OPERATIONS & SAFETY EVALUATION QUESTION GUIDE

OPERATIONS EVALUATION QUESTION GUIDE
LEVEL 1

1. Are there identifiable bottlenecks in the project area?

Guidance: This question helps determine if there are specific bottlenecks in the area and starts the conversation about where the bottleneck begins and how the project can address those bottlenecks. Field visits should be conducted to observe the congestion and verify data.

FHWA Guidance: https://ops.fhwa.dot.gov/plan4ops/focus_areas/cmp.htm, https://ops.fhwa.dot.gov/congestion_report/

Process: Review the Operational Level of Service (OLOS) web tool - see Use Case 1 to identify larger bottleneck impacts, appearing in red. If a deeper dive is needed, CDOT HQ can help you with data analytics and other dashboards.

Documentation: Provide screenshot of OLOS data or print out data if available.

SME Contacts: elena.farhadi@state.co.us or dot_tsmoevaluation@state.co.us

2. Are there recurring, daily congestion patterns?

Guidance: This question establishes if there are consistent issues with congestion within the project area and if the project is able to implement strategies to mitigate those issues. Field visits should be conducted to observe the congestion and verify data.

Process: Review the Operational Level of Service (OLOS) web tool - see Use Case 3 to determine daily PTI/TTI. Check both weekday and weekend days for daily congestion patterns.

Documentation: Provide screenshot of OLOS data or print out data if available.

SME Contacts: elena.farhadi@state.co.us or dot_tsmoevaluation@state.co.us

3. Are there directional peak hour traffic volumes that reciprocate one another?

Guidance: This question helps identify commuting patterns through the project area. Examples include weekday work trips where weekday AM and PM trips reciprocate each other and weekend recreation trips where weekend AM and PM trips or Saturday AM and Sunday PM trips reciprocate each other. The purpose of this is to identify strategies that can promote efficient traffic flow for these types of travel patterns and discuss if they are appropriate for implementation as part of the project. For projects that need modeling, field visits should be conducted to observe the congestion and verify data.

Process: Review using OTIS, Transportation Data Management System, or traffic counts collected for project. D% value from 50 – 60 indicates directional peak hour traffic volumes that reciprocate one another.

Documentation: Provide screenshot of OTIS or Transportation Data Management System or provide results of calculations from traffic counts.

4. Are there specific peak traffic times?

Guidance: Each project should establish when traffic peaks on the corridor during a typical day to ensure that traffic volumes during those periods are accommodated in the project design.

Process: Review project traffic counts or historical traffic from OTIS or Transportation Data Management System for

peak times. Review the Operational Level of Service (OLOS) web tool - see Use Case 3 with Peak Period and Day of Week analysis.

Documentation: Provide peak hour calculations from traffic counts, if applicable. Document all relevant peak hours

including AM, PM, Midday, Weekend, and other peak hours as applicable.

SME Contacts: elena.farhadi@state.co.us or dot_tsmoevaluation@state.co.us

5. Are there recurring, seasonal congestion patterns?

Guidance: Similar to question 2, this question is to establish if there is regular congestion that occurs at different times of the year within the project area and if the project is able to implement strategies to mitigate those issues.

Process: Review the Operational Level of Service (OLOS) web tool - see Use Case 3 to determine monthly PTI/TTI.

Documentation: Provide screenshot of OLOS data.

SME Contacts: elena.farhadi@state.co.us or dot_tsmoevaluation@state.co.us

6. Is there non-recurring or special event congestion?

Guidance: This question is to establish if congestion occurs at relatively infrequent intervals and seeks to start a conversation about if this type of congestion can be anticipated and mitigated as part of the project.

Process: Review the Operational Level of Service (OLOS) web tool (see Use Case 4) and permits for special events. This dashboard use case will be re-released in Spring of 2023. If you need help please contact the SMEs below.

Documentation: Provide screenshot of OLOS data or a brief summary of special event permits.

SME Contacts: elena.farhadi@state.co.us or dot_tsmoevaluation@state.co.us

7. Are there issues with specific turning movements?

Guidance: Is there a high-volume turning movement that requires special accommodations such as signal re-timing or review of signal timing and phasing?

FHWA and CDOT Guidance: https://highways.dot.gov/safety/proven-safety-countermeasures/dedicated-left-and-right-turn-lanes-intersections
https://www.codot.gov/business/designsupport/bulletins_manuals/cdot-roadway-design-guide-2018

Process: Review crash patterns at the intersection to see if they indicate significant issues related to a turning movement. If so, review turning movements as part of the Level 1 Safety analysis. Also consider turning movement volumes compared to the number of dedicated turn lanes provided. Heavy truck turning movements may also indicate a need to improve the turning movement.

Documentation: If found, describe issues and create a map exhibit or collision diagram to illustrate issues.

