NEW HAMPSHIRE DOT WORKSHOP SUMMARY

Improving Business Processes for More Effective Transportation Systems Management and Operations (TSMO) in Road Weather Management

Prepared by: Athey Creek Consultants

Overview of Document

This document provides a summary of the workshop on "Improving Business Processes for More Effective Transportation Systems Management and Operations (TSMO) in Road Weather Management" conducted for the New Hampshire Department of Transportation (DOT) on July 11, 2018 in Concord, New Hampshire. The workshop educated participants about the importance of TSMO business processes and featured several tools and resources stemming from the Second Strategic Highway Research Program's (SHRP2) Reliability[1] emphasis area.

The workshop focused on road weather management, and attendees worked together to develop a business process for the Transportation Management Center (TMC) Storm Desk. It was sponsored by the USDOT Federal Highway Administration (FHWA) and delivered by an American Association of State Highway and Transportation Officials (AASHTO) team that included Athey Creek Consultants.

This Workshop Summary includes the following sections:

- Proposed Action Items for New Hampshire DOT – Actions that New Hampshire DOT may consider pursuing to enhance existing practices and refine the business process developed during the workshop for the TMC Storm Desk.
- Business Processes and Application to TSMO – Definitions of key terms and a brief summary of background information presented during the workshop.
- Resources and Tools to Improve TSMO Business Processes – Overview of a seven-step approach and available tools and resources to support business process improvement.
- New Hampshire DOT Business Process Improvement for Road Weather Management – Summary of participant discussion during the workshop and the Business Process Diagram for the New Hampshire DOT TMC Storm Desk developed during the workshop.
- Appendices of Supporting Materials:
  - Appendix A: Workshop Participant List – Name, role, and contact information of participants.
  - Appendix B: Workshop Agenda – Order and structure of activities conducted at the workshop.
  - Appendix C: E-tool Discussion Guide Output – Log of inputs to the *E-tool for Business Processes to Improve Travel Time Reliability*[2], as provided by participants during the workshop, to step through their specific business process improvement.

[1] For more information on SHRP2 Solutions for Reliability, see: https://www.fhwa.dot.gov/goshrp2/Solutions/Reliability/List.

[2] *E-Tool for Business Processes to Improve Travel Time Reliability* (FHWA). www.ops.fhwa.dot.gov/plan4ops/focus_areas/organizing_for_op/shrp2_le34_etool.htm

Proposed Action Items for New Hampshire DOT

The following action items are largely derived from the Business Process Diagram for the New Hampshire DOT TMC Storm Desk (See Figure 3) developed during the workshop to support its implementation for the 2018-2019 winter season, and institutionalization.

1. **Develop supporting protocols for the TMC Storm Desk business process.** This includes developing, finalizing, and, as necessary, securing approval of the following:
   - A standard operating procedure with identified roles and responsibilities for the developed business process, including identified Storm Desk needs within Web Emergency Operations Center (EOC) and Compass, the NHDOT Advanced Traffic Management System (ATMS).
   - A decision tree to help identify trigger points for activating the TMC Storm Desk for both winter and non-winter weather events. This can help to clarify the role of the Storm Desk versus activating an extra operator in the TMC during storm events. Discussions with the Massachusetts DOT (MassDOT) may be helpful to understand their Storm Desk process.
   - A background guide for establishing the Storm Desk that includes the original purpose, goals and objectives, what has worked, and what has not worked.
2. **Complete related activities that support the TMC Storm Desk.** These activities are external to the business process, but will help to streamline the activities conducted by the TMC Storm Desk:
   - Examine options for staffing the TMC Storm Desk, including identifying specific activities that could be accomplished by staff from the TMC or the Districts with minimal cross-training or routine experience with those activities.
   - Identify and implement modifications for Compass to streamline reporting processes, including unique identifiers that can be used to push entered information to Web EOC.
   - Examine whether the Storm Desk can receive funding when a disaster is declared as part of emergency protective measures. Note that this would exclude reimbursement for regularly scheduled employees. Note that funding for the Storm Desk would not fall under any applicable funding category from FHWA.
   - Discuss agency needs and examine the best strategy for obtaining and using weather forecasts, including a discussion about whether all three forecasts currently used are necessary.
   - Discussion with DTN forecasters, NHDOT's private sector weather service provider, may help to make consistent criteria and more automated processes to support the Storm Desk.
3. **Share this business process and secure ongoing buy-in from the champion, management, and involved stakeholders.** Provide justification for the developed Storm Desk business process and present it to a variety of audiences as described below:
   - Link the developed business process to NHDOT goals and provide monthly activity measures.
   - Present the developed TMC Storm Desk business process at an Executive Briefing.
   - Meet with the NHDOT Commissioner to discuss the Storm Desk business process, confirm expectations, and discuss resources. Consider presenting alternate approaches for implementing the Storm Desk based on different weather scenarios and/or resource levels.
   - Conduct a management review and present the business process to other internal and external stakeholders. This will help to secure their buy-in, address their needs, and help justify the business process.
   - Review TMC Storm Desk processes with involved staff in a pre-season / annual refresher training course. The annual fall Technical Communications Conference with maintenance supervisors and NHDOT District staff is a potential venue.

- Conduct an after-action review after every winter season to identify improvements to the TMC Storm Desk business process.

Business Processes and Application to TSMO

The term **Business Process** is defined in several SHRP2 Reliability products as *"a series of actions or activities that result in a specific or desired outcome to accomplish a specific organizational goal."*

Attributes of Business Processes include:

- A set of structured actions that, once completed, result in a desired outcome to accomplish a specific goal
- Activities performed in a specific sequence, with defined inputs and output(s) – structured workflow
- Process that adds value
- Continued focus on re-engineering processes to improve efficiency

In the context of TSMO, business processes refer to activities such as planning, programming, project development, standard operating procedures, training, human resource management, and agreements. Figure 1 shows examples of management, operational, and supporting processes to support TSMO.

