer is responsible to write a final letter of acceptance to the Contractor. This letter should be written when all work has been completed, including punch list items.

  The Consulting Engineer is responsible to write a letter to the Contractor outlining the start and ending dates of the one- and two-year warranty time period. Depending on the size and nature of the project, the letter of acceptance and warranty letter may be the same or separate letters.

- The Consulting Engineer is responsible to coordinate the one- and two-year warranty inspections. A letter to the Contractor from the consultant should be sent after each respective inspection. The Contractor does not need to attend these inspections unless corrective action is needed. It is recommended that both the Consulting Engineer and Project Manager place a reminder on their calendars to conduct the warranty inspections.

- The Consultant shall coordinate with the Project Manager to ensure that:

  - All courthouse filings and field-monumentation are complete and correct.
  - The Load Rating needs to be provided to the SDDOT Local Government Assistance Office for structures.
  - The County's bridge engineer to schedule the Initial Bridge Inspection.

- Payments to easement holders and utility companies are complete.

Documents: Project Close-out Procedures

SECTION 5 - WARRANTY INSPECTIONS

ONE AND TWO YEAR WARRANTY INSPECTIONS

The Consulting Engineer is responsible to coordinate the one- and two-year warranty inspections. A letter to the Contractor from the Consulting Engineer should be sent after each respective inspection. The Contractor does not need to attend these inspections unless corrective action is needed. It is recommended that both the Consulting Engineer and Project Manager place a reminder on their calendars to conduct the warranty inspections.

SECTION 6 – HIGHWAY PLATS AND EASEMENTS

6.1 GENERAL

The intention of this guidance is to:

- Identify the need for and timing of easements.
- Create standards and commonality within the exhibits,
- Streamline review and acceptance at the Register of Deeds when filing, and
- Provide consistency in our work products and deliverables.

Consulting Engineers should have experience and knowledge in applying the standards and guidance found in the SDDOT's *Highway Surveying Manual,* which can be found at South Dakota Department of Transportation Highway Surveyors.

The MCHD deals with three main right-of-way (ROW) documents discussed below. In-house staff generate the easement agreements, purchase agreements, and warranty deeds. The exhibits for each are created by the consultant.

6.2 TEMPORARY CONSTRUCTION EASEMENTS

Temporary Construction Easements are required when additional areas outside of the existing right-of-way are needed to properly construct the project. This easement gives highway workers the right to temporarily trespass onto private property. Typically, this occurs when minor grading is required to blend newly grades slopes into their surrounding landscape. Another example is when constructing a bridge or large culvert: in order to improve channel flows and also to stabilize channel embankments, sometimes it is necessary to blend these contours up and downstream of the structure, outside of public right-of-way.

Therefore, the appropriate time to begin negotiating with landowners in pursuit of getting these easements is as soon as the horizontal and vertical alignments are set and the grading limits are established. It is good practice to add 10-15 feet to the grading limits of construction in order to provide room for workers to maneuver. Other considerations for additional temporary easement area include stockpiling outside of grading limits (topsoil, waste dirt, material laydown) and erosion control placement.

Generally, landowners understand the need to perform such work and negotiations proceed relatively smoothly; however, some provisions are usually requested by the landowner – of which, compensation for inconvenience or other reasons is common. The goal of these negotiations is to leave the landowner with the perception that they have not been harmed by actions taken by the MCHD. It is important to ensure temporary easement limits encompass changes precipitated from property owner meetings.

It is very important for a successful project that all special provisions, conditions, and other unique items negotiated and agreed upon by the Highway Department appear in the plans (removals and installations) and are accounted for in the bid items and notes. Therefore, it is highly recommended that the Consulting Engineer request copies of all easements prior to developing their final review plans.

Temporary Easements are an agreement between the landowner and the MCHD, lasting one year after final acceptance. The one-year time frame is consistent with our one-year warranty period such that, if additional work is necessary after construction, the contractor (or, in-house highway workers) may again occupy that area outside of the existing right-of-way and perform the remedy.

Temporary Easements are not filed at the Register of Deeds. The agreement between the two parties resides solely with each signing party. The property owner(s), MCHD Highway Superintendent, and a public notary sign this document. Electronic files are kept with the project records and originals are kept in storage at the Highway Department. Once temporary easements are fully signed, a copy is provided to all signing parties. At the conclusion of the right-of-way negotiations, electronic versions of all easements are provided to the consultant to ensure any special provisions are included in the plans. It is important to double check easement areas encompass any resulting grading changes. All easement provisions should be re-checked during the One-year Warranty Inspection. Any special conditions or unique provisions should be reviewed with the Contractor during the Pre-Construction meeting.

The Consulting Engineer shall use Section D of the construction plans for their exhibits which are attached to the Temporary Easement documents. For these exhibits, aerial images should be turned on to assist with property owners being better able to understand the work being proposed. The Consulting Engineer and MCHD project manager should ensure all special provisions in the temporary easements are accounted for, in the plans, at the 90% plan review if possible and definitely prior to bidding. To ensure compliance with the easements during construction, the Consultant shall show the temporary easement footprints on any plan pages that direct work outside of the right-of-way.

6.3 PERMANENT DRAINAGE EASEMENTS

Permanent drainage easements allow for the placement and maintenance of MCHD infrastructure and other interests. Easements for culverts and rip rap aprons must encompass at least the footprint of the appurtenances. Preferably, additional area is provided on all sides for maintenance crews and equipment to operate within -- without trespassing onto private land. The sizing and purpose are further described in 1.3.G.xiv of this manual.

Like the temporary construction easements, MCHD staff prepares the permanent easement documents. Permanent drainage easements use a standalone exhibit provided by the

Consultant, and required to be signed and stamped by a Registered Land Surveyor prior to filing. Unlike the temporary construction easements, these easements are filed at the Register of Deeds and run with the land. No special provisions are included with these easements. Once again, electronic files are kept at MCHD and provided to the Consultant. Hard or electronic versions shall also be provided to the signees. The property owner(s) and public notary are the only required signatories. Any special conditions requested by the property owner shall be included in the temporary construction easement. Hatching for the permanent drainage easements should be displayed in Sections D, L, and S of the plans.

