December 4, 2024

ADDENDUM #1

RFQ 24-177 Prof. Svcs. CMAQ 7302(714) St. Charles County Fiber Interconnect Expansion

Addendum #1 is being issued to provide answers to questions received concerning this RFQ.

Q: Under this Qualifications section, it lists a maximum page limit for the Letter of Interest at 2-3 pages, followed by all the items that should be shown in the letter. Then in the Evaluation section, it lists a page limit for each of the scoring criteria (totally 27 pages). Can you confirm whether the page limit for this response is the 2-3 pages of the LOI or the 30 pages of LOI+each evaluation criteria section?

A: The page limit for the response shall be 30 pages total. 2-3 pages for the Letter of Interest, and 27 pages for responses to the evaluation criteria.

Q: Is the intent to have the winning consultant perform the construction and installation of the tasks outlined in Task 1-3? Or is the consultant responsible for the design and oversight/inspection of the construction contractor performing the installation?

A: The County is not intent on the winning Consultants performing the construction and installation of Tasks 1-3 and their subtasks. The Consultant shall be responsible for the preparation of design plans, specifications, and construction estimate, as well as provide construction engineering and inspection services to the County during the construction of the project.

Q: What is the expected timeline?

A: The timeline expected for the project is provided in the CMAQ application.

Q: What is the overall budget for the project?

A: The project budget is provided in the CMAQ application.

Q: Can you provide a copy or link to the GGL Feasibility Study?

A: The Feasibility Study Report is also incorporated within the CMAQ application.

Q: Can you provide a copy of the CMAQ application?

A: A copy has been posted with this Addendum #1.

Interested Consultants shall sign this Addendum as acknowledgment and return it with the bid.

RFQ ADDENDUM

Addendum #1 **Dated**_____

We the undersigned, acknowledge the receipt of the above addendum, as dated.

By:_____

Title:_____

Company:_____

Date:_____

Project Application Form

CMAQ

Congestion Mitigation & Air Quality Improvement Program

2024 Call for Projects

For the St. Louis Region

Sponsoring Agency: St. Charles County

Project Title: St. Charles County Fiber Interconnect Expansion

Federal Amount Requested: $2,718,970

Applications Due: February 8, 2024 by 4:00 pm

*** If applying for Carbon Reduction Program (CRP) funds, fill out this application. More information on CRP is provided in Appendix B of the CMAQ Project Development Workbook.**

EAST-WEST GATEWAY
Council of Governments
Creating Solutions Across Jurisdictional Boundaries

November 2023

CONGESTION MITIGATION & AIR QUALITY IMPROVEMENT PROGRAM (CMAQ)

PROJECT APPLICATION FORM

Please refer to the CMAQ Project Development Workbook for more information on the program requirements, available funding, and scoring criteria. The CMAQ Project Development Workbook and supplemental materials are available on the East-West Gateway Council of Governments (EWG) CMAQ Call for Projects web page: https://www.ewgateway.org/transportation-planning/transportation-improvement-program/competitive-transportation-programs/call-for-projects-cmaq/

The call for projects begins on **November 3, 2023** and ends on **February 8, 2024** at 4:00 pm. Applications received after the deadline will not be accepted. Submit the completed application and necessary attachments electronically to EWG at cmaq@ewgateway.org. Save the electronic copy as a PDF file using the following format: 2024CMAQ_[Sponsor]_[Project Name].pdf. The electronic submission must include scanned signatures and attachments. Please submit one application per email. You will receive an email confirmation within one business day of submittal. If you do not receive confirmation or have questions about the application, contact EWG staff. The information provided in this application is public record.

APPLICATION FEE

An application fee is required for each project that is submitted for consideration. The application fee is ½ of one percent of the federal funds being requested. For example, a project sponsor requesting $800,000 in federal funding would be required to pay a $4,000 application fee. Counties make annual contributions to EWG and, as such, a credit equal to their annual contribution is applied against their application fee. Counties will be invoiced for any amount above the annual contribution credit.

The TIP Application Fee Payment Information Form must be included with the TIP application fee. This form is available on the CMAQ Call for Projects web page. Application fees may be submitted by check via mail or through electronic funds transfer (EFT). Mailed application fees must be postmarked by February 8, 2024. For check payments, send the TIP Application Fee Payment Information Form and check to:

TIP Application
East-West Gateway Council of Governments
1 S. Memorial Drive, Suite 1600
St. Louis, MO 63102-2451

For EFT payments, send the TIP Application Fee Payment Information Form via email to tipappfees@ewgateway.org. EFT payments are due by February 15, 2024.

CONTACT INFORMATION

Jason Lange, TIP Coordinator
East-West Gateway Council of Governments
One Memorial Drive, Suite 1600
St. Louis, MO 63102-2451
E-mail: cmaq@ewgateway.org

PROJECT CHECKLIST AND SUBMITTAL REQUIREMENTS

The evaluation and scoring of all projects will be based on the answers provided in the application and the attachments submitted.

The materials should be submitted in the following order.

Project Application:

- ☑ **Completed CMAQ application**
- ☑ **Scanned required signatures** – Notification of Title VI & Nondiscrimination Requirements, Financial Certification of Matching Funds, Person of Responsible Charge Certification, Right-of-Way Acquisition Certification Statement, Policy on Reasonable Progress Certification (MO only).

Attachment A:

- ☑ **Project location map** – depict the location of the project on a base map such as a town road map, GIS map, aerial photo, or another base map suitable to clearly show the project's overall location. Provide on an 8 ½ x 11 page.
- ☑ **Detailed cost estimate** – use Estimate of Project Costs excel file provided by EWG.
- ☑ **Letter of permission from facility owner** – provide if sponsor does not own roadway.
- ☐ **Letter of support from match source** – provide if individual, business, other local public agency, or other third-party is providing matching funds.
- ☐ **Coordination letter(s)** – provide if sponsor requires coordination with other agencies to implement the project (e.g., Bi-State Development, Madison County Transit District, or St. Clair County Transit District).

Attachment B:

- ☐ **Photographs** – attach photo(s) (e.g., showing current roadway congestion).
- ☐ **Typical section** – show details of before and after roadway improvements.
- ☑ **CMAQdata spreadsheet** – required for project evaluation.
- ☑ **Traffic engineering analysis** – required for roadway projects.

Attachment C: *(optional)*

- ☑ **Documentation of an approved or adopted plan, ordinance, and/or policy that supports the project** – do not attach entire plan documents, only include the necessary pages.
- ☑ **Letters of support** – endorsements or petitions from associations, boards, school districts, citizens, businesses, etc. Only attach letters of support that pertain to specific project.
- ☐ **Documentation of public involvement process** – public meeting minutes, newspaper clippings, press announcements, etc.

Attachment D:

- ☑ **ITS architecture consistency** – submit ITS Architecture Project Consistency Statement Form provided by EWG if project includes ITS elements or modifies existing ITS.

SPONSOR INFORMATION

Sponsoring agency:	St. Charles County						
Secondary sponsor agency (if applicable):							
Chief Elected Official/Chief Executive Director:							
Name:	Steve Ehlmann			Title:	County Executive		
Street address:	100 N Third St						
City:	St. Charles	State:	MO	County:	St. Charles	ZIP code:	63301
Project contact:							
Name:	Jacob Becher			Title:	Project Manager		
Agency:	St. Charles County						
Street address:	201 N Second St						
City:	St. Charles	State:	MO	County:	St. Charles	ZIP code:	63301
Phone Number:	636-949-7900 x7230			E-mail address:	JBecher@sccmo.org		
Application contact:							
Name:	Jacob Becher			Phone Number:	636-949-7900 x7230		
E-mail address:	JBecher@sccmo.org						

PROJECT INFORMATION

Project title:	St. Charles County Fiber Interconnect

Project status:
- ☑ New project
- ☐ Continuation of STP-S/CMAQ/TAP project
- ☐ Add to existing non-federally funded project

Is this application request for a piece of a larger project (phase) or the entire length of project?
- ☐ Phase
- ☑ Full project

If project is a continuation of another project that was previously programmed in the TIP, provide TIP ID # of existing project and also explain this relationship:

If this project is a phase of a full project, how many phases are left to complete the project? Briefly explain each phase (i.e., project limits and general improvements):

Has your agency previously competed for funds for this specific project?
☐ Yes ☑ No

If yes, when?

Does this project touch MoDOT or IDOT right-of-way or involve a MoDOT or IDOT roadway?
☐ Yes ☑ No

Does the sponsoring agency own and maintain this facility?
☑ Yes ☐ No

If no, a letter of support for this project is required from the facility owner.

If no, who owns the facility?	

ROADWAY INFORMATION				
Name of street or facility to be improved:	O'Fallon Rd, Upper Bottom Rd, Knaust Rd, Jungs Station			
Project length (miles):	9.3			
Project limits – north/west reference point, cross street, or intersection:	Various			
Project limits – south/east reference point, cross street, or intersection:	Various			
Federal functional classification of road (per EWG)[1]:	Local Collector			
	CURRENT:		**PROPOSED (Year of Construction):**	
Traffic volumes (AADT):	8500	Year: 2019	2027	Year: 10500
Identify source of AADT[2]:	Manual Count		Travel Demand Model	
Speed limit of street (mph):	35		35	
Number of through lanes (both directions):	1		1	
Number of turn lanes:	0		0	
Two-way left turn lanes?	☐ Yes ☑ No		☐ Yes ☑ No	
Typical lane width (feet):	12		12	
Outside lane width (feet):	0		0	
Shoulder width (feet):	4		4	
On-street parking allowed?	☐ Yes ☑ No		☐ Yes ☑ No	
Curb and gutter?	☐ Yes ☑ No		☐ Yes ☑ No	
Sidewalks?	☑ One side ☐ Both sides ☐ None		☑ One side ☐ Both sides ☐ None	
Sidewalk width (feet):	Varies		Varies	
Existing sidewalk surface condition[3]:	☐ Poor ☑ Fair ☐ Good ☐ Excellent ☐ None		n/a	
Sidewalk/roadway separation width (feet):	0			
On-road bicycle facility[4]?	☐ Yes ☑ No		☐ Yes ☑ No	
On-road bicycle facility width (feet):	N/A		N/A	
Shared-use path/sidepath?	☐ Yes ☑ No		☐ Yes ☑ No	
Shared-use path/sidepath width (feet):	N/A		N/A	

[1] EWG Functional Classification maps: www.ewgateway.org/FuncClass.

[2] If source is state DOT, use data from most recent available year. If source is a count conducted by the local agency, must be within five years.

[3] **Poor**: the sidewalk has deep cracking and buckling, poor drainage, or a bulging surface (due to tree roots). Impassable to mobility impaired pedestrians. **Fair**: the sidewalk contains cracks or an uneven and distressed surface. Hinders mobility of the average pedestrian. **Good**: the sidewalk is free from significant cracking, buckling, or gravel surfaces. Unlikely to hinder mobility of the average pedestrian. **Excellent**: the sidewalk is in like new condition and contains no cracking or buckling. Does not hinder mobility of the average pedestrian. **None**: no sidewalk is present

[4] On-road bicycle facility includes: bike lanes (separated, buffered, and standard). Shared-lane markings (sharrows) and share the road signage are not bicycle facilities. View EWG Bicycle Planning Guide for a description of bicycle facilities: https://www.ewgateway.org/wp-content/uploads/2018/07/BicyclePlanningGuide_June2018.pdf.

LAND ACQUISITION INFORMATION

Status of right-of-way acquisition (all properties, permanent and/or temporary easements, Temporary Slope Construction License (TSCL), and other rights-of-way):

- [x] All acquired or none needed
- [ ] In process
- [x] Not started

If applicable, list the number of parcels to be acquired (all properties, permanent and/or temporary easements, TSCL, and other rights-of-way):

None needed

If any residential or commercial displacements are anticipated, give details on how many and if they are residential and/or commercial:

n/a

Right-of-way acquisition by:	n/a
Right-of-way condemnation by:	n/a

Will the project traverse any public property, such as a public park that has used federal funds (e.g., Land and Water Conservation Funds) in the past?

- [ ] Yes
- [ ] No
- [x] Unknown

UTILITY COORDINATION

Note: *Project sponsor must coordinate with utilities prior to construction.*

Will the project require the relocation of any utilities?

- [ ] Yes
- [x] No

If yes, check the appropriate box to select the type of utility. Then give the names of the utility companies.

☐ Electric	CREC, Ameren UE
☐ Phone	AT&T, Lumen, MCI, Spectrum, i3 Broadband, Gateway Fiber, Bluebird, Everstream
☐ Gas	Spire
☐ Water	Missouri American, City of St. Peters, City of O'Fallon
☐ Cable TV	Spectrum, AT&T
☐ Storm sewer	Duckett Creek, PWSD #2
☐ Sanitary sewer	Duckett Creek, PWSD #2
☐	
☐	

Give details concerning potential utility conflicts, problems, or issues:

n/a

Utility coordination completed by:	Consultant
Designed by:	Consultant
Inspected by:	Consultant

RAILROAD COORDINATION

Does the project traverse any property owned by a railroad?
☐ Yes ☑ No

Is there a railroad within 500' of project limits?
☐ Yes ☑ No

Name of railroad:	n/a
Number of crossings impacted:	n/a
Are the crossings active?	☐ Yes ☐ No
Width of crossing:	n/a

What is the crossing type?
☐ Timber
☐ Rubberized
☐ Asphalt
☐ Concrete
☐ Other

Describe other:
n/a

PROJECT MAINTENANCE

List any regular maintenance tasks anticipated over the next 25 years:
Locating and marking facilities, making repairs as needed.

Estimated annual cost to maintain facility and funding source:
$25,000
St. Charles County Roads and Traffic (1/2 cent Transportation sales tax)

AMERICANS WITH DISABILITIES ACT

Under the 1990 Americans with Disabilities Act (ADA), Title II requires public entities with more than 50 employees to complete a self-evaluation and create an effective ADA transition plan[5].

Does your local public agency have more than 50 employees?
☑ Yes ☐ No

If yes, does your agency have an adopted ADA transition plan?
☐ Yes ☑ No

If your agency has an ADA transition plan, when was it adopted?	
If ADA transition plan is not adopted, when is it expected to be adopted?	

[5] FHWA Questions and Answers about ADA/Section 504: https://www.fhwa.dot.gov/civilrights/programs/ada_sect504qa.cfm.

EQUITY

Transportation equity populations (TEPs) are population groups that face barriers related to transportation or are disproportionately affected by negative effects of past transportation decisions. They are people of minority races and ethnicities, those with income below the poverty level, seniors (aged 65+), those with limited English proficiency (LEP), persons with disabilities, and no-vehicle households. See EWG's Transportation Equity Assessment for additional details: https://www.ewgateway.org/transportation-planning/long-range-transportation-planning/connected-2050/trans-equity-assessment/

Are you familiar with EWG's Transportation Equity Assessment?

☑ Yes ☐ No

Have you considered how this project would affect one or more of these groups that travel in or through your community?

☑ Yes ☐ No

If yes, please describe either positive or negative impacts on TEP populations that would be associated with this project.

This project will serve to stengthen the backbone of St. Charles County's communications systems which are utilized to operate the Gateway Green Light Advanced Traffic Management System, as well as provide broadband netowrking for government services. Expanding this footprint and imrpoving this infrastructure provides residents and travelers throughout the County more responsive, reliable, and resilient transportation infrstructure. The positive impacts are improved travel time efficiency and reliability and expanded capabilities for other County initiatives to improve roadway safety and emissions.

How can EWG help you incorporate equity into your transportation projects?

EWG can help agencies by specifically identifying both areas of TEPs and the specific needs of each area to allow for implementation of critical, targeted projects.

PROJECT DESCRIPTION

Define the **scope** and **specific elements** of the project. Describe current conditions / problems / issues that the project will address. Be as specific as possible.

The 2020 St. Charles County Gateway Green Light Feasibility Study identified need to expand fiber optic network and need to improve communications network redundancy and self-healing as top priorities for the County. Two key program areas addressed by this project are the backbone fiber optic communications expansion and the fiber optic connections to municipalities for transportation and essential services uses. This project will serve to provide fiber interconnect to 15 existing and one future traffic signal along various roadways through St. Charles County. The new high speed fiber backbone will improve communications to traffic signals for real-time traffic management, and provide far greater bandwith for data flows, which combined, will allow the County to improve traffic signal operations. These intersections represent the majority of the final signalized intersections in St. Charles County to be brought onto fiber interconnect; upon completion of this and other County projects 213 of the 218 non-MoDOT intersections in St. Charles County will be fiber connected; 350 of 360, MoDOT included. A universally connected system will better serve the County's advancements in Emergency Vehicle Priority serve, and Signal Performance Measures for traffic signal optimization.

PROJECT DEVELOPMENT SCHEDULE

Note: *many stages can occur concurrently.*

Activity Description	Start Date (MM/YYYY)	Finish Date (MM/YYYY)	Time Frame (Months)
Receive notification letter	10/2024	10/2024	1
Execute agreement (project sponsor and DOT)	11/2024	1/2025	2
Engineering services contract submitted and approved*	2/2025	3/2025	2
Obtain environmental clearances (106, CE-2, etc.)	3/2025	4/2025	2
Public meeting/hearing	4/2025	4/2025	1
Develop and submit preliminary plans	4/2025	10/2025	6
Preliminary plans approved	10/2025	12/2025	2
Develop and submit right-of-way plans	5/2025	2/2026	9
Review and approval of right-of-way plans	2/2026	3/2026	2
Submit and receive approval for notice to proceed for right-of-way acquisition (A-Date)*	n/a	n/a	0
Right-of-way acquisition			
Utility coordination	5/2025	2/2026	9
Develop and submit PS&E	1/2026	5/2026	5
District approval of PS&E/advertise for bids*	6/2026	7/2026	2
Submit and receive bids for review and approval	8/2026	8/2026	1
Project implementation/construction	10/2026	6/2027	9

***** Finish date must match fiscal year for each milestone shown in **bold** text.

FINANCIAL PLAN

Note: *federal participation for a phase of work must not exceed 80% for most projects. Carpool/vanpool acquisition and marketing projects may be reimbursed up to 100%. Sponsor share of at least 50% is required for public-private partnerships.*

Activity[6]	Starting Federal Fiscal Year[7]	Total Phase Cost	Federal Funds Requested	Sponsor Share	Sponsor Share Percentage
PE / Planning / Environmental Studies	FY 2025	$ 424,839	$ 339,871	$ 84,968	20.00%
Right-of-Way (ROW)	FY 2026	$ 0	$ 0	$ 0	0.00%
Construction Engineering	FY 2027	$ 141,613	$ 113,290	$ 28,323	20.00%
Construction / Implementation	FY 2026	$ 2,832,260	$ 2,265,808	$ 566,452	20.00%
TOTAL PROJECT COST		$ 3,398,712	$ 2,718,970	$ 679,742	20.00%

Identify the source(s) of local matching funds (e.g., state DOT, city, county, county road board, county motor fuel tax, private entity), and the amount for each source:	St. Charles County Roads and Traffic (1/2 Transporation sales tax)

[6] **Illinois**: preliminary engineering (PE) funds are available in FY 2025, right-of-way (ROW) in FY 2025 or FY 2026, and construction/construction engineering in FY 2026 or FY 2027.

Missouri: PE funds are available in FY 2025, ROW in FY 2025 or FY 2026, and construction/construction engineering in FY 2026 or FY 2027. **Note**: FY 2026 construction/construction engineering must be less than $1 million federal.

[7] Fiscal years are federal fiscal years (October 1 through September 30).

PROJECT TYPE

Check the box below that describes the primary benefit of the proposed improvement. More information can be found in **Appendix A** of the CMAQ Project Development Workbook.

Transit:
- ☐ System startup
- ☐ Transfer center
- ☐ Vehicle replacement
- ☐ New vehicle
- ☐ Park-and-ride facilities
- ☐ Other (specify):

Diesel retrofits:
- ☐ Diesel engine replacement
- ☐ Installation of after treatment hardware
- ☐ Other (specify):

Traffic flow improvements:
- ☑ Traffic signal interconnect
- ☐ Traffic signal replacement
- ☐ New traffic signal(s)
- ☑ Signal controller upgrades
- ☐ Intersection improvements
- ☐ Roundabout
- ☐ Other (specify):

Rideshare:
- ☐ Rideshare marketing
- ☐ Vanpool/carpool program
- ☐ Vanpool vehicle acquisition
- ☐ Park-and-ride facilities
- ☐ Reverse commute program
- ☐ Other (specify):

Bicycle and pedestrian:
- ☐ Bicycle parking improvements
- ☐ Bicycle lanes
- ☐ Shared use path
- ☐ Sidewalk
- ☐ Other (specify):

Inspection maintenance program (I-M)/other:
- ☐ Alternative fuel project
- ☐ Enhanced I-M program
- ☐ Mechanic training program
- ☐ Transit information/marketing
- ☐ Educational program
- ☐ Other (specify):

EMISSIONS DATA

Attach all applicable data identified in the CMAQdata spreadsheet (found on the CMAQ Call for Projects web page) for the type of project selected above. Provide all information from the area of primary benefit. A traffic engineering analysis is required for roadway projects. Traffic volumes must be based on present conditions/land use. If a large development is scheduled to open prior to the year of construction, the sponsor must provide its methodology to EWG staff for approval. Please contact EWG staff if any of the information requested is unclear or unavailable or if there are any questions concerning applicability. Failure to include the required data will result in rejection of the project application. Additional project data may be submitted and is encouraged. EWG staff will calculate the emissions reductions. Contact EWG staff by January 8, 2024 if the CMAQdata spreadsheet does not include the proposed project type or to seek approval to use proposed traffic volumes (for after) based on the anticipated development.

NOTIFICATION OF TITLE VI & NONDISCRIMINATION REQUIREMENTS

Title VI

A recipient of any federal funds from the U.S. Department of Transportation ("DOT") must comply with federal statutes, regulations, executive orders, and other pertinent directives that govern nondiscrimination in federally assisted programs. Below is a list of the statutes and regulations that may apply to a recipient's program; however, other federal requirements regarding nondiscrimination may be imposed by DOT.

A. Title VI of the Civil Rights Act of 1964, 78 Stat. 252, 42 U.S.C. §§ 2000d *et seq.*
B. All requirements imposed by or pursuant to the Code of Federal Regulations, Title 49: Transportation, Subtitle A: Office of the Secretary of Transportation, Part 21: *Nondiscrimination in Federally-Assisted Programs of the Department of Transportation—Effectuation of Title VI of the Civil Rights Act of 1964.*

As part of federal requirements, a recipient of funds from DOT must ensure that it has written policies and procedures in place to ensure nondiscrimination in its programs, up to and including, developing a Title VI Plan.