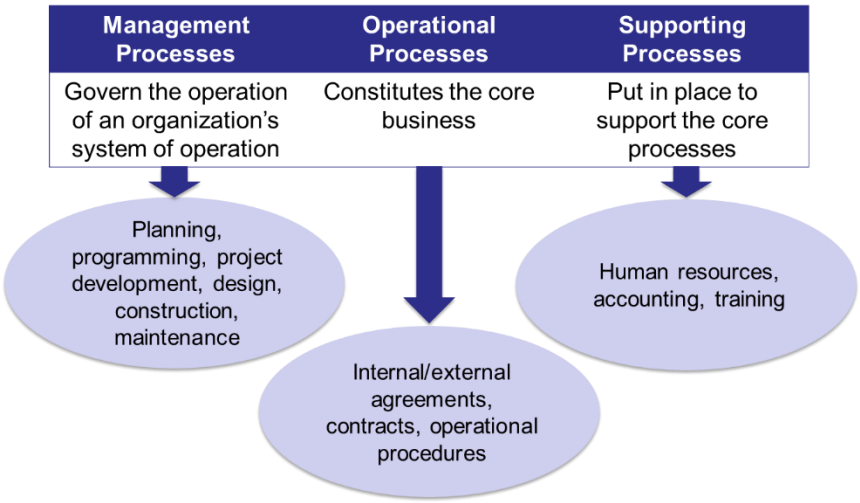


Figure 1. TSMO Business Processes

The SHRP2 "Businesses Processes for Reliability" effort has focused on how business processes can improve TSMO, where TSMO is defined as "integrated strategies to optimize the performance of existing infrastructure through the implementation of multimodal and intermodal, cross-jurisdictional systems, services, and projects designed to preserve capacity and improve security, safety, and reliability of the transportation system management."[3] Examples of these TSMO strategies include incident management, road weather management, planned special event management, work zone management, and traffic management.

[3] As defined in *Moving Ahead for Progress in the 21st Century* [MAP-21] (Federal Highway Administration [FHWA], 2012)

Business Process Mapping is a visual representation of the steps, connections, information flows, and responsibilities involved in a business process from start to finish. Business process mapping provides a concise picture of the sequences of tasks needed to bring a service from genesis to completion, including decision points in the process, when the process takes place, why it takes place, who is involved in the process and responsible for decisions. A good business process map can be validated (that is, represents reality) and can help stakeholders identify where delays exist, where smooth handoffs are not taking place, and what steps may be eliminated so as to improve processes.

Resources and Tools to Improve TSMO Business Processes

The seven-step approach described in this section and shown in Figure 2 was used during the second half of the workshop to help practitioners define and evaluate and improve a specific business process, and to capture key action items. The seven-step approach is summarized as follows:

- **Step 1: Influences.** At some point, it becomes apparent that a business process needs to be improved. The catalyst for action can be top down, event driven, or needs based. Examples of such influences for action are directives from senior management or elected officials (top down), a significant natural disaster that exposes gaps in current agency processes or response plans (event driven), or a recognized need for the improvement from a grass-roots level (needs based).
- **Step 2: Define Goals.** The second step is to identify, define and input the reliability (and other operations-oriented) goal or goals that the agency can use to measure the effect of the business process implemented. Such goals help focus agency efforts and assist in the development of benchmarks that an agency can use to determine how well the processes are addressing the identified need.
- **Step 3: Identify and Document Current Business Processes.** This step is important to understand an agency's current business processes, identify any missing stakeholders, identify gaps in communications or data flows, and formalize roles and responsibilities to ensure continuity and retention of institutional knowledge. A key element of this step is to develop a visual representation of the operations process – business process mapping – that represents the agency's process.
- **Step 4: Develop/Change and Implement Process.** This step involves identifying areas of improvement and identifying changes to be made to the business process or developing a new process. It likely involves several iterations. The implementation can be formal or informal, depending on the complexity of the process and the agencies involved.
- **Step 5: Assess Process.** Once the new process has been implemented, it is assessed or evaluated against the identified goals. This includes identifying appropriate performance measures (based on the goals developed in Step 2), collecting the necessary data, and comparing the results against pre-implementation conditions as part of a continuous improvement process.
- **Step 6: Document Process.** Once the new business process has been implemented and proven effective, it is important to document the details of the new business process, the details of the evaluation process, benefits, and the roles and responsibilities of the stakeholders. Documentation can be as simple as an interagency agreement or as complex as a multi-volume operations manual.
- **Step 7: Institutionalize Process.** The seventh step of business process integration may consist of adopting operational activities and processes, implementing formal policies, establishing training, or

other actions. Institutionalization requires the buy-in and support of upper management, as well as additional stakeholders who have a vested interest in the outcomes of the business process. This step will have a direct impact on the long-term survival of a process within an organization.

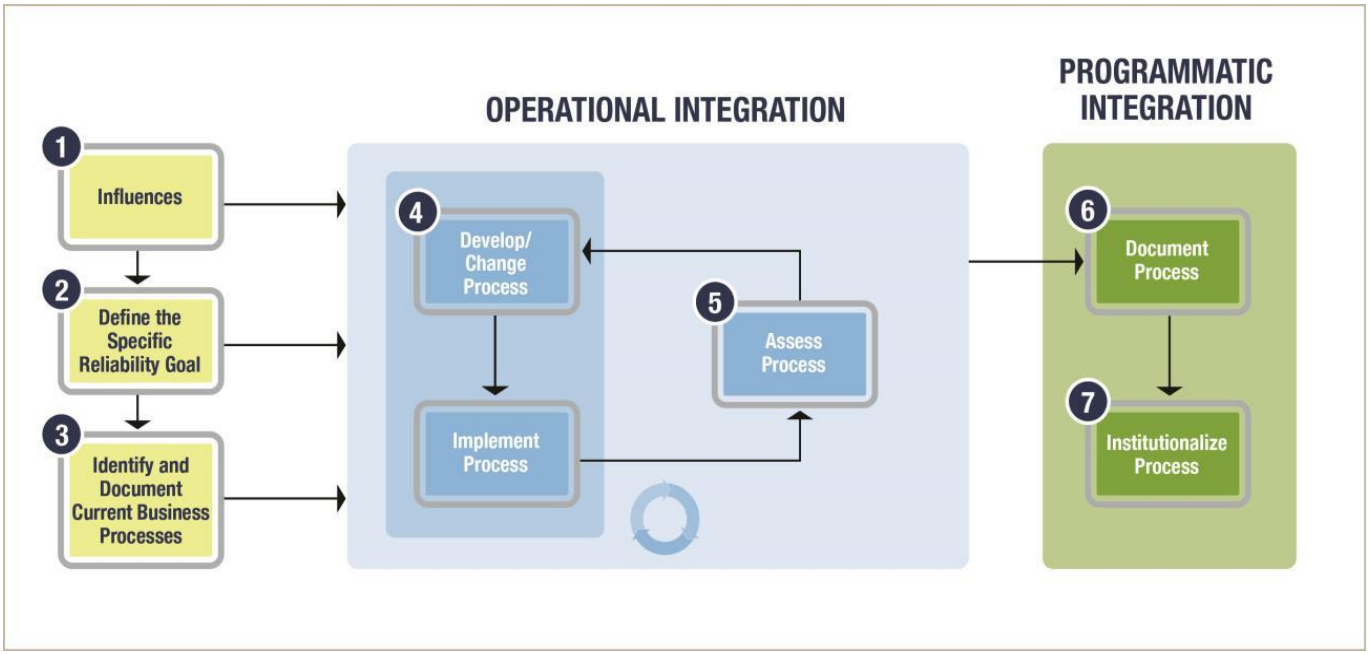


Figure 2. Seven-step approach for business process improvements

Available resources for assisting agencies with improving TSMO business processes include:

- *Primer on Improving Business Processes for More Effective Transportation Systems Management and Operations*, a guidance resource for using the a seven-step approach to improve business processes within traffic incident management, work zone management, planned special events, road weather management, and traffic management. Content includes business process issues, case studies, questions to consider when identifying business process issues, business process challenges, and potential stakeholders. https://ops.fhwa.dot.gov/publications/fhwahop16018/fhwahop16018.pdf.
- *E-tool for Business Processes to Improve Travel Time Reliability,* a downloadable tool for applying the seven-step approach to improve a TSMO business process in a group setting. www.fhwa.dot.gov/goshrp2/Solutions/Available/L06_L01_L31_L34/Organizing_for_Reliability_Tools
- *FHWA Business Process Frameworks to support TSMO*, featuring Capability Maturity Frameworks (CMFs) and supporting documentation for Road Weather Management, Planned Special Events, Traffic Incident Management, Traffic Management, Traffic Signal Management, and Work Zone Management. https://ops.fhwa.dot.gov/tsmoframeworktool/index.htm.

New Hampshire DOT Business Process Improvement for TMC Storm Desk

This section presents a summary of the discussion during the workshop. During introductions, participants provided their personal goals or objectives for the workshop, as follows:

- A defined process on the Storm Desk, what is our role, what is helpful to stakeholders, when should it be initiated, and with what resources and staffing.
- Target areas that are being done well and areas of improvement, what resources we can use, and what resources we need to secure.
- Learn how to make a more efficient Storm Desk.
- Streamline and not duplicate efforts, especially with EOC and TMC during major events.
- Learn anything I can on my first day with NHDOT.
- A more efficient Storm Desk that can interact together with everyone and not against each other.
- Streamline and minimize duplication of efforts that could create errors and inconsistencies.
- See what Storm Desk can provide to help me do my job and how I can help them.
- See impacts to maintenance operation crews.
- Learn about how NHDOT can improve the way they conduct business.
- Improve coordination between EOC and Storm Desk, and gain a better understanding of who has needed information to improve distribution.
- Defining roles and responsibilities to the EOC, DOT, and the public, as well as resources and reporting to the public. Transitioning from legacy systems gives an opportunity to have a statewide Storm Desk that more formally collects and disseminates the information, so formalize this process, define roles and responsibilities, and improve on that.

Current business processes at New Hampshire DOT. An informal poll at beginning of the workshop via Mentimeter® showed that most participants (8) use business processes daily, with some saying they use business processes weekly to monthly (2), on occasion (2), or never (1) at New Hampshire DOT. Additionally, ten participants responded that business processes are very important, and only three responded that they are somewhat important.

Participants identified the following examples of business processes that are currently used or needed:

- Operations on the TMC floor follow an outlined process every day with calls.
- Systems engineering process for procuring intelligent transportation system (ITS) products.
- Meet with partners at Department of Safety (DOS) in a pre-winter meeting, often after the first storm of the season; this sometimes feels late, but it provides a recent event to discuss. During the pre-winter meeting, refresh processes for storm messaging, content of storm messages to post under what conditions, and what messages patrol can ask for. (These are not formally documented.)

Business process improvement background for New Hampshire DOT. Following the presentation of background information regarding business processes and the tools available to assist agencies, Susan Klasen of New Hampshire DOT provided background about the TMC Storm Desk that was initiated for the 2017-2018 winter season. She noted her observations about not knowing when to initiate the Storm Desk, issues with awareness of current information, activities, and storm status, and the need for an improved, more sustainable approach. Susan described difficulties with collecting and documenting information during and after the storm, such as maintenance requests (e.g. slippery roads that need surface treatment) and the dynamic message sign (DMS) messages that were requested and when they were

posted. The EOC is also interested in the down-postings for speeds.

Specific discussion items and inputs relating to current and proposed TMC Storm Desk activities included:

- *Current processes*.
  - The TMC Storm Desk documents and monitors crashes, TMC statuses, and event-related actions and information, and also responds to requests. The TMC Storm Desk collaborates with operators in the TMC, captures data into a clean summary document that is shared with stakeholders, is the single point of contact for the media and Districts, and works to communicate information to the public.
  - NHDOT Districts and NH State Police will call the TMC Storm Desk to report wires down on the roadway, or operators may pass along this type of information. The established protocol is to document the location, cross street, trees, and other relevant information and then notify utilities via phone. Unitil, a regional utility company, has a system to enter information via an online application, and NHDOT is working to coordinate with the Public Utilities Commission (PUC).
  - The TMC Storm Desk is typically busy for the first several hours to get everything up and running, and tracking closures.
  - Weather forecast updates are received through a DTN website dashboard and logged by the TMC Storm Desk, and then disseminated to a distribution list of stakeholders. An internal log is distributed to stakeholders; TMC staff will sometimes modify the format but not the content. NHDOT always initiates communication with DTN: staff look at current forecasts, identify approaching inclement weather, contacts DTN online, receives a response within 10-15 minutes, and then considers activating the Storm Desk.
  - The TMC Storm Desk provides the current status of road closures, conditions, and speeds when the public information officer (PIO) requests the information.
  - Flex hours and staffing are possible at the TMC based on weather conditions, as available. In the summer, staff are not doing as much road condition reporting, message boards, and other functions. The shift supervisor should know answers to questions about incidents and other information for summer events. During less impactful storms and when adequately staffed, the TMC performs the role of the Storm Desk. It is primarily when the rate of activities is high enough compared to the available staff in the TMC that the Storm Desk is most needed to help maintain an overarching view of storm-related activities and information.
- *Stakeholders* include Homeland Security Emergency Management – ESF-5; Executive Office; Public; Highway Maintenance; Turnpike Bureau; Media; Utilities; FHWA; local emergency responders, police departments, fire departments, and Bureaus of Public Works; state police; tourism; and weather service providers. The executive office, Commissioner's office, and governor's office were also identified as stakeholders, as well as NHDOT District staff, who need to know the current status when they arrive in the morning after the TMC has handled the night shift.
- *Activation.* Prefer TMC to have a year-round function for the TMC Storm Desk, because non-winter weather such as wind events in the summer place high demands on the TMC, especially since the Districts are not open overnight. Potential weather events include heavy snow, ice secretion, high winds/gusts, and visibility events. One parameter could be the number of crews, e.g., open the Storm Desk if 75% of crews are active, which would be different for non-winter events. However, there is not a lot to do during large-scale, high accumulation winter events. The first three hours is biggest lift because forecasts provide sufficient advanced notice for public to respond, so the TMC Storm Desk is not required at all times. Smaller events or high winds could require more time and resources. As one example, the EOC typically looks at ice accumulation and will open if more than ¼" is predicted, e.g. EOC looks at moisture content because that matters more than heavy volume. For non-winter storms, weather service warnings could be considered. However, then a time threshold might be required,