6.4 HIGHWAY PLATS (H-PLATS)

Right-of-way allows for public passage through a corridor. Right-of-way begins at a minimum of 66 feet centered on the section line. Today's MCHD roadway standards require at least 100 feet of width centered on the section line. H-Plats are a specific type of plat uniquely designed to increase the right-of-way width for highway use.

During the design of every project the Consultant shall verify the existing right-of-way width. If the width does not meet MCHD's 100 feet minimum, explore the possibility of obtaining that minimum. H-Plats are also used to obtain the required footprint to install and maintain structures on the MCHD highway system. Refer to 1.3Gxiv of this manual for additional details.

H-Plats are filed at the Register of Deeds. They must be signed and stamped by the Surveyor and Register of Deeds. The accompanying Warranty Deed is prepared by MCHD staff and signed by the Property owner(s). The Warranty Deed allows the property owner to reduce their tax burden by the H-Plat's area. Electronic files of the H-Plat and Warranty Deed are kept with the project records. Once H-Plats and Warranty Deeds are fully signed, a copy is provided to the property owner(s). When producing plan sets and other exhibits, the Consultant shall ensure the current right-of-way limits are shown on all applicable pages.

6.5 NON-HIGHWAY PLATS

A. General

Plats filed in South Dakota require a Road Authority's signature. In Minnehaha County, on Minnehaha County roadways, this signature comes from the Highway Superintendent. Plats should be sent to the Highway Department along with a Highway Access Application & Permit for review at least one week prior to requesting signatures.

Prior to submitting a plat for review and approval, the individual or parties seeking approval need to comply with SDCL 11-3-12.1, which states:

> SDCL 11-3-12.1
> *The owner of any parcel of land proposing to develop such land for residential or commercial purposes shall obtain written approval of the proposed access to an abutting*

highway or street from the appropriate highway or street authority. The approval shall be obtained prior to filing of the plat in accordance with this chapter and may not replace the need for any permits required by law.

Therefore, when property is being platted adjacent to a county highway and the parcel owner is requesting access to said highway, an approved HIGHWAY ACCESS APPLICATION AND PERMIT is needed ***prior to requesting signature*** from the Highway Superintendent.

These permits can be found at:
Minnehaha County Bridge Weight Restriction Permit ,
or by contacting the highway department.

Additional information can be found in the Minnehaha County Access Management Policy for guidelines on access placement along county highways.

B. Signature Block Requirements

After the access permit is approved, within the plat, the following language and formatting is to be used when requesting the Highway Superintendent's approval.

CERTIFICATE OF ROAD AUTHORITY
I, _____, Highway Superintendent of Minnehaha County, do hereby certify that this plat has been reviewed by me or my authorized agent and that this plat is recommended for approval. This does not constitute approval of the specific design or precise location of access, and further, does not constitute the approval of access to private streets, city, state or township roads or highways, or any roadways outside the jurisdiction of the Minnehaha County Highway Department. Signed on this _____ day of _____, 20____. _____ Highway Superintendent, Minnehaha County

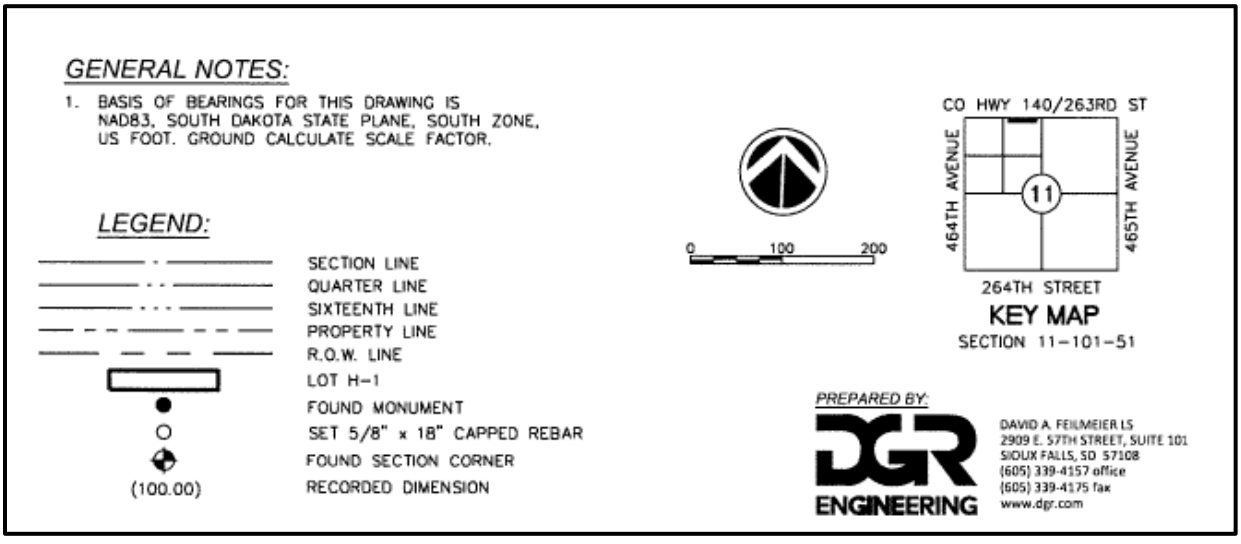
Any plats presented for signature having different text and formatting than what is shown above will be rejected.

Any person seeking a plat approval from the Minnehaha County Highway Department is strongly encouraged to contact an Engineering Specialists at 605-367-4316 as early in the process as possible in order to avoid extra work. Their job is to provide assistance in placing an access that complies with county standards which keeps our roadways as safe as possible for both the property owner and the traveling public.

