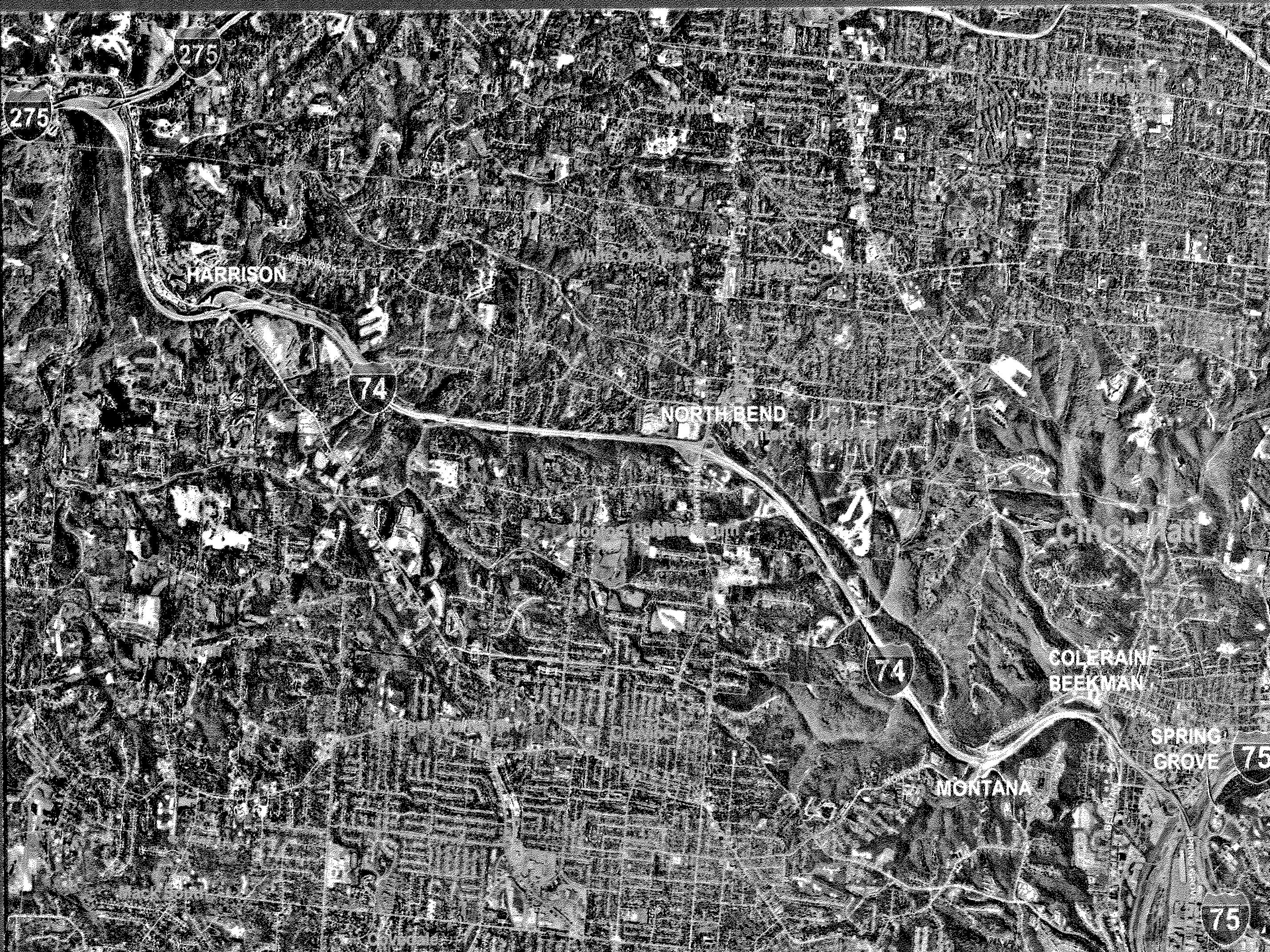
I-74 RAMP METERING STUDY



August 2004

STATE OF OHIO DEPARTMENT OF TRANSPORTATION

HNTB

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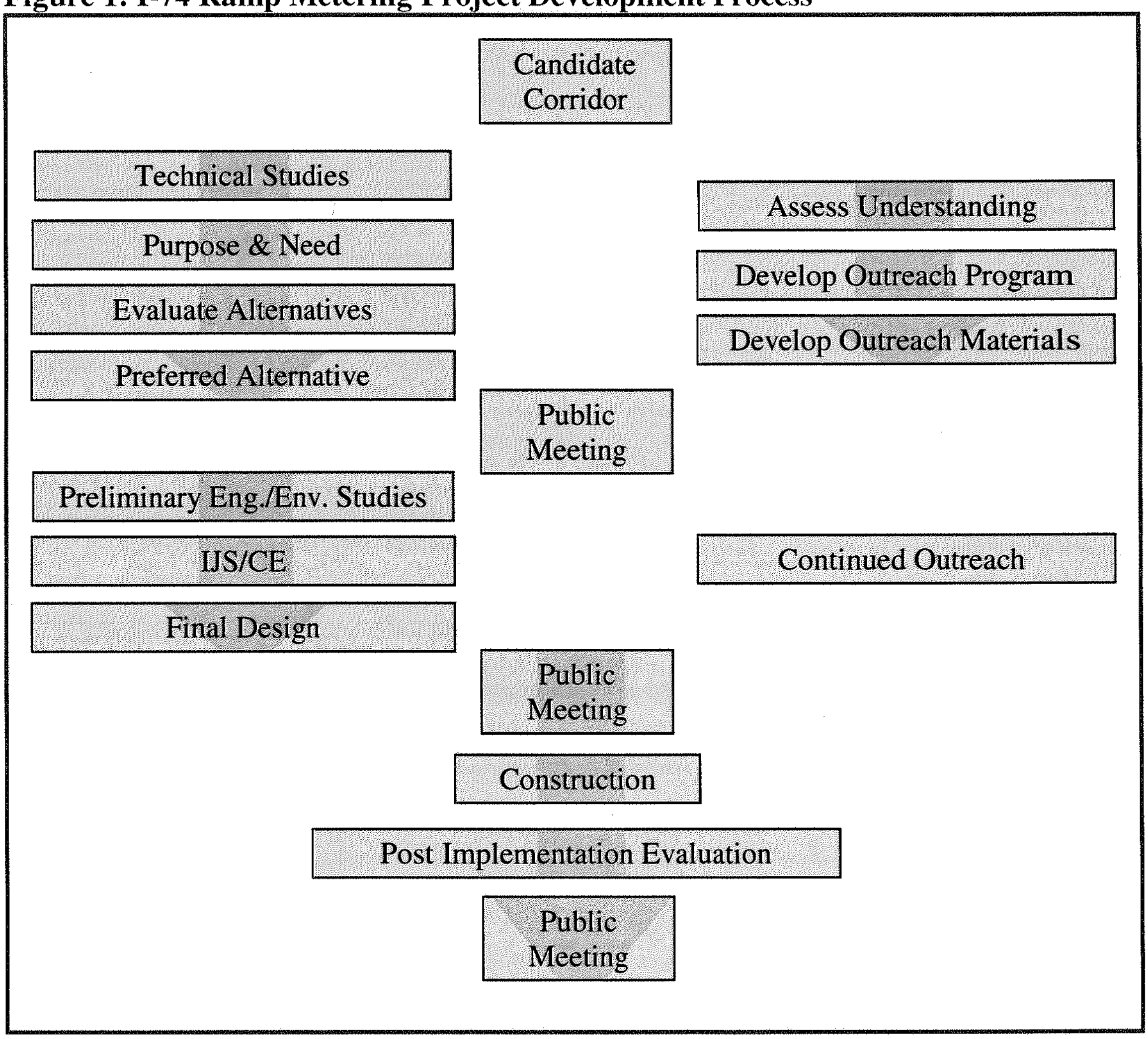
I. Introduction

The purpose of this document is to summarize HNTB Ohio, Inc.'s work on the I-74 ramp metering project, specifically the impact ramp meters may have on inbound (eastbound) I-74 safety and traffic flow. Interstate 74, in Hamilton County, Ohio, is approximately 8.5 miles from I-275, the western terminus, to I-75, the eastern terminus.

