Work Zone Safety & Mobility Implementation Guide

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List of Acronyms

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ATSSA	American Traffic Safety Services Association
CCTV	Closed-Circuit Television
CFR	Code of Federal Regulations
CMS	Changeable Message Sign
DMS	Dynamic Message Sign
EOP	Emergency Operating Procedures
FHWA	Federal Highway Administration
FR	Federal Register
HAR	Highway Advisory Radio
HOV	High Occupancy Vehicle
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation System(s)
MASH	Manual for Assessing Safety Hardware
MOTAA	Maintenance of Traffic Alternative Analysis
MOT	Maintenance of Traffic
MUTCD	Manual on Uniform Traffic Control Devices
NCHRP	National Cooperative Highway Research Program
NDOT	Nevada Department of Transportation
NEPA	National Environmental Policy Act
PI	Public Information
PPCBR	Portable Precast Concrete Barrier Rail
QA	Quality Assurance
TRB	Transportation Research Board
TTC	Temporary Traffic Control
TMA	Transportation Management Area
TMC	Transportation Management Center
TMP	Transportation Management Plan
TO	Transportation Operations
USDOT	United States Department of Transportation

Table of Contents

Work Zone Safety and Mobility Implementation Guide

1.0 Introduction

1.1 Authority

The Federal Highway Administration (FHWA) published the Work Zone Safety and Mobility Rule (the Rule) on September 9, 2004 in the Federal Register (69 FR 54562). This Rule updates and renames the former regulation on "Traffic Safety in Highway and Street Work Zones" in 23 CFR 630, Subpart J referred to as "Work Zone Safety and Mobility Rule" and Sub part K referred to as "Temporary Traffic Control Devices Rule". The Safety and Mobility Rule was effective January 1, 2008 and subpart K was effective March 1, 2009. The Nevada Department of Transportation is authorized by N.R.S. 408.100 (Declaration of legislative intent.), N.R.S. 408.210 (Powers of director: Closing and construction of highways; removal of encroachments.) and N.R.S. 408.423 (Permit required to excavate state highway; exception; fee.) to implement the Rule.

1.2 Purpose

Establish the fundamental principles, roles, responsibilities and procedures for systematically addressing the safety and mobility impacts of work zones and developing strategies to help manage these impacts. The principals and procedures of the Rule and Work Zone Safety and Mobility Implementation Guide are to be followed by each District and Division.

The Work Zone Safety and Mobility Implementation Guide supersede all policies and procedures previously established for Temporary Traffic Control and Temporary Traffic Control Zones (Work Zones).

1.3 Scope

While the Rule applies specifically to Federal-aid highway projects, it is the Nevada Department of Transportation's intent to follow this rule for all work zones on state maintained roadways. These procedures shall be implemented on all federal and non-federal aid construction and maintenance projects, including permits and those administered by Local Public Agencies (LPA) anticipated to have work zone impacts.

1.4 Definitions

Informal Project - A project estimated to cost less than $250,000. Approval for informal TMPs may be granted by the District Traffic Engineer, or designated representative residing over the area where the project is constructed.

Significant Project - Is defined as one that, alone or in combination with other concurrent projects nearby is anticipated to cause sustained work zone impacts greater than what is considered tolerable based on NDOT guidelines and engineering judgment. **Significant Projects** usually require a Major Transportation Management Plan (TMP) consisting of three

parts; a Temporary Traffic Control plan, Transportation Operations strategies, and Public Information strategies.

Transportation Management Area (TMA) - Is an urbanized area with a population of more than 200,000 residents. In Nevada these areas are Las Vegas and Reno. The following counties will also be considered as a TMA urbanized area: Clark, Carson, Douglas, Lyon, Storey and Washoe. In the TMA urbanized areas, any project located on an interstate or US designated roadway will be considered significant and will require a Major TMP.

Transportation Management Plan (TMP) - Lays out a set of coordinated transportation management strategies and describes how they will be used to manage the work zone impacts. A TMP is required on all projects and may be comprised of one or more of the following elements; a Temporary Traffic Control (TTC) plan, Transportation Operations (TO) strategies and Public Information (PI) strategies. These elements are integrated into a single document that demonstrates an understanding of site specific issues and project requirements. A TMP shall make provision for updates and revisions throughout the project lifecycle to address issues as they occur.

Temporary Traffic Control (TTC) Plan - TTC plan is used for managing traffic through a work zone. The TTC will follow NDOT and Federal Standards and Guidance for the layout and placement of traffic control devices, signs, and related equipment for the project. The degree of detail in the TTC would depend on the project complexity and traffic interference with construction activity.

Temporary Traffic Control Zone (Work Zone) – The area of a roadway with construction, maintenance, or utility work activities. A work zone is typically marked by signs, channelizing devices, barriers, pavement markings, and/or work vehicles. It extends from the first warning sign or high-intensity rotating, flashing, oscillating, or strobe lights on a vehicle to the END ROAD WORK sign or the last TTC device.

Transportation Operations (TO) Strategies - The TO component addresses transportation operations strategies that will be used to ease work zone impact areas. The TO component contains agreements or instructions between stakeholders that describe how a transportation asset is to be used or modified during the construction of a project.

Public Information (PI) Strategies - The PI component consists of strategies that address communication with the public before and during the project. The PI plan will inform those affected by the project of anticipated work zone impacts and changing conditions.

Incident Management – Work zone safety is complicated by traffic incidents or other emergencies that occur within the work zone. The policies and procedures that govern the management of incidents is called Incident Management. Incident management is led by 1st responders.

1.5 Project Significance Assessment

In accordance with the Rule and NDOT's objectives, all projects necessitating work zone establishment under NDOT jurisdiction and oversight shall follow the procedures in this Manual. A project that is deemed "significant" requires a high level of work zone impact mitigation including Temporary Traffic Control plan, Transportation Operations Strategies, and Public Information Strategies. A project that is not found to be "significant" requires fewer mitigation strategies. The most basic projects require only a work zone traffic control plan.

The first steps in developing a Transportation Management Plan (TMP) for a work zone is to determine the level of Significance. This first step is referred to as the Project Significance Determination. This procedure determines whether a project is defined as Significant or Non-Significant. It should be noted that if a project is determined to be Significant, it does not necessarily mean that the development of the TMP will be a time-consuming or exhausting effort. If a project is determined to be Significant, it simply means that additional mitigation strategies should be implemented to reduce congestion and improve safety within the work zone. Often, these strategies are things that NDOT is already doing for many work zones. Excluded projects and types of work for which standing TMPs may be used are discussed in 1.5.2 below.

In order to complete the determination of significance, the project is categorized into one of two groups:

a) **Significant Project** - Requires a high level of work zone impact mitigation. Requires a Temporary Traffic Control plan (TTC plan, or TTC) as well as consideration and use of both TMP strategies to help mitigate the impacts of a significant project:
   - Transportation Operations (TO) Strategies
   - Public Information (PI) Strategies

b) **Non-Significant Project** - Requires varying levels complexity ranging from only a TTC plan, up to TTC plan with both strategies, as needed.

The basic process of significance determination is outlined in Figure 1.1. See section 1.5.2 for types of TMPs.

If a project's traffic control will not involve a lane closure and is otherwise not determined to have unacceptable impacts, the project will not be considered significant. In this case, the project is **non-significant. Non-significant projects** will have either a **Moderate TMP** or a **Basic TMP**.

A **Significant Project** is one for which any of the following criteria exist:

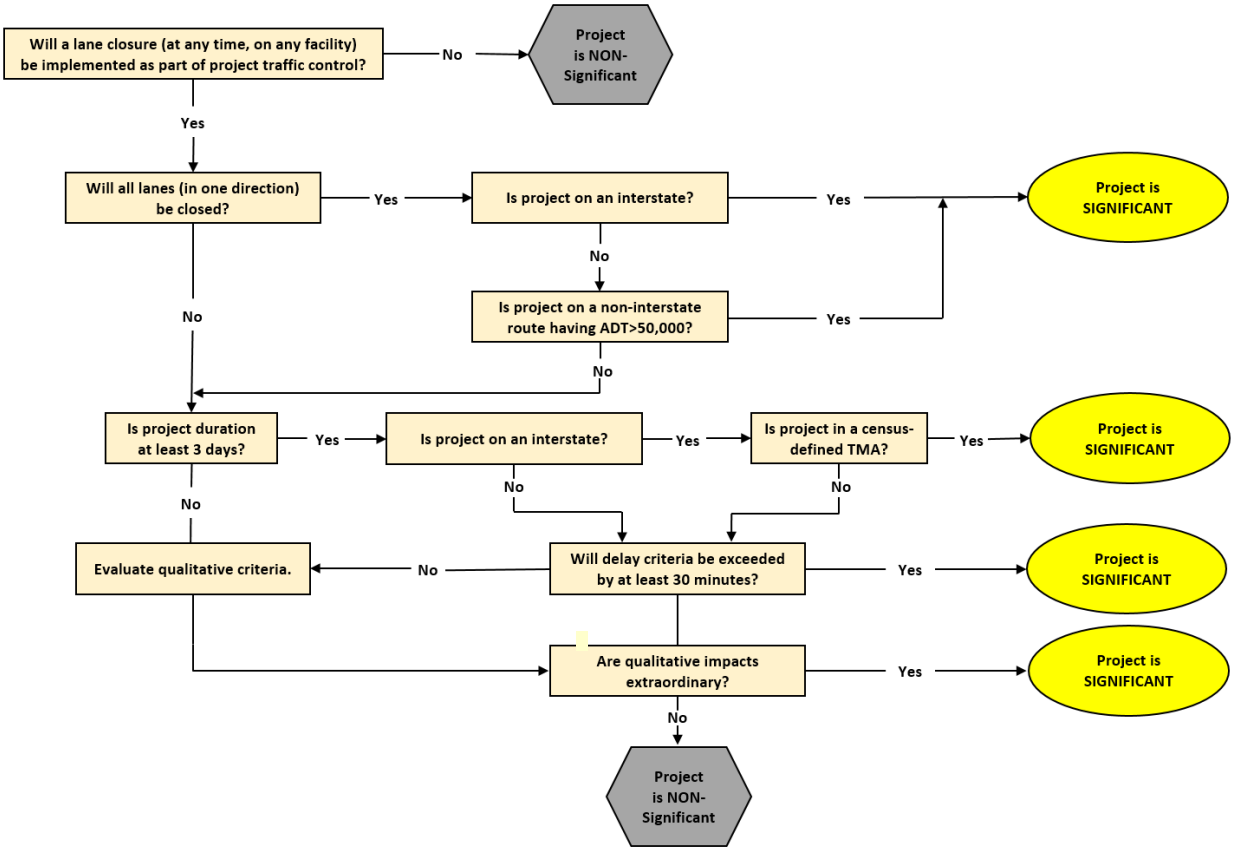
a) Any project on the interstate system located within a recognized Transportation Management Area (TMA) that occupies a given location for at least three days duration with either continuous or intermittent lane closures.

b) Any project of any duration on an interstate route or any route with an AADT of at least 50,000 vehicles per day for which all lanes in one direction will be closed to traffic.

c) Any project for which the delay through the limits of the work zone is at least 30 minutes above the normal delay under typical non-work conditions.

d) Any project deemed Significant by extraordinary qualitative characteristics. This determination may be made on the basis of conditions such as high levels of public interest, business/community impacts, or long work zone duration. All Significant Projects defined in this manner shall only be done with careful consideration and strategic decision making.

Figure 1.1: Project Significance Flowchart



The Significance determination helps to ensure the appropriate level of TMP strategies to be applied to each work zone.

Classification as a Significant Project distinguishes a project as one requiring a high degree of work zone impact mitigation. The project is anticipated to affect large numbers of roadway users, cause excessive delays, and/or present at least one of several qualitative impacts to the transportation system or affected community. Due to the impacts introduced by a Significant Project, special consideration must be made to minimize its negative effects. These considerations, or strategies, can be categorized as TO strategies, and/or PI strategies, which make up two parts of the TMP. The TTC plan is the third and final part of the TMP. Guidance for the development of a project TMP can be found in Part 4 of this guide.

When a project is determined to be Non-Significant that does not mean that its work zone impacts are unimportant or should be disregarded. Rather, the TMP of a Non-significant project will generally not provide mitigation strategies at the same level as the Major TMP. Additionally,

some components of a Non-Significant project's TMP may be pre-defined or standardized to simplify the TMP development for common small-scale work zones.

The FHWA's Rule allows a project defined as a Significant Project to be excluded from the requirements of a Major TMP if it is approved by FHWA's Nevada Division Office. If a project meets the definition of a Significant Project, but careful consideration of either qualitative or quantitative work zone characteristics predicts minor impacts, completion of a Major TMP may not be required. For a Significant Project to be exempt from Major TMP completion, a written request must be submitted to FHWA's Nevada Division office by the Project Manager and corroborated by the NDOT Division Manager, or by the NDOT Division Manager. The justification should include specific and quantifiable measures of effectiveness documenting how the project would not be expected to create sustained work zone impacts. For multiple projects of the same type that are not expected to exhibit considerable safety or mobility impacts, a blanket exemption request may be submitted. A blanket exemption should be created in the same manner as an individual project request.

1.6 Types of TMPs

Transportation Management Plans (TMPs) will be used to plan transportation management strategies to meet both NDOT's performance measures goals and the requirements of the Rule. The impacts that a work zone is expected to have on a roadway or a community vary from project to project, so no two TMPs will be exactly the same. The level of planning required for an individual TMP will depend on the project's anticipated impacts.

The NDOT Work Zone Safety and Mobility Implementation Guide uses a TMP to define the strategies to be used in the mitigation of work zone impacts. Whether defined as Significant or Non-Significant, a TMP must be completed for all projects having a work zone, unless classified as exempt.

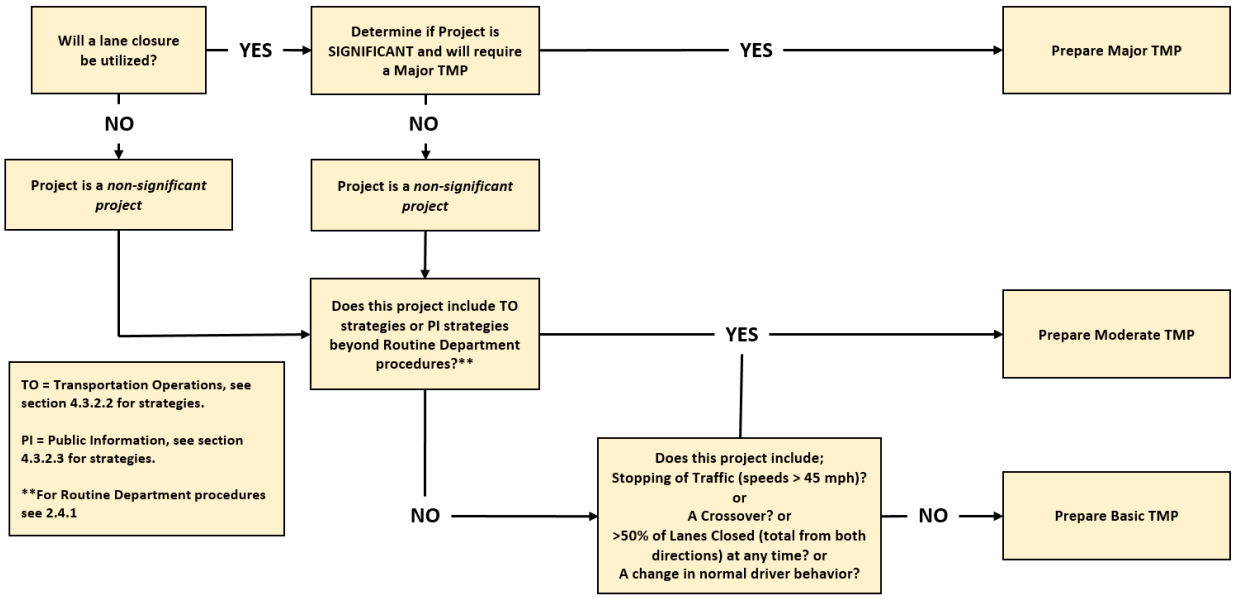
The second step in developing a TMP (after determining significance) for a work zone is to determine the appropriate level of TMP to be utilized. Projects can be divided into three separate groups:

- **Basic TMP Projects** requires a site specific TTC plan. TO and PI strategies may be included if they are only Routine Department procedures as defined in 2.4.1.

- **Moderate TMP Projects** require additional planning, coordination, etc. beyond a Basic TMP, but not to the level of a Major TMP. The Moderate TMP typically includes TTC plan and a document for project scope, traffic characteristics, location and other details but only have minor or Routine TO and PI strategies. See Figure 1.2.

- **Major TMPs** require a higher level of work zone impact mitigation and require consideration of various TMP strategies to help mitigate the impacts of a significant project. Major TMPs require three parts, a Temporary Traffic Control plan, TO strategies, and PI strategies. Typically, the two strategies are discussed in a single document that also explains the project scope, location, and other project specific details. The TTC plan is a companion document that, when combined with the strategies document make a complete TMP. Unless FHWA Exception is issued, all Significant projects will have a Major TMP.

