MEMORANDUM

TO: **Mr. Gregory Masota**
North Central Texas Council of Governments

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DATE: **June 29, 2022**

SUBJECT: **RTSRP IV – IH 30 Corridor**

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Lee Engineering, as a subconsultant on the Kimley-Horn team, has developed incident timing plans for the IH 30 Corridor in Fort Worth between Las Vegas Trail and Summit Avenue/8th Avenue under the North Central Texas Council of Governments (NCTCOG) Regional Traffic Signal Retiming Program (RTSRP) Phase IV. The timing plans are intended for deployment when a significant incident occurs on the mainlanes of IH 30 causing traffic to divert to the frontage roads. Generally, the incident timing plans are intended to maximize capacity and one-way progression on the frontage roads. This memorandum documents the development and expected benefits of the incident timing plans.

BACKGROUND

Frontage road coordination is typically not a priority when developing coordinated timing. Crossing arterial progression is typically given priority under the assumption that drivers choose the mainlanes of a freeway facility rather than traveling along frontage roads. The ability to coordinate operations at interchanges, when necessary, with incident management timing plans provides a preferable alternative to the coordinated signal timing that is appropriate for frontage roads during normal operations.

Pilot Study

The first task of RTSRP IV included an assessment of operational characteristics and common performance measures for 46 candidate project segments along 18 different freeways or tollways throughout Dallas and Tarrant Counties.

The Kimley-Horn team delivered an initial inventory in March 2015. Based on a variety of factors and critical corridor characteristics, SH 161 from IH 30 to IH 20 in Grand Prairie and SH 360 from IH 30 to IH 20 in Arlington were selected as pilot corridors for incident management timing plans. Critical factors included continuity of frontage roads and communications to signals.

Positive Corridor Attributes

Based on the initial pilot corridor evaluation, the following attributes lead to successful incident timing implementations:

- Continuous frontage roads
- Favorable lane designations and control
- Controller capability to store incident plans
- Communications with permanent or remote Traffic Management Center (TMC)
- Designated TMC staff responsible for identifying incidents and implementing changes
- Ability and willingness to adjust diamond operations
- Video surveillance or other detection equipment in corridor
- Available dynamic signs or other media to communicate with drivers
- Available capacity in corridor during peak or off-peak periods
- Buy-in from key staff to make use of incident plans

Benefits of the Program

RTSRP IV has a wide range of benefits. Continuing the project and implementing incident management timing plans on corridors throughout the NCTCOG region has potential safety, air quality, operational, and economic benefits.

Incident management timing plans help improve safety for first responders, support teams, and the public by reducing non-recurrent congestion created by incidents on freeways. The likelihood of secondary incidents, such as unsuspecting drivers colliding with the back of a stopped queue on the mainlanes, can be reduced by diverting traffic to the frontage roads.

Reducing congestion improves air quality by reducing idling time and emissions.

Delay is reduced as congestion is cleared from the mainlanes more quickly, saving fuel and delay costs.

By maintaining as much capacity and safety as practical during an incident through taking advantage of additional capacity on frontage roads and adjacent arterials during incidents, both the incident itself and related congestion can be cleared more quickly.

Overall, incident management timing plans work toward the goal of providing a safer and more secure transportation environment for people and goods.