Study Process

Earlier this year, ODOT established a ramp metering project development process to guide the study and deployment of ramp meters across Ohio. The process was modified for the I-74 Cincinnati metropolitan area study to allow for technical studies prior to the first steering committee meeting (see **Figure 1**). ODOT District 8 also decided it would be beneficial to hold an additional public meeting after the post implementation evaluation is complete.

Figure 1: I-74 Ramp Metering Project Development Process



The left side of the flow chart includes all the technical studies and design, while the right side focuses on the outreach program. The study is currently in the preliminary engineering and environmental studies stage.

Report Organization
Section II of this document provides some background on the study area lane use, existing traffic and some basic information on ramp meter operation. Sections III and IV discuss the technical crash and traffic modeling studies prepared as part of this project development process. Section V identifies design concerns associated with installing ramp meters at each inbound ramp. Section VI summarizes the public involvement effort thus far, and Section VII identifies the next steps in the study and design process.

II. Background

Study Area

Eastbound I-74 is two lanes from I-275 to the Montana Avenue entrance ramp. An auxiliary lane runs from the Montana Avenue entrance ramp to the Colerain/Beekman Street exit ramp. Two lanes continue from the Colerain/Beekman Street exit ramp until a lane is added at the Colerain/Beekman Street entrance ramp. There are three lanes from the Colerain/Beekman Street entrance ramp to the I-75 split, where the center lane splits and two lanes continue to I-75 southbound and two lanes continue to I-75 northbound. The Spring Grove entrance ramp is curb separated from the I-74 ramp to the I-75 southbound merge for approximately 600 feet after the loop ramp. Just past the Spring Grove merge, the two lanes from I-74 eastbound have an inside merge with three lanes from I-75 south. See **Figure 2** for existing lane use for the study area.

A multi-agency Steering Committee was formed to guide the study. Members of the Steering Committee include: ODOT Central Office, ODOT District 8, ARTIMIS, City of Cincinnati Public Works and Police, Hamilton County Public Works and Sheriff, and Green Township.

Existing Traffic

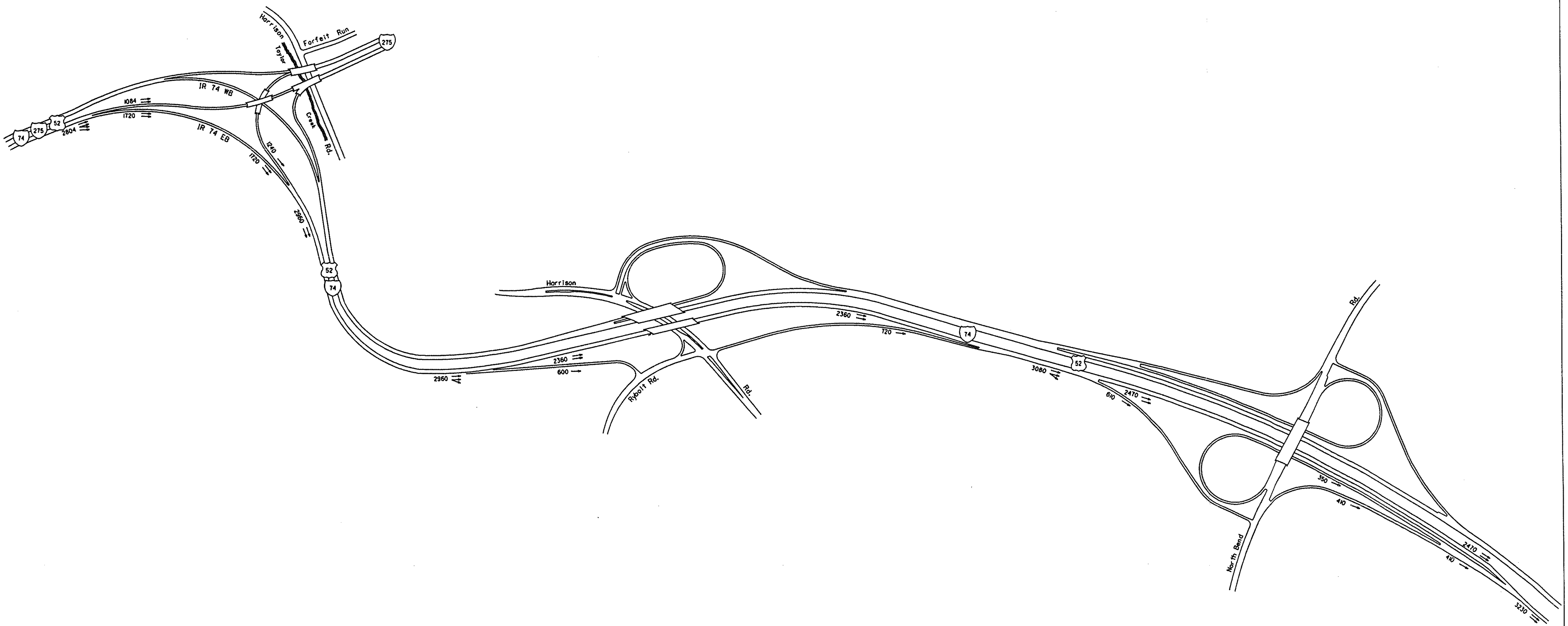
I-74 experiences heavy inbound traffic during the AM peak and heavy outbound traffic during the PM peak. A field visit confirmed that congestion occurs during the later half of the AM peak hour from west of the Montana Avenue entrance ramp through the I-75 split. Heavy congestion was observed at the I-74 and I-75 southbound merge. Since this study focuses on inbound operation, the AM peak was evaluated. From corridor volume data provided by ODOT, it was concluded that the AM peak hour occurs from 7 AM to 8 AM. See **Figure 2** for design hour volumes.

Ramp Meters

Ramp meters are an operational tool to improve safety and help manage traffic flow on limited access highways. The application of ramp meters involves the addition of traffic signals, vehicle detection and communication devices to meter the traffic flow on an entrance ramp where it merges with the mainline traffic. Ramp metering can reduce crashes, improve travel speeds, and create a more uniform travel flow while increasing mainline capacity and the reliability of corridor travel times. Some ramp meter projects include ramp widening, right of way acquisition and utility relocations. Ramp widening should be considered when the demand at a ramp exceeds the capacity of a single-lane ramp meter. Ramp widening can provide additional storage for queues at the meters and increase the capacity of the meter.

The recommended range for ramp metering rates is between 4 and 15 seconds to ensure complete stops and maximize driver compliance. For a one-lane metered entrance ramp, traffic volumes can range between 900 to 240 vehicles per hour. A two-lane ramp meter can handle up to 1,800 vehicles per hour if two vehicles are released per each green signal.