SME Contacts: Safety - david.swenka@state.co.us , Signals - david.craft@state.co.us

8. Are there Planning Time Index (PTI) values higher than expected compared to similar facilities?

Guidance: This question helps to establish the travel time reliability on the corridor. If travel time reliability is very poor the project may look for opportunities to improve operations in an effort to stabilize experienced travel times.

Process: Review the Operational Level of Service (OLOS) web tool - see Use Case 3 Peak Period OLOS dashboard. A roadway's OLOS rank is determined based on the number of standard deviations the roadway's PTI is from the average PTI of similar facilities across the state. This is a relative assessment, therefore the ranges change based on the roadway characteristics and filters selected by the user. The OLOS is ranked from Category I (best) to Category IV (worst).

Documentation: Document PTI and OLOS rank of project area by providing a screenshot of dashboard results including "Weekday - AM Peak", "Weekday - PM Peak", and "Weekend - Day" results. Document range of OLOS ranks and PTI values on project for each time period.

SME Contacts: elena.farhadi@state.co.us or dot_tsmoevaluation@state.co.us

9. Are there Travel time Index (TTI) values higher than expected compared to similar facilities?

Guidance:

Process: Review the Operational Level of Service (OLOS) web tool see Use Case 1 Localized Botleneck dashboard. A roadway's TTI rank is determined based on the number of standard deviations the roadway's TTI is from the average TTI of similar facilities across the state. This is a relative assessment, therefore the ranges change based on the roadway characteristics and filters selected by the user. The TTI rank ranges from Category I (best) to Category IV (worst). A TTI rank of III or IV indicates TTI values higher than expected compared to similar facilities.

Documentation: Document TTI rank of project area by providing a screenshot of dashboard results including "Weekday - AM Peak", "Weekday - PM Peak", and "Weekend - Day" results. Document range of TTI ranks and TTI values on project for each time period.

SME Contacts: elena.farhadi@state.co.us or dot_tsmoevaluation@state.co.us

10. Are there opportunities to provide or improve the following features: Turn Around Points, Staging Areas, Debris Flow Areas, Avalanche Safety Zones, and slopes for vegetation maintenance?

Guidance: Projects should seek to incorporate improvements that would help with maintenance and emergency response when possible. This question pertains to mountainous or rolling terrain roadway segments where roadway geometry or terrain limits vehicle mobility in execution of their purpose. Example: Do emergency or maintenance vehicles have turn around points to allow quick response to a critical task. Example: Are there places outside of avalanche zones for refuge for vehicles.

Process: Review project scope and verify with *Region or Section Maintenance LTC Ops II*.

Documentation: If any of the listed features can be improved, document proposed improvements and create a map exhibit of improvements. Include supporting emails from maintenance (if a concern).

11. Are there lane geometry deficiencies including shoulders, lanes, sight distance, curves, intersections, and accesses?

Guidance: Project should seek to incorporate safety improvements into the scope of the project when possible.

Process: Use OTIS/Google Earth maps, survey, or lidar data to check acceleration/deceleration lengths, passing lanes/zones, and sight distance and compare to current regulations. If no information is available, this may require a field visit. Reference CDOT Roadway Design Guide Chapter 3 and CDOT State Highway Access Code for lane geometry requirements. Projectwise and OnBase should have original plansets for many of CDOT's roadways that have the geometry data.

Documentation: If lane geometry deficiencies are present create a map exhibit of deficiencies on a google map, ArcGIS print out, or a white paper.

SME Contacts: Access Requirements (sight distance) - daniel.roussin@state.co.us , Roadway Geometry - Region Roadway Engineers and HQ Design Area Engineer - jerome.estes@state.co.us

12. Will the project require a traffic study for signals, changes to operations, or new configurations?

Guidance: Project should review existing and future intersections to determine the possible need for the installation of new traffic signals, changes to existing signal operations, or other changes of intersection control. Signalized intersections adjacent to the project may need to be considered for coordination purposes. Examples of changes to existing signal operations include but are not limited to: a full re-timing, a change in sequence or phasing, the addition of a phase, protective only left-turn phasing, and pedestrian or cyclist exclusive phasing.

Process: Review intersections within and immediately adjacent to the project limits and consider the operational impacts of the project. Consider the project impact on user movement through each signalized intersection. Review any available tools such as ATSPM, INRIX Signal Analytics, etc. to determine current signalized operations.

Documentation: A document that summarizes where a signal warrant analysis or ICAT evaluation may need to occur, proposed high-level changes in signal operations, and any performance metrics available for existing signalized intersections.

SME Contacts: Signals - david.craft@state.co.us and ICAT - melissa.gende@state.co.us or dot_tsmoevaluation@state.co.us

13. Will there be any significant operational or geometric changes to any intersection in the project limits?

Guidance: Examples of significant operational changes include changing lane assignments for vehicle movements or restricting a previously allowed movement. Examples of significant geometric changes include adding a turn lane or adding through lanes on any approaches.