6.6 CHECK LIST FOR H-PLATS

The following is a list of items the Highway Department requests to see on each exhibit or H-Plat:

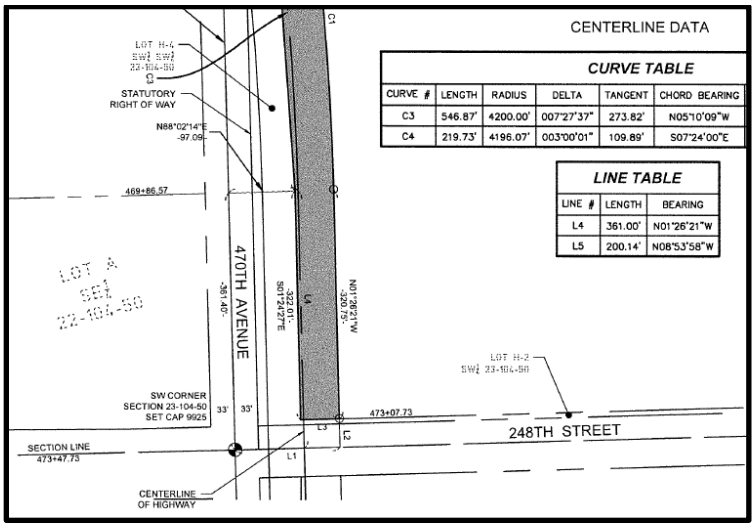
- Specify coordinate system used (UTM 14 or State Plane)
- Include a well-organized and comprehensive legend to include:
  - Monument types
  - Line types
  - Common symbols
- Magnify the new dimensions with a dimension insert or detail, required when text is hard to read or scale is greater than 200
- Indicate the cardinal direction north
- Show a useable bar scale (written scales do not suffice)
- Hatch new parcels with light solid hatches
- Write text in block-outs if text is included in hatching
- Dimension all existing and proposed property lines to the nearest .01 feet and areas to the nearest 1 sq.ft. or .01 acre.
- Insert a Key Map (Vicinity Map)
- Double check work and include "Drawn By:_____" or "Checked By:_____" when completed



The above example shows a well populated Legend, a simple yet easy to understand Key Map, Bearings used, and a North arrow with a usable bar scale.

The following is a list of items the Highway Department requests to be avoided when preparing exhibits and H-Plats:

- Reference a specific project by name or number
- Use dot-text or fonts that look like older dot-matrix typing for existing data



Note the use of the dot-text in the above graphic.
This font style is to be avoided.

Things to double-check prior to preparing or submitting final plats or exhibits.

- Match the parent parcel's legal description per records at the Register of Deeds' office.
- Sign each H-Plat prior to filing with Register of Deeds.
- Ask the Register of Deeds prior to using County Auditor's Lot nomenclature.

6.7 FINAL PROCEDURES

Completing the right-of-way process in an orderly and efficient manner helps minimize errors and omissions. The review process for exhibits and H-Plats involves the Surveyor, Highway Department, and Register of Deeds. Reviewers should be diligent and detail oriented in order to minimize re-work. This simplifies the filing process as well as the ROW negotiations.

Once an exhibit or H-Plat's "Drawn/Checked By:_____" has been initialed, the electronic document should be sent to the Highway Department for review. If uncommon legal descriptions or drawings are included in the document, the Highway Department may send it to the Register of Deeds for a preliminary review. Once the document has been approved, ROW discussions will take place with property owners.

If the property owner has changes for the document, it will go back through the review process and be approved by the property owner. Once documents have been executed with the property owner, the Surveyor shall sign their documents. Documents requiring County Commission signature will then be placed on a Commission Meeting Agenda. Fully signed documents are submitted to the Register of Deeds for filing.

By following these procedures, complete and accurate documents are created which streamlines reviews and approvals.

PROJECT INFORMATION SHEET

Date: _____
Structure or HWY #_____: MRM_____to MRM
Project Number: _____
Type of Work: _____
Project Funding: ☐ County ☐ State ☐ Federal
☐ Other:_____
Project Length:_____PE
Start Date:_____Completion Date: _____
FD Start Date:_____Completion Date: _____
Scheduled Letting: _____
Construction Start/End: _____

Project Information

Design Speed: Rural Urban_
Posted Speed: Rural Urban_
Clear Zone: Rural _____ Urban _____

Highway Type

☐ Two lane, rural ☐ Turn Lanes/Intersection
☐ Two lane, urban ☐ Multi-lane
☐ Gravel (Township) ☐ Round-a-bout

Terrain: ☐ Level ☐ Rolling ☐ Rough

Traffic Volume

Current AADT_____vpd Current % Trucks:_____
Based on: ☐ actual counts ☐ Other _____

Design AADT (20___)_____vpd Design % Trucks: _____
Based on _____

☐ Yes ☐ No Crash Data Available _____

Access Control ☐ Full ☐ Partial ☐ None
Access Notes: _____

Bridge Project Information
☐ Yes ☐ No Bridge Structure(s) involved
Structure Numbers: _____
General Work: _____

Design Standards

☐ County / LGA
☐ SD DOT
☐ Platting Jurisdiction (Municipal) _____

Plan Review Submittal Requirements

☐ 30%/TS&L ☐ 60% ☐ 100% ☐ Other _____
☐ Paper Submittals ☐ PDF Submittals
Final Submittals: paper copies and one electronic PDF

Plan Scales and Sections

Rural: 50 Scale (Vert. 10:1)
Bridge P&P/Urban: ☐ 30 Scale ☐ 40 Scale (Vert. :1)___

☐ Yes ☐ No Section A: Title Sheet, Legend, Control Data
☐ Yes ☐ No Section B: Estimate of Quantities and General Notes
☐ Yes ☐ No Section C: Typical Sections
☐ Yes ☐ No Section D: Right of Way & Easements
☐ Yes ☐ No Section E: Traffic Control
☐ Yes ☐ No Section F: SWPPP & Erosions Control
☐ Yes ☐ No Section H: Existing Conditions & Removals
☐ Yes ☐ No Section L: Plan & Profile
☐ Yes ☐ No Section M: Permanent Signing, Pavement Markings, & Fencing
☐ Yes ☐ No Section S: Structures
☐ Yes ☐ No Section X: Cross Sections
☐ Yes ☐ No Section Z: Pipe Sections
* *Standard Plates by section*

Typical Section

Lane Width:_____☐ Paved ☐ Unpaved ☐ PCCP
Paved Shoulder Width:___
Unpaved Shoulder Width:_____☐ Granular ☐ Turf
Curb and Gutter: ☐ Yes ☐ No
Ditch Foreslope: ☐ 4:1 ☐ 5:1 ☐ 6:1
Ditch Standard Bottom Width: _____
Ditch Options:_____
Ditch Backslope: ☐ 4:1 ☐ 5:1 ☐ 6:1 ☐____:1
Special Backslopes for Ag Property: ☐ 10:1 ☐____:1