FIGURE 2A
LANE USE AND PEAK HOUR VOLUMES



NOT TO SCALE

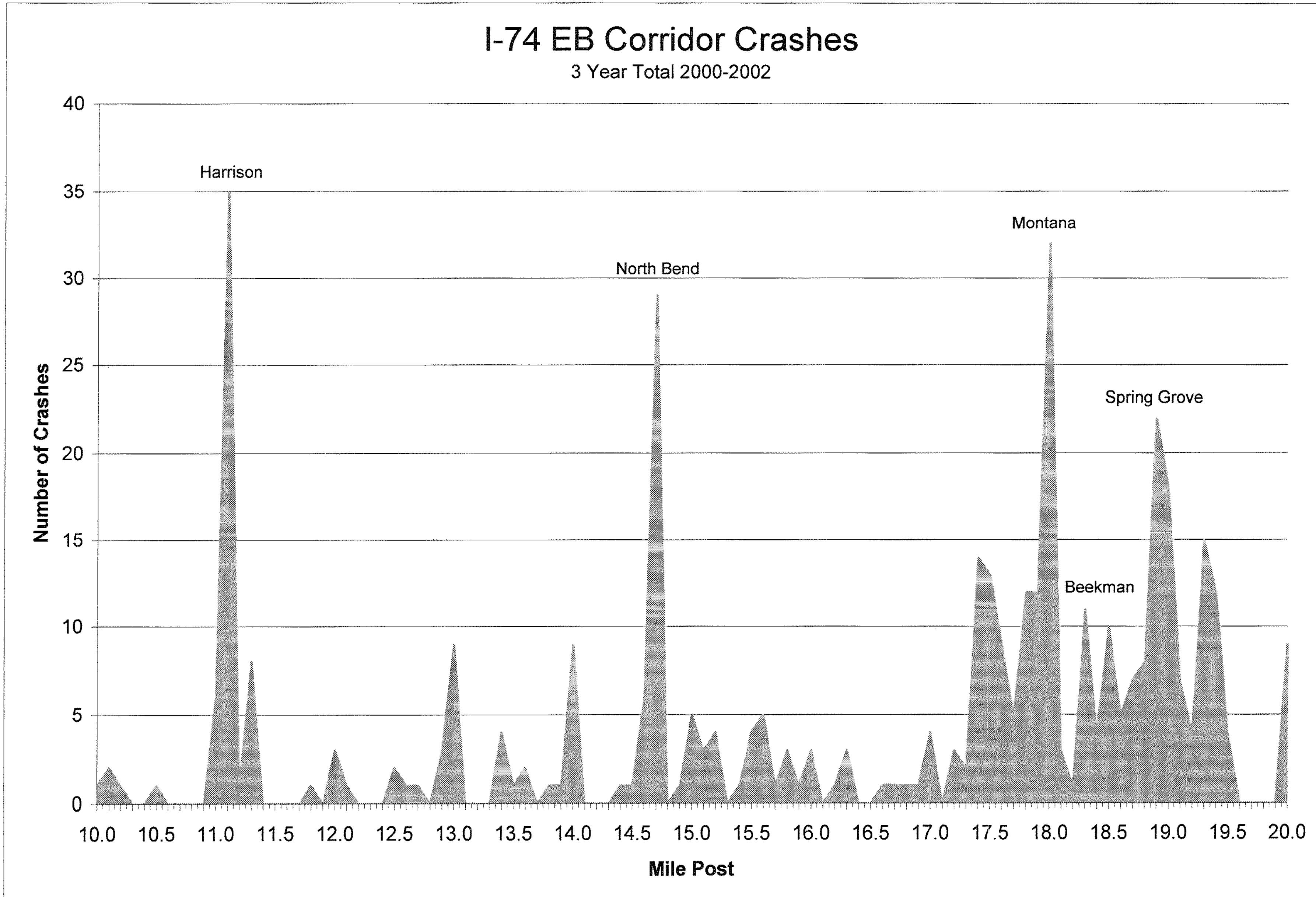
FIGURE 2B
LANE USE AND PEAK HOUR VOLUMES

NOT TO SCALE

III. Crash Studies

ODOT crash reports from January 2000 through December 2002 were analyzed. During this three-year period, 416 crashes occurred within the study area in the eastbound direction. Of these crashes, 189 were rear end, 78 were fixed object crashes, 35 were sideswipes, and the remaining 114 are distributed among the other crash types. Of the 416 crashes, a total of 342 crashes (82 percent) occurred on weekdays. During two hours of the AM peak, 147 crashes (35 percent) occurred. Ninety six of the crashes involved an injury; two of those were fatal.

Crash diagrams were compiled from the data and show the approximate location of these crashes in the study area. As shown in **Figure 3**, the crash frequency spikes near the interchanges. Majority of these crashes appear to be due to congestion and merging in the ramp influence area.


I-74 EB Corridor Crashes
3 Year Total 2000-2002
Number of Crashes
Mile Post
Harrison
North Bend
Montana
Spring Grove
Beekman
40
35
30
25
20
15
10
5
0
10.0
10.5
11.0
11.5
12.0
12.5
13.0
13.5
14.0
14.5
15.0
15.5
16.0
16.5
17.0
17.5
18.0
18.5
19.0
19.5
20.0

IV. Traffic Modeling

The corridor was modeled in CORSIM, a micro-simulation traffic program. CORSIM utilizes a variety of inputs from pavement type, curve radii, grade changes, car following characteristics, and origin-destination data to replicate existing and future roadway conditions. Once the I-74 corridor model was developed, several parameters were adjusted to ensure the traffic volumes entering the system matched the ground counts and model speeds emulated existing conditions. Parameters adjusted to calibrate the model included: desired free flow speed, car following sensitivity factor, lag to accelerate/decelerate, time to complete a lane change, minimum separation for vehicle generation, lane changing probability, percent of cooperative drivers, and non-emergency acceleration.

Assumptions

When modeling the corridor several assumptions were made.

- Existing ramp lane use and geometry was assumed for all ramps on all alternatives.
- Existing AM peak hour traffic volumes, provided by ODOT were used.
- The two eastbound North Bend entrance ramps are metered downstream from their merge point.
- Four second meter rates are used for all metered ramps on all alternatives. This means each meter releases one vehicle once every four seconds, allowing for maximum metered flow onto I-74 and limiting backups on entrance ramps.

Preliminary Alternatives

Five alternatives were analyzed with CORSIM:

- Alternative 1: No ramp meters (no-build)
- Alternative 2: Ramp meters at all inbound entrance ramps (Harrison, North Bend, Montana, Colerain/Beekman, Spring Grove)
- Alternative 3: All inbound ramps metered except Harrison
- Alternative 4: All inbound ramps metered except Harrison and North Bend
- Alternative 5: All inbound ramps metered except Harrison and Spring Grove

The model was initially run without ramp meters to calibrate it to existing conditions, prior to adding ramp meters. Once additional alternatives were modeled the no-build alternative helped quantify the average speed benefits expected along the corridor.

After running the model with meters at each inbound entrance ramp, a comparison to the no-build alternative allowed for identification of locations which would likely experience the most benefit from ramp meters. The model indicated that travel speeds at Harrison were not affected by the addition of ramp meters. Since the Harrison interchange is approximately three and a half miles west of the proposed North Bend ramp meter, it would not likely have system benefits that occur with ramp meters at closely spaced entrance ramps.

Alternative 4 and 5 were developed to determine what benefits the North Bend and Spring Grove ramps have on corridor traffic safety and operation.

Modeling Results

Figure 4 graphs the travel speeds modeled along the corridor for each of the five alternatives. Without ramp meters, significant speed fluctuations occur from just west of Montana through the eastern terminus of the study area, at the I-75 interchange.

Alternative 2, Alternative 3, Alternative 4, and Alternative 5 all indicate that speeds are likely to stabilize when ramp meters are introduced. The Montana interchange is the best example of this. Under existing conditions, speeds drop to 20 mph at Montana. With ramp meters, the model indicates that travel speeds remain at normal freeway speeds (60 mph). Despite the improvement of the mainline, substantial backups are present at the Montana entrance ramp unless additional ramp storage is provided. Accommodation of this traffic is addressed in Section V: Design Considerations.

Alternative 2 and Alternative 3 have almost identical results indicating that a ramp meter at Harrison does little to benefit corridor traffic flow operation. This can be attributed to the lower volume to capacity ratios in this section which indicates that vehicles can more easily enter and merge onto mainline I-74 without conflict.

In Alternative 4, without ramp meters at North Bend or Harrison, the mainline speeds are similar to Alternatives 2 and 3. However, mainline speeds are slightly lower for this alternative near the North Bend interchange, the Colerain/Beekman interchange, and the Spring Grove interchange.

Alternative 5 was tested because, at the time, it was thought that the Spring Grove ramp would require significant expenditures to allow for adequate storage on the loop ramp. Also, safety is a concern when construction a dual lane loop ramp. This alternative was examined to determine how critical this ramp meter is to the system improvements. After the decision was made to model this alternative, it was determined that the traffic volumes were much lower than originally thought, so the design and cost concerns are no longer a critical issue. Without the Spring Grove ramp meter or the Harrison ramp meter, the mainline speeds are almost identical to Alternative 2 and 3.

Based on a suggestion from the Steering Committee, an incident was simulated just south of the I-75 southbound and I-74 eastbound merge, a high crash location. The committee was interested in seeing what impact ramp meters would have if a crash was to occur. The incident modeled closed the right two lanes and caused rubbernecking in the other two lanes for fifteen minutes during the design hour. **Figure 5** indicates that ramp meters would continue to have a positive impact on traffic flow during an incident. Once the incident clears the model shows the I-74 system rebounding to normal travel speeds more quickly when ramp meters are operational.

