Town of Ripton, Vermont
Engineering Investigations and Recommendations Study
Old Town Road (Potash) Bridge over South Branch of the Middlebury River
(Bridge No. 6 on TH 25)

By

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Executive Summary

When reviewing this report, please refer to the glossary of terms in Appendix A.

Old Town Road connects VT 125 in Ripton at about milemarker 2.0 to VT 125 in Middlebury at about milemarker 3.5. The portion of the road that is in Middlebury is a class 4 Town highway, and is also known as National Forest Road (NFR) 296. The portion that is in Ripton has been assumed to be a private road for a number of years. In 2014 a study of the history of the road was undertaken and a legal opinion concerning ownership was obtained (Appendix B). The legal opinion was that the portion of Old Town Road that is in Ripton is also a class 4 Town highway. The 2017 and 2018 Vtrans bridge inspection reports and the VTrans Town highway maps for Ripton, indicate that Old Town Road (Town Highway 25), in the area of Bridge 6, is a Class 3 Town Highway.

The Addison County Regional Planning Commission, hired DuBois and King on the Town's behalf, to do a bridge study of the bridge that connects VT 125 to Old Town Road in the Town of Ripton. The goal of the study is to determine the feasibility of repairing or replacing the bridge, in order to allow Old Town Road to function as an emergency route, should VT 125 become impassable during a flood event.

DuBois & King, Inc. (D&K) has evaluated alternatives for replacing the Old Town Road Bridge. D&K does not recommend retaining the substructure, due to it configuration and condition. Our recommendation is to completely replace the bridge. Our evaluation considered key components of bridge design and construction and the specific impacts that would affect the municipality and the public.

In preparation of a recommendation, thought and consideration were given toward: natural and cultural resources, substructure conditions, hydraulic requirements, structure durability, impacts to Right-of-Way and utilities, construction schedule, maintenance of traffic, and the opinion of probable construction costs. Following is a summary of the evaluation.

D&K recommends that new a precast concrete slab superstructure be built on a cast-in-place concrete foundation, in a new location, while maintaining traffic on Old Town Road on the existing structure.

Existing Conditions

The latest VTrans inspection report dated August 13, 2018 (Appendix C) indicates that the deck is in good condition, the superstructure (beams) are in very good condition, and the substructure is in fair condition, which is less than satisfactory.

The existing Old Town Road Bridge has a clear span of approximately 27'-8", over the North Branch of the Middlebury River. It is comprised of a timber deck, made up of 2 x 6 lumber, with timber runner planks, supported on painted steel beams which are supported on cast-in-place concrete abutments, founded on bedrock. No record plans of the existing bridge were found. The rail to rail width is 13.0 feet, and total superstructure width is 16.0 feet.

The traffic volume estimate from the inspection report was 20 vehicles per day in 2017.

The scour rating is "stable for scour". Although the substructure is founded on bedrock, which would normally make scour unlikely, on this bridge there is a layer of boulders and other material between the concrete and the bedrock, which could scour out and cause a significant problem. Of note, one of the wingwalls has scoured out and is leaning outward. The eastern abutment is leaning forward, out of plumb, by about 2 ¼" in 4 feet, according to the inspection report.

According to the most recent bridge inspection report, the bridge was built in 1970 and reconstructed, with a new deck and new steel beams, in 2015. It is unlikely that the bridge itself would be considered historically significant.

On July 24, 2018, VTrans completed a hydraulic study of this structure. The study is included in this report (Appendix D). This study resulted in a determination that the existing bridge meets VTrans current hydraulic standards. It is adequate to pass the 25-year (4%Annual Exceedance Period (AEP)) flow with at least 1 foot of freeboard. However, the existing bridge does not meet the state stream equilibrium standards for bankfull width (span). The existing structure constricts the channel.

Since no Right-of-Way plans are available for this bridge, D&K has contacted the Town of Ripton for information concerning the existing Right-of-Way. Based on information provided by the Town of Ripton an assumed 3-Rod (49.5-foot) Right-of-Way along Old Town Road, in the area of the bridge, has been used in developing this bridge study. It is anticipated that additional Right-of-Way would be required in order to replace the bridge. D&K previously worked on VT 125 in the project vicinity. The state Right-of-Way in this area is also a 3-rod Right-of-Way.

Field Evaluation

A field visit was conducted on May 16, 2019. The field visit was used to evaluate the condition of both the substructure and the superstructure, and to obtain dimensional information, since no record plans were available. The existing substructure is in fair to poor condition. It is our recommendation that both abutments and all four wingwalls be replaced.

The existing timber deck and steel stringer (beam) superstructure is in good condition. The stringers are painted and the paint is in good condition. The bridge rail and approach rail do not meet current standards. There are no connections between the bridge rail and the approach rail on any of the four corners.

Old Town Road serves as access for a few year round residences. The other end of Old Town Road is not adequate for year round vehicular travel. The Town of Ripton is interested in upgrading Old Town Road as an emergency route, should VT 125 be impacted by flooding, as it has been in recent years. Because there are year round residents that use this bridge on a daily basis, D&K recommends that the Town of Ripton chose an alignment for the replacement structure which would allow the existing structure to continue to function while the new bridge is built. We have also considered the option of replacing the structure in its current location and installing a temporary bridge to provide access to the residents during construction.

View of the Old Town Road Bridge looking south

Introduction:

The Old Town Road Bridge (Bridge #6) is located just off of VT 125 approximately 5 miles east of the intersection of VT 125 and US 7. The bridge has experienced flood damage on several occasions, the latest being in July of 2017.

The Town of Ripton undertook research to determine whether Old Town Road was in fact town owned infrastructure. The legal opinion that they received at the conclusion of the study was that the road is a Class 4 Town Highway. The portion of Old Town Road that is within the Town of Middlebury is also a Class 4 Town Highway.

Once town ownership was verified, VTrans began inspecting the bridge. VTrans has now completed two bridge inspections, one in 2017 and one in 2018. Prior to 2015, any maintenance that we conducted on the bridge was done by the residents who own property on the Ripton end of Old Town Road.

The existing bridge superstructure consists of seven (7) steel stringers (beams) with a nail laminated timber deck spanning over the North Branch of the Middlebury River. The superstructure has a width of 13'-0" rail to rail. The bridge has a clear span length of 27'-9". The bridge rail consists of steel beam rail mounted on steel posts, with steel base plates bolted to the deck and steel offset blocks. The existing substructure consists of cast-in-place concrete abutments and wingwalls. Bedrock can be seen in the stream and beneath the existing substructure units.

The structure is not skewed, the angle between superstructure and substructure is 90 degrees. The bridge substructure does not currently align with the stream. The existing bridge provides a vertical clearance of 12'-6" +/-. It is estimated that the total waterway opening is approximately 350 ft^2. The deck, steel stringers and bridge rail were replaced in 2015. The date of construction of the substructure (abutments and wingwalls) is unknown. Ripton has contracted for further repair work to be done including scour protection in front of the eastern abutment. A load rating was performed on the bridge after the superstructure (deck, and stringers) was replaced. The bridge is posted for maximum four axle load of 29 tons. Old Town Road past the bridge is posted for a maximum load of 24,000 pounds.

The existing bridge railings are substandard, as they are not an acceptable, crash tested system. The bridge approach rail is also substandard. There is no connection between the bridge rail and the approach rail.

The bridge is currently open to traffic. There are six (6) year round residences which use the bridge to access their homes. Emergency services, such as fire and ambulance for these residents use this bridge. The Addison Regional Planning Commission has given the town of Ripton a grant, which is to be used to prepare a study concerning the replacement of Bridge 6. DuBois & King, Inc. was hired by the Regional Planning Commission to perform an engineering study and determine the best option for replacement of the bridge.

I. Project Development:

Following documentation of existing conditions, DuBois & King, Inc. identified and evaluated several feasible alternatives to replace the existing structure. Factors in determining appropriate structure selection included:

- Proper Waterway Opening
- Overall Geometry Conforming to the Site
- Durability
- Initial and Long Term Costs
- Length of Service Life
- Maintenance of Traffic during Construction

A conceptual opinion of probable construction and engineering cost was developed for the alternatives investigated.

The following are the results of our evaluation:

II. Existing Conditions:

A. Site Observation

A site observation was conducted in May 2019. The observation consisted of two DuBois & King engineers visiting the site and making visual observations of the existing bridge, roadway approaches, streambed conditions, site constrictions and documentation of any utilities that were present. Several key measurements of the existing bridge were recorded. The observation concluded with a photo documentation of the bridge site and surroundings.

B. Field Survey

Survey information was available from previous work done by D&K for VTrans on the VT 125 corridor. Complete survey information is available for the VT 125 end of the bridge. Limited information is available for the opposite end of the bridge. A basemap was developed from the available field survey of the project area. An Existing Conditions Site Plan is included in Appendix G.

C. Identification of Natural and Cultural Resources

It is unlikely that the existing bridge would be considered to be historic. There are no other additional structures in the vicinity of the bridge, which might be considered to be historic. When the design of a replacement structure proceeds, possible archeological resources will need to be investigated.

There is a small stream that joins the North Branch of the Middlebury River, on the southwestern corner of the bridge site. If a new bridge location is chosen, this area should be avoided.

There are no mapped wetlands in the area of the project. The possibility of un-mapped, Class 3, wetlands exists and will need to be investigated further as the design of the project continues.

There are no mapped threatened or endangered species within the project area. There are trees within the project area that would need to be cut to proceed with construction. This would likely trigger time of year restrictions, which would require that the trees not be cut during the summer months, when the bats are out of hibernation.

D. Subsurface Investigation

No subsurface investigation has been performed. The existing substructure is founded on bedrock. Bedrock is also present in the stream at numerous locations. Prior to final design, a geotechnical evaluation should be performed at the chosen bridge location to determine what elevation and ultimate bearing capacity of the bedrock.

E. Existing Condition Assessment

The condition of the existing abutments is such that it is not recommended that they be reused. There is material below the abutment stems, between the bedrock and the cast-in-place concrete, which interferes with the contact and bearing between the rock and the concrete. Also, there appear to be no footings below the abutment stems. Because of this, the resistance to sliding and overturning of the existing abutments is likely inadequate for the applied loads. There are no weepholes in the abutments. This can lead to a buildup of hydrostatic pressure behind the abutments, which is detrimental to the abutment stability. We observed that the eastern abutment has been backfilled with boulders. This material does not compact, and therefore exerts a non-uniform pressure on the back of the abutments.

The western abutment is in much better condition than the eastern abutment. If it becomes necessary to retain one abutment, we would recommend keeping the western abutment and replacing the eastern abutment.

- The southeast wingwall has failed, tilted, and is in danger of collapse.

- On the western abutment, there is a "mud slab" consisting of mortar and stone between the concrete and the bedrock which interferes with contact and bond.

- The steel stringers and timber deck are in good condition

- The approach rails are not continuous with the bridge rails. The backfill at the eastern abutment consists of boulders.

F. Hydrologic and Hydraulic Analysis

An important step in planning for a proposed bridge replacement over a waterway is determination of the required area of the bridge opening to pass specified storm flow events. VTrans hydraulic standards for bridges on Town highways require that they be designed to accommodate a 25-year storm, which is equal to a 4 % annual exceedance probability (AEP), with 1-foot minimum of freeboard. Due to the inconvenience that would result in having this bridge washed out in the future, the 100-year storm, or 1 % AEP should also be evaluated. Maintaining the 100-year storm elevation below the proposed bridge low chord elevation would be beneficial, especially since one of the purposes that the Town has in mind for this bridge is as an emergency access, should VT 125 be washed out in a flood event.

In addition to the hydraulic requirements, the bank full width of the stream should also be evaluated, and, if possible, accommodated with a new bridge design.

VTrans did an initial hydraulic evaluation of this bridge (Appendix D). Their report, dated July 24, 2018, was part of the information provided at the beginning of this study. Their hydraulic study concluded that the current structure meets VTrans' hydraulic standards, but does not provide a width of opening consistent with the bank full width of the stream.

VTrans recommends, if a new structure is built, that it have a minimum open span of 44 feet, perpendicular to the flow of the river, and a minimum clear height of 9 feet, providing a waterway opening of 400 square feet.

III. Permitting and Clearances:

In order to maintain passage of traffic during construction, it is advantageous to choose a location other than the existing location for the new bridge. The disadvantage to this approach is that by going off the existing alignment more Right-of-Way must be acquired and there is the potential for more environmental impacts.

Wetlands may be present in the area of the stream located near the southwest corner of the bridge. If a downstream bridge location is chosen, impacts to this area can be avoided.

A complete replacement of this bridge will be subject to several regulatory permits and clearances that must be obtained prior to construction of the preferred alternative. Based on our review of the site, the following permits may be required:

- Historical and archeological clearances from the State Historic Preservation Office.
- Preparation of project-specific Erosion and Sediment Pollution Control Plan.
- VT ANR stream alteration permit
- US Corp of Engineer's Permit

Permitting is typically performed during the preliminary design phase and is based on the preferred alternative that has been selected.

IV. Right-of-Way and Utilities:

A. Right-of-Way

The Town of Ripton has assumed for this study that the existing Right-of-Way is 3-Rods or 49.5-feet wide. There is also a 3-Rod Right-of-Way for VT 125 in this area. For a complete replacement of the bridge it is unlikely that the work can be kept completely within the existing Right-of-Way. Temporary construction easements would likely be needed to provide the contractor room to work and access the site. If the existing bridge can be used to maintain traffic during construction, no temporary easements for maintaining traffic will be necessary.

B. Utilities

Two overhead utility lines were the only documented utilities found during the site observation. One line is located directly above the existing bridge, and continues along the alignment of Old Town Road. The other crosses the intersection of Old Town Road and VT 125 and continues along the alignment of VT 125. The electrical utility in this area is Green Mountain Power. The line that follows VT 125 will not need to be relocated to construct a new bridge. However, the line that follows Old Town Road will likely need to be either temporarily or permanently relocated in order to construct a new bridge. Since the existing line is located within the Town's Right-of-Way, the expense for relocating the utility will be borne by the utility companies. The relocation route for a temporary or permanent relocation route should be identified early in the project development process, since it often takes some time to get the utility companies to relocate their lines.

C. Abutting Properties

The Town has identified tax map parcel and property owners that abut the project. Abutter information can be found on the Existing Conditions Site Plan, included in Appendix G.

V. Alternatives Investigation:

Two (2) bridge superstructure types have been evaluated as part of this study. The superstructure types are a precast, pre-stressed concrete slab superstructure, and cast-in-place concrete slab bridge. The recommended bridge superstructure alternative is precast pre-stressed concrete slab as it is economical, quick to construct, practical, durable, and low-maintenance.

The recommended substructure is a cast-in-place substructure, on bedrock. Based on the observed bedrock elevations at the site, the height of the substructure units will be approximately 12 feet, from finished grade to bedrock.

A. Design Criteria

The functional classification of Old Town Road is "local road". The following summarizes the design criteria we believe are appropriate for this bridge site:

Bridge Design Codes and Specifications:

- AASHTO LRFD Bridge Design Specification, 8th Edition
- AASHTO Policy on Geometric Design of Highways and Streets, 6th Edition
- Vtrans Vermont State Design Standards, 1997
- VTrans Structures Bridge Design Manual, 2011 revision
- Structural Capacity: AASHTO HL-93
- Traffic Volume: 20 vehicles per day

Bridge Width: Vermont State Design Standards, Table 6.3, specify a minimum lane width of 7 feet and a minimum shoulder width of 0 feet, for a local road with an average daily traffic (ADT) count of between 0 and 25 vehicles per day, when the design speed is less than 40 miles per hour. If the ADT is between 25 and 50 vehicles per day, the recommended minimum lane width is 8 feet. A bridge with a rail to rail width of 16 feet, would meet this requirement. This would be the case for the current conditions on Old Town Road.