Traffic Handling During Construction

☐ Full Closure with Detour and Temporary Access
☐ Single Lane Closed ☐ Flaggers/Pilot Car ☐ Temp Signals
☐ Closed to Thru Traffic Only (require Detour)
☐ Construct under Traffic (no detour required)
☐ Detour on State Route ☐ Detour on Township Road

Property

☐ Yes ☐ No Right-of-way is required
☐ Yes ☐ No Temporary easements required
☐ Yes ☐ No Permanent easements required

Bicycle and Pedestrian Considerations

☐ Yes ☐ No Bicycle lanes are planned
☐ Yes ☐ No Improvements to existing bicycle/pedestrian access
☐ Yes ☐ No Existing bicycle/pedestrian access eliminated

Notable Adjacent Property Owners

☐ Yes ☐ No Businesses/Organizations along project.
_____
_____

Permitting

☐ Yes ☐ No SD DOT

☐ Yes ☐ No Railroad

Railroad Authority: _____

☐ Yes ☐ No ☐Possible 404 Permit ☐ Wetland Mitigation

Other:_____

Hydraulics

☐ Q_{10} ☐ Q_{25} Primary Design Storm Event ____Other

☐ Yes ☐ No Are there known drainage issues?

☐ Yes ☐ No Is there channel/bank stabilization required?

☐ Yes ☐ No Is there floodplain(s) regulated by FEMA?

☐ Yes ☐ No Established Base Flood Elevations

☐ Yes ☐ No Flood Insurance Study Available

☐ Yes ☐ No Is County No Rise certificate(s) Required?

☐ Yes ☐ No Permanent Water Quality Requirements

Mainline and Intersection Structures & Culverts

Type: RCP

Minimum Size: 24" Diameter

Design: Pass the 4% chance event with 1-foot of freeboard

End Sections: Sloped ends up to 30" diameter

Flared ends when greater than 24" diameter

Safety ends within Clear Zone

Cutoff Walls for 48" diameter and larger (US and DS)

End Treatments

☐ Yes ☐ No Riprap

☐ Yes ☐ No TRM/ECB

☐ Yes ☐ No None

Approach Culverts

Type: CMP

Minimum Size: 24" Diameter

Design: Pass the 10% chance storm

End Sections: Flared ends

Safety ends within Clear Zone

Field Approaches

☐ Yes ☐ No Match existing size and geometry

Minimum width for new: _____

Maximum width for new: _____

Radius with roadway shoulder edge: Match existing or____-foot

☐ Yes ☐ No Gravel surface (4" thickness)

Farm/Residence Approaches

☐ Yes ☐ No Match existing size and geometry

Minimum width for new:_____(20' std)

Maximum width for new:_____(32' std)

Radius with roadway shoulder edge: R=25'

3"ACC/6"Gravel surfacing section within Right-of-way

Gravel Intersecting Roads

☐ Yes ☐ No Match existing size and geometry

Minimum width for new: _____

Maximum width for new: _____

Radius with roadway shoulder edge: Match existing or 25-foot

4"ACC/6"Base Course surfacing section within Right-of-way

Paved Intersecting Roads

☐ Yes ☐ No Match existing size and geometry

Paved width for new: _____

Shoulder width for new: _____

Radius with edge of paved roadway:

☐ Yes ☐ No Match existing

☐ Yes ☐ No _-foot radius

☐ Yes ☐ No Design for truck turn movements

Pavement Section: ☐ Yes ☐ No Match existing

Minimum Pavement Section:____" ACC /____" Base Course

Environmental

Type of NEPA Document Anticipated: ☐ CE ☐ EA ☐ EIS

☐ Yes ☐ No T/E Species in project area

☐ Yes ☐ No Wetland Delineation required

☐ Yes ☐ No Sites on/eligible for Nat'l Historic Register

☐ Yes ☐ No Cultural Resource Survey required

☐ Yes ☐ No Work within wetlands

☐ Yes ☐ No SWPPP Required

☐ Yes ☐ No NOI and NOT Required

☐ Yes ☐ No Hazardous waste or contaminated sites

Utilities

Known utilities:_____

_____

Relocations required:_____

_____

**Utility must be notified 90 days prior to construction*

Utility on Structure? ☐ Yes ☐ No

Financial Responsibility ☐ County ☐ Utility ☐ Cost Share

Available Data

☐ Yes ☐ No As-built plans_____

☐ Yes ☐ No Bridge Inspection Reports_____

☐ Yes ☐ No Right of Way Plans_____

☐ Yes ☐ No Engineering Studies_____

☐ Yes ☐ No Environmental Documents_____

☐ Yes ☐ No LiDar Data_____

☐ Yes ☐ No Aerial Mapping_____

☐ Yes ☐ No Utility Mapping_____

☐ Yes ☐ No Other Reports/Data_____

Adjacent/Previous/Future Projects

☐ Yes ☐ No Is this part of a larger project?

☐ Yes ☐ No Are there adjacent projects that may impact this project? _____

☐ Yes ☐ No Have there been construction issues on similar projects?

☐ Yes ☐ No Future area projects to be aware of?

_____

_____

Preconstruction Meeting Agenda Instructions

1. This agenda provides a guideline for discussion items in Preconstruction meetings. **Items may be deleted if they do not apply to the project**. However, all applicable items should be included.

2. County Engineering should be contacted to provide new specifications and requirements which should be discussed in Item 8.

3. This agenda, with a cover letter, shall be completed by the Consultant. The Consultant shall invite the Prime Contractor and the affected utility companies. The Prime Contractor shall invite all subcontractors and suppliers they wish to attend. The Project Manager shall invite all applicable County employees.

4. In the invitation cover letter, the Consultant should list all paperwork that the Contractor needs to submit prior to construction – INCLUDING SCHEDULE.

5. The Consultant shall add all discussion notes from the Preconstruction Meeting to the agenda to create the meeting minutes. A cover letter signed by the Consultant shall be sent with a copy of the meeting minutes, the attendance roster, contractor list, and supplier list to the County, Contractor, Utilities, and all others requesting a copy. Meeting minutes may be distributed by email.

Preconstruction Meeting Agenda

Project No.

Date:

1. Attendance of Preconstruction Conference

a) Distribute attendance roster for everyone to sign.

b) Have everyone introduce themselves if needed.