Figure 4: Preliminary Alternatives

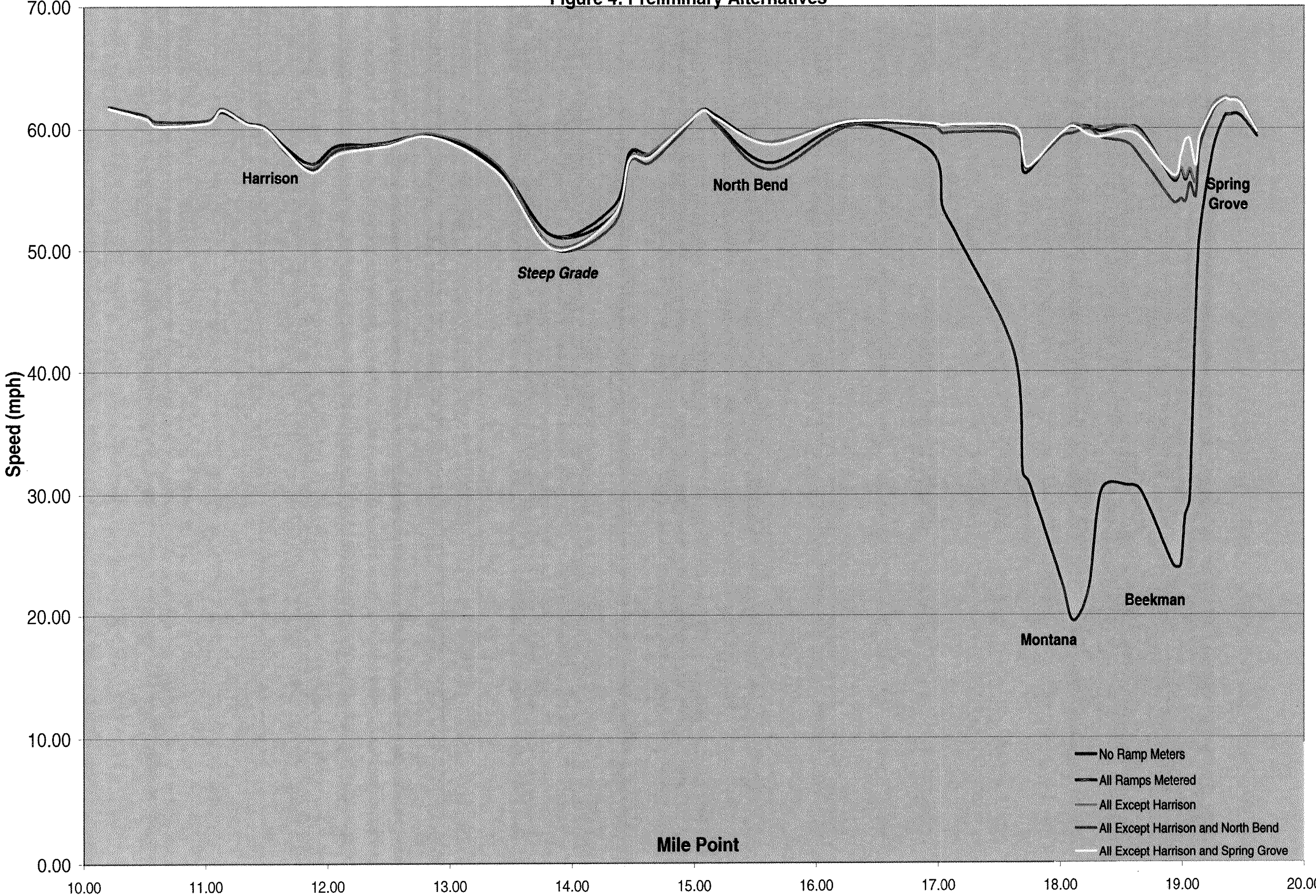
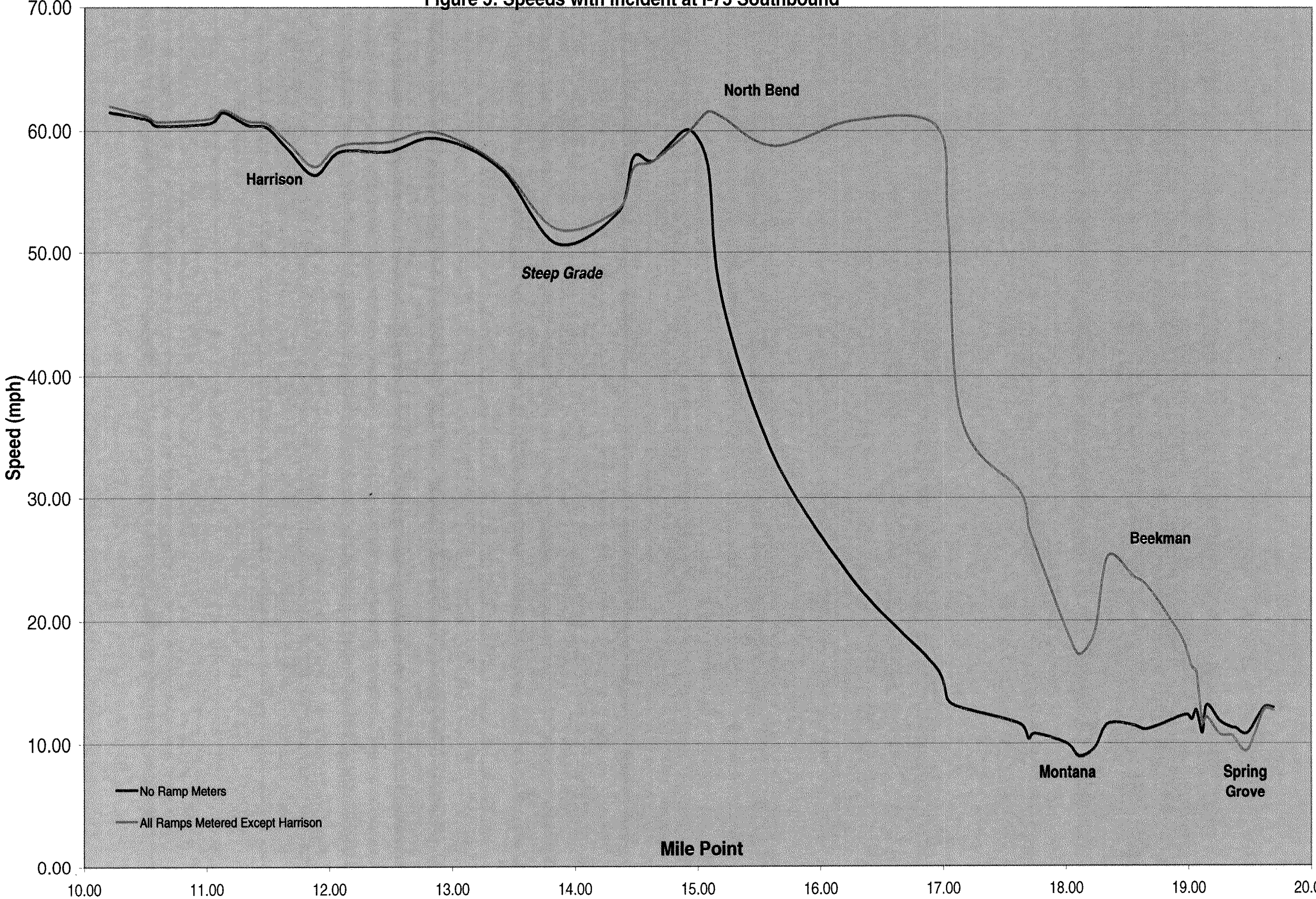


Figure 5: Speeds with Incident at I-75 Southbound



V. Design Considerations

Metering the vehicles on inbound entrance ramps during the AM peak hour could help stabilize speeds and reduce rear-end and side-swipe crashes that result when there are sudden drops in speed at merge points. Of the build alternatives presented, Alternative 3 is recommended. It focuses on the four interchanges from North Bend to Spring Grove. Harrison is not metered in this alternative because mainline speeds do not appear to be improved with the addition of a ramp meter. Also, given the distance between Harrison and North Bend, there were no quantifiable system benefits to adding a meter at Harrison. ODOT District 8 is undertaking a safety study to determine what geometric changes are necessary at the Harrison Road interchange to reduce crashes in this area.