The Town of Ripton believes that they should consider the future possibility of this road being the only road out of Ripton, in the event of a flood event that washes out sections of VT 125. This type of flood event has happened in the past. The Town requested that D&K also investigate what width would be appropriate if the traffic on Old Town Road increased considerable, and investigate the cost associated with the construction of a wider bridge.

Vermont State Design Standards Table 6.3 specifies a minimum lane width of 9 feet and a minimum shoulder width of 2 feet for a traffic volume between 100 and 1500 vehicles per day.

D&K recommends that Old Town Road be designed for a rail to rail width of 22 feet, or two 9 foot lanes and two 2 foot shoulders. This width would be adequate for traffic now and in the future. A new bridge can be expected to last 75 years, and it would be short-sighted, if additional traffic is expected in the future, to build a bridge that will not be adequate to meet the future needs.

The existing width of Old Town Road, is about 16 feet. If a replacement bridge is built, with a width of 22 feet, Old Town Road will need to be upgraded in the future to match the width of the bridge.

Appendix G contains plans and profiles for several alternatives which were considered.

Design Speed: The AASHTO Policy on Geometric Design of Highways and Streets, Table 5.1 gives minimum design speeds for local roads. If the traffic volume is less than 50 vehicles per day and the terrain is either rolling or mountainous, the recommended design speed is 20 miles per hour. In mountainous terrain, this table gives a recommended design speed of 20 mph, for up to 400 vehicles per day. Vermont State Design Standards for Local roads do not require a minimum design speed.

D&K recommends that Old Town Road be design for a speed of 20 miles per hour.

Complete Streets: During the 2011 legislative session, the Complete Streets Bill (Act 34) was passed to "ensure that the needs of all users of Vermont's transportation system - including motorists, bicyclists, public transportation users, and pedestrians of all ages and abilities - are considered in all state and municipally managed transportation projects and project phases." The language in the bill specifically excludes unpaved highways. Since Old Town Road is at this point an unpaved road, the Complete Streets Bill does not apply to Old Town Road. Should Old Town Road be paved in the future, the Town of Ripton may have to consider the elements of complete streets at that time.

B. Alignment Alternatives

Appendix G of this report contains four (4) possible bridge layouts. Each of the layouts meets the 44 foot minimum clear span normal to the stream.

Alternative 1 leaves VT 125 at a 90 degree angle. It is located slightly downstream of the existing river crossing. Using this new bridge location would eliminate the need for a utility relocation and would not require the use of a temporary bridge. At the far end of the bridge there is an 80 foot radius to connect to existing Old Town Road. This radius is acceptable for a 20 mph design speed. The vertical alignment would be a 5 % grade coming off VT 125. This grade would need to be connected to the existing grade of Old Town Road, which is approximately 12%, using a sag vertical curve. This alignment would utilize the existing Right-of-Way on upstream (south) side of the bridge. New Right-of-Way would need to be acquired on the north side of the bridge. The land which would need to be acquired is owned by the US Forest Service and by one private property owner. The bridge length for this alternative would be 51’-0”.

Alternative 2 also departs from VT 125 at a 90 degree angle. This alternative would require either a temporary or a permanent utility relocation. It includes a 65 foot radius curve at the end of the bridge followed by a tangent section that is about 20 feet long and then a switchback 90 foot radius curve. These radii are acceptable for a 15 mph design speed. This alignment comes closer to the nearby stream and might require a wetland permit. This alignment is almost completely outside the existing Right-of-Way, and would require Right-of-Way acquisition from at least two private property owners, as well as from the federal government. The bridge length of this alternative is 50’-0”.

Alternative 3 departs from VT 125 at an angle of about 60 degrees. This is similar to the angle that Old Town Road currently makes with VT 125. This alternative would require either a temporary or a permanent utility relocation. There is a curve with a radius of 80 feet near the end of the bridge, a tangent section of about 60 feet, and a curve with a radius of 90 feet to get it back on the alignment of Old Town Road. These radii are acceptable for a 20 mph design speed. This alternative utilizes less of the existing Right-of-Way than alternate 1, but more of the existing Right-of-Way than alternate 2. The bridge length for this alternative is 57’-0”, and the substructure would be skewed to the superstructure by an angle of 60 degrees.

Alternative 4 keeps the alignment of the bridge in roughly the same location as the existing bridge. It departs from VT 125 at an angle of about 70 degrees. This alternative would require either a temporary or a permanent utility relocation. There is a curve with a radius of 60 feet near the end of the bridge. This radius is acceptable for a 15 mph design speed. This alternative eliminates the need for obtaining additional permanent Right-of-Way. Temporary construction easements would likely be needed. The bridge length for this alternative is 50’-0”, and the substructure would be skewed to the superstructure by an angle of 10 degrees. This alternative would require that either a temporary bridge be installed, or the road be closed to traffic during construction of the new bridge.

Alternative 1A and 3A The preferred alternative is also shown with a bridge width of 16 feet, rail to rail. This is illustrated in Alternative 1A. The other alternative which the Town of Ripton was most interested in at our public information meeting was alternative 3. Therefore, Alternative 3 is also shown for illustration with a bridge width of 16 feet, rail to rail. This is alternative 3A.

C. Bridge Type Alternatives

Two superstructure types were considered in this study. Both superstructure types would be paired with a substructure replacement which would consist of a cast-in-place substructure, founded on the bedrock that is evident in the area.

1) Precast non-voided slab

This option uses 6 adjacent precast slabs. Four of the slabs would be 4 feet wide, and the outer two slabs would be 3 feet wide. This would provide the required width of 22 feet. The slabs would be pre-stressed with steel pre-stressing strands. There would be post tensioning that would hold the slabs together from fascia to fascia. The depth of the slabs would be 18 inches, for alternatives 1 and 2, and would be 21 inches for alternative 3. The slabs would be solid concrete with no voids in them. They would be made in a pre-casting plant under controlled conditions using a high strength concrete mix. The bridge rail would be fascia mounted to the bridge deck. The advantages and disadvantages of this superstructure are:

Advantages: High quality, durable superstructure.

Expected service life of 75 years for the new structures.

Controlled casting and curing conditions, and high strength concrete increase the durability of the superstructure.

Quicker construction duration

Disadvantages: Additional lead time needed to order precast sections longitudinal joints between units.

2) Cast in Place Slab

This option uses a single, full-width, cast in place concrete slab. The total width would be 22 feet. The slab would be constructed of high performance concrete. It would be cast and cured in place. The depth of the slab would be 18 inches for alternatives 1 and 3 and 21 inches for alternative 3.

Advantages: Durable superstructure.

Expected service life of 75 years for the new structure.

Less lead time needed to order construction materials

No longitudinal joint

Disadvantages: Longer construction duration than precast superstructure

Less control of curing conditions for cast in place concrete

Because of the difficulties of shoring and constructing a cast-in-place slab of this size, D&K does not recommend this superstructure alternative. The precast alternative is our recommendation.

D. Maintenance of Traffic During Construction

The existing bridge would be used to maintain traffic while building a new structure.

If the existing alignment is chosen instead, the road would need to be closed to traffic during construction of the new structure or a temporary bridge would need to be installed on a different alignment, prior to constructing the permanent bridge.

E. Opinion of Probable Construction Cost

We have developed a conceptual opinion of probable construction cost for each alternative in this report. The costs were prepared by estimating quantities and applying unit prices obtained from previously bid VTrans projects for bridge and roadway construction. The conceptual costs are subject to change due to fluctuations in the cost of labor and materials, and with the refinement of the overall design during subsequent phases of the project. See Appendix F. The costs outlined below are based on D&K's recommended alternative.

Project Cost Estimates:

Final Engineering Design	$ 80,000
Bridge Construction	$ 578,000
Construction Administration	$ 42,000
Preliminary Opinion of Budget for project	**$ 700,000**

F. Schedule and Budget

Regardless of the alternative selected, construction would be anticipated to last approximately 3-months. Estimated project durations and opinion of probable construction costs have been included in this report and summarized below, for the purposes of establishing an appropriate schedule and budget.

A schedule should be selected that will allow the Town to advertise (bid) the project during the winter months, and construct the project during the summer and fall.

Project Durations:

Engineering design, and permitting	9 months
Advertising and bidding	1 month
Construction	3 months
Total Duration for project	**13 months**

VI. Funding Alternatives:

The Town of Ripton will need to obtain funding to complete design plans, obtain permits and Right-of-Way, advertise for construction bids and complete the construction of the new bridge.

Some of the options that Ripton might consider are:

1. The Town Highway Bridge program. This program is through VTrans. Typically the funding is 80% federal, 10 % state and 10% local. This funding would cover all required design, permitting, Right-of-Way identification and acquisition, advertisement and construction. The funds are administered thought VTrans and design would be carried out either by VTrans employees, or consultants chosen by VTrans. This program has limited funding. Priorities are defined by the Regional Planning Commission, which forward their priorities to the VTrans. VTrans then develops their own list of statewide priorities, and allocates the available funding accordingly.

2. VTrans Town Highway Bridge grants. These funds are available through the VTrans Transportation District. The maximum for a single grant award is $175,000. These grants can be used for design or construction or both. It is possible, depending on availability of funding, to get a grant for design and a separate grant for construction. They are awarded on a competitive basis, as long as there is funding available. The local share for this funding source is 10%, if certain conditions are met, or 20% if those conditions are not met. More information concerning these grants is available in the VTrans "Orange Book", also known as A Handbook For Local Officials.

3. FEMA, Hazard Mitigation grants, these grants can be accessed after a major disaster declaration, and are intended to eliminate a future flood hazard. A 25% local match of funds is required. In order to be considered for these grants the Town of Ripton must meet the following requirements.

    i. Have a FEMA approved and adopted local hazard mitigation plan.
    ii. Be in good standing with the National Flood Insurance Program (NFIP)
    iii. Have an adopted Local Emergency Operations Plan (LEOP)

4. FEMA, Public Assistance Program. These grants can be accessed after major disaster declaration, and are intended to aid in the repair or replacement of flood damaged public infrastructure. A 25% local match (a portion of which may be paid by the state based on the following criteria), of funds is required. The state of Vermont contributes a minimum of 7.5% of eligible costs or 12.5% where communities take the following 4 specific actions.

    i. Participate in the national flood insurance program or have applied.

ii. Have adopted road and bridge standards that meet or exceed those found in the VTrans Handbook for Local Officials (The orange book).

iii. Have adopted a local emergency operations plan.

iv. Have adopted a local hazard mitigation plan.

If, in addition to these actions, the Town also protects their river corridors from new encroachment, or protect their flood hazard areas from new encroachment and participate in the FEMA community Rating System, the state of Vermont will contribute 17.5% of the total eligible costs.

VII. Recommendations:

D&K recommends Alternative 1. This alternative has several advantages. It does not require an overhead utility relocation. It does not impact the stream which is located to the south of the existing bridge. It only requires Right-of-Way acquisition from one private property owner and from the US government. It does not require temporary bridge. It leaves VT 125 at a 90 degree angle, which is considered to be the safest manner of intersecting the mainline road. At a 90 degree angle, the operator leaving the sideline can easily see in both directions. The vehicle exiting the sideline also is aware of the need to come to a stop for the mainline traffic.

D&K recommends that the superstructure type be precast concrete slabs, with a bare deck, and fascia mounted bridge railing. Installation the precast elements takes less time and labor than cast-in-place concrete. Precast concrete reduces construction duration, as the curing time for the concrete takes place prior to installation. Precast concrete is placed and cured under controlled conditions resulting in a more durable product. There is a local pre-caster in the Ripton area.

D&K recommends that the substructure be cast-in-place concrete. The presence of bedrock near or at the ground surface, makes precast concrete for the substructure a less desirable choice. Cast-in-place concrete can be placed directly on the bedrock, conforming to the uneven profile. The stem of the substructure units, once the footing is cast, could be made of pre-cast concrete. This would further reduce the construction duration, but would also have cost implications, as pre-cast concrete is oftn more expensive than cast-in-place concrete.

It is recommended that the entire bridge be removed and replaced with a new structure. The existing structure is undersized, horizontally and restricts the channel. In addition, the existing substructure is not structurally stable.

APPENDIX A
GLOSSARY OF TERMS

GLOSSARY OF BRIDGE TERMS

AASHTO – American Association of State Highway and Transportation Officials.

ADT – Average Daily Traffic.

ABUTMENT – A substructure element supporting each end of a single span bridge of superstructure and, in general, retaining or supporting the approach embankment.

BEAM – A linear structural member designed to span from one support to another.

CAST-IN-PLACE – Concrete poured within formwork on site to create a structural element in its final position.

CAMBER – A slight convexity on the road surface.

CHORD – A horizontal member of a truss.

COLUMN – A verticle structural member that transfers dead and live load from the bridge deck and girders to the footings or shafts.

COMPRESSION – The pushing force, which tends to shorten a member; opposite of tension.

CONCRETE – A mixture of water, sand, stone, and a binding element, which hardens to a rock-like consistency.

CROSS BRACE – Transverse brace between two main longitudinal members.

DEAD LOAD – A static load due to the weight of the structure itself.

DECK – The roadway portion of a bridge that directly supports vehicular and pedestrian traffic.

DIAGONAL – A sloping structural member of a truss or bracing system.

EXPANSION JOINT – A joint designed to provide means for expansion and contraction movements produced by temperature changes, load, or other forces.

FATIGUE – Cause of structural deficiencies, usually due to repetitive loading over time.

FLANGE – The flat top and bottom plates of a beam, stringer, or girder.

FLOORBEAM - A transverse beam supporting other beams (stringers) and the bridge deck.

FOOTING – The enlarged, lower portion of a substructure that distributes the structure load either to the earth or to supporting piles; the most common footing is the concrete slab.

GIRDER – A main support member for the structure that usually receives loads from floor beams and stringers; also, any large beam, especially if built up.

GVW – Gross Vehicle Weight.

HINGE – A point in a structure at which a member is free to rotate.

INVENTORY RATING - A live load, which can safely utilize an existing structure for an indefinite period of time.

LIVE LOAD – Vehicular traffic, wind, water, etc.

LOAD RATING – The determination of the live load carrying capacity of an existing bridge.

LOWER CHORD – The bottom horizontal member of a truss.

MEMBER – An individual angle, beam, plate, or built piece intended to become an integral part of an assembled frame or structure.

OPERATING RATING – The maximum permissible live load to which the structure may be subjected.

OVERLAY – A layer of concrete or pavement placed on top of a structure or pavement.

PIER – A vertical support or substructure unit that supports the spans of a multi-span superstructure at an intermediate location between its abutments.

PILE – A verticle shaft driven into the ground that carries loads through weak layers of soil to those capable of supporting such loads.

PLATE GIRDER – A large, solid web plate with flange plates attached to the web plate by flange angles or fillet welds; fabricated from steel.

POSTING LOAD – A live load a bridge may safely utilize on a routine basis for a limited period of time.

PRE-CAST GIRDER, SLAB, OR BOX BEAM – Fabricated off site of Portland Cement Concrete, reinforcing steel, and post -tensioning cables. These girders, slabs, or box beams are shipped to the construction site by truck and hoisted into place by cranes.

REINFORCED CONCRETE – Concrete with steel reinforcing bars bonded within it to supply increased tensile strength and durability.

