1.0 PURPOSE AND NEED

According to the Federal Highway Administration (FHWA), Intersection Control Evaluation (ICE) is a data-driven, performance-based framework and approach used to objectively screen alternatives and identify an optimal geometric and control solution for an intersection or interchange\(^1\). FHWA recommends that state agencies adopt an ICE policy. The Virginia Department of Transportation (VDOT) has adopted principles from the FHWA ICE framework to establish the Virginia Intersection and Interchange Control Assessment Program (Virginia iCAP), and this IIM serves as VDOT’s policy.

This Memorandum serves to:
- Convey goal of establishing Virginia iCAP as the ICE policy for VDOT.
- Establish VDOT's process and requirements for evaluating intersection and interchange ramp termini control and configuration.
- Provide guidance on how VDOT, localities, and private developers should consider and evaluate traffic control and intersection configuration throughout the project development process.

2.0 DEFINITIONS

The following terms are used within this Memorandum:
- Virginia iCAP program – the overall initiative that VDOT is establishing; includes all the policies, processes, and procedures that the program entails.
- Virginia iCAP policy – this Memorandum.

• Virginia iCAP process – the set of steps, as outlined in Figure 1, to perform a Virginia iCAP assessment.
• Virginia iCAP assessment – the outcome or deliverable of applying the Virginia iCAP process to specific intersections and ramp termini.

3.0 BACKGROUND

Virginia iCAP uses a holistic approach with a consistent, data-driven process to determine the type of intersection control and configuration that provides the best value and outcomes to enhance traffic operations, improve safety and access management, and accommodate all modes of travel (e.g., bicyclists, pedestrians, and transit) where feasible. Traffic engineering studies with multi-functional consideration like these have become increasingly popular amongst state departments of transportation to evaluate intersection traffic control because of their many benefits.

Like other state departments of transportation, VDOT is adopting this process of consistent data driven decision making for intersection control to realize the many benefits that the FHWA notes other agencies that have adopted ICE processes experience, including:

• Safer and more cost-effective solutions being implemented,
• More consistent documentation of decisions for improved transparency,
• Increased consideration and awareness of innovative intersection solutions,
• Objective performance metrics being used to compare alternatives consistently, and
• Better solutions for all modes of transportation, including pedestrians, bicyclists, and transit.

The goal of the Virginia iCAP program is to integrate holistic consideration of intersection control into VDOT business practices by providing a process, guidance, and performance-based approach to aid in selecting the optimal configuration meeting each project’s purpose and need. There are several existing initiatives and directives that will benefit from Virginia iCAP support, for example:

• Application of the Virginia iCAP program will advance objectives aligned with VTrans 2040’s Guiding Principle #4 to “Maximize capacity of the transportation network through increased use of technology and operational improvements as well as managing demand for the system before investing in major capacity expansions.”
• The overarching goal of VDOT’s Arterial Preservation Program (APP) is to preserve and enhance the safety and capacity of the Arterial Preservation Network (APN). This Virginia iCAP policy serves to support that program goal by promoting assessments of new and modified intersections and interchange termini on VDOT’s APN.

This Virginia iCAP policy evolves VDOT’s intersection control decision-making process and should also be considered as best practice for intersection control decisions throughout the Commonwealth. Since intersection control is considered within many aspects of policies and projects developed across the Department, Virginia iCAP will be integrated into the relevant policies and manuals to reflect VDOT’s goals of this holistic data-driven approach.
4.0 STANDARD

A Virginia iCAP assessment shall follow the process outlined in this IIM. Additional guidance can be found in the Virginia iCAP Manual. This process, described in the next section of this IIM, includes a determination of whether Virginia iCAP is applicable to an intersection, requirements of the assessment, scenarios to be tested, and documentation. Other traditional aspects of an intersection improvement study, such as forecasting, analysis tools and methodology, and/or reporting requirements, shall follow the associated VDOT policies, guidance, and publications.