Process: Discuss the operational deficiencies of intersections in the project area with the project manager and regional traffic operations engineers. If major changes will be made to any intersections the Intersection Control Analysis Tool should be utilized in the Level 2 analysis to assess alternatives at the intersection.

Documentation: Describe operational deficiencies at the intersection that may require significant operational or geometric changes.

SME Contacts: melissa.gende@state.co.us or dot_tsmoevaluation@state.co.us

14. Are there opportunities for Variable Speed Limits within the project limits?

Guidance: Variable Speed Limits (VSL) may be implemented on freeways with specific safety concerns to improve safety and increase throughput during weather events or congested periods.

Process: Review Chapter 2 of the Variable Speed Limit Guidelines (publication coming soon, reach out to SME with questions) for decision support for VSL projects.

Documentation: If a project would like to consider VSLs, submit documentation that VSLs are warranted per the decision support flowcharts (Figures 2 and 3 in the Guidelines).

SME Contacts: melissa.gende@state.co.us or dot_tsmoevaluation@state.co.us

15. Can the current project incorporate signing and striping improvements?

Guidance: Projects should seek to incorporate signing and striping improvements such as removing obsolete signs, replacing signs with substandard retroreflectivity, and repainting striping where it is faded into the scope of the project when possible.

Process: Review with Survey or Maintenance. If no information is available, this may require a field visit. See CDOT Signing and Striping Standards. Regulatory and warning signs should be reviewed for potential replacement if roadway improvements are made or proposed. Coordinate with Region Traffic Representative (TEs) as needed.

Documentation: If signing and striping improvements can be incorporated, document improvements and create map exhibit. Create a list of potential signs to be checked for age/night vision.

SME Contacts: Headquarters: esayas.butta@state.co.us or Region Traffic Maintenance Teams

16. Are there signs that are 7+ years old within the project limits and no region wide sign project planned within one (1) year?

Guidance: Projects should seek to incorporate signing improvements such as removing obsolete signs or replacing signs with substandard retroreflectivity into the scope of the project when possible.

Review with Survey or Maintenance. If no information is available, this may require a field visit. See CDOT Signing and Striping Standards. Regulatory and warning signs should be reviewed for potential replacement if roadway improvements are made or proposed. Coordinate with Region Traffic Representative (TEs) as needed.

Documentation: If signing and striping improvements can be incorporated, document improvements and create map exhibit. Create a list of potential signs to be checked for age/night vision.

SME Contacts: Headquarters: esayas.butta@state.co.us or Region Traffic Maintenance Teams

17. Are there intersection or roadway geometry and cross-section elements that cause issues for unique users (frequent large trucks, trailers, RVs)?

Guidance: Projects should be aware of unique roadway users and document potential issues so that they can be addressed early on in the project life-cycle.

Process: Review Freight Corridors Map (requires ARCGIS login) and traffic projections for the percent trucks. Review project plans for any superelevation/roundabout features. Request check of turning movements from PM. Coordinate with CDOT Freight Program Office Manager as needed.

Documentation: If potential issues for unique users exist document issues and create a map exhibit.

SME Contacts: Roadway Geometry - Region Roadway Engineers and HQ Design Area Enginer - jerome.estes@state.co.us

18. Has appropriate consideration been given to the tie-ins at each end of the project? Consider operations upstream and downstream of the project.

Guidance: Changes within a project area can impact adjacent roadway sections. Considering how a project will tie-in early on in the project can avoid re-work in the later stages.

Process: Review for tie-ins for lane configuration, ties into existing roads, signal timing, etc. using OTIS/Google Earth maps. If no information is available, this may require a field visit.

Documentation: Provide brief description of considerations given to tie-ins and include map exhibits as needed.

19. Is there an opportunity to incorporate transit improvements (bus pullouts, concrete pads, etc.) with the project?

Guidance: Projects should seek to incorporate improvements that would improve access to transit for all users when possible.

Process: Review local transit website for infrastructure.

Documentation: If there are opportunities to improve existing transit infrastructure create a map exhibit to document the location and improvement type.

SME Contacts: Region Mobility Representatives and HQ Transit Representatives

20. Are there railroad crossings or facilities within the project boundaries?

Guidance: Railroad crossings can present unique challenges to a project during construction and to traffic operations once constructed. If a railroad is present it is important to start planning for those impacts early in the project life-cycle.

Process: Review for railroad crossings using OTIS/Google Earth maps.

Documentation: If a railroad crossing is present, create a map exhibit to document location.

SME Contacts: HQ Railroad Liaison - scott.hoftiezer@state.co.us

21. Is there on-street parking on the facility?

Guidance: On-street parking is an important feature of many downtown areas to promote access but can create additional conflicts for multi-modal users of the transportation system. If on-street parking is present the project should consider the impacts to multi-modal users and mitigate them where possible.