Figure 1.2: Transportation Management Plan (TMP) Type Flowchart



"Standing" TMP for Typical, Recurring Activities/Projects

This additional class of activities/projects has been identified as those that are typical and regularly performed by Design staff or contracted workforces. The projects are characterized as having the potential to impact traffic operations due to required lane closures or roadside/shoulder work. They may include, but are not limited to Emergency Repairs, Resurfacing, Noise Wall and Slope Repair projects, roadway marking refresh, Bridge Inspection, Bridge Painting, Deck Patching, and Joint Repair.

The "standing" TMP methodology **SHALL NOT** be considered for a project/activity that meets the following conditions:

- ✓ On an Interstate system or US designated route within a Transportation Management Area (TMA), AND
- ✓ Having a project/activity duration longer than three days, AND
- ✓ Includes use of lane closures (intermittent or continuous).

If a project/activity developed by the Design Division, Maintenance and Asset Management Division, or District Office meets the above criteria, the project shall follow NDOT's TMP procedures as previously described. Otherwise the "standing" TMP will consist of the following:

A. Temporary Traffic Control Plans per current NDOT standard drawings which should follow the current version of the Manual on Uniform Traffic Control Devices, Part VI (a custom traffic control plan may be developed as deemed necessary).

B. Work Zone Standard General Notes shall be considered and followed per current NDOT procedures.

C. Where lane closures will be necessary as part of work effort, **Public Information Outreach** and/or **Time-of-Day Restrictions** on lane closures should be considered.

An opportunity occurs later in the project development process for a project's significance determination to be verified. Projects that are the responsibility of NDOT's Design or Project Management Divisions, are to undergo a secondary significance determination since there is potential for a project's scope to change during preliminary design.

The following maintenance activities are examples of TYPICAL, RECURRING projects/activities that may qualify for “standing” TMP consideration:

- Pavement Patching/Pot-Hole Repair Joint Repair
- Pavement Marking Work Sign Repair/Replacement
- Attenuator Installation/Repair Guardrail Installation/Repair
- Shoulder Repair/Construction “No Plans” Contract Activities
- “On Call” Contract Activities Tunnel Maintenance

*These types of projects **will not** require completion of the Project Significance Determination or TMP development.* A custom TMP for each occurrence of these activities will not be required. However, these projects/activities must include provisions for appropriate Temporary Traffic Control Plans as outlined and shall follow NDOT’s Public Involvement Plan where deemed necessary by the Assistance District Maintenance Engineer and interested division managers (particularly where lane closures are implemented).

1.6.1 Maintenance Division or District Maintenance Projects/Activities

It has been determined that projects originating within the Maintenance Division or District Maintenance Office should have a different approach. This is because of the repetitive nature of much of the work and the fact that many of the activities are not considered actual “projects” with planning and design phases. Many Maintenance Division or District Maintenance Office activities have minimal impact on motorists. In addition, there are many instances where repair and rehabilitation activities must be completed within a short period of time.
To address these issues, two groups of activities/projects have been identified that will either be exempt from the TMP process or be covered by existing Temporary Traffic Control and Public Outreach procedures. The latter will be addressed using a "Standing TMP" approach.

- **Exempt Activities**

The following list of NDOT Maintenance activities identifies typical work that is exempt from the TMP requirement. This list may be revised by adding or removing activities as the department deems appropriate.
The following maintenance activities are proposed for exclusion; *project significance determination and TMP development not required*:

- Brush Control/Mulching (Roadside) Vegetation Spraying (Roadside)
- Litter Removal Sweeping/Debris Removal
- Fence Repair Erosion Control
- Drainage Structure Repair Ditch Repair
- Brine/Snow Removal Mowing

For all exempted projects/activities, NDOT will implement appropriate temporary traffic control and advanced warning signage per existing Department processes and procedures for a given project. Due to their short-term nature and relative low impact on highway operations, the exempt projects will not require Significance Determination or TMP Development.

In certain cases, projects which are normally exempt may require development of an original TMP. An example of this case is a culvert replacement, which may be considered drainage structure repair, which requires closing a road. In special cases such as these, the significance determination should be completed and a TMP developed. The District Engineer or their designee will be responsible for making this judgment.

- **"Special" Maintenance Division or District Maintenance Projects**

These projects are outside the regular activities completed by the Maintenance Division. In general, these projects have greater scopes and last for longer durations. Consequently, these projects may have greater impact on motorists and traffic operations. "Special" projects include road lane additions, intersection modifications, major pavement construction/repair (i.e. interstate concrete pavement installation/repair), individually-contracted/site specific projects, etc. The projects described above and other projects that are identified as "Special" by NDOT Maintenance Division or District Maintenance Offices shall be analyzed by NDOT's TMP process as described on section 1.5.1 above.

- **District Encroachment Permits**

Various work occurs on the routes maintained by NDOT including US-routes and interstate routes that are not developed or contracted by the Department. This work is allowed on department R/W through a permit that allows the department to review plans, and TTC plans. These projects should go through the same process of determining type of TMP through significance and figure 1.1 as all other TMPs. TMPs associated with permits shall be approved by the District Engineer or their designee.

- **Local Public Agency (LPA) projects**

Various work will be developed at the local level within or near NDOT Right of Way. Projects within NDOT Right of Way that utilize the encroachment permit process will follow the TMP process required for permits and be approved by the District Engineer or their designee. Projects outside of NDOT Right of Way are outside of the jurisdiction of this document and may need a TMP, based upon the policy of the appropriate jurisdiction.

1.7 Audience

The purpose of these guidelines is to provide information and guidance to all individuals engaged in the planning, design, construction, permitting, inspecting or maintenance of work zones on State maintained roadways on how to develop, implement and evaluate Transportation Management Plans.

1.8 Update Procedure

A process review will be performed at a minimum once every two years. The review team will consist of the following individuals or their appointed representative**:**

Chief Road Design Engineer
Chief Construction Engineer
Chief Traffic Operations Engineer
FHWA Transportation Engineer
District Engineers
Chief Traffic Safety Engineer
Public Information
Project Management

The process review will be conducted by the Chief Traffic Operations Engineer or their designee, who will be in charge of scheduling, setting the agenda, and conducting the biennial review meeting. The process review will assess the effectiveness of the work zone safety and mobility procedures contained within this guide. The agenda will include a discussion on the effectiveness of the work zone process at the agency level. Consideration should be made for the following agenda items:

- How are work zones performing with respect to mobility and safety?
- Are customer expectations being met with respect to maintaining safety and mobility and minimizing business and community impacts both, in and around the work zone?
- How have areas for improvement that were identified in the past been addressed?
- What has worked/not worked – which strategies have proven the most/least effective in improving the safety and mobility of work zones?
- What other strategies can be considered for implementation?
- Have any work zone safety and mobility trends been identified, at the national level or local level? What can be done to address identified trends?
- How do work zone performance, the effectiveness of strategies, or areas of improvement vary between day work and night work?
- Should policies or agency procedures be adjusted based on what has been observed or measured?

It is left to the discretion of the Department to update this document at any time as policy and procedures change.

1.9 Fundamental Principles

Improving highway safety and mobility are two key performance measures for NDOT's Strategic Plan. Consideration and application, as appropriate of the following principles will enhance the performance of work zones:

Provide a safe work zone for all workers and road users.

- Provide safe work zone design by using positive protection measures where possible and practical.
- Provide safe work zone design by using the same basic safety principles used to design permanent roadways when designing work zones.
- Utilize available intelligent transportation systems (ITS) and enforcement strategies to enhance safety.
- Employ incident management strategies during design and construction.
- Conduct investigations on work zone accidents and implement improvements where appropriate.
- Follow guidelines for speed limit reductions in work zone.
- Provide a continuous, safe working environment by monitoring and maintaining work zone devices during construction.
- Provide information to the public for work zones.

Plan for mobility and access.

- Consider innovative technologies, including ITS, for advancement of mobility in work zones.
- Consider all possible alternatives in order to minimize work zone delay and perpetuate flow.

- Maintain bicycle, pedestrian and ADA access through and around work zones.

Plan, design, and construct projects for an economical and timely delivery.

- Consider work zone impacts during design by developing transportation management plans (TMPs)
- Use innovative technologies and techniques to accelerate project construction.
- Coordinate work zone activities and operations with public agencies and other stakeholders.

Communicate project information to stakeholders.

- Provide and disseminate useful and essential information to keep stakeholders informed of work zone activities.
- Coordinate operations with those who have jurisdiction over any impacted operations, including other roads, railroads, transit facilities, emergency operations, school bus operations, etc.
- Maintain relationships through regular feedback and follow-up.

Continuously assess and improve work zone strategies, practices, and procedures.

- Assess, document, and implement successes via work zone inspections, crash data, and performance monitoring of work zone impact management strategies.
- Provide and disseminate essential temporary traffic control design and operations information to traffic control professionals.
- Provide work zone personnel with training commensurate to their level of responsibility.

1.10 Responsibility

Development of a Moderate or Major TMP is the responsibility of the project team, however Project Management, or the approving Division/District (if no project manager) will be responsible for collecting relevant information and authoring the TMP. TMP development may be delegated to consultants, contractors, permitees, or relevant local agencies, as appropriate for that project. The following responsibilities are for a typical project but do not constitute requirements for contributions on all TMPs.

a. Project Management

1. Coordinate with team members to determine whether a project is significant.
2. Manage the development of the TMP, and its' documentation.
3. Providing the Public Information Office with information for the development of the PI strategies.
4. Lead the TMP team to develop a consultant scope of services (as needed), to include a TMP that reflects efforts to comply with this document.
5. Collect and retain TMP documentation.
6. Participate in the biennial work zone safety and mobility review.

b. Traffic Operations:

1. Manage the development of the TMP (unless Project Management does this).
2. Participate in the development of TO strategies.
3. Participate in the development of TTC Plan.
4. Evaluate effectiveness of the TTC plan and any TO or PI strategies, and their documentation during the post construction review meeting.
5. Notify and coordinate with PIO on the PI strategy.
6. Manage the biennial work zone safety and mobility review.
7. Review and approval of the TMP to comply with the Work Zone Safety and Mobility Implementation Guide.
8. Review TTC plans submitted by the contractor when requested by the Resident Engineer.

c. Roadway Design

1. Participate in the development of the TMP.
2. Coordinate and develop relevant specifications for Lump Sum TTC strategy (see 2.5.1 for further information), or development of the TTC Plan as necessary.
3. Participate in the development of TO strategies.
4. Participate in the development of the PI strategies.

5. Participate in the biennial work zone safety and mobility review.
6. Review TTC plans submitted by the contractor when requested by the Resident Engineer.

d. Construction

1. Participate in the development of the TMP.
2. Participate in the development and implementation of the TTC Plan.
3. Participate in the development and compliance of TO strategies.
4. Provide technical guidance.
5. Evaluate effectiveness of the TMP during the post construction review meeting.
6. Participate in the biennial work zone safety and mobility review.
7. Develop Special Provisions language related to TTC, including limitations of operations in section 108.04, and device use in 625.

e. District

1. District Traffic Engineer will participate in the development of the TMP.
2. District Traffic Engineer will participate in the development and compliance of the TTC Plan.
3. District Traffic Engineer will participate in the development and compliance of TO strategies.
4. District Engineer or their designee will approve TMP for all permits, District contracts, and maintenance projects.
5. District Traffic Engineer will coordinate relevant permits, with the Project Manager.
6. District Traffic Engineer will participate in the biennial work zone safety and mobility review.

f. Resident Engineer

1. Resident Engineer will participate in the development of the TMP.
2. Ensure compliance with contract documents, policies and guidelines
3. Participate in post construction review meetings.
4. Recommend and implement traffic control improvements to address field conditions pertaining to traffic flow, visibility, and work and motorist safety.

5. Review and approve TTC Plans submitted by the contractor.
6. Re-evaluate /Revise the TTC plan, the TO strategies, and the PI strategies.
7. Monitor the performance of the TMP.

g. Public Information Office:

1. Ensure the proper information is communicated to the public.
2. Development, review and approval of the PI strategies .

1.11 References

Current Editions

Design Guidance

AASHTO Policy on Geometric Design of Highways and Streets

AASHTO Roadside Design Guide

ADAAG American's with Disabilities Act Accessibility Guidelines

Construction Manual, NDOT

Highway Capacity Manual, TRB

Manual on Uniform Traffic Control Devices for Streets and Highways

FHWA Standard Highway Sign Book

PROWAG Proposed Public Rights of Way Accessibility Guidelines

Nevada Standard Sign Book

Planning and Scheduling Work Zone Traffic Control, USDOT

Road Design Guide, NDOT

Standard Plans for Road and Bridge Construction

Standard Specifications for Road and Bridge Construction

Access Management System and Standards, NDOT

Supporting Information

Work Zone Impacts Assessment: An Approach to Assess and Manage Work Zone Safety and Mobility Impacts of Road Projects, FHWA

Smarter Work Zones, FHWA

Developing and Implementing Transportation Management Plans for Work Zones, FHWA

American Traffic Safety Services Association (ATSSA)
http://www.atssa.com/default.asp

Crashworthy Work-Zone Traffic Control Devices Report 553, NCHRP

FHWA Work Zone Operations Best Practices

http://ops.fhwa.dot.gov/wz/practices/practices.htm

FHWA Work Zone Safety and Mobility
http://ops.fhwa.dot.gov/wz/index.asp

ITE Temporary Traffic Control Device Handbook

ITS in Work Zones, AASHTO

Manual for Assessing Safety Hardware (MASH)

Work Zone and Traffic Analysis
http://www.ops.fhwa.dot.gov/wz/traffic_analysis.htm

NDOT State Level Emergency Operations Plan (EOP)

Highway Safety Manual, AASHTO

2.0 Policy

2.1 Applicable NRS for Work Zones

The following is a list of the most relevant Nevada Revised Statues concerning work zones. Other NRS may be applicable depending on circumstances.

NRS 408.100 Declaration of legislative intent.

NRS 408.210 Powers of director: Closing and construction of highways; removal of encroachments

NRS 408.313 Manner of Construction

NRS 408.319 Report of projects for construction and maintenance: Preparation; contents; revision; public inspection.

NRS 408.403 Freeways

NRS 408.423 Permit required to excavate state highway; exception; fee.

NRS 484B.330 Obedience to signal of authorized flagman; prosecution of violations; penalties.

NRS 484B.130 Double penalty for certain traffic violations committed in work zones.

2.2 Transportation Policy Referenced

Copies of all transportation policies can be obtained through the Administrative Service Division. Relevant transportation policies to work zone safety include TP 1-7-4, Protective Clothing and TP 1-6-9, Flagging Certification.

2.3 Transportation Management Plan Approval

Informal projects with TMPs can be approved by the District Traffic Engineer responsible for oversight of the district where the project is constructed. Formal projects may require a certification approval memo by the Chief Traffic Operations Engineer certifying the TMP meets the requirements of the Work Zone Safety and Mobility Implementation Guide. The Approval memo for the projects' Transportation Management Plan will be forwarded to Contract Services in preparation of the processing memo.

2.4 Standard Procedures Applicable to Work Zones

2.4.1 Routine Procedures

In addition to procedures outlined in the 2014 Standard Specifications for Road and Bridge construction, the Department engages in strategy and device use to increase work zone safety in consistent and logical applications. If a strategy has a pull sheet, appears in the Work Zone Speed Mitigations Matrix (Appendix D), or is explained by the Standard Specifications for Road and Bridge Construction, or has a detail in the Standard Plans for Road and Bridge Construction, it is a Routine Procedure. Strategies in the Work Zone Speed Mitigations Matrix that are not used in conjunction with a speed reduction still constitute Routine Procedure, however "Smarter Work Zones", and Queue Detection do not qualify. Variance in number of devices used between different projects does not disqualify that procedure as Routine. Routine

Procedures should be proposed for inclusion in future editions of the Departments' Standard Plans or Standard Specifications. Advance social media posts and written press-release strategies are the only PI strategies that constitute Routine Procedure. Interviews, targeted series of posts, or releases corresponding with different phases of work are each greater than a Routine Procedure.

2.4.2 Standard Specifications Applicable to Work Zones

1) Public Traffic Delay –Subsection 107.07 and Subsection 108.04
2) Temporary Lighting –Subsection 107.07
3) Public Convenience and Safety – Subsection 107.07
4) Relations with Railroads –Subsection 107.08
5) Signal Management Operations –Subsection 623.01.06
6) Accommodations for Public Traffic –Subsection 624
7) Business Access –Subsection 624.03.01
8) Detour Routes –Subsection 624.03.02
9) Flaggers –Subsection 624.03.03
10) Flagger Illumination –Subsection 624.03.03
11) Traffic Control Supervisor –Subsection 624.03.06
12) Temporary Traffic Control Devices –Subsection 625
13) Device Placement 625.03.01
14) Temporary Traffic Signals –Subsection 625.02.08
15) Contractor Designed Traffic Control Plans –Subsection 625.03.05

2.5 Policies Applicable to Work Zones

2.5.1 Policies for alternate TC plan delivery

The Department primarily uses two methods of TC plan development for all projects: Internal Plan Development, and "Lump Sum". The main distinction is that the TMP for Internal Plan Development is entirely developed by the Department, however for Lump Sum the Department only creates the TO strategies and PI strategies sections.