4.1 The Virginia iCAP Process

The procedures for the Virginia iCAP process, as well as the assessment criteria, are defined in this section. The process is required for a variety of study types involving intersections and interchanges, including Multimodal Project Pipeline, STARS, Arterial Management Plans, and studies to support SMART SCALE applications. The iCAP process is recommended for locality-administered and developer projects. The Virginia iCAP process is depicted in Figure 1. The process consists of an applicability stage and two assessment stages:

- Applicability
  - This step determines whether a Virginia iCAP assessment is required or recommended. The main criterion for applicability of a two-stage assessment is that the study location is on the APN and VDOT-administered or in-house studies and design projects. A Virginia iCAP assessment is recommended for locality-administered (state or federally funded) and land use permit requests. A map of the APN can be found at the following site: VDOT APN map (always check for the latest version of the APN Map). If the intersection is not on the APN and a signal is recommended as the intersection traffic control, then refer to the most recent version of JIM-TE-387. See Table 1 for additional information regarding applicability.

- Assessment Stage 1 – Alternatives Screening
  - This stage identifies potential alternatives, screens them using traffic operations, safety, pedestrian/bicyclist accommodations, and planning-level cost factors; and determines the most appropriate alternatives to advance to Stage 2, if required as noted in Table 1.

- Assessment Stage 2 – Alternatives Analysis
  - This stage evaluates potential traffic operations and safety benefits, pedestrian/bicycle accommodations, and total estimated costs of the alternatives retained from the Alternatives Screening stage to help the user identify the most effective relative to cost and benefits of the intersection type.

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2 https://vdot.maps.arcgis.com/apps/webappviewer/index.html?id=6a024b2739e44b5b8599d86aa3b2c6d7
Table 1. Virginia iCAP Applicability Assessment Requirements by Facility Type and Intersection Location

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Intersection Location</th>
<th>Off the APN and Signal Recommended*</th>
<th>Off the APN and Signal Not Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>On VDOT-maintained road</td>
<td>Full iCAP assessment required</td>
<td>Conduct Stage 1 iCAP assessment and warrant study per the latest version of <strong>IIM-TE-387</strong></td>
<td>iCAP not required</td>
</tr>
<tr>
<td>On locality-maintained road</td>
<td>Full iCAP assessment recommended</td>
<td>Conduct study per the latest version of <strong>IIM-TE-387</strong></td>
<td>iCAP not required</td>
</tr>
</tbody>
</table>

* If initial screening of traffic volumes and crashes reveal a signal is not likely to be warranted, then the iCAP process and signal warrant study are not required.

A Virginia iCAP assessment can be part of a variety of project types, but as a minimum for each intersection or interchange where a Virginia iCAP assessment is being completed on a VDOT-maintained APN roadway, the following items should be provided and constitute the deliverables for a Virginia iCAP assessment:

1. VJuST output
2. VJuST-C output
3. Virginia iCAP tool output
4. Intersection analysis tool output using tool selected in accordance with the current version of VDOT’s *Traffic Operations and Safety Analysis Manual (TOSAM)*
5. Conceptual layout and cost category of recommended alternatives in Stage 1 as defined in the Virginia iCAP Manual
6. Refined sketch and cost estimate for alternatives in Stage 2 as defined in the Virginia iCAP Manual (if required based on Table 1)
7. Signal justification report if a traffic signal is included within the recommended alternative in accordance to **IIM-TE-387**.
8. Recommendations/Summary document
The Virginia iCAP Applicability Form included in the iCAP tool should be completed whether or not an assessment is required. If it is unclear whether the Virginia iCAP assessment is required, the District Traffic Engineer (DTE), or their designee, holds the authority for making the final decision. If the Applicability step reveals a Virginia iCAP assessment is not applicable, this decision must be documented as approved by the DTE or designee and Items #1 through #6, listed above, are not required. Additional guidance on the Virginia iCAP process is shown in Figure 2 and addressed in detail in the Virginia iCAP Manual.

Virginia iCAP shall also list all potential Access Management Waiver or Access Management Exception requests that would be necessitated by the recommended intersection control method, due to substandard distance to adjacent traffic signals or commercial entrances. Virginia iCAP approval does not negate the requirement to seek Access Management Waiver or Exception approval.