Process: Review on-street parking using OTIS/Google Earth maps. If no information is available, this may require a field visit.

Documentation: If there is on-street parking create a map exhibit of on-street parking locations (if a concern).

22. Will a temporary reduction of speed limit be required for work zones within the project limits?

Guidance: Temporary speed limit reductions are governed by Procedural Directive 1502.2 which must be followed in the case of any temporary reductions to speed limits in work zones.

Process: Coordinate with the project designer and construction resident engineer to determine if a temporary speed limit reduction may be needed for the project. Review Procedural Directive 1502.2 for requirements for the reduction of speed limits.

Documentation: If applicable, prepare Form 568: CDOT Temporary Speed Limit Reduction

SME Contacts: Region Traffic Engineers - Reach out to your region traffic engineer (PE III/PE II)

23. Are there elements of the project that warrant consideration of the CDOT Work Zone Safety and Mobility procedures as part of the scoping efforts?

Guidance: The CDOT Work Zone Safety and Mobility rules and procedures should be considered on all projects that will impact the roadway and require any type of lane closures. Transportation Management Plans are required on all projects with roadway impacts.The CDOT Work Zone Safety and Mobility can help step you, the project manager and the designer through what procedures are needed on the project early in the scoping phase.

Process: Check to determine if a Traffic Management Plan (TMP) is anticipated with the PM. Review Work Zone Safety and Mobility Rule (WZSM) document for more information. Flow chart on page 3 provides guidance to identify significant projects that will require a TMP.

Documentation: If the project qualifies as a “significant” project per the WZSM, note that a TMP is required. Submit TMP documentation. Coordinate with *Regional Traffic Engineers* as needed.

SME Contacts: Headquarters: esayas.butta@state.co.us or benjamin.acimovic@state.co.us or Region Traffic Maintenance Teams

24. Are there opportunities or need for multiple phases or work zones during construction?

Guidance: Multiple phases or concurrent multiple locations on a construction project can be challenging for one traffic control supervisor to manage. There are options if the project manager/designer anticipates a need for more than one TCS and wants to incorporate it into the plans and specifications.

Process: At the scoping meeting or at a separate meeting with the project manager and/or designer, consider the scope of construction work. Ask if the construction work will have multiple concurrent work locations or if the project will have multiple phases or lane closures that could require more traffic control maintenance and operation that a typical project. Acquire the appropriate specification and add it to the FIR specification package.

Documentation: Utilize the Revision to 630 Traffic Control Management (Special) specifications. Follow the instructions on the project special specification that fits the project and recommend them to the project manager as part of the specifications package.

SME Contacts: Headquarters: esayas.butta@state.co.us or benjamin.acimovic@state.co.us

25. Are their opportunities to deploy Smart Work Zone devices during construction?

Guidance: Smart Work Zone (SWZ) implementations are relatively new (Twin Tunnels 2012 and I-25 Gap 2016) to CDOT and have only been deployed on major projects. SWZ device and SWZ system specifications are available for project to utilize. Most projects will only use the SWZ device specification that can be scaled to any project size. The SWZ system specification should only be used on projects that have a need for numerous devices, subsystems that need software for control and operation, data analytics, traffic control centers, and/or a project need.

Process: If there are opportunities to deploy SWZ devices during construction, the project manager/designer should work with the region traffic engineer and HQ traffic support staff to step through the SWZ Analysis Tool. If the summary indicates that one or both specifications should be utilized, the project team should notify ITS as part of the first SEA document required on every project.

Documentation: A completed SWZ Analysis Excel tool summary print out, specification drafts, and the required SEA project documentation are required and should be filled out as soon as the scoping meeting for project incorporation.

SME Contacts: Headquarters: esayas.butta@state.co.us or benjamin.acimovic@state.co.us

26. Are there bicycle and pedestrian, transit users present that require analysis(known issues, underserved, trails, crossing issues, public lands)?

Guidance: Projects should seek to incorporate improvements that would improve access and safety for multi-modal users of the transportation system when possible.

Process: Review local land uses, local plans for proposed bicycle/pedestrian improvements, and traffic counts that include bicycle and pedestrian data. Review High Demand Bicycle Corridors of Colorado map, a Tier 1 or Tier 2 corridor indicate significant bicycle usage. Review Access Control Plans (ACP). Coordinate with *CDOT Bicycle and Pedestrian Program* and *Regional Traffic Representatives* as needed.

Documentation: If applicable, create a map exhibit of existing facilities or ACP.

SME Contacts: Primary Contacts: Region Bike/Ped Representatives

27. Does the project fall on or intersect with a recognized local, regional or national bicycle route?

Guidance: Projects with a bicycle route in the project area may need to make special accommodations during construction to ensure bicyclists are provided with a safe alternative during construction. Project designers should also be aware of bicycle routes and strive to provide safe connections to the bicycle route as part of the project when possible.