IH 30 CORRIDOR

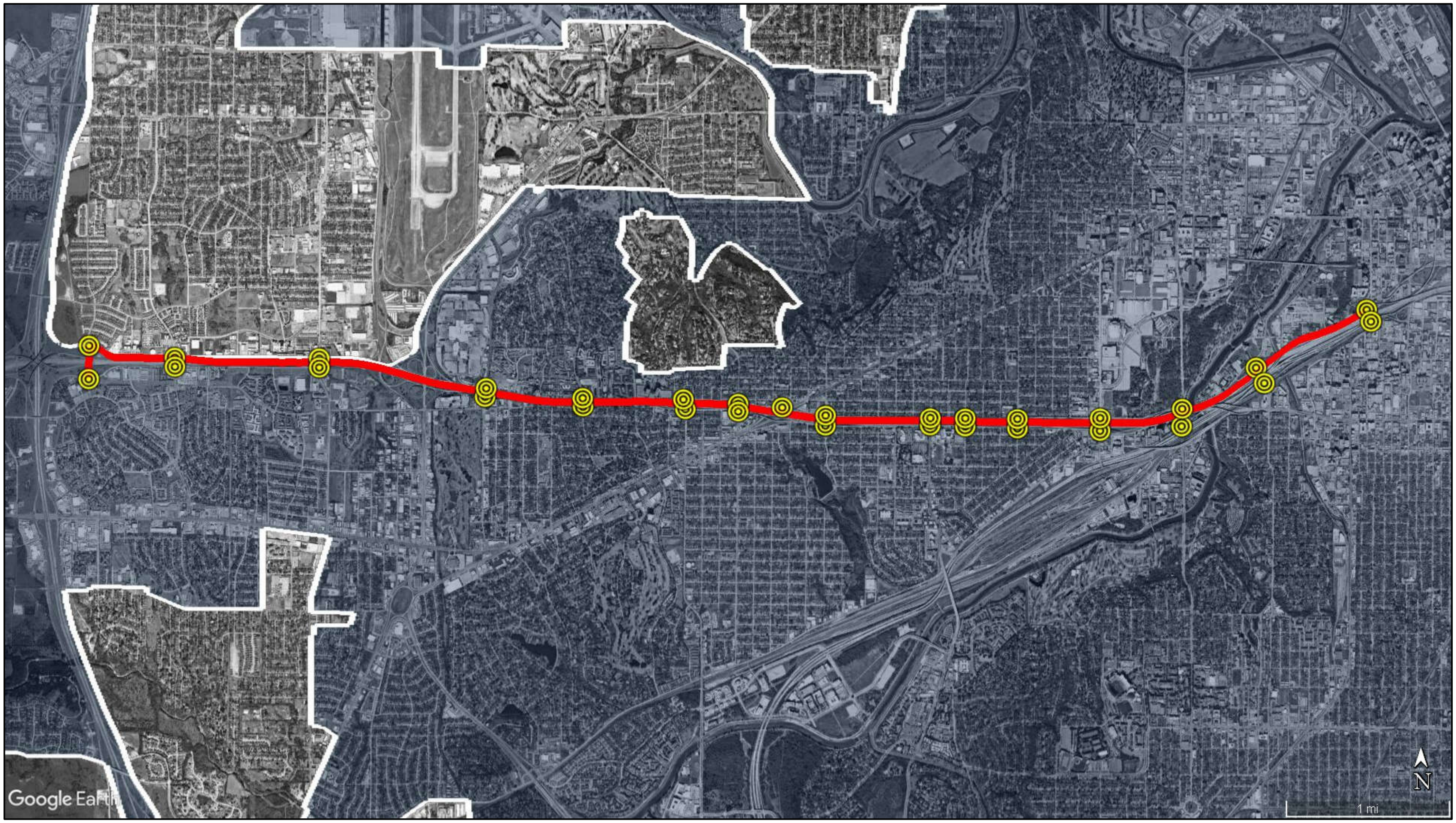
Following the pilot study, Kimley-Horn re-evaluated potential project corridors. The IH 30 Corridor in Fort Worth between Las Vegas Trail and Summit Avenue/8th Avenue met the criteria listed above and was selected as a production corridor. The corridor consisted of 11 diamond interchanges, one (1) frontage road intersection and five (5) adjacent intersections, for a total of 28 project intersections. **Figure 1** shows the project corridor (Fort Worth city limits in blue), and **Table 1** lists the project intersections. As seen in Table 1, one (1) of the original project adjacent intersections was removed since the City of Fort Worth does not operate and maintain the intersection.