Figures 6, 7, 8 and **9** illustrate the preliminary design of ramp meters at North Bend, Montana, Colerain/Beekman, and Spring Grove. These include queue detector loops, ramp meter signals, demand loops, passage loops, count loops, mainline loops, ramp meter controller, law enforcement areas, and ramp widening where necessary. The required storage lengths were based upon the Wisconsin DOT's *Intelligent Transportation Systems Design Manual* and are shown in **Table 1** below. A recommended acceleration length of 1000 feet is shown beyond the ramp meter stop-bar based on AASHTO guidelines.

Table 1: Recommended Storage Lengths

Entrance Ramp	2005 Traffic Volume VPH	2025 Traffic Volume VPH	Existing Length Feet	2005 Recommended Storage (WisDOT) Feet	2025 Recommended Storage (WisDOT) Feet	Recommended Acceleration Lane (AASHTO) Feet
Harrison Road to I-74 EB	720	890	1592	900	1113	1000
SB North Bend Road to I-74 EB (loop)	650	710	2675	813	888	1000
NB North Bend Road to I-74 EB	410	590	1575	513	738	1000
Montana Avenue to I-74 EB -Dual Lane Recommended	1540	1480	1200	963	925	1000
SB Beekman Street to I-74 EB -Dual Lane Recommended	1480	1460	1350	925	913	1000
Spring Grove Road to I-74 EB (loop)	350	270	1860	438	338	1000

Some of the congestion on I-74 may be attributed to backups caused by the I-74 and I-75S inside merge. This area is being redesigned as part of a major improvement study to reduce the congestion related to the merge. Coordination between this ramp meter project and the I-75 improvement project needs to continue.

Harrison

As stated previously, results from Alternative 2 and Alternative 3 are essentially identical, so little traffic flow benefit is realized by placing a ramp meter at Harrison Road. The Harrison interchange is approximately 3.5 miles west of the North Bend interchange and 890 vehicles per hour are expected to enter I-74 from Harrison by 2025, which is below the merge capacity. Essentially, Alternative 3 will achieve the same stabilization in traffic flow without the addition of a ramp meter at Harrison. As a result, no ramp meter at Harrison is recommended.

North Bend

Improvements resulting from Alternative 2, Alternative 3, and Alternative 5 are essentially identical at North Bend. Speeds are shown to increase approximately 2 mph from Alternative 1 and Alternative 4 in which a there was not a ramp meter at North Bend.

At the North Bend interchange there is an entrance ramp for northbound North Bend and a loop ramp for southbound North Bend. This traffic merges before entering I-74. As seen in **Figure 6**, the preliminary design for the ramp meters show the stop-bars for each ramp side-by-side and equidistant from the I-74 merge. With the stop-bars side-by-side, the release of vehicles from each ramp can be staggered. Officers will be able to use the same enforcement pad to monitor traffic and driver compliance on both ramps. The existing single lane ramps provide adequate storage space for the ramp meters.

Montana

The most significant improvement in mainline speed occurs near the Montana interchange, regardless of which ramp metering alternative is selected. At Montana, the model indicates that mainline speeds improve by approximately 40 mph for each alternatives. However, the queue on the entrance ramp from the meter would present an unsafe condition unless storage capacity on the ramp is increased. The backup is due to the demand volume of almost 1540 vehicle per hour at this ramp in 2005, which exceeds the capacity of a single lane ramp with metering (900 vph). The backup from the Montana entrance ramp spills back onto the side street of northbound Montana. Montana Avenue in the northbound direction is a steep grade, - 7.5%, with limited sight distance. A metered two lane ramp has a potential capacity of 1,800 vph and would potentially eliminate the backup problems. Additional queue detectors at Montana could also initiate a faster metering rate to limit queues and eliminate the queue spilling onto Montana Avenue. Ramp meters should not be implemented unless adequate storage is provided to enhance safety and accommodate the ramp demand volume.

As seen in **Figure 7**, the existing single lane entrance ramp does not provide adequate storage capacity and acceleration. Widening must occur on the north or inside section of the ramp. The south side is in a steep cut section and widening on the south side would require much grading work, cost, and potential relocation of Baltimore Avenue. to provide for a dual lane ramp meter.

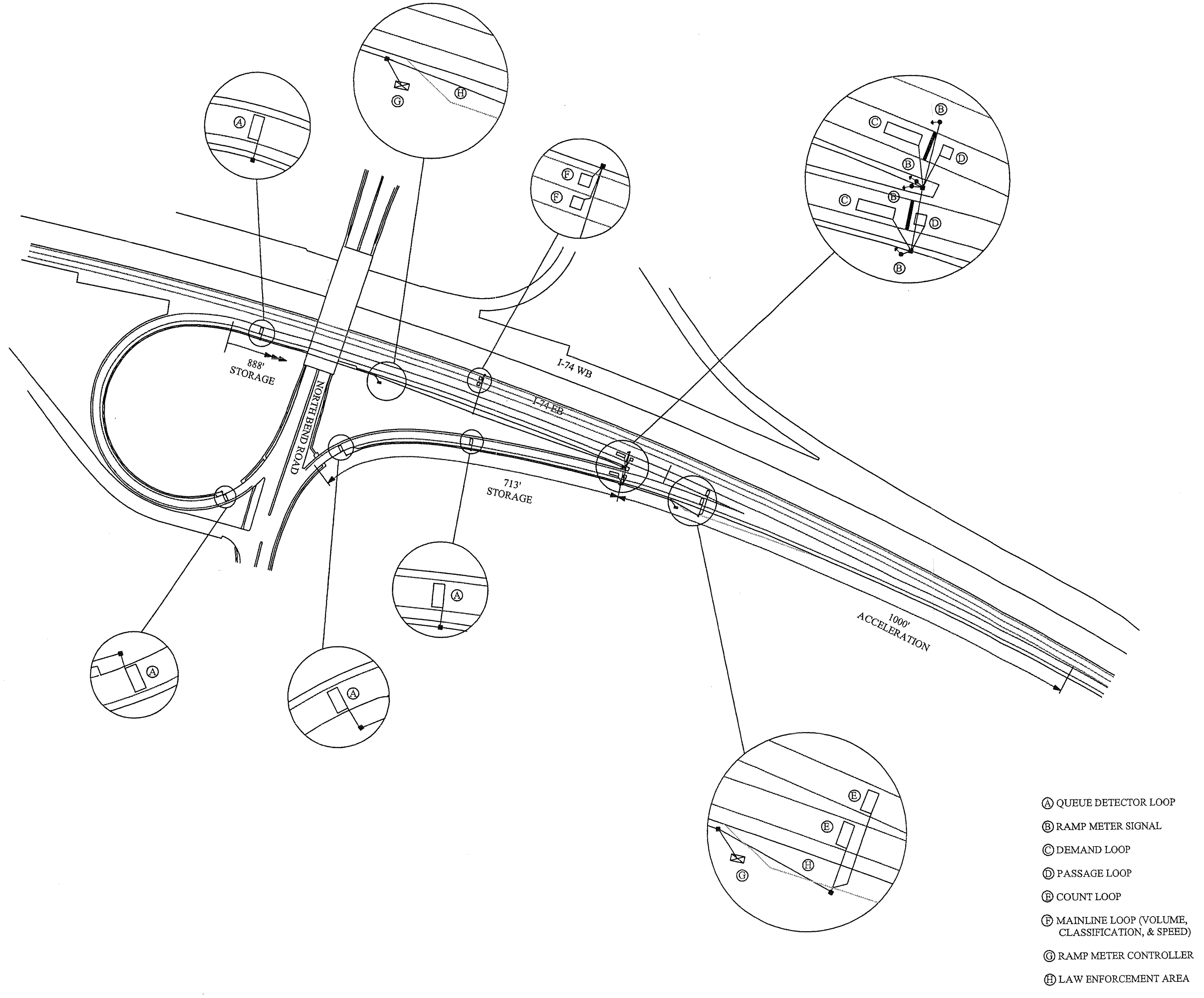
Colerain/Beekman

Improvements in mainline speed are also present at Colerain/Beekman when ramp meters are introduced regardless of which ramp metering alternative is selected. The greatest improvement in mainline speed occurs when a ramp meter is present at the North Bend ramp (Alternatives 2, 3 and 5). However, substantial backups are present on the ramp due to the high demand volume of 1480 vph in the AM peak hour. A metered two lane ramp has a potential capacity of 1,800 vph and would potentially eliminate the backup problems. Additional queue detectors could also initiate a faster metering rate to limit queues and eliminate the queue spilling onto Colerain Avenue. . Ramp meters should not be implemented unless adequate storage is provided to enhance safety and accommodate the ramp demand volume.