Nondiscrimination

A recipient of any federal funds from the U.S. Department of Transportation ("DOT") must comply with federal statutes, regulations, executive orders, and other pertinent directives that govern nondiscrimination in federally assisted programs. Below is a list of the statutes and regulations that may apply to a recipient's program; however, other federal requirements regarding nondiscrimination may be imposed by DOT.

A. Title VI of the Civil Rights Act of 1964, as amended, 42 U.S.C. § 2000d, and implementing regulations at 49 CFR Part 21 – *Nondiscrimination in Federally Assisted Programs of the Department of Transportation—Effectuation of Title VI of the Civil Rights Act.*
B. The equal employment opportunity provisions of 49 U.S.C. § 5332 and Title VII of the Civil Rights Act of 1964, 42 U.S.C. §§ 2000e *et seq.*, and implementing regulations, including;
    1. 41 CFR Part 60 – *Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor.*
C. Title IX of the Education Amendments of 1972, as amended, 20 U.S.C. §§ 1681 *et seq.*, and implementing regulations at 49 CFR Part 25 – *Nondiscrimination on the Basis of Sex in Education Programs or Activities Receiving Federal Financial Assistance.*
D. Section 504 of the Rehabilitation Act of 1973, as amended, 29 U.S.C. § 794, and the Americans with Disabilities Act of 1990, as amended, 42 U.S.C. §§ 12101 *et seq.*, and implementing regulations, including:
    1. 49 CFR Part 27—*Nondiscrimination on the Basis of Handicap in Programs and Activities Receiving or Benefiting from Federal Financial Assistance.*
    2. 49 CFR Part 37—*Transportation Services for Individuals with Disabilities (ADA).*
    3. 36 CFR Part 1192 and 49 CFR Part 38—*Americans with Disabilities (ADA) Accessibility Specifications for Transportation Vehicles.*
    4. 28 CFR Part 35—*Nondiscrimination on the Basis of Disability in State and Local Government Services.*
    5. 28 CFR Part 36—*Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities.*
    6. 41 CFR Subpart 101 – 119—*Accommodations for the Physically Handicapped.*
    7. 29 CFR Part 1630—*Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act.*
    8. 47 CFR Part 64, Subpart F—*Telecommunications Relay Services and Related Customer Premises Equipment for the Hearing and Speech Disabled.*
    9. 36 CFR Part 1194—*Electronic and Information Technology Accessibility Standards.*

10. 49 CFR Part 609—*Transportation for Elderly and Handicapped Persons*.
11. Federal civil rights and nondiscrimination directives implementing those federal laws and regulations, unless the federal government determines otherwise in writing.

E. The Age Discrimination Act of 1975, as amended, 42 U.S.C. §§ 6101 *et seq*.
F. The Age Discrimination in Employment Act, 29 U.S.C. §§ 621 through 634, and implement regulations of the U.S. Equal Employment Opportunity Commission at 29 CFR Part 1625—*Age Discrimination in Employment Act*.
G. The Drug Abuse Office and Treatment Act of 1972, as amended, 21 U.S.C. §§ 1101 *et seq.*, the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970, as amended, 42 U.S.C. §§ 4541 *et seq.*, and the Public Health Service Act of 1912, as amended, 42 U.S.C. §§ 290dd through 290dd-2.
H. Executive Order 12898—Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 42 U.S.C. § 4321 note, and DOT Order 5620.3 at Federal Register Vol. 62 No. 18377—*Department of Transportation Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*.
I. Executive Order 13166 – Improving Access to Services for Persons with Limited English Proficiency, 42 U.S.C. § 2000d – 1 note, and implementing policy guidance at Federal Register Vol. 70 No. 74087—*DOT Policy Guidance Concerning Recipients' Responsibilities to Limited English Proficiency (LEP) Person*.

By submitting its application as part of the TIP process and signing below, the Project Sponsor certifies that it has reviewed the federal requirements regarding nondiscrimination in federally assisted programs and believes that the Project Sponsor complies with the required policies and procedures.

Also, the Project Sponsor acknowledges its understanding that if the Project Sponsor does not have the required policies and procedures in place prior to federal funds being obligated, then the Project Sponsor's project may become ineligible for federal funding.

Amanda Brauer
Name (print)

Managing Director of Road + Traffic
Title


Signature

2-5-24
Date

FINANCIAL CERTIFICATION OF MATCHING FUNDS

This is to ensure sufficient funds are available to pay the non-federal share of project expenditures for the following project to be funded under the provisions of the Infrastructure Investment and Jobs Act (IIJA).

Project Title: St. Charles County Fiber Interconnect

Local Match Amount: $679,742.00

Sponsoring Agency: St. Charles County Government

Chief Elected Official (or Chief Executive Officer):

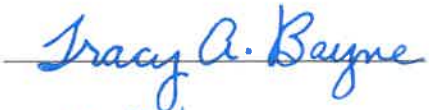
Name (print): Steve Ehlmann

Signature: 

Date: 2-5-24

Chief Financial Officer:

Name (print): Tacy Bayne

Signature: 

Date: 2/8/24

PERSON OF RESPONSIBLE CHARGE CERTIFICATION

The key regulatory provision, 23 CFR 635.105 – Supervising Agency, provides that the State Transportation Agency (STA) is responsible for construction of federal-aid projects, whether it or a local public agency (LPA) performs the work. The regulation provides that the STA and LPA must provide its full-time employee to be in "responsible charge" of the project.

The undersigned employee(s) of the Project Sponsor will act as person of responsible charge. If at any point the employee leaves the LPA, the LPA is responsible for finding a suitable replacement and notifying EWG. If the person of responsible charge is found to not be a full-time employee of the LPA, it will result in the loss of federal funds for this project. One employee can act as person of responsible charge for all three phases. All three phases must be signed.

Person of Responsible Charge – Design Phase

Name (print): Jacob Becher

Title: Project Manager Email: JBecher@sccmo.org

Signature: Jacob Becher

Date: 2-6-2024

Person of Responsible Charge – Right-of-Way Acquisition Phase

Name (print): Jacob Becher

Title: Project Manager Email: JBecher@sccmo.org

Signature: Jacob Becher

Date: 2-6-2024

Person of Responsible Charge – Construction/Implementation Phase

Name (print): Jacob Becher

Title: Project Manager Email: JBecher@sccmo.org

Signature: Jacob Becher

Date: 2-6-2024

RIGHT-OF-WAY ACQUISITION CERTIFICATION STATEMENT

The State Department of Transportation and the Federal Highway Administration (FHWA) have the right and responsibility to review and monitor the acquisition procedures of any federally funded transportation project for adherence to The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970. Those projects found in non-compliance may jeopardize all or part of their federal funding.

A. The Project Sponsor hereby certifies that any right-of-way, and/or permanent or temporary easements necessary for this project, obtained prior to this application, were acquired in accordance with The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

B. The Project Sponsor also certifies that any additional right-of-way, and/or permanent or temporary easements, subsequently required to complete the project, will be acquired according to The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

Jacob Becher

Name (print)

Project Manager

Title

Signature

2-6-2024

Date

POLICY ON REASONABLE PROGRESS CERTIFICATION – MISSOURI SPONSORS ONLY

Following on the next page is a copy of the policy on reasonable progress adopted by the East-West Gateway Council of Governments Board of Directors.

The undersigned representative of the Project Sponsor hereby certifies that s/he has read this policy and understands its requirements. The representative acknowledges that failure to meet all of the reasonable progress requirements could result in federal funds being revoked and returned to the regional funding pool, as dictated by the policy.

Jacob Becher

Name (print)

Project Manager

Title

Signature

2-6-2024

Date

POLICY ON REASONABLE PROGRESS – MISSOURI SPONSORS ONLY

Reasonable Progress

For projects or programs included in the Transportation Improvement Program (TIP), "reasonable progress" will have been made if the project has advanced to the point of obligating all federal funds programmed for that project in the current fiscal year, regardless of the phase of work (*i.e., preliminary engineering, right-of-way acquisition, or plans, specifications, and estimates*). If a project fails to obligate the programmed federal funds by September 30 of the current year, the funding will be forfeited and returned to the regional funding pot. Actual progress toward implementation is measured against the schedule submitted by the Project Sponsor in the project application.

Policy Procedures and Enforcement

Projects that do not obligate all federal funds by the Board-approved suspense date will be removed from the TIP and the federal funds associated with those projects will be returned to the regional funding pool for redistribution. The removal of projects from the TIP will require no further Board action and the sponsor will have to repay any federal funds already spent if the funding is forfeited.

If a project is realizing delays that will put the federal funding at risk of forfeiture (*i.e., not meet a September 30 deadline*), the Project Sponsor will have the opportunity to ask for consideration of a "one-time extension" in their project schedule. The one-time extension can only be requested for the implementation/construction phase of the project. The extension request will only be considered once a year, and has to be made before June 1 of the current fiscal year of the TIP.

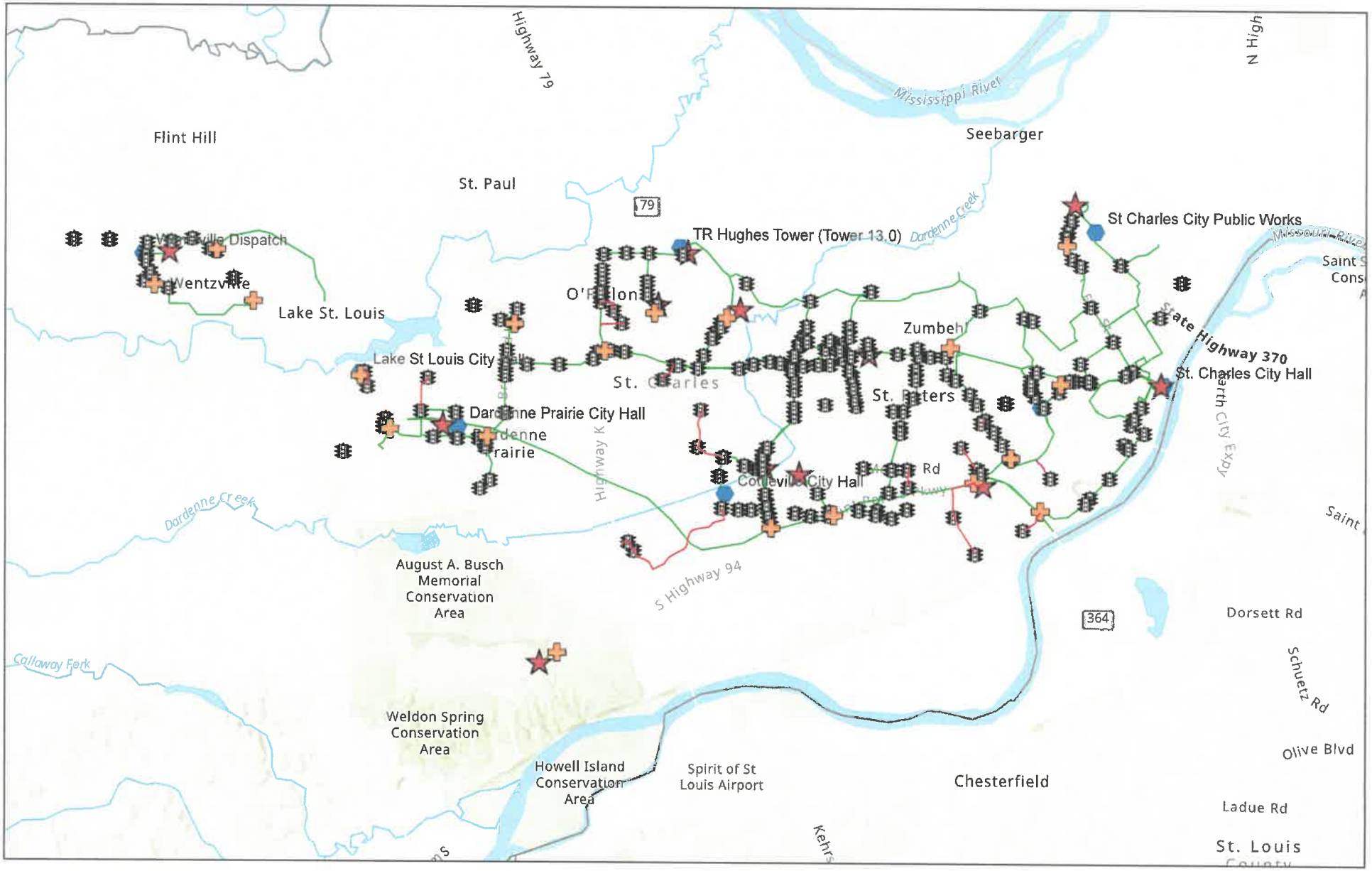
To be considered for this extension the Project Sponsor has to demonstrate on all counts: a) the delay is beyond their control and the sponsor has done due diligence in progressing the project; b) federal funds have already been obligated on the project or in cases that no federal funds are used for PE and/or ROW acquisition, there has been significant progress toward final plan preparation; and c) there is a realistic strategy in place to obligate all funds.

One-time extensions of up to three (3) months may be granted by EWG staff and one-time extensions greater than three (3) months, but not more than nine (9) months, will go to the Board of Directors for their consideration and approval. Projects requesting schedule advancements will be handled on a case-by-case basis, subject to available funding, and are subject to the Board-adopted rules for TIP modifications.

Project Monitoring

An extensive monitoring program has been developed to help track programmed projects and ensure that funding commitments and plans are met. Monthly tracking reports are developed and posted on the EWG website, utilizing project information provided by the Project Sponsor, IDOT, and MoDOT district offices. Additionally, project sponsors are contacted at least every three (3) months by EWG staff for project status updates.

GGL 2024 CMAQ Map



1/31/2024

- CROSS CONNECT CABINET
- GGL Signal Cabinet
- LAYER 3 NODE
- LAYER 2 AGENCY
- SCC GGL Phase 5
- World Hillshade

1:232,320

0 1.5 3 6 mi

0 2.5 5 10 km

Esri, NASA, NGA, USGS, County of St. Louis, Missouri Dept. of Conservation, Missouri DNR, Esri, TomTom, Garmin, SafeGraph, METI/

Estimate of Project Costs

Project Sponsor:	St. Charles County
Project Title:	SCC Fiber Redundancy and ITS Replacements
Date:	2/8/2024

Specific Roadway Items

Item	Quantity	Unit	Unit Price	Amount
16GE+4G SFP Managed Ethernet Switch, -40~75°C	172	EA	$2,650.00	$455,800.00
24GE+4 10G SFP L2 Managed Switch	8	EA	$2,650.00	$21,200.00
CCTV Camera	20	EA	$5,000.00	$100,000.00
SFP-GSM-20k	376	EA	$110.00	$41,360.00
Conduit, 2" HDPE, underground	50,000	LF	$23.00	$1,150,000.00
72 CT SM Fiber Optic Cable	50,000	LF	$3.80	$190,000.00
Pull Box, Class 2	76	EA	$3,000.00	$228,000.00
Pull Box. Class 5	14	EA	$3,300.00	$46,200.00
Fiber Optic Fusion Splice	396	EA	$75.00	$29,700.00
Fiber Optic Termination (pigtail)	216	EA	$75.00	$16,200.00
Fiber Optic Jumper	36	EA	$50.00	$1,800.00
In-Ground Splice Enclosure	12	EA	$2,500.00	$30,000.00
Fiber Optic Termination Panel (in-cabinet)	12	EA	$1,000.00	$12,000.00
Smart Weather Information Station	2	EA	$5,000.00	$10,000.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
			SUBTOTAL	**$2,332,260.00**

Specific Bicycle Items

Item	Quantity	Unit	Unit Price	Amount
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
			SUBTOTAL	**$0.00**

Specific Pedestrian Items				
Item	Quantity	Unit	Unit Price	Amount
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
			SUBTOTAL	$0.00

Specific Transit Items				
Item	Quantity	Unit	Unit Price	Amount
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
			SUBTOTAL	$0.00

Miscellaneous Other Items				
Item	Quantity	Unit	Unit Price	Amount
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
			SUBTOTAL	$0.00

Construction Cost Total	$2,832,260.00
Contingency	$250,000.00
Inflation	$250,000.00
Preliminary Engineering	$424,839.00
Right-of-Way	$0.00
Construction Engineering/Inspection	$141,613.00
Project Total *	$3,398,712.00

* The project total cost should match the total cost reported in the project application.

Add lines as needed.

TRAFFIC FLOW

Title:	St. Charles County Fiber Interconnect

Each segment should be one roadway affected by project. Most projects will have only one segment. However, projects with larger influence may include multiple segments. Contact EWG staff to clarify.

For traffic flow projects, vehicle mix assumed to be constant.

Describe Bike/Ped Elements:	none

Input Data - Year Used	
Before (i.e. 2023)	After (Year of project opening)
9000	9600

Traffic volumes must be based on present conditions/land use. If a large development is scheduled to open prior to the year of construction, the sponsor must provide its methodology to EWG staff no later than January 8, 2024 for approval to use proposed traffic volumes (for after) based on the anticipated development. Exceptions will not be granted to sponsors who miss this deadline and the project application will not be considered further.

	Route	Limit 1	Limit 2
Segment 1	Gutermuth Rd	O'Fallon Rd	Motherhead Rd
Required Input Data / Assumptions	Before	After	Remarks
ADT (veh/day), or	6,500	8,000	Manual ADT; 1.5% growth per year
Peak Hour Volume (veh/hr)			
Section length (mi)	1.97	1.97	
Average speed (mph)			not speed limit

Vehicle mix assumed to be 55% passenger car, 34% passenger truck, and 11% light commercial truck

Use Peak Hour Volume for worst peak hour of day (weekday AM or PM)

	Route	Limit 1	Limit 2
Segment 2	Jungs Station Rd	N St Peters Pkwy	Upper Bottom Rd
Required Input Data / Assumptions	Before	After	Remarks
ADT (veh/day), or	11,900	12,500	Manual ADT; 1% growth per year
Peak Hour Volume (veh/hr)			
Section length (mi)	1.43	1.43	
Average speed (mph)	35.00	38.00	not speed limit

Vehicle mix assumed to be 55% passenger car, 34% passenger truck, and 11% light commercial truck

	Route	Limit 1	Limit 2
Segment 3	Knaust Rd	Laura Hill Rd	Weiss Rd/ Cottelville Pkwy
Required Input Data / Assumptions	Before	After	Remarks
ADT (veh/day), or	13,500	14,000	manual ADT; 0.5% growth per year
Peak Hour Volume (veh/hr)			
Section length (mi)	1.76	1.76	
Average speed (mph)	31.00	33.80	not speed limit

Vehicle mix assumed to be 55% passenger car, 34% passenger truck, and 11% light commercial truck

Copy and paste additional segments below (if necessary)

	Route	Limit 1	Limit 2
Segment 3	Sonderen St	Pitman Ave	Veterans Memorial Pkwy
Required Input Data / Assumptions	Before	After	Remarks
ADT (veh/day), or	7,000	7,350	manual ADT; 0.5% growth per year
Peak Hour Volume (veh/hr)			
Section length (mi)	0.55	0.55	
Average speed (mph)	22.00	24.00	not speed limit

Vehicle mix assumed to be 55% passenger car, 34% passenger truck, and 11% light commercial truck

	Route	Limit 1	Limit 2
Segment 3	O'Fallon Rd	Route K	Gutermuth Rd
Required Input Data / Assumptions	Before	After	Remarks
ADT (veh/day), or	7,000	7,350	manual ADT; 0.5% growth per year
Peak Hour Volume (veh/hr)			
Section length (mi)	0.95	0.95	
Average speed (mph)			not speed limit

Vehicle mix assumed to be 55% passenger car, 34% passenger truck, and 11% light commercial truck

	Route	Limit 1	Limit 2
Segment 3	Upper Bottom Rd	MO 364	Jungs Station Rd
Required Input Data / Assumptions	Before	After	Remarks
ADT (veh/day), or	8,000	8,500	manual ADT; 1% growth per year
Peak Hour Volume (veh/hr)			
Section length (mi)	1.80	1.80	
Average speed (mph)	36.00	39.25	not speed limit

Vehicle mix assumed to be 55% passenger car, 34% passenger truck, and 11% light commercial truck

GGL Feasibility Study Report

Final

February 28, 2020

PREPARED BY

AECOM

LOCHMUELLER GROUP

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Table of Contents

1. Project Background 1

2. Goals and Objectives 2

3. Existing Conditions 3

3.1 Traffic Signal Inventory 3
City of Cottleville 3
City of Dardenne Prairie 3
City of Lake St. Louis 3
City of O'Fallon 4
City of St. Charles 4
City of St. Peters 4
City of Wentzville 4
St. Charles County 5
Other Traffic Signal Accomplishments 5

3.2 ITS Equipment 5
CCTV Cameras 5
Dynamic Message Signs 6
Travel Time Detectors 7
Video Detection / Permanent Count Stations 8

3.3 Communications Network 9

3.4 ATMS 10

3.5 Other 11

4. Needs and Gaps Analysis 13

4.1 Needs Identification and Prioritization 13

4.2 Gaps and Opportunities 13
Communications Network Physical Gaps and Bandwidth Constraints 14
Network and Device Monitoring 14
GGL Device Maintenance 15

5. Technology Assessment 16

5.1 ITS Technology 16
Data Collection and Situational Awareness 16
Traffic Control and Management 18
Information Sharing 19
Safety, Crash Reduction and Incident Management 20
Communications Infrastructure 23

5.2 Emerging Technologies 24
Connected Vehicle Technologies 24
Automated/Autonomous Vehicles 30
Smart City Technologies 33

6. Program Areas and Projects 35

6.1 Program Areas 35

6.2 Project Identification, Analysis and Prioritization 36

6.3 Recommended Program Areas and Projects 37

Program Area: Traffic Management 38

Program Area: Communications Infrastructure 44

Program Area: Interagency Coordination and Asset Sharing 46

Program Area: Traveler Information 47

Program Area: Asset Management 50

Program Area: Data Collection and Management 52

Program Area: Connected and Automated Vehicle Technology 54

Program Area: Smart City Technology 56

Program Area: Roadway Construction and Maintenance 57

Program Area: Training and Outreach 59

7. Implementation Plan 64

7.1 Project Costs 64

7.2 Procurement Strategies 65

7.3 Operations and Maintenance 69

List of Figures

Figure 1. Municipalities within St. Charles County 1

Figure 2. CCTV Camera Locations 6

Figure 3. DMS Locations 7

Figure 4. Travel Time Detector Locations 8

Figure 5. Permanent Count Station Locations 8

Figure 6. GGL Fiber Optic Network (Through Phase 4) 9

Figure 7. GGL Central Software 11

Figure 8. Project Analysis Workflow 36

List of Tables

Table 1. Municipal Route CCTV Cameras by GGL Partner 6

Table 2: CV Application Overview and Readiness Status 25

Table 3. GGL Program Areas 35

Table 4. Recommended GGL Projects and Implementation Timeframes 37

Table 5. Project Capital and Annual O&M Costs 64

Table 6. Recommended CMAQ Application Bundles 66

Table 7. Other Projects and Deployment Considerations 69

Table 8. Estimated O&M Costs by Project and Procurement Bundle 70

1. Project Background

St. Charles County conducted a feasibility study for its Gateway Green Light (GGL) project in 2012. The study evaluated the feasibility and developed conceptual design requirements for an advanced transportation management system (ATMS) as part of the GGL project. St. Charles County retained AECOM and Lochmueller Group to perform an update to the 2012 Feasibility Study. The purpose of the updated study is to incorporate devices and systems put into place during previous project phases since 2012 and prepare for the next evolution of the GGL system with consideration of connected vehicles (CV), automated vehicles (AV), smart city applications, and other emerging technology.