e.g., if the warning is only for 45 minutes. Other DTN states have specific criteria to elevate to an active warning state, e.g., accumulating snow, re-freeze, flooding, tropical storms, with parameters based on road condition and sub-parameters below that. These agencies conduct an annual review to assess whether their parameters are still relevant or need to be modified.

- *Summer weather events.* Eventually, the TMC Storm Desk will populate the road closure database in the summer. This function has not been moved from the Districts to the TMC. When the EOC is open for a summer weather event, the TMC Storm Desk can be activated. If the EOC is not open, staffing needs may vary as there are different capability requirements for entering road closures or contacting utilities. For other major summer events, the TMC staffs accordingly. For non-winter events, District offices are not open 24/7, and no-notice events are challenging because it takes time to initiate activities, which makes staff feel behind before getting started.
- *Staffing.* Compass is not easy to use for only a few hours every couple months. Note that Compass is the New Hampshire DOT ATMS and provides field status, device status, and road closure information. Sometimes there are not enough staff available with sufficient training (e.g., with Compass) to perform all duties required by the Storm Desk and statewide TMC operations. District offices could be asked to open and provide staffing during a major weather event, if they have staff available to cover the statewide TMC when part time staff are maxed out. District staff could help at the statewide TMC by fielding calls that come into the Storm Desk, but not events. If the EOC is open, the District offices are responsible for entering closures into the road closure database and bring staff in. The Storm Desk could enter closures instead of District offices, but is not current protocol. Current protocol is to enter information into Web EOC and then notify the TMC. NHDOT is transitioning to have information that is entered into Compass pushed to Web EOC to facilitate this process; Web EOC will continue to receive road closure information. Currently this information is duplicated as TMC staff enter this information into Compass and Web EOC. When District offices are open, they enter it into Web EOC and call the TMC to enter it into Compass.
- *Available data and information.* The TMC Storm Desk becomes the overall shift supervisor and is required to know everything that is happening.
    - *Weather and pavement forecasts.* NHDOT has worked with DTN for 20 years, and technology has improved with road weather information systems (RWIS) and apps. Winter maintenance specialists get maintenance decision support system (MDSS) pavement forecast outputs and National Weather Service (NWS) weather forecasts in addition to DTN weather information. The TMC receives all forecasts but does not want multiple reports to affect decision making. A comparison was made with MDSS pavement forecasts and DTN forecasts, and DTN information was more accurate. Last winter, the NWS had great forecasts and packages with very useful information. NHDOT receives three different forecasts now, and all of the forecasts are very accurate. There was a historic need to have these different sources because they were not always great forecasts. NHDOT staff should discuss agency needs and examine how to use these forecasts and whether all three forecasts are necessary.
    - *RWIS.* The TMC Storm Desk or a TMC operator monitors RWIS devices in the field before the storm for uptime/downtime reliability to check that these devices are operational. Maintenance staff are notified to address any outages, then the TMC Storm Desk monitors these devices and available information during the storm. RWIS feeds are provided to help push information to DMS and cameras are used as available to verify conditions.
    - *Crashes.* The TMC Storm Desk reaches out to state police headquarters to get an idea of crashes that are occurring around the state. The state police query their CAD system to identify the number of crashes within an identified time period. State police have many more crash reports than NHDOT as many incidents do not require DOT assistance. NHDOT needs to have a regular

frequency report indicating how many crashes have occurred.
  - *Impacts to schools.* If schools are not being cancelled, NHDOT knows there is a high probability that plow drivers will need to be called in early at 4am to clear roads in enough time for buses to run prior to school opening times. Schools also need to look at the long-term to make sure students can get home.
  - *Road conditions and closure status.* The TMC Storm Desk monitors road closures and communicates with District offices, as necessary. TMC operators receive closure information and enter it. The TMC Storm Desk requires operators to yell out closures, monitor the event summary, and make updates within Compass. If the EOC is open, road closures are easy to manage in Web EOC. Web EOC helps with road conditions, as well as main artery closures that impact evacuations, safety facilities, vulnerable populations, and utility access to key nodes.
  - *Vehicle locations.* The Bureau of Traffic uses GPS devices in their vehicles and some plow trucks have live AVL information on a map.
  - *Pole outages and wires down.* The TMC Storm Desk monitors pole outages and contacts utilities. An event indicating "wires down" is not included in Compass, even though it is an obstruction and should be. There are planned enhancements for Compass to add unique identifiers for a better linkage between Compass and Web EOC.
  - *Other information.* DMS messages posted; reduced speed areas, i.e., mostly advisory on DMS but also a regulatory variable speed limit (VSL) on I-93; time to bare pavement; personnel status currently active in the field, i.e., 10-1 and 10-2.
- *Summary report.* There is a filtering process within the current log to make selections by District and make comparisons, and to monitor when staff are dispatched or when a downed tree is cleared, for example. This information can also be queried. There is a need for a dashboard for every crew, e.g., traffic, turnpike, and others. The Districts use a magnetic board to do this monitoring. Currently, staff have to manually connect reports for 10-1 and 10-2 in Compass, and automating this process could be a potential enhancement.
  - Compiling the log with reduced speeds on VSLs and District activities is a manual effort. Information cannot be queried from the log because of how actions are entered, and separate log entries may be created. Districts are also now doing combined log entries. There may be a way to copy a single entry and change the field and copy into multiple entries for what is queried. A technological solution should exist to simplify this process or change the way that it is entered into the log to make post-event queries more efficient.
- *Document after actions*. The TMC Storm Desk identifies what went wrong and mitigation approaches, including operator actions and situational awareness. This role can be very different depending on who is staffing the TMC Storm Desk. For example, for road condition reporting when there is a change to "difficult", the operator updates the condition in Compass and the TMC Storm Desk monitors to ensure the status reflects current situation. There was a recurring situation where the condition was not accurately changed within the system, so a correction was made and the operator told about their error. However, a system failure was later identified such that the operator actually had entered the status, but it did not remain infinite in the system. In summary, the first instinct was to think it was operator error, but it was actually a system error. Other errors regarding DMS messages have been identified.