Internal Plan Development means the Department provides a TC plan to the contractor with itemized devices, phases, and TO strategies. This method may include a PI strategy as well. Since all aspects of the TC plan were developed by the department, the department is able to create a complete TMP.

Lump Sum means the Department will create parameters in the project's Special Provisions that will dictate how the contractor develops their own TTC plan. Typically, any aspects of the PI strategies and TO strategies are included in the specs and the Department will create those portions of the TMP. The TC plan is provided by the contractor, and approved by the Resident Engineer. The combined strategies and from the Department and TTC plan from the contractor make the TMP.

In both cases the department will develop the PI and TO strategies in a TMP. The difference is that the Department provides a complete TMP for Internal Plan Development and Lump Sum requires the contractor to create the TTC plan part of the TMP and the Department creates the other parts of the TMP based upon our requirements.

In rare but often high-profile projects the Department will utilize Design-Build (DB) or Construction-Manager-at-Risk (CMAR) delivery processes that rely heavily on contractor-consultant teams. The department will approach these projects by developing contract

requirements to dictate how the TTC will be developed and minimum safety requirements similar to the Lump Sum approach. The difference is that the Department allows for a greater degree of contractor freedom in choosing phasing, as well as direction for the overall improvements so often not enough direction is provided for the Department to create a formal TMP document based upon the two strategy types. In these cases, TMP development shall be completed by the contractor and their consultant team. In some cases separate TMPs are created for each phase, or group of phases in the project, this is acceptable, however a TMP shall be completed and approved by NDOT Traffic Operations prior to breaking ground on each phase of project regardless of delivery type or responsible entity for TMP development.

2.5.2 TTC plan development

A fundamental part of the TMP is a TTC plan. TTC plans are required for all projects on the Interstate system by federal law. Additionally NDOT requires a TTC plan for all other routes maintained by the state, excluding exemptions in section 1.5. A standard plan sheet may be used for projects that fit into the in the Basic TMP category, however Basic TMP projects that require the use of multiple standard plan sheets or one sheet plus some other details will be required to have a complete set of developed TTC plans. Major and Moderate TMP projects within a TMA should include complete TTC plans for each phase of work. These plans should be built around configurations from NDOTs standard plans, however turning in standard plan sheets as a TTC plan or accompanying a partial TTC plan will not be acceptable unless otherwise approved.

Complex TTC plans may require additional planning to place and remove devices. The planning of such activities should be approved by the RE prior to implementation.

2.5.3 Safety Measures for WZ Implementation

Anytime contractors are working on the roadway without Temporary Traffic Control they are exposing workers and motorists to an unsafe and unpredictable situation. To increase safety, anytime workers will be on the paved roadway (including while operating equipment) a minimum of safety devices should be used including attenuator truck with integrated message and/or arrow board. Typical situations where this applies include placement of TTC devices, removal of TTC devices, inspection/resetting of TTC devices, field investigation, and testing. Contracts should include specific requirements to ensure these safety measures are used appropriately based upon scope and location. In any case, NDOT's RE shall approve any procedure prior to placement of any TC devices, channelizers, or positive protection on the paved surface.

2.5.4 Temporary Speed Reduction

Existing speed limits shall remain in effect through work zones on state highways except where those work zone activities would create a condition that would be aggravated by retaining the existing speed limits.

A temporary speed reduction on projects may be requested. The MUTCD recommends a maximum speed reduction of 10 mph. Projects with an existing speed limit greater than 55 MPH may be temporarily reduced by 10 MPH or to 55 MPH, whichever is lower with the concurrence from the Chief Traffic Operations Engineer. If approved, the limits and mitigation devices of the temporary reduced speed limit shall be incorporated into the TMP.

Any temporary reductions to a speed lower than 55 mph may be reduced with concurrence from the Chief Traffic Operations Engineer and a recommendation forwarded by Traffic Operations to the Directors Office for approval.

When workers are exposed to live traffic, **do not assume that a lower speed limit will improve worker safety**. Reduce worker exposure and traffic speeds using these effective safety strategies:

- Use a pilot car for two lane paving operations to effectively control traffic speed past workers.
- Provide positive protection such as barriers and Truck Mounted Attenuators.
- Provide a lateral buffer space between workers and live traffic, defined by channelization devices, to allow space for minor traffic intrusions or occasional encroachment by workers. A half to full lane width is an acceptable lateral buffer for high speed conditions.
- Use closely spaced drums or tall channelizing devices to improve work area separation and motorist guidance.
- Additional warning devices such as temporary rumble strips, portable changeable message signs, or an automated flagger assistance device may improve flagger protection.

If a speed reduction is proposed, these qualitative factors together with other speed reduction mitigations (see Appendix D) shall be considered to determine if a work zone speed limit reduction is needed:

1. **Roadway Factors**
   - Roadway surface is rough, uneven, gravel, has abrupt edges, etc.
   - Temporary Concrete Barrier (TCB) is 2 feet or closer to high speed traffic (45 mph or more).
   - Traffic lanes are less than 11 feet wide.
   - Shoulders are less than 4 feet wide.
   - Work zone elements such as temporary road approaches, intersections, or intersection control (such as a temporary signal) have changed the roadway or roadside environment.
   - Work zone has unusual or reduced roadway geometrics such as lane closures and shifts, ramp closures, and reduced or removed acceleration/deceleration tapers.
2. **Operational Factors**
   - Sight distance is restricted due to traffic barriers, temporary alignment, or intersection locations.
   - Unprotected work activities or workers are closer than 10 feet to high speed traffic.
   - Work zone has detours or alignment changes designed for speeds below the existing limit.
3. **Human Factors**
   - When considering a speed limit reduction be aware that drivers generally do not slow down until there is a perceived reason to do so. If motorists do not see the

reason for a reduced speed limit, it is often ignored. In addition, note these factors when assessing the need for a speed limit reduction

- A “Reduced Speed Limit” sign is not automatically noticed or effective in slowing traffic. Most drivers determine their speed by observing visual cues from their surroundings, including the visible work activity, specific warning signs, pavement markings, and other traffic control devices.
- Studies show that drivers slow down more in work zones with Portable CMS, electronic driver feedback signs (“Your Speed Is XX”), and flashing warning lights.
- Most drivers do not voluntarily reduce their speed more than 10 mph unless law enforcement is active.
- Work zone speed limit reductions of more than 10 mph show an increase in crashes due to a wider speed differential between vehicles.

A temporary reduction in the regulatory speed limit may be established as part of the traffic control plan, including those furnished by contractors, if the reduction plan is approved by the Chief Traffic Operations Engineer, and (if necessary) the Director’s Office. Temporary regulatory speed limit signs shall not be erected or uncovered until all appropriate work zone signs have been placed in accordance with the approved traffic control plans.

The use of TC devices outside of hours of operations is prohibited unless the roadway surface is unsuitable for vehicle travel at normal operating speeds (i.e. a milled surface) or the work area must be protected from live traffic (e.g. drop off of greater than 2”). The Work Zone speed limit should not be left in effect beyond the hours of operations unless the condition for which the speed reduction was implemented continues to exist, and devices are justifiably used outside of those hours of operations.

The original regulatory speed limit shall be resumed by posting new signs at the end of the work zone for each direction of traffic.

Appendix D contains the Work Zone Speed Reduction Countermeasure Matrix. This matrix was developed as a tool to assist with the selection of additional mitigation strategies to implement in the work zone in conjunction with temporary speed limit reductions.

All merge and shifting tapers should be designed based on pre-work zone speeds.

All device spacing shall be designed based on work zone speed.

2.5.5 Positive Protection Devices

Positive protection devices may be used to manage work zone exposure and reduce the risks of crashes resulting in fatalities or injuries to workers and road users. Positive protection devices may be used to prevent the intrusion of motorized traffic into the work space and other potentially hazardous areas in the work zone. Positive Protection Devices means devices that contain and/or redirect vehicles and meet the crashworthiness evaluation criteria contained in MASH.

Positive protection devices shall be considered in work zone situations that place workers at increased risk from motorized traffic and offer the highest potential for increased safety for workers and road users, such as:

1. work zones that provide workers no means of escape from motorized traffic e.g. tunnels, bridges, etc.)
2. long duration work zones (two weeks or more) resulting in substantial worker exposure to motorized traffic
3. projects with high anticipated operating speeds (45mph or greater) especially when combined with high traffic volumes
4. work operations that place workers close to travel lanes open to traffic
5. roadside hazards, such as drop-offs or unfinished bridge decks that will remain in place overnight or longer

The need for positive protection devices may be based on an engineering study or by reference to AASHTO Roadside Design Guide. The engineering study should be based on consideration of factors and characteristics such as:

1. Project scope and duration
2. Anticipated traffic speeds and volume through the work zone
3. Vehicle mix
4. Type of work (as related to worker exposure and crash risks)
5. Distance between traffic and workers and extent of worker exposure
6. Escape paths available for workers to avoid a vehicle intrusion into the work space
7. Time of day (e.g. night work)
8. Work area restrictions (including impact on worker exposure)
9. Consequences from/to road users resulting from roadway departures
10. Potential hazard to workers and road users presented by device itself and during device placement and removal
11. Geometrics that may increase crash risks (e.g. poor sight distance, sharp curves)
12. Access to/from work space
13. Roadway classification
14. Impacts on project cost and duration

2.5.6 Uniformed Law Enforcement

A number of conditions may indicate the need for or benefit of uniformed law enforcement in work zones. The presence of a uniformed law enforcement officer and marked law enforcement vehicle in view of motorized traffic on a highway project can affect driver behavior, helping to maintain appropriate speeds and improve driver alertness through the work zone.

The use of uniformed law enforcement shall be considered on Federal-aid projects. The need for law enforcement is greatest on projects with high traffic speeds and volumes and where the work zone is expected to result in substantial disruption to or changes in normal traffic flow patterns. Project conditions should be examined to determine the need for or potential benefit of law enforcement, such as:

1. Frequent worker presence adjacent of high-speed traffic without positive protection devices.
2. Traffic control setup or removal that presents significant risks to workers and road users.
3. Complex or very short term changes in traffic patterns with significant potential for road use confusion or worker risk from traffic exposure.
4. Night work operations that create substantial traffic safety risks for workers and road users.

5. Existing traffic conditions and crash histories that indicate a potential for substantial safety and congestion impacts related to the work zone activity and that may be mitigated by improved driver behavior and awareness of the work zone.
6. Work zone operations that require brief stoppage of all traffic in one or both directions.
7. High-speed roadways where unexpected or sudden traffic queuing is anticipated, especially if the queue forms a considerable distance in advance of the work zone or immediately adjacent to the work space.
8. Other work site conditions where traffic presents a high risk for workers and road users, such that the risk may be reduced by improving road user behavior and awareness.
9. Locations where traffic conditions and crash history indicate substantial problems may be encountered during the project.

2.5.7 Work zone ITS

Intelligent Transportation Systems (ITS) provide an opportunity to provide a safer and more efficient work zone through communication, work zone monitoring, driver feedback, and traffic and incident management. ITS devices are supported throughout this manual, including changeable message signs, speed feedback signs, temporary traffic signals, and many other devices and strategies. State of the practice in work zone ITS is rapidly evolving and work zones are implementing devices in new ways every year. The FHWA maintains a website of work zone ITS devices, along with best practices at https://ops.fhwa.dot.gov/wz/its/index.htm.

2.5.8 Temporary Transverse Rumble Strips

Rumble strips provide noise and vibration as roadway feedback to users, alerting them to change to the roadway, or notification of change in the roadway. Temporary transverse rumble strips should be placed to bring driver awareness to the work zone prior to signage that will require the driver to deviate from current behaviors or patterns. Dynamic rumble strips used either temporarily or permanently shall not be considered. Temporary transverse rumble strips should not be considered for application on roadways with more than 2 lanes per direction, with AADTs greater than 10,000, or with work zone speeds greater than 55 mph. Rumble strips are recommended for crossovers, stop conditions, and speed reductions. See MUTCD section 6F.87, contract Special Provisions, and manufacturer recommendations for details on rumble strip use.

2.5.9 MOT Checklist

To ensure that all concerns of TMP planning applicable to each project is considered during plan development, a checklist has been developed. This list ensures that any sub-topics and uncommon strategies are considered as needed. Signs, Striping, and Traffic Control section staff shall use the checklist on each of their projects with a TMP. See Appendix C;

2.5.10 Ghost Striping

During TTC striping is often modified to accommodate work areas, maintenance of traffic lanes, or otherwise convey traffic with available space. At project conclusion the temporary work zone striping will be removed and new striping (not always in same place as original striping) will be placed. One consequence is that areas where striping is removed will be shaded different than surrounding pavement, may have residual paint, and/or provides a channel for rainwater to collect. Each of these consequences may lead to driver perception that the removed stripe (or ghost stripe) is appropriate traffic control which leads to encroachment into parallel lanes, use of shoulder or preferential lane as a general purpose lane, or even directing vehicle path to intersect other lanes. To avoid these hazards, anytime striping is removed the roadway surface

should be made uniform. There are many acceptable strategies that may make the surface uniform; however resurfacing is recommended. Any project that does not address ghost striping should receive approval from the District Engineer, or their designee prior to project Doc.

2.5.11 Coordinating with Adjacent projects

The department and various local agencies throughout the state have a responsibility to maintain roads within their respective jurisdictions however this leads to project schedules overlapping at adjacent locations. These overlaps sometimes have adverse impacts on detours, lane closures, project area, and general public mobility. It is imperative during project design that adjacent agencies are contacted and informed of project schedules, TO strategies, and PI strategies. The Department should adjust project strategies and timeline to coordinate with the impacted agencies to ensure impacts to the public are minimized.

3.0 Training Requirement

3.1 General

All individuals engaged in the planning, design, construction and maintenance, permitting or inspecting of work zones must be trained in the following courses:

- Traffic Control Technician (ATSSA or approved equivalent)
- Traffic Control Supervisor (ATSSA or approved equivalent)
- Other courses as needed

For approved equivalent and other training required by contract see the Special Provisions.

4.0 Development of Transportation Management Plan (TMP)

4.1 Planning Development of TMP

4.1.1 General

Transportation Management Plan (TMP) development begins during the planning phase and progresses through the design phase of a project. A full TMP document is not developed until the intermediate design phase. A TMP scope analysis during planning and preliminary engineering ensures that the TMP development and implementation costs are included in the project budget. This makes it essential that the design engineer and the Project Manager work together to develop an effective TMP. The National Environmental Policy Act (NEPA) process should be considered a key source for inputs or constraints on the project.

4.1.2 Development

4.1.2.1 Project Budget –The Project Management Division will establish project budgets that reflect the expected efforts for developing and implementing the TMPs.

4.1.2.2 Scope of work – The Project Manager will develop a consultant scope of work (as needed), including a TMP that reflect efforts to comply with this document.

4.2 Preliminary Development of TMP

4.2.1 General

TMP development continues in the preliminary engineering phase of a project. During this phase, a design strategy will be developed based on the project significance. Critical construction work will be identified and evaluated as having either large public impact or schedule impact. Adjacent projects will be considered in this evaluation.

4.2.2 Develop TMP

4.2.2.1 Create TMP Team – a well-balanced TMP team consisting of a variety of disciplines and stakeholders is important for developing a successful TMP. It is essential that personnel from appropriate divisions and the district(s) be involved to provide their specialty input. The team composition may vary from project to project. The Project Manager will assess the needs of the project and determine the team's composition.

4.2.2.2 Identify Stakeholders - Once the project type is known, appropriate stakeholders should be identified. The TMP team and the Project Manager will need to work together to identify the stakeholders. . Stakeholders may include FHWA, other public agencies, the railroad, trucking associations, community groups, schools, enforcement agencies, emergency services, convention and visitor authority, local public works, the local chamber of commerce, home owner associations, and businesses.

4.2.2.3 Compile Project Material - Obtain current conditions by use of aerial photos, "as-built" plans and survey data. Concepts should be drawn to scale for further refinement. *For in-house design projects, this task is accomplished by Roadway Design.* The level of detail for these layouts should be sufficient to convey and validate the concepts. Aerial photography, mapping files, street maps, photographs, previous contracts, field notes and maintenance records should be used to insure that the layouts fit actual site conditions.

4.2.2.4 Determine TMP needs –Before work can begin on the TMP, preliminary information needs to be obtained on the project. Project scope will need to be

determined, geometrics set and the structural section known. The roadway classification will need to be known and the traffic data collected. Appendix B has been developed to assist the project team in determining if the project is significant. Other projects in the area should also be considered when determining if the project is significant.