Process: Review local and statewide transportation plans for mention of bicycle routes. Coordinate with *CDOT Bicycle and Pedestrian Program* and *Regional Traffic Representatives* as needed.

Documentation: If applicable, create a map exhibit of existing bicycle routes.

SME Contacts: Primary Contacts: Region Bike/Ped Representatives

28. Does the project area include or overlap with any bicycle and/or pedestrian priority areas or corridors in local, regional, or state plans?

Guidance: Projects with planned bicycle routes or pedestrian priority areas within or overlapping with project boundaries should consider the long-term increases in bicycle and pedestrian activities in the project design. Project designers should be aware of planned bicycle and pedestrian routes and strive to provide bicycle and pedestrian accommodations that will be appropriate for the future level of bicycle and pedestrian traffic.

Process: Review local, regional, and statewide transportation plans for mention of planned bicycle routes and pedestrian priority areas. Coordinate with *CDOT Bicycle and Pedestrian Program* and *Regional Traffic Representatives* as needed.

Documentation: If applicable, create a map exhibit of future bicycle and pedestrian routes.

SME Contacts: Primary Contacts: Region Bike/Ped Representatives

29. Is there an immediate adjacent option for local bike-ped traffic or impact established bike and ADA/Ped traffic?

Guidance: Bicycle, pedestrian, and ADA/Ped traffic can be highly impacted by CDOT or local agency construction work. CDOT is legally required to maintain bicycle, pedestrian, and ADA access during construction. If the project impacts established bicycle, pedestrian or ADA traffic, accommodations like pilot cars,

Process: Bicycle, pedestrian, and ADA/Ped traffic data should be obtained through CDOT data sources or counted during field visits. The Colorado Bicycle & Byways Map, CDOT Windshield, and OTIS data can be utilized as well.

Documentation: Project documentation can include prints outs from data sources, field maps, traffic counts, other information about ADA accessibility.

SME Contacts:HQ: Primary Contacts: Region Bike/Ped Representatives

30. Is the project on an uphill or downhill roadway?

Guidance: Projects on roadways with a significant grade require additional planning to accommodate bicycle and pedestrian detour traffic and should be considered early in the project life-cycle. Anything at or above **4% to 6%** should be considered hard to navigate for bicyclists and planning for where detours begin or lane closures require stopping should consider these factors.

Process: Review surveys of the project site or grades through OTIS data.

Documentation: Create a map exhibit that identifies the locations (MM limits) of steep grades.

31. Are there opportunities for Speed Management infrastructure in the project limits?

Guidance: Speed Management, also know as speed zoning, is changing throughout the United States. In Colorado, Vision Zero is one of the main goals that incorporates speed management infrastructure to calm speeds and protect vulnerable roadway users.

FHWA Guidance:

- https://highways.dot.gov/safety/zero-deaths/vision-zero-cop/vision-zero-action-plans
- https://highways.dot.gov/safety/speed-management/traffic-calming-eprimer
- https://highways.dot.gov/safety/speed-management/speed-management-countermeasures-more-just-speed-humps
- https://safety.fhwa.dot.gov/intersection/ssi/
- htts://highways.dot.gov/safety

Process: Speed Management should be considered on every project where there are speed related crash patterns, vulnerable road users, and where the context could be considered for lowering speeds. Reach out to your speed management group at CDOT HQ and see if there have been any recent speed studies that recommended speed management infrastructure. Also consult crash data to see if there are any pedestrian, bicycle, or speed related accidents in the past 3-5 years.

Documentation: Speed study memos, strip maps, safety data summaries and graphs, and field visit documentation can be utilized for making speed management or speed calming recommendations for the project.

SME Contacts: Headquarters: elena.farhadi@state.co.us or benjamin.acimovic@state.co.us or brooke.podhajsky@state.co.us

SAFETY EVALUATION QUESTION GUIDE
LEVEL 1

1. Were there any correctable intersection related or driveway access crash patterns detected?

Guidance: All projects that have roadway impacts and are not exempt from operations evaluations should run at least a level 1 analysis with the Vision Zero Suite. Overall detailed summaries should be created along with SPF graphs and direct diagnostic charts should be generated as well. Each intersection should be analyzed if crash patterns are detected.

Process: Process study area with Vision Zero Suite, safety performance function (SPF) and direct diagnostics. Local road ADTs can be sourced here: https://cdot.public.ms2soft.com/tcds/tsearch.asp?loc=Cdot&mod=

Documentation: Detailed Summaries, SPF graphs (total and severe crashes) and direct diagnostic charts.

SME Contact: david.swenka@state.co.us

2. Were there any correctable non-intersection related crash patterns detected?

Guidance: All projects that have roadway impacts and are not exempt from operations evaluations should run at least a level 1 analysis with the Vision Zero Suite. Overall detailed summaries should be created along with SPF graphs and direct diagnostic charts should be generated as well.