Figure 8 shows the preliminary design for the ramp meter at the Colerain/Beekman entrance ramp. Additional pavement is available in this section, but will need to be re-striped for a dual lane ramp meter. The ramp should provide for two lane storage prior to the overpass structure. Downstream of the stop-bar, the ramp should narrow to one-lane across the bridge. This design allows for additional storage capacity, adequate acceleration distance, and does not require widening the bridge which would be costly.

Spring Grove

The model indicates that Spring Grove speeds improve by a couple miles per hour when a ramp meter is included at Spring Grove. The ramp meter stop bar should be placed prior to the bridge. This will simplify the signal installation, by keeping it off the structure. Vehicles will queue on the loop ramp and accelerate across the bridge. The barrier separating the entrance ramp traffic and mainline traffic should be maintained to protect entering traffic. Given the geometric constraints in this area, an enforcement pad is not recommended for this ramp. The preliminary plans for the Spring Grove ramp meter are illustrated in **Figure 9**.

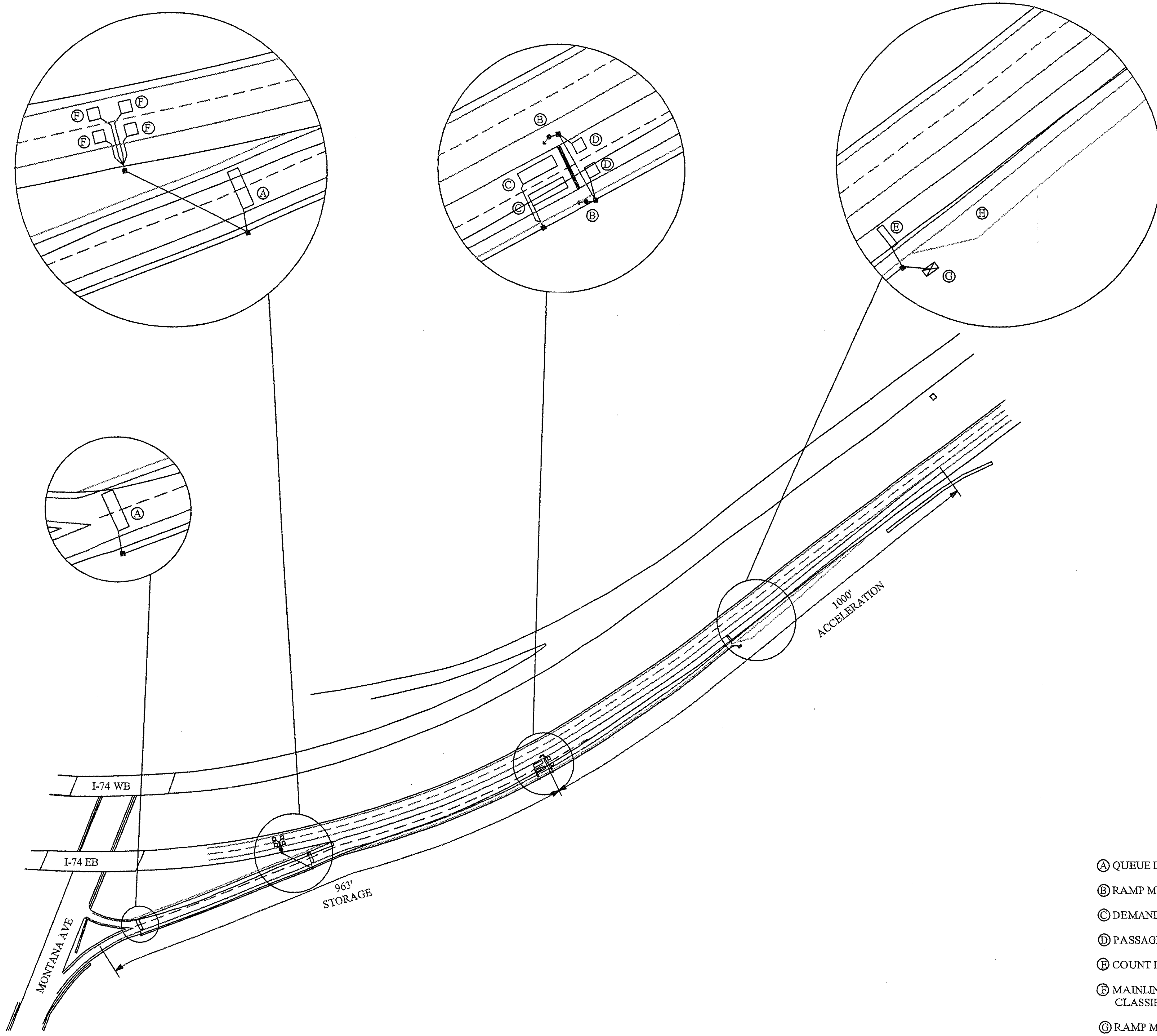


HNTB ARCHITECTS ENGINEERS PLANNERS

CALCULATED RAW CHECKED KAO

NORTH BEND ROAD RAMP
RAMP METER PLAN
AND DETAILS

HAM-74



Ⓐ QUEUE DETECTOR LOOP

Ⓑ RAMP METER SIGNAL

Ⓒ DEMAND LOOP

Ⓓ PASSAGE LOOP

Ⓔ COUNT LOOP

Ⓕ MAINLINE LOOP (VOLUME, CLASSIFICATION, & SPEED)