The next generation of Intelligent Transportation Systems (ITS) and other emerging technologies will transform transportation over the next several years. Several trends are already occurring, including the collection and use of "big data", advancements in communications, robust travel information dissemination and sharing, smart phone applications, and connected and self-driving vehicles. These developments have the potential to make our transportation system safer, more efficient, and more accessible. The update of the Feasibility Study allows St. Charles County and its municipal partners to make strategic investments and be better positioned to leverage these trends for safer and more efficient travel.

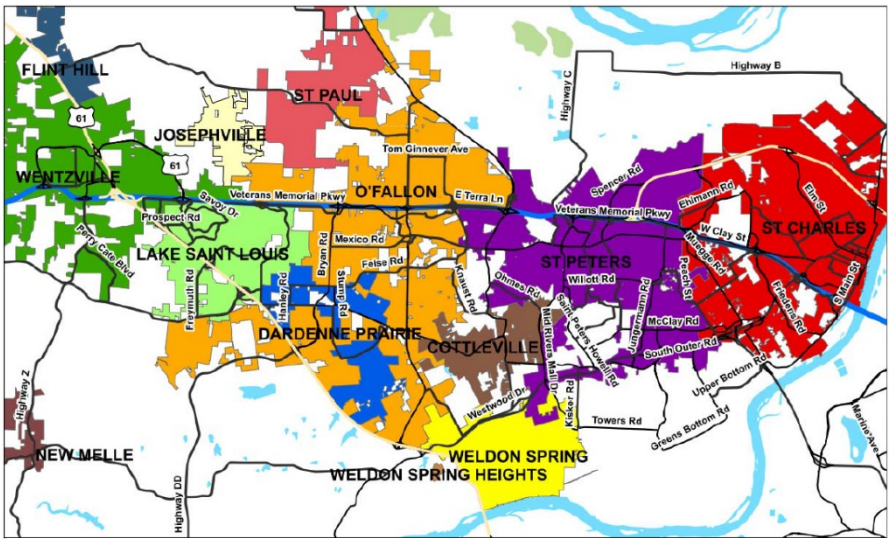


Figure 1. Municipalities within St. Charles County

The GGL system has already connected traffic signal systems in St. Charles County. However, there are opportunities to further integrate with other systems (such as other departments in city and county government) to enhance system operations and efficiency and the sharing of data. Enhanced data can also be provided to the private sector for the development of traveler smart phone applications. The updated GGL Feasibility Study explores possible ways for St. Charles County and its municipal partners to share and use data to improve operations.

Additionally, CV and AV technologies will present new opportunities and also require changes to the transportation infrastructure. Early deployments on parts of the publicly owned vehicle fleet can provide valuable data to City and County government and help those involved in the GGL project better understand what public infrastructure adjustments will be most effective when the technology becomes widely deployed in the private market. The technology is progressing and requires careful planning prior to procurement and deployment by public agencies. This study update explores how these imminent technologies can be leveraged for safer, more efficient travel in St. Charles County.

2. Goals and Objectives

The initial goals of the GGL project were developed in 2012 to improve transportation operations in St. Charles County by leveraging emerging ITS technologies and are listed below.

- Creation of a countywide high speed communications network
- Procurement of a centralized ATMS for efficient use and improved management of shared resources located on the arterial roadway system
- Development and implementation of coordinated traffic signal plans
- Installation of adaptive traffic signals on priority corridors
- Installation of ITS devices such as close-circuit television (CCTV) cameras, dynamic message signs (DMS), emergency vehicle preemption (EVP) and travel time sensors

An important step to set the framework for the GGL project and the updated study is to confirm and update as appropriate the goals and objectives. Based upon input received during the survey process, and dialogue at stakeholder meetings, a refined GGL Vision, Focus, and Goals were established as the following:

- Complete Gaps from Original Vision
- Address Needs for Upgrades or Replacements (ATMS, Signal Controllers, etc.)
- Review and Deploy Next Generation Applications
    - New or Enhanced ITS Devices and Uses
    - Connected and Automated Vehicle (CV/AV) Integration
    - Smart City Elements/Systems
    - Enhanced Data Sharing

In addition to the program area-based goals identified above, specific project goals include the following:

- Review projects, systems and devices deployed on each past GGL project phase for current frequency of use and future functionality.
- Determine applicable elements yet to be deployed which may enhance existing systems.
- Develop a strategy for the next evolution of the GGL system to better position the County and municipal agencies for strategic investments to leverage upcoming emerging technologies.

3. Existing Conditions

Since the initial GGL Feasibility Study was developed in 2012, significant investments in capital projects have led to a much more connected system with expanded capabilities. This section provides a summary of the existing infrastructure and systems for the GGL project. Key accomplishments of the GGL program since 2012 are also presented in this section. Information was gathered from system inventory, stakeholder meetings and follow-up interviews with various agencies.

3.1 Traffic Signal Inventory

City of Cottleville

Prior to GGL initiation, none of the City of Cottleville signals were interconnected at the on-street or central level. Some fiber optic cable existed between intersections along Cottleville Parkway from the St. Charles County Community College entrances to Mid-Rivers Mall Drive, but the cables were unterminated.

Subsequent projects have connected each of the six signals within Cottleville's jurisdiction to the central signal system via a mixture of fiber optic cable and cellular modems. St. Charles County maintains signals within the City of Cottleville, except those along Mid Rivers Mall Drive, which are part of the coordinated system that the City of St. Peters maintains.

City of Dardenne Prairie

A total of four signalized intersections are within the jurisdiction of Dardenne Prairie, located along the Route N and Hanley Road corridors. Two solar-powered pedestrian flasher locations are located on Barathaven Boulevard adjacent to the Dardenne Greenway multi-use trail. None of those locations were connected prior to initiation of the GGL program. Installation of 5.8GHz radios has allowed each of the four signalized intersections to be connected to the network, while the pedestrian flasher locations remain isolated. The pedestrian crossings will have little benefit of connection to the central signal system, as they do not provide positive control, nor are they located on a priority route. The video detection system at the Route N/Crossroads Elementary intersection has been defined with the TransSuite system, allowing for continuous turning movement count data to be collected and stored for analysis.

City of Lake St. Louis

Signalized intersections under the jurisdiction of the City of Lake St. Louis, a total of six, were previously disconnected. The only interconnection was a short piece of multimode fiber optic cable along Ronald Reagan Drive between Hawk Ridge Drive and Lila Lane within the Shoppes at Hawk Ridge commercial center.

Further GGL fiber optic cable installation, in combination with some 5.8GHz radio installations, has allowed for each of the six signals under the purview of the City to be connected to the network. Further, detection systems at Lake St. Louis Boulevard and Technology Drive, and Technology Drive at Meadows Circle Drive, have been connected for continuous turning movement count data.

City of O'Fallon

The City of O'Fallon, with the largest population amongst the municipalities, maintains 36 signalized intersections. Prior to GGL projects getting underway, four intersections had some type of network media in place (fiber or wireless), although none were connected or active. The majority of the signalized intersections in O'Fallon are along priority routes noted in the initial GGL feasibility study - Bryan Road / Winghaven Boulevard, Mexico Road, North Main Street, and TR Hughes Boulevard.

Since 2012, each of the existing signals within the City's jurisdiction have been connected to the GGL network, except for the recently constructed signals at Sommers Road and Paul Renuad Boulevard. The majority of the 35 connected signals are on fiber optic corridors, with a handful of 5.8GHz radios and cellular modems also being used for intersections on lower priority routes where fiber optic cable has not been installed. Detection systems at 11 intersections have been integrated into TransSuite for constant volume data logging.

City of St. Charles

The City of St. Charles maintains 47 signals within the overall system including priority routes such as Zumbehl Road, Muegge Road, and Fifth Street. Prior to GGL projects, various on-street coordination efforts were accomplished by twisted pair cabling and relatively short sections of fiber optic cable installed during the 2012/2013 timeframe. No central signal system was in use.

With a combination of GGL capital projects and substantial fiber optic infrastructure investments by the City's IT department, nearly all of the signals under their responsibility are on the robust fiber optic network, or soon will be following ongoing projects. Additionally, 20 detection systems have been tied to the central system.

City of St. Peters

The City of St. Peters had the most robust arterial management system of all municipal partners at the start of the GGL program, with a high percentage of their signalized intersections located along priority routes. Out of the 81 signals under their maintenance in 2012, only seven were not connected to their central system, as almost all of the 74 networked intersections were on either an Ethernet or serial fiber optic solution. The City also had the only municipal CCTV camera infrastructure, at a total of eleven deployed at various sites.

The phased GGL capital projects have added a modest amount of fiber optic infrastructure to the City, allowing for nearly all of the signals within St. Peters to be on the fiber optic Ethernet network. Additional network redundancy and 15 additional CCTV cameras have been added through the GGL projects and other City-led projects. A large number of intersection detection systems are also tied into the central system. Five additional signalized intersections will come online during 2019 within the logistics development along Premiere Parkway in 2019/2020.

City of Wentzville

The City of Wentzville, experiencing a high rate of growth and development for several years, was beginning to implement fiber optic infrastructure during the timeframe when the initial GGL feasibility study was developed, although attempts to provide coordinated corridors were still in the early stages.

Currently all of the 14 signals within the City are connected to the central system. Eleven of the signals are connected via fiber optic Ethernet, while two utilize 5.8GHz radios and one utilizes a cell modem. The majority of the City's intersection detection systems are collecting 24/7 turning movement data through the central system.

St. Charles County

Out of the 12 signals along St. Charles County routes, a small wireless interconnect system on St. Peters-Howell Road represented the extent of coordinated signal timing efforts prior to GGL projects beginning in earnest.

Since that time, a mix of fiber optic and wireless infrastructure has allowed each of the County's signalized intersections to be connected to the central system. Additionally, five detection systems are integrated for intersection count retrieval purposes.

Other Traffic Signal Accomplishments

The successes listed below are signal inventory-based accomplishments that have been realized on a program level since the project kickoff. These accomplishments focus on the establishment of remote connectivity between traffic signal hardware devices and include the following:

- Malfunction Management Units (MMU)
- Video Detection Systems, including raw video feeds
- Networked Power Strips, allowing for remote power reboots
- Direct connection to signal controller for advanced configuration and troubleshooting
- Battery Backup Systems

3.2 ITS Equipment

CCTV Cameras

At the conclusion of Phase 4 construction, the GGL system will include a total of 87 CCTV cameras on municipal routes, 86 CCTV cameras on the Missouri Department of Transportation (MoDOT) routes, and 48 video detection systems integrated into the TransSuite ATMS video control system module. Table 1 shows the numbers of CCTV cameras by GGL participating agency. Additional 14 CCTV cameras will be installed in the Phase 5 project. The majority of the cameras are Cohu products. Cohu HELIOS™ CCTV models are currently undergoing a replacement program, being rolled out in deference to the Cohu RISE™ models. Other cameras installed within the various municipalities have also been periodically replaced with Cohu, Axis, or WTI products if the existing models cannot be repaired in the field. A need to standardize the minimum features and functions of replacement cameras has been identified as an item the GGL partners will need to address.

Table 1. Municipal Route CCTV Cameras by GGL Partner

Agency	St. Charles County Highway Department	St. Charles	St. Peters	O'Fallon	Lake St. Louis	Wentzville	Cottleville	Dardenne Prairie
Number of Cameras	2	17	31	11	3	4	2	2

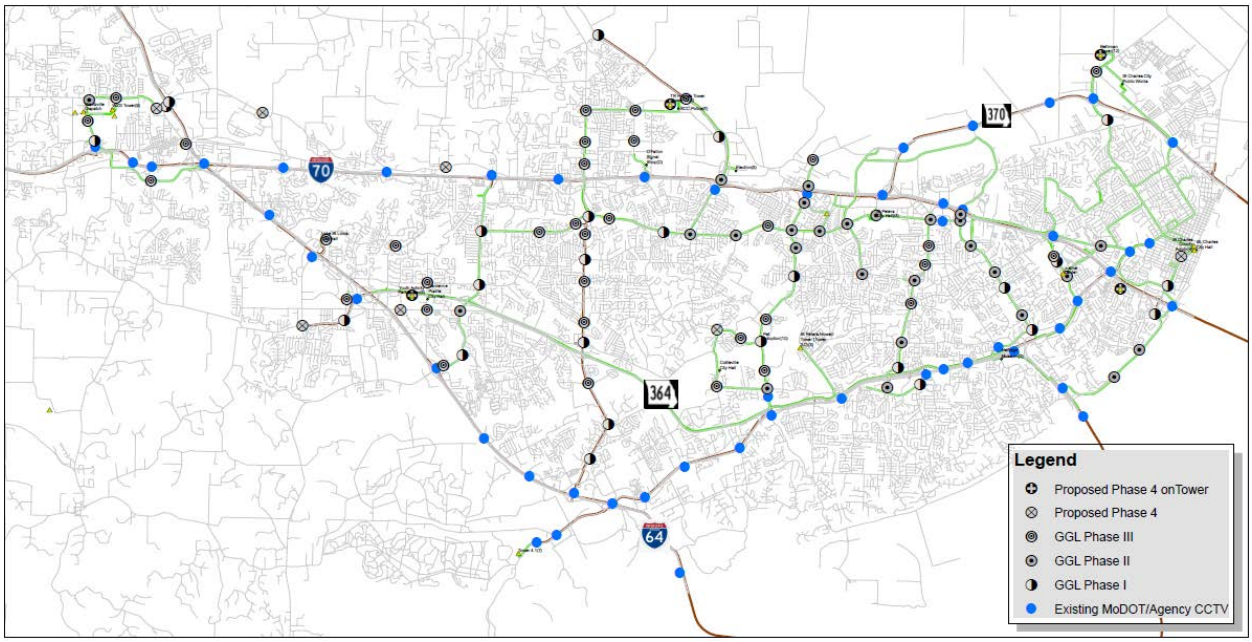


Figure 2. CCTV Camera Locations

Dynamic Message Signs

Upon completion of a new arterial DMS on Premiere Parkway in St. Peters, there are 32 DMS in St. Charles County. DMS are primarily located along I-70, I-64, and Routes 364, 370, 94 and 79. Three DMS are located on municipal roadways. DMS are located prior to key decision points to provide motorists with information regarding prevailing roadway conditions.

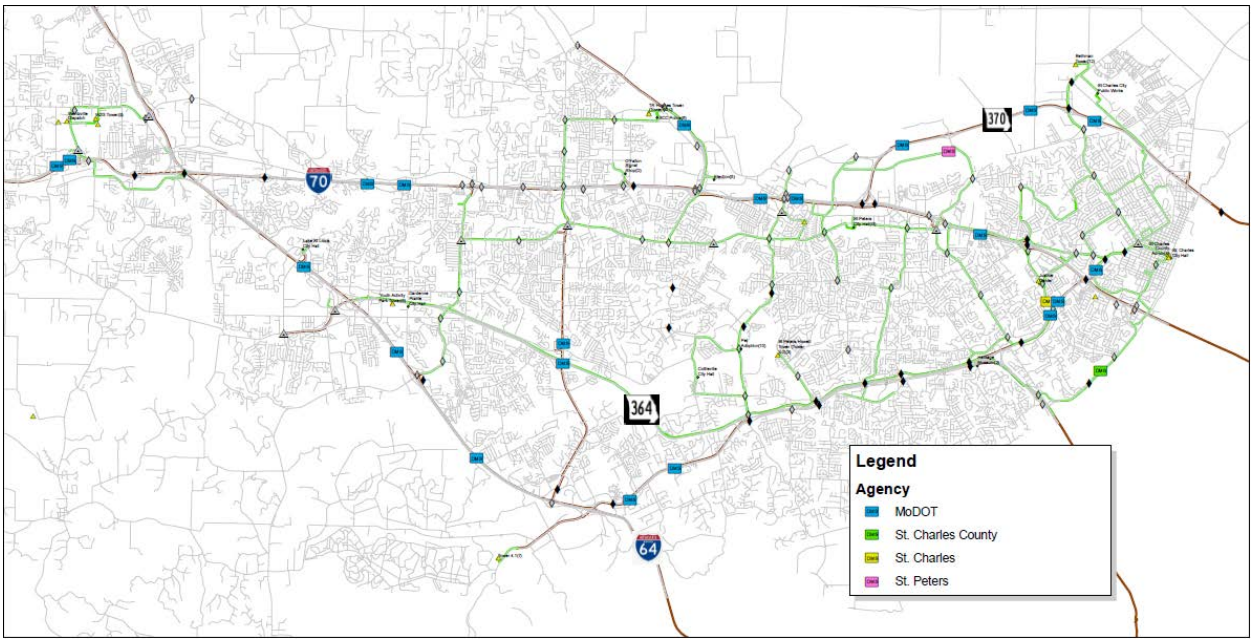


Figure 3. DMS Locations

Travel Time Detectors

The GGL project has installed approximately 112 travel time detectors inclusive of the current Phase 4 construction project. The Bluetooth travel time detectors originally purchased with the Phase 2 project are in the process of being replaced with the BlueTOAD products. BlueTOAD receivers will be installed in subsequent projects in place of Bluetooth devices as failures occur. Bluetooth (along with CCTVs) currently provide the lowest rate of steady functionality out of the existing GGL field equipment. Replacing Bluetooth with the BlueTOAD technology should assist in providing increased reliability of St. Charles County's travel time system, while also offering future functionality as roadside units (RSUs) in a CV/AV environment, assuming Spectra RSU models with dedicated short range communications (DSRC) are procured and installed.

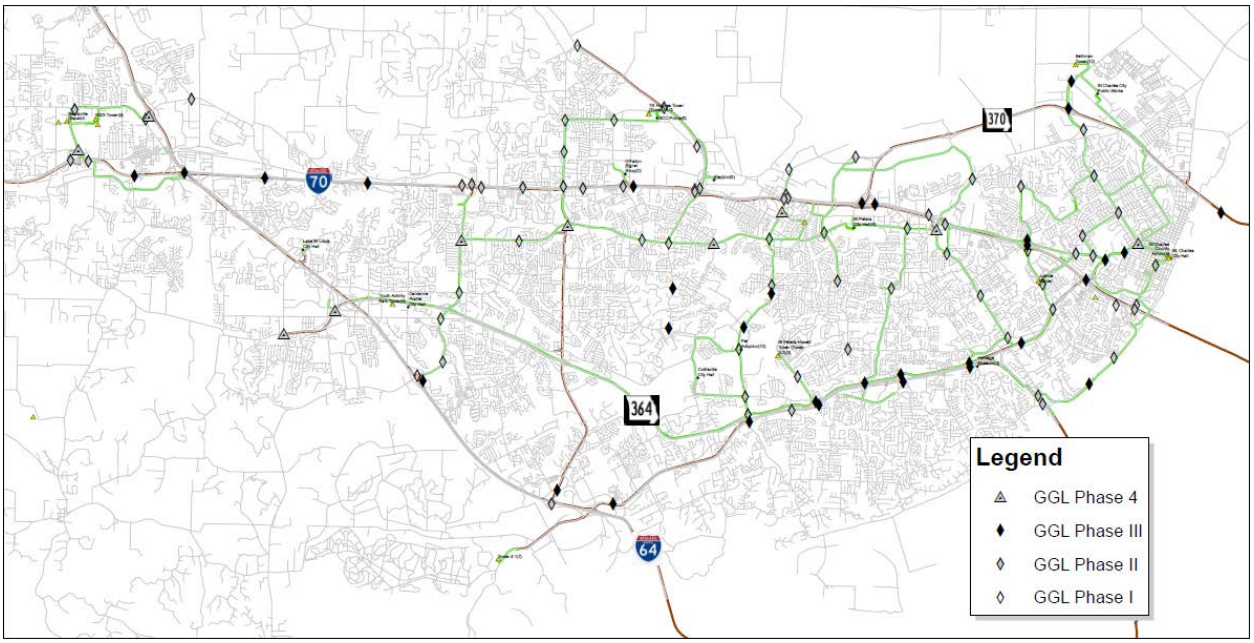


Figure 4. Travel Time Detector Locations

Video Detection / Permanent Count Stations

Upon completion of the Phase 4 installation, the GGL system will have 16 video detection / permanent count stations to collect vehicle volumes and classification data. Nine of the existing count stations are comprised of Sensys arrays in a cordon count configuration, while the other seven locations are Autoscope Vision video detection systems at signalized intersections for continuous turning movement counts. Video detection at six locations will be upgraded and six additional permanent count stations will be installed in the Phase 5 project.