Table 1: IH 30 Corridor Project Intersections

Index	NCTCOG #	Corridor Street	Cross Street	City
1	253	IH 30 EBFR	Las Vegas Trail	Fort Worth
2	254	IH 30 WBFR	Las Vegas Trail	Fort Worth
3	307	IH 30 EBFR	Cherry Lane	Fort Worth
4	308	IH 30 WBFR	Cherry Lane	Fort Worth
5	304	IH 30 EBFR	Green Oaks Road	Fort Worth
6	321	IH 30 WBFR	Green Oaks Road	Fort Worth
7	305	IH 30 EBFR	Ridgmar Boulevard	Fort Worth
8	306	IH 30 WBFR	Ridgmar Boulevard	Fort Worth
9	333	IH 30 EBFR	Bryant Irvin Road	Fort Worth
10	334	IH 30 WBFR	Bryant Irvin Road	Fort Worth
11	336	IH 30 EBFR	Horne Street	Fort Worth
12	337	IH 30 WBFR	Horne Street	Fort Worth
13	338	IH 30 WBFR	Camp Bowie Boulevard	Fort Worth
14	345	IH 30 EBFR	Hulen Street	Fort Worth
15	344	IH 30 WBFR	Hulen Street	Fort Worth
16	452	IH 30 EBFR	Ashland Avenue	Fort Worth
17	453	IH 30 WBFR	Ashland Avenue	Fort Worth
18	459	IH 30 EBFR	Montgomery Street	Fort Worth
19	460	IH 30 WBFR	Montgomery Street	Fort Worth
20	517	IH 30 EBFR	Forest Park Boulevard	Fort Worth
21	518	IH 30 WBFR	Forest Park Boulevard	Fort Worth
22	525	IH 30 EBFR	Summit Avenue/8th Avenue	Fort Worth
23	526	IH 30 WBFR	Summit Avenue/8th Avenue	Fort Worth
~~24~~ [1]	~~309~~	~~Scott Street~~	~~Cherry Lane~~	~~Haltom City~~
25	303	Green Oaks Road	Calmont Avenue	Fort Worth
26	335	Camp Bowie Boulevard	Horne Street	Fort Worth
27	5027	Hulen Street	Arlington Heights High School	Fort Worth
28	5414	Montgomery Street	Lovell Avenue	Fort Worth
29	530	Summit Avenue	Rio Grande Avenue	Fort Worth

[1]Intersection removed – outside City of Fort Worth City Limits (not maintained by City of Fort Worth)

Figure 1: IH 30 Corridor



Source: Google Earth

Many of the included signals had existing coordination. In such cases, if capacity was available, new timing plans considered retaining existing cycle lengths and/or control groups whenever possible (i.e., if the normal, non-incident traffic plus the diverting volume could be accommodated by the existing cycle length).

APPROACH

Lee Engineering developed a total of 12 incident timing plans based on three variables for the IH 30 Corridor: peak period (AM, midday, PM), direction (eastbound or westbound), and incident intensity (moderate or severe):

- AM Eastbound Moderate Intensity
- AM Westbound Moderate Intensity
- MD Eastbound Moderate Intensity
- MD Westbound Moderate Intensity
- PM Eastbound Moderate Intensity
- PM Westbound Moderate Intensity
- AM Eastbound Severe Intensity
- AM Westbound Severe Intensity
- MD Eastbound Severe Intensity
- MD Westbound Severe Intensity
- PM Eastbound Severe Intensity
- PM Westbound Severe Intensity

Moderate intensity plans typically used existing cycle lengths in an effort to maintain existing crossing arterial coordination. Severe intensity plans increased cycle lengths to provide additional frontage road capacity.

In general, timing plans were developed to maximize capacity and bandwidth on the frontage road in the direction of the incident. Frontage road phases were set as the coordinated phase to allow any unused split time to be returned to the incident direction. Splits on all other approaches were set to a volume/capacity (v/c) ratio of 0.99, maximizing the time available for the incident direction. Plans were designed to be modular, allowing agencies to deploy only when and where necessary. For example, an eastbound incident on the IH 30 Corridor at the Montgomery Street intersection might only require incident plans to be activated at the Montgomery Street interchange and the two (2) signalized interchanges west of Montgomery Street with the remaining interchanges continuing normal operations.

All plans were provided to the City of Fort Worth and programmed into controllers. The programming was verified in the field using the Kimley-Horn team's standard implementation process. However, the plans cannot be fine-tuned in advance because they are designed for an unplanned incident. The plans have all been deployed and tested, ready to be deployed during an incident.