7-step E-Tool approach for TMC Storm Desk. Nex, the workshop shifted to interactive sessions focused on improving the business process for the NHDOT TMC Storm Desk. Workshop participants walked through the 7-step approach as a group to begin thinking about the development, implementation, and institutionalization of the process. This section summarizes the inputs provided by the group, while the

full E-tool Discussion Guide Output from this exercise is in a later section of this document.

Step 1 – Identify Influences. The group identified the impetus for developing this business process as top down. Specifically, the NHDOT Commissioner required the TMC to establish a Storm Desk. Limited direction was given, but a need was recognized for the Storm Desk to have a full picture of ongoing activities during major weather events. There was a need for a central, additional resource to alleviate the extra tasks that operators complete during storms. Tasks that are related specifically to the storm can be done by the Storm Desk to help relieve operators.

In October 2017, a weather event occurred where the TMC was behind in entering road closure information. About 500 calls were received at the TMC from the public and media. The EOC was open, but the TMC was not able to enter information into Web EOC since it was not yet entered into Compass. The Storm Desk is not just for when the EOC is open, but a duty officer to the EOC is available for all non-business hours to coordinate information exchange with NHDOT on smaller and local events that may not be on the EOC level.

Step 2 – Define Goals. Participants defined the following as possible goals for this process improvement:

- The overall goal is to have a central location where information is contained and communicated to stakeholders, and to relieve burden on TMC operators during major weather events. A specific goal to improve the process is to identify when to activate the Storm Desk, staffing, and the roles and responsibilities.
- A goal is for NHDOT to know the condition of infrastructure and share that condition information internally with the NHDOT and other state agencies, primarily through the EOC, and externally to the public. The way information is collected now on a 24/7 basis is through the TMC and TMC operators, but for major events that overwhelm the TMC operators, the 6 NHDOT Districts will open their District offices to collect and share information with the EOC. Because the TMC and District Offices lack resources, these activities cannot be completed effectively. The TMC Storm Desk is to help relieve the TMC and provide a bridge when the District offices are open, and then assimilate information for the NHDOT, share with the NHDOT representative with the EOC, and continue to make sure information is being pushed to the public and stays current.
- Another goal is to identify sufficient staffing resources. At one time, some staff were cross-trained to help with major events. Since Compass is not easy to learn, some functions of the Storm Desk such as calling utility companies might be better suited for supplemental staff to conduct. That is, it takes a long time to notify utilities, including identifying the correct utility company and pole number, and the Storm Desk does that to relieve the operators who have other activities.

Step 3 – Identify the Business Process. Participants considered winter weather events, as well as other weather scenarios such as high winds during a large group discussion in the afternoon session for developing a business process. Much of the Current business processes at New Hampshire DOT related to the TMC Storm Desk were discussed earlier in this workshop and described in this document above, so this step focused on formalizing that process. For the mapping exercise, participants collaboratively developed a business process map for the Storm Desk. Specifically, participants considered the following questions during process mapping:

1. Identify Major Weather Event and Activate Storm Desk
   - When will the Storm Desk be activated? De-activated?
2. Gather Information from Field Personnel and ITS Devices

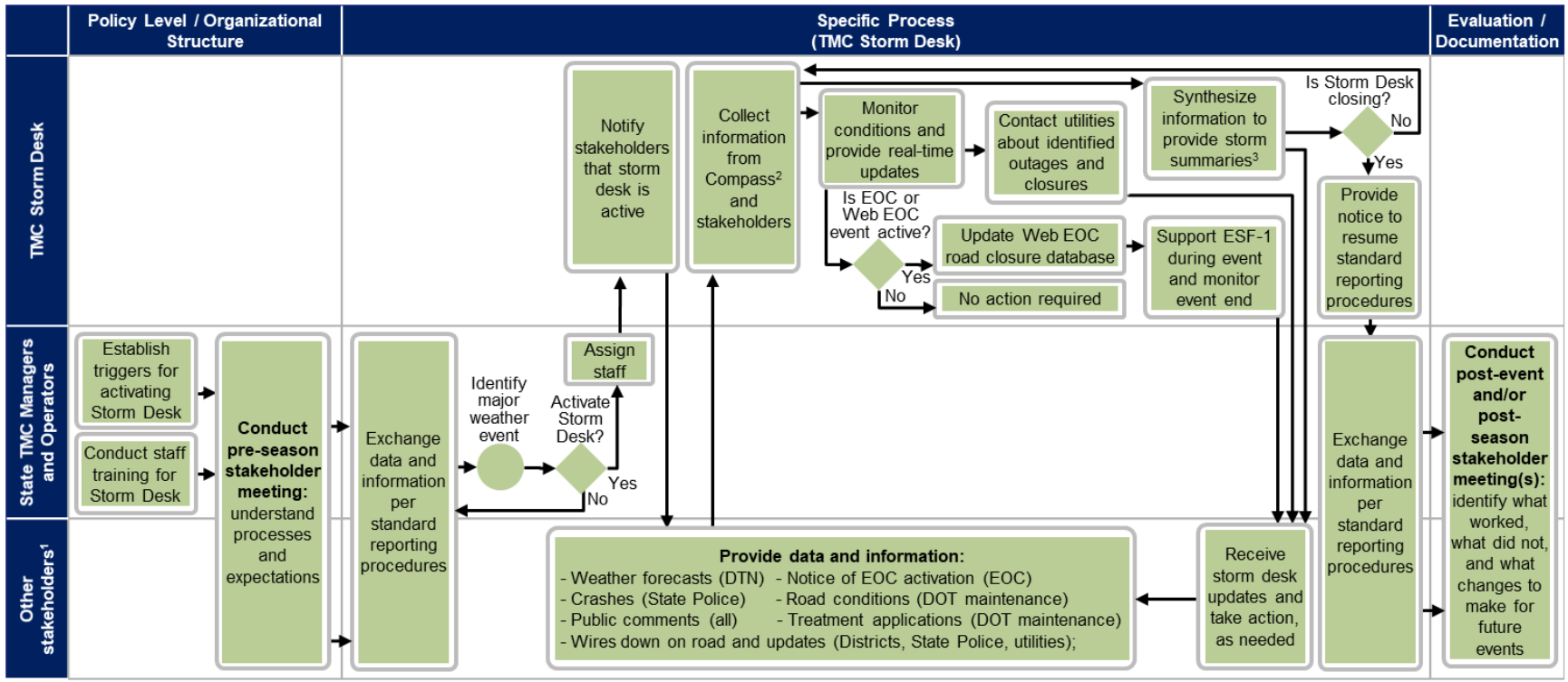
  - What information is gathered into the Storm Desk? (e.g. road conditions, weather conditions, incidents, etc.)
  - How is it communicated to the Storm Desk?