Ⓖ RAMP METER CONTROLLER

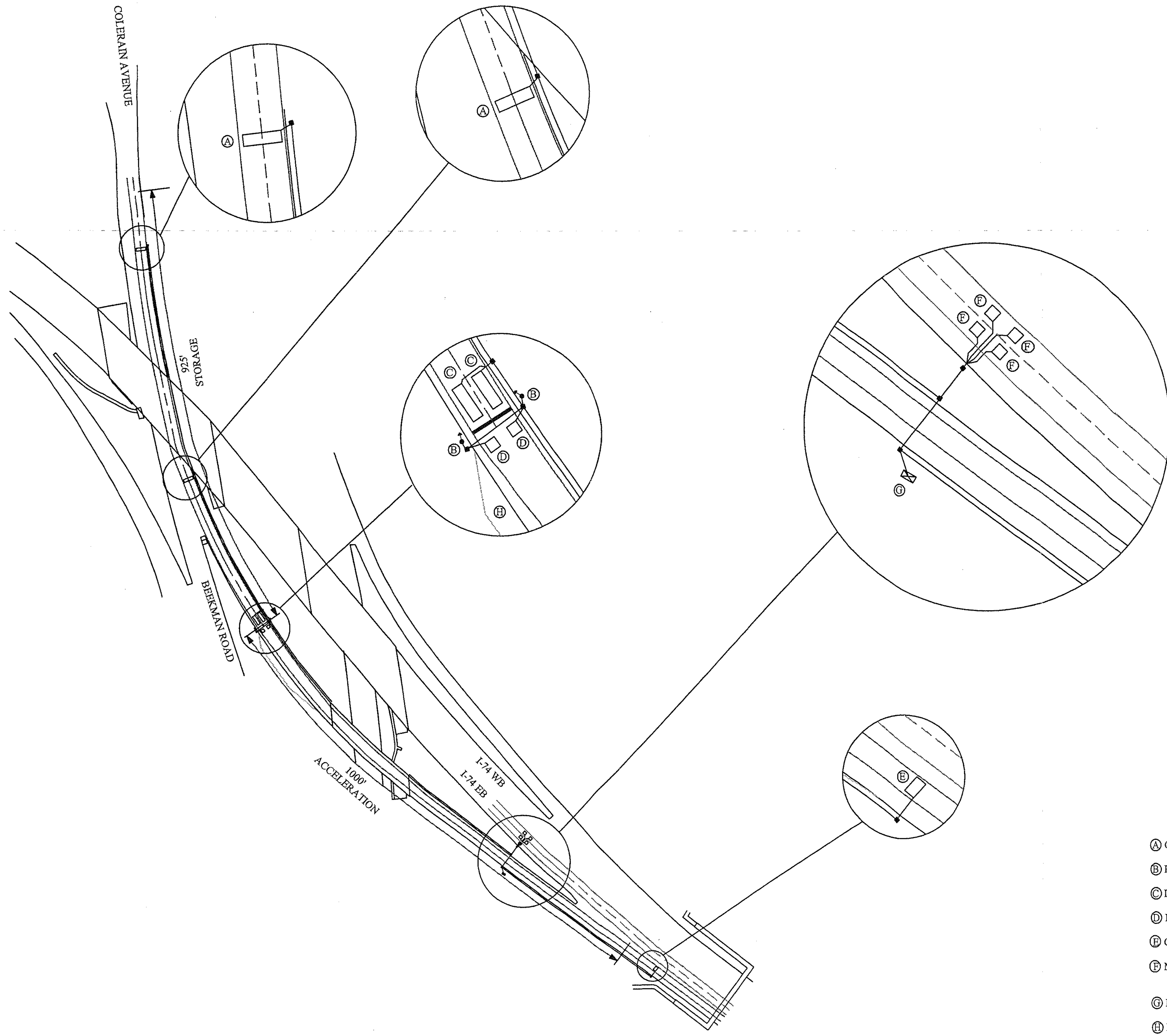
Ⓗ LAW ENFORCEMENT AREA

HNTB ARCHITECTS ENGINEERS PLANNERS

CALCULATED RAW
CHECKED KAO

MONTANA AVENUE RAMP
RAMP METER PLAN
AND DETAILS

HAM-74



Ⓐ QUEUE DETECTOR LOOP

Ⓑ RAMP METER SIGNAL

Ⓒ DEMAND LOOP

Ⓓ PASSAGE LOOP

Ⓔ COUNT LOOP

Ⓕ MAINLINE LOOP (VOLUME, CLASSIFICATION, & SPEED)

Ⓖ RAMP METER CONTROLLER

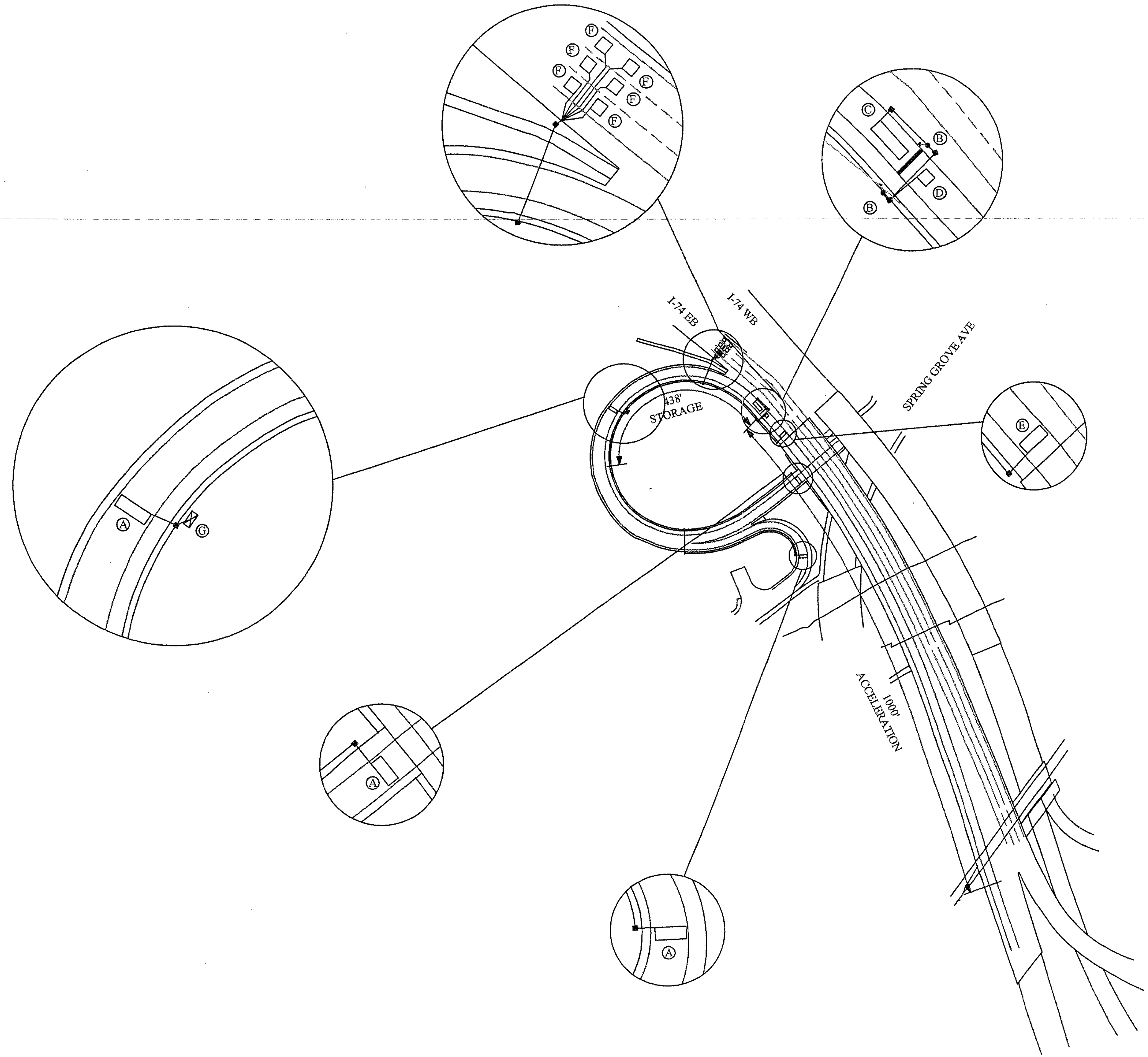
Ⓗ LAW ENFORCEMENT AREA

HNTB ARCHITECTS ENGINEERS PLANNERS

CALCULATED RAW
CHECKED KAO

COLERAIN / BEEKMAN ROAD RAMP
RAMP METER PLAN
AND DETAILS

HAM-74



Ⓐ QUEUE DETECTOR LOOP

Ⓑ RAMP METER SIGNAL

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Ⓔ COUNT LOOP

Ⓕ MAINLINE LOOP (VOLUME, CLASSIFICATION, & SPEED)