RIVETED CONNECTION – A rigid connection of metal bridge members that is assembled with rivets. Riveted connections increase the strength of the structure.

SPALLS – Pop outs, shallow holes and deteriorated areas in concrete.

SPAN – The distance between piers or abutments.

SECTION LOSS – Loss of material (thickness or width) in steel members, usually from corrosion.

STAGED CONSTRUCTION – A construction method in which one-half of the bridge is constructed first and the second half constructed later. The purpose of this method is to maintain traffic through the bridge site during construction.

STAY – Diagonal brace installed to minimize structural movement.

STRINGER – A longitudinal beam supporting the bridge deck.

SUBSTRUCTURE – The parts of a bridge that are below the bottom of the girders. Pilings, shafts, spread footings, piers and abutments are part of the substructure.

SUPERSTRUCTURE – The parts of a bridge that are above the piers and abutments. Girders, trusses, bridge deck, and bridge railing are parts of the superstructure.

TENSION – A force that pulls or stretches.

TRUSS – A rigid, jointed structure made up of individual straight pieces arranged and connected, usually in a triangular pattern, so as to support longer spans.

TRUSS BRIDGE – A bridge having a pair of trusses for the superstructure.

UPPER CHORD – The top longitudinal member of a truss.

WEB – The portion of a beam located between and connected to the flanges.

APPENDIX B

LEGAL OPINION

July 30, 2014

To: Ripton Selectboard

From: Paul Gillies

RE: Draft opinion letter

The issue is whether the road that runs off of Route 125 easterly along the height of land in Ripton—the track of the former Centre Turnpike—is a town highway. This has been a subject of considerable research, surveying, and struggle over the years, but the evidence is clear enough for me to conclude that the track is a Class 4 town highway of Ripton. Here's how I get to that conclusion:

The highway was laid out by Middlebury Selectmen in 1793. Exhibit 1. This road was never discontinued, and as the land over which it travels is, since 1814 and 1829, located in Ripton, it is a town road in that town. Exhibits 2 and 3.

Discussion of the creation of the Centre Turnpike Company and its doings over its history are, for purposes of this conclusion, irrelevant. The Company had control over the route for 53 years, but in 1853 sold its interests to Ripton. Exhibits 4 and 5.

The records of the Town of Ripton prior to 1830 are lost, and no survey of that portion of the route that runs from the old town line of Middlebury to the road to Goshen has been located. But that problem is solved by evidence that Ripton spent funds to improve the road in 1853. Exhibit 6. In highway law, that is evidence of dedication and acceptance, which would be an alternative basis to conclude it is a town highway in lieu of a survey and on top of the 1853 purchase of the route from the Turnpike Company.

There is a lot of information on this issue in the U.S. Forest Service Office in Rutland, including surveys tracking the 1793 route with ground evidence. Exhibit 7. The Sheldon Museum has the corporation records of the Center Turnpike Company, and the Ripton and Middlebury town land records have even more information, but nothing in any of it suggests that the road is not a Ripton town road. Middlebury recognized it as a town road as it runs through that municipality, in 1982. It's time for Ripton to do the same.

Ripton has had opportunities in the 1980s to take this step, but its Selectboard was cautious and resistant, largely because of a concern that landowners along the route would be upset. Apparently there are successor landowners who have a similar idea, including one who has erected signs insisting that the road is not a public highway. This resistance does not change the underlying fact that the road is a highway, however. Road easements can't be extinguished the way private easements can. 19 V.S.A. § 1102.

Some have complained that they spent money improving the road, and hinted that this changes things, but that is a mistaken theory. That they went ahead and made improvements without the approval of the Selectboard has no impact on the underlying facts either.

The running of utility lines along the route, beginning in 1881, is of some value in confirming that it is a town highway, but that is not determinative either.

What matters is the 1793 survey and the 1853 purchase of the route and payment of funds to improve it by the Town of Ripton, plus a lack of any evidence of discontinuance. The lesson of the ancient roads law and the various cases that have come from fights between landowners and towns on old roads is that a highway never ceases to exist without some affirmative act of the Selectboard, discontinuing the public interest in the road. There is no evidence that that has occurred. There is neglect and a failure to acknowledge, but no discontinuance.

The Town should, however, ensure that the highway is placed on the official town highway map, by providing the evidence of its creation to the Agency of Transportation Mapping Division.

Paul Gillies, Esq.

APPENDIX C
2018 INSPECTION REPORT

STRUCTURE INSPECTION, INVENTORY and APPRAISAL SHEET

Vermont Agency of Transportation ~ Structures Section ~ Bridge Management and Inspection Unit

Inspection Report for: RIPTON **Bridge No.:** 00006 **District:** 5
Located on: C3025 **over** S. BR. MIDDLEBURY RIV. **approximately** 0.01 MI TO JCT VT125 **Owner:** TOWN-OWNED

CONDITION

Deck Rating: 7 GOOD
Superstructure Rating: 8 VERY GOOD
Substructure Rating: 5 FAIR
Channel Rating: 6 SATISFACTORY
Culvert Rating: N NOT APPLICABLE
Federal Str. Number: 100116000601161
Federal Sufficiency Rating: 61.8
Deficiency Status of Structure: ND

AGE and SERVICE

Year Built: 1970 **Year Reconstructed:** 2014
Service On: 1 HIGHWAY
Service Under: 5 WATERWAY
Lanes On the Structure: 01
Lanes Under the Structure: 00
Bypass, Detour Length (miles): 99
ADT: 000020 **% Truck ADT:** 01
Year of ADT: 2017

GEOMETRIC DATA

Length of Maximum Span (ft): 0029
Structure Length (ft): 000033
Lt Curb/Sidewalk Width (ft): 0
Rt Curb/Sidewalk Width (ft): 0
Bridge Rdwy Width Curb-to-Curb (ft): 12.8
Deck Width Out-to-Out (ft): 16
Appr. Roadway Width (ft): 020
Skew: 20
Bridge Median: 0 NO MEDIAN
Min Vertical Clr Over (ft): 99 FT 99 IN
Feature Under: FEATURE NOT A HIGHWAY OR RAILROAD
Min Vertical Underclr (ft): 00 FT 00 IN

STRUCTURE TYPE and MATERIALS

Bridge Type: ROLLED BM TIMB DECK
Number of Approach Spans: 0000 **Number of Main Spans:** 001
Kind of Material and/or Design: 3 STEEL
Deck Structure Type: 8 TIMBER
Type of Wearing Surface: 7 WOOD OR TIMBER
Type of Membrane: 0 NONE
Deck Protection: 7 CCA.CREOSOTED WOOD

APPRAISAL *AS COMPARED TO FEDERAL STANDARDS

Bridge Railings: 0 DOES NOT MEET CURRENT STANDARD
Transitions: 0 DOES NOT MEET CURRENT STANDARD
Approach Guardrail: 0 DOES NOT MEET CURRENT STANDARD
Approach Guardrail Ends: 0 DOES NOT MEET CURRENT STANDARD
Structural Evaluation: 5 BETTER THAN MINIMUM TOLERABLE
Deck Geometry: 4 MEETS MINIMUM TOLERABLE CRITERIA
Underclearances Vertical and Horizontal: N NOT APPLICABLE
Waterway Adequacy: 5 OCCASIONAL OVERTOPPING OF BRIDGE & ROADWAY WITH SIGNIFICANT TRAFFIC DELAYS
Approach Roadway Alignment: 5 BETTER THAN MINIMUM TOLERABLE CRITERIA
Scour Critical Bridges: 8 STABLE FOR SCOUR

DESIGN VEHICLE, RATING and POSTING

Load Rating Method (Inv): 2 ALLOWABLE STRESS(AS)
Posting Status: P POSTED FOR LOAD
Bridge Posting: 5 NO POSTING REQUIRED
Load Posting: 10 NO LOAD POSTING SIGNS ARE NEEDED
Posted Vehicle: POSTING NOT REQUIRED
Posted Weight (tons):
Design Load: 0 OTHER OR UNKNOWN

INSPECTION

Insp. Date: 082018 **Insp. Freq. (months):** 24 **X-Ref. Route:**
X-Ref. BrNum:

INSPECTION SUMMARY and NEEDS

8/13/2018 Bridge post welds are cracked along their lower bases and need repairs. Post are bent. Standard approach rail should be installed. Abutment 1 has rotated approx. 2-1/4" in 4' and should be monitored till repairs are made. End wing section upstream has rotated approx. 13". Town should consider adding knee wall along abutments if hydraulically adequate to do so. MJK AC

07/14/2017 - Special inspection of 28' span H-pile with timber deck bridge. Bridge is considered a "Long structure" and will be added to the NBIS inventory. Recent high water caused severe erosion behind each abutment which has been filled in with boulders and gravel. The north abutment has tipped forward approximately 6" rotating along a horizontal pour line just above the ledge streambed. The abutment needs to be monitored for any further movement and should be considered for augmentation with a gravity type knee wall off the ledge streambed to help stabilize. A concrete wing extension should also be added that extends several feet upstream on a more obtuse angle along the upstream end of the northern abutment, where the wing is damaged. If the north abutment does continue to rotate, then it will need full replacement. The bridge does appear to be hydraulically inadequate (undersized). It may be necessary to lower the substructure condition rating if the northern abutment continues to list. Note: * The 5 axle semi-truck schematic on the posting sign is incorrect, as it is showing only 4 axles. ~ MJ

APPENDIX D
HYDRAULIC STUDY

State of Vermont
Structures and Hydraulics Section
One National Life Drive
Montpelier, Vermont 05633-5001
vtrans.vermont.gov

[phone] 802-371-7326
[fax] 802-828-3566
[ttd] 800-253-0191

Agency of Transportation

TO: Richard Hosking, District 5 Project Manager
Ashley Bishop, District 5 Technician

CC: Jaron Borg, ANR River Management Engineer
Alison Dickinson, Ripton Town Clerk

FROM: Keith Friedland, Hydraulics

DATE: July 24, 2018

SUBJECT: Ripton TH-25, Old Town Road, over the South Branch Middlebury River
Site location: intersection with VT-125, mm 2.0
GPS coordinates: 43.967380, -73.030533

We have completed our hydraulic study for the above referenced site, and offer the following for your use:

Hydrology

The following physical characteristics are descriptive of this drainage basin:

Drainage Area	16 square miles
Land Cover	Forest
Avg. Drainage Basin Slope	4.8 %
Water Bodies and Wetlands (NLCD 2006)	1.5 %

Using the USGS hydrologic method, the following design flow rates were selected:

Annual Exceedance Probability (AEP)	Flow Rate in Cubic Feet per Second (cfs)	
43 %	720	
10 %	1,300	
4 %	1,700	Design Flow – Local Road
2 %	2,100	
1 %	2,500	Check Flow

Channel Morphology

The channel for this perennial stream is sinuous with an estimated local channel slope of 2%. Field measurements of bankfull width varied from 40 to 48 feet at a bankfull depth of 2.0 to 2.5 feet upstream and downstream of the structure. The Vermont Hydraulic Geometry Relationships anticipate a bankfull width of 44.4 feet for stream channels in equilibrium at this watershed size. There is exposed ledge upstream and downstream of the structure.

Existing Conditions

The existing structure is a timber deck bridge on steel girders with a clear span of 27.8 feet and a clear height of

12.5 feet, providing an approximate waterway opening of 350 square feet. The concrete bridge abutments are founded on ledge and in poor condition.

Our calculations, field observations and measurements indicate the existing structure does meet current standards of the VTrans Hydraulic Manual. However, it does not meet the state stream equilibrium standards for bankfull width (span length). The existing structure constricts the channel width, resulting in an increased potential for debris blockage. This complication is known to cause ponding at the inlet, increase stream velocity and scour at the outlet, and may also lead to erosion and failure of channel banks. This structure results in a headwater depth of approximately 7.4 feet at 4% AEP and 9.8 feet at 1% AEP.

Replacement Recommendations

In sizing a new structure, we attempt to select structures that meet both the current VTrans hydraulic standards, state environmental standards with regard to span length and opening height, and allow for roadway grade and other site constraints.

Based on the above considerations and the information available, we recommend any of the following structures as a replacement at this site:

- A bridge with a 44-foot opening span between face of abutments perpendicular to the flow and minimum clear height of 9.0 feet would provide a waterway area of approximately 400 square feet. If sloping stone fill is placed in front of each abutment and the waterway area is reduced, this structure will need to be larger. Stone Fill Type E4 will need to be used to build the channel through this structure. This structure will result in a headwater depth of 5.8 feet at 4% AEP and 7.6 feet at 1% AEP. This provides 1.0 foot of freeboard at the design AEP.

Note: *Any similar structure that fits the site conditions could be considered. Please contact the VTrans Hydraulics Section with alternatives that have significantly different inlet geometry, so headwater depths may be calculated.*

Stone Fill, Type IV should be used to protect any disturbed channel banks or roadway slopes at the structure's inlet and outlet, up to a height of at least one-foot above the top of the opening. The stone fill should not constrict the channel or structure opening.

Prior to any action toward the implementation of any recommendations received from VTrans, stream type and structure size must be confirmed, and may be modified, by the VT ANR River Management Engineer to ensure compliance with state environmental standards for stream crossing structures. Regulatory authorities including the US Army Corps of Engineers may have additional concerns or requirements regarding this structure.

General Comments

Please note that while a site visit was made, these recommendations were made without the benefit of a survey and are based on limited information. The drainage area is large enough that if a survey of the site does become available, a more detailed model should be built for this structure.

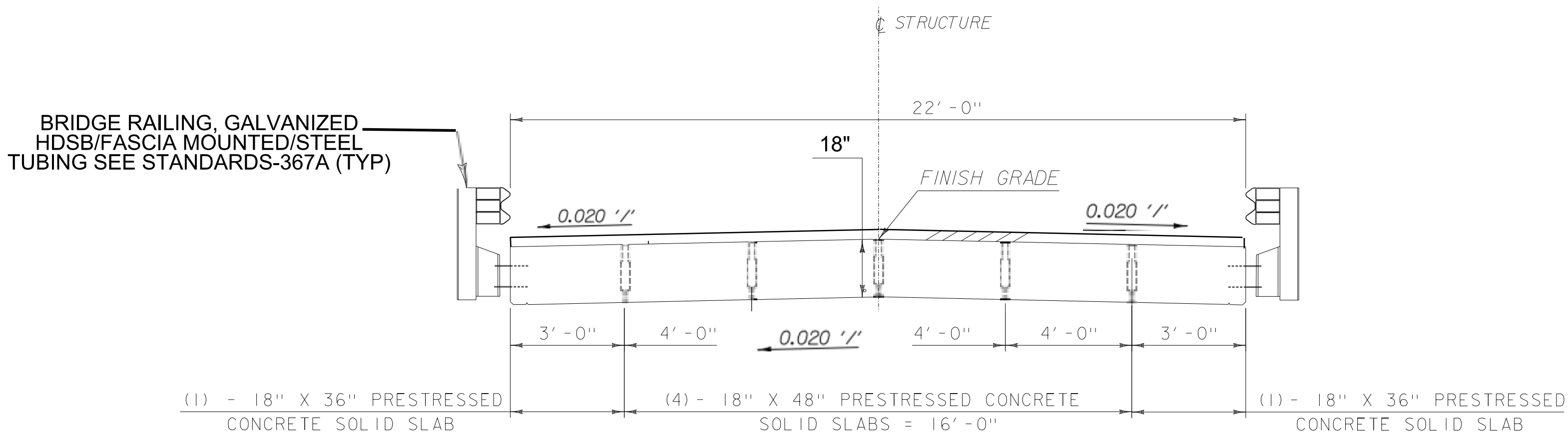
It is always desirable for a new structure to have flared wingwalls, matched into the channel banks at the inlet and outlet, to smoothly transition flow and protect the structure and roadway approaches from erosion. The bottom of abutment footings should be at least six feet below the channel bottom, or to ledge, to prevent undermining. Abutments on piles should be designed to be free standing for a scour depth at least 6 feet below channel bottom. Any new structure should be properly aligned with the channel, span the natural channel width, and be constructed on a grade that matches the channel.