If the recommendation is based on qualitative factors outside of those documented in the tool, then the Recommendations/Summary document (Item #8) of the deliverable shall include discussion of any these qualitative factors (e.g., place making, corridor contextual consistency, accessibility, special heritage area design requirements, utility impacts, environmental constraints, network considerations, etc.).

**Figure 2. Virginia iCAP Process Summary**

![Virginia iCAP Process Summary Diagram]
4.2 Virginia iCAP Tool and Manual

The Virginia iCAP Tool is an Excel-based spreadsheet tool used to analyze unsignalized and signalized intersection and interchange configurations. The accompanying Virginia iCAP Tool Manual consists of background, instructions, and guidance on how to use the Virginia iCAP Tool.

The latest version of the Virginia iCAP Tool shall be used in a Virginia iCAP assessment. However, within 2 months of release of a new tool, the previous version of the tool may be used, and results submitted. The designated VDOT Project Manager or DTE has the discretion to extend the allowable use period of the previous version of the tool on a project-by-project basis, which should be documented.

Once the first draft of the Virginia iCAP assessment has been submitted to VDOT using the latest versions of the Virginia iCAP tool and/or the Manual, future submissions within a two-year period of the original submission may remain in accordance with those versions until they are approved.

4.3 Virginia iCAP Approval

Virginia iCAP assessments shall be submitted first to the DTE or their designee for review and approval. If the DTE or designee concurs with the request as a result of the Virginia iCAP for a new signal, then the DTE will forward the Virginia iCAP assessment to the Innovative Intersection Committee (IIC), which will provide a recommendation to the State Traffic Engineer. The IIC is further explained in IIM-TE-389/IIM-LD-257.

5.0 EFFECTIVE DATES AND APPLICABILITY

5.1 Effective Dates

Table 2 summarizes the effective dates for application of this IIM.
Table 2. Effective Dates

<table>
<thead>
<tr>
<th>Project Type</th>
<th>Applicability &amp; Effective Date</th>
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</table>
| Land Use Permit Projects | This IIM shall be in effect for all projects where the first draft of the assessment that recommends a proposed intersection configuration and traffic control has not yet been submitted to VDOT as of July 1, 2023.  
If VDOT has completed its review of a Traffic Impact Analysis (TIA) for a proposed development that included a recommendation for a new traffic signal or other intersection configuration, and did not add any qualifying conditions, this Memorandum does not apply if the proposed development is under construction within 2 years and the intersection improvements are under construction within 5 years following the completion date of the TIA. The District Engineer (DE) may allow an exemption to the stated time limits. |
| VDOT Construction Projects                  | Design-Bid-Build: This IIM shall be in effect for all projects for which the start of final scoping and/or Preliminary Field Inspection (PFI) meeting has not occurred as of the issuance date of this IIM.  
Design-Build or Public-Private Transportation Act (PPTA): This IIM shall be in effect for all projects for which the Request for Qualifications (RFQ) has not yet been published as of the issuance date of this updated IIM. |
| All Projects                                                       | For any of the above-referenced projects that are in development beyond the stages noted as of this IIM issuance date, this IIM may be applied if desired by the permittee (for Land Use/Permit projects) or VDOT project manager (for Construction projects). Documentation shall be provided to support any change in recommendation based on the revised criteria in this IIM. |

5.2 Project Applicability

This IIM applies to VDOT studies located on the latest version of VDOT’s defined Arterial Preservation Network (APN). As shown in Table 1, this IIM does not apply to projects constructed using funds other than state or federal monies on locality-maintained roadways. A Virginia iCAP assessment may still be applied and is encouraged for intersection improvement studies for non-APN, locally administered APN, or locality-maintained facilities.

The requirements of this IIM are applicable for VDOT-administered studies of all new intersections introduced on the APN where intersection control type and configuration are being evaluated and for non-APN facilities when a traffic signal is proposed as shown in Table 1.