Ⓖ RAMP METER CONTROLLER

Ⓗ LAW ENFORCEMENT AREA

HNTB ARCHITECTS ENGINEERS PLANNERS

CALCULATED RAW
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SPRING GORVE AVENUE RAMP
RAMP METER PLAN
AND DETAILS

HAM-74

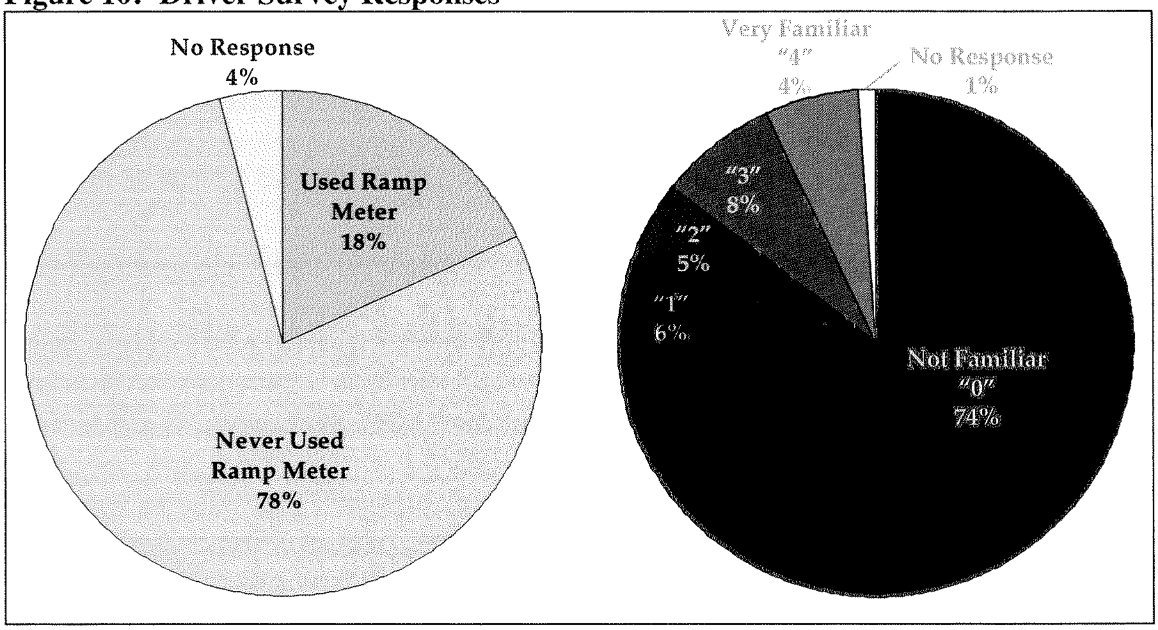
VI. Public Involvement

A formal public involvement plan was developed for this project and is included with the attached Meeting #2 materials. Public input for this project has come from a variety of sources. An initial driver survey was conducted to gauge driver awareness and solicit comments and suggestions for ramp meter implementation. Ongoing steering committee meetings have been held throughout the process. The Steering Committee assists in reviewing the technical materials and public input and directing the study. The first of three planned public meetings was held in July of 2004 to introduce the concept of ramp meters to residents and gather public comments.

Driver Survey

A driver survey was developed by the study team and sent to 1,000 property owners in the study area. The final survey is included in the attached Steering Committee #2 folder. Of the 1,000 surveys mailed, 254 responses were received and six were returned as undeliverable. The results show that most respondents have never used a ramp meter and are not familiar with ramp meters (see **Figure 10**).

Figure 10: Driver Survey Responses



The following is a summary of the comments received:

- What are ramp meters?
- Ramp meters are a waste of tax dollars
- Problem lies in driver behavior
- Ramp meters will help
- Use other methods to reduce congestion
    - Take alternate routes
    - Perform construction during off peak
    - Increase travel lanes on freeways
    - Promote safer driving
    - Increase speed limit

- Restrict heavy vehicles
- Lengthen ramp/freeway merges

The results of the survey are not unlike what other State DOT agencies have found when implementing ramp meters for the first time. Generally, the public is unfamiliar with the concept and an education campaign is needed to help demonstrate the purpose of the project and the potential benefits that could arise from the implementation of ramp meters. The steering committee decided that one of the focuses of the first public meeting should be to help educate the public on what ramp meters are and how they have improved traffic operations in other cities.

Steering Committee Meetings

The Steering Committee is made up the state, county, city, and community officials, engineers, and law enforcement personnel. **Table 2** lists the Steering Committee members and the agencies that they represent.

Table 2: Steering Committee Members

First Name	Last Name	Title	Agency
Tim	Schoch	ARTIMIS Operations	ARTIMIS/Northrop Grumman
Andy	Fluegeman	ARTIMIS Program Manager	ARTIMIS/ODOT - District 8
Robert	Hungler	Traffic Unit Supervisor	Cincinnati Police Department
Steve	Bailey	City Traffic Engineer	City of Cincinnati
Kevin	Celarek	Administrator	Green Township
Bart	West	Lieutenant Col.	Green Township
Timothy	Gilday		Hamilton County Engineer's Office
Tom	Langenbrunner	Traffic Analyst Supervisor	Hamilton County Engineer's Office
Walt	Bally	Sergeant	Hamilton County Sheriff
Joe	Knab	Real Estate Agent	MHWOCA
Dave	Lopez	Attorney	MHWOCA
Tim	Schaller	President	Mt. Airy Town Council
Dave	Holstein	Traffic Administrator	ODOT - Central Office
Greg	Murphy	Safety Program	ODOT - Central Office
George	Saylor	Senior ITS Engineer	ODOT - Central Office
Diana	Martin	Planning Administrator	ODOT - District 8
Ron	Mosby	Public Information Officer	ODOT - District 8
Jay	Hamilton	Traffic Engineer	ODOT- District 8
Mike	Brestel	President	Westwood Civic Association

As of August 2004, the Steering Committee has met a total of four times to oversee the I-74 ramp metering project. The following is a list of items presented and discussed at each meeting:

Meeting 1, April 9, 2004

- Study Overview
- Statewide Initiative
- What are Ramp Meters and how do they work?

- Case Study
- I-74 Corridor Technical Studies
- Discussion
- Next Steps

Meeting 2, May 7, 2004
- Project Status
- Case Studies
- Technical Studies
- Ramp Improvements
- Driver Survey
- Public Meeting

Meeting 3, June 4, 2004
- Overview
    - Study area, process and schedule
    - Purpose and Need
    - Safety & Congestion Initiative
    - What are ramp meters and how do they work?
- Goals & Performance Measures
- Technical Studies
    - Crash analysis
    - Modeling results
    - Logistics
- Next Meeting
- Public Meeting

Meeting 4, July 9, 2004
- Project Status
- Case Studies
- Technical Studies
- Ramp Improvements
- Driver Survey
- Public Meeting

Public Meeting

The first public meeting was held at the Senior Center on Epley Lane in the Montfort Heights neighborhood on July 21, 2004 from 4 PM to 7 PM. The meeting was conducted in an open house format with tables set up for focus groups. Two sets of boards were displayed. One set was corridor specific. This included: the study process, a list of advisory committee agencies, a map of the study area, results from the driver survey, goals and performance measures, crashes by mile post and the traffic modeling results with and without an incident south of the I-74/I-75S merge.

The second set of boards helped educate the public about ramp meters. These boards included frequently asked questions, before and after implementation schematics, benefits realized from ramp meters in various cities across the country and a ramp meter components and operations guide.

As participants entered the meeting a Steering Committee representative would walk them through the material and answer any questions they had. Attendees were provided with a brochure explaining the study activities to date. They were provided a comment card and encouraged to submit it to ODOT District 8. Additional handouts with materials similar to those presented on the boards were available, along with the preliminary ramp layouts shown in **Figures 6 - 9**.

Greg Murphy, ODOT Central Office and Diana Martin, ODOT District 8, made a presentation to attendees at 5 PM and answered questions until 5:45 PM. They offered to make a similar presentation for any agencies or community groups desiring more information. Forty people attended the meeting.

Public meeting materials can be found in the Public Meeting # 1 folder.

VII. Next Steps

As previously outlined in this memo, the recommended alternative is to meter all inbound entrance ramps on I-74 between I-275 and I-75, except for Harrison Road. Additional storage capacity and acceleration distance is needed at Montana and Beekman/Colerain. As a result, physical ramp widening is needed. Engineering and environmental studies should begin on these ramps.

The ramp metering electronics are conceptually laid out in the preliminary design figures. Additional coordination is required with ARTIMIS to determine the needs for additional surveillance of the entrance ramps. Fiber-optic, wireless or less costly communication solutions are needed to provide communication back to the ARTIMIS system.

Operational issues should continue to be discussed. These considerations should include: 1) time-of-day vs. traffic responsive operating modes; 2) queue thresholds; 3) mainline thresholds for traffic responsive modes; 4) controller and firmware selection and functionality; 5) data archival; 6) ramp meter signal displays when meters are not operating; 7) operating hours; 8) ARTIMIS control and manual over-ride of the system; and 9) planning for turn-on.

The outreach campaign should continue to roll-out information to the public. This will help introduce the potential benefits of the ramp meter project to the media, public and other stakeholders and help generate awareness of the project.

Lastly, ODOT should continue to work with the City of Cincinnati Police and Hamilton County Sheriff to develop an enforcement strategy and funding grant to place patrols on the enforcement pads at each ramp meter. The grant and continued presence should only be required in the first 3-4 weeks of the turn-on.