4.2.2.5 Preliminary Traffic Control meeting The TMP team members will need to discuss the overall traffic control strategies for the project. The team should strive towards work zone safety, and construction productivity with minimal impacts to the traveling public. Concepts need to be developed on how to accomplish individual construction activities anticipated on the project. The considerations listed in this section should be evaluated and incorporated into the conceptual traffic control accordingly.

Identify critical areas –Some potential critical areas are:

- Airport proximity - If the project is within one mile of an airport, the Project Manager will need to apply to the Federal Aviation Authority (FAA) for construction permits.
- Critical vertical clearances – Any vertical clearance over the traveled way of less than 16 feet.
- Critical horizontal clearances – Travel lanes that have 16-foot or less physical clearance from fixed object to fixed object and turning movements which cannot accommodate the roadway design vehicle.
- Critical closures – minimum number of lanes to remain open versus time of day / day of week.
- Restricted working days – Certain special events and holidays may require that no lane restrictions are present.
- Environmental restrictions such as noise and dust may impact the construction activities.
- Seasonal restrictions – placement of open graded material is restricted to time of year. Temperature restrictions may apply in paving or other activities.
- Utility and railroad conflicts.
- Encroachment permits from a neighboring state.
- Bikes and Pedestrians

Preliminary TTC Design - The TTC can either be designed “up front”, and included in the plan set, or submitted by the contractor for approval. Specific construction staging or constructability issues may necessitate that traffic control plan sheets be provided. The decision to provide Lump Sum Contractor Supplied traffic control or traffic control plan sheets should be determined during preliminary traffic control review meetings.

4.2.3 Outcome

4.2.3.1 Determine Project Significance - Project traffic impact has been reviewed and resources allocated accordingly. The TMP team has determined the projects’ significance.

4.2.3.2 Preliminary work zone strategies - Overall traffic control strategies have been agreed upon. Documentation of TTC has been determined (supplied with the contract or submitted by the contractor). The Project Manager will need to take the meeting minutes and distribute them to the team and all interested outside entities. The Project Manager

will need to prepare a summary of Maintenance of Traffic Alternative Analysis (MOTAA). The MOTAA will include a list of alternative work zone strategy options considered and the justification for the selected alternative.

4.2.4 Resources

Requests for traffic information used in determining traffic control issues are to be coordinated with the Traffic Operations Division. The District Traffic Engineer needs to be contacted for local information when developing a TMP.

4.3 Intermediate development of TMP

4.3.1 General

Maintenance of Traffic concepts have been fully considered and developed. During this stage, the TTC plans sets (when required) should be created for review. The initial PI and TO strategies are created for review. The attention of the TMP team will now need to focus on finalizing the TTC plans, developing the TO and PI strategies, and developing various sections in the special provisions.

4.3.2 Develop TMP

On a few projects, it is possible for the department to use a design-build and/or contractor supplied process. A performance-based specification will be developed for the project with the contractor being responsible for developing a TMP that best meets the performance specification. The TMP is subject to approval by the TMP team.

4.3.2.1 TTC Intermediate Plan Development - All unresolved issues need to be addressed at this time. The Traffic Operations Division should determine limitations of operations for lane closures and times. The Traffic Operations Division will need to provide input on the TTC plans regarding compliance to the MUTCD and standard practices. The Construction Division will need to provide input and make recommendations to address any potential construction problems with the TTC. It will be the responsibility of the District Engineer, or his or her representative, to review the traffic control plans at the intermediate level. There should be meetings with the local entities to gain their support. Stakeholders should be consulted during this development phase to seek their input and concurrence.

Recommendations regarding the constructability of the traffic control plans will be provided to the designer. Information to be shown includes, but is not limited to:

- Devices – types, locations and spacing of traffic control devices used
- Work zone – area to be occupied by the work forces, equipment and materials.
- Roadside hazards – identification and mitigation as required
- Lane assignments – number of lanes, directions of travel and turning movement
- Flagger/pilot car operation – location and pilot car route
- Work zone access– ingress/egress, business and ramp access.
- Temporary striping – number of lanes, widths, and markings.
- Detours – complete plan to reroute traffic or bike/pedestrian users

- Phasing and Staging plans – based on preliminary work zone strategy outcome
- Bike and Pedestrian access

Additional considerations can be found in table 1 of Appendix A.

4.3.2.2 TO Strategies Development - The TO strategies should include all of the mandatory and/or prohibited requirements that involve temporary traffic control during construction and for coordination with other projects and/or other agencies. Discussion in the TMP should include explanations or why each mandatory and/or prohibited requirement was included in the project, including reasoning from TC meetings, and correspondence with various divisions of NDOT, the crew, other agency, and/or consultant involvement. Typical TO strategies include demand management, corridor/network management, work zone safety management, and traffic/incident management and enforcement.

The Project Manager/coordinator will need to coordinate the TO items with the local agencies. It is recommended that a letter of understanding and/or an agreement be drafted between the state and the local agency addressing relevant items. Specifications need to be discussed and addressed. Information to be shown includes, but is not limited to:

- Critical clearance – inform Administrative Services (Over-dimensional Permits) of critical clearance issues and time frames
- Closures - inform Road Ops (to be placed in 511/NVRoads) and Administrative Services of planned closures and time frames
- Signal timing - Special attention should be given to the signal timing coordination along with ITS components of the TMP
- Local agency representative - A contact number for the local representative along with how many days prior notification is required to the local representative will be included in the contract special provisions
- Limitations on construction operations will be documented.

Additional considerations can be found in table 2 of Appendix A.

4.3.2.3 PI Strategies Development – PIO strategies should be considered for all projects and included on all four digit contracts. The strategies used should increase public awareness and provide information to motorists. It will be the responsibility of the public information office to prepare the Public Information (PI) strategies. Traffic Operations should inform the PIO after the 90% review of project scope, TC plan/strategies, and its expected Doc date. The Project Manager, along with representatives from the Design, Construction and Traffic Operation Divisions may provide input into the PI plan.

Additional considerations can be found in table 3 of Appendix A.

4.3.3 Outcome

At the end of the intermediate TMP process, the TTC plan, TO and PI strategies have been reviewed by headquarters and district management and the construction sequence has been reviewed and validated by the construction division. Documentation of the traffic control meetings has been placed in the project workbook.

- **TTC needs identified** - preliminary traffic control plans are drafted. TO strategies are proposed and the PIO has been contacted. .

- **TO needs identified** - Limitations on the contractor's operations have been established. . The Traffic Operations Division will need to document their analysis as outlined in section 4.5 and provide copies of this documentation will need to be provided to the Project Manager. Agreements concerning the TO have been drafted and coordinated with the local agencies and/or law enforcement.

- **PI needs identified** – Public Information Office has reviewed information provided by the TMP coordinator and preliminary strategies have been developed.

4.3.4 Resources

Local agencies should be contacted for local development and/or street closure considerations. Requests for traffic information used in determining traffic control are to be coordinated with the Traffic Operations Division. Review the district work program, the NDOT project status report and other local agencies for other projects that may have an impact on the project.

4.4 Final Development of TMP

4.4.1 General

During final development of the TMP, all comments and new design issues need to be addressed. The quality assurance and specifications submittals will need to be developed. The TTC, TO, and PI documents will be completed.

During final development of the TMP, focus should also be on the coordination and agreement of the TMP with local entities.

4.4.2 Finalize TMP

- **TTC Final Plan Development** - It will be the responsibility of the designer to make the necessary changes to the TTC from the intermediate review meeting. The designer will need to ensure that the TTC is in conformance with drafting and plan preparation standards.

The designer will review the comments made by the QA reviewer and incorporate those changes agreed upon. Once the QA comments have been incorporated, the Project Manager will need to determine if additional meetings are necessary. The TTC plans will need to be finalized.

- **TO Final Strategies Development** - In the development of the TO, the TMP team must finalize any constraints and requirements that are needed for the TTC plan. The TMP should include explanations or why each mandatory and/or prohibited requirement was included in the project, including reasoning. These constraints and requirements will be included to Specifications or otherwise addressed in the contract documents. The TMP team should consider:

    1. A requirement to furnish minimum quantities of certain traffic control devices such as changeable message boards, traffic drums, arrow boards, etc.

2. Requiring the use of traffic barriers, such as portable concrete barriers, to shield traffic from longitudinal drop-offs, excavations and other construction activities.
3. Any constraints affecting traffic operations such as reducing the number of lanes, lowering the speed limit, diminishing the lane widths, working days and hourly limitations based on traffic volume.
4. The impacts to adjacent property owners such as restricted access, hours of operation, pollution control, etc.

Additional considerations can be found in table 2 of Appendix A.

- **NDOT advertised contract plans -** On projects administered by NDOT, the Roadway Design Division is responsible for writing the specifications. All TO information is addressed in the specifications. The Construction Division will provide the number of working days, project completion date, flagger hours and liquidated damages. Traffic Operations Division will provide information on device use in section 625.03.05.

Specific sections and items of the special provisions that need to be addressed are:

- **Limitation of Operations (Section 108.04):** This section of the specifications limits the contractor's construction operations. The operations are usually limited by working hours, conditions of the work and the size of the construction zone.

- **Liquidated Damages (Section 108.09):** This section of the specifications tells the contractor what he will be assessed in withheld payment in the event that the conditions of the contract are not met.

- **Accommodations for Public Traffic (Section 624):** This section of the specifications tells the contractor what items or personnel to use to safely pass traffic through the work zone. It will address the use of detours, flaggers, traffic control supervisor, uniformed traffic control officer and pilot car or a combination of these methods.
- **Contractor Designed Traffic Control Plans (Section 625.03.05)**: This section of the specifications requires numbers of devices or types of devices to be used in the TTC plan for various situations or locations as needed to ensure a safe work zone. This section addresses lighting concerns, types of channelizers, message boards, and any other specific devices needed.

4.4.3 Outcome

Once the specifications have been incorporated and the TTC plan, TO and PI strategies finalized, the TMP will be considered complete. Documentation of decisions made in the development of the TMP along with TMP meeting minutes will be placed in the project workbook and copies of all TMP documentation will have been forwarded to the Project Manager.

- **Receive Approvals –** The Chief Traffic Operations Engineer will approve the project meets the provisions set forth in the Work Zone Safety and Mobility Implementation Guide. The Chief Traffic Operations Engineer will provide a certification memo in order to produce the processing memo. All permits and informal projects will comply with the Work

Zone Safety and Mobility Implementation Guide and will be certified by the District Traffic Engineer prior to the notice to proceed.

4.5 TMP Documentation

4.5.1 General

This section contains a comprehensive list of the components that ***may*** be included in a TMP report. The order, terminology and inclusion of components may vary from project to project. The level of detail of the TMP will reflect the level of work zone impacts of the project.

4.5.2 Responsibilities

The State and contractor are required to designate a person at the project level who has the primary responsibility and sufficient authority for applying and modifying the TTC plan, TO Strategies, PI strategies, and other safety and mobility aspects of the project. The individual designated to be the State's representative shall be the Resident Engineer assigned to the project. It will be the Project Managers responsibility to submit the completed TMP along with any supporting documentation to the Resident Engineer prior to the project being advertised for construction.

4.5.3 Potential Elements in a TMP Document

The components discussed in this section include elements of the TMP document, as well as elements for TMP implementation and evaluation. The following table summarizes the components that may be included in the TMP document. Individual TMP components are described in more detail in the subsections that follow the table.

TMP Component	✓
1. Introductory Material	
▪ Cover Page	□
▪ Table of Contents	□
▪ List of figures	□
▪ List of tables	□
2. Executive Summary	□
3. TMP Roles and Responsibilities	
▪ Project Manager	□□
▪ TMP Team	□□
▪ TMP Implementation Task Leaders	□□
▪ Emergency Contacts	□□
4. Project Description	
▪ Project background	□□
▪ Project type	□□
▪ Project area/corridor	□□
▪ Project goals and constraints	□□
▪ Proposed construction phasing/staging	□□
▪ General schedule and timeline	□□
▪ Need for detours (Traffic and Ped/Bike detours)	□□
▪ Related projects	□□

5. Existing and Future Conditions	
▪ Data collection and modeling approach	□□
▪ Existing roadway characteristics	□□
▪ Existing and historical traffic data	□□
▪ Existing traffic operations	□□
▪ Crash data	□□
▪ Stakeholder concerns/issues	□
▪ Traffic Mobility Issues	□□
▪ Traffic predictions during construction	□□
6. Work Zone Impacts Assessment Report	
▪ Qualitative summary of anticipated work zone impacts	□□
▪ Summary of Maintenance of Traffic Alternative Analysis (MOTAA)	□□
▪ Impacts assessment of alternative project design and management strategies	□□
▪ Construction approach/phasing/staging strategies	□□
▪ Work zone impacts management strategies	□□
▪ Traffic analysis strategies	□
▪ Measures of effectiveness	□□
▪ Selected Alternative	□□
7. TMP Monitoring	□□
▪ Monitoring requirements	□
▪ Evaluation report	□
8. Public Information and Outreach Plan	□□
9. Incident Management	□□
10. Special Considerations (As Needed)	□□
11. Attachments (As Needed)	□□

Introductory Material - Components may include:

- **Cover Page** –Should contain the title/project name, date, and the name of the agency and/or person responsible for the report with contact information.
- **Table of Contents** –Lists the sections and subsections of the report with their page numbers.
- **List of Figures**
- **List of Tables**

Executive Summary - The executive summary should include a brief overview and summary of the project, general approach, selected construction phasing and staging approach(es), anticipated work zone impacts of the project, the chosen TMP strategies, and conclusions/recommendations for the project.

TMP roles and responsibilities - The roles and responsibilities for the development, implementation, monitoring and evaluation of the TMP should be documented. These may include, but are not limited to:

- **Project Manager** – The person responsible for the overall development of the TMP.

- **TMP Team** –departmental members and stakeholders who were involved in the development and review of the TMP.
- **TMP Implementation Task Leaders** – These are the individuals responsible for implementing specific tasks recommended by the TMP. This should include contact information for the person in the Public Information Office who is responsible for PI and Outreach support during construction.
- **Emergency Contacts** – List of known contact persons for each emergency service agency, including police, fire, and ambulance.

Project Description - Lists the scope and definition of the project. Much of this information will have already been gathered as part of Project Planning and Preliminary Engineering. It may include:

- **Project Background** –Includes a brief description of the project, its purpose, and its developmental history. It may also include additional information related to the project, roadway, or study area.
- **Project Type** – The nature of the project, which may range from capital projects, new construction, rehabilitation, major maintenance, to regular maintenance.
- **Project Area/Corridor** –Describes physical extents of the construction or maintenance work, as well as the estimated region(s) and corridor(s) that may be affected by the project. Using a map to show this information is recommended.
- **Project Goals and Constraints** – A brief listing of the goals, benefits, and challenges that are expected by this project.
- **Proposed Construction Phasing/Staging** – This includes the project phasing, lane and/or facility closure strategies, whether HOV/temporary lanes/shoulders will be used for general traffic, ramp/interchange closures, construction strategies, lane closure hours, duration, etc. Identify holiday, event, seasonal and/or night time restrictions. The Sequence of Construction and Traffic Control Plans should be provided.
- **General Schedule and Timeline** – The start and finish dates for the project and phasing schedule (if appropriate), including all major milestones and planned shutdown times for events for winter, environmental windows, special events, etc.
- **Need for Detours** – Include where detours are identified for staging purposes or for alternate routes. Detour plans should be provided separately from TTC plans.
- **Related Projects** – Other on-going or planned projects in the vicinity of the project area that may cause cumulative impacts to the region(s) and corridor(s).

Existing and future conditions - Provides information on existing and anticipated future (i.e. during construction) conditions in the project area including traffic, safety, and business and community access. While the level of detail will vary based on the project, it should consider:

- **Data Collection and Modeling Approach** – Traffic volumes will be used to make recommendations for maximum impacts without exceeding reasonable delay. Reasonable delay means TTC will provide enough capacity for demands and delays will not exceed 10 minutes, and for stop conditions, traffic will not be stopped for more than 20 minutes and delayed for more than 30 minutes. If these reasonable delays will be exceeded, a statement of expected traffic impacts will be included in the TMP.
- **Existing Roadway Characteristics –** This includes a history of roadways in the study area, roadway classification(s), and number of lanes, geometrics, and urban/suburban/rural.

- **Existing and Historical Traffic Data –** This includes measures such as volumes, speed, capacity, volume to capacity ratio, truck percentage, queue length, peak traffic hours, through versus local traffic, etc. Historical traffic data should be no more than three (3) years old.
- **Existing Traffic Operations –** This includes signal timing, delay, and traffic control types.
- **Crash Data –** An accident history including number and type of crashes should be documented.
- **Stakeholder Concerns/Issues –** Include a list of project stakeholders and others potentially impacted by the project. Input from the community and business representatives and other stakeholders should be included and prioritized to address local concerns.
- **Traffic Mobility Issues –** List major events that have the potential to impact mobility during the project.
- **Traffic Predictions During Construction (Volume, Delay, Queues) -** Based on existing and historical data, traffic growth rates, and the modeling/estimating approach used, estimates of traffic and safety during construction should be developed and documented. Future estimates should be compared to the existing data.