3. Notify Internal and External Stakeholders
   - What type of data/info is required?
   - What communication method should be used to disseminate information?
   - When (at what intervals) should information be disseminated?
   - To whom is the information disseminated (single points of contact)?
   - Interactions with DOT public information officer and media – who feeds what to the public?

4. Interact with Emergency Operations Center (when activated)
   - What coordinated actions are required?
     - Between ESF-I or HSEM direct
   - Monitoring and maintenance of Web-EOC Road Closures
     - Is this the responsibility of only the TMC or the District offices as well?

The Business Process Diagram for the New Hampshire DOT TMC Storm Desk in Figure 3 reflects the business process and supporting interactions as suggested by workshop participants during the workshop, developed by the AASHTO team following the workshop. The TMC Storm Desk is activated during a major weather event to provide a comprehensive statewide view and allow TMC operators to focus on individual events and interact with NHDOT Districts.

- At the far left, thresholds are established for activating the Storm Desk. At least once annually or before the winter season, a stakeholder meeting is conducted so that all entities understand the processes, roles, and responsibilities during a major weather event.
- When activated, the Storm Desk receives information from stakeholders and systems to monitor conditions. Updates are provided to stakeholders as needed and also periodically as storm summaries that include detailed information on messaging, closures, and forecasts.
- Finally, stakeholder meetings are conducted after events, after the winter season, or both to discuss lessons learned and identify ways to enhance the business process for future weather events.



1) Other stakeholders include DOT maintenance staff, emergency managers, utilities, weather service providers, law enforcement, and the public.
2) Compass is the New Hampshire DOT Advanced Transportation Management System and provides field status, device status, and road closure information.
3) Provide an initial summary, periodic updates, and final summary with the weather forecast, Storm Desk schedule, and operations and closure updates.

Figure 3. Business Process Diagram for the New Hampshire DOT TMC Storm Desk

Step 4 - Develop and Implement the Process. In order to implement a new road weather management business process for the TMC Storm Desk, the group felt the following were important considerations to increase awareness and further enhance this business process.

- Develop, finalize, and seek approval of a decision tree identifying when to activate the Storm Desk.
- Management review of the developed TMC Storm Desk business process.
- Meet with the Commissioner to discuss the TMC Storm Desk business process, confirm expectations, and discuss resources.
- Consider presenting alternate approaches for the TMC Storm Desk based on different weather scenarios and/or resource levels.
- The expected timeframe for implementing this business process is in time for the 2018-2019 winter season.
- Engage MassDOT to understand their Storm Desk.
- Talk through these processes and New Hampshire criteria with DTN forecaster to make consistent and more automated processes.

Step 5 – Assess the Process. Participants identified the following as ways to assess the newly developed business process:

- Track and monitor dissemination frequency performance. For example, are defined requirements for dissemination being met, such as storm summaries every two hours?
- Conduct a survey of TMC Storm Desk mailing list recipients about whether storm summaries are meeting their needs.

Step 6 - Document the Process. Several places to document the new business process were identified:

- Create a standard operating procedure with identified roles and responsibilities for the developed business process.
- Review the TMC Storm Desk processes with staff in a pre-season / annual refresher training course.
- Document a background guide for establishing the Storm Desk, what worked and what did not.
- Meet annually with maintenance supervisors during the TMC communications conference in fall with NHDOT District staff to discuss the TMC Storm Desk business process.
- Conduct an after-action review after every winter season to identify improvements to the TMC Storm Desk business process.
- Identify Storm Desk needs within Web EOC and Compass.

Step 7 – Institutionalize the Process. The group identified the following as potential ways to institutionalize the new business process:

- Present the developed business process at the Executive Briefing.
- Present the developed business process at the Technical Communications conference.
- Talk to the NHDOT Districts about the developed business process.
- Tie the developed business process to NHDOT goals and provide monthly activity measures.
- Identify stakeholders, both internal and external, to help justify the developed business process.

Appendix A: New Hampshire DOT Workshop Participant List

Improving Business Processes for More Effective Transportation Systems Management and Operations (TSMO), July 11, 2018

	Name	Organization/Agency	Position Title or Area (e.g. District, TMC Operations, State Maintenance)	Email address
1.	Susan Klasen	NHDOT / TSMO Bureau	Bureau Administrator	Susan.Klasen@dot.nh.gov
2.	Nicholas King	NHDOT / TSMO Bureau	TMC Operations Supervisor	Nicholas.King@dot.nh.gov
3.	Curtis Chamberlin	NHDOT / TSMO Bureau		Curtis.Chamberlin@dot.nh.gov
4.	Charles Blackman	NHDOT / TSMO Bureau		Charles.Blackman@dot.nh.gov
5.	Michael Servetas	NHDOT / Commissioners Office	Asst. Director of Operations	Michael.Servetas@dot.nh.gov
6.	Caleb Dobbins	NHDOT / Highway Maintenance	Maintenance Engineer	Caleb.Dobbins@dot.nh.gov
7.	Mark Kirouac (ESF-I)	NHDOT / Highway Maintenance	Asst. Maintenance Engineer	Mark.Kirouac@dot.nh.gov
8.	John Corcoran (ESF-I)	NHDOT / Turnpike Bureau	Bureau Administrator	John.Corcoran@dot.nh.gov
9.	Dix Bailey	NHDOT / Turnpike Bureau	Maintenance Superintendent	Dix.Bailey@dot.nh.gov
10.	Gary Clifford	NHDOT / District 5		Gary.Clifford@dot.nh.gov
11.	Roger Appleton	NHDOT		Roger.Appleton@dot.nh.gov
12.	David Rodrigue	NHDOT	Director of Operations	Dave.Rodrigue@dot.nh.gov
13.	Bob Christensen	NH DOS / HSEM	Operations Section Chief	Robert.Christensen@dos.nh.gov
14.	Jeffrey Ladieu (Lieutenant)	NH DOS / SP HQ	Commander, HQ Communications	Jeffrey.Ladieu@dos.nh.gov
15.	Robert Bollinger	FHWA Operations – NH Division		Robert.bollinger@dot.gov
16.	Shawn Truelson	DTN	Transportation Account Manager	Shawn.Truelson@dtn.com
17.	Roemer Alfelor	FHWA Road Weather Program		Roemer.Alfelor@dot.gov
18.	Pam Hutton	AASHTO		phutton@aashto.org
19.	Dean Deeter	AASHTO/Athey Creek		deeter@acconsultants.org
20.	Jeremy Schroeder	AASHTO/Athey Creek		schroeder@acconsultants.org