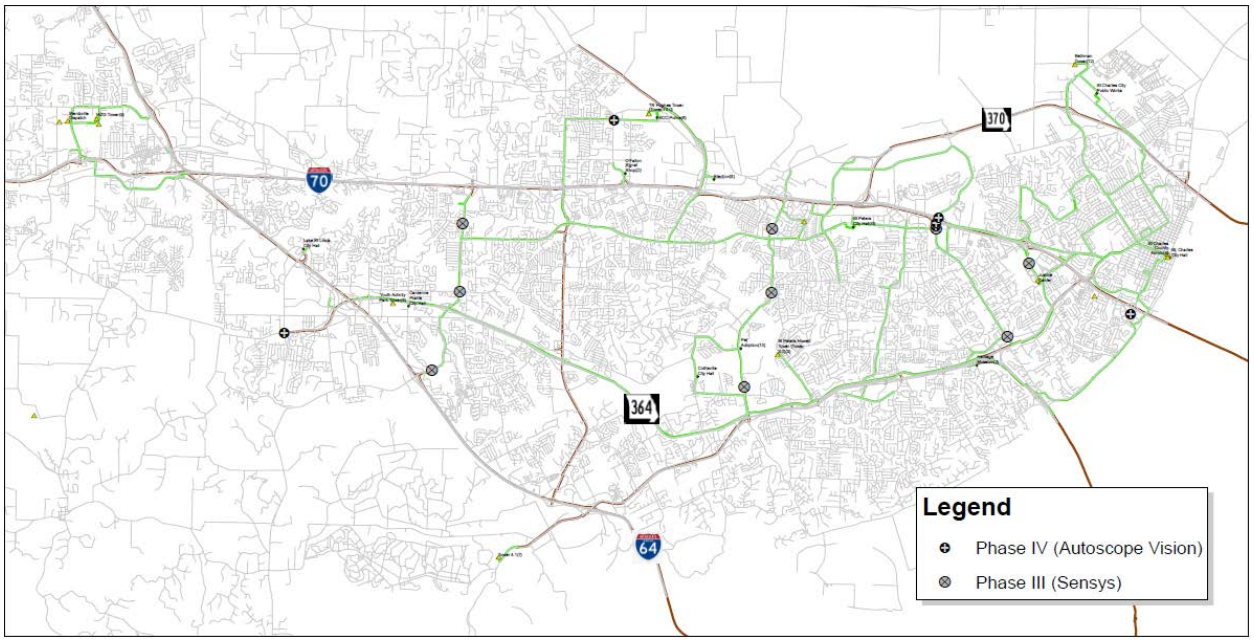


Figure 5. Permanent Count Station Locations

3.3 Communications Network

An overall network communications inventory was created based on information gathered from the documentation of Phases 1 through 4 of the GGL project. It was found that various communication methods were previously used within St. Charles County. These include direct fiber Ethernet connection, fiber serial connection via multimode cable, wireless connection (radio and cellular), twisted pair, as well as wire master/local configuration. The current GGL communications infrastructure network consists primarily of fiber optic cable connections and high bandwidth radio connections installed during previous phases.

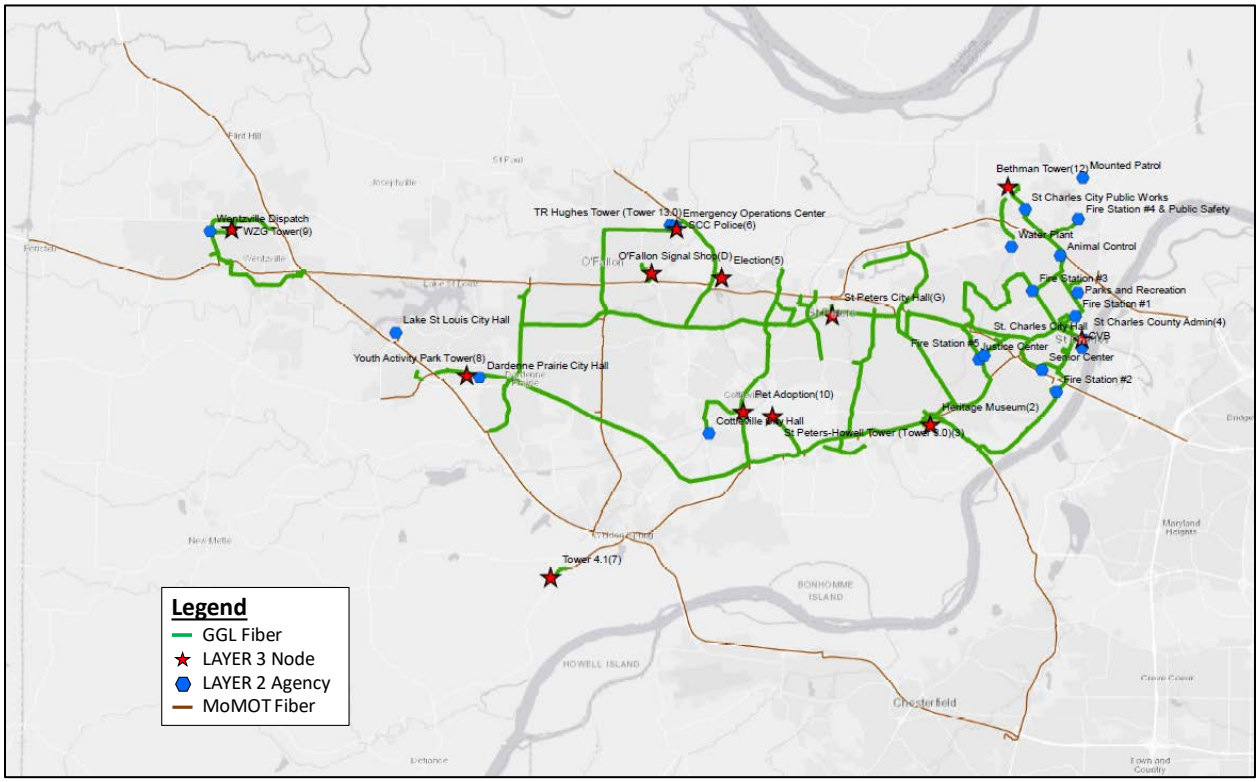


Figure 6. GGL Fiber Optic Network (Through Phase 4)

Starting in the mid-2000s, MoDOT constructed and maintained a dedicated fiber optic network throughout St. Charles County. The backbone of the network is located along each of the freeway corridors, with multiple redundant paths to the overall St. Louis District network. Infrastructure contained within major state-maintained arterials ties MoDOT's signals to the central control system, while also providing intra-county redundancies. Expansion of MoDOT's network within St. Charles County has largely centered on the construction of several miles of Route 364 from Route 94 to I-64. Existing MoDOT fiber optic cable strands have been utilized where feasible to deliver connectivity for the GGL network, in addition to providing the critical physical link between the GGL network and the central servers located at MoDOT's Transportation Management Center (TMC) in Chesterfield.

In 2017, MoDOT completed a large-scale node replacement project throughout the district, allowing for a robust and sustainable network with higher bandwidth capabilities, mitigating various issues that developed since the initial buildout along state routes.

St. Charles County currently deploys a wireless radio communications network that is part of the regional STARRS network and supports a 700/800 MHz land mobile radio connection. An example of a location that features a wireless communications network is St. Peters-Howell Road, between McClay Road and Toelle Drive signals. These two signals are also connected wirelessly to the signal at Central School Road to the south (a City of St. Peters-owned signal). In addition, the City of O'Fallon has one wireless connection at TR Hughes Boulevard at Widel Lane/Public Works Drive.

MoDOT currently maintains approximately eighteen signals equipped with wireless equipment, these include three signals along Route A near the GM plant, the intersection of Highway N at Winghaven, along with signals near I-70 at Route K, TR Hughes Boulevard, Zumbehl Road, and along north and south outer roads of West Clay and Veterans Memorial Parkway along I-70. In addition, MoDOT has approximately three signals in the project area that utilize a cellular connection.

A key communications network-based accomplishment since 2012 is the ability to share fiber optic network infrastructure between stakeholders. This results in the following benefits:

- Cooperation between each member agency allows for reduced capital costs during network build out
- Reductions in ISP costs at agency facilities
- Providing connection and redundancy for radio tower network utilized by first responders
- Setting stage for next generation of connectivity for St. Charles County residents, businesses, and visitors

3.4 ATMS

The current GGL ATMS software, TransSuite, has been in place since the inception of the GGL program. Through the use of NTCIP communication protocols, the software allows for use of ITS field hardware from various manufacturers. The caveat with any ATMS software is the end devices typically require some upfront development to add the device to the system, with NTCIP-compliant devices being most easily integrated. Advanced product-specific functions can be added if the product manufacturer and the integrator can work through software development details. TransSuite also offers a mature data management system, allowing for tremendous amounts of historical data to be stored and mined. Access to the software is currently available by TMC operator workstation, virtual desktops for remote users, and a web-based "lite" version.

Several ATMS-based accomplishments have been realized since 2012. These accomplishments focus on the steady integration of new ATMS field devices into the St. Charles County roadway network using TransSuite software and include the following:

- Central traffic control on common platform, allowing for interagency signal coordination across jurisdictional boundaries, a primary goal for the program

- CCTV Camera coverage of freeways and majority of arterials throughout the County, including 72 CCTV cameras on municipal corridors
- Arterial mobility and permanent count detection capabilities via multiple hardware solutions
- DMS at three locations along municipal roadways, with others to be added on upcoming projects

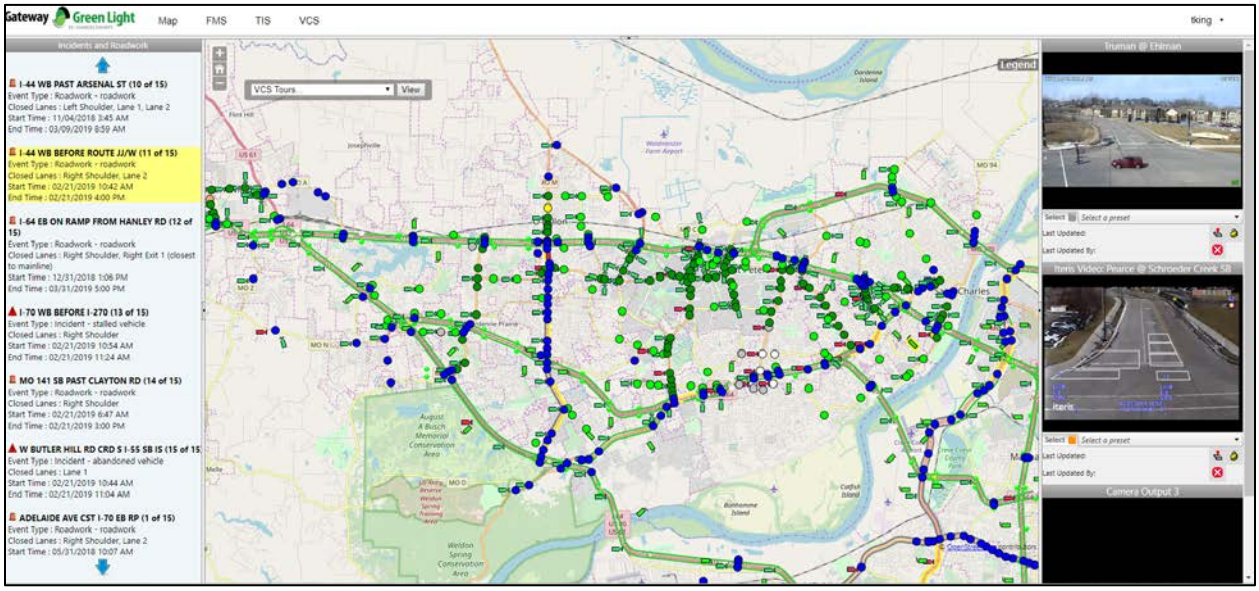


Figure 7. GGL Central Software

Since the initial acquisition of TransSuite, multiple follow-on contracts have been enacted to perform general maintenance of the software and add functionality requested by GGL partners. The current contractual period is set to expire within a calendar year, meaning a new solicitation will be necessary. Concurrently, MoDOT will be issuing a solicitation for ATMS software on statewide level. While the GGL program and MoDOT could experience some efficiencies if the same ATMS solution were acquired, center-to-center standards and data stream capabilities may allow for differing ATMS software to be implemented.

3.5 Other

In addition, the following activities have occurred for the GGL program since 2012.

- MS2 Integration
  - Consolidates traffic count and crash data within a single platform, available via a web portal
  - Count data from properly configured detection quickly provides valuable inputs and insight
  - Approximately 45% of the 330 signals configured in TransSuite are included in the MS2 platform
- Public/Private Partnerships

  - An agreement with Traffic Technology Services to share real-time signal phasing and timing (SPaT) data will allow for first steps in vehicle to infrastructure integration within the County
- Cooperative System Maintenance
  - Intergovernmental agreement sets responsibilities of each member agency as it relates to network infrastructure and edge devices
  - Shared contracted field maintenance agreement executed in 2019 will provide external resources for member agencies to address day-to-day issues
- Public Safety and Emergency Response
  - Sharing of video and information from the GGL system to individual public safety entities within the County permits faster response to incidents with better insight relative to the type and level of equipment needed to clear the roadway
  - Gains buy-in from other departments within the municipal agencies, noting the GGL program can provide benefits beyond the traffic management realm
- Smart City Initiatives
  - As technology advancements presented solutions to emerging needs, Smart City elements such as Smart Lighting and remote public safety surveillance have been deployed
  - Competitive grant applications have been developed and/or submitted for other Smart City solutions, such as Smart Parking and autonomous shuttle vehicles.

4. Needs and Gaps Analysis

4.1 Needs Identification and Prioritization

Stakeholder outreach has been a key component for identifying and prioritizing the needs for the updates to the GGL Feasibility Study. Prior to the first stakeholder workshop meeting, an online stakeholder survey was conducted, which produced a list of 59 needs that the GGL program may be able to help address. The resulting needs were reviewed and prioritized at the first stakeholder meeting. The overall top 30 ranked needs identified in the stakeholder meeting are listed below in the order of priority from high to low:

1. Enhance communications and information sharing among agencies
2. Reduce congestion / delay on arterials
3. Improve incident detection capability on major routes
4. Improve traffic data collection capability
5. Improve alternate route traffic management and provide detour information
6. Reduce crashes at intersections
7. Expand fiber optic network
8. Reduce congestion / delay on freeways
9. Identify alternate / quickest routes for emergency vehicles
10. Integration of enforcement tools
11. Reduce rear-end collisions due to queues
12. Improve incident management and coordination
13. Provide advanced warning / real time information about flash flood areas / weather conditions / locations to the public
14. Utilize GGL ITS infrastructure to improve public safety
15. Improve communications network redundancy / self-healing capability
16. Reduce crashes in and around work zones
17. Improve real-time traffic monitoring capability
18. Improve signal coordination across jurisdictions
19. Address truck parking issues
20. Provide travel times / delays / incidents / roadway closures / lane restrictions / work zone information on roadways to the public
21. Collection of information on weather / road surface conditions
22. Implement and use high-resolution data for automated performance measures
23. Develop and implement a communications infrastructure maintenance program
24. Improve reliability and availability of communications network
25. Enhance transportation information collection for use by planners
26. Staffing / resources for maintenance of communications network
27. Reduce crashes due to weather conditions
28. Address aging system inventory
29. Reduce delays due to temporary work zones
30. Share video images with public safety agencies / centers

4.2 Gaps and Opportunities

While significant accomplishments have been realized since 2012, opportunities for further GGL capabilities exist. The following sub-sections consolidate information gathered during the initial system inventory and stakeholder engagement process, noting items that may need resolution in subsequent projects and initiatives to continue and grow the GGL system.

Communications Network Physical Gaps and Bandwidth Constraints

The previous phases associated with the GGL program developed a relatively robust backbone network utilizing multiple node locations and cross-connect cabinets. The critical network node locations are generally within controlled facilities such as city halls and other municipal buildings, limiting exposure to the environment and potential damage. Redundant links exist at the node level for a portion of the overall network. Nevertheless, the following communications network-related issues have been identified as elements leaving the network and users open to outages or loss of service.

- Nearly all City Hall facilities throughout St. Charles County are spurs off the backbone network.
    - Existing VPN internet connection to the GGL server at the MoDOT TMC is unable to match functionality of a direct GGL network connection.
    - Hubs located at municipal locations may become aggregation points for additional edge devices in the near future, meaning the reliability and available bandwidth from those facilities will take on greater importance
    - St. Peters, the largest non-MoDOT GGL field network, only has a single existing communications link to the rest of the GGL network, although multiple options are available to set up a redundant path.
    - The 1-Gig link afforded to municipal office locations is sufficient for current network traffic levels but may become strained over time with the addition of next generation data needs.
- The capability of the GGL field network, except for MoDOT edge devices, is heavily tied to the node equipment located at the County Heritage Museum near the Route 364 / Route 94 interchange.
    - All GGL network traffic is currently routed through the museum, before connecting to the TMC via Route 364 / Route 141.
    - An existing physical connection to the TMC via an I-64 route path is available but not actively used, due to previous agreements between MoDOT and a 3rd party fiber optic cable provider (DTI/Lightcore/CenturyLink).
    - A secondary link using I-64 is allowable only during emergency periods, limiting the current ability to program load balancing network routing policies.
    - The available bandwidth through the single active link to TransSuite servers via Route 364 / Route 141, is becoming so strained that video quality of the installed CCTV cameras has been dialed back to limit bandwidth needs.

Network and Device Monitoring

Multiple network monitoring tools are available on the market, varying in complexity and capabilities based upon the maintaining entity and owners. Currently, SolarWinds is running on the GGL system, with the Layer 3 devices and at least a portion of the Layer 2 switches configured to allow for scanning and IP database management.

Based upon input from municipal staff members, this tool is not actively used by individual GGL partners on a regular basis. Further, access by each maintaining agency to information such as IP addresses for each of the devices under their purview is not readily available, leading to inefficiencies in troubleshooting

existing devices or adding new elements to the network. A weekly e-mail from outsourced personnel is provided to responsible parties for investigation and resolution, with inconsistent response to offline devices by partners.

Detection of network or device issues is typically evident via TransSuite modules, as icon color or other alarms will be apparent to users or TMC operations staff. Functionality tests such as pan-tilt-zoom control of CCTV cameras does not appear to be consistent, and data quality testing from devices such as permanent count stations or video detection units is not performed on a systemic basis.

GGL Device Maintenance

Beyond the weekly e-mails to GGL partners noting offline devices or network errors/alarms, tracking of daily or weekly maintenance tasks appears inconsistent. Adjacent to the TransSuite suite of modules, a Maintenance Online Management System (MOMS) product, called Insight, has been discussed amongst the GGL partners, although full use of that or similar maintenance management tools have not been implemented.

The execution of a contracted field maintenance agreement with a local electrical firm is anticipated to assist in supplementing GGL partner staff in resolving device or network outages on a routine or emergency basis. Preventative maintenance tasks allocated to the contracted entity should aid in limiting remedial maintenance needs as well. A formal maintenance policy amongst the municipal GGL partners, along with an agreed upon process for daily maintenance (including a manual of standard operating procedures) has been identified as a need in order to address the operability of the current and future GGL network.

On the device level, the existing monitored devices generally operate reliably, with CCTVs and Bluetooth representing the lowest rate of steady functionality. Signal controllers, DMS, wireless radios, and permanent count stations perform at a 95% or more level of reliability.

5. Technology Assessment

5.1 ITS Technology

This section provides a summary of available ITS technologies currently under consideration for future GGL deployments. The assessment focuses on technologies that can be used to address the needs and gaps identified in Section 4 of this document. The assessment also includes an evaluation of how various agencies have applied these technologies to address similar needs, as well as a summary of best practices and lessons learned regarding the ITS technologies.

In this section, ITS technologies are grouped into the following five general categories:

1. Data Collection and Situational Awareness
2. Traffic Control and Management Applications
3. Information Sharing
4. Safety, Crash Reduction and Incident Management
5. Communications Infrastructure

Data Collection and Situational Awareness

Based on the stakeholder needs survey, top ranked needs related to data collection and situation awareness include the following:

- Need to improve alternate route traffic management, including the communication of detour information
- Need to identify alternate routes for the traveling public during major roadway incidents
- Need to provide information on travel times / delays / incidents / roadway closures / lane restriction / work zones on roadways to the public
- Need to know locations of maintenance/snow plow vehicles

GGL stakeholders noted that providing advanced warnings of inclement weather conditions to the general public was an important need. Challenges to providing these warnings include challenges with gathering accurate and real-time information on weather conditions, as well as challenges in communicating the warnings to the public for their use in making safe and efficient travel decisions. Stakeholders identified the following gaps and shortfalls to addressing this need:

- Current response to providing warning is reactive to current conditions
- Notification method is cumbersome, and warnings / information does not reach key stakeholders
- Difficult to provide real-time updates on maintenance activities

The following ITS technologies can be applied to addressing these identified gaps and assist with communicating advanced warnings and real-time information to the general public:

Automated Vehicle Location (AVL) for Public Agency Vehicles

AVL uses location-based technologies (usually Global Positioning Systems (GPS) satellites) along with a wireless data communications system to allow for agencies to manage vehicle fleets while in operation. GPS units located inside the vehicle detect the vehicle's location in real-time and communicate the

location data (via radio or cellular modem) to a central office processor that coordinates the location of all GPS units in the fleet. This enables the dispatch center to locate vehicles and calculate average speeds on a real-time basis.

The AVL technology can be used for various types of public service vehicles, from police squad cars and maintenance trucks to transit buses. AVL in public safety agency vehicles will allow dispatchers to quickly locate and notify the closest response team for timely responses. Dispatchers could also access traffic operations data on current traffic and road conditions information and suggest the most efficient routes to the response team based on that real-time data.

Flash Flood Detection Systems

Flood detection systems gather data on traffic and water-level conditions along specific routes and communicate the data to central office locations via cellular or satellite networks. This allows operators from traffic or emergency management centers to receive flood data notifications and then provide alerts to the public about the need to use detour routes to avoid potentially flooded corridors. Flooding alerts can also be provided to motorists in the region through flashing beacons about flooded roadways ahead.

Systems can be installed as either stand-alone systems or can be integrated with existing traffic management or emergency management systems.

Performance Reporting Systems

Centralized reporting systems can be developed to accept information shared from multiple ITS systems located in the field and can also be designed to communicate with other central offices. For the St. Charles County area, the GGL reporting system can be used to receive flash flood alerts from areas that experience frequent flooding events or to present the locations of winter maintenance vehicles to the general public during snow storms. The webpage can also present road conditions based on data from traffic detection equipment along arterials within the area or based on data collected from public works vehicles equipped with AVL systems. This application will require integration of separately deployed ITS applications with a centralized software that can present the data in real-time. This application may also require interagency

Best Practices: Reporting System

The Utah DOT (UDOT) developed a Snow and Ice Performance Dashboard that presents real-time statistics on winter maintenance operations. UDOT integrated AVL system data with weather station data and data from other sources into a Snow and Ice Performance Dashboard. UDOT maintenance crews utilize the real-time statistics from the Dashboard to determine how effective the winter maintenance strategies are at maintaining good road conditions during a storm. UDOT also shared real-time vehicle location data with the general public through the state's traffic information page at: http://udottraffic.utah.gov/.