2. Contract, Notice to Proceed, Liquidated Damages

a) Date of Contract:

b) Notice to Proceed

Date of Notice:

Contract shall start on the date construction begins, but not later than ten calendar days after notice.

c) Liquidated Damages: Liquidated damages—$ per working day.

Incentives:

d) Contractor Documents: Up to sets of no charge documents will be provided.

e) Contractor to inform Engineer a minimum of 48 hours in advance of street closure(s) and detour changes.

Message boards for arterial or selected projects will be in place one week prior to the street closure or construction operations.

f) Engineer will contact County so that a news release may be published.

3. Subcontractors

(List of Subcontractors shall be provided by Contractor prior to the Preconstruction Meeting.)

4. Plan Sequence and Construction Progress Schedule

a. Project Phasing and Work Schedule provided by Contractor:

b. Engineer Project Phasing and Work Schedule Comments:

c. Contract Requirements:

- Start Date:
- Completion Date:
- Calendar/Working Days:

- Substantial Completion Requirements:
- Interim Date(s):
- Interim Requirements:

5. Horizontal and Vertical Control

a) will provide all construction staking. Twenty-four- (24) hour notice required for significant staking.

6. Construction Utilities

a) Unless specifically provided for otherwise in specifications, Contractor is responsible for providing all utilities necessary to fully execute his contract.

b) Contractor is responsible for verifying utility information and calling for utility locations.

c) Plan shown utility locations for reference only.

Utility Contacts: (Engineer shall verify that contact information is correct prior to meeting.)

d) Discuss all utility conflicts and relocations.

7. Project Meetings

a) Weekly project meeting time and place:

8. New Requirements and Critical Issues

a) Discuss all known hazards on site – confined spaces, trenches, electrical safety, etc.

b) The contractor must notify the County in writing when the contractor considers the work complete. This is what triggers the final inspection, generation of the punch list, and final acceptance. The warranty period doesn't begin until final acceptance.

c) Contractors must do a better job with asphalt tacking. Reference the ASPHALT CONCRETE COMPOSITE note in the plans and the DOT Spec Book.
   - o Uniform distribution
   - o 100% coverage, even on vertical surfaces

d) Sidewalk ADA Compliance
   - o There is no tolerance on the maximum allowable slopes. 2% maximum means 2% maximum. No consideration will be allowed for slopes above the maximum allowed. Recommend setting forms up at less than the maximum allowed to provide some construction tolerance in the field.

e) Storm Sewer
   - Make sure the keyed construction joints are being constructed between the inlet walls and the throat per the standard plate.
   - Field changes need to be discussed with the County's Drainage Engineer prior to implementation
   - determine sampling points and ensure that this will be acceptable for Engineering.

f) Property Pins and Section Corners
   - All found property pins and section corners shall be preserved if at all possible during construction.

9. If property pins or section corner monumentation must be disturbed during construction, the Engineer will make provisions to locate/witness said monument(s) so they can be reset after the project.**Discussion of Plans (Dismiss those not interested in plan compliance information.)**

10. Equipment and Materials

a) Contractor shall submit a list of materials suppliers at Preconstruction Meeting.

b) Furnish equipment, components, or materials as named in specifications. Requests for product substitutions should be considered only under circumstances outlined in specifications.

11. Testing

a) GeoTek will provide soils testing and concrete testing.

b) Owner will pay for the soils and concrete testing. Owner responsibility will include the first test and a backup test if required.

c) Contractor will pay for all additional soils and concrete testing until plan compliance is achieved, if testing is required beyond the backup test. Contractor will also provide and pay for all other testing specified by the contract.

d) Contractor shall provide 24-hour notice for all testing with a 1-hour confirmation for concrete pours.

e) Lab test reports, concrete, compaction reports, etc.

(1) Identify station and offset on all test reports.

12. Additions or Deletions to Contract

a) The Owner, through the Engineer, may request changed or extra work by the use of change orders. Change orders shall be executed prior to performing work.

b) Minor additions/subtractions may be made at current unit prices without the use of a change order.

13. Coordination with Landowners

a) Engineer to provide coordination information to the affected property owners.

b) Landowner coordination by the Contractor as required.

14. Contacts and Chain of Command

a) **Owner: County of Minnehaha County**

Primary Contact:

Mailing Address:

Telephone: Fax: Mobile:

After-Hours Phone Number:

b) **Engineer:**

Project Manager:

Mailing Address:

Telephone: Fax: Mobile:

After-Hours Phone Number:

Project Engineer—On-Site:

Telephone: Fax: Mobile:

After-Hours Phone Number:

Project Technician/Inspector—On-Site:

Telephone: Fax: Mobile:

After-Hours Phone Number:

If changes are made to the project staff, the Consultant shall provide written documentation identifying the new individuals.

c) **Material Testing Engineer:**

Project Testing Manager:

Primary Contact:

Mailing Address:

Telephone: Fax: Mobile:

After-Hours Phone Number:

d) **Contractor:**

Primary Contact:

Mailing Address:

Telephone: Fax: Mobile:

After-Hours Phone Number:

Project Superintendent:

Mailing Address:

Telephone: Fax: Mobile:

After-Hours Phone Number:

The Contractor will provide written documentation if changes are made to the Project Superintendent.

e) **Traffic Control:**

Primary Contact:

Mailing Address:

Telephone: Fax: Mobile:

After-Hours Phone Number:

15. Payment to Contractor

a) Final payment will be made in accordance with the General Conditions.

b) No payment will be made for material stored off site.

c) Engineer will prepare pay estimates.

d) Contractor ***required to*** review and sign all progress estimates prior to submittal.

16. Correlation and/or Interpretation of Documents

a) If discrepancies occur between Drawings and Specifications, request Engineer's interpretation.

b) The Inspector cannot authorize deviations from the contract documents without the Engineer's approval.

17. Differing Site Conditions and/or Out of Scope Work

a) If the Contractor encounters site conditions that differ from those shown in the contract documents, he must notify the Engineer in writing before the site is disturbed and before the affected work is performed.

b) If any out of scope work is required or requested, the cost of said work must be agreed to in writing prior to the commencement of said work when there are no bid items for the work in the contract.