Process: Process study area with Vision Zero Suite, pattern recognition. Process study area with Vision Zero Suite, direct diagnostics.

Documentation: , Detailed Summaries, SPF graphs (total and severe crashes), and crash pattern recognition graphs.

SME Contact: david.swenka@state.co.us

3. Is there any extensive paving within the project limits?

Guidance: If a project is projected to have extensive paving, defined as more than 1,000 tons and requiring paving specifications, there are several automatically generated recommendations that may apply to the project.

Process: Check with the project manager/designer to determine if the scope of work has more than 1,000 tons and requiring paving specifications. Large quantities for patching asphalt bid items do not qualify. Paving may not be the overall main component of the project but there may still be extensive asphalt paving! If yes is answered for this question, please review and agree to patterns to accept which recommendations are appropriate for the project. Then add the specifics of each recommendation to the description entry.

Documentation: General recommendations associated with resurfacing projects will be generated, descriptions added, and then send to the project manager/designer in PMWeb.

OPERATIONS EVALUATION QUESTION GUIDE
LEVEL 2

1. **Have you assessed and documented the overall condition of the corridor or network?**

   Guidance: Understanding the existing conditions through office work and field visits is a key to creating a successful model.

   Process: Review site imagery and conditions assessment using OTIS/Google Earth maps and conduct a site visit. Consider existing traffic volumes, roadway classification, and other operational characteristics in this assessment.

   Documentation: Provide description of existing overall conditions on project corridor/network.

2. **Have you determined and documented the appropriate Measures of Effectiveness (MOEs) to fully understand the existing issues?**

   Guidance: Picking MOEs that will best represent operational issues and that match with project goals will help the project highlight its successes in the future.

   Process: Review CDOT's Traffic Analysis and Forecasting Guidelines for more information. MOEs that serve to compare alternatives and communicate how a project is meeting stated goals and objectives should be chosen for reporting.

   Documentation: Provide list of MOEs that will be used for this project along with a brief description of how the MOE relates to the project goals and objectives.

   SME Contact: Modeling Team: Lead: melissa.gende@state.co.us , Modelers: elena.farhadi@state.co.us and david.craft@state.co.us

3. **Have you determined and documented the modeling requirements and level of detail needed to achieve the desired MOE's for future alternatives analysis?**

   Guidance: Planning for what the future analysis will look like early in the project life-cycle ensures that important stakeholders get a chance to comment on the methodology prior to investing significant time and resources into the project.

   Process: Review CDOT's Traffic Analysis and Forecasting Guidelines for more information.

   Documentation: Provide a modeling plan/scope for the project, if applicable.

   SME Contact: Modeling Team: Lead: melissa.gende@state.co.us , Modelers: elena.farhadi@state.co.us and david.craft@state.co.us

4. Have you determined and documented the required spatial limits of the model(s) to be used?

Guidance: Spatial limits should extend past the construction projects limits to encompass all existing and expected future congestion on the project.

Process: Review CDOT's Traffic Analysis and Forecasting Guidelines for more information.

Documentation: Provide a description of model spatial limits, include a map exhibit.

SME Contact: Lead: melissa.gende@state.co.us , Modelers: elena.farhadi@state.co.us and david.craft@state.co.us

5. Have you determined and documented the required temporal limits of the model(s) to be used?

Guidance: Temporal limits should at a minimum include a full peak hour plus any seeding time the model may need (if applicable). For complex projects, consider modeling the full peak period from the beginning of congestion buildup until congestion has dissipated to normal operations.

Process: Review congestion patterns and traffic count data to determine the peak hours and the start/end times of congestion as needed. Review CDOT's Traffic Analysis and Forecasting Guidelines for more information.

Documentation: Provide a list of peak hours/periods that will be analyzed for the project.

SME Contact: Lead: melissa.gende@state.co.us , Modelers: elena.farhadi@state.co.us and david.craft@state.co.us

6. Have the analysis years been determined and documented for this project?

Guidance: It is important to analyze the project over the course of its lifecycle, from open to the expected horizon year. Existing operations are an important benchmark to compare future operations with.

Process: Work with the project team to determine years to represent existing traffic conditions (the most recent year from which reliable traffic data is available), open year (the year that the project is expected to open to traffic), and design year (typically open year + 20 years). Interim analysis years may be considered for projects that will be completed in stages or for projects near developments that will be constructed and opened in stages. Review CDOT's Traffic Analysis and Forecasting Guidelines for more information.

Documentation: Provide the years of each scenario to be analyzed for the project.

SME Contact: Lead: melissa.gende@state.co.us , Modelers: elena.farhadi@state.co.us and david.craft@state.co.us

7. Have the assumptions regarding project alternatives to be modeled been determined and documented?

Guidance: All stakeholders should be in agreement about which project alternatives will be considered in the traffic analysis.