The development effort was supported by internal GIS staff that assisted with the presentation of real-time data on maps for staff and general public use. The information gathered by the dashboard is also shared with traffic operations for improved situational awareness and proactive traffic management during winter storms.

data sharing agreements and the establishment of a performance management program to define how the reporting system is performing for the region.

Traffic Control and Management

A summary of ITS technologies that can be used to address the traffic control and management related gaps and needs is presented in the following. Top ranked GGL needs related to traffic control and management include the following:

- Need to mitigate congestion/delay on arterials and freeways
- Need to improve traffic data collection capability
- Need to improve traffic signal timing and coordination
- Need to improve real-time traffic monitoring capability
- Need to enhance traffic signal controller capabilities to support collection of high-resolution data and automated performance measures

Reducing arterial traffic congestion and delay was a high priority need for the GGL program. The GGL stakeholders identified the following gaps and shortfalls to addressing this need:

- Current response to congestion is reactive and driven by complaints received from general public
- Lack of automation in terms of signal optimization and adjustments to proactively change signal timings in response to current arterial traffic congestion / delays
- Lack of high-resolution data / analytics to understand how to adjust signal optimization or proactively change approach to reducing arterial congestion / delay

The following ITS technologies can be applied to addressing these identified gaps and assist with reducing overall arterial traffic congestion and delay:

High Definition Data Performance Measures

A high definition of the amount of data collected from ITS deployments will allow for an improved measurement of the success of ITS enhancements at achieving the overall goals and objectives of an ITS project. One example is Automated Traffic Signal Performance Measures (ATSPM). ATSPM is defined as a suite of performance measures, data collection and data analysis tools to support objectives and performance-based approaches to traffic signal operations, maintenance, management and design of the signal system. The purpose of the application is to improve the overall safety, mobility and efficiency of signalized intersections for all system users. The technology allows for agencies responsible for traffic signal timing updates to use the data provided through ATSPM to determine how best to optimize traffic signal timings based on the collected data.

Lessons Learned: ATSPM

The Utah Department of Transportation, an early adopter of the technology, notes that since implementing its ATSPM program, there was a significant drop in public complaints and requests for traffic signal retiming. The ATSPM system quickly identifies problems such as failed detectors and sends a simple email notification. These alerts allow UDOT to respond to issues before they become public nuisances and prolonged threats to mobility. More information on ATSPM and case studies can be found at: https://ops.fhwa.dot.gov/arterial_mgmt/performance_measures.htm.

Integrated Corridor Management

Integrated Corridor Management (ICM) refers to a collaborative approach taken by multiple transportation agencies to improve the efficient movement of people and goods by managing key transportation corridors as an integrated and multimodal system. Through this type of collaborative approach, operational decisions regarding traffic signal control or alternate route management are made for the benefit of the transportation corridor as a whole.

Lessons Learned: ICM

Through its prior efforts on the Dallas and San Diego efforts, the USDOT summarized the following lessons:

- Obtain planner and modeler input early in the process. Transportation planners and modelers can provide input into the performance measures selected and can help the team understand how best to track them against established goals.
- Utilize a Systems Engineering process, including the development of a Systems Engineering Management Plan and a Concept of Operations to define the system to be built and set overall goals and objectives.
- Include all potential stakeholders within a corridor and encourage broad participation throughout the project. Keep them informed about the decisions being made even if they may not be able to participate

Best Practice: RTOP

Development of the RTOP for the Georgia DOT has resulted in the creation of performance measure dashboards that can present how individual RTOP corridors are performing compared to others.

An example of the performance measures can be found at the following: http://www.dot.ga.gov/DriveSmart/SafetyOperation/Documents/TrafficOperations/RTOP-Summary-Performance-Report-0717.pdf#search=RTOP

Regional Traffic Operations Program

The Regional Traffic Operations Program (RTOP) was developed for the Georgia Department of Transportation (GDOT) and is a multi-jurisdictional signal timing program with the overall goal of improving traffic flow and reducing vehicle emissions through improved signal timing. GDOT signal timing and operations staff actively manage the enhancement, operations and maintenance of signalized intersections on regionally significant commuter corridors in metro Atlanta.

Regional Traffic Maintenance Program

A regional traffic maintenance program can also be developed given the work done by the region in developing the GGL system. The RTOP project in Georgia described above also assists local jurisdictions to quickly find and repair problems with signal timing and operations. The GDOT program includes over 1,000 traffic signals and, once completed, RTOP will be able to remotely monitor all corridors which will allow quicker response times to repair signal problems.

Information Sharing

This section presents a summary of ITS technologies that can be used as Information Sharing applications to address regional gaps and meet stakeholder needs within the region. Top ranked needs related to law enforcement from the survey during Task 1 of the project include the following:

- Enhance communications and information sharing among agencies
- Expand fiber optic network
- Identify alternate routes for public during major incidents
- Communications network redundancy / self-healing

- Need to provide remote controlling / programming / managing capabilities for traffic control devices (i.e. message boards, temporary traffic signals, etc.)

The integration of law enforcement tools with other transportation stakeholders was described as an important need at the February 2019 stakeholder workshop. The lack of law enforcement tool/stakeholder integration can create difficulties for law enforcement in responding to events and pursuing violators across jurisdictions, as well as communicating the need to staying off roads during inclement weather or other events. Stakeholders from this area identified the following gaps and shortfalls to addressing this need:

- Slow communications via radio during events requiring enforcement
- No data depository from law enforcement to other agencies
- Funding for equipment to support integration with other agencies

The following ITS technologies can be applied to addressing these identified gaps and assist with incident detection and response.

GGL Road Conditions Webpage

The GGL Reporting system can also be used as a means of traffic information dissemination to the general public through a public-facing road conditions webpage. The system will communicate automated alerts through existing communications channels (i.e. social media accounts) currently used by the County. The development of a road conditions webpage can also allow for potential partnerships with 3rd party traveler information outlets that will need real-time road condition data.

ITS Device Control for Regional Agencies

To improve the ability for public agencies to manage ITS devices in response to major incidents or road construction, agencies can be provided client access to the ATMS that currently manages ITS devices throughout the County. This can be achieved via a client-server architecture that allows for agencies to use a web-based interface to access the ATMS and communicate to ITS devices, which will increase the safety and efficiency of agency management of incident response and road construction.

Alternate Route Signage Deployments

To improve the communication of available alternate routes to vehicle traffic, dynamic signage can be deployed at strategic locations to detour traffic along agreed upon detour routes during periods of heavy freeway congestion. Dynamic signage should be small enough to have a directional arrow light up as an inset to static route signage instructing drivers to take an alternate route. Integration of the signage with the GGL system can reduce congestion in specific areas and will require the identification of agreed upon detour routes to minimize the potential of impacts to cross street routes.

Safety, Crash Reduction and Incident Management

ITS technologies that can be used for safety improvements, crash reduction and incident management to address GGL specific needs and gaps are summarized below. Top ranked needs related to this area include the following:

- Need improved incident detection on major routes

- Need to reduce vehicle crashes at intersections
- Need improved incident management and coordination
- Need to reduce rear-end collisions due to queues
- Need to provide alternate / quickest routes for emergency vehicles
- Need to reduce crashes in and around roadway work zones

Improving incident detection on major routes was identified as an important need by the GGL stakeholders. Gaps and shortfalls to addressing this need include:

- Data from GGL system is difficult to use for emergency agencies and responders
- Lack of camera access and control to view incident scenes and understand response needs
- Dispatchers not actively monitoring for incidents along the roadway (reactive to 911 calls)

The following ITS technologies can be applied to addressing these identified gaps and assist with incident detection and response.

Increased Camera / Video Sharing between Traffic and Emergency Agencies

To address gaps and shortfalls related to the key need of incident detection, the expansion of camera and video sharing between traffic and emergency management agencies can help to further reduce incident response times. Potential solutions may include the following items:

- Incident and traffic information sharing between traffic management and incident responders via web-based systems or other means of information sharing
- Sharing of camera images and control of CCTV cameras with emergency management agencies
- Tools to assist 911 dispatchers and responders in proactive monitoring (this may be accomplished by camera sharing). This can include Automated Incident Detection Systems described below.

Automated Incident Detection Systems

Automated incident detection systems have been deployed to provide automated alerts about various types of incidents, such as stopped vehicles on the roadway or wrong way vehicles in certain areas. Advanced detection systems can use analytics-based software to monitor and interpret live video feeds from existing CCTV cameras along roadways. Upon detection of an event, for example a stopped vehicle, an alert can be provided to dispatchers in a central office for verification and can also be relayed to incident responders on the road.

Automated incident detection systems are relatively new given recent advances in video analytics-based software over the past few years and its use for traffic management agencies. A 2012 research study on the use of these systems found mixed results among state DOTs using the systems on the accuracy of incidents detected.[1] Further investigation will need to be performed with vendors that can offer this type of solution for incident detection and management prior to deployment and testing.

[1] Automated Video Incident Detection Systems. Produced by CTC & Associates, LLC, October 2012. Available at: http://www.dot.ca.gov/newtech/researchreports/preliminary_investigations/docs/automated_incident_pi.pdf.

Work Zone Speed Enforcement Systems

Enforcing vehicle speeds within active work zones can be challenging to law enforcement agencies given the lack of available space within the work zone for police vehicles to park in an area that allows them to detect the speeds of oncoming vehicles and then perform enforcement. While automated speed enforcement technology can be utilized in some work zones, this technology requires authorizing legislation at a state level to allow for the automated enforcement and ticketing of violators by mail. In the absence of authorizing legislation, a speed enforcement system can be placed within a work zone to assist law enforcement staff with performing speed enforcement.

Best Practices: Work Zone Speed Enforcement Systems

The Minnesota DOT tested a work zone speed enforcement system to detect the speed of vehicles traveling through a work zone and relayed the information in real-time to a State Patrol vehicle positioned in an area where speed enforcement can be safely and efficiently performed. The system was tested in 2016 within an active work zone in the Minneapolis – St. Paul metro area. Observed project benefits included:

- Improved officer safety during speed violation enforcement outside of the work zone
- Improved work zone safety for field maintenance staff and for travelers
- Enforcement approach is consistent with existing state law

More information on the project is available at: http://www.dot.state.mn.us/its/projects/2011-2015/enhancedspeed.html

Traffic Signal Preemption

Traffic signal preemption for emergency vehicles, often referred to as Emergency Vehicle Preemption (EVP), can be utilized to improve emergency response times along arterial signalized corridors to the scene of an incident. Typically, signal preemption systems require the installation of hardware on vehicles and at signalized intersections to facilitate the request from vehicle to intersection in the field. However, in the event that a centralized traffic signal system exists to communicate in real-time with traffic signals on a corridor, this will remove the need for additional field hardware by enabling a center-to-center communication for traffic signal preemption.

Best Practices: EVP

An excellent resource for reviewing the issues associated with emergency vehicle operations and EVP technologies can found at: https://rosap.ntl.bts.gov/view/dot/3655.

The purpose of the study is to increase awareness among police, fire, rescue and emergency medical services (EMS) responders about the benefits and costs of emergency vehicle preemption. Agencies using EVP technology on vehicles and at intersections have experienced a reduction in incident response times, as well as a reduction in the number of emergency vehicle crashes.

Opportunities also exist for potential cost sharing with public transit agencies of field-based hardware that may be needed to facilitate traffic signal preemption. Transit agencies have the opportunity to leverage field-based hardware to communicate transit signal priority requests, which are less disruptive to traffic operations than traffic signal preemption requests from emergency vehicles.

License Plate Readers

Automated License Plate Readers (ALPRs) can capture digital images of license plates that allow computers within law enforcement to check plate images against a list of plates on other lists of interest, such as stolen cars. The devices can be mounted on the front of police cars for reading plate images but can also be mounted at the roadside as well to capture thousands of images of plates as they pass by.

The data collected can enhance law enforcement's ability to investigate and enforce the law, but also raises concerns about the accuracy of the plate data collected, the data retention policy for how long data is stored and accessed, accessibility of the data to other government employees, and whether the data is being used or abused in ways that will raise general public privacy concerns.

Automated Gate Operations Systems

Automated gate closure and operations systems allow for traffic agencies to prevent access to roadways that are unsafe for passenger or commercial vehicle travel due to various types of weather conditions or incidents that may be affecting traffic. Systems can be operated from a remote location, where an operator will lower gate arms that can be installed at on-ramps along interstate highways or other major routes. The systems can include CCTV cameras that will send video confirmation to the operator that the gate has been lowered, and perhaps be integrated with other web-based information systems that will send automated notices out to the general public about the roadway closure.

Best Practices: Automated Gate Operations Systems

The Minnesota DOT developed and deployed an automated gate control system at the interchange of I-90 and US 71 just north of Jackson, Minnesota. It was the goal of this project to test different technologies, communications, and public/private operational and maintenance partnering scenarios to develop the optimal freeway management system for I-90. More information on the project is available at: http://www.dot.state.mn.us/guidestar/1996_2000/i90_i94_gate_operations.html

These systems can increase the safety of passenger vehicle travel, as well as the safety of law enforcement staff from having to respond to stalled vehicles on roadways experiencing inclement weather. Systems can also be combined with flash flood detection systems to reduce the potential for responding to emergency calls from vehicles stalled in flooded areas.

Communications Infrastructure

This section presents a summary of ITS technologies that can be used as communications infrastructure applications to address gaps and stakeholder needs within the region. Top ranked needs related to network and data applications include the following:

- Need to enhance communications and information sharing among agencies
- Need to expand fiber optic network
- Need to improve communications network redundancy and self-healing

Enhancing communications and information sharing among agencies was identified as an important need by the GGL stakeholders. The lack of information sharing can be the result of gaps in existing communications infrastructure (i.e. fiber-optic cable), as well as a lack of agreements in place to facilitate the data sharing. Stakeholders identified the following gaps and shortfalls to addressing this need:

- No sharing platform
- Costs for starting up and maintaining a data sharing platform
- Lack of data sharing between agencies

The following ITS technologies can be applied to addressing these identified gaps and assist with enhancing communications and information among agencies.

Regional ITS Data Hub

Through the addition of fiber-optic cable and related communications infrastructure, real-time data sharing can be enabled among agencies within the region related to traffic management and other transportation related areas. The information sharing initiative can allow for real-time monitoring of traffic conditions in the region and also for archived and historical data to be utilized by member agencies as well. Member agencies will need to be identified as champions to lead various portions of the overall initiative to enable data and information sharing.

> ***Best Practices: Regional ITS Data Hub***
> Travel Midwest (https://www.travelmidwest.com/lmiga/home.jsp) provides a web-based interface for accessing travel time and other traveler information in the Chicago region and surrounding areas. The site grew out of efforts that started with the Gary-Chicago-Milwaukee (GCM) corridor in 1993 and was recently organized as the Lake Michigan Interstate Gateway Alliance. The collective efforts of stakeholders involved in the group have helped to develop the traveler information site that is currently available to the public.

Data sharing with external agencies also becomes possible with the development of a Regional ITS Data Hub. External agencies can include private agencies, such as Traffic Technology Services whom the region currently has an agreement, or other private agencies that provide traveler information via web-based or mobile interfaces.

5.2 Emerging Technologies

This section provides a technology assessment that summarizes the current trends in CV/AV, smart city applications, and other emerging technologies for consideration as part of the update to the GGL Feasibility Study.

Connected Vehicle Technologies

With numerous CV pilot projects and deployment efforts emerging across the country, an exploration step was performed to review the known CV application concepts and assess their readiness for deployment based on their current stage of development. A comprehensive scan of pilot program information from the United States Department of Transportation (USDOT) and its Connected Vehicle Reference Implementation Architecture (CVRIA) was performed to gather data on CV applications.

Connected Vehicle Applications and Readiness Status

The USDOT CV Pilot Deployment Program maintains a suite of CV applications for the following overall categories:

- Vehicle-to-Infrastructure (V2I) Safety
- Vehicle-to-Vehicle (V2V) Safety
- Environment
- Road Weather
- Mobility
- Smart Roadside
- Agency Data

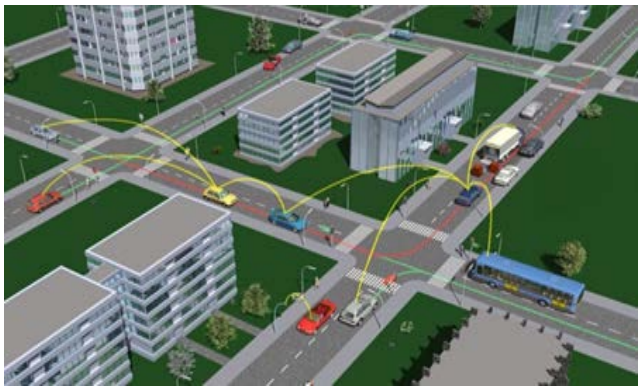


Table 2 provides a consolidated list of the CV applications and indicates the current readiness status of each application. The CV applications are classified by the following deployment statuses:

- Deployment Ready: These are applications that are currently being tested or are already field deployed.
- Deployment Near-Ready: These are applications that are being researched or planned.
- Further Development Required: Applications that require further development typically have a concept of operations developed but will necessitate research, infrastructure investments, and potentially more time for technologies to develop before deployment is feasible.

Table 2: CV Application Overview and Readiness Status

Application	Deployment Ready	Deployment Near Ready	Further Development Required
CV Application Group: Vehicle to Infrastructure (V2I) Safety			
SPaT MAP Display Signal Timing, Time to Green	●		
Red Light Violation Warning	●		
Reduced Speed Zone Warning / Lane Closure	●		
Spot Weather Impact Warning	●		
Pedestrian Collision Warning	●		
Speed Limit Warning	●		
Curve Speed Warning	●		
End of Ramp Deceleration Warning (ERDW)	●		
Restricted Lane Warnings	●		
Stop Sign Violation Warning			●
Stop Sign Gap Assist			●
Warnings about Hazards in a Work Zone			●
Warnings about Upcoming Work Zone			●
Railroad Crossing Violation Warning			●
CV Application Group: Vehicle to Vehicle (V2V) Safety			
Intersection Movement Assist	●		
Left Turn Assist (LTA)			●
Vehicle Emergency Response			●

Application	Deployment Ready	Deployment Near Ready	Further Development Required
CV Application Group: Environmental			
Advanced Traveler Information Systems		●	
Eco-Approach and Departure at Signalized Intersections		●	
Eco-Traffic Signal Timing			●
Eco-Integrated Corridor Management			●
Eco-Integrated Corridor Management Decision Support System			●
Eco-Freight Signal Priority			●
Eco-Transit Signal Priority			●
CV Application Group: Road Weather			
Enhanced Maintenance Decision Support System			●
Road Weather Information for Maintenance and Fleet Management Systems			●
Variable Speed Limits for Weather-Responsive Traffic Management			●
CV Application Group: Mobility			
Intelligent Traffic Signal System	●		
Emergency Vehicle Preemption	●		
Freight Signal Priority	●		
Transit Signal Priority	●		
Advanced Automatic Crash Notification Relay			●
Performance Monitoring and Planning			●
CV Application Group: Agency Data			
Probe-enabled Traffic Monitoring	●		
Vehicle Data for Traffic Operations		●	
Work Zone Traveler Information		●	

CV applications that can potentially be considered to address GGL gaps and stakeholder needs are described below. The technologies described are either deployment-ready or deployment near-ready, in order to emphasize technologies that are currently available or will become available in the near future.

V2I Safety Applications

SPaT MAP Display Signal Timing, Time to Green (Deployment Ready)

The RSU broadcasts a standard SPaT message containing the current signal states plus the time remaining until the signal change. The RSU also broadcasts standard MAP messages indicating the lane locations and the signal phase associated with each lane. The vehicle's onboard unit (OBU) compares its location, direction, and speed to the MAP and SPaT. The signal countdown for the phase associated with the lane is displayed to the driver. Distracted drivers blocking traffic are alerted to start up. Drivers starting up normally are not distracted with a startup warning.

Red Light Violation Warning (Deployment Ready)

The Red Light Violation Warning application is a cooperative vehicle and infrastructure application that assists drivers in avoiding crashes. The application cross references the driver's approach speed, acceleration profile, and distance to the intersection, with the intersection's signal phasing and timing (SPaT) information, and geometry (MAP) to determine if it appears likely that the vehicle will violate a red light signal. The intersection geometry information can be received by the connected vehicle from road side equipment at the intersection or earlier in the trip. If received at the intersection, the geometric information can cross reference the weather information, further improving the effectiveness of the safety message. The application will broadcast a warning message if it appears likely that the driver may violate an upcoming red light. The application can work in tandem with the Queue Warning (Q-WARN) application to ensure the vehicle will be issued a warning if there is a queue at the intersection.

Reduced Speed Zone Warning/Lane Closure Warning (Deployment Ready)

The Reduced Speed Zone Warning / Lane Closure (RSZW/LC) application provides connected vehicles which are approaching a reduced speed zone or closed lane with information on the zone's posted speed limit and/or the configuration of the roadway if altered (such as lane closures and lane shifts). Reduced speed zones can include work zones, school zones, pedestrian crossing areas, and rural towns. The RSZW/LC application inside the connected vehicle can receive the revised speed limit and any roadside configuration changes to determine if the driver should receive a warning message. To provide warnings to non-connected vehicles, infrastructure equipment static infrastructure can measure the speed of the approaching vehicle and, if greater than the reduced speed, provide a warning on a sign. The application can provide an advance warning message to drivers when rapid deceleration is required to reduce to the posted speed limit.

Spot Weather Impact Warning (SWIW) (Deployment Ready)

The Spot Weather Impact Warning application warns drivers of local hazardous weather conditions, road closures at specific points due to inclement weather, and potential detours. Weather conditions causing alerts can include floods, snow, fog, high winds, and ice. The weather information is processed to determine the nature of the alert or warning to be delivered and is then broadcasted to the connected vehicles. The application receives weather data from multiple sources (which can include traffic management centers and road weather information systems [RWIS]) to the road side equipment which broadcasts the weather information to near-by connected vehicles. Weather alerts and warnings can be broadcasted to non-equipped vehicles using physical infrastructure such as DMS. The SWIW application

weather information can be assisted by or used to assist the Weather Responsive Traffic Management Variable Speed Limit application which adjusts the speed limit on a road based on weather conditions.