Work Zone assessment - The work zone impacts may include:

- **Qualitative Summary of Anticipated Work Zone Impacts** – This involves a brief discussion on how the project is expected to impact its vicinity, including major corridors, local streets, how traffic patterns are expected to change, and an estimate on how traffic demand might change due to the project.
- **Summary of Maintenance of Traffic Alternative Analysis (MOTAA) –** Summary of the MOTAA conducted during planning should include a List of staging/phasing and traffic control options investigated for the selected alternative only.
Summarize constraints of each MOT option, anticipated impacts, and costs.
- **Impacts Assessment of Alternative Project Design and Management Strategies** – This is a discussion on how the project's work zone design and other mitigation efforts would impact the project area, how they would affect each other, and how they might adversely impact specific areas, if any.
- **Construction Approach/Phasing/Staging Strategies** – Include any additional staging/phasing/MOT options investigated since the completion of the MOTAA. As the design evolves, there may be a need to revise construction strategies. Impacts should be investigated for new strategies in a similar approach as was taken in the MOTAA. Minimally, the new construction strategies should be investigated for impacts on:

1. Access to communities and businesses
2. Decision sight distance (especially at on-ramps)
3. Ramp capacity
4. Right-of-way
5. Environment (wetlands, noise, dust control, BMP's, historical, etc.)
6. Bridge widths
7. Earthwork, retaining walls, pier clearances, profile differences, etc.
8. Ability to maintain existing drainage, utility, and lighting systems
9. Pedestrian and bicycle facilities
10. Construction duration
11. Constructability and construction equipment access
12. Emergency services (fire, ambulance, police, hospitals)

13. Over-height, over-weight vehicles
14. Public safety (workers and traveling public)
15. Traffic and mobility (see Traffic Analysis)
16. Construction and MOT costs

Work Zone Impacts Management Strategies – List work zone impact management strategies considered (recommended, and considered but rejected) and discuss feasibility and anticipated traffic or safety impacts. In table 2 of Appendix A of this document lists a variety of work zone impact management strategies for consideration. A determination of the pros and cons of each strategy should be considered to determine whether the strategies are likely to improve mobility and/or safety. Strategies may include:

- Temporary traffic control and devices
- Project coordination, contracting and accelerated construction
- Demand management
- Corridor/network management
- Work zone safety
- Work zone ITS
- Police traffic
- Public awareness
- Motorist information
- Incident management

For cost effectiveness, constructability needs to be balanced with the work zone transportation management strategies in order to best serve the public, construction workers, and agency. There may be more than one option for addressing safety and mobility during construction. In order to decide which option is appropriate, the benefits and costs of the strategies should be estimated and compared. The cost evaluation may consider on-site costs (e.g. strategy implementation, right-of-way, environmental, delay, safety, accessibility to businesses and community, user costs), and detour costs, both capital and operating. Comparing the cost to implement work zone impact management strategies to the reduction in user delay costs may be an effective measure. Where appropriate, strategies should be documented on plan sheets, in separate plans (PI), in specifications and/or special provisions, and in construction estimates.

Traffic Analysis Strategies – A brief description on how the expected future (construction) traffic conditions were determined. Any traffic reduction factors or other parameters assumed for the calculations should be documented.

Measures of Effectiveness – List the measure of effectiveness used for the analysis, such as capacity, volume queue, speed, travel time, diversion, safety, noise, environmental, adequacy of detour routes, cost effectiveness, etc.

Selected Alternative – Plans, specifications, and estimates should be developed for the selected alternative. Describe the selected construction approach, including the construction phasing/staging strategy selected and the work zone impact management strategies selected. Any work hour restrictions should be documented for each stage (e.g., night work, peak hour restrictions, etc.). The following documents will need to be developed:

- Construction phasing/staging plans - Provide the construction approach/phasing/staging strategy on plan sheets.
- Work zone impact management strategies should be documented on plan sheets where possible (e.g. geometric improvements, control devices, etc.). If not on

the plans, strategies should be listed with text describing any restrictions, usage, or other considerations in the contract documents.

- Detour Plans (traffic or Ped/Bike as necessary)
- Temporary Traffic Signal Plans, including any timing modifications (if required)
- Temporary Lighting Plans (if required)
- Public Information and Outreach Plan
- Necessary Special Provisions covering TMP elements

TMP monitoring / evaluation criteria - Develop project specific criteria and methods for measuring and evaluating the TMP and determine how it will be modified if improvements are needed.

- **Monitoring Requirements –** Monitoring requirements for the TMP should be included in the TMP and be made part of the contract documents. The evaluation should consider both the performance of individual TMP strategies as well as overall performance of the work zone and work zone impact area. This may include, but is not limited to:

1. Verification of work zone set-up
2. Identification and process for monitoring TMP performance (e.g. volume counts, queue length, crashes, complaints and feedback, surveys, etc.)
3. Tracking TMP implementation costs and comparing them to the budgeted costs
4. Approach for corrective action when TMP performance requirements are not met
5. Submission of revised/alternative TMPs and the approval process
6. Person(s) responsible for each component of the TMP monitoring

- **Evaluation Report for the TMP –** The TMP should include reference to the development of an evaluation report upon completion of construction to document lessons learned and provide recommendations on how to improve the TMP process and/or modify guidelines. The Evaluation Report should be completed by the Project Manager.

Public Information and outreach strategies - The public information and outreach strategies serves two main purposes. It informs the public about the overall purpose of the project to generate and maintain public support and encourages changes in travel behavior during the project to minimize congestion. Public awareness and motorist information strategies should be included in the public information and outreach plan. Separate documentation for public information and outreach efforts may be required by the Public Information Office. Refer to table 3 of Appendix A for strategies on how to develop public information and outreach plans as part of the TMP effort.

TMP Incident management - Emergency communications should be discussed at the pre-construction meeting. Important elements to discuss include:

- Roles and responsibilities of those who are involved in incident management
- Key contacts and their contact information
- Emergency and essential services contacts

Special considerations (as needed) - Any special considerations related to the project that have not been included in a previous section should be identified here. This may include reiterating special provisions, highlighting considerations that may need to be included in contracting documents, identifying work zone management strategies that require implementation prior to construction, etc.

Attachments (as needed) - Appendices may be included in the TMP document to include information that may be relevant or of interest to the TMP reviewer, implementer, or other stakeholders. This could include, but is not limited to:

- Observed, historical, and/or estimated traffic volumes, speeds travel times, level-of service, delay, and crashes.
- Maps
- TTC Plans
- Detailed analysis methodology, assumptions and parameters used
- Special provision text

5.0 Implementation of TMP

5.1 General

Implementing the TMP consists of providing the processes and personnel required for the placement, inspection, monitoring and documentation of the TMP elements. The implementation of the TMP will start at the pre-construction meeting and continue through the final day of the project.

5.2 Processes and Personnel

Pre-Construction Meeting - The pre-construction meeting should be held prior to the Notice to Proceed date. The procedures the contractor plans to use for the handling of traffic through the project will be discussed at the pre-construction meeting. Limitations of operations will be discussed; as well as, the process for providing the public with information regarding lane restrictions, detours and access restrictions.

Communication is vital for the safe and effective use of TMP elements. All contact information for personnel in charge of the aspects discussed in the pre-construction meeting should be documented to help with the communication throughout the life of the project.

Highway Restriction Report - The highway restriction report will be completed by the Resident Engineer 24 hours prior to work that will restrict or change the flow of traffic. This report will be forwarded to the appropriate district to assist in the PI Plan. Information from the report will be used on the 511 phone line and nvroads.com Website. The highway restriction report will also be utilized in the operations of emergency response, public transit systems and oversized load permitting.

Assigning technician's inspection and monitoring duties - The Resident Engineer will assign an ATSSA certified technician the duties of inspection and monitoring of the TTC set up, maintenance and removal. The Resident Engineer should supply the assigned technician all available information, training and equipment necessary for he/she to complete these duties safely and thoroughly. Some of these duties are as follows:

- Attending contractor safety meetings
- Inspection and documentation of TTC set up and removal and the documentation of any identified deficiencies.
- Inspection of in-place TTC and the documentation of any deficient elements identified during inspection
- Monitoring flaggers and documenting their certification, location, hours worked, handling of traffic and compliance with specifications
- Monitoring and assessing the flow of traffic through the project. Discuss all ideas for improvement of the TTC with the resident engineer.
- Driving through the TTC several times throughout the work day/night to assure proper installation and effectiveness.
- Reporting to the Resident Engineer all information documented during the completion of these duties daily

Assigned Traffic Control Supervisor - The Traffic Control Supervisor assigned to the TTC will be responsible for the safe and timely flow of traffic through a project. The Traffic Control

Supervisor will maintain a current certification (See section 3.0 of this document) per section 107.07 of the Special Provisions. NDOT Special Provisions, section 624.03.06 outlines the inspection requirements of the Traffic Control Supervisor. The reports generated by these requirements will be reviewed by the Resident Engineer and included in the contract documentation.

Uniformed Traffic Control Officer - A Uniformed Traffic Control Officer may be required for special traffic control situations. Contact information will be listed in Subsection 624.03.07 of the Special Provisions. The contractor will be responsible for contacting the appropriate personnel and scheduling the work to be performed accordingly. Some of the situations that may require a uniformed Traffic Control Officer are as follows:

- Signal repair, signal redesign or new signal construction
- Rolling stop for the placement of overhead signs.
- Emergency closures or detours

Contractor Generated Traffic Control Plans –Projects with a Lump Sum TTC bid item will have Contractor generated TTC plan. The Resident Engineer, will review and accept or reject these TTC plans. The Resident Engineer may request TMP team review of the TTC plan. The Resident Engineer will work with the contractor and local agencies in his review of these plans. All TTC plans generated by the contractor will comply with all references listed in this document and the limitations provided in the Special Provisions.

Resident Engineer Changes to TTC - The Resident Engineer can propose changes to the TTC Plan provided in the contract documents or the TTC plan provided by the contractor. These changes may be considered when field conditions are different than what has been planned for or field conditions have changed prior to implementing the TTC.

5.3 Outcome

The proper implementation of a TMP should provide safe and effective work zones. The processes and personnel utilized in the implementation should be instrumental in the evaluations for future projects.

5.4 Post Construction Review

The Construction Division will be responsible for initiating a post construction review on all projects. This review will be an information gathering tool used for modifying procedures and specifications to better our future projects. The Construction Division will produce and distribute a quarterly report. This report will identify the aspects of the TMP that work well and those that did not work well.

6.0 Incident Management

6.1 Overview

Incident management is a planned and coordinated approach to remove incidents from the highway and restore traffic capacity as safely and quickly as possible. Incident management considers emergency response routes, public transit routes, school zones, and detour routes. It should clearly define authority during an incident and contact information for contractors and inspectors who can ensure work zone traffic control can be safely manipulated as needed during an incident. The local Traffic Incident Management (TIM) Coalition will define provisions for a quick and efficient incident area. The TMP will define contact info for contractors, and NDOT's inspectors. During an incident, the first 1st responder on the scene is the Incident Commander and has authority over all activities until the incident is entirely cleared from the roadway. It is the responsibility of NDOT maintenance, the contractor(s), and NDOT's inspection crew to coordinate with the Incident Commander to ensure he can safely manage the incident area and return the roadway to its pre-incident condition. These authority levels combined with Traffic Incident Management (TIM) procedures will ensure work zone mobility is maintained and/or restored as quickly and safely as possible.

6.2 TMP Information

The TIM Coalition will define parameters and procedures for the management of an Incident area. The TIM procedures will also define an Incident Commander who will manage all 1st responders. When an incident occurs in a work zone the rules stay the same but new stakeholders, in the form of NDOT and its' contractor(s), become resources at the disposal of the Incident Commander. Subcontractors, consultant REs and their crews are included in these requirements.

To ensure the roles are defined and communication is facilitated the TMP will include contact information for the RE and one other member of the crew, and for a TIM Coalition member in the project area, see figure 6.1. If contractor is known at TMP development, contact information for their Project Manager and one additional contact should be provided. The Assistant District Engineer over maintenance activities will also be identified in the TMP as a contact for NDOT maintenance. Each District Engineer (or their designee) shall participate in the TIM coalition.

Figure 6.1 – Contact Information for TIM Coalition in each area.

	NDOT TIM contact	NHP TIM contact
Las Vegas	Mario Gomez - Mgomez@dot.nv.gov 702-630-4091	Captain Kevin Honea - Khonea@dps.state.nv.us 702-985-5497
Tonopah	Sami Yousuf - Syousuf@dot.nv.gov 702-523-8674	Sergeant Loy Hixon - lhixson@dps.state.nv.us 702-499-2205
Elko	Boyd Ratliff - bratliff@dot.nv.gov 775-777-2700	Lieutenant Jeff Howell - Jhowell@dps.state.nv.us 775-240-7146
Winnemucca	Vacant	Lieutenant Tony Roth - nroth@dps.state.nv.us 775-720-8518
Ely	Steve Baer - Sbaer@dot.nv.gov 775-289-1703	Lieutenant Scott Simon- Msimon@dps.state.nv.us 775-720-8519
Reno	---	Captain John Dondero - Jdondero@dps.state.nv.us 775-687-9628

*Contact LaShonn Ford for updated contacts.

It is the responsibility of NDOT, the contractor, and any consultants to defer to the Incident Commander until the incident area is clear. The TMP and contact information for the contractor (if not included in TMP) shall be provided to the local TIM Coalition prior to groundbreaking. The TIM Coalition shall be provided with an opportunity to comment on TC plans for Significant projects.

Appendix A

Strategy Tables

Appendix A, (Table 1) Temporary Traffic Control (TTC)		
A. Control Strategies	**B. Traffic Control Devices**	**C. Project Coordination, Contracting, and Innovative Construction Strategies**
IA1. Construction phasing/staging IA2. Full roadway closures IA3. Lane shifts or closures: ▪ Reduced lane widths to maintain number of lanes (construction) ▪ Lane closures to provide worker safety ▪ Reduced shoulder width to maintain number of lanes ▪ Shoulder closures to provide worker safety ▪ Lane shift to shoulder/median to maintain number of lanes IA4. One-lane, two-way operation IA5. Two-way traffic on one side of divided facility (crossover) IA6. Reversible lanes IA7. Ramp closures/relocation IA8. Freeway-to-freeway interchange closures IA9. Night work IA10. Weekend work IA11. Work hour restrictions for peak travel IA12. Pedestrian/bicycle access improvements IA13. Business access improvements IA14. Off-site detours/use of alternate routes	IB1. Temporary signs: ▪ Warning ▪ Regulatory ▪ Guide/Information IB2. Message signs ▪ Dynamic (DMS) ▪ Changeable (CMS) IB3. Arrow panels IB4. Channelizing devices IB5. Temporary pavement markings IB6. Flaggers and uniformed traffic control officers IB7. Temporary traffic signals IB8. Lighting devices IB9. Balloon lighting IB10. Flashing beacons	IC1. Project coordination: ▪ Coordination with other projects ▪ Utilities coordination ▪ Right-of-Way coordination ▪ Coordination with other transportation infrastructure IC2. Contracting strategies: ▪ Design-build ▪ A+B bidding ▪ CMAR ▪ Incentive/Disincentive clauses ▪ Lane rental IC3. Innovative construction techniques (pre-cast members, rapid cure materials)

Appendix A, (Table 2) Transportation Operations (TO)

A. Demand Management Strategies	B. Corridor/Network Management Strategies	C. Work Zone Safety Management Strategies	D. Traffic/Incident Management and Enforcement Strategies
III-A1. Transit service improvements	III-B1. Signal timing/coordination improvements	III-C1. Speed limit reduction/variable speed limits	III-D1. ITS for traffic monitoring/management
III-A2. Transit incentives	III-B2. Temporary traffic signals	III-C2. Temporary traffic signals	III-D2. Transportation Management Center (TMC)
III-A3. Shuttle services	III-B3. Street/intersection improvements	III-C3. Temporary traffic barrier	III-D3. Surveillance [CCTV, loop detectors, lasers, probe vehicles]
III-A4. Ridesharing/carpooling incentives	III-B4. Bus turnouts	III-C4. Movable traffic barrier systems	III-D4. Helicopter for aerial surveillance
III-A5. Park-and-ride promotion	III-B5. Turn restrictions	III-C5. Crash-cushions	III-D5. Traffic screens
III-A6. High-occupancy vehicle (HOV) lanes	III-B6. Parking restrictions	III-C6. Temporary rumble strips	III-D6. Call boxes
III-A7. Toll/Congestion pricing	III-B7. Truck/heavy vehicle restrictions	III-C7. Intrusion alarms	III-D7. Mile-post markers
III-A8. Ramp metering	III-B8. Separate truck lanes	III-C8. Warning lights	III-D8. Tow/freeway service patrol
III-A9. Parking supply management	III-B9. Reversible lanes	III-C9. Automated Flagger Assistance Devices (AFADs)	III-D9. Total station units
III-A10. Variable work hours	III-B10. Dynamic lane closure system	III-C10. Project task force/committee	III-D10. Photogrammetry
III-A11. Telecommuting	III-B11. Ramp metering	III-C11. Construction safety supervisors/inspectors	III-D11. Coordination with media
	III-B12. Temporary suspension of ramp metering	III-C12. Road safety audits	III-D12. Local detour routes
	III-B13. Ramp closures	III-C13. TMP monitor/inspection team	III-D13. Contract support for incident management
	III-B14. Railroad crossings controls	III-C14. Team meetings	III-D14. Incident/emergency management coordinator
	III-B15. Coordination with adjacent construction site(s)	III-C15. Project on-site safety training	III-D15. Incident/emergency response plan
	III-B16. Bicycle and pedestrian access	III-C16. Safety awards/incentives	III-D16. Dedicated (paid) police presence
	III-B17. Bicycle and pedestrian detours	III-C17. Windshield surveys	III-D17. Dedicated (paid) police enforcement
			III-D18. Cooperative police enforcement
			III-D19. Automated enforcement
			III-D20. Increased penalties for work zone violations