Process: For corridor projects, consider reasonable lane configurations that may be constructed. For intersections, use the Intersection Control Analysis Tool (ICAT) to assess which alternatives should be included in the traffic analysis. Review CDOT's Traffic Analysis and Forecasting Guidelines for more information.

Documentation: Provide a description of alternatives that will be analyzed. If an ICAT was used, provide the printouts of the intersection data, stage 1, costs, and stage 2 sheets for each intersection that will be undergo significant operational or geometric changes within the project area.

SME Contact: Lead: melissa.gende@state.co.us(ICAT), Modelers: elena.farhadi@state.co.us and david.craft@state.co.us

8. Has the regional travel demand model informing demand volumes for this project been reviewed and modified as needed to show the appropriate level of detail for the surrounding roadway network, capacities, and existing and future land uses?

Guidance: Applicable when using macroscopic regional travel demand models or mesoscopic modeling. Regional travel demand models are a key component of forecasting future traffic.

Process: Identify the regional travel demand model that covers the project area and review the model for the model years, roadway links, included projects, traffic analysis zones, and other features relevant to the project. Review CDOT's Traffic Analysis and Forecasting Guidelines for more information.

Documentation: Affirm that that land use has been verified, model is correctly calibrated, and list of modifications made to network for the project. Provide supporting emails, if applicable.

SME Contact: erik.Sabina@state.co.us and scott.ramming@state.co.us

9. Have growth rates been determined and documented for each project alternative to be analyzed?

Guidance: Growth rates that will be applied to existing traffic volumes should be documented for each scenario being analyzed.

Process: Growth rates provided in OTIS may be sufficient for small projects that will significantly impact the roadway capacity or expected demand in the area. For larger projects, utilize a range of data including historical traffic, forecasts from regional travel demand models, and other sources as necessary. Review CDOT's Traffic Analysis and Forecasting Guidelines for more information.

Documentation: Provide growth rates that will be used for the project in the methodology memo, including data sources and calculations to reach the proposed rates.

SME Contact: Regional Travel Demand Models – erik.Sabina@state.co.us, Forecasting Generally – melissa.gende@state.co.us

10. **Have you determined and documented the temporal limits of the data collection (time periods and duration to capture existing demand)?**

    Guidance: This is similar to question 5 regarding the temporal limits to be modeled. If data collection is needed to create the model for the agreed upon temporal limits, document the data collection plan.

    Process: Review CDOT's Traffic Analysis and Forecasting Guidelines for more information.

    Documentation: Provide a list of dates, times, and locations that data will be collected.

    SME Contact: Lead: melissa.gende@state.co.us(ICAT), Modelers: elena.farhadi@state.co.us and david.craft@state.co.us

11. **Is local agency data available?**

    Guidance: Local agencies may have recent data from local studies that can supplement other data collected by CDOT or available from third party data sources.

    Process: Check with your *Region Local Agency Representative* or contact your *Local Agency*.

    Documentation: Provide a brief summary of data available via local agencies including type of data, date data was collected, time period of data collection, and how it will be utilized for the traffic analysis.

    SME Contact: Region Local Agency Staff.

12. **Are third party data sources needed to perform the modeling and analysis?**

    Guidance: Third party data sources can provide a wealth of information to supplement field collected data and should be considered as an alternative to intense data collection for some projects.

    Process: Review CDOT's Traffic Analysis and Forecasting Guidelines for more information. Coordinate with Regional and HQ modeling resources as needed.

    Documentation: If third-party resources are needed, provide a description of data needs and proposed sources for the data.

    SME Contact: Lead: david.craft@state.co.us

13. **Is additional data required to meet the modeling and analysis requirements?**

    Guidance: After reviewing available data from the previous questions, is there anything else that the project team will need for the traffic analysis?

    Process: Review CDOT's Traffic Analysis and Forecasting Guidelines for more information.

    Documentation: Provide a list of additional data needed to perform analysis, including proposed data sources.

    SME Contact: david.craft@state.co.us

14. Has a data collection plan been prepared?

Guidance: Collecting, compiling, verifying, and validating traffic data can be a huge undertaking for even small projects. A data collection plan can help organize the process from delegating tasks to storing data.

Process: Review CDOT's Traffic Analysis and Forecasting Guidelines for more information about created a data collection plan.

Documentation: Provide data collection plan.

SME Contact: Lead: melissa.gende@state.co.us(ICAT), Modelers: elena.farhadi@state.co.us and david.craft@state.co.us

15. Have future open and design year traffic demand volumes for all alternatives to be analyzed been developed, documented, and QC'd for this project?

Guidance: Future traffic forecasts are among the most critical inputs into the analysis of a future condition and should be thoroughly reviewed for accuracy and feasibility.