BENEFITS OF DIVERSION TIMING

Typically, the benefits of signal retiming are quantified through direct measurements, such as travel time runs. On other RTSRP projects, "before" and "after" conditions of the corridor are compared. Measurements rely on comparing changes in the standard metrics included in all signal timing projects: travel time, stops, average speed, and delay. Travel time runs form the basis of traditional signal timing performance metrics. Data used to calculate the improvements in each metric can be collected using a traditional floating car technique or through crowd-sourced probe-based data.

The frontage road timing presents particular challenges to objective quantification. The plans are not activated at a set time, or for a set duration. Not all intersections will require an incident plan for every incident. The unpredictable nature of the events precludes the collection of floating car travel time data. Probe-based data provides many advantages over traditional data collection methods in this scenario. The data (including historical data) is readily available and does not require infrastructure investment. Because the data is automatically collected and stored by the provider, there is no need for local storage of data. Additionally, collecting the data does not require a driver in the field traveling the corridor during each time period to be analyzed. Data can be analyzed for an entire day, not just during peak periods when collected by a floating car; this is especially useful for analyzing incident plans, which are unpredictably deployed by nature.

Counting vehicles to determine the changes in throughput at each intersection is also impractical. Hand counts are not possible, due to the unpredictability of the incidents. Automated counts, collected with devices such as Autoscope cameras or Bluetooth readers, would require devices installed at every potentially affected intersection. These counts would provide valuable data but would cost approximately $500,000 to install just on the pilot corridors. Thus, it was determined costs outweighed benefits of installing equipment to gather this volume data, and equipment was not installed.

Because diversion timing is not conducive to directly measuring benefits, a surrogate method of modeling benefits was used to compare benefits between different diversion timing plans.

Modeled Benefits

Synchro models of normal traffic conditions for AM, Midday, and PM peak conditions provide a baseline for comparison of anticipated benefits. Though each incident will have different characteristics and will add different amounts of demand to the frontage roads, one consistent benefit of each incident timing plan deployed is the additional capacity added to signalized movements intended to handle diverting traffic. In theory, the more capacity that can be added or moved to the critical intersection approaches, the greater the delay savings; thus, the more beneficial implementation of incident plans developed through this program. **Table 2** provides a summary of the total capacity added to the signalized movements at the frontage roads.

Table 2: IH 30 Corridor Project Modeled Benefit

Incident Plan	Cycle Length (sec)	Max Δ (veh)	Min Δ (veh)	Average Δ (veh)
AM Eastbound Moderate Intensity	120 / 130 / 140	1,570	0	607
AM Westbound Moderate Intensity	120 / 130 / 140	3,010	210	1,015
MD Eastbound Moderate Intensity	120 / 130	1,680	130	767
MD Westbound Moderate Intensity	120 / 130	2,490	90	1,049
PM Eastbound Moderate Intensity	120 / 130 / 140	2,050	40	617
PM Westbound Moderate Intensity	120 / 130 / 140	1,640	0	769
AM Eastbound Severe Intensity	140 / 160	1,940	410	962
AM Westbound Severe Intensity	140 / 160	3,260	380	1,371
MD Eastbound Severe Intensity	140 / 150 / 160	2,270	430	1,182
MD Westbound Severe Intensity	140 / 150 / 160	2,620	480	1,405
PM Eastbound Severe Intensity	140 / 150 / 160	2,280	160	918
PM Westbound Severe Intensity	140 / 150 / 160	1,970	170	1,126

AM and PM peak traffic is near- or over-capacity on many intersection approaches within the IH 30 Corridor, resulting in more modest opportunities to serve diverting traffic from the IH 30 main lanes than outside of the actual peaks. This is especially true within the currently operating background cycle lengths being maintained for "moderate intensity" incident timing. However, during midday and off-peak periods, opportunities to provide additional capacity (and time) for traffic diverting to the frontage road approaches is much greater, resulting in much more significant potential benefit. Because midday/off-peak plans operate for a majority of the day and week, these plans provide the best assessment of potential project benefits.