The structures recommended above have been sized with respect to hydraulic and environmental standards and do not consider debris blockage complications. To minimize maintenance and ensure constructability, it is recommended that the structure height be adequate for the passage of debris.

The final decision regarding replacement of this structure must comply with state regulatory standards, and should take into consideration matching natural channel conditions, roadway grade, environmental concerns, safety, and other requirements.

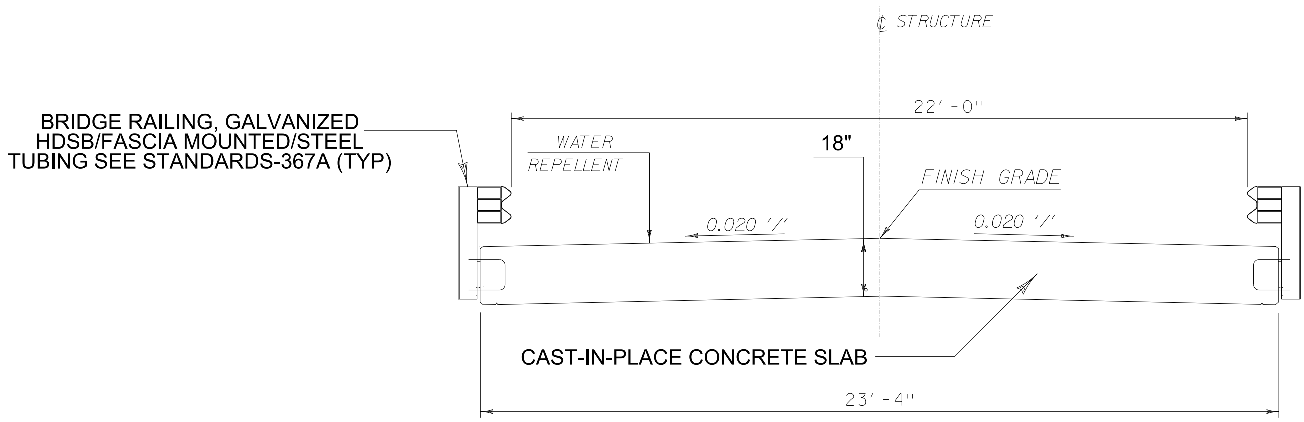
Please contact us if you have any questions or if we may be of further assistance.

APPENDIX E
TYPICAL SECTIONS



TYPICAL SECTION

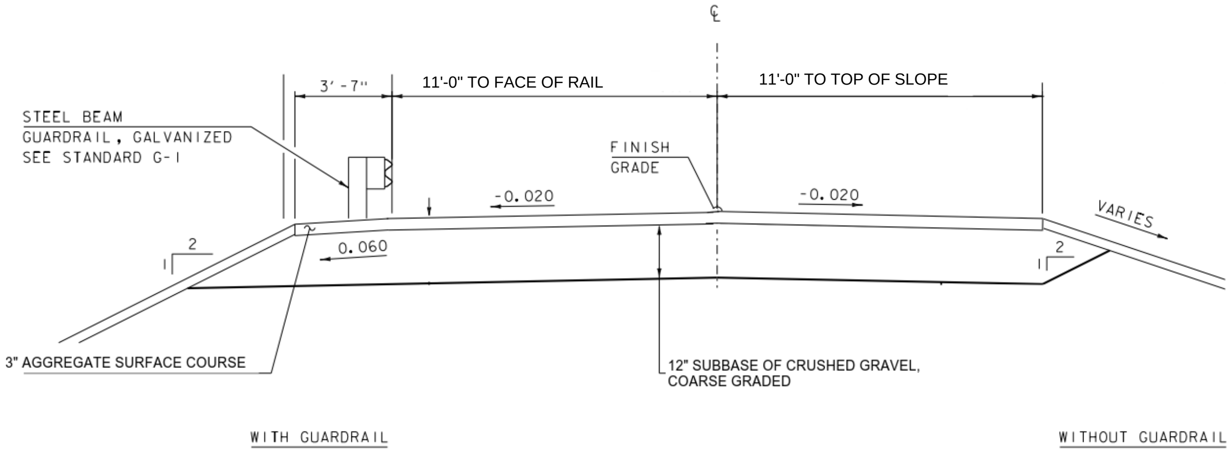
PRECAST CONCRETE UNITS
NOT TO SCALE



TYPICAL SECTION

CAST-IN-PLACE SLAB

NOT TO SCALE



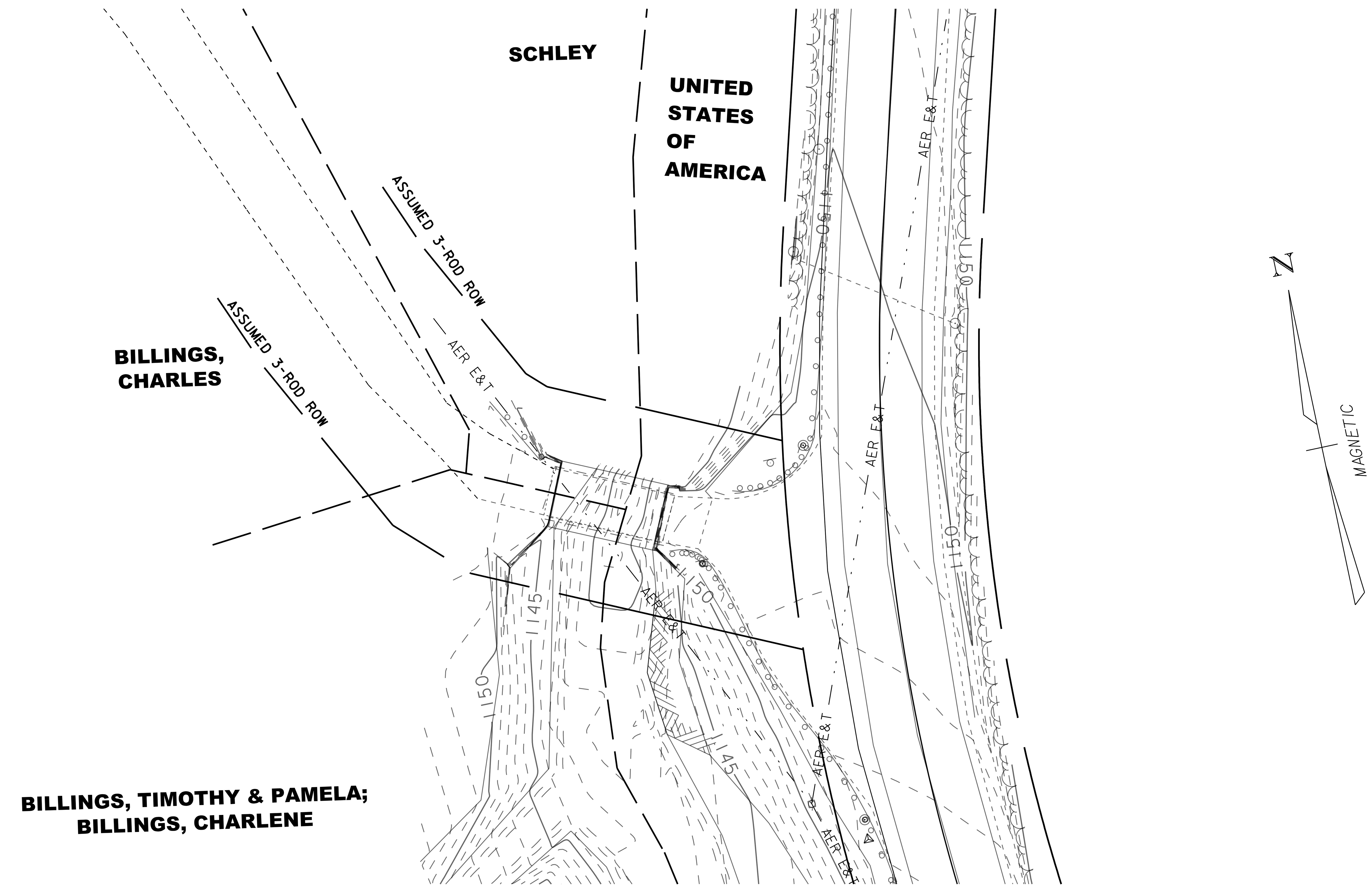
ROADWAY TYPICAL SECTION

APPENDIX F
DECISION MATRIX

Decision Matrix for Ripton, Old Town Road, Potash Bridge

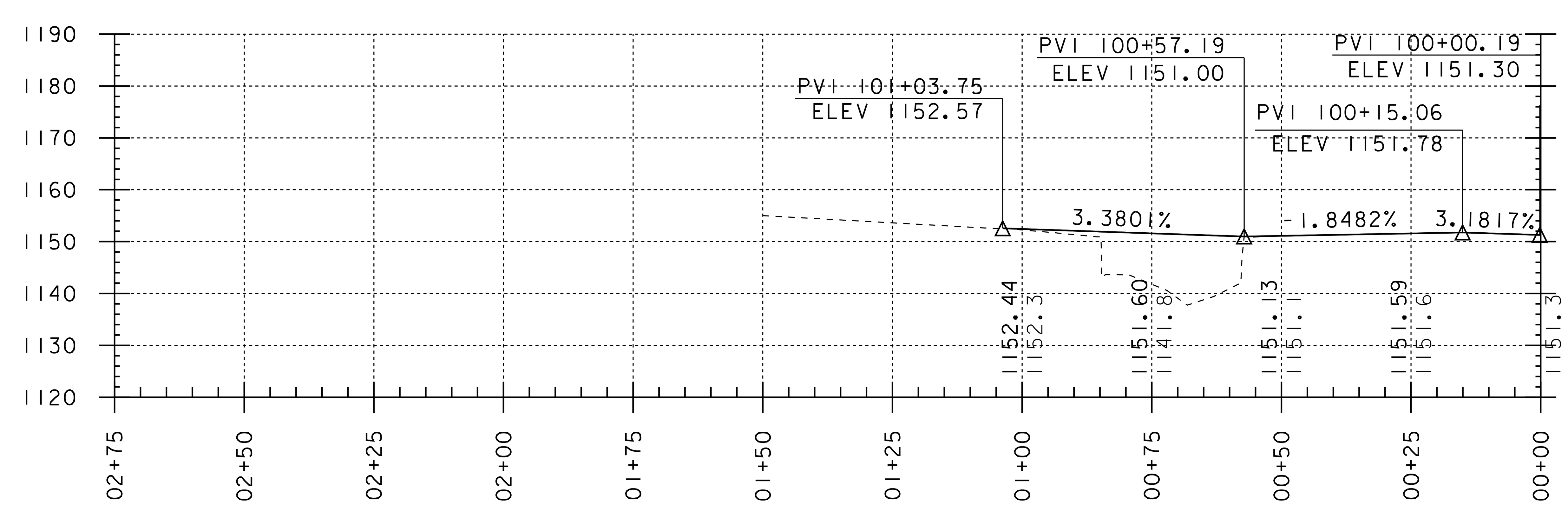
	Maintain Traffic on Existing Bridge	Relocated Overhead Utilities	Design Speed	Impact to Stream and Wetland	Affected Property Owners	Bridge Length	Bridge Skew	Angle to VT 125	Rail to Rail Bridge Width	Total estimated cost - Precast Superstructure
Alternative 1	yes	no	20	no	Schley, USA	51 ft	0 degrees	90 degrees	22 feet	$ 578,000
Alternative 2	yes	yes	15	yes	Billings, Billings, USA	50 ft	0 degrees	90 degrees	22 feet	$ 610,000
Alternative 3	yes	yes	20	yes	Billings, Billings, USA	57 ft	60 degrees	60 degrees	22 feet	$ 656,000
Alternative 4	no	yes	15	no	None	50 ft	10 degrees	70 degrees	22 feet	$ 610,000
Alternative 1A	yes	no	20	no	Schley, USA	51 ft	0 degrees	90 degrees	16 feet	$ 498,000
Alternative 3A	yes	yes	20	yes	Billings, Billings, USA	57 ft	60 degrees	60 degrees	16 feet	$ 584,000

APPENDIX G
ALTERNATIVES
PLAN AND ELEVATION



EXISTING CONDITION
OLD TOWN ROAD

SCALE 1" = 20'-0"



EXISTING PROFILE - OLD TOWN ROAD

SCALE 1" = 20'-0"

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NO.	DATE	DESCRIPTION	BY	CK'D

TOWN OF RIPTON, VERMONT

OLD TOWN ROAD BRIDGE STUDY

SHEET TITLE

EXISTING CONDITIONS

DRAWN BY: MEM	DATE: $$DATE$$
CHECKED BY: JCH	D&K PROJECT #: 625162
PROJ. ENG.: MEM	D&K ARCHIVE #:

DRAWING NUMBER

1

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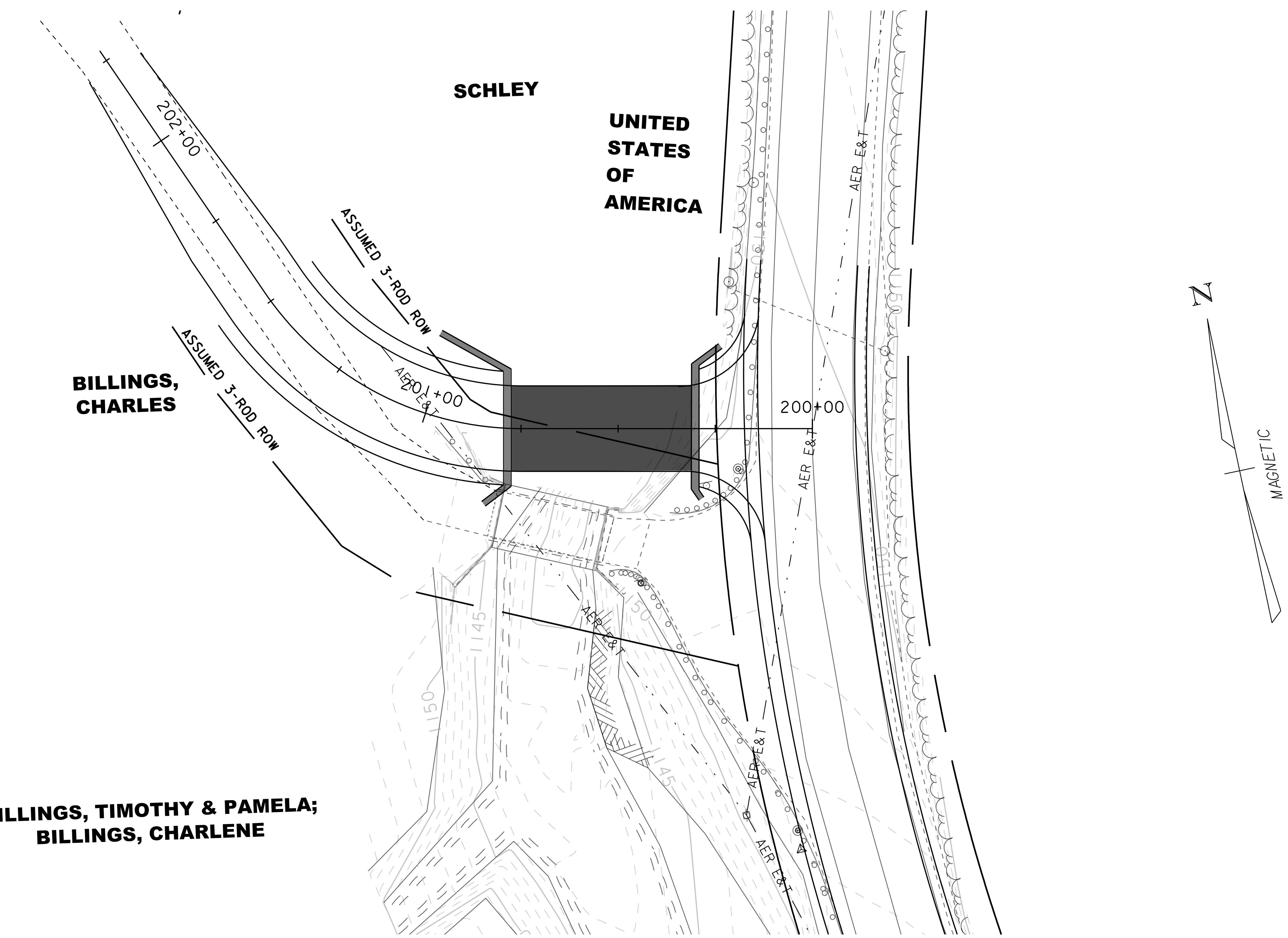