Process: Check calculations and ensure future traffic volumes are balanced across the analysis limits. Demand volumes may not be capacity constrained but should makes sense given the expected geometric design of the alternative being analyzed. Review CDOT's Traffic Analysis and Forecasting Guidelines for more information.

Documentation: Affirm that traffic forecasts are accurate and feasible per the agreed upon methodology.

SME Contact: Lead: melissa.gende@state.co.us(ICAT), Modelers: elena.farhadi@state.co.us and david.craft@state.co.us 4

16. Has the collected data been verified and validated?

Guidance: Almost all data that is collected is done so without direct human contact and it is important to review raw data being ingested into a traffic analysis for reasonableness and outlier scenarios.

Process: Review all collected data for accuracy before utilizing them in the analysis. Review CDOT's Traffic Analysis and Forecasting Guidelines for more information.

Documentation: Provide list of data collection locations and include verification/validation status of each.

SME Contact: Lead: melissa.gende@state.co.us(ICAT), Modelers: elena.farhadi@state.co.us and david.craft@state.co.us

17. Have microscopic models been calibrated per established thresholds? (Deliverable)

Guidance: Applicable to existing conditions models if using microscopic or mesoscopic modeling.

Process: Ensure existing condition model outputs are within the acceptable calibration thresholds. Review CDOT's Traffic Analysis and Forecasting Guidelines for more information.

Documentation: Provide documentation that base model meets established calibration targets.

SME Contact: Lead: melissa.gende@state.co.us(ICAT), Modelers: elena.farhadi@state.co.us and

david.craft@state.co.us

18. Has each new or modified intersection been analyzed using the Intersection Control Analysis Tool to recommend intersection alternatives and document preferred build geometry?

Guidance: ICAT should be completed for all intersections that will have significant operational or geometric changes as part of the project, per question 5 of the Level 1 Operations Evaluation. Examples of significant operational changes include changing lane assignments for vehicle movements or restricting a previously allowed movement. Examples of significant geometric changes include adding a turn lane or adding through lanes on any approaches. This process should be completed early in the project modeling process to assess which alternatives will be analyzed at each intersection.

Process: Complete an Intersection Control Analysis Tool (ICAT) workbook for each intersection that will have significant operational or geometric changes as part of the project.

Documentation: Provide the printouts of the intersection data, stage 1, costs, and stage 2 sheets for each intersection that was analyzed.

SME Contact: Lead: melissa.gende@state.co.us(ICAT)

SAFETY EVALUATION QUESTION GUIDE
LEVEL 2

1. Was a Safety Assessment Report generated?

Guidance:: A Safety Assessment Report provides an in-depth analysis of safety issues and mitigation strategies within a project area over and above analysis required for a Level 1 Safety Analysis. The report should contain a thorough review of crash data to assess crash causality, suggest applicable countermeasures, and recommend improvements based on project budget and scope.

Process: Regions should coordinate with HQ if they believe a Safety Assessment Report is needed on a project. Contact the *HQ Safety Programs, Data, and Analysis Unit* (contact: David Swenka).

Documentation: If yes, upload the report to the web tool.

SME: david.swenka@state.co.us

2. Was Data Driven Safety Analysis (e.g., Predictive Crash Analysis) generated?

Guidance: A predictive analysis involves calculating the expected number of crashes in the future at a specific location based on geometric and operational characteristics. A predictive analysis is most typical for projects where an Environmental Assessment is required, when comparing alternative designs, or may be required when applying for a design exception variance.

Process: This task is typically assigned to a consultant and HQ is available to assist Regions in this task. Contact the *HQ Safety Programs, Data, and Analysis Unit* (contact: David Swenka).

Documentation: If yes, upload the supporting safety analysis to the web tool.

SME: david.swenka@state.co.us

3. Was CDOT Form 464 (Design Variance) generated?

Guidance: In the geometric design of highway projects there are certain design values that are prescribed in the CDOT Roadway Design Guide and the AASHTO A Policy for Geometric Design of Highways and Streets (Green Book) that have been determined to be par amount to a properly designed highway. When it is determined that it is not practical for these design values to be met, documented justification must be submitted and approval must be obtained for inclusion in the design plans. Section 1.4 PERFORMANCE BASED PRACTICAL DESIGN in the CDOT Roadway Design Guide covers design variances

Process: Check with *Region Project Manager* or *Resident Engineer*. Fill out a CDOT Form 464 for each design variance that is implemented on the project and in the project construction specifications and plan.

Documentation: If yes, upload each form to the web tool.

SME: The CDOT designer should contact their Region Traffic Representative and reach out to the Design Area Engineer as early in project lifecycle as possible to begin PBPD coordination. For any safety analysis for design variables or performance based practical design, reach out to your Region Traffic Representative or david.swenka@state.co.us.