For existing intersections on the APN and administered by VDOT, the requirements for a Virginia iCAP assessment as presented in this IIM apply to projects involving the assessment of appropriate intersection configuration and traffic control. Examples include:

- When partial or full widening (i.e., through capacity) is proposed at the existing intersection.
- When a new intersection approach is introduced.
- When an intersection is being reconfigured.

Existing intersections with proposed improvements that may not require a Virginia iCAP assessment include:

- New turn lanes or other auxiliary lanes without modifications to existing traffic control
- Modifications to existing signal phasing or timing
- New or modified pedestrian or bicycle accommodations
• Emergency repairs
• Maintenance work
• If a locality approved a proffer agreement that included a traffic signal or other intersection configuration as a condition of rezoning or other land use decision, and the proposed proffer was reviewed and approved by VDOT DTE or designee prior to finalizing the rezoning with no objections submitted to the locality
• Locations with a previously VDOT-approved SJR if approved within 2 years and/or if conditions haven’t changed
• Reconstruction of existing signal equipment
• Replacement of signal controllers and/or upgrades to controller software that does not alter the operation or display of pedestrian signals
• Installation of other sign, signal, communication, or ITS equipment
• Pavement marking installation or maintenance, including revisions to crosswalk marking patterns
• In-pavement detector installation or replacement
• Installation of a crosswalk

Projects excluded from performing a Virginia iCAP assessment should be verified and documented with the DTE or their designee.

5.3 Assessment Stage – Planning vs. Implementation

A Virginia iCAP assessment is not required for planning studies that are conceptual in nature, and the recommendations would be used as a guide for future development access and understanding of longer-term travel patterns, network needs, and funding. A Virginia iCAP assessment conducted in accordance with the requirements of this IIM is applicable for VDOT-administered studies being performed with the specific intent of identifying appropriate conceptual design options and/or gaining VDOT approval for the intersection concept prior to advancing the project for funding for implementation (design and construction). Table 3 provides additional guidance for the use of Virginia iCAP for planning studies.

<table>
<thead>
<tr>
<th></th>
<th>Project Phases¹</th>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Design Level</td>
<td></td>
</tr>
</tbody>
</table>

Notes: 1. See TOSAM Table 32 for Project Phase definitions
2. Studies in this category are wide ranging and a Virginia iCAP assessment may not be judicious for some, depending on the intended next steps that come from the study findings. During study scoping, discuss with District Planning whether the detailed assessment is required. Some projects at Program Level shall require a Virginia iCAP assessment, such as those for which the next stage is to advance the study for state funding of a specific intersection concept (e.g., projects submitted to SMART SCALE, Project Pipeline).

5.4 Virginia iCAP and Interchange Access Reports

The requirements for Virginia iCAP assessment and approvals still apply to all interchanges pursuant to the latest version of IIM-LD-200. If the findings of a Virginia iCAP assessment result in a recommendation for signal control, then a warrant study shall be submitted as part of the Virginia iCAP assessment (as demonstrated previously in Figure 2).
6.0 REFERENCES

Road Design Manual, Appendices A and F
2009 Manual on Uniform Traffic Control Devices (MUTCD), with revisions
Virginia Supplement to the MUTCD
Traffic Forecasting Guidebook
IIM-TE-362, Sealing and Signing of Plans and Documents by Licensed Professional Engineers
IIM-TE-387, Signal Justification Report
IIM-LD-255, Practical Design Flexibility in the Project Development Process
IIM-LD-257/IIM-TE-389, Innovative Intersection/Interchange Committee
IIM-TMPD-1, Implementation of the CTB Policy for Integrating Bicycle and Pedestrian Accommodations
IIM-TMPD-2, Process for Conducting Planning Studies on the Arterial Preservation Network
IIM-TMPD-7, Traffic Forecasting
IIM-LU-100, Review of Comprehensive Plans and Comprehensive Plan Amendments
IIM-LU-200, Review of Rezoning Proposals
IIM-LU-500, Review of Site Plans and Subdivision Plats
IIM-LU-501, Access Management Spacing Exceptions/Waivers

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