Appendix A, (Table 3) Public Information (PI)

II-A1. Brochures and mailers as appropriate	II-B1. Traffic radio as appropriate
II-A2. Press releases/media alerts as appropriate	II-B2. Changeable message signs (CMS)
II-A3. Paid advertisements as appropriate	II-B3. Temporary motorist information signs
II-A4. Public information center as appropriate	II-B4. Dynamic speed message sign
II-A5. Telephone hotline as appropriate	II-B5. Highway advisory radio (HAR)
II-A6. Planned lane closure web site as appropriate	II-B6. Extinguishable signs
II-A7. Project web site as appropriate	II-B7. Highway information network (web-based)
II-A8. Public meetings/hearings as appropriate	II-B8. 511 traveler information systems (wireless, handhelds)
II-A9. Community task forces as appropriate	II-B9. Freight travel information
II-A10. Coordination with media, schools, businesses, and/or emergency services as appropriate	II-B10. Transportation management center (TMC)
II-A11. Work Zone education and safety campaigns as appropriate	II-B11. Social Media (Facebook, Twitter) as appropriate
II-A12. Work Zone safety highway signs	
II-A13. Rideshare promotions	
II-A14. Visual information (videos, slides, presentations) for meetings and website	

Appendix B

TMP Examples

Transportation Management Plan

US 50A
Lyon County
MP 16.3 and MP 17.07

Install New Signals

February 2021

Nevada Department of Transportation
1263 S. Stewart Street
Carson City, Nevada 89712

Prepared By: Shina Sato

Executive Summary

This project consists of installing traffic signals at two locations along US 50A in Lyon County. The new signals will be installed at River Ranch Road at milepost LY 16.3 and at Nevada Pacific Parkway at LY 17.07. The road is classified as a Rural Principal Arterial. The intersections of US 50A with River Ranch Rd and Nevada Pacific Pkwy are both High-T intersections with One-Way Stop-Control, with US 50A as the major roadway. There are two through lanes per directions on US 50A, with left and right turn pockets from US 50A to the cross streets. There is a left turn receiving lanes from both cross streets to US 50A. The posted speed limit is 65 mph. Traffic control will consist of single lane closures on a multi-lane facility.

This Transportation Management Plan (TMP) will describe the transportation management strategies developed throughout the course of this project. The strategies developed include the Maintenance of Traffic Plan and the Transportation Operations Plan.

TMP Roles and Responsibilities

TMP Coordinator

The Nevada Department of Transportation's (NDOT) Project Coordinator for this project is Chris Deal. Shina Sato will serve as the Transportation Management Plan (TMP) Project Manager and is responsible for the overall development of the TMP.

Chris Deal
Office: (775) 888-7468
cdeal@dot.nv.gov

Shina Sato
Office: (775) 888-7559
ssato@dot.nv.gov

TMP Team

The TMP Team is comprised of the individuals who have been involved in the development and review of the TMP. The TMP team consisted of Chris Deal (Roadway Design), Steven Loff (Roadway Design), Ashley Hurlbut (Resident Engineer), Wes Osmer (Assistant Resident Engineer), Jason Bertolino (Assistant Resident Engineer), Jeff Bickett (Traffic Operations), Shawn Patterson (Roadway Design), Craig Hutton (Constructability), Shina Sato (Traffic Operations) and Jamie Fuller-Dunn (Traffic Operations).

TMP Implementation Task Leaders

The following are some of the implementation responsibilities of Task Leaders as defined in this TMP:

NDOT Resident Engineer

1. Approve staging areas.
2. Coordinate with other construction activity in the general area of this project.
3. Enforce the contract limitations of operations.
4. Review the safety of in-place traffic control and contractor operations.
5. Provide construction information to District II so that they can place it on the 511 website.
6. Identify additional emergency contacts.

Contractor

1. Choose staging areas.
2. Coordinate with other construction activity in the general area of this project.
3. Design and submit traffic control plans.
4. Provide traffic control supervision and inspection.

Emergency Contacts

Rick Bosch, Asst. District II Engineer:	(775) 834-8300 Office; (775) 434-4810 Cell phone
Ashley Hurlbut, Resident Engineer:	(775) 888-7899 Office; (775) 881-8934 Cell phone
Wes Osmer, Assistant Resident Engineer:	(775) 888-7899 Office; (775) 315-1252 Cell phone
Jason Bertolino, Assistant Resident Engineer	(775) 888-7899 Office; (775) 443-7159 Cell phone

Additional emergency contacts will be identified at the Pre-Construction Meeting.

Project Description

The project consists of installing traffic signals at two locations on US 50A in Lyon County at mileposts LY 16.3 River Ranch Road and LY 17.7 Nevada Pacific Parkway.

Project Type

This project is new construction and is state funded.

General Schedule and Timeline

This project is anticipated to begin construction in Summer of 2021. The contractor will be allowed 40 working days for this project.

Existing and Future Conditions

The following Traffic Analysis is provided as a recommendation/guidance for the lane closure hours. This is not to supersede the 108.04 of the Special Provisions. Please refer to that section for the contract Limitations of Operations in development of Contractor designed Lump Sum Traffic Control Plan.

US 50A in the project area is a Rural Principal Arterial with two 12 foot lanes per direction, 4 foot interior shoulders and 10 foot exterior shoulders. There are dedicated left and right turn lanes from US 50A to the cross streets. There is a left turn receiving lanes from both cross streets to US 50A. The directional traffic is separated by raised concrete curb. The posted speed limit is 65 mph. Both intersections with US 50A are High-T intersections with stop-control for River Ranch Road and Nevada Pacific Parkway. The heavy truck percentage is 6.6 %.

The typical morning peak hour traffic volumes on US 50A are 475 vehicles per hour (vph) westbound and 343 vph eastbound. The morning peak traffic periods are from 6:00 AM to 7:00 AM westbound and 10:00 AM to 12:00 PM eastbound. The afternoon peak hour traffic volumes are 478 vph westbound and 577 vph eastbound. The afternoon peak traffic periods are from 12:00 PM to 6:00 PM westbound and 3:00 PM to 7:00 PM eastbound.

US 50A: 0.65 miles East of Jessica Lane (2017) ..... 12,700 AADT

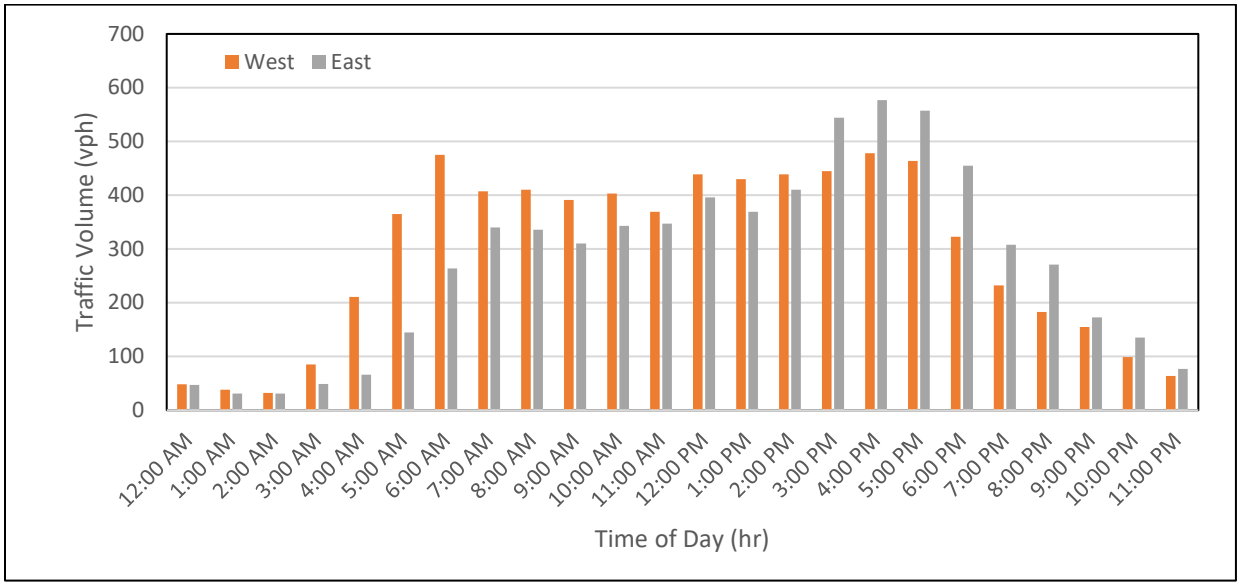


Figure 1: Typical Weekday Traffic Characteristics on US 50A

Traffic Operations recommends maintaining one lane per direction.

Stakeholder Concerns/Issues

Project stakeholders and organizations potentially affected by the project include:

- Nevada DOT
- Lyon County
- Lyon County School District
- Local utility companies
- Nevada Highway Patrol (NHP)
- Adjacent local and commercial businesses
- Adjacent residents
- Emergency Medical Services

Stakeholder traffic concerns and issues, including those by the community and business representatives, known are:

- Delays to traffic and increased travel times
- Impacts to pedestrians and bicyclists
- Construction noise impacts on residents adjacent to the roadway
- Inconvenience to access local businesses and residences

Work Zone Impacts Assessment Report

Qualitative Summary of Anticipated Work Zone Impacts

The work is expected to have impacts on mobility. Project areas with a posted speed limit higher than 55 mph may reduce to 55 mph during construction, as directed. In order to mitigate impacts to traffic, public traffic should not be

stopped more than a 20-minute duration for a total delay of no more than 30 minutes. At least one lane of public traffic shall always be open, and all lanes shall be open to traffic during non-working hours.

A work zone impact assessment will be developed throughout construction. This ongoing assessment will include daily field surveys that monitor traffic mobility, evaluation of work safety records, and daily evaluation of stakeholder and public complaints. Upon review of the assessments, NDOT and the contractor may choose to modify the traffic control to improve deficiencies as appropriate.

Construction Approach/Phasing/Staging Strategies

This project will be completed using lump sum traffic control, submitted by the contractor and approved by the Resident Engineer.

Regardless of traffic control operations, traffic will not be stopped for more than a 20-minute duration and will not be delayed for more than a total of 30 minutes.

A minimum of 6 changeable message signs will also be deployed to assist the travelling public during construction.

The temporary stoppage of traffic for the installation and removal of mast arms is permitted between the hours of 9:00 PM and 4:00 AM nightly, Sunday night through Friday morning. Temporary traffic stoppages shall have a maximum time allowed of 30 minutes, upon which traffic shall be released and allowed to clear for a duration determined by the engineer. Contact the Nevada Highway Patrol in accordance with section 624.03.07 to coordinate the temporary stoppage and release of public traffic.

Traffic drums will be mandatory on US50A to enhance safety.

The regulatory speed of 65 mph may be reduced to 55mph for lane closures or shifts. To enhance safety and conspicuity a minimum of 2 trailer-mounted speed feedback signs along with yellow flashing beacons placed on the W3-5A signs will be required during approved speed reductions.

The temporary regulatory speed limit should not be left in effect beyond the daily hours of operations unless the conditions for which the speed reduction was implemented continues to exist, or channeling devices are required to route traffic through the work zone area.

The original regulatory speed limit shall be resumed by posting new signs at the end of the work zone for each direction of traffic.

Drums are mandatory for use on US-50A.

The use of Temporary Transverse Rumble Strips and advance warning signage for them may be used as directed by the Engineer for lane closure as specified in 625 of the Special Provisions.

Traffic control operations that take place at night, the use of portable overhead trailer mounted balloon lighting will be mandatory as determined and specified in 625 of the Special Provisions.

Work Zone Impacts Management Strategies

A variety of management strategies may be deployed to minimize disruption to traffic and maintain a safe working environment. Suggested strategies to minimize impacts are documented in Table 1 (temporary traffic control), Table 2 (traffic operations control), and Table 3 (public information) as shown below:

Table 1- Temporary Traffic Control (TTC) Strategies		
A. Control Strategies	B. Traffic Control Devices	C. Project Coordination, Contracting, and Innovative Construction Strategies
Construction phasing/staging Lane shifts or closures: ▪ Reduced lane widths to maintain number of lanes (construction) ▪ Lane closures to provide worker safety ▪ Reduced shoulder width to maintain number of lanes ▪ Shoulder closures to provide worker safety Night work	Temporary signs • Warning • Regulatory Changeable message signs Arrow panels Channelizing devices Flaggers and uniformed traffic control officers Lighting devices	Project Coordination • Coordination with other projects • Utilities coordination • Right-of-Way coordination • Coordination with other transportation infrastructure

Table 2- Transportation Operations (TO)			
A. Demand Management Strategies	B. Corridor/Network Management Strategies	C. Work Zone Safety Management Strategies	D. Traffic/Incident Management and Enforcement Strategies
		Construction safety supervisors/inspectors TMP monitor/inspection team Team meetings Temporary rumble strips Warning lights	Incident/emergency management coordinator Incident/emergency response plan Dedicated (paid) police enforcement Increased penalties for work zone violations

Table 3- Public Information (PI)	
Press releases/media alerts (Done by Headquarters) Coordination with media, schools, businesses, and/or emergency services	Changeable Message Signs (CMS) Highway information network (web-based) 511 traveler information systems (wireless, handhelds) Social Media (Facebook, Twitter) Dynamic speed message signs

Selected Alternative

The selected alternative for work will be completed using lump sum traffic control submitted by the contractor and approved by the Resident Engineer. Traffic control plans submitted by the contractor will be subject to the construction restrictions and limitations as written in the Special Provisions.

TMP Monitoring

Monitoring Requirements

The Resident Engineer will monitor the effectiveness of the TMP through general inspection and traffic control supervision. The NDOT Resident Engineer will document unforeseen events relevant to the TMP as well as lessons learned. If any relevant information is documented, it should be distributed to the TMP Project Manager.

Public Information and Outreach Plan

As appropriate, portable CMSs will be used to inform road users of traffic information, such as to alert drivers of possible delays, dates construction will occur, incidents, or alternate routes. The current plan is to deploy 6 changeable message signs 10 days prior to construction activities.

NDOT also maintains work zone information for motorists on the 511 Traveler Information Line as well as on their website (http://www.nvroads.com). This project will be posted on the Traveler Information System.

Incident Management Plan

The Incident Management Plan is to be developed, maintained, and monitored by the District Engineer and will follow the standard for National Incident Command System (ICS) principles. Emergency communications are to be discussed at the pre-construction meeting. The traffic control strategies employed will be continuously monitored. Incidents occurring in or near construction will be investigated to identify and address contributing causes. Emergency services and law enforcement will be relied upon to oversee incident response and management.

Rick Bosch from District II 775-834-8300 (office) will be the point of contact for Nevada's Traffic Incident Management (TIM) Coalition. In the event Rick Bosch is unavailable, Ashley Hurlbut from District II will be the point of contact. Ashley Hurlbut can be reached at 775-888-7899 (office) and 775-881-8934 (cell). The TIM Coalition is a partnership of agencies and organizations working together towards common objectives. These common objectives include enhancing first responder safety, reducing roadway and incident clearance times and reducing secondary crashes. TIM will also be discussed, planned and reviewed at the bi-weekly meeting with NDOT, contractor and the stakeholders.

Transportation Management Plan

SR 431, Washoe County milepost 0.000 to 8.130 and SR 28, Washoe County, mileposts 0.000 to 1.000, 3.685 to 3.845 and 5.217 to 10.990

Cold milling and place plantmix bituminous surface with open grade, construct soil nail wall, ADA ramps, stormwater/hydraulic improvements, ITS conduit. Water quality restoration and erosion control. Reconstruct various roadway locations, shoulder slopes and barrier rail.

December 2020

Nevada Department of Transportation
1263 S. Stewart Street
Carson City, Nevada 89712

By: Jody Steele

Executive Summary

The contract consists of three projects all located in Washoe County. SR 431, Mount Rose Hwy, from SR 28 to 0.062 miles east of Mount Rose Summit, milepost WA 0.00 to 8.130. SR 28, Tahoe Blvd., 1.0 miles north of Sand Harbor to the Nevada/California state line, milepost WA 3.685 to 3.845 and WA 5.217 to 10.990. SR 28 at Marlette Creek, milepost WA 0.00 to 1.00.