Pedestrian Collision Warning (Deployment Ready)

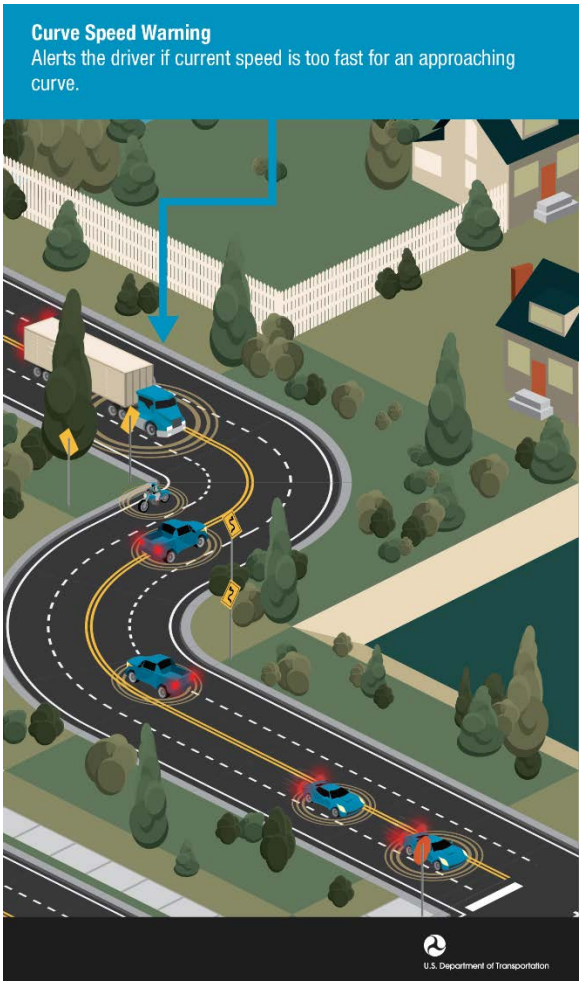
This application will alert and/or warn drivers who are approaching any crossing if it is determined that the vehicle's path will collide with an oncoming pedestrian. The application uses both vehicle-based and infrastructure-based technologies to determine if a warning is transmitted or not. The roadside equipment (RSE) will send the vehicle the intersection geometry, and information about the pedestrian approaching (or already at) the crossing to the vehicle. The information about the approaching pedestrian can be obtained from the intersection infrastructure or from a connection between the pedestrian and the RSE. To enhance the safety improvements of the application, the weather-related information and road condition information can be incorporated into determining which vehicles receive a message.

Speed Limit Warning (Deployment Ready)

Driver is alerted when the vehicle is exceeding the legal posted speed limit.

Curve Speed Warning (Deployment Ready)

The Curve Speed Warning application is a cooperative vehicle and infrastructure system that assists drivers in avoiding crashes. The application provides alerts to drivers who are approaching a curve at a speed that may be too high to safely travel through that curve. Alerts are based on the location of the vehicle within the curve and the vehicle speed.



End of Ramp Deceleration Warning (ERDW) (Deployment Ready)

The End of Ramp Deceleration Warning application was developed for the USDOT Connected Vehicle Pilot in Tampa FL. The application warns the driver to slow down to a recommended speed as the driver approaches the end of a queue. It can be enhanced to measure queue lengths and dynamically adjust the speed advice messages based on the end of the queue. In this case the speed advice varies according to the safe stopping distance to the end of the queue ahead. This application differs from simple in-vehicle signage in that:

- Drivers decelerating properly are not distracted by false positive alerts
- Drivers not decelerating properly are first alerted and then warned

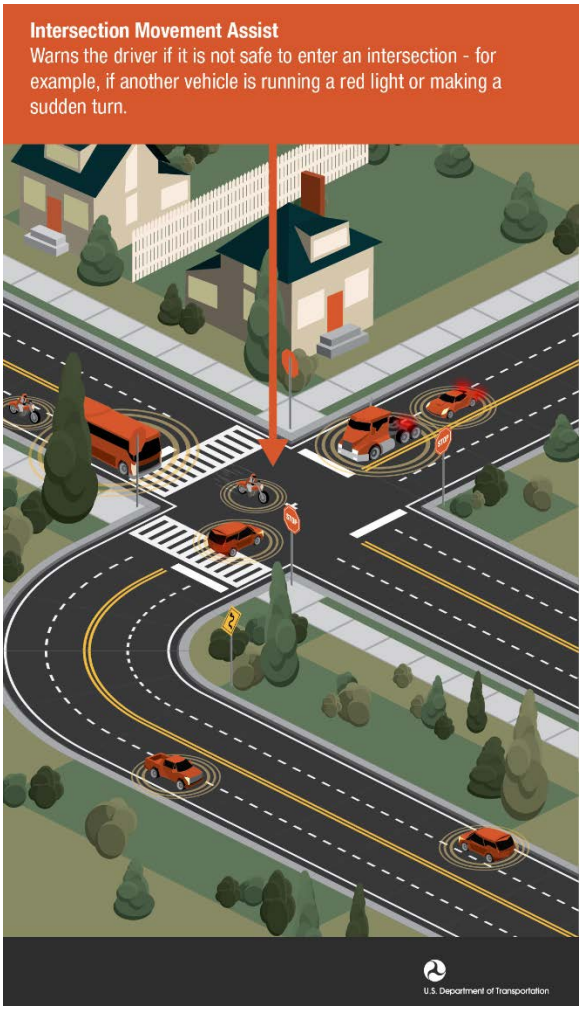
Restricted Lane Warning (Deployment Ready)

The Restricted Lane Warnings application provides the connected vehicle with restriction information about the travel lanes, such as if the lane is restricted to high occupancy vehicles (HOV), transit, or public safety vehicles only or has defined eco-lane criteria. A connected vehicle can use this information to determine if the vehicle is in a lane that has lane restrictions.

V2V Safety Applications

Intersection Movement Assist (Deployment Ready)

The Intersection Movement Assist (IMA) application warns the driver when it is not safe to enter an intersection due to a high collision probability with other vehicles. The IMA application is particularly useful when a driver's view of the intersection is obstructed and additional information would allow for safe passage through the intersection, similar to the SSGA application. The IMA application can provide collision warning information to the vehicle on board unit (OBU) which can display a message to the driver who can perform actions to reduce the likelihood of crashes at the intersections.



Environmental Applications

Advanced Traveler Information Systems (Deployment Near-Ready)

The Advanced Traveler Information Systems application provides a database for the collection, aggregation, and dissemination of a wide range of transportation information. The collection of information can include traffic and congestion along a route, transit arrival time and delays, road weather, work zone locations, and connected vehicle related data. All data can be aggregated into a database which can be used to process and discriminate appropriate travel using technologies such as mobile devices, in vehicle displays, web portals, and roadside signage.

Mobility Applications

Intelligent Traffic Signal System (Deployment Ready)

The Intelligent Traffic Signal System application (ISIG) optimizes the signal timing plan at an intersection for all roadway users. The application serves as an over-arching system optimization application, accommodating other mobility applications such as Transit Signal Priority, Freight Signal Priority, Emergency Vehicle Preemption, and Pedestrian Mobility to maximize overall arterial network performance. To adjust the signal timing plan for an intersection to improve traffic flow through the intersection, the ISIG application receives speed, location, and heading data from connected vehicles,

measurements from non-equipped vehicles, and roadway geometric information from road side equipment (RSE).

Emergency Vehicle Preemption (Deployment Ready)
The Emergency Vehicle Preemption (PREEMPT) application provides signal preemption to emergency vehicles, and accommodates multiple emergency requests. Similar to existing intersections with preemption, the Emergency Vehicle Preemption application is a high priority preemption application for emergency and first responder vehicles that will adjust the signal timing plan to ensure emergency vehicles will have minimal delays and a green light when the vehicle arrives at the intersection. Because primary goal of the Emergency Vehicle Preemption application is to ensure the emergency vehicle can safely and efficiently move through the intersection, it may take additional time to clear a standing queue for congested conditions. Transitioning back to normal traffic signal operations after providing emergency vehicle preemption is an important consideration because the signal timing plan is modified.

Freight Signal Priority (Deployment Ready)
The Freight Signal Priority (FSP) application provides signal priority to freight and commercial vehicles in signalized networks. This application can contribute to improved operating performance of freight vehicles by reducing stops and delays and enhancing safety at intersections.

Agency Data Applications

Probe-enabled Traffic Monitoring (Deployment Ready)
This application utilizes communication technology to transmit real time traffic data to transportation management centers for monitoring and improvement of system-wide performance.

Vehicle Data for Traffic Operations (Deployment Near-Ready)
The Vehicle Data for Traffic Operations (VDTO) application uses probe data information obtained from vehicles in the network to support traffic operations, including incident detection and the implementation of localized operational strategies. The implantation of incident detection enables transportation agencies to determine the location of potential incidents so the agencies can respond more quickly to the incident and mitigate any negative impacts to the transportation network. Vehicle data that can be used to detect potential incidents include changes in vehicle speeds indicating the disruption of traffic flow, when a vehicle's safety systems have been activated or deployed, or sudden vehicle turns or deceleration at a specific location (indicating a potential obstacle in the roadway). Operational strategies might include altering signal timing based on traffic flows or using vehicle data collected on the freeway mainline to employ speed harmonization or to optimize ramp metering rates.

Work Zone Traveler Information (Deployment Near-Ready)
This application monitors and aggregates work zone traffic data.

Automated/Autonomous Vehicles

This section provides an overview of known, specific automated/autonomous (AV) applications and AV program advancements across the North America that can address some of the key GGL needs identified by the stakeholders.

State of AV Deployments

An assessment of the AV deployment state in locations throughout the North America is provided below.

Passenger Cars

Automated passenger cars are being tested in a variety of states including:

- Arizona (AV vendors testing include Waymo);
- California (Agencies testing include City of San Diego, City of San Francisco, City of Sacramento [planned], City of Palo Alto, and AV vendors testing include Waymo, Lyft, Apple, Phantom Auto, Cruise Automation by GM, Nissan, Delphi, Bosch, BMW, Mercedes, Ford, Tesla, Honda, and Volkswagen);
- Colorado (AV vendors testing include Ford);
- Florida (Agencies testing include The Village; AV vendors testing include Voyage);
- Georgia (AV vendors testing include Waymo);
- Michigan (AV vendors testing include Waymo, Fiat Chrysler Automobiles (FCA), Ford, General Motors, Hyundai, Mercedes Benz, Nissan, Subaru, Toyota, and Uber);
- New Jersey (AV vendors testing include Nvidia-Uber [currently discontinued]);
- New York (AV vendors testing include Audi [currently halted], and Cruise Automation by GM [planned]);
- Texas (AV vendors testing include Waymo, Drive.ai, and Audi);
- Transport Canada (Agencies testing include City of Ottawa; AV vendors testing include Blackberry's QNX); and
- Washington (AV vendors testing include Waymo, and TORC Robotics).

Shuttle Services

Automated shuttle services are being tested in a variety of states including:

- California (Agencies testing include Contra Costa Transportation Authority, City of San Ramon, City of San Jose [planned], City of San Francisco, California Public Utilities Commission (Planned), and City of Concord; AV vendors testing include Easy Mile, and AutoX);
- Colorado (Agencies testing include Colorado DOT, and the City of Denver; AV vendors testing include Easy Mile);
- Connecticut (Agencies testing include Connecticut DOT);
- Florida (Agencies testing include Gainesville Autobus, and Downtown Tampa Autonomous Transit);
- Maryland (AV vendors testing include STEER Tech);
- Michigan (Agencies testing include University of Michigan, and the City of Ann Arbor; AV vendors testing include Navya, and May Mobility);
- Minnesota (Agencies testing include MnDOT; AV vendors testing include Easy Mile);

- Nevada (Agencies operating in Las Vegas)
- Pennsylvania (Agencies testing include the City of Pittsburgh);
- Tennessee (Agencies testing include City of Nashville [planned]; AV vendors testing include Olli);
- Texas (Agencies testing include City of Austin, Texas Innovation Alliance, City of Houston, City of San Antonio, City of Arlington, and City of Frisco; AV vendors testing include Easy Mile);
- Transport Canada (Agencies testing include City of Calgary, City of Edmonton, City of Montreal (planned), and City of Toronto (planned); AV vendors testing include Easy Mile);
- Washington (Agencies testing include Pierce County, City of SeaTac (planned), and City of Seattle (planned); AV vendors testing include Mighty AI); and
- Wisconsin (Agencies testing include University of Wisconsin–Madison; AV vendors testing include Navya).

Commercial Trucks

Automated commercial trucks are being tested in a variety of states including:

- Arizona (AV vendors testing include Waymo, TuSimple, Uber [currently discontinued]);
- Colorado (Agencies testing include Colorado DOT);
- Georgia (AV vendors testing include Waymo);
- Minnesota (Agencies testing include MnDOT); and
- Texas (Agencies testing include North Central Texas Council of Governments [NCTCOG]; AV vendors testing include Navistar).

State Specific AV Applications and Advancements

Selected AV applications and program advancements that can address some of the key GGL needs identified by the stakeholders are presented below.

Colorado: Develop Communication Infrastructure for CV and AV to Share Road and Safety Data

The Colorado Department of Transportation (CDOT) has partnered with Panasonic to build an ecosystem for connected transportation where smart vehicles, self-driving vehicles, and infrastructure share instantaneous data and information about road and safety conditions, eventually reducing crashes by 80 percent, quadrupling the capacity of our highways, and dramatically improving travel time reliability. In fewer than 10 years, it's expected that up to 4 million vehicles in Colorado will be "talking" to each other and to the roadway infrastructure.

Colorado: Autonomous Vehicles to Improve Worker Safety

CDOT will use a self-driving Autonomous Impact Protection Vehicle (AIPV), as a barrier to protect highway workers. Crash protection vehicles are generally large lumbering garbage truck-like vehicles equipped with bright yellow crash bumpers. They function as moving barriers to keep workers on the other side of them safe from careening cars. The AIPV, developed by Royal Truck & Equipment along with Kratos Defense and Security Solutions and Colas UK, takes the driver out of the truck, which is equipped with autonomous vehicle technology. The AIPVs are connected electronically to the human-driven lead truck. The autonomous system is accurate to within four inches, said DOT officials.

Washington: Automated Work Zone Vehicles [Autonomous Truck Mounted Attenuator (TMA)] Pilot

The Washington State Department of Transportation (WSDOT) Cooperative Automated Transportation (CAT) program focuses on how new, semi-automated and automated capabilities can advance the multimodal transportation system and enhance the communities. One of the CAT program's pilot projects is the Automated Work Zone Vehicles Pilot which aims to improve safety by eliminating the need for a driver in some staging vehicles. This project includes:

- Pilot Truck and Autonomous Attenuator Vehicle
- 2018 Pilot with Other States
- Considering Low Speed Striping Operations

Smart City Technologies

This section provides a technology assessment that summarizes the current trends in smart city technology as it relates to the GGL program. A smart city refers to any metropolitan area that incorporates Information and Communication Technology (ICT) to enhance the quality and performance of urban services such as energy, transportation and utilities in order to reduce resource consumption, wastage and overall costs. The overarching goal of a smart city is to enhance the quality of living for its citizens through the incorporation of smart technology.

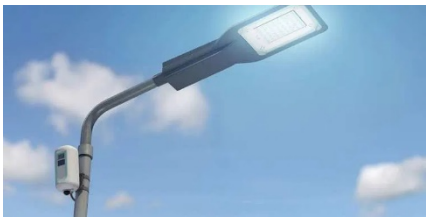
With smart cities still being a relatively new concept in the ITS field, additional research and testing of system applications will continue to be performed. Advances in smart city technology can be aided by using existing CV/AV technologies, which are often incorporated into smart city systems, as a point of reference for developing new smart city applications.

Potential Smart City Applications

A list of smart city technologies applicable to the GGL program were identified based on the stakeholder needs. The potential smart city technologies applicable to the GGL program include:

- Smart street lights
- Electric vehicles (EVs)
- EV charging infrastructure
- Smart parking
- Integrated data platforms

Smart Street Lights



Smart Street Lights can adjust their brightness based on the time of day or presence of vehicles along the roadway. A smart street light system will consist of a brightness sensor, a motion sensor and a short-distance communication network. It will adapt to movement by vehicles, pedestrians and cyclists to adjust brightness. Cameras or other sensors can also be placed on the smart street lights and be added to the smart street light networks to offer other services such as traffic monitoring, smart parking, air quality monitoring, etc. Street lights can also be equipped with CV technology to detect the presence of CVs and obtain traffic and environment data from the vehicles as an input to support adjustment of the lighting based on adverse weather conditions such as fog, rain or snow.

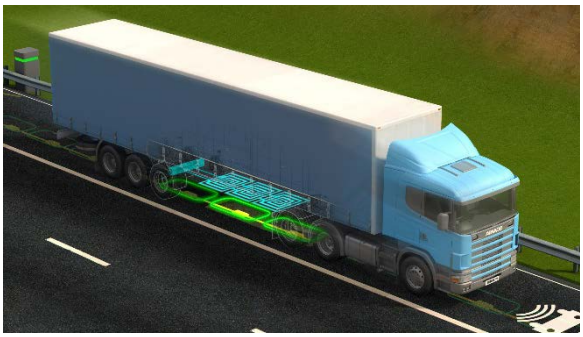
Electric Vehicles

The deployment of an Electric Vehicle (EV) fleet to replace the existing gas-powered models will provide a cleaner, more energy efficient, and more sustainable method of operation than the existing models can provide. The EVs would be powered by one or more electric motors and would run entirely on electric energy. They receive electricity by plugging into existing charging infrastructure and storing the electricity in batteries or fuel cells. A single charge can be expected to last roughly 80 to 100 miles. EVs also consume no petroleum-based fuel and produce no tailpipe emissions.

EV Charging Infrastructure

EV charging infrastructure provides access to EV supple equipment that is used to charge hybrid and all-electric vehicles. This includes public charging stations, workplace charging stations and fleet charging stations. Fixed charging stations are stationary public ventures that allow access to electric plug-ins in order for EV operators to recharge their vehicle while parked at the station. The charging device may be slow or high speed and can be located at public parking lots, shopping malls, train stations and rest areas.

In-motion charging (IMC) is a method of EV charging that can allow the vehicle to charge while driving along a corridor. IMC will enable EV operators to simultaneously recharge their vehicle while continuing on their desired travel route. The most common IMC application is inductive charging, which uses an electromagnetic field from coils embedded in the ground to transfer electricity to the battery pack of an EV without requiring the use of a cord.



Smart Parking

Smart Parking is a vehicle parking system that uses technology including video cameras, vehicle counting equipment, and pavement sensors among others to determine real-time occupancy and availability of a parking lot. Smart parking systems aid in the prevention of drivers from spending too much time searching for a parking space.

Integrated Data Platforms

Integrated data platforms are database migration tools allowing public agency IT operations staff to combine public and private sector data to improve real-time operations, historical analysis, and decision-making. An integrated data platform's primary function is to merge and centralize data for ease of access, management, and business intelligence.

6. Program Areas and Projects

6.1 Program Areas

In order to address the specific needs and gaps identified by the GGL stakeholders during the project outreach, these needs have been organized into logical groups or "program areas." Table 3 shows the program areas that were identified as being the most critical for the GGL program based on the needs the stakeholders identified. These program areas are more overarching in nature and highlight the need for integration in the development and deployment of ITS and emerging technologies.

Table 3. GGL Program Areas

GGL Program Area	Description
Traffic Management	Traffic flowing across a network of roads is complex, dynamic, and it is affected by many variables such as weather, special events, and time of day. Traffic managers need to continually monitor and measure the performance of the GGL roadway network. As incidents arise, these managers need to have appropriate countermeasures to preserve the flow of traffic.
Communications Infrastructure	Communications is the common denominator for the exchange of information. This program area emphasizes the need for expanding and enhancing the communications infrastructure.
Traveler Information	This program highlights the need for timely, accurate, and useful information for the traveling public. Such information is useful to travelers before they embark on their trip, allowing them to make modal and routing decisions, during a trip to inform travelers of changing traffic conditions, and near the completion of a trip to help with travel services, like parking information.
Incident Management	This program area emphasizes the need for improved incident management tools and techniques and better coordination between incident and traffic managers to bring about reduced time for incident detection, assessment, response, and clearance.
Data Collection and Management	This program area highlights the need for transportation agencies to be able to collect, store, process, purge, and mine the data that it collects so that it can be turned into useful information and more easily shared. This involves the combination or linkage of different agency databases.
Roadway Construction and Maintenance	This program area covers problems associated with road and bridge construction as well as maintenance operations. When work is needed, motorists need to know about problem areas and be able to determine alternate routes. Safety within the work zone – both for motorists and for workers – is paramount and should be continually improved and emphasized.
Transportation Safety	This program area cites the need to improve the safety of travelers, including motorists, transit riders, cyclists, and pedestrians. Transportation managers need ways to identify high accident locations and determine ways to remedy unsafe conditions. For locations where safety is affected by weather conditions, managers may need to dynamically monitor the environment before enacting a response.

GGL Program Area	Description
Asset Management	This program area addresses the need for accurately document and effectively manage the GGL program assets. This includes developing and maintaining a database to document GGL infrastructure and communications inventory, documenting and managing changes/additions to the system, and maintaining documentation and as-built plans for the GGL assets.
Interagency Coordination and Asset Sharing	This program area addresses the need for interagency information and resource sharing and coordination. It also emphasizes the need to build common, integrated systems for opportunities to combine these systems and then establish the appropriate access rights for each member to access information or control remote devices, where feasible. Asset sharing has many advantages including lower costs per agency, instant compatibility, more powerful functions, simpler archiving, and lower maintenance costs.
Connected and Automated Vehicle Technology	This program area reflects the rapidly emerging area of connected and automated vehicles within the transportation sector. The technologies included within this program area provide a starting point for transportation connectivity that will potentially enable countless applications that promote safety, mobility, and the environment.
Smart City Technology	This program area addresses the need to support smart city and community projects that integrate digital technology into transportation infrastructure and services through new innovations.
Training and Outreach	This program area cites the need to emphasize agency training programs in the areas of data utilization, system operations, maintenance and incident management. This program area also reflects the need to perform outreach and education to agency management and the public regarding the value and benefits of the GGL program.

6.2 Project Identification, Analysis and Prioritization

Based on the needs brought forward by stakeholders, potential ITS solutions were identified and examined to address those identified needs. Fifty-two (52) candidate ITS projects containing potential solutions across the 12 program areas were identified and presented to the GGL stakeholders.

When addressing the needs identified by the stakeholders, it is important to look at many different potential solutions to ensure an efficient and coordinated use of resources. While some solutions can be used to address a single identified area of need, other solutions can be used to address multiple needs, which can lead to significant cost savings. An analysis of different alternatives helps to identify the solutions that provide the most benefit while addressing the highest priority problems.