18. Safety

a) The Contractor is responsible for safety on the project, both for their own staff and for the general public. The Contractor shall also provide safe access on the project for the Engineer and Inspector.

Attendance Roster			
Name	**Company**	**Cell**	**Email**

List of Contractors				
	Company	**Supt./Forman**	**Cell**	**Email**
Grading				
Traffic Control				
Underground				
Electrical				
Erosion Control				
Asphalt				
Concrete				
Other				

List of Suppliers				
	Company	**Address/Pit Data**	**Phone**	**Email**
Asphalt				
Concrete				
Gravel				
Borrow				
Storm Pipe				
Other				

Report No. _____

MINNEHAHA COUNTY
INSPECTOR'S DAILY REPORT

Date: _____

Inspector: _____

Project No. (####)_____

Project: (PROJECT NAME)
(PROJECT SUBTITLE)
(CITY, STATE)

Prime Contractor: (NAME)
(ADDRESS)
(CITY, STATE ZIP)

Arrival on Site: _____ Departure From Site: _____

Barricade Status:

- ☐ In Place per Plans
- ☐ Open for Access
- ☐ Not in Place (see remarks)

Utility Trench Status:

- ☐ All Trenches Backfilled or Protected
- ☐ Working in Open Trench
- ☐ Unprotected Open Trench (see remarks)

☐
☐
☐

Weather:

Sky: _____

Temperature Range: _____deg F

Wind Range: _____mph

Precipitation:

- ☐ Rain
- ☐ Snow
- ☐ Lastnight
- ☐ Morning
- ☐ Afternoon
- ☐ Evening

Total Precip: _____in

Remarks:

Erosion Control Status:

- ☐ All Erosion Control in Place
- ☐ Out of Compliance (see remarks)

☐ ☐ ☐

WORK ACCOMPLISHED

OFFICE OF COUNTY ENGINEER
MINNEHAHA COUNTY, SOUTH DAKOTA
BIWEEKLY PROGRESS REPORT NO. _____

Contract Date. _____

PROJECT _____ PERIOD ENDING _____

_____ PLAN COMPLETION DATE _____

_____ (working days or calendar days)

TYPE OF WORK _____ CONTR. ACTUAL COMPLETION DATE _____

PRIME CONTRACTORS _____ CONTRACTOR SCHED. COMPLETION DATE _____

WORK IN PROGRESS THIS PERIOD

_____

_____

_____

_____

_____

_____

_____

_____

GENERAL COMMENTS: _____

_____

CONTRACTORS WORKING: (Indicate after each: 1-1st Week; 2-2nd Week; 3-Both Weeks)

_____ WORK STARTED _____

_____ WORK SUSPENDED _____

_____ WORK RESUMED _____

_____ FIELD WORK COMPLETED _____

DAY	DATE	Working Days	WEATHER AND COMMENTS
SUNDAY			
MONDAY			
TUESDAY			
WEDNESDAY			
THURSDAY			
FRIDAY			
SATURDAY			
SUNDAY			
MONDAY			
TUESDAY			
WEDNESDAY			
THURSDAY			
FRIDAY			
SATURDAY			

PREPARED BY: _____ SUBMITTED BY _____

PROJECT RPR

PHOTOS FOR WEEK

Minnehaha County Highway Department

Engineering Payment Request

Date _____

Period _____

Request No. _____

Contract No. _____

Phase _____

Project Name _____

Architect/Engineer _____

_____

_____

Original Contract $ _____

Total of Amendments $ _____

Revised Contract $ _____

Work Completed To Date $ _____

Less Previous Payments $ _____

Payments Due This Period $ _____

Balance Remaining After This Payment $ _____

Percent Completed _____ %

Submitted By:

_____ _____

Signature Architect/Engineer Date

Approved By:

_____ _____

Minnehaha County Highway Dept. Date

Billing Summary Documentation / Billing Report Attached _____

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MINNEHAHA COUNTY HIGHWAY DEPARTMENT
APPLICATION AND RECOMMENDATION FOR CONTRACTOR PAYMENT

Project No. _____

Project Name _____

Dated _____ Application No. _____

For work accomplished through the date of _____

Contractor Name _____

Payment Amount

1. Original Contract Price $_____

2. Net Change Orders $_____
No. 1 through ____

3. Current Contract Price $_____

4. Amount Due to Date $_____

5. Less Previous Payments $_____

6. Amount Due This Application $_____

Engineer Certification

This application meets the requirements of the Contract Documents.

In accordance with the contract, the undersigned recommends payment to the contractor of the amount due as shown above.

_____
Engineer

Dated: _____ Signature: _____

Contractor Certification

The undersigned Contractor certifies that (1) all previous progress payments received from Owner on account of Work done under the Contract referred to above have been applied to discharge in full all obligations of Contractor incurred in connection with work covered by prior Application and Recommendation for Payments numbered 1 through _____ inclusive; and (2) title to all materials and equipment incorporated in said Work or otherwise listed in or covered by this Application will pass to Owner at time of payment free and clear of all liens, claims, security interests, and encumbrances (except such as covered by Bond acceptable to Owner).

_____
Contractor

Dated: _____ By: _____

County Approval

_____
Project Manager

Dated: _____ Signature: _____

- Attach Bid Item Payment Schedule -

MINNEHAHA COUNTY HIGHWAY DEPARTMENT
CONSTRUCTION CHANGE ORDER NO.

Original Contract Amount:		Project Name:	
Net Change by Previous CCOs:			
Increase/Decrease this CCO:	$ -	Contractor Name:	
Current Contract Amount:	$ -	Project No.:	

All CCO's must comply with South Dakota Codified Law 5-18B-19. To view the law in its entirety: http //legis.state.sd us/statutes/index.aspx.

The following change in plans and/or specifications for the subject project is hereby made. Attach supporting documents as required.

	Line Item(s) or RFP #	Description of Proposed Work	Justification	Cost
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
See Attachment for Quantities and/or Justifications: ☐ Yes ☐ No			Net Increase/Decrease this Change Order:	$ -

Original Completion Date:		Net Time Change of Previous CCO's:		Time Change Due OnThis Change Order:		Revised Contract Completion Date:	
Time Extension Jus ification:							

The changes contained in this Construction Change Order are made in accordance with the provisions of the Contract for subject project, and when accepted by the Contractor and upon approval by Minnehaha County, shall become part of said Contract.