"Incident-Critical" in this assessment refers to a frontage road approach that serves anticipated diversion traffic traveling in the same direction as the mainlane traffic impacted by an incident. Added capacity on these critical approaches theoretically results in driver benefit by reducing overall system delays in the corridor.

For all three peak periods (AM, MD, PM), estimated benefits were higher during the severe incident timing plans than the moderate incident timing plans, as the severe incident timing plans had an average added capacity per incident-critical approach of approximately 1,160 vehicles per hour (vph) compared to approximately 800 vph for moderate incident timing plans.

In terms of increasing available capacity, this redistribution of time to incident-critical approaches significantly increases the ability to serve diverting traffic.

Assumed Benefits

Diverting traffic from the congested mainlanes to coordinated frontage roads during incidents can be assumed to provide additional safety benefits by shifting demand from the mainlanes to the frontage roads. According to the Federal Highway Administration[1], approximately 20 percent of all incidents are secondary crashes. Queue lengths and durations should be reduced by diverting traffic

1 https://ops.fhwa.dot.gov/aboutus/one_pagers/tim.htm

to the frontage roads, therefore reducing driver exposure to secondary crashes. Shorter queues can also be cleared faster, further improving safety, reducing delay, and decreasing emissions.

These assumed benefits are difficult to accurately quantify, due to the unique characteristics and unpredictable nature of each freeway incident and drivers' reactions to incidents. Assumptions could be made based on historical crash records or national statistics to quantify benefits, but these calculations would be rough approximations at best.

IMPACTS TO POTENTIAL BENEFITS OF INCIDENT PLANS

Based on the initial pilot corridor evaluation, there are several factors that can impact how much benefit can be recognized by incident plans, outside of the specific corridor characteristics:

- The time the incident takes place (availability of operational staff)
- Severity of the incident
- Duration of the incident and subsequent queue impact
- How early in the incident a plan is deployed
- Weather conditions during the incident
- Information able to be provided to the motorists

RECOMMENDATIONS

Incident plans for the IH 30 Corridor should be deployed by the City of Fort Worth as needed when a significant unplanned incident occurs on the mainlanes of IH 30 causing traffic to divert to the frontage roads. Crowd-sourced data could be utilized to detect, monitor, and evaluate incidents and operations. Communications to drivers, including DMS, traveler information systems, and social media, should be considered in developing incident management strategies. The incident management strategy and procedure should be formalized and documented. Incident timing deployment should be logged and tracked for retrospective analysis; **Table 3** below shows an example incident timing deployment log from the City of Arlington (as of November 8, 2018):

Table 3: Incident Timing Deployment Log (City of Arlington)

Date	Incident Plan Deployment Start Time	Incident Plan Deployment End Time	Duration	Direction	Comments
Friday, February 9, 2018	8:35 PM	9:32 PM	57 minutes	NB	Incident/Backup due to lane closure
Wednesday, May 23, 2018	8:20 AM	8:35 AM	15 minutes	NB	Incident/Backup due to lane closure
Tuesday, July 10, 2018	2:40 PM	3:09 PM	29 minutes	SB	Incident/Backup due to lane closure
Saturday, July 28, 2018	9:59 AM	12:39 PM	160 minutes	SB	Full mainlane closure due to construction
Friday, August 10, 2018	1:25 PM	2:55 PM	90 minutes	SB	Incident/Backup due to lane closure
Thursday, October 11, 2018	8:40 AM	9:05 AM	25 minutes	NB	Incident/Backup; Park Row Intersection Only
Saturday, November 3, 2018	12:30 PM	3:00 PM	150 minutes	Both	Full mainlane closure due to construction; Park Row Intersection Only
Thursday, November 8, 2018	8:20 AM	8:35 AM	15 minutes	NB	Incident/Backup; Park Row Intersection Only

CONCLUSIONS

Twelve modular incident timing plans have been developed and deployed for the IH 30 Corridor. The plans are ready for activation by the City of Fort Worth as needed to meet the goals of RTSRP Phase IV, most notably maximizing capacity and one-way progression on the frontage roads during a significant incident.