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# Transportation of Hazardous Materials through Eisenhower-Edwin C Johnson Memorial Tunnel – Study

## Executive Summary

Stantec Consulting Services Inc.

COLORADO
Department of Transportation

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| 16. Abstract<br>Senate Bill (SB) 19-032 required CDOT to conduct a study assessing the feasibility of allowing the transportation of hazardous materials through EJMT and to prepare a study report that includes the findings and recommendations as to whether and under what conditions the transportation of hazmat through the tunnel could be allowed. | | |
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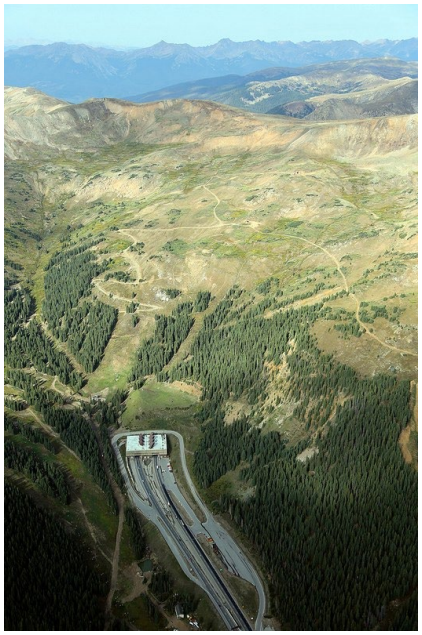
## Executive Summary



The Eisenhower/Johnson Memorial Tunnels (EJMT) are located approximately 60 miles west of Denver, Colorado, on Interstate 70 at an elevation of 11,000 feet. Each tunnel consists of two 8,900-foot-long lanes that carry one-way traffic. The Eisenhower Tunnel carries westbound traffic and the Johnson Tunnel carries eastbound traffic. In current practice, hazardous materials (hazmat) trucks, such as gasoline tankers, are not allowed to pass through EJMT and are routed over Loveland Pass via US Highway 6 (US 6). Loveland Pass is a difficult route, with tight switchbacks and steep grades; it is a route that often must be closed due to snow, which creates even more hazardous driving conditions and avalanche danger. When US 6 must be closed, portal attendants close EJMT to normal traffic and allow hazmat vehicles to enter EJMT once per hour.

The transport of hazmat using US 6 and I-70 is complicated by balancing the low probabilities of some of the events that concern CDOT and the public (such as major fires, explosions, and environmental catastrophes) with the daily need for the safe transport of people, energy, and chemicals that facilitate Colorado's economy.

Per Senate Bill (SB) 19-032, Colorado Deportment of Transportation (CDOT) obtained the services of the Stantec Consulting Services Inc. risk assessment team to study whether and under what circumstances hazmat should be allowed in EJMT, compared to the risk of these vehicles traveling over Loveland Pass.

The international team, which consisted of risk analysis experts, tunnel specialists, fire and life safety authorities, and former CDOT EJMT-experienced professionals, collected all relevant route information, traffic data, crash data, population exposure, tunnel design information, and hazmat truck transport data. The team combined its extensive knowledge and experience with the best available tools and data to assess the feasibility and risk of allowing the transport of hazmat through EJMT. They used two modeling tools, Tunnel Risk Model (TuRisMo) and Dangerous Goods Quantitative Risk Assessment Model (DG-QRAM) to assess and quantify the risk of

hazmat transport scenarios, and developed a range of options to mitigate risk. TuRisMo allows for a detailed analysis of many kinds of safety measures and for interactions between different safety measures in tunnels, and follows a simulation-based approach using 120 fire scenarios, 120 toxic gas scenarios, and 240 propane scenarios. DG-QRAM follows a scenario-based event-tree approach evaluating the probability of 13 representative scenarios occurring and then estimating the expected consequences. DG-QRAM was used to model the shift of hazmat transport from US 6 to I-70 in three alternatives ("empty" tankers, quiet hours, and all hazmat at all times) in this Study.

SB19-032 identified specific entities as stakeholders including towns and counties, emergency responders, and organizations located and/or involved with the mountain corridor. Data and feedback from stakeholders were incorporated into the quantitative modeling efforts and used to calibrate and develop qualitative analyses. Stakeholders provided feedback on the scope items addressed in this Study; they also expressed hazmat transport concerns including driver and community safety, tunnel and roadway resiliency, economic loss, and impacts to sensitive environmental resources. All stakeholders identified the relationship between speed-related hazmat incidents, as well as extended tunnel closure due to damage, as the primary risks that need to be mitigated.