Signature	Date	Signature	Date
Architect/Engineer Recommendation		Project Manager Recommendation	
Contractor Acceptance		Highway Supt: ☐ Approval ☐ Recommendation	
The following signatures are required when the amount of the increase/decrease is greater than or equal to $25,000.			
Commission Chairman Approval			

EROSION AND SEDIMENT CONTROL INSPECTION REPORT

MINNEHAHA COUNTY

Inspection Date: _____

Project Eng./Inspector: _____

Field Office Phone #: _____

Prime Contractor: _____

EC Sub Contractor: _____

PROJECT #	
PROJECT NAME	
DESCRIPTION	
MILE MARKER	

Reason for Inspection: **Weekly** **Rain** **Stage** **Other** _____ **(circle one)** **Weather:** _____

Estimated percent of project open and not landscaped: _____

Modifications Required:	YES	NO	Not Applicable	**Modifications Required:**	YES	NO	Not Applicable
Silt Fence	☐	☐	☐	Mulch	☐	☐	☐
Ditch Checks	☐	☐	☐	Silt Screen	☐	☐	☐
Erosion Mat	☐	☐	☐	Turbidity Barrier	☐	☐	☐
Riprap	☐	☐	☐	Temp. Diversion Channel	☐	☐	☐
Inlet Protection	☐	☐	☐	Temp. Settling Basin	☐	☐	☐
Temporary Seeding	☐	☐	☐	Grading Practices	☐	☐	☐
Permanent Seeding	☐	☐	☐	ECIP	☐	☐	☐
Sod	☐	☐	☐	Other	☐	☐	☐
Project Schedule	☐	☐	☐	Other _____	☐	☐	☐

Note: Any boxes checked "YES" must have comments and recommendations. Describe them below.

Comments/Recommendations concerning the effectiveness of, and any reasonable corrections needed to maintain or increase the effectiveness of, in-place erosion control and storm water management measures are described below by the individual erosion control item or other general erosion control measures.

EROSION CONTROL ITEM	**COMMENTS / RECOMMENDATIONS**

☐ **See Additional Sheets or Optional Erosion Control Diary – Page 2 for additional comments (Attached)**

COMMUNICATION NOTES:

To Whom	Type of Communication (circle one)	Comments
_____	Direct E-mail Phone Fax Written Order Diary	_____
_____	Direct E-mail Phone Fax Written Order Diary	_____

Optional Page 2 - EROSION CONTROL DIARY

Inspection Date: _____

Additional Comments / Descriptions for Specific Erosion Control Practices

EROSION CONTROL ITEM	COMMENTS / RECOMMENDATIONS FOR SPECIFIC EROSION CONTROL PRACTICES

Description of Erosion Control Site Inspection Report

The form may be printed and used in the field for notes and/or as an electronic record of erosion control inspections. Contractor follow-up is mandated and is a required part of this inspection report. If the contractor fails to accomplish the required corrective actions enforcement will result.

PAGE 1

General Information

- Provide date of inspection, inspector(s), general construction project information, project staff, and contractors involved including appropriate phone numbers.

Best Management Practices Evaluation

- Include specific comments regarding erosion and sediment control BMPs throughout the project.
    - Are the BMPs implemented and installed correctly?
    - Are they adequately installed for site conditions?
    - Are they functioning properly?
- For each applicable BMP, list detailed information not only regarding specific failures and deficiencies, but also successes and improvements. It is usually helpful to reference location.
- Mark appropriate box.
- If corrective actions are needed, indicate what should be done to remedy deficiencies in the "Required Corrective Actions" column.
- When the contractor has taken corrective action, record the date it was implemented and/or accepted (satisfactory installation).

PAGE 2

Best Management Practices Evaluation (continued)

- Utilize "Other" and "General Comments" sections as needed.

Mobilizations

- Note whether the corrective actions will require a mobilization (substantial replacements/additions, heavy equipment, extensive labor force, etc.) by checking "yes." If a mobilization is not required (i.e., normal, small-scale maintenance) check "no."
- If a mobilization is required, check which type is required. Note that a $300/day fine is associated with non-response to either mobilization after the grace period indicated on the form has passed.

Signature Lines

- Sign, date, and record the time at which this form was submitted to the contractor. Also record the type of contact (direct, fax, e-mail, phone call, etc.).
- For routine maintenance, the contractor is required to respond within 24 hours of receiving notification. When the required corrective actions have been completed, the contractor should sign and date (including time) the form and submit it to the project engineer (or other responsible person).
- The corrective actions taken by the contractor must be properly installed and accepted by the project engineer (or other responsible person). This acceptance is indicated by the project engineer's signature on the final line.

MINNEHAHA COUNTY HIGHWAY DEPARTMENT

APPLICATION AND RECOMMENDATION FOR CONTRACTOR FINAL PAYMENT

Project No. _____

Project Name _____

Dated _____ Application No. _____ and final

For work accomplished through the date of _____

Contractor Name _____

Payment Amount

1. Original Contract Price $_____

2. Net Change Orders $_____
No. 1 through _____

3. Current Contract Price $_____

4. Net Deviation in Qty's $_____

5. Gross Amount Due $_____

6. Less Previous Payments $_____

7. Amount Due This Final Application $_____

Engineer Certification

This application meets the requirements of the Contract Documents.

In accordance with the contract, the undersigned recommends payment to the contractor of the amount due as shown above.

_____
Engineer

Dated: _____ Signature: _____

Contractor Certification

The undersigned Contractor certifies that (1) all previous progress payments received from Owner on account of Work done under the Contract referred to above have been applied to discharge in full all obligations of Contractor incurred in connection with work covered by prior Application and Recommendation for Payments numbered 1 through _____ inclusive; and (2) title to all materials and equipment incorporated in said Work or otherwise listed in or covered by this Application will pass to Owner at time of payment free and clear of all liens, claims, security interests, and encumbrances (except such as covered by Bond acceptable to Owner).