On SR 431, Mount Rose Hwy, this project consists of a mill and overlay with open grade, reconstruct shoulders to a uniform slope, full depth reconstruct at various locations, removing and reconstruct barrier rail, storm drain along with hydraulic improvements and installation of ITS conduit. SR 431 in the project area in an urban minor arterial. The posted speed limits are 45 mph from mileposts WA 0.0 to 0.6 and mileposts WA 7.6 to 8.1, 50 mph from milepost WA 0.6 to 7.6, with a 25 mph “Recreation Area When Flashing” from milepost WA 6.5 to 7.6 and the heavy truck percentage is 0.6%.

On SR 28, Tahoe Blvd., this project consists of mill and overlay with open grade, constructing a soil nail wall, upgrading ADA ramps, stormwater and hydraulic improvements, and installing ITS conduit. SR 28 in the project area is a rural minor arterial. The posted speed limit is 45 mph from mileposts WA 5.2 to 6.0, 35 mph from milepost WA 6.0 to 10.6, and 25 mph from milepost WA 10.6 to 11.0 and the heavy truck percentage is 0.7%.

On SR 28 at Marlette Creek from milepost WA 0.00 to 1.00 this project consists of water quality restoration and erosion control.

Traffic control for all projects will consist of single lane closures which will be done utilizing flaggers and a pilot car. There will be intermittent nighttime closures on the multiuse path. The majority of the work will be completed during nighttime hours with exception of the residential area defined in 108.04 of the Special Provisions that will be daytime working hours.

This Transportation Management Plan (TMP) will describe the transportation management strategies developed throughout the course of this project. The strategies developed include the Maintenance of Traffic Plan and the Transportation Operations Plan.

TMP Roles and Responsibilities

TMP Coordinator

The Nevada Department of Transportation’s (NDOT) Project Coordinator for this project is Billy Ezell. Jody Steele will serve as the Transportation Management Plan (TMP) Project Manager and is responsible for the overall development of the TMP.

Billy Ezell
Office: (775) 888-7661
bezell@dot.nv.gov

Jody Steele
Office: (775) 888-7783
jsteele@dot.nv.gov

TMP Team

The TMP Team is comprised of the individuals who have been involved in the development and review of the TMP. The TMP team consisted of Billy Ezell, Eirik Berggren and Jacob Kelgard (Roadway Design), Bhupinder Sandhu, Erik Blackwell, and Austin McCoy, (Crew 911), Rick Bosch, (District 2), Jeff Bickett, Jody Steele and Jamie Fuller-Dunn (Traffic Operations).

TMP Implementation Task Leaders

The following are some of the implementation responsibilities of Task Leaders as defined in this TMP:

NDOT Resident Engineer

1. Approve staging areas.
2. Coordinate with other construction activity in the general area of this project.

3. Enforce the contract limitations of operations.
4. Review the safety of in-place traffic control and contractor operations.
5. Provide construction information to District II so that they can place it on the 511 website.
6. Identify additional emergency contacts.

Contractor

1. Choose staging areas.
2. Coordinate with other construction activity in the general area of this project.
3. Design and submit traffic control plans.
4. Provide traffic control supervision and inspection.

Emergency Contacts

Rick Bosch, Asst. District III Engineer:	(775) 834-8300 Office
Bhupinder Sandhu, Resident Engineer:	(775) 888-7708 Office; (775) 434-3458 Cellphone
Erik Blackwell, Assistant Resident Engineer	(775) 888-7708 Office; (775) 720-5044 Cellphone
Austin McCoy, Professional Engineer	(775) 888-7708 Office; (775) 430-3814 Cellphone

Additional emergency contacts will be identified at the Pre-Construction Meeting.

Project Description

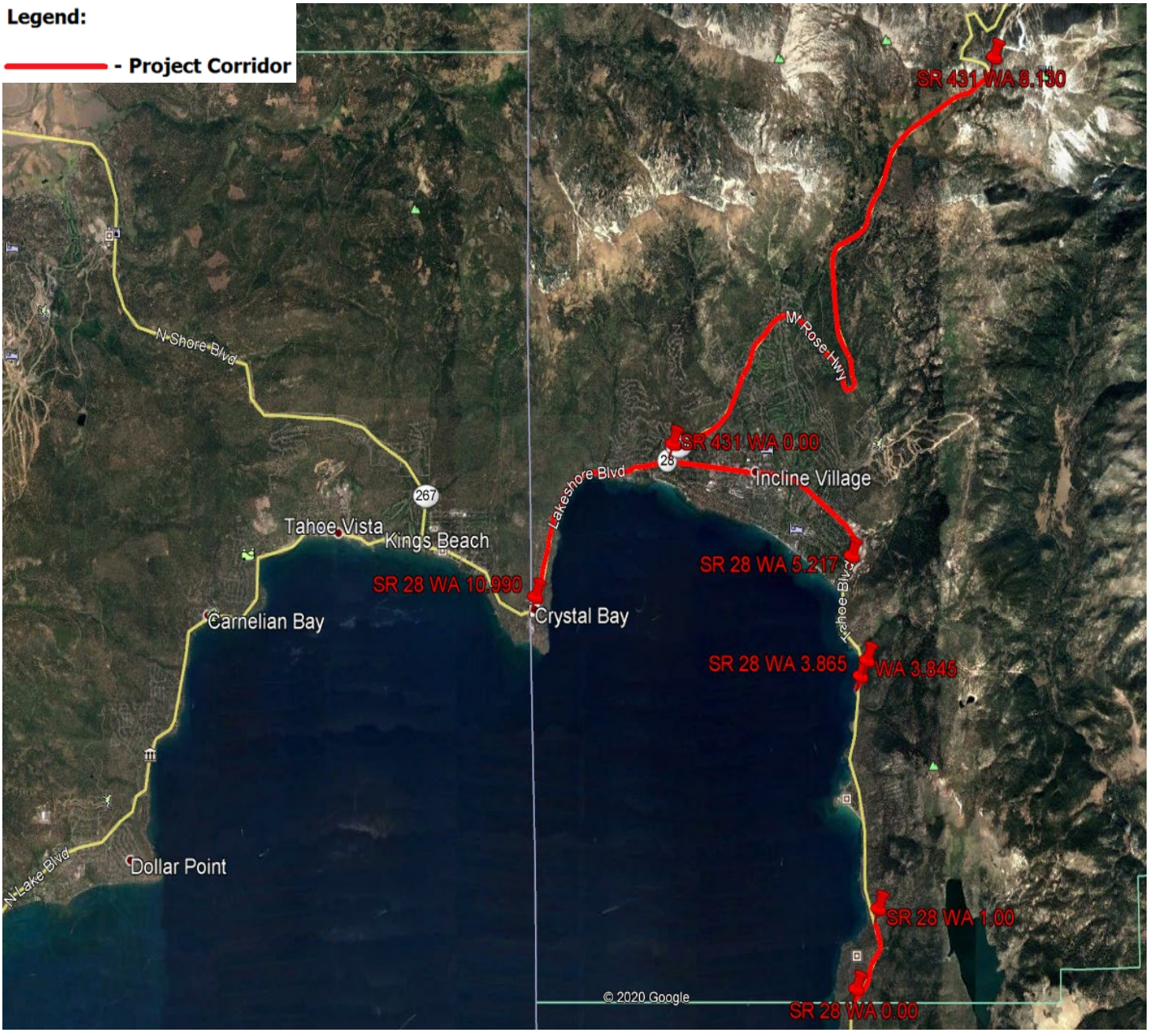
On SR 431, Mount Rose Hwy, this project consists of a mill and overlay with open grade, reconstruct shoulders to a uniform slope, full depth reconstruct at various locations, removing and reconstruct barrier rail, storm drain along with hydraulic improvements and installation of ITS conduit. SR 431 in the project area in an urban minor arterial. The posted speed limits are 45 mph from mileposts WA 0.0 to 0.6 and mileposts WA 7.6 to 8.1, 50 mph from milepost WA 0.6 to 7.6, with a 25 mph “Recreation Area When Flashing” from milepost WA 6.5 to 7.6 and the heavy truck percentage is 0.6%.

On SR 28, Tahoe Blvd., this project consists of mill and overlay with open grade, constructing a soil nail wall, upgrading ADA ramps, storm water and hydraulic improvements, and installing ITS conduit. SR 28 in the project area is a rural minor arterial. The posted speed limit is 45 mph from mileposts WA 5.2 to 6.0, 35 mph from milepost WA 6.0 to 10.6, and 25 mph from milepost WA 10.6 to 11.0 and the heavy truck percentage is 0.7%.

On SR 28 at Marlette Creek from milepost WA 0.00 to 1.00 this project consists of water quality restoration and erosion control.

Project Type

These projects are preservation and hydraulic projects and are state funded.



General Schedule and Timeline

This project is anticipated to begin construction in Spring of 2021. The contractor will be allowed 300 working days for this project.

Need for Detours

This project utilizes lump sum traffic control, traffic control plans will be developed and supplied by the contractor and will be approved by the Resident Engineer. Any detours shall be provided in the traffic control plans. Pedestrian traffic

control and detours shall be submitted together with the work zone traffic control plans. Plans for any closures and detours shall be submitted 14 days prior for approval.

Existing and Future Conditions

The following Traffic Analysis is provided as a recommendation/guidance for the lane closure hours. This is not to supersede the 108.04 of the Special Provisions. Please refer to that section for the contract Limitations of Operations in development of Contractor designed Lump Sum Traffic Control Plan.

SR 431 (Mount Rose Hwy)

SR 431 (Mount Rose Hwy) in the project area in an Urban Minor Arterial with one 12-foot lane per direction with 4-foot wide shoulders in both directions. From milepost WA 6.6 to 6.8 the northbound shoulder widens to 12-feet to accommodate on street parking. The directional traffic is separated by yellow lane markings. Rumble strips are present on the median and shoulders for both directions. Guard rails are present along some curves outside the shoulders. There is a roundabout intersection at milepost WA 0.0, with all other intersections as Two-Way Stop-Controlled with SR 431 as the major roadway. The posted speed limits are 45 mph from milepost WA 0.0 to 0.6 and milepost WA 7.6 to 8.1, 50 mph from milepost WA 0.6 to 7.6, with a 25 mph “Recreation Area When Flashing” from milepost WA 6.5 to 7.6. The heavy truck percentage is 0.6 %.

The typical morning peak hour traffic volumes on SR 431 are 167 vehicles per hour (vph) southbound and 143 vph northbound. The morning peak traffic periods are from 8:00 AM to 10:00 AM southbound and 10:00 AM to 12:00 PM northbound. The afternoon peak hour traffic volumes are 163 vph southbound and 196 vph northbound. The afternoon peak traffic periods are from 3:00 PM to 6:00 PM for both directions.

SR 431: 100 feet East of SR 28 (Tahoe Boulevard) (2017) ..... 4,300 AADT

SR 431: 50 feet West of Barbara Street (2018) ..... 3,900 AADT

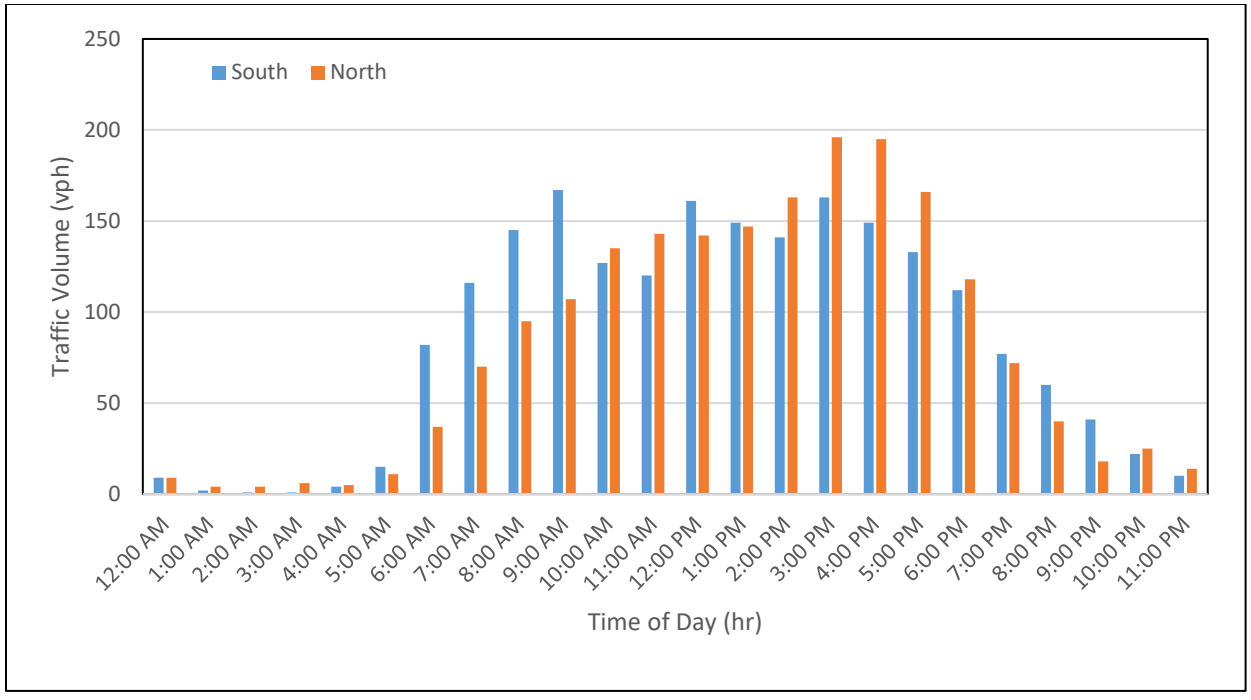


Figure 1: Typical Weekday Traffic Characteristics on SR 431

Traffic Operations recommends that pilot car operations be limited to 2.8 miles (measured from flagger to flagger).

SR 28 (Tahoe Blvd)

SR 28 (Tahoe Blvd) in the project area is a Rural Minor Arterial with one 12-foot lane per direction. Shoulder widths vary 1-10 foot on each side from milepost WA 5.2 to 7.9 and vary 1-3 feet from milepost WA 7.9 to 11.0. There are 4-

foot bike lanes in both directions from milepost WA 5.2 to 7.6 and pedestrian sidewalk from milepost WA 7.4 to 7.6 in both directions. The directional traffic is separated by yellow lane markings. There is metal guard rail present outside the shoulders on some curves. There are left and right turn pockets at some intersections. At milepost WA 8.1 there is a one lane roundabout with raised concrete curb. All other unsignalized intersections are Two-Way Stop-Control with SR 28 as the major roadway. The posted speed limit is 45 mph from milepost WA 5.2 to 6.0, 35 mph from milepost WA 6.0 to 10.6, and 25 mph from milepost WA 10.6 to 11.0. The heavy truck percentage is 0.7 %.

The typical morning peak hour traffic volumes on SR 28 are 475 vehicles per hour (vph) southbound and 486 vph northbound. The morning peak traffic periods are from 8:00 AM to 12:00 PM southbound and 11:00 AM to 12:00 PM northbound. The afternoon peak hour traffic volumes are 613 vph southbound and 561 vph northbound. The afternoon peak traffic periods are from 12:00 PM to 6:00 PM for both directions.

SR 28: 450 feet North of SR 431 (Mount Rose Highway) (2018) ..... 10,900 AADT

SR 28: 415 feet South of Village Blvd (2018) ..... 9,500 AADT

SR 28: 750 feet South of SR 431 (Mount Rose Boulevard) (2018) ..... 10,100 AADT

SR 28: 790 feet North of Lakeshore Boulevard East (2016) ..... 7,400 AADT

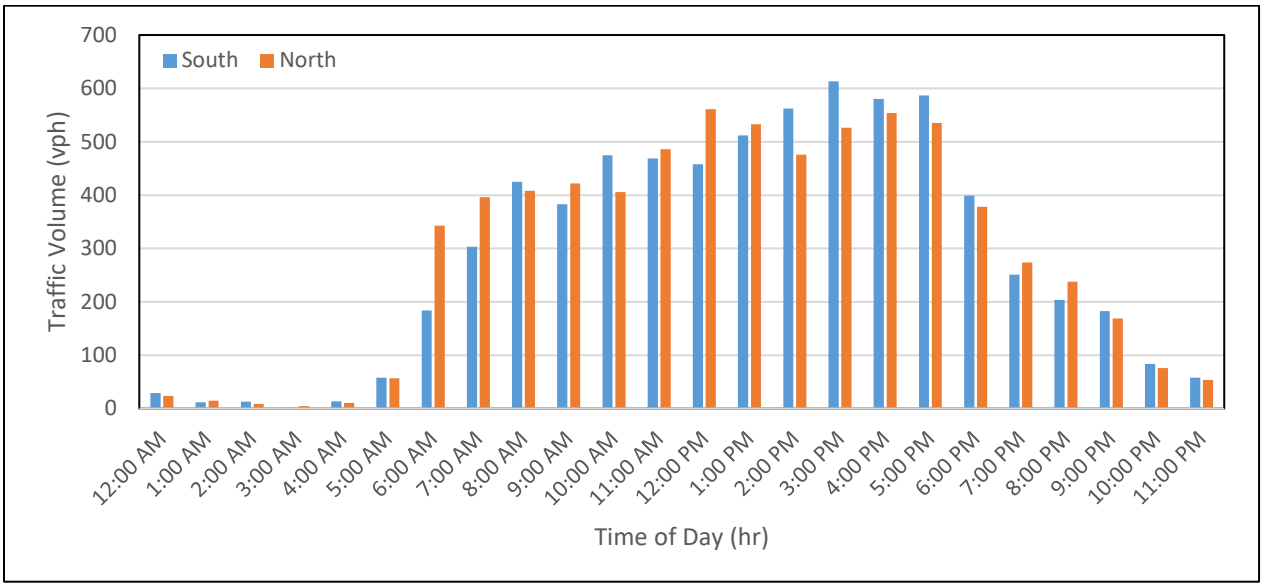


Figure 1: Typical Weekday Traffic Characteristics on SR 28

Traffic Operations recommends the use of detours and limiting lane closure hours from 8:00 PM to 6:00 AM. Pilot car operations should be limited to 2.5 miles (measured from flagger to flagger) from 8:00 PM to 6:00 AM.