Appendix B: Workshop Agenda



Photos Courtesy of FHWA and New Hampshire DOT

Agenda
Improving Business Processes for More Effective Transportation Systems Management and Operations (TSMO)

Business Processes for Road Weather Management
TMC Storm Desk

New Hampshire Department of Transportation
Incident Planning and Operations Center, New Hampshire DOT
110 Smokey Bear Blvd., Concord, NH 03301
IPOC Media Room
July 11, 2018
8:30 AM – 4:00 PM

8:30 – 9:00 AM	**Welcome and Introductions** • Welcome • Purpose of Workshop and Agenda Overview • Background on SHRP2 and Reliability Research • Self-introductions and Interests	**Susan Klasen, NHDOT** **Roemer Alfelor, FHWA** **Pam Hutton, AASHTO** **Self-introductions by All**

9:00 – 10:00 AM	**Business Processes and Application to TSMO**
	• Overview of Business Processes
	• Business Process Mapping
	• Application to TSMO and Road Weather Management
	  ○ Discussion: What business processes do you use in your work?
	• Tools for Developing Business Processes
	  ○ Capability Maturity Frameworks, Primer, E-tool
		Dean Deeter and Jeremy Schroeder, Athey Creek
		Discussion by All

10:00 – 10:15 AM	**Break**	
10:15 – 10:30 AM	**Improving Business Processes** • Preparing for Business Process Improvement • 7-Step Approach	**Athey Creek**

10:30 – 11:30 AM	**Process for Operating the TMC Storm Desk**
	• Background on TMC Storm Desk
	  – History and Major Components of Storm Desk
	• Influences, Goals, Current Storm Desk Process
	• Develop TMC Storm Desk Process
	  – Who are the stakeholders?
	  – What data/info is required from the Storm Desk?
	  – Identifying a major weather event
		Susan Klasen
		Facilitated by Athey Creek
		Input and Discussion by All

11:30 AM – 12:00 PM	**Lunch** (on-site)	
12:00 – 1:30 PM	**Business Process Mapping Exercise** • Small Group Breakouts – Focus on process steps: Activating/de-activating the storm desk, gathering data/info into storm desk, notifying stakeholders during storm desk operations, and interactions with Emergency Ops Center • Re-convene and Report Out • Mini-Break and/or Small Group Discussion	**All**
1:30 – 2:15 PM	**First Iteration of Process Map for TMC Storm Desk** • Confirm Roles and Responsibilities: Storm Desk, District Offices, TMC Operators, Single Points of Contact (POCs), Emergency Operations Center	**All**
2:15 – 2:30 PM	**Break**	
2:30 – 3:00 PM	**Looking Ahead** • Continue 7-step Approach: Implement, Assess, Document, Institutionalize the Process	**All**
3:00 – 3:45 PM	**Action Planning** • Small Group Breakouts • Groups Report Out • Discussion and Documentation of Actions	**All**
3:45 – 4:00 PM	**Applying What You've Learned and Next Steps** • Additional Business Process Improvements for Road Weather Management • Workshop Evaluation • Closing Comments	**Input and Discussion by All** **Susan Klasen**

Appendix C: E-tool Discussion Guide Output

Report for Project: New Hampshire DOT TMC Storm Desk

Type of process assessed: **Weather Management**

Case study best matching process: **Case Study 8: I-80 Winter State Line Closures (California and Nevada State Line)**

Type of influence identified: **Top Down**

Influence description: **Commissioner informed TMC to have a Storm Desk. Limited direction was given, but a need was recognized given limited situational awareness to get a full picture of ongoing activities. It was recognized through the events that occurred that there was a need for a central, additional resource to alleviate the additional tasks that operators do during storms. Operators were glad because they are aware of the tasks they need to do. The Storm Desk is not just for when the EOC is open.**

In October, an event occurred where the TMC was behind in entering road closure information – 500 calls were received at the TMC from the public, media. EOC opened, but things were not entered into Web EOC since it was not yet entered into Compass. Learned interactions and available resources.

There is a duty officer to the EOC for all non-business hours to help coordinate information exchange with DOT and small towns on smaller events that may not be EOC level.

Anything related specifically to the storm can be done by the Storm Desk to help relieve operators.

Goals: **Goal is to have a central location where information is contained to help communicate that out, relieve burden on TMC operators. Identify when to activate the Storm Desk, staffing, and the roles and responsibilities.**

TMC Storm Desk does not replace activities, but is intended to be a single source to summarize operator functions to know what is happening statewide. Goal is for NHDOT to know condition of infrastructure and share that condition information internally with the NHDOT and other state agencies, primarily through the EOC, and externally to the public. The way information is collected now on a 24/7 basis is through the TMC and TMC operators, but major events that overwhelm the TMC operators, the 6 NHDOT Districts will open their District offices to collect and share information with the EOC. Because the TMC and District Offices lack resources, these activities cannot be completed effectively. The TMC Storm Desk is to help relieve the TMC and provide a bridge when the Districts open, and then assimilate information for the NHDOT, share with the NHDOT representative with the EOC, and continue to make sure information is being pushed to the public and stays current.

For example, it takes a long time to notify utilities, and the Storm Desk will do that to relieve the operator who has other activities. The utility company wants the pole number, so it is important to have the information, as well as understanding who the correct utility company is.

Information about the status of a specific road closure or how many crews are out.

At one time, some staff were cross-trained to help out with a major event. Compass is not easy to learn, but some functions of the Storm Desk such as calling utility companies might be better suited for this.

Business process model files associated with the process:

Description of existing process: **Currently, respond to requests, document, track – point of contact for media and Districts, monitor crashes and TMC statuses for accuracy (see handout). Storm Desk is busy for first several hours to get everything up and running, and track closures. Capturing data, having a single point of contact, and communicate that information to the public, collaborate with operators on the floor, and capturing the data into a nice clean summary that can be pushed out to stakeholders.**
Districts will call TMC Storm Desk to report wires down, or operators will pass along the information. Calls also come from state police – protocol is to get location, cross street, trees, etc. and then notify utilities. Unitil has a system to enter information via an application. Working to coordinate with PUC Randy Neffer.

DTN weather updates – various forecasts, and receive updates that are logged by the Storm Desk then disseminated to a distribution list to stakeholders. Receiving through a dashboard on the DTN website, communicate online with a 10-15 minute response. Internal log is distributed to stakeholders, sometimes modify format but not the content. NHDOT is always the initiator to DTN – look at current forecasts, identify inclement weather approaching, and reach out to DTN. Then consider activating the Storm Desk.