"Statement of Labor Compliance" from South Dakota Department of Labor is attached: Yes_____ No_____

SRF Funding / Federal Funds: Yes_____ No_____ If yes, have Forms C & H been filed: Yes_____ No _____

_____
Contractor

Dated: _____ By: _____

County Approval

_____
Project Manager

Dated: _____ Signature: _____

- Attach Bid Item Payment Schedule -

Minnehaha County Highway Department

Engineering Payment Request - *FINAL*

Date _____

Period _____

Request No. _____

Contract No. _____

Phase _____

Project Name _____

Architect/Engineer _____

_____

_____

Original Contract $ _____

Total of Amendments $ _____

Revised Contract $ _____

Work Completed To Date $ _____

Less Previous Payments $ _____

Payments Due This Period $ _____

Balance Remaining After This Payment $ _____

Percent Completed _____ %

Submitted By:

_____ _____

Signature Architect/Engineer Date

Approved By:

_____ _____

Minnehaha County Highway Dept. Date

Billing Summary Documentation / Billing Report Attached _____

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PROJECT CLOSE-OUT PROCEDURES

Project Name:_____ Contractor: _____

Consultant: _____ CN Completion Date: _____

☐ **Contractor Final Pay Request**

The **Consulting Engineer** is required to prepare the final pay application using the *Contractor Final Pay Application* form. A spreadsheet or other supporting documentation of the pay items must also be attached.

☐ - The Contractor must submit a "Statement of Labor Compliance" with the final pay application on all formally bid projects and the Contractor must sign the final pay application. The "Statement of Labor Compliance" can be obtained from the South Dakota Department of Labor at 605-626-2312.

☐ The **Project Manager** shall update the "Project Payment Summary" spreadsheet with the final payment amount.

☐ **Architect/Engineer Final Payment Request**

The **Consulting Engineer** is required to submit a final architect/engineer progress payment request when the project is completed for services rendered as part of the construction administration agreement.

- Invoice documentation must be attached.
- A fully executed PDF or one original paper copy of the final payment request must be submitted to the **Project Manager** for review and approval.

☐ **Notice of Termination**

The **Project Manager** is responsible to submit the Notice of Termination. The Notice of Termination must not be submitted until final stabilization, as defined in the general permit, has been achieved. If no N.O.I. permit was applied for prior to construction, obviously an N.O.T. is not required.

☐ **Certificate of Completion (only when there is a COE 404 Permit)**

The **Project Manager** is responsible to submit the Certificate of Completion. The Certificate of Completion must not be submitted until final stabilization.

☐ **No-Rise Certification (Structure projects only)**

The **Consulting Engineer** is responsible to prepare a No-Rise Certification letter and submit to the **Project Manager**. This is typically included in the Consultant's Final TS&L/H&H report.

☐ The **Project Manager** will transmit the letter to the Minnehaha County Planning Director or Floodplain Administrator.

☐ **Final Acceptance Letter and Warranty Letter**

The **Consulting Engineer** is responsible to write a final letter of acceptance to the Contractor. This letter should be written when all work has been completed, including punch list items.

The **Consulting Engineer** is responsible to write a letter to the Contractor outlining the start and ending dates of the one- and two-year warranty time period. Depending on the size and nature of the project, the letter of acceptance and warranty letter may be the same or separate letters.

☐ **Project Report**

The **Consulting Engineer** is responsible to provide a project report in electronic format to the County Highway Department. This final report shall contain the following information:

☐ a. Daily reports and field representative's diaries.

- ☐ b. Biweekly reports.
- ☐ c. Material tests reports.
- ☐ d. All correspondence relating to the project including letters and emails.
- ☐ e. All records related to quantity measurements and calculations. This may include copies of handwritten notes and calculations, Excel files, or copies of marked up tables in plan sheets.
- ☐ f. Final as-built construction plans in a PDF format. Also include *.shp files for violations of passing, stopping, and intersection site distance, and k-values.
- ☐ g. Verify all deeds, plats, and permanent easements are filed at Register of Deeds along with setting any boundary pins and cadastral monuments. Request copies of recorded ¼-corners.
- ☐ h. All project videos and photos. These should be submitted on a separate DVD from all other information as these files are very large and multiple DVDs may be needed.
- ☐ i. Other pertinent records and documentation as necessary.
- ☐ j. Specific Items that are not needed since the County already has copies of them include: pay estimates, and contract change orders.
- ☐ k. Summary index listing all submitted documents.

- The format should be PDF and the files should be submitted on a DVD. A CD may be used if all the information can be submitted on one CD. Files should be labeled in a clear and logical systematic format.
- For correspondence or any other data containing signatures, a scanned copy including the signature should be included and should not contain the source word file without signatures.
- Project photos do not need to be individually named as these typically already have the date and time on them or the dates are listed in the files properties.
- The project report will be subject to review by the County Auditor. Therefore, the entire report submitted should be organized in a systematic way. On a small project, it may be possible to place all the files in one location. On larger projects, it may be necessary to create folders within the DVD to provide for better organization.
- The **Consulting Engineer** is responsible to retain hard copies of all the above documents for a period of three years after project completion.

☐ **One- and Two-Year Warranty Inspections**

The **Consulting Engineer** is responsible to coordinate the one- and two-year warranty inspections. A letter to the Contractor from the consultant should be sent after each respective inspection. The Contractor does not need to attend these inspections unless corrective action is needed. It is recommended that both the **Consulting Engineer** and **Project Manager** place a reminder on their calendars to conduct the warranty inspections. **Proposed week of Warranty Inspection _____**

☐ **In-House Project Close-Out:** The **Project Manager** will ensure this checklist is completed.

- ☐ • Assemble PDF of email correspondence and move into the project file.
- ☐ • Receive and file the consultant's Project Report.
- ☐ • Submit final plans and load rating for bridges to SDDOT Local Government Assistance.
- ☐ • Coordinate initial inspection of new structures with Chris Brozik, CDI.
- ☐ • Copy the following documents from the project folder to a new folder (20xx Reconstruction) in the bridge folder: Final As-Built Plans, Load Rating Analysis and cover letter, COE 404 Permit, and shop drawings for pre-cast culverts.
- ☐ • Update "Project Payment Summary" spreadsheet with final payment amounts for construction administration agreement and construction contract.
- ☐ • Work with RLS to verify all items in "g" above have been filed and properly recorded, including corner records filing.
- ☐ • Verify and update with Collector App: Culverts, Permanent Signs, Structures, and Guardrail.