Stakeholder Concerns/Issues

Project stakeholders and organizations potentially affected by the project include:

- Nevada DOT
- Washoe County
- Washoe County School District
- Tahoe-Douglas Fire Station
- Incline Village General Improvement District (IVGID)
- Tahoe Transportation District
- Local utility companies
- Mt. Rose Ski Resort
- Nevada Highway Patrol (NHP)
- Nevada State Parks (NSP)
- Federal Highway Administration (FHWA)
- United States Forest Service (USFS)
- Tahoe Regional Planning Agency (TRPA)
- Caltrans
- Adjacent local and commercial businesses
- Adjacent residents
- Emergency Medical Services

Stakeholder traffic concerns and issues, including those by the community and business representatives, known are:

- Delays to traffic and increased travel times
- Impacts to bicyclists and pedestrians
- Construction noise impacts on residents adjacent to the roadway
- Inconvenience to access local businesses and residences

Work Zone Impacts Assessment Report

Qualitative Summary of Anticipated Work Zone Impacts

The work is expected to have impacts on mobility. During construction, lane closures will be necessary on SR 431 and SR 28 utilizing flagger and pilot car operations. Trucks will be prohibited on SR 431 from mileposts WA 0.00 to 11.10 during lane closures. The multi-use path adjacent to SR 28 will require pedestrian protection to maintain pedestrian traffic during the soil nail wall construction or closure of the multi-use path which should only be closed during nighttime hours. Speed reductions to include advanced warning signs and additional mitigation strategies to assist with compliance to the reduced speed will be implemented throughout the work zone to promote safety and awareness. It is anticipated that the traveling public will experience inconveniences in the form of delay and longer commute times during construction, even with the public outreach efforts implemented. Significant congestion may occur near work zones especially during daytime operations allowed in the residential areas. To reduce impacts to traffic work between Memorial Day and Labor Day requiring lane closures is recommended to be nighttime hours. Unfortunately, despite every effort to minimize the impact of the construction work on the traveling public, there will be portions of the work that will result in increased travel times because of congestion. Although the traffic volumes are expected to cause congestion and delays through the work zone, the work zone will operate safely and efficiently with implementation of advanced warning signs, DMS controlled by Reno Road Operations Center (ROC), CMS and notices to residences and businesses.

Staging areas that are located in the Tahoe Basin are subject to TRPA review and approval.

a noise abatement plan, as specified in Section 637, prior to beginning work.

A work zone impact assessment will be developed throughout construction. This ongoing assessment will include daily field surveys that monitor traffic mobility, evaluation of work safety records, and daily evaluation of stakeholder and public complaints. Upon review of the assessments, NDOT and the contractor may choose to modify the traffic control to improve deficiencies as appropriate.

Construction Approach/Phasing/Staging Strategies

This project will be completed using lump sum traffic control, submitted by the contractor, and approved by the Resident Engineer. The team developed conceptual plans of traffic control and then outlined the parameters the contractor must work within. These are shown in the specifications, and the cost estimate includes a lump sum amount. The conceptual design was developed throughout the course of the project as the design progressed with participation from personnel from NDOT divisions such as Construction Administration, Specifications, Structures, Hydraulics, District I, Roadway Design and Traffic Operations.

Coordinate all lane closure lengths, lane closure locations, and distance between lane closure locations to comply at all times with the total project delay restrictions within the project limits.

Regardless of traffic control operations, traffic will not be stopped for more than a 20-minute duration and will not be delayed for more than a total of 30-minutes.

Provide two (2) “Trucks Prohibited Beyond This Point” signs as detailed in the plans for the project 10 days prior to construction and coordinate locations with the Engineer.

The use of yellow flashing beacons will be required to be placed on the W3-5A signs during approved speed reductions.

Flaggers are required for all truck ingress and egress locations and for cross street intersections when deemed necessary and directed for safety.

During speed reductions, a minimum of 4 trailer mounted speed feedback signs shall be provided to enhance safety.

A minimum of 6 changeable message signs will also be deployed to assist the travelling public during construction.

Traffic control operations requiring the stopping of traffic shall use Temporary Transverse Rumble Strips and advance warning signage as specified in 625 of the Special Provisions.

Traffic control operations that take place at night, the use of portable overhead trailer mounted balloon lighting will be mandatory as determined and specified in 625 of the Special Provisions.

Work Zone Impacts Management Strategies

A variety of management strategies may be deployed to minimize disruption to traffic and maintain a safe working environment. Suggested strategies to minimize impacts are documented in Table 1 (temporary traffic control), Table 2 (traffic operations control), and Table 3 (public information) as shown below:

Control Strategies	Traffic Control Devices	Project Coordination, Contracting, and Innovative Construction Strategies

• Construction phasing/staging
• One-way, two-way operations
• Shoulder closures to provide worker safety
• Night work
• Work hour restrictions for peak travel
	• Temporary signs:
	  ○ Warning
	  ○ Regulatory
	  ○ Guide/Information
	• Message signs
	  ○ Dynamic
	  ○ Changeable
	• Arrow panels
	• Channelizing devices
	• Flaggers and uniformed traffic control officers
	• Lighting devices
	• Business Open signs
		• Project coordination:
		  ○ Utilities coordination
		  ○ Right-of-Way coordination
		  ○ Coordination with other projects
		• Innovative construction techniques
		  ○ Marathon construction activities
		  ○ Rapid cure concrete

Table 4.4.2: Transportation Operations (TO)

Demand Management Strategies	Corridor/Network Management Strategies	Work Zone Safety Management Strategies	Traffic/Incident Management and Enforcement Strategies
	• Signal timing/coordination • Turn restrictions • Coordination with adjacent construction site(s) • Parking restrictions • Truck/heavy vehicle restrictions • Coordination with adjacent construction site(s) • Bicycle and Pedestrian Access	• Speed limit reduction • Temporary traffic barrier • Crash-cushions • Warning lights • Temporary Rumble Strips • Project task force/committee • Construction safety supervisors/ inspectors • TMP monitor/inspection team • Team meetings • Project on-site safety training	• ITS for traffic monitoring/management • Transportation Management Center (TMC) • Surveillance (CCTV) and loop detectors • Coordination with media • Local detour routes • Incident/emergency management coordinator • Incident/emergency response plan • Dedicated (paid) police presence • Cooperative police enforcement • Increased penalties for work zone violations • Early coordination with the Traffic Incident Coalition (TIM)

Table 4.4.3: Public Information (PI)

Public Awareness Strategies	Motorist Information Strategies
• Brochures and mailers • Press releases/media alerts • Project web site • Coordination with media, schools, businesses, and/or emergency services • Work Zone safety highway signs • Rideshare promotions	• Changeable message signs (CMS) • Temporary motorist information signs • Highway information network (web-based) • 511 traveler information systems (wireless, handhelds) • Transportation management center (TMC) • Social Media (Facebook, Twitter) email text blast

Selected Alternative

The selected alternative for work will be completed using lump sum traffic control submitted by the contractor and approved by the Resident Engineer. Traffic control plans submitted by the contractor will be subject to the construction restrictions and limitations as written in the Special Provisions. Due to the proximity of the state line the traffic control plans must be signed and stamped by a California Civil Engineer.

TMP Monitoring

Monitoring Requirements

The Resident Engineer will monitor the effectiveness of the TMP through general inspection and traffic control supervision. The Resident Engineer will document unforeseen events relevant to the TMP as well as lessons learned. If any relevant information is documented, it should be distributed to the TMP Project Manager.

Public Information and Outreach Plan

As appropriate, portable CMSs will be used to inform road users of traffic information, such as to alert drivers of possible delays, dates construction will occur, incidents, or alternate routes. The current plan is to deploy 6 changeable message signs 10 days prior to construction activities.

NDOT also maintains work zone information for motorists on the 511 Traveler Information Line as well as on their website (http://www.nvroads.com). This project will be posted on the Traveler Information System.

Incident Management Plan

The Incident Management Plan is to be developed, maintained, and monitored by the District Engineer and will follow the standard for National Incident Command System (ICS) principles. Emergency communications are to be discussed at the pre-construction meeting. The traffic control strategies employed will be continuously monitored. Incidents occurring in or near construction will be investigated to identify and address contributing causes. Emergency services and law enforcement will be relied upon to oversee incident response and management.

Rick Bosch from District II 775-834-8300 (office) will be the point of contact for Nevada's Traffic Incident Management (TIM) Coalition. In the event Rick Bosch is unavailable, Bhupinder Sandhu from District II will be the point of contact. Bhupinder Sandhu can be reached at 775-888-7708 (office) and 775-434-3458 (cell). The TIM Coalition is a partnership of agencies and organizations working together towards common objectives. These common objectives include enhancing first responder safety, reducing roadway and incident clearance times and reducing secondary crashes. TIM will also be discussed, planned and reviewed at the bi-weekly meeting with NDOT, contractor and the stakeholders.

Appendix C

MOT Red Flag Checklist

MAINTENANCE OF TRAFFIC RED FLAG SUMMARY

Early in the project, after the project corridor or study area is defined, the SSTC Designer in consultation with the TMP Team will identify maintenance of traffic issues that are present or should be considered during project development. Red flags are meant to identify locations that may entail additional study coordination; creative management, design or construction approaches; or increased right-of-way or construction costs. Uncovering problem areas prior to developing engineering alternates could help reduce project costs and eliminate project delays.

The maintenance of traffic summary shall include an identification of existing barriers that may affect safety and mobility during construction. Identifying any major construction issues at this stage is important so that costly and complex conflicts can be avoided, or at a minimum identified, during the development of preliminary alternates. During the Preliminary Design Field Survey (PDFS), the Maintenance of Traffic Summary chart should be completed. Any red flags identified should be presented at the Scoping Meeting (and included in the Scoping Meeting Report). The summary should also be updated and/or expanded on during the Traffic Control meeting.

Maintenance of Traffic Red Flag Summary:

Make a preliminary determination if the following issues are present or should be considered during project development. Provide additional comments as needed.

Project Location: _____ **EA:** _____

Completed by/Date: _____ **Project Scope:** _____

Number of lanes: _____ **Posted Speed limit:** _____

Mark all that apply:	**NOTES:**	**Mark all that apply:**	**NOTES:**
☐ TMA Area ☐ Interstate ☐ AADT 50,000 or greater ☐ High level of WZ impact mitigation ☐ Mill and Pave ☐ Chipseal/Microsurface ☐ Full Reconstruct ☐ Partial Reconstruct ☐ Roadbed Modification ☐ Drop off's during construction ☐ Structures ☐ Replacement/New ☐ Rehab ☐ Widening ☐ Elevation difference – btwn existing conditions & new improvements ☐ Work outside of roadway ☐ Work under roadway ☐ Hydraulic ☐ SLI conduit ☐ Speed limit above 55mph		☐ Geometric considerations ☐ R/W constraints ☐ Striping removal necessary ☐ School zone/bus route ☐ Pedestrian/Bicycle/ADA considerations ☐ Traffic Signals ☐ Bus stops ☐ High % of Truck Traffic ☐ Police/Fire in area ☐ Holiday/Special Event Consideration ☐ Coordination w/local agencies necessary ☐ Will completed work change normal driver behavior? ☐ Can recommended lane/WZ restrictions be followed?	

	Issue	Comments
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	**1. Can traffic be detoured?** If yes, answer the questions below:	
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	Is the local alternate detour route in good condition?	
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	Will the detour route have a detrimental impact on emergency vehicles, school buses, or other sensitive traffic?	
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	Are there load limit restrictions on the detour?	
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	Are there bridge/culvert width restrictions on the detour?	
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	**2. Is the existing shoulder in good enough condition to support traffic during construction?**	
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	**3. Could additional width be required on culverts or bridges to maintain traffic?**	
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	**4. Will existing lighting be down/affected during construction – can Balloon lighting be specified for use as temp lighting during construction**	
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	**5. Is there a pedestrian/bicycle facility that needs to be maintained or detoured?**	
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	**6. Could a temporary structure(s) be required?**	

☐ Yes ☐ No ☐ Possible ☐ Not Applicable	**7. Could a cross-over be needed?**	
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	**8. Are there any issues regarding construction timeframes (e.g, time of day, time of year limits)?**	
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	**9. Could there be a need to maintain railroad traffic?**	
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	**10. Could maintenance of traffic have an impact on existing or proposed utilities?**	
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	**11. Does it appear that maintenance of traffic will require additional right-of-way?**	
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	**12. Are there any other maintenance of traffic issues? Specify.**	
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	**13. Are there any geometric considerations? Specify.**	
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	**14. Do you anticipate the need for a speed reduction?**	
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	**15. Will temp striping be needed?**	
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	**16. Is this project a good candidate for a que detection system or other smart WZ component?**	
☐ Yes ☐ No ☐ Possible ☐ Not Applicable	**17. Will additional PIO outreach be necessary?**	

Appendix D

Work Zone Speed Mitigations Matrix

Appendix D
Work Zone Speed Mitigations Matrix

Work Zone Conditions	Changeable Message Sign	Uniform Traffic Control Officer	*Temporary Lighting	**Temporary Rumble Strips	Speed Feedback Sign	Lateral Deflection	***Lane Narrowing	Flashing Beacon	*Smarter Work Zone System	Center-line Cones	Queue detection	Decrease Device spacing	****Required Cumulative Point Value
Alignment changes designed for speed below the existing posted speed limit	1	1	1	2	1	2	2	1	0	1	1	1	5
Concrete barrier rail less than 2 feet from high speed traffic	1	1	0	2	1	0	2	1	0	0	0	0	3
Insufficient sight distance	1	1	1	2	1	2	2	1	0	0	2	1	4
Pilot Car	1	1	0	2	1	2	2	1	2	2	2	0	6
Ramp Closure	1	1	1	2	1	0	2	1	0	0	0	1	3
Traffic lanes less than 11 feet wide	1	1	0	2	1	2	2	1	0	1	0	1	3
Trucks entering roadway	1	1	1	2	1	0	2	1	2	0	1	0	4
Uneven Lanes/Rough Road	1	1	0	2	1	2	2	1	0	1	0	1	3
Unprotected Work Activities	1	1	0	2	1	2	2	1	0	1	0	2	3
Unusual/Reduced Roadway Geometrics	1	1	1	2	1	2	2	1	0	1	1	1	3
Narrow Shoulders	1	1	1	2	1	2	2	1	0	1	1	1	3
Expected Reduction (mph)	1.4 - 2.8	2 - 6		2.5 - 5.5	2 - 10		3 - 8	3 - 6					
Source	Ukkusuri, S. V., Gkriza, K., Qian, X., & Sadri, A. M. (2016)	NCHRP 482 Work Zone Speed Management	NCHRP 476 Guidelines for Design and Operation of Nightime Traffic Control for Highway Maintenance and Construction	Bai & Li 2009, 2011	FHWA Guidelines on managing speeds in work zones, 2010.		Traffic Control Devices Handbook, ITE, 2013	FHWA Desktop Reference of Potential Effectiveness in Reducing Speed, 2014.		Distric 3 Traffic - Karim Yousuf		Spacing based on speed at least 10mph lower than posted, see sheet TC-1	

*These measures do not necessarily decrease operating speeds but are proven safety countermeasures.

**Rumble strips may be used in advance of speed reduction signing, or advance flagger/signal signing. Applications with both are counted twice (points).

***Minimum lane widths to be used for this strategy is 11', measured edge of vertical cone/drum to vertical cone/drum on each side of lane, unless temporary striping is used. Further reductions in lane width are a safety concern, reduce capacity and mobility, and are discouraged.

****Cumaltive point values are determined by aggregating scores of all mitigation strategies implemented in particular work zone.

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