PLAN VIEW - OLD TOWN ROAD
ALTERNATIVE 1

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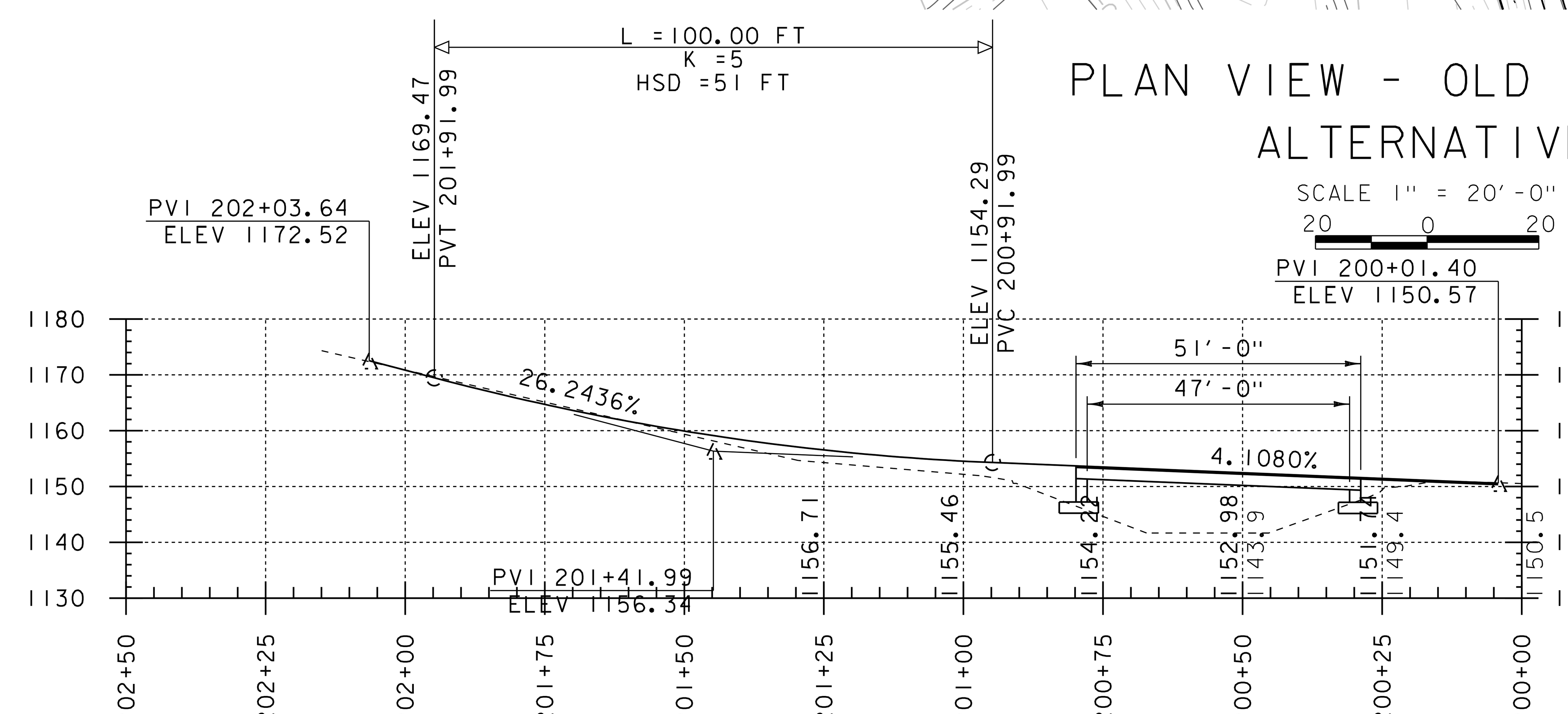

PROFILE- OLD TOWN ROAD
ALTERNATIVE 1 AND 1A

SCALE 1" = 20'-0"
20 0 20

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DRAWN BY: MEM	DATE: $$DATE$$
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PROJ. ENG.: MEM	D&K ARCHIVE #:

DRAWING NUMBER

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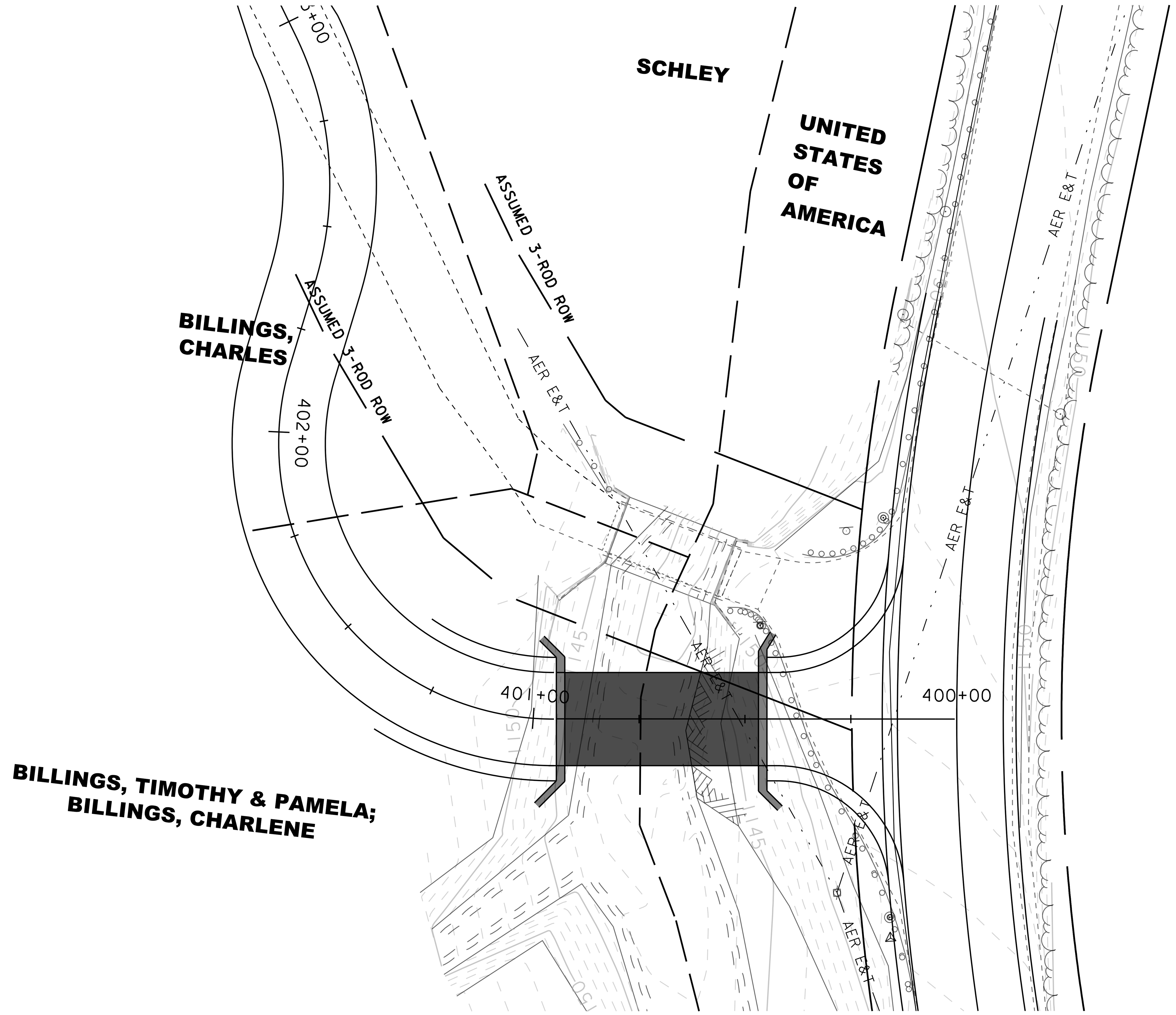

PLAN VIEW - OLD TOWN ROAD
ALTERNATIVE 2

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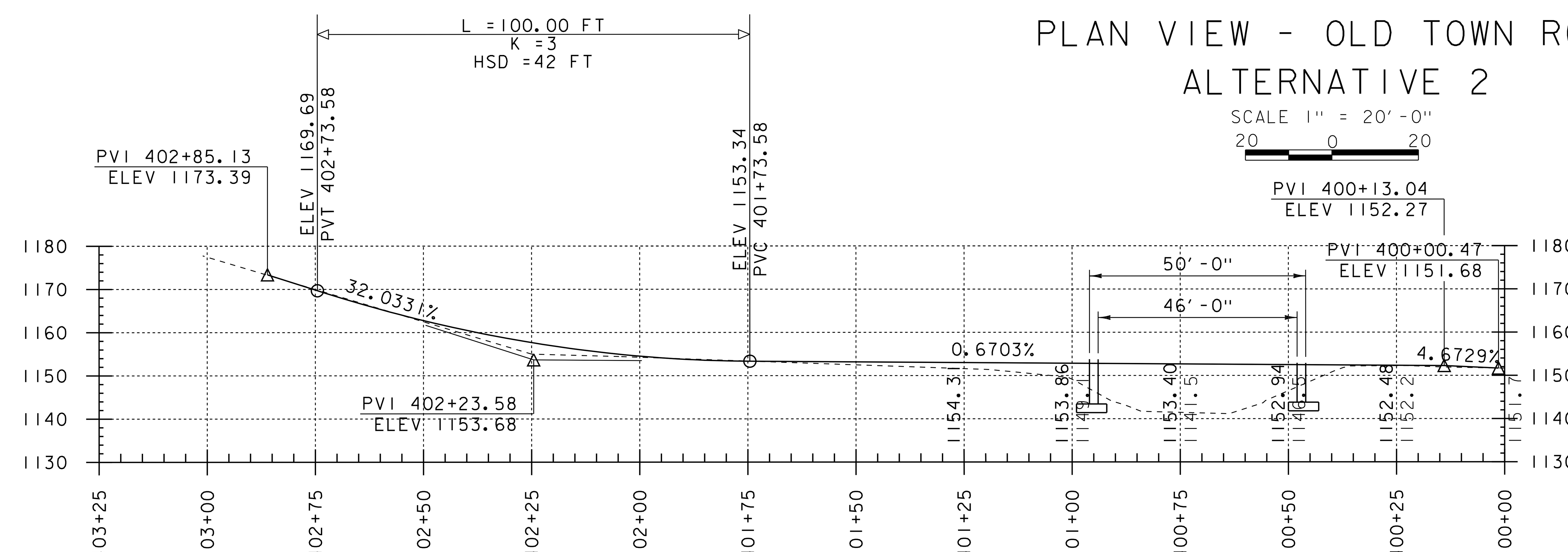

PROFILE - OLD TOWN ROAD
ALTERNATIVE 2

SCALE 1" = 20'-0"
20 0 20

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TOWN OF RIPTON, VERMONT

OLD TOWN ROAD BRIDGE STUDY

SHEET TITLE

ALTERNATIVE 2

DRAWN BY: MEM	DATE: $$DATE$$
CHECKED BY: JCH	D&K PROJECT #: 625162
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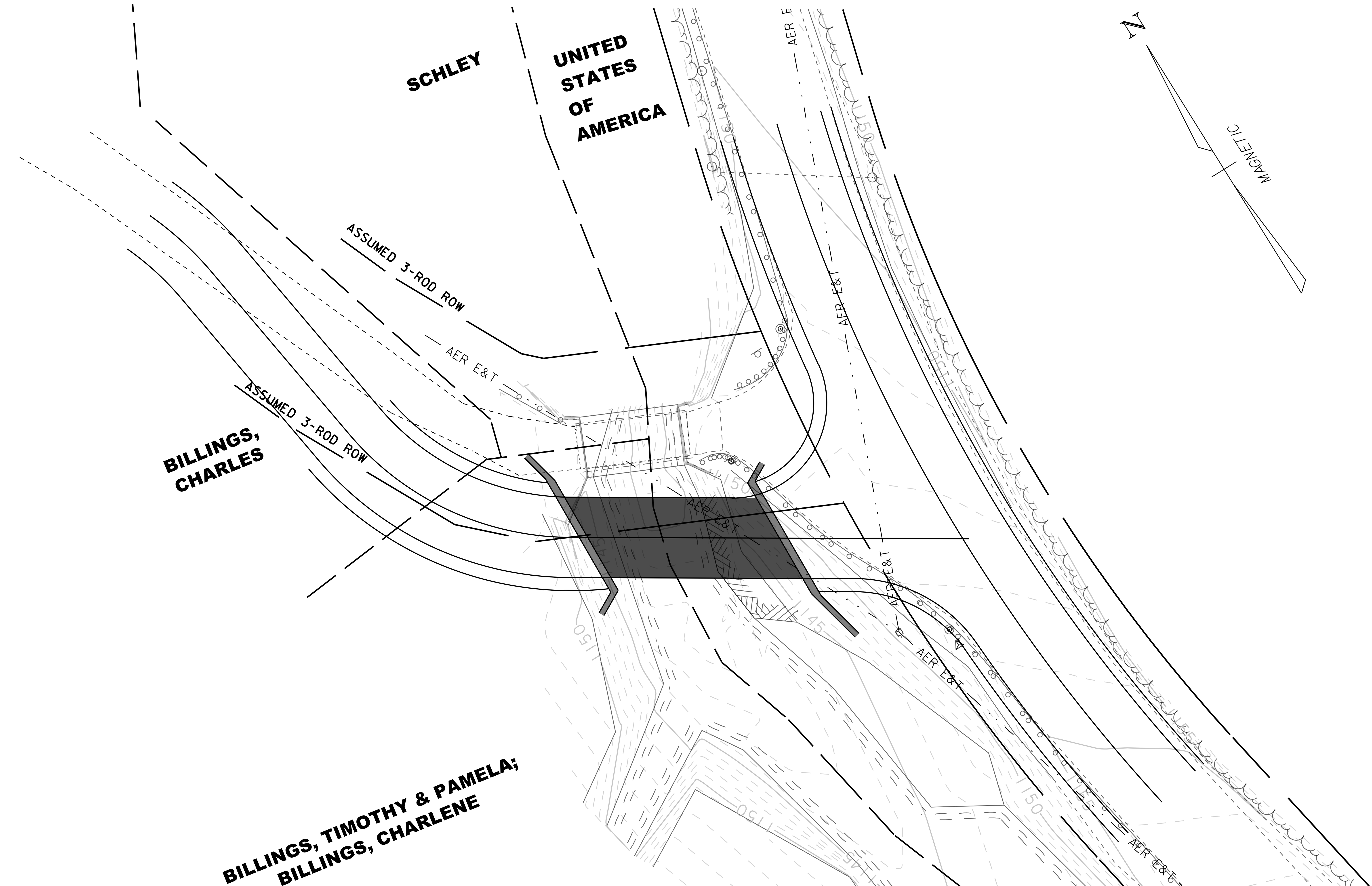
DRAWING NUMBER