For the purposes of this analysis, the following evaluation criteria were considered:

Figure 8. Project Analysis Workflow

- Support GGL Vision and Goals
- Address GGL Stakeholder Needs
- Expected Benefits (in mobility, safety, productivity, agency efficiency, etc.)
- Technology Maturity/Readiness
- Leverage Existing GGL Technology/Capabilities
- Integration with GGL Components/Projects/Agencies
- Provide Opportunity to Position for Emerging Technology
- Costs

Applying these criteria will ensure that the GGL deployments are an efficient use of the resources and will provide a substantial benefit to travelers and residents at a reasonable cost. Upon review and discussion, the GGL stakeholders used the above criteria as a guide to modified and prioritize the 52 potential projects during the second workshop on August 21, 2019. Twenty (20) projects were identified as with high priorities for implementation consideration over the next 7 to 10 years as described in the next section.

6.3 Recommended Program Areas and Projects

Table 4 show a summary of the high-priority projects with an initial assessment of the expected timeframe for implementation. Three timeframes are being considered:

- ●○○ Short Term: Estimated to be implemented within the next 2 years
- ○●○ Medium Term: Estimated to be implemented in 3 to 5 years
- ○○● Long Term: Estimated to be implemented in 6 years and beyond

Table 4. Recommended GGL Projects and Implementation Timeframes

ID	Project	Primary Program Area	Timeframe
TM-1	Automated Traffic Signal Performance Measures	Traffic Management	●●●
TM-2	Adaptive Traffic Signal Control Systems	Traffic Management	●●●
TM-3	ATMS Software Study and Procurement	Traffic Management	●○●
TM-4	Integrated Corridor Management Enhancements	Traffic Management	○●●
CO-1	Backbone Fiber Optic Communications Expansion	Communications Infrastructure	●●○
CO-2	Fiber Optic Connection to Municipalities for Transportation & Non-transportation Uses	Communications Infrastructure	●●○
IC-1	Traffic Condition Information and Video Sharing with Public Safety, Traffic Agencies and Emergency Responders	Interagency Coordination and Asset Sharing	●●○
TI-1	Travel Information Program	Traveler Information	●○○
TI-2	Third-Party Data Partnerships	Traveler Information	●○○
AM-1	ITS and Communications Asset Management System	Asset Management	●●○
AM-2	ITS and Communications Maintenance Program	Asset Management	●●●
DM-1	Road Weather Information Stations at Strategic Locations	Data Collection and Management	●●○

ID	Project	Primary Program Area	Timeframe
DM-2	GGL Performance Management and Reporting System	Data Collection and Management	●●●
CV-1	Smart Corridor	Connected and Automated Vehicle Technology	●●○
SC-1	Smart City Committee/Task Force	Smart City Technology	●○○
CM-1	Smart Work Zones	Roadway Construction and Maintenance	●○○
TO-1	Communication and Outreach Program	Training and Outreach	●○○
TO-2	GGL Data and System Operations Training Program	Training and Outreach	●○○
TO-3	GGL Maintenance Training Program	Training and Outreach	●○○
TO-4	Incident Management Training Program with Public Safety	Training and Outreach	●○○

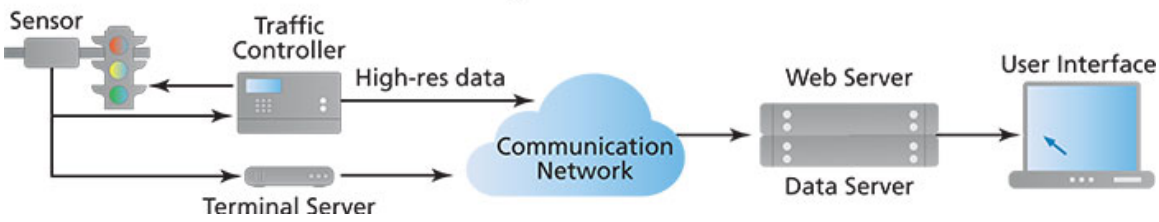
The following pages provide further information on those projects. Project information is organized by primary program area. Each project is described with the following information:

- **ID:** Project identifier.
- **Project:** Title of the project.
- **Timeframe:** Recommended timeframe for implementation.
- **Program Area:** Program area(s) relevant to the project.
- **Description:** A short description of the project.
- **Extents:** Recommended location(s) and extent of implementation.
- **Stakeholders Involved:** Lead and support agencies of the project.
- **Needs Addressed:** Stakeholder needs that can addressed by the project.
- **Technology Readiness:** Assessment of the readiness level of relevant technology.
- **Estimated Costs:** Preliminary cost estimates for the project.

Program Area: Traffic Management

ID: TM-1
Project: Automated Traffic Signal Performance Measures
Timeframe: Short- to Long-Term (0 to 5 years and beyond)
Program Area: Traffic Management, Data Collection and Management

Description
Automated Traffic Signal Performance Measures (ATSPM) is defined as a suite of performance measures, data collection and data analysis tools to support objectives and performance-based approaches to traffic signal operations, maintenance, management and design of the signal system. ATSPM modernizes traffic signal management by providing high-resolution data to support objectives and performance-based maintenance and operations strategies. The purpose of the application is to improve the overall safety, mobility and efficiency of signalized intersections for all system users while cutting congestion and cost. The technology allows for agencies responsible for traffic signal timing updates to use the data provided through ATSPM to determine how best to optimize traffic signal timings based on the collected data.



(Source: FHWA)

Extents

Ideal locations for implementing ATSPM should have the following equipment:

- ATC controllers with high-resolution data logging capabilities
- Communications for transmitting data to a central location
- Reliable detection to collect data

Potential locations for this project include:

- Route K: between I-70 and Route 364 (14 signals, 2020 signal optimization)
- Mid River Mall Dr.: between I-70 and Mexico Road (7 signals, 2019 signal optimization)
- Bryan Road: between Mexico Road and Route N (6 signals, 2018 signal optimization)
- Main Street/Route M in O'Fallon: between I-70 and St. Joseph Avenue (8 signals, 2020 signal optimization)
- Muegge Road: between North Outer Road/South Old Highway 94 and Mexico Road (9 signals, 2017 signal optimization)
- Wentzville Parkway: between Veterans Memorial Parkway and US 61 (14 signals, 2019 signal optimization)
- Mexico Road: between Knaust Road/Belleau Creek Road and Spencer Road (12 signals, 2019 signal optimization) and can be extended east to Muegge Road/Cave Springs Road (6 additional signals)

Stakeholders Involved

- Lead Agency: St. Charles County
- Support Agencies: City of O'Fallon, City of St. Peters, City of Lake St. Louis, City of Dardenne Prairie, City of Wentzville, City of St. Charles

Needs Addressed

- Reduce congestion / delay on arterials
- Improve alternate route traffic management and provide detour information
- Improve traffic data collection capability
- Improve real-time traffic monitoring capability
- Implement and use high-resolution data for automated performance measures
- Enhance transportation information collection for use by planners
- Improve signal timing and coordination
- Improve signal coordination across jurisdictions

- Improve timing adjustments of traffic signal operations based on traffic flow

Technology Readiness
ATSPM technology is mature and has been deployed by many traffic signal operating agencies in the U.S. Traffic signal controllers with high-resolution data logging capabilities are available from multiple vendors.

Estimated Costs
The cost is estimated to be $500 per signal. This cost includes data server cost, SQL Database license, IT and engineering consultants for detector configuration. The cost does not include ATSPM software, new or upgraded controllers, controller firmware updates, communications, data storage or detectors.

The cost per signal that includes controller software and firmware upgrades, detectors, ATSPM software and data storage is estimated to range from $15,000 to $20,000.

ID: TM-2
Project: Adaptive Traffic Signal Control Systems
Timeframe: Short- to Long-Term (0 to 5 years and beyond)
Program Area: Traffic Management

Description

The purpose of this project is to improve the operation of closed loop traffic signal systems by utilizing adaptive signal control technology. Adaptive signal control technology adjusts the timing of red, yellow and green lights to accommodate changing traffic patterns and ease traffic congestion. The main benefits of adaptive signal control technology over conventional signal systems are that it can continuously distribute green light time equitably for all traffic movements, improve travel time reliability by progressively moving vehicles through green lights, reduce congestion by creating smoother flow, and prolong the effectiveness of traffic signal timing. Based on the experience from various agencies, adaptive signal control systems are very effective when demand conditions are variable or unpredictable, while other options such as fixed timing may work better for a tight grid roadway system.

Adaptive signal control systems may require higher agency capabilities for maintenance and keeping the systems and components, especially detection, up and running. Capabilities of agency technicians, preferably IMSA certified, should be considered prior to planning and implementing the systems.

Extents
Candidate corridors for adaptive signal control systems include:

- Mexico Road from Bryan Road to Muegge Road (26 signals)
- Bryan Road from West Terra Lane to I-64 (17 signals)

- Mid Rivers Mall Drive from St. Peters Howell Road to N. Service Road (14 signals)
- Mid Rivers Mall Drive from Route 364 to Dye Club Drive (7 signals)
- Muegge Road/Cave Springs Road from Route 364 to W Clay Street (13 signals)

Stakeholders Involved

- Lead Agency: St. Charles County
- Support Agencies: City governments, MoDOT

Needs Addressed

- Reduce congestion / delay on arterials
- Enhance transportation information collection for use by planners
- Improve signal timing and coordination
- Improve signal coordination across jurisdictions
- Improve timing adjustments of traffic signal operations based on traffic flow

Technology Readiness

Adaptive signal control systems are readily available from vendors.

Estimated Costs

The cost of an adaptive traffic signal control system, including detection, is estimated to be $50,000 per intersection. Mid-block detection is estimated to be $20,000 per location.

ID: TM-3
Project: ATMS Software Study and Procurement
Timeframe: Short or Long-Term (0 to 2 years or 5 years and beyond)
Program Area: Traffic Management, Incident Management, Data Collection and Management

Description

The current GGL ATMS software, TransSuite, has been in place since the inception of the GGL program. Since the initial acquisition of TransSuite, multiple follow-on contracts have been enacted to perform general maintenance of the software and add functionality requested by GGL partners. The current contractual period is set to expire within a calendar year. The purpose of this two-phase project is to: 1) Study the currently available ATMS software packages for control and management of field-based ITS devices (i.e. traffic signals, CCTV cameras, DMS, detectors, etc.) and investigate their applicability and suitability for the current and future GGL program, and 2) Develop a procurement package and procure an ATMS software package.

The ATMS software assessment/study will also investigate available ATMS software packages that utilize NTCIP standards, open sources, and/or cloud-based solutions. An integrated solution to support remotely access of ATMS data, camera images and videos by emergency dispatchers, law enforcement and emergency responders should be considered, as noted in *Project IC-1: Traffic Condition Information and Video Sharing with Public Safety, Traffic Agencies, and Emergency Responders*.

Concurrently, MoDOT will be issuing a solicitation for ATMS software on a statewide level. While the GGL program and MoDOT could experience some efficiencies if the same ATMS solution were acquired, center-to-center standards and data stream capabilities may allow for differing ATMS software to be implemented.

Extents

- Countywide

Stakeholders Involved

- Lead Agency: St. Charles County and MoDOT
- Support Agencies: City governments

Needs Addressed

- Reduce congestion / delay on arterials
- Improve incident detection capability on major routes
- Improve alternate route traffic management and provide detour information
- Reduce congestion / delay on freeways
- Identify alternate / quickest routes for emergency vehicles
- Improve real-time traffic monitoring capability
- Enhance transportation information collection for use by planners
- Remote controlling / programming / managing of ITS devices
- Share video images with public safety agencies / centers

Technology Readiness

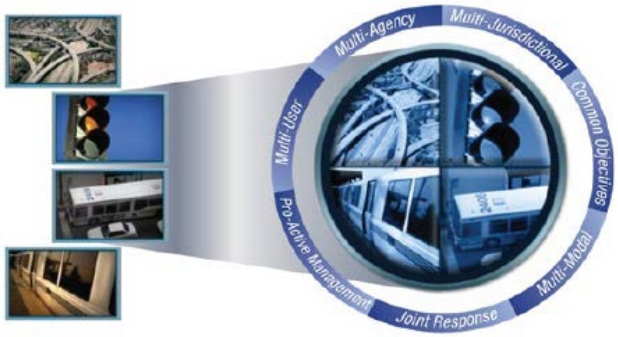
Several ATMS software packages are commercially available and have been used by many transportation management agencies.

Estimated Costs

The cost for the Phase 1 – ATMS Study is estimated to be $75,000. The cost of ATMS software ranges between $1,000,000 and $5,000,000, depending on the desired features and functions. This cost includes initial maintenance and support agreement.

ID: TM-4
Project: Integrated Corridor Management Enhancements
Timeframe: Medium- to Long-Term (3 to 5 years and beyond)
Program Area: Traffic Management, Incident Management, Traveler Information

Description



Integrated Corridor Management (ICM) refers to a collaborative approach taken by multiple transportation agencies to improve the efficient movement of people and goods by managing key transportation corridors as an integrated and multimodal system. Through this type of collaborative approach, operational decisions regarding arterial signal control, freeway management, or alternate route management are made for the benefit of the transportation corridor as a whole.

ICM has been implemented to some extent in the GGL program area. This project will focus on the following enhancements for more robust and efficient ICM operations.

- Developing response strategies and plans
- Enhancing interagency communication and coordination to enable coordinated response strategies
- Increasing availability of information about travel times to drivers
- Increasing pre-trip and en-route traveler awareness of incidents and alternate options
- Implementing ICM to additional corridors in the region

Extents

- I-70 Corridor within the County and extended eastward to I-270
- I-64/US 61 Corridor from Lincoln County to St. Louis County

Stakeholders Involved

- Lead Agency: St. Charles County and MoDOT
- Support Agencies: City governments

Needs Addressed

- Reduce congestion / delay on arterials
- Improve alternate route traffic management and provide detour information
- Identify alternate routes for public during major incidents
- Reduce congestion / delay on freeways
- Improve incident management and coordination
- Provide travel times / delays / incidents / roadway closures / lane restrictions / work zone information on roadways to the public
- Improve signal timing and coordination

- Improve signal coordination across jurisdictions

Technology Readiness
This project will enhance the integration of existing technology and systems already deployed along the corridors. Key focuses will be on enhancing the operational coordination and integration among agencies as well as improving traveler information dissemination both pre-trip and en-route.

Estimated Costs
The costs for ICM implementation are estimated to be between $75,000 and $125,000 per mile.

Program Area: Communications Infrastructure

ID: CO-1
Project: Backbone Fiber Optic Communications Expansion
Timeframe: Short- to Medium-Term (0 to 5 years)
Program Area: Communications Infrastructure

Description
The project will continue the expansion of the backbone segments of the fiber-optic cable infrastructure system utilized for the GGL program as well as for non-GGL use. The backbone expansion will also include increasing the capacity of the fiber optic communications, connecting to additional ITS devices/traffic signals, as well as implementing redundant rings within the fiber communications network to maintain communications in the event of fiber cable damage to one area of the network.

This project relates to the "Priority 4" and "Priority 5" fiber expansions discussed in more detail in the St. Charles County Information Systems Wide Area Network Master Plan from 2017.

Extents
Potential locations for this project include:

- Route 364 between Mid Rivers Mall and Arena Parkway (in MoDOT existing conduit)
  - Including cross-connect cabinet at the Jungermann Interchange to allow for physical ring to Mid Rivers Mall Driver corridor within the St. Peters portion of the network.
- Route 364 & Mid Rivers Mall to Route 94 & Francis Howell High School Entrance (in MoDOT existing conduit)
- Tower 9.9 to Route N & Orf Road
- Route N & Orf Road to a future MORENet Node location on Orf Road
- Fiese Road between Henke Road and Hanley Road
- Hanley Road between Fiese Road and Route N
- Route N between Merz Farm Lane and Bryan Road (removing existing radios to tower connection)

Stakeholders Involved

- Lead Agency: St. Charles County Information Systems
- Support Agency: St. Charles County Roads & Traffic, MoDOT

Needs Addressed

- Enhance communications and information sharing among agencies
- Expand fiber optic network
- Improve communications network redundancy / self-healing capability
- Improve reliability and availability of communications network
- Remote controlling / programming / managing of ITS devices
- Enhance security of communications network
- Expand communications network capacity
- Share video images with public safety agencies / centers

Technology Readiness

This project will expansion the fiber optic backbone communications network using the technology that has been implemented for the GGL project.

Estimated Costs

The cost for fiber optic connection is estimated between $20 and $25 per linear foot for new conduit and cable, while new cable in existing conduit is estimated between $5 and $8 per linear foot. This cost includes installation of fiber optic cables (and conduit if applicable), fiber splicing and enclosures, termination, switches, and pull boxes.

ID: CO-2
Project: Fiber Optic Connection to Municipalities for Transportation & Non-Transportation Uses
Timeframe: Short- to Medium-Term (0 to 5 years)
Program Area: Communications Infrastructure

Description

This project will expand the deployment of fiber optic cable infrastructure to connect municipalities with the GGL fiber optic backbone for transmitting transportation related data, as well as additional uses beyond transportation. This includes connecting schools, police and fire departments, County Emergency Management Center (EOC), Heritage, Humane Society and others to the GGL fiber optic backbone.

This project relates to the “Priority 1” and “Priority 2” fiber projects discussed in more detail within the St. Charles County Information Systems Wide Area Network Master Plan from 2017.

Extents

This project could connect the existing fiber infrastructure to the following sites:

- Schools
- Police departments
- Fire departments
- Ambulances
- Tower 9.9
- Tower 9.9 to Youth Activity Park

- Juvenile Justice Center
- Family Arena
- Community Health
- Central Highway Shed & Tower 3.0
- Eastern Highway Shed & Tower 14.1

Stakeholders Involved

- Lead Agency: St. Charles County
- Support Agencies: City governments

Needs Addressed

- Enhance communications and information sharing among agencies
- Expand fiber optic network
- Improve communications network redundancy / self-healing capability
- Improve reliability and availability of communications network
- Enhance security of communications network
- Remote controlling / programming / managing of ITS devices
- Share video images with public safety agencies / centers

Technology Readiness

This project uses the technology that has been implemented for the GGL project.

Estimated Costs

The cost for fiber optic connection is estimated to be $20 per linear foot. This cost includes installation of conduit and fiber optic cables, fiber splicing and enclosures, termination, switches, and pull boxes. The cost will be substantially lower if existing conduit is utilized.

Program Area: Interagency Coordination and Asset Sharing

ID: IC-1

Project: Traffic Condition Information and Video Sharing with Public Safety, Traffic Agencies, and Emergency Responders

Timeframe: Short- to Medium-Term (0 to 5 years)

Program Area: Interagency Coordination and Asset Sharing, Incident Management, Traffic Management

Description

The purpose of this project is to share real-time traffic conditions, camera snapshots, and live video gathered through the GGL system with public safety agencies, emergency responders and dispatch centers. Sharing of this information can help reduce overall incident response times by providing public agency dispatchers with traffic congestion information and video or snapshots at specific locations and improving the efficiency of public safety dispatching around the congestion.

Traffic condition information sharing can be accomplished by sharing of ATMS data, images and video remotely through web-based platforms or installing Thin Client devices and bandwidth friendly enablers (e.g. virtual private network (VPN) technology) on public safety / dispatch center workstations.

St. Charles County is currently working on implementation of a Countywide video sharing initiative through Genetec. Upon implementation, public safety agencies and dispatchers will have access to GGL cameras to view traffic conditions.

Extents

- Countywide – public safety dispatch centers, public safety agencies and emergency responders

Stakeholders Involved

- Lead Agency: St. Charles County
- Support Agency: City governments and GGL technical staff

Needs Addressed

- Enhance communications and information sharing among agencies
- Improve incident management and coordination
- Identify alternate / quickest routes for emergency vehicles
- Utilize GGL ITS infrastructure to improve public safety
- Enhance evacuation procedures for large scale disasters / emergencies
- Improve emergency notification / dispatch / response times
- Share video images with public safety agencies / centers

Technology Readiness

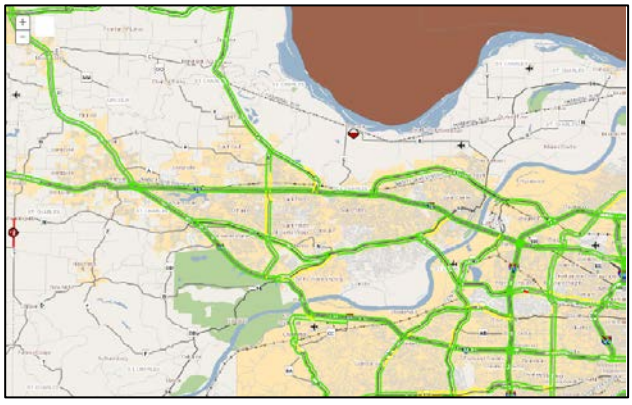
This project features technology that is readily available and currently implemented and used by many agencies in the U.S.

Estimated Costs

The costs for a web-based or thin-client solution for traffic condition information sharing are estimated to range from $200,000 to $500,000. The costs of the hardware at the client locations (e.g. dispatch centers) are not included in the estimates.

Program Area: Traveler Information

ID: TI-1
Project: Travel Information Program
Timeframe: Short-Term (0 to 2 years)
Program Area: Traveler Information



Description

The purpose of this project would be to develop a traveler information program for the GGL program to deliver information (such as roadway congestion, closures, incidents, work zones, weather, special events, upcoming constructions, parking availability, etc.) to travelers. This project could include the following three components:

- Travel Information Website – The GGL program could partner with MoDOT and integrate the GGL traveler information into the MoDOT Traveler Information website. The MoDOT Traveler Information Map and website (http://traveler.modot.org/map/index.html) currently presents traveler information along some corridors within the GGL program area.
- GGL Mobile Application – A mobile application could also be developed that presents similar types of traveler information as the website version.
- Major Employer-Based Traveler Information – This part of the program would proactively provide traveler information to major employers and freight shipping/delivery centers within the region.

Extents

The initial focus of the program will be major corridors within the County where data is readily available. Ultimately, the program will cover the entire County with additional traveler information when it becomes available.

Stakeholders Involved

- Lead Agency: St. Charles County
- Support Agency: MoDOT

Needs Addressed

- Improve alternate route traffic management / detour information
- Identify alternate / quickest routes for public during major incidents
- Reduce congestion / delay on freeways
- Improve incident management and coordination
- Reduce crashes in and around work zones
- Provide travel times / delays / incidents / roadway closures / lane restrictions / work zone information on roadways to the public
- Provide advanced warning / real time information about flash flood areas / weather conditions/location to the public
- Reduce delays due to temporary work zones
- Provide special event traffic information to the public
- Address truck parking issues
- Proactively provide information to major employers and freight shipping/delivery centers
- Provide traveler information at employment sites
- Provide real-time snowplow location information to the public

Technology Readiness

Technology for information dissemination through website, mobile apps and social media is mature and readily available.