This Study provides a variety of options that the Team believes merit further consideration by decision makers when evaluating changes to the transportation of hazardous materials through EJMT. Modeling and qualitative assessment focused on the differences between these options based on four key risk areas: risks to life, risks to public infrastructure (investment and repair costs), risks to the environment, and economic risks. The level of effort to implement provides a comparison of the processes, construction and operational costs, and stakeholder acceptance.

Options presented are grouped in four general categories: **hazmat routing, tunnel, roadway,** and **operational safety.** Hazmat routing rule change options were evaluated to compare the shift of various types of hazmat transport from US 6 to I-70 through EJMT. Additionally, risk mitigation options for tunnel, roadway, and operational safety may be considered for implementation in conjunction with or independent of hazmat route change options.

## Study Options Presented for Consideration

| Type of Option | Option | Recommended for further Consideration |
|---|---|---|
| **Hazmat Routing** | **Option 1 –** Status quo, allowing selective hazmat through tunnel/I-70 subject to platooning and strict traffic control during quiet hours when US 6/Loveland Pass is closed | Yes |
| | **Option 2 –** Allowing all hazmat through tunnel/I70 at all times | No |
| | **Option 3 –** Allowing selective hazmat through tunnel/I-70 at all times | No |
| | **Option 4 –** Allowing selective hazmat through tunnel/I-70 on weekdays (Monday through Thursday) only | No |
| | **Option 5 –** Allowing selective hazmat through tunnel/I-70 during quiet hours (11:00 PM to 6:00 AM) | Yes |
| | **Option 6 –** Allowing empty hazmat (with placards) through tunnel/I-70 | Yes |
| **Tunnel Infrastructure** | Adding new foam system | No |
| | Adding foam concentrate to existing fixed fire suppression system (FFSS) | Yes |
| | Lining or reinforcing tunnel ceiling with fireproof insulation | Yes |
| | Removing ceiling and installing jet fans | No |
| | Managing tunnel entry with barriers, continuous flow metering (CFM), thermal sensors, weigh-in-motion (WIM) | Yes |
| | Visual speed indicators in tunnel | No |
| | Tunnel communication and public address in tunnel | Yes |
| | Prioritize funding for variable speed drives (VSD) in Johnson Tunnel | Yes |
| | Prioritize funding for deferred maintenance | Yes |
| **Roadway Infrastructure** | Improve roadway geometry on US 6 and I-70 | No |
| | Add brake cooling area past lower Straight Creek escape ramp | Yes |
| | Provide spill containment/response and enhanced drainage | Yes |
| **Operations Safety** | Requirements for use of EJMT/I-70 by trucking companies (safety scores, education, and equipment) | Near term |
| | Mitigation fund by trucking companies to cover damage to tunnel | Long term |
| | Speed management and dynamic downhill speed warning | Near term |
| | Truck-only lane during non-peak hours | Near term |
| | EJMT tunnel operator response training and support | Near term |
| | Support for local emergency responders with emergency response plan and emergency operations | Near term |
| | Work with trucking and automotive industries on emerging technologies | Long term |

**Implementation Statement**

If hazmat routing is shifted from US 6/Loveland Pass to I-70 through EJMT, risk is essentially transferred between the two corridors. Two hazmat routing rule change options show promise:

- **Allowing some classes of hazmat through the tunnel during times of lower traffic (quiet hours)** decreases risk by lowering the frequency of crashes and by reducing the exposed population. This would allow selective hazmat (2 CCR 601-8 Tunnel Rules Green Table) to travel through EJMT only during quiet hours (11:00 PM to 6:00 AM seven days a week). This would require regulatory change to implement.

- **Allowing some empty (placarded) hazmat vehicles to use EJMT** offers a slight reduction in overall risk. This would require organizational and regulatory change. Because empty but not purged vehicles must still display hazmat placards, it is recommended that a process be established for tunnel operators to identify which placarded hazmat cargo tanks are empty.

Multiple tunnel, roadway, and operational safety mitigation options have been identified that will further reduce risk of hazmat incidents on public safety, infrastructure, local economies, and the environment. CDOT would need to identify funding to implement tunnel or roadway options while operational safety mitigation may be implemented though a collaborative approach between CDOT, CSP, the trucking industry, and emergency responders.

If decision makers elect to implement changes, it is recommended that a combination of options be carried forward for further evaluation; these combinations will have a greater cumulative benefit and risk reduction. Any options pursued will require time, stakeholder engagement, collaboration, and funding commitments from decision makers along the corridor.