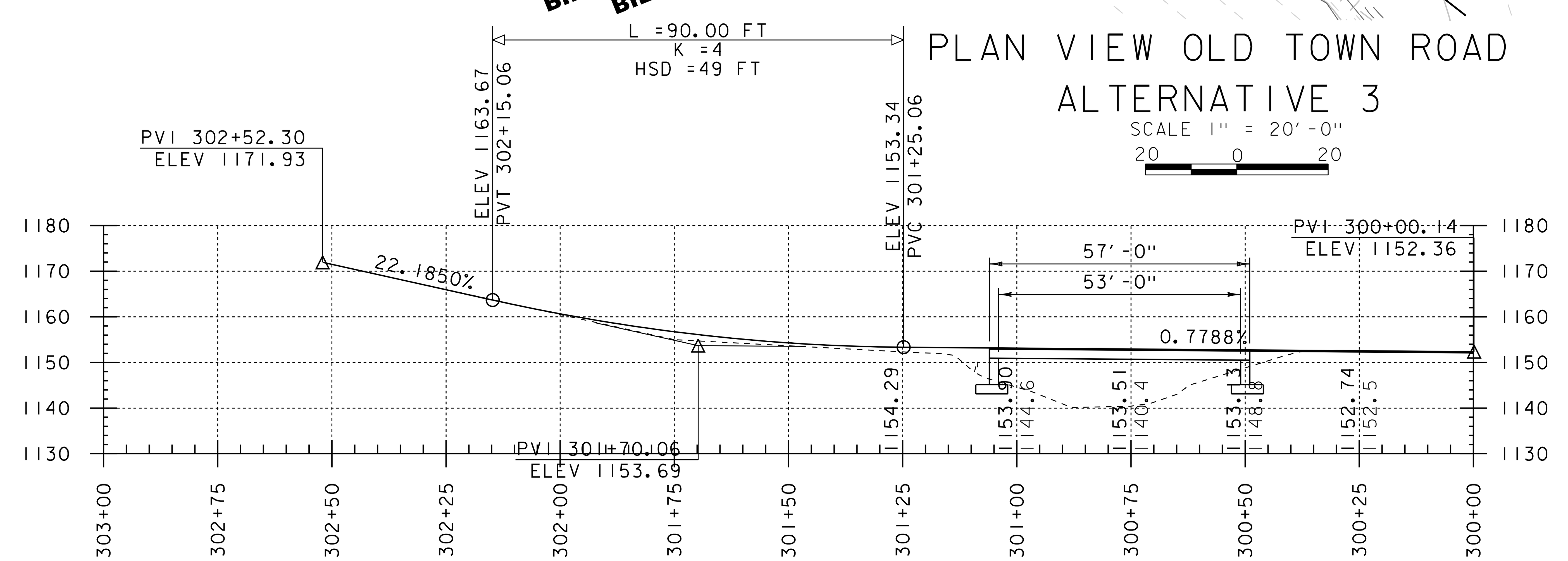
3

SHEET 3 OF 7



PLAN VIEW OLD TOWN ROAD ALTERNATIVE 3

SCALE 1" = 20'-0"
20 0 20



PROFILE - OLD TOWN ROAD ALTERNATIVE 3 AND 3A

SCALE 1" = 20'-0"
20 0 20

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NO.	DATE	DESCRIPTION	BY	CK'D

TOWN OF RIPTON, VERMONT

OLD TOWN ROAD BRIDGE STUDY

SHEET TITLE

ALTERNATIVE 3

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CHECKED BY JCH	D&K PROJECT # 625162
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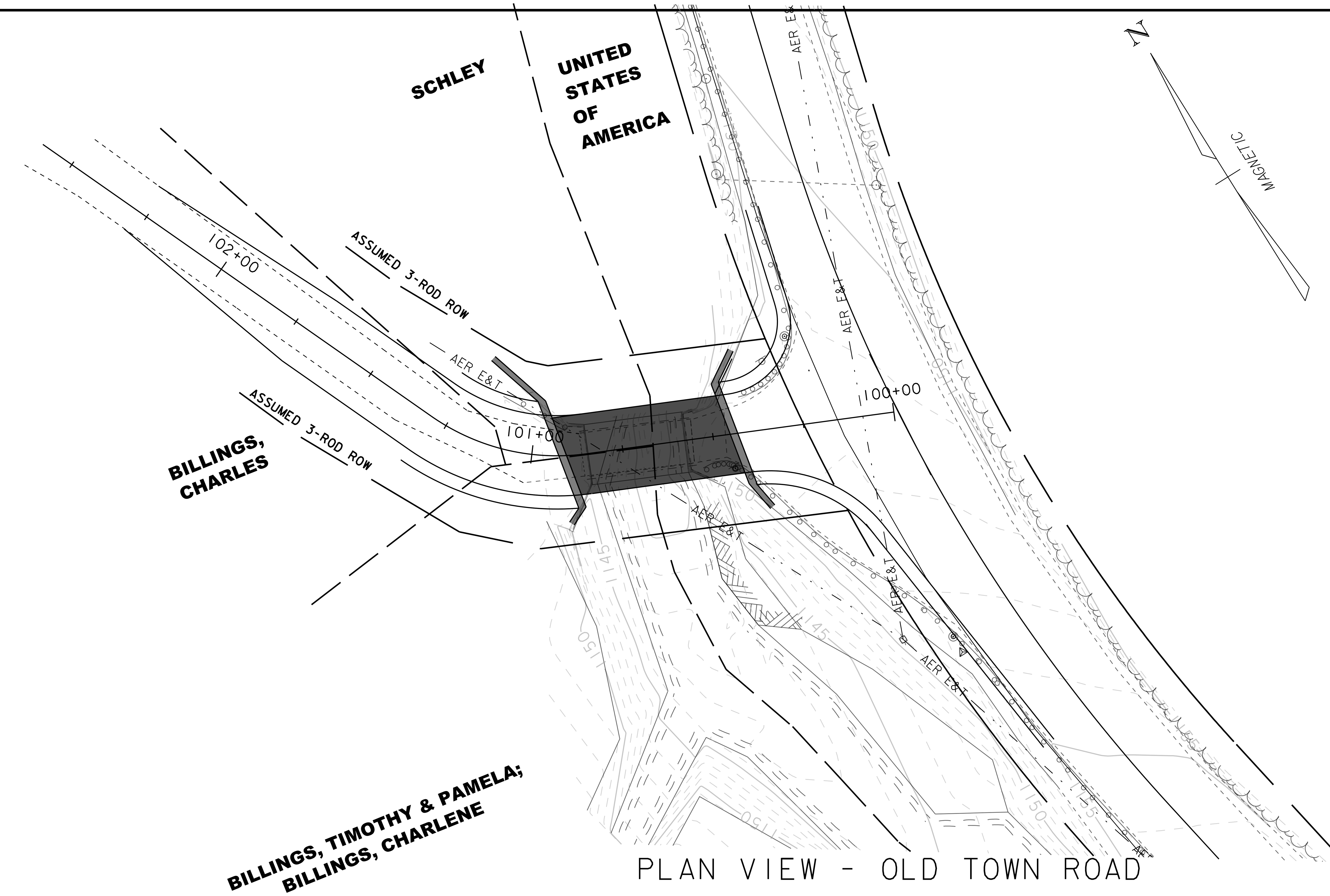
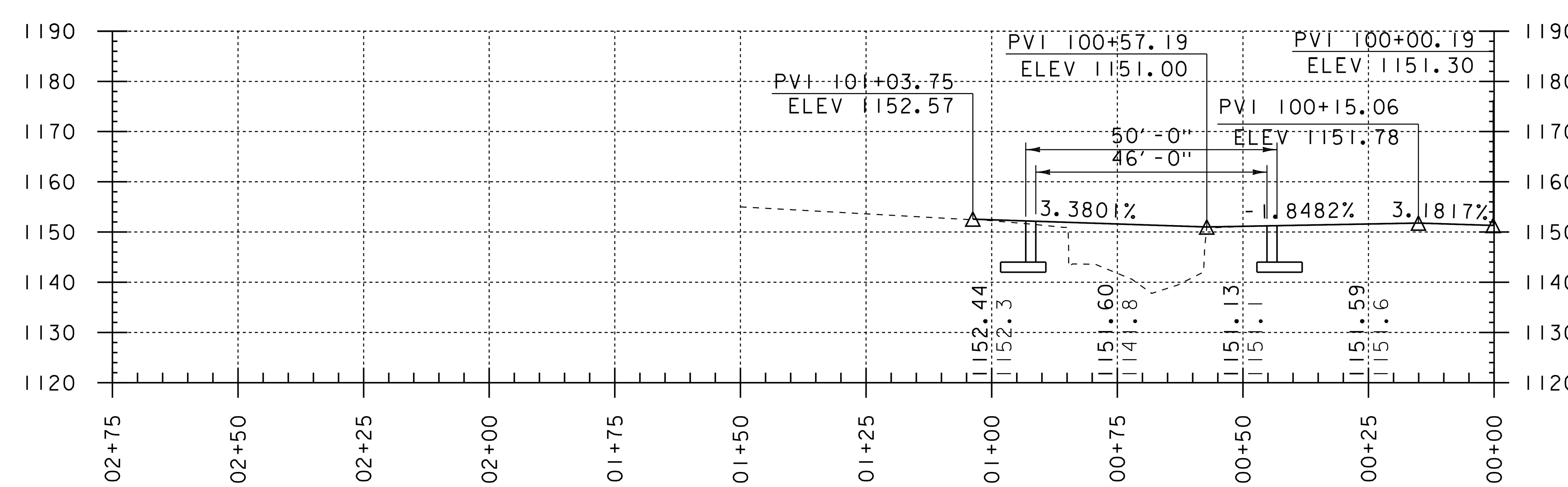


PLAN VIEW - OLD TOWN ROAD
ALTERNATIVE 4

SCALE 1" = 20'-0"



PROFILE - OLD TOWN ROAD
ALTERNATIVE 4

SCALE 1" = 20'-0"

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NOT FOR CONSTRUCTION CONCEPTUAL PLANS