Estimated Costs

The cost associated with integrating the GGL data into the MoDOT Traveler Information Website ranges roughly between $80,000 to $150,000. The cost for developing a GGL Mobile App ranges roughly between $5,000 and $30,000, depending on the features and functionalities desired for the app.

ID: TI-2
Project: Third-Party Data Partnerships
Timeframe: Short-Term (0 to 2 years)
Program Area: Traveler Information, Data Collection and Management

Description
This project would establish partnerships with third-party companies (e.g. HERE, Waze, INRIX, etc.) to obtain traffic data such as travel times, incidents, road conditions to supplement the data collection capability of the GGL program. The information could be used by the traffic operations agencies as well posted on the traveler information website for the public.

Extents
- Major corridors where traffic monitoring and data collection capabilities are limited
- Secondary roadways where traffic monitoring and data collection capabilities are lacking
- Countywide

Stakeholders Involved
- Lead Agency: St. Charles County
- Support Agencies: All GGL partners

Needs Addressed
- Improve alternate route traffic management and provide detour information
- Improve traffic data collection capability
- Identify alternate routes for public during major incidents
- Reduce congestion / delay on freeways
- Improve incident management and coordination
- Reduce crashes in and around work zones
- Provide travel times / delays / incidents / roadway closures / lane restrictions / work zone information on roadways to the public
- Provide advanced warning / real-time information about flash flood areas / weather conditions / locations to the public
- Collection of information on weather / road surface conditions
- Reduce delays due to temporary work zones
- Provide special event traffic information to the public

Technology Readiness
The private sector has the ability to collect traffic flow and speed/travel time data on roadways beyond what is currently collected by detector-based systems deployed by public agencies. It has also greatly expanded its geographic coverage of both urban and rural areas

Estimated Costs
The cost for third-party data service ranges between $1,200 and $2,000 per centerline miles per year.

Program Area: Asset Management

ID: AM-1
Project: ITS and Communications Asset Management System
Timeframe: Short- to Medium-Term (0 to 5 years)
Program Area: Asset Management

Description
The purpose of this project is to plan for and subsequently procure an asset management system or systems to document and store ITS and communications asset information and to monitor and manage the health and performance of the ITS devices and the communications network for the GGL program. The asset management system(s) should store detailed inventory information such as as-built plans, signal controller cabinet inventories, ITS device and cabinet inventories, fiber and splicing details, network switches and configurations, network IP addresses, etc.

This project could start with an investigation of available systems and desired functions and features for the GGL program. The investigation may determine that separate management systems are needed for ITS devices separate from the communications network. The potential of enhancing the County's current GIS/Asset Management System to include asset management features for ITS and communications should also be considered. Based on the investigation, the GGL program could develop an asset management system in-house or develop a bid document and procure an asset management system or systems from vendors.

Extents
- Countywide

Stakeholders Involved
- Lead Agency: St. Charles County
- Support Agencies: City governments throughout the County

Needs Addressed
- Improve communications network redundancy / self-healing capability
- Develop and implement a communications infrastructure maintenance program
- Improve reliability and availability of communications network
- Staffing / resources for maintenance of communications network
- Address aging system inventory
- Enhance communications network monitoring and management system
- Enhance security of communications network

Technology Readiness
Commercial off the shelve products for ITS and communications asset management are currently available. The GGL program currently uses a Maintenance Online Management System (MOMS), called Insight – TransSuite module, for asset management.

Estimated Costs

The cost associated with the initial study and investigation of asset management systems and tools suitable for the GGL program is estimated to be $75,000. The cost of a robust asset management system for ITS asset and communications network will be identified from the study.

ID: AM-2

Project: ITS and Communications Maintenance Program
Timeframe: Short- to Long-Term (0 to 5 years and beyond)
Program Area: Asset Management

Description

The purpose of this project is to plan for and implement an ITS and Communications Maintenance Program for the GGL region. The planning stages of this project is to assess maintenance needs and staff capabilities as well as to determine whether to use in-house staff or hire contractors to perform maintenance and repairs of the GGL ITS and communications infrastructure. The finding and recommendations from the planning stages could be the development of templates for in-house staff requisition or contractor service procurements (i.e. sample RFPs).

Extents

- Countywide

Stakeholders Involved

- Lead Agency: St. Charles County
- Support Agencies: City governments

Needs Addressed

- Improve communications network redundancy / self-healing capability
- Develop and implement a communications infrastructure maintenance program
- Improve reliability and availability of communications network
- Staffing / resources for maintenance of communications network
- Address aging system inventory
- Enhance communications network monitoring and management system
- Enhance security of communications network

Technology Readiness

This project is not technology-dependent.

Estimated Costs

The cost for the planning stage, including needs assessment, recommendations, and templates development for staff requisition or service procurements is estimated at $100,000.

Program Area: Data Collection and Management

ID: DM-1

Project: Road Weather Information Stations at Strategic Locations

Timeframe: Short- to Medium-Term (0 to 5 years)

Program Area: Data Collection and Management, Traveler Information, Transportation Safety

Description

The purpose of this project would be to install Road Weather Information System (RWIS) stations at strategic locations in the GGL program area to gather real-time weather conditions that could impact travel along the roadway network. An RWIS station measures multiple types of weather information, such as air / pavement temperatures, precipitation types / amounts, surface conditions, wind velocity, and air pressure, among other types of information. Data can be reported to a central office location for processing and review by agency staff responsible for maintenance and / or traffic operations. RWIS may be used to monitor key problem locations, such as bridges prone to icing, or to provide conditions that are representative of a broader geographic area to support a general assessment of conditions over a region. This should be considered in selecting locations for RWIS stations.

MoDOT currently has four RWIS stations in the St. Charles County. They are located at:

- I-70 at Missouri River
- I-70 at Wentzville
- I-64 at Boone Bridge
- US 67 at Route 94 in West Alton

In addition, there are three Automated Surface Observing System (ASOS) and Automated Weather Observing System (AWOS) stations located within or adjacent to the County. They are located at:

- St. Charles County Airport
- Spirit of St. Louis Airport
- Washington Regional Airport

Extents

Candidate locations for RWIS stations include:

- I-70 at I-64
- I-64 at Dardenne Creek
- Route 364 at Route K
- US 61 at Big Creek and/or McCoy Creek
- Route 79 at Belleau Creek
- Route 79 at N. Main Street/Peruque Creek

- I-70 at Dardenne Creek
- Route 370 at Cole Creek
- Route 364 at Veterans Memorial Bridge

Stakeholders Involved

- Lead Agency: St. Charles County and MoDOT
- Support Agencies: City governments

Needs Addressed

- Provide travel times / delays / incidents / roadway closures / lane restrictions / work zone information on roadways to the public
- Provide advanced warning / real time information about flash flood areas / weather conditions / locations to the public
- Collection of information on weather / road surface conditions
- Reduce crashes due to weather conditions
- Provide flood monitoring on susceptible roadways

Technology Readiness

RWIS technology is mature and readily available.

Estimated Costs

The cost components of a RWIS station consist of capital costs for equipment, plus costs for installation, operation and ongoing maintenance. Equipment and installation costs include the remote processing unit, telecommunication equipment, tower support structure, and the chosen weather sensors. These costs have been reported to be between $70,000 and $130,000.

ID: DM-2

Project: GGL Performance Management and Reporting System
Timeframe: Short- to Long-Term (0 to 5 years and beyond)
Program Area: Data Collection and Management

Description

This project will enhance the GGL system's current performance management and reporting capability. Enhancements will include improvements to the graphical displays of performance measures to the general public that could allow for dynamic changes in the graphics based on changes to variables such as period of time or area of interest. The project will also expand upon the performance management and reporting by providing additional measures of interest such as incident clearance times or amount of roadway

congestion along key arterials. Ultimately, this project will establish a performance management and reporting system for the GGL program. The system will have a series of dashboards for displaying multiple performance metrics and use the available GGL data sources to generate the performance metrics and reports. Performance dashboards are effective tools for conveying traffic operations and roadway performance to the traffic management agencies, TMC operators, the public, media and decision makers. The performance management and reporting system will be a software program with web-based user interface to enable users, including the public, to pull and depict real-time and historical roadway network monitoring and performance information.

Extents

- Countywide

Stakeholders Involved

- Lead Agency: St, Charles County
- Support Agencies: City governments and MoDOT

Needs Addressed

- Improve real-time traffic monitoring capability
- Implement and use high-resolution data for automated performance measures
- Improve signal timing and coordination
- Improve signal coordination across jurisdictions

Technology Readiness

Performance management and reporting systems have been utilized by many transportation agencies throughout the U.S. Example of the systems include: Las Vegas' FAST Dashboard and Utah DOT's Performance Program.

Estimated Costs

The capital costs for the development and implementation or procurement of a robust performance management and reporting system are estimated to be between $1,000,000 and $4,000,000.

Program Area: Connected and Automated Vehicle Technology

ID: CV-1
Project: Smart Corridor
Timeframe: Short- to Medium-Term (0 to 5 years)
Program Area: Connected and Automated Vehicle Technology, Smart City Technology

Description

The purpose of this project is to plan for and deploy a Smart Mobility Corridor that will as a proving ground for emerging CV and smart city technologies. This project will deploy emerging technologies including CV technology, smart street lights and electric vehicle charging infrastructure.

This project will install RSUs at signalized intersections and other strategic locations along the Smart Mobility Corridor. OBUs will be installed on selected public agency fleet that will connect them to one another and to RSUs. CV applications for this project can include:

- Signal Phase and Timing (SPaT)
- Signal Priority / Preemption
- Weather Data Collection
- Red Light Violation Warning
- Pedestrian / Cyclist / Scooter Collision Warning
- Braking Assist (Emergency Electronic Brake Lights or EEBL)
- CV work zone applications, including Reduced Speed Zone Warning / Lane Closure and Work Zone Traveler Information

The smart street light system will consist of a brightness sensor, a motion sensor and a short-distance wireless communication network. Street lights could also be equipped with CV technology to detect the presence of CVs and obtain traffic and environmental data from the vehicles as an input to support adjustment of the lighting based on adverse weather conditions such as fog, rain or snow.

Extents

High-speed, high-capability fiber optic communications is desired for a smart mobility corridor. Potential candidates for smart mobility corridors include:

- Fifth Street/S. River Road
- Zumbehl Road
- Mexico Road
- Main Street in O'Fallon

Stakeholders Involved

- Lead Agency: St. Charles County
- Support Agencies: City governments and MoDOT

Needs Addressed

- Reduce congestion / delay on arterials
- Improve incident detection capability on major routes
- Improve traffic data collection capability
- Reduce crashes at intersections

- Reduce congestion / delay on freeways
- Reduce rear-end collisions due to queues
- Reduce crashes in and around work zones
- Improve real-time traffic monitoring capability
- Provide travel times / delays / incidents / roadway closures / lane restrictions / work zone information on roadways to the public
- Collection of information on weather / road surface conditions
- Enhance transportation information collection for use by planners
- Deploy connected vehicle applications
- Provide automated alerts to drivers of speeding
- Reduce vehicle conflicts / incidents with pedestrians / bikes
- Reduce wrong way driving incidents
- Provide signal priority for pedestrians / cyclists
- Reduce crashes due to low clearance bridges

Technology Readiness

Most of the CV applications listed for this project have been deployed and tested by other transportation agencies. Few of the applications may need further development and testing to be fully ready for deployment. Technologies for smart street lights and electric vehicle charging stations are commercially available.

Estimated Costs

The costs for RSUs for CV deployment are estimated to be $10,000 per unit, including the equipment, installation and configuration. Traffic signal controller upgrade is estimated to be $3,500 per controller. The costs for connected vehicle OBUs are estimated to be $2,000 per unit.

Capital costs for a direct current fast charging system with a six-vehicle charging capacity and maximum 50 kWh unit power output is estimated to be $400,000. Capital costs for a system with the same charging capacity and maximum 350 kWh unit power output is estimated to be $1,730,000.

Program Area: Smart City Technology

ID: SC-1
Project: Smart City Committee / Task Force
Timeframe: Short-Term (0 to 2 years)
Program Area: Smart City Technology

Description

This initiative would be to establish a Smart City Committee / Task Force to provide leadership to raise awareness about what smart infrastructure is, advocate for public policy to enable smart city innovation, and facilitate planning and deployment of smart city technologies for the GGL program. The establishment of the Committee / Task Force should be a regional effort that involves stakeholders throughout St. Charles County, as well as engagement of the general public. This project was identified as a top priority during the stakeholder workshop group voting exercise and should remain as a primary need for the GGL program going forward.

Extents

- Countywide

Stakeholders Involved

- Lead Agency: East-West Gateway Council of Governments (EWGCOG) and MoDOT
- Support Agencies: St. Charles County and City governments

Needs Addressed

- Enhance communications and information sharing among agencies
- Reduce congestion / delay on arterials
- Improve traffic data collection capability
- Reduce congestion / delay on freeways
- Enhance transportation information collection for use by planners
- Deploy connected vehicle applications
- Provide automated alerts to drivers of speeding
- Implement or enhance data storage and management capabilities

Technology Readiness

This project is not technology-dependent.

Estimated Costs

There are no capital costs for this project.

Program Area: Roadway Construction and Maintenance

ID: CM-1
Project: Smart Work Zones
Timeframe: Short-Term (0 to 2 years)
Program Area: Roadway Construction and Maintenance

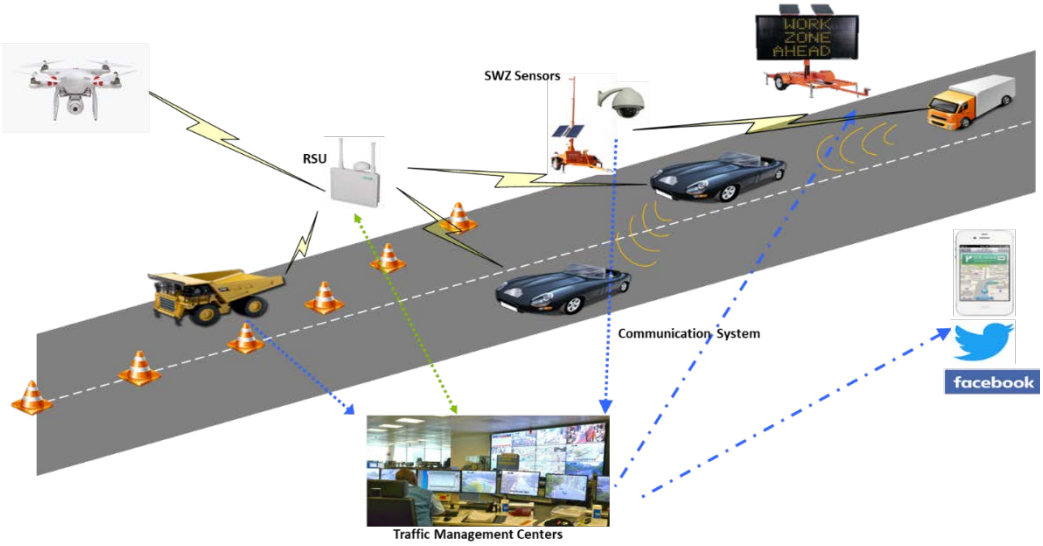
Description

The purpose of this project is to deploy work zone ITS technology to improve the safety and efficiency travel through the work zone for both work zone personnel and motorists. Technology will include some or all of the following:

- Mobile ITS Devices – These include mobile traffic detectors for measuring travel time or the amount of traffic congestion within the work zone and portable DMS to communicate the amount of congestion/delay within the work zone. Mobile cameras can also be deployed at key locations of the work zone to support work zone monitoring and incident response
- Intrusion Detection / Warning Devices – These include mobile devices placed on work zone barriers that communicate a work zone intrusion (i.e. an errant vehicle) to work zone personnel through radio or personal devices on the work zone personnel
- Arrow board Signage – This includes the use of DMS at key locations of the work zone to present arrow boards to motorists alerting them of the need to merge into another lane in advance of the

merge point. Arrow boards can be activated through the use of ITS equipment within the work zone.

- Work Zone Dashboard – Central software system can be used to monitor and provide visual displays of the overall performance of the work zone in terms of traffic safety and efficiency.
- Connected Vehicle Work Zone Applications – This utilizes CV technology to enhance work zone safety and mobility. The includes install CV technology on roadside and in vehicles to gather work zone traffic data and provide work zone traffic and safety information to vehicles.



Extents

- Construction projects along major roadways

Stakeholders Involved

- Lead Agency: St. Charles County and MoDOT
- Support Agencies: City governments

Needs Addressed

- Improve traffic data collection capability
- Reduce crashes in and around work zones
- Improve real-time traffic monitoring capability
- Provide travel times / delays / incidents / roadway closures / lane restrictions / work zone information on roadways to the public
- Enhance transportation information collection for use by planners
- Improve temporary work zone safety for workers
- Reduce delays due to temporary work zones
- Provide automated alerts to drivers of speeding

Technology Readiness

Smart work zone technology has been utilized by transportation agencies throughout the U.S. on roadway construction projects to reduce congestion and delay, improve safety, and improve traffic management

in and around work zones. CV work zone applications have been tested in various states with noticeable success. These applications can be included as part of the Smart Corridor project

Estimated Costs
The costs to deploy a smart work zone system vary greatly depending on several key factors:

- Purchase vs. lease the system
- Temporary vs. permanent components of the project (e.g., equipment used in a work zone is later deployed as permanent equipment on the same or different project)
- Size and function of the system

The unit cost for portable DMS is estimated to be between $20,000 and $50,000. The unit cost for remote traffic sensors is estimated to be between $10,000 and $15,000. The unit cost for a portable, temporary pan/tilt/zoom camera for work zones is estimated to be $7,000.

A smart work zone system can also be rented by construction contractors, in which case the contractor is responsible for setup and maintenance. Typical smart work zone costs can be expected to range between 1% and 5% of total project cost. The cost can vary significantly due to project specific characteristics and needs. The cost typically is included in the construction project.

Program Area: Training and Outreach

ID: TO-1
Project: Communication and Outreach Program
Timeframe: Short-Term (0 to 2 years)
Program Area: Training and Outreach

Description
The GGL project offers many benefits to the GGL partners and the traveling public. However, in many cases these benefits are not fully communicated to and realized by the executive management of the government agencies, media and the public. The purpose of this project is to develop a program to facilitate communication and outreach of the GGL program activities and achievements to those target audience groups.

The project will start with establishing a Communication and Outreach Committee for the GGL program. The Committee will consist of GGL partner agency staff with experience in areas including public outreach and communication, policy, traffic and technology. A critical next step within the project is to create a communication/outreach plan. The communication/outreach plan will:

- Define the GGL internal and external communication processes and responsibilities
- Develop a strategic and measurable approach to communication and outreach
- Identify materials and tools that can be developed to support communication and outreach
- Identify venues and opportunities to conduct communication and outreach activities and develop a schedule

This project will also include development of outreach materials and tools identified in the communication/outreach plan. Such materials and tools may include videos, brochures, display booth, etc. to introduce ITS, describe benefits, and provide information and resources to the public. For internal GGL partner communication, key messages in addition to GGL benefits can include how to access and use available data and resources; strategies, tools and messages to communicate with management, the public, specific groups and private sectors; etc.

Outreach activities can be done through County Fair, media events, public open houses, training sessions, publications and public presentations.

Extents

- Countywide

Stakeholders Involved

- Lead Agency: St. Charles County and MoDOT
- Support Agencies: EWGCOG

Needs Addressed

This project supports the overarching vision of the GGL program – deploying technology to make the County's transportation system safer, more efficient and more accessible.

Technology Readiness

This project is not technology-dependent.

Estimated Costs

The development of a communication/outreach plan is estimated to be $20,000. The costs for the program are estimated to be $25,000 per year for developing outreach materials and conducting outreach to introduce the GGL program and technology implemented, describe benefits, and provide resources to the public, media, partner agencies, and other specific groups.

ID: TO-2
Project: GGL Data and System Operations Training Program
Timeframe: Short-Term (0 to 2 years)
Program Area: Training and Outreach, Data Collection and Management, Traffic Management

Description

The purpose of this project is to develop a training program that supports the use of data obtained from various GGL devices and systems, as well as trains operations staff in the use of GGL ATMS software to configure, control and monitor field devices through the software. The training program will focus on building an understanding of data availability and sources. The program will also cover data utilization for multiple service areas, including but not being limited to: traffic monitoring and control, incident response and management, traveler information, work zone management, traffic law enforcement, snow and ice control/removal, traffic studies, roadway design, etc. It is envisioned that the program will develop two one-day training courses: a data user training and a system operations training.

Extents

- Countywide

Stakeholders Involved

- Lead Agency: St. Charles County
- Support Agencies: City governments and MoDOT

Needs Addressed

- Enhance communications and information sharing among agencies
- Improve incident management and coordination
- Improve real-time traffic monitoring capability
- Implement or enhance data storage and management capabilities
- Enhance evacuation procedures for large scale disasters / emergencies
- Remote controlling / programming / managing of ITS devices
- Share video images with public safety agencies / centers

Technology Readiness

The training will be conducted in a classroom setting and can be recorded. Training materials and the recorded training sessions can be made available to staff who are unable to attend or for refresher training.

Estimated Costs

The costs for the training program are estimated to be $100,000 per year, including development of training materials and delivery of a one-day data user training and a one-day system operations training.

ID: TO-3
Project: GGL Maintenance Training Program
Timeframe: Short-Term (0 to 2 years)
Program Area: Training and Outreach, Asset Management

Description

The purpose of this project would be to develop a training program that could support the maintenance of ITS devices for the GGL program. Training topics would cover the routine and preventative maintenance activities, diagnosis and troubleshooting, and repairs related to ITS and communications equipment that would be performed by in-house GGL maintenance personnel. Specific training program activities may include:

- Identifying available training courses provided by MoDOT, other agencies or third parties
- Identifying train-the-trainer courses and individual to attend them
- Developing and providing training to GGL maintenance technicians

Extents

- Countywide

Stakeholders Involved

- Lead Agency: St. Charles County
- Support Agencies: City governments

Needs Addressed

- Improve communications network redundancy / self-healing capability
- Develop and implement a communications infrastructure maintenance program
- Improve reliability and availability of communications network
- Staffing / resources for maintenance of communications network
- Address aging system inventory
- Enhance communications network monitoring and management system

Technology