Winter maintenance specialists also get MDSS outputs and NWS forecasts. TMC receives those other forecasts, but don't want multiple reports to affect decision making. With MDSS and DTN a comparison was made, and noted that DTN was more accurate.

NHDOT has worked with DTN for 20 years, technology has improved with RWIS and apps – used to have Northwinds and others to call meteorologists for detailed information. Last winter, NWS had great forecasts and great packages with very useful information. But we need to talk, because we have three different forecasts – historically, we were not getting great forecasts, but now that we are, we need to talk – the forecasts we've been receiving are very accurate – there was a historic need to have these different sources. NWS does not provide consistent information on storms, only when they're working with… NWS wants to hear that feedback to get the products and information that NHDOT wants.

RWIS monitoring: uptime and available information – uptime/downtime reliability with devices in the field: pre-storm, the Storm Desk checks that these devices are operational – the maintenance staff are notified and can address outages, and then the Storm Desk monitors these devices. Provides RWIS feeds to help push information to DMS and use cameras as available to verify conditions. An operator may do the pre-storm activities depending on staffing and other activities.

Getting an idea of crashes that occurring around the state – when Storm Desk is active, they reach out to state police HQ who query their CAD system to identify number of crashes within an identified time period – many incidents where no DOT assistance is required. State police get a lot more crashes reported than DOT. Initially police were surprised to receive this question, but now it is easy. Need is

for DOT to have a regular frequency report of how many crashes have occurred. If we know schools aren't being cancelled, we know there is a high probability of being called in, and can call in drivers early at 4a to be ahead of the game. Schools also need to look at the long-term to make sure students can get home.

Filtering process within current log that can select District and do comparison – monitor when staff are dispatched and the down tree is cleared. This can now be queried since operations has been modified to accommodate that request. Need a dashboard for every crew – traffic, turnpike, etc. Districts use a magnetic board. Currently have to manually connect reports for 10-1 and 10-2 in Compass, and that could be a potential enhancement.

Bureau of Traffic uses GPS devices in their vehicles. Some plow trucks are live with AVL on a map.

Monitor road closure statuses – communicate with District office as necessary. TMC receive closure information and enter it. Storm Desk requires operators to scream out closures, or monitor event summary and then update it on their own within Compass.

Coordinate with PIO – when PIO calls, Storm Desk provides all current statuses of road closures, conditions, and speed statuses.

Storm desk is required to know everything happening – becomes overall shift supervisor. Document after actions, what went wrong and mitigation – monitor operator actions and situational awareness. This role can be very different depending on who is staffing the Storm Desk. Do road condition reporting, notify a change to "difficult" – operator updates the condition in Compass, Storm Desk monitors to ensure it reflects current situation, may see that the condition was not accurately changed – either make the correction themselves or alert the operator. Identified system failures – would be entered, but it would not remain infinite – first instinct was to think operator error, but it was an error within the system. Identified other errors regarding DMS messages. The roles for the TMC and department determine the person who is able to staff the Storm Desk.

Operational Integration Iteration 1: ***Who are the stakeholders?*** **Homeland Security Emergency Management – ESF-5; Executive Office; Public; Highway Maintenance; Turnpike Bureau; Media; Utilities; FHWA; local emergency PDs, fire depts, BPWs; state police; tourism; weather service providers.**
When will the Storm Desk be activated and de-activated? **One parameter is number of crews – e.g., if 75% of crews are active, should Storm Desk be open? This would be different for non-winter events. Every statewide winter storm, but that is not feasible.**

Other DTN states have specific criteria to elevate to an active warning state. E.g., accumulating snow, re-freeze, flooding, tropical storms – sub-parameters below that, and then parameters based on road condition. Have an annual review to assess whether parameters are still relevant or need to be modified.

For non-winter storms, can look at weather service warnings – is there a time threshold required for that if the warning is only for 45 minutes. Flex hours and staffing at the TMC based on weather, as available. In summer, not doing road condition reporting, message boards, and other functions. Shift supervisor should know answers to questions about incidents, etc. for summer events.

Winter events: large-scale, high accumulation does not have a lot to do – beginning 3 hours is biggest lift because forecasts provide sufficient advanced notice for public to respond. Smaller events or high winds require more. Storm Desk is not required at all times.

EOC typically looks at ice secretion – if ¼" is predicted, e.g. EOC looks at moisture content – heavy volume or content? The water content matters more.

Heavy snow, ice secretion, high winds/gusts, visibility

Eventually would like Storm Desk to populate the road closure database in the summer – this hasn't been moved from Districts to TMC. When EOC is open for summer event, Storm Desk can open. If EOC is not open, what staffing is needed – to enter road closures or contact utilities are different staff capability requirements. For other major summer events, the TMC staffs accordingly.

EOC staff are the five system administrators = first on deck. Road closures are easy in Web EOC if EOC is open.

Prefer TMC to have a year-round function.

What information is gathered into the Storm Desk? How is communicated to the Storm Desk? **Pole outages for utilities; summary of incidents highway patrol responds to; DMS messages posted; road closures and condition reports; reduced speed areas – mostly advisory on DMS, a regulatory VSL; crashes; time to bare pavement; personnel status – currently active in the field (10-1, 10-2); RWIS data – status and incoming data; weather forecasts; pavement forecasts.**

● Implementation description: **Decision tree of when to activate the Storm Desk needs to be finalized and approved. Management review. Meet with Commissioner to discuss business process for Storm Desk, confirm expectations, and discuss resources. Consider presenting alternate approaches based on different weather scenarios and/or resource levels. Timeframe: implement for 2018-2019 winter season. Engage MassDOT to understand their Storm Desk. Talk through these processes and NH criteria with DTN forecaster to make consistent and more automated processes.**

● Process evaluation description: **Are you meeting defined frequency requirements for dissemination, e.g., storm summaries every 2-hours? Survey if storm summaries are meeting needs.**

Process documentaiton description:
Standard operating procedure with roles and responsibilities
Review processes in a pre-season / annual refresher training course
Document a background guide for establishing the Storm Desk, what worked and what didn't.
Meet annually - with maintenance supervisors, TMC communications conference in fall with Districts
After-action review after every winter season to identify improvements
Identify Storm Desk needs within Web EOC and Compass

Process documentation files:

Process institutionalizing description:

Present at Executive Briefing to Executive Meeting
Technical Communications conference (?)
Talk to Districts
Tie to NHDOT goals, provide monthly activity measures
Identify stakeholders, both internal and external, to help justify process