TOWN OF RIPTON, VERMONT

OLD TOWN ROAD BRIDGE STUDY

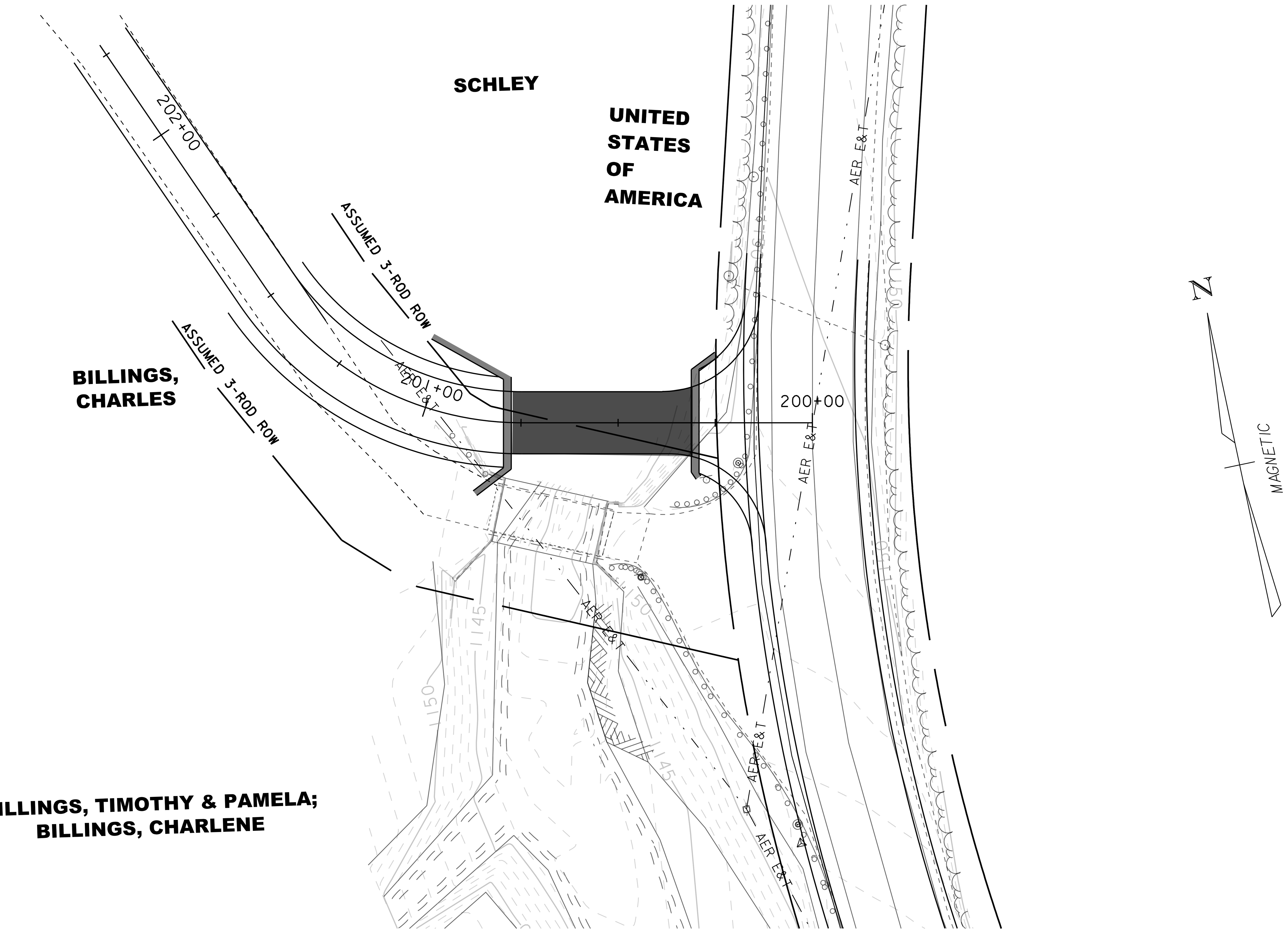
SHEET TITLE

ALTERNATIVE 4

DRAWN BY MEM	DATE $$DATE$$
CHECKED BY JCH	D&K PROJECT # 625162
PROJ. ENG. MEM	D&K ARCHIVE #

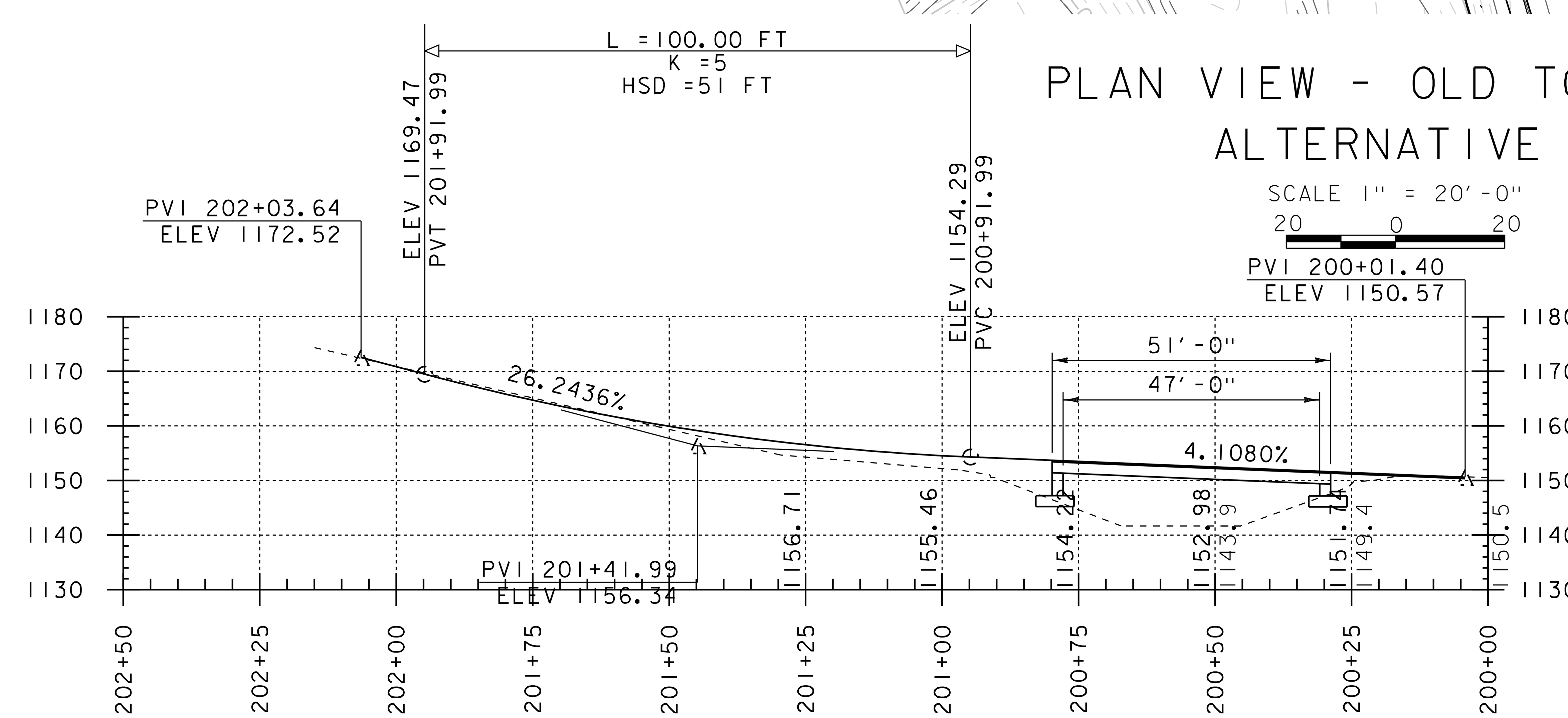
DRAWING NUMBER

5



PLAN VIEW - OLD TOWN ROAD
ALTERNATIVE 1A

SCALE 1" = 20'-0"



PROFILE- OLD TOWN ROAD
ALTERNATIVE 1 AND 1A

SCALE 1" = 20'-0"

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ALTERNATIVE 1

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MEM	$$DATE$$
CHECKED BY	D&K PROJECT #
JCH	625162
PROJ. ENG.	D&K ARCHIVE #
MEM	

DRAWING NUMBER

6

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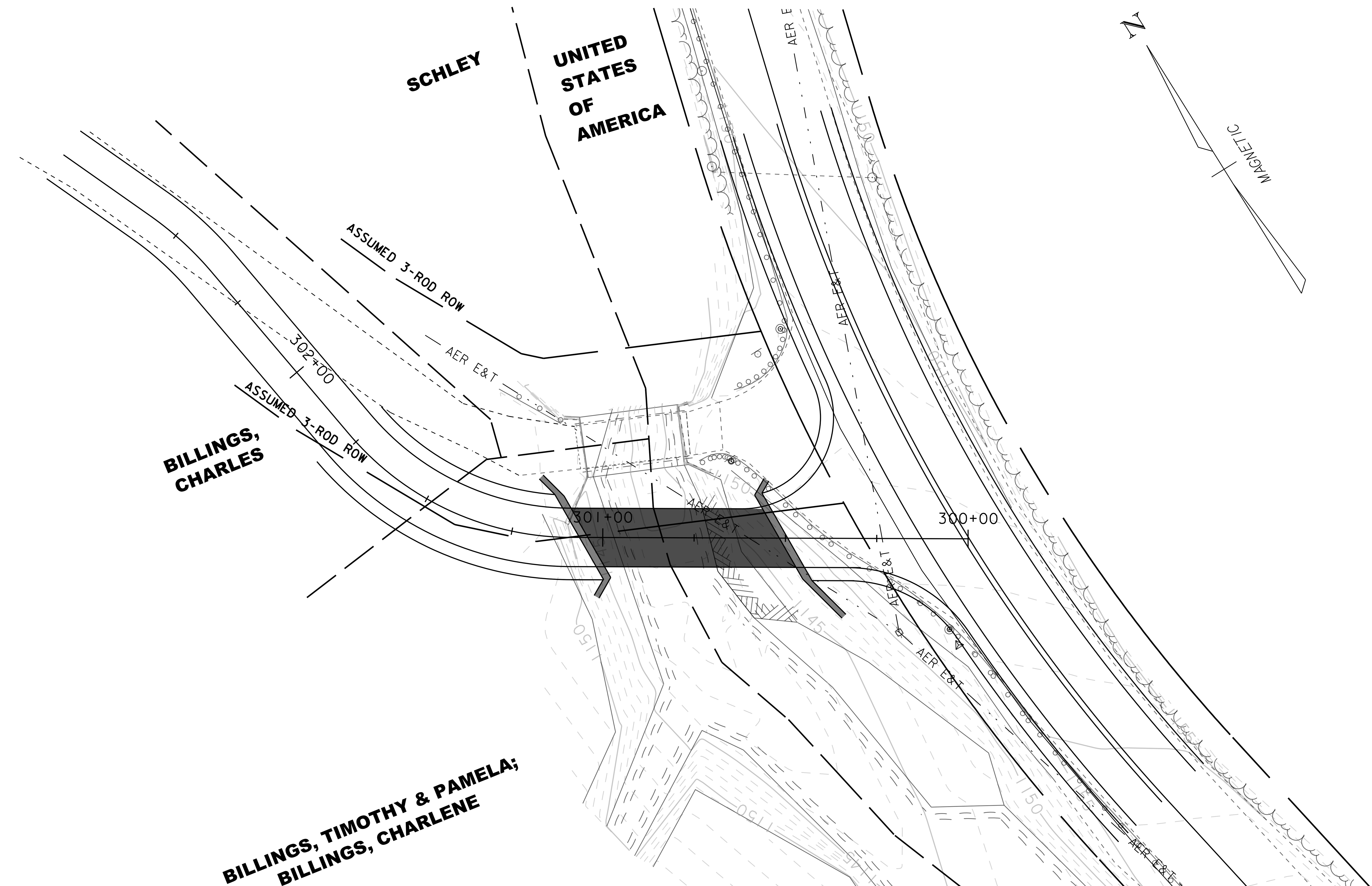
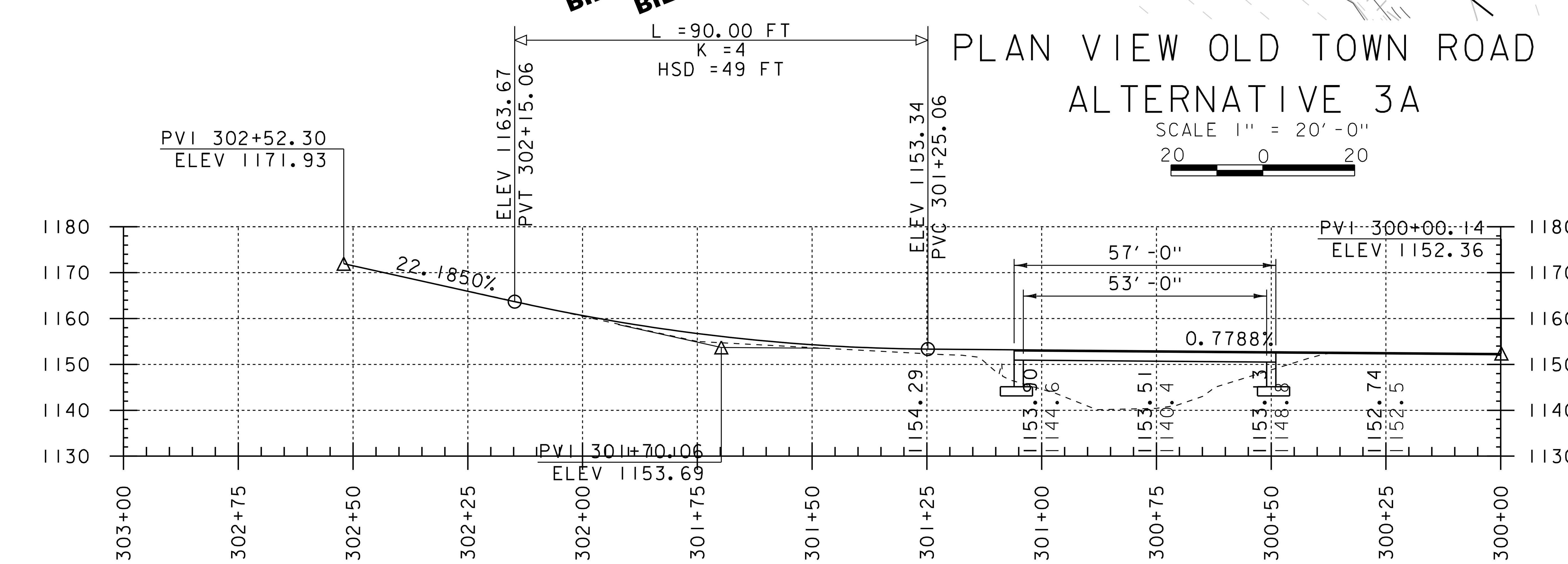


PLAN VIEW OLD TOWN ROAD
ALTERNATIVE 3A

SCALE 1" = 20'-0"
20 0 20



PROFILE - OLD TOWN ROAD
ALTERNATIVE 3 AND 3A

SCALE 1" = 20'-0"
20 0 20

$FILE$

DuBois & King inc.
ENGINEERING • PLANNING • MANAGEMENT • DEVELOPMENT
6 GREEN TREE DRIVE
SO. BURLINGTON, VT 05403
TEL: (802) 878-7661
www.dubois-king.com
BEDFORD, NH
RANDOLPH, VT
LACONIA, NH
SPRINGFIELD, VT

PROFESSIONAL SEAL

NOT FOR CONSTRUCTION CONCEPTUAL PLANS

NO.	DATE	DESCRIPTION	BY	CK'D

TOWN OF RIPTON, VERMONT

OLD TOWN ROAD BRIDGE STUDY

SHEET TITLE

ALTERNATIVE 3

DRAWN BY MEM	DATE $$DATE$$
CHECKED BY JCH	D&K PROJECT # 625162
PROJ. ENG. MEM	D&K ARCHIVE #

DRAWING NUMBER

7

APPENDIX H

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

DuBois & King inc.

☐ Randolph, VT 05060 (802) 728-3376
☐ Bedford, NH 03110 (603) 637-1043
☒ S. Burlington, VT 05403 (802) 878-7661
☐ Laconia, NH 03246 (603) 524-1166

Engineering ● Planning ● Development ● Management

PROJECT: Ripton Old Town Road BR 6

SHEET NO. 1 OF 1

CALCULATED BY: MEM DATE: 12-Jul-19

SCALE:

ALTERNATIVE 1, WIDTH OF 22 FEET, DOWNSTREAM LOCATION

ITEM NO.	DESCRIPTION	UNIT	QUANT.	UNIT PRICE	AMOUNT
201.10	CLEARING AND GRUBBING, INCLUDING INDIVIDUAL TREES AND STUMPS	LS	1	$10,000.00	$10,000.00
203.15	COMMON EXCAVATION	CY	95	$18.00	$1,710.00
203.30	EARTH BORROW	CY	1070	$18.00	$19,260.00
203.16	SOLID ROCK EXCAVATION	CY	10	$100.00	$1,000.00
204.25	STRUCTURE EXCAVATION	CY	155	$30.00	$4,650.00
204.30	GRANULAR BACKFILL FOR STRUCTURES	CY	155	$40.00	$6,200.00
301.15	SUBBASE OF GRAVEL	CY	210	$40.00	$8,400.00
401.10	AGGREGATE SURFACE COURSE	CY	55	$55.00	$3,025.00
501.38	HIGH PERFORMANCE CONCRETE, CLASS PCS (FPQ)	CY	130	$700.00	$165,000.00
507.11	REINFORCING STEEL, LEVEL I (EPOXY COATED)	LB	23400	$1.30	$30,420.00
510.24	GROUTING SHEAR KEYS	LF	255	$25.00	$6,375.00
514.10	WATER REPELLENT, SILANE	GAL	12	$75.00	$900.00
525.44	BRIDGE RAILING, GALVANIZED HDSB/FASCIA MOUNTED/STEEL TUBING	LF	90	$300.00	$27,000.00
529.15	REMOVAL OF STRUCTURE	LS	1	$15,000.00	$15,000.00
531.16	BEARING DEVICE ASSEMBLY, PLAIN ELASTOMERIC PAD	EA	24	$300.00	$7,200.00
613.06	STONE FILL, STREAM BED MATERIAL (E-STONE, TYPE IV)	CY	45	$65.00	$2,925.00
621.06	ANCHOR FOR STEEL BEAM RAIL	EA	2	$900.00	$1,800.00
621.20	STEEL BEAM GUARDRAIL, GALVANIZED	LF	100	$25.00	$2,500.00
630.15	FLAGGERS	HR	150	$30.00	$4,500.00
631.16	TESTING EQUIPMENT CONCRETE	LS	1	$1,000.00	$1,000.00
635.11	MOBILIZATION/DEMOBILIZATION	LS	1	$43,000.00	$43,000.00
641.10	TRAFFIC CONTROL	LS	1	$10,000.00	$10,000.00
	EROSION CONTROL	LS	1	$20,000.00	$20,000.00
900.640	SPECIAL PROVISION (PRESTRESSED CONCRETE SOLID SLABS EXTERIOR)(18"X36")	LF	102	$520.00	$53,040.00
900.640	SPECIAL PROVISION (PRESTRESSED CONCRETE SOLID SLABS EXTERIOR)(18"X48")	LF	204	$650.00	$132,600.00

Construction:

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST TOTAL: $578,000.00

Note:

In providing opinions of probable construction cost, the Client understands that D&K has no control over the cost or availability of labor, equipment or materials, or over market conditions or the Contractor's method of pricing, and that our Opinion of Probable Construction Costs are made on the basis of our professional judgment and experience. D&K makes no warranty, expressed or implied, that the bids or the negotiated cost of the Work will not vary from the Opinion of Probable Construction Cost provided herein.

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Engineering ● Planning ● Development ● Management

PROJECT: Ripton Old Town Road BR 6

SHEET NO. 1 OF 1

CALCULATED BY: MEM DATE: 12-Jul-19

SCALE:

ALTERNATIVE 2, WIDTH OF 22 FEET, UPSTREAM LOCATION NO SKEW

ITEM NO.	DESCRIPTION	UNIT	QUANT.	UNIT PRICE	AMOUNT
201.10	CLEARING AND GRUBBING, INCLUDING INDIVIDUAL TREES AND STUMPS	LS	1	$10,000.00	$10,000.00
203.15	COMMON EXCAVATION	CY	95	$18.00	$1,710.00
203.30	EARTH BORROW	CY	1990	$18.00	$35,820.00
203.16	SOLID ROCK EXCAVATION	CY	10	$100.00	$1,000.00
204.25	STRUCTURE EXCAVATION	CY	250	$30.00	$7,500.00
204.30	GRANULAR BACKFILL FOR STRUCTURES	CY	250	$40.00	$10,000.00
301.15	SUBBASE OF GRAVEL	CY	350	$40.00	$14,000.00
401.10	AGGREGATE SURFACE COURSE	CY	90	$55.00	$4,950.00
501.38	HIGH PERFORMANCE CONCRETE, CLASS PCS (FPQ)	CY	110	$700.00	$165,000.00
507.11	REINFORCING STEEL, LEVEL I (EPOXY COATED)	LB	19800	$1.30	$25,740.00
510.24	GROUTING SHEAR KEYS	LF	250	$25.00	$6,250.00
514.10	WATER REPELLENT, SILANE	GAL	12	$75.00	$900.00
525.44	BRIDGE RAILING, GALVANIZED HDSB/FASCIA MOUNTED/STEEL TUBING	LF	88	$300.00	$26,400.00
529.15	REMOVAL OF STRUCTURE	LS	1	$15,000.00	$15,000.00
531.16	BEARING DEVICE ASSEMBLY, PLAIN ELASTOMERIC PAD	EA	24	$300.00	$7,200.00
613.06	STONE FILL, STREAM BED MATERIAL (E-STONE, TYPE IV)	CY	45	$65.00	$2,925.00
621.06	ANCHOR FOR STEEL BEAM RAIL	EA	2	$900.00	$1,800.00
621.20	STEEL BEAM GUARDRAIL, GALVANIZED	LF	375	$25.00	$9,375.00
630.15	FLAGGERS	HR	150	$30.00	$4,500.00
631.16	TESTING EQUIPMENT CONCRETE	LS	1	$1,000.00	$1,000.00
635.11	MOBILIZATION/DEMOBILIZATION	LS	1	$46,000.00	$46,000.00
641.10	TRAFFIC CONTROL	LS	1	$10,000.00	$10,000.00
	EROSION CONTROL	LS	1	$20,000.00	$20,000.00
900.640	SPECIAL PROVISION (PRESTRESSED CONCRETE SOLID SLABS EXTERIOR)(18"X36")	LF	100	$520.00	$52,000.00
900.640	SPECIAL PROVISION (PRESTRESSED CONCRETE SOLID SLABS EXTERIOR)(18"X48")	LF	200	$650.00	$130,000.00

Construction:

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST TOTAL: $610,000.00

Note:

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Engineering • Planning • Development • Management

PROJECT: Ripton Old Town Road BR 6

SHEET NO. 1 OF 1

CALCULATED BY: MEM DATE: 12-Jul-19

SCALE:

ALTERNATIVE 3, WIDTH OF 22 FEET, UPSTREAM LOCATION SKEWED

ITEM NO.	DESCRIPTION	UNIT	QUANT.	UNIT PRICE	AMOUNT
201.10	CLEARING AND GRUBBING, INCLUDING INDIVIDUAL TREES AND STUMPS	LS	1	$10,000.00	$10,000.00
203.15	COMMON EXCAVATION	CY	95	$18.00	$1,710.00
203.30	EARTH BORROW	CY	1680	$18.00	$30,240.00
203.16	SOLID ROCK EXCAVATION	CY	10	$100.00	$1,000.00
204.25	STRUCTURE EXCAVATION	CY	215	$30.00	$6,450.00
204.30	GRANULAR BACKFILL FOR STRUCTURES	CY	215	$40.00	$8,600.00
301.15	SUBBASE OF GRAVEL	CY	310	$40.00	$12,400.00
401.10	AGGREGATE SURFACE COURSE	CY	75	$55.00	$4,125.00
501.38	HIGH PERFORMANCE CONCRETE, CLASS PCS (FPQ)	CY	115	$700.00	$165,000.00
507.11	REINFORCING STEEL, LEVEL I (EPOXY COATED)	LB	20700	$1.30	$26,910.00
510.24	GROUTING SHEAR KEYS	LF	285	$25.00	$7,125.00
514.10	WATER REPELLENT, SILANE	GAL	12	$75.00	$900.00
525.44	BRIDGE RAILING, GALVANIZED HDSB/FASCIA MOUNTED/STEEL TUBING	LF	102	$300.00	$30,600.00
529.15	REMOVAL OF STRUCTURE	LS	1	$15,000.00	$15,000.00
531.16	BEARING DEVICE ASSEMBLY, PLAIN ELASTOMERIC PAD	EA	24	$300.00	$7,200.00
613.06	STONE FILL, STREAM BED MATERIAL (E-STONE, TYPE IV)	CY	45	$65.00	$2,925.00
621.06	ANCHOR FOR STEEL BEAM RAIL	EA	2	$900.00	$1,800.00
621.20	STEEL BEAM GUARDRAIL, GALVANIZED	LF	325	$25.00	$8,125.00
630.15	FLAGGERS	HR	150	$30.00	$4,500.00
631.16	TESTING EQUIPMENT CONCRETE	LS	1	$1,000.00	$1,000.00
635.11	MOBILIZATION/DEMOBILIZATION	LS	1	$47,000.00	$47,000.00
641.10	TRAFFIC CONTROL	LS	1	$10,000.00	$10,000.00
	EROSION CONTROL	LS	1	$20,000.00	$20,000.00
900.640	SPECIAL PROVISION (PRESTRESSED CONCRETE SOLID SLABS EXTERIOR)(18"X36")	LF	114	$600.00	$68,400.00
900.640	SPECIAL PROVISION (PRESTRESSED CONCRETE SOLID SLABS EXTERIOR)(18"X48")	LF	228	$720.00	$164,160.00

Construction:

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST TOTAL: $656,000.00

Note:

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Engineering • Planning • Development • Management

PROJECT: Ripton Old Town Road BR 6

SHEET NO. 1 OF 1

CALCULATED BY: MEM DATE: 12-Jul-19

SCALE:

ALTERNATIVE 4, WIDTH OF 22 FEET, EXISTING LOCATION

ITEM NO.	DESCRIPTION	UNIT	QUANT.	UNIT PRICE	AMOUNT
201.10	CLEARING AND GRUBBING, INCLUDING INDIVIDUAL TREES AND STUMPS	LS	1	$10,000.00	$10,000.00
203.15	COMMON EXCAVATION	CY	95	$18.00	$1,710.00
203.30	EARTH BORROW	CY	310	$18.00	$5,580.00
203.16	SOLID ROCK EXCAVATION	CY	10	$100.00	$1,000.00
204.25	STRUCTURE EXCAVATION	CY	150	$30.00	$4,500.00
204.30	GRANULAR BACKFILL FOR STRUCTURES	CY	150	$40.00	$6,000.00
301.15	SUBBASE OF GRAVEL	CY	90	$40.00	$3,600.00
401.10	AGGREGATE SURFACE COURSE	CY	25	$55.00	$1,375.00
501.38	HIGH PERFORMANCE CONCRETE, CLASS PCS (FPQ)	CY	130	$700.00	$165,000.00
507.11	REINFORCING STEEL, LEVEL I (EPOXY COATED)	LB	23400	$1.30	$30,420.00
510.24	GROUTING SHEAR KEYS	LF	255	$25.00	$6,375.00
514.10	WATER REPELLENT, SILANE	GAL	12	$75.00	$900.00
525.44	BRIDGE RAILING, GALVANIZED HDSB/FASCIA MOUNTED/STEEL TUBING	LF	90	$300.00	$27,000.00
528.10	ONE-WAY TEMPORARY BRIDGE	LS	1	$50,000.00	$50,000.00
529.15	REMOVAL OF STRUCTURE	LS	1	$15,000.00	$15,000.00
531.16	BEARING DEVICE ASSEMBLY, PLAIN ELASTOMERIC PAD	EA	24	$300.00	$7,200.00
613.06	STONE FILL, STREAM BED MATERIAL (E-STONE, TYPE IV)	CY	45	$65.00	$2,925.00
621.06	ANCHOR FOR STEEL BEAM RAIL	EA	2	$900.00	$1,800.00
621.20	STEEL BEAM GUARDRAIL, GALVANIZED	LF	100	$25.00	$2,500.00
630.15	FLAGGERS	HR	150	$30.00	$4,500.00
631.16	TESTING EQUIPMENT CONCRETE	LS	1	$1,000.00	$1,000.00
635.11	MOBILIZATION/DEMOBILIZATION	LS	1	$45,000.00	$45,000.00
641.10	TRAFFIC CONTROL	LS	1	$10,000.00	$10,000.00
	EROSION CONTROL	LS	1	$20,000.00	$20,000.00
900.640	SPECIAL PROVISION (PRESTRESSED CONCRETE SOLID SLABS EXTERIOR)(18"X48")	LF	102	$520.00	$53,040.00
900.640	SPECIAL PROVISION (PRESTRESSED CONCRETE SOLID SLABS EXTERIOR)(18"X48")	LF	204	$650.00	$132,600.00

Construction:

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST TOTAL: $610,000.00

Note:

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Engineering • Planning • Development • Management

PROJECT: Ripton Old Town Road BR 6

SHEET NO. 1 OF 1

CALCULATED BY: MEM DATE: 12-Jul-19

SCALE:

ALTERNATIVE 1A, WIDTH OF 16 FEET - DOWNSTREAM LOCATION

ITEM NO.	DESCRIPTION	UNIT	QUANT.	UNIT PRICE	AMOUNT
201.10	CLEARING AND GRUBBING, INCLUDING INDIVIDUAL TREES AND STUMPS	LS	1	$8,000.00	$8,000.00
203.15	COMMON EXCAVATION	CY	61	$18.00	$1,098.00
203.30	EARTH BORROW	CY	810	$18.00	$14,580.00
203.16	SOLID ROCK EXCAVATION	CY	10	$100.00	$1,000.00
204.25	STRUCTURE EXCAVATION	CY	140	$30.00	$4,200.00
204.30	GRANULAR BACKFILL FOR STRUCTURES	CY	140	$40.00	$5,600.00
301.15	SUBBASE OF GRAVEL	CY	145	$40.00	$5,800.00
401.10	AGGREGATE SURFACE COURSE	CY	35	$55.00	$1,925.00
501.38	HIGH PERFORMANCE CONCRETE, CLASS PCS (FPQ)	CY	115	$700.00	$165,000.00
507.11	REINFORCING STEEL, LEVEL I (EPOXY COATED)	LB	20700	$1.30	$26,910.00
510.24	GROUTING SHEAR KEYS	LF	153	$25.00	$3,825.00
514.10	WATER REPELLENT, SILANE	GAL	10	$75.00	$750.00
525.44	BRIDGE RAILING, GALVANIZED HDSB/FASCIA MOUNTED/STEEL TUBING	LF	90	$300.00	$27,000.00
529.15	REMOVAL OF STRUCTURE	LS	1	$15,000.00	$15,000.00
531.16	BEARING DEVICE ASSEMBLY, PLAIN ELASTOMERIC PAD	EA	16	$300.00	$4,800.00
613.06	STONE FILL, STREAM BED MATERIAL (E-STONE, TYPE IV)	CY	40	$65.00	$2,600.00
621.06	ANCHOR FOR STEEL BEAM RAIL	EA	2	$900.00	$1,800.00
621.20	STEEL BEAM GUARDRAIL, GALVANIZED	LF	100	$25.00	$2,500.00
630.15	FLAGGERS	HR	150	$30.00	$4,500.00
631.16	TESTING EQUIPMENT CONCRETE	LS	1	$1,000.00	$1,000.00
635.11	MOBILIZATION/DEMOBILIZATION	LS	1	$37,000.00	$37,000.00
641.10	TRAFFIC CONTROL	LS	1	$10,000.00	$10,000.00
	EROSION CONTROL	LS	1	$20,000.00	$20,000.00
900.640	SPECIAL PROVISION (PRESTRESSED CONCRETE SOLID SLABS EXTERIOR)(18"X48")	LF	204	$650.00	$132,600.00

Construction:

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST TOTAL: $498,000.00

Note:

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Engineering ● Planning ● Development ● Management

PROJECT: Ripton Old Town Road BR 6

SHEET NO. 1 OF 1

CALCULATED BY: MEM DATE: 12-Jul-19

CHECKED BY: DATE:

SCALE:

ALTERNATIVE 3A, WIDTH OF 16 FEET, UPSTREAM LOCATION SKEWED

ITEM NO.	DESCRIPTION	UNIT	QUANT.	UNIT PRICE	AMOUNT
201.10	CLEARING AND GRUBBING, INCLUDING INDIVIDUAL TREES AND STUMPS	LS	1	$8,000.00	$8,000.00
203.15	COMMON EXCAVATION	CY	61	$18.00	$1,098.00
203.30	EARTH BORROW	CY	1273	$18.00	$22,914.00
203.16	SOLID ROCK EXCAVATION	CY	10	$100.00	$1,000.00
204.25	STRUCTURE EXCAVATION	CY	190	$30.00	$5,700.00
204.30	GRANULAR BACKFILL FOR STRUCTURES	CY	190	$40.00	$7,600.00
301.15	SUBBASE OF GRAVEL	CY	210	$40.00	$8,400.00
401.10	AGGREGATE SURFACE COURSE	CY	50	$55.00	$2,750.00
501.38	HIGH PERFORMANCE CONCRETE, CLASS PCS (FPQ)	CY	100	$700.00	$165,000.00
507.11	REINFORCING STEEL, LEVEL I (EPOXY COATED)	LB	18000	$1.30	$23,400.00
510.24	GROUTING SHEAR KEYS	LF	171	$25.00	$4,275.00
514.10	WATER REPELLENT, SILANE	GAL	10	$75.00	$750.00
525.44	BRIDGE RAILING, GALVANIZED HDSB/FASCIA MOUNTED/STEEL TUBING	LF	102	$300.00	$30,600.00
529.15	REMOVAL OF STRUCTURE	LS	1	$15,000.00	$15,000.00
531.16	BEARING DEVICE ASSEMBLY, PLAIN ELASTOMERIC PAD	EA	16	$300.00	$4,800.00
613.06	STONE FILL, STREAM BED MATERIAL (E-STONE, TYPE IV)	CY	40	$65.00	$2,600.00
621.06	ANCHOR FOR STEEL BEAM RAIL	EA	2	$900.00	$1,800.00
621.20	STEEL BEAM GUARDRAIL, GALVANIZED	LF	325	$25.00	$8,125.00
630.15	FLAGGERS	HR	150	$30.00	$4,500.00
631.16	TESTING EQUIPMENT CONCRETE	LS	1	$1,000.00	$1,000.00
635.11	MOBILIZATION/DEMOBILIZATION	LS	1	$43,000.00	$43,000.00
641.10	TRAFFIC CONTROL	LS	1	$10,000.00	$10,000.00
	EROSION CONTROL	LS	1	$20,000.00	$20,000.00
900.640	SPECIAL PROVISION (PRESTRESSED CONCRETE SOLID SLABS EXTERIOR)(18"X48")	LF	265	$720.00	$190,800.00

Construction:

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST TOTAL: $584,000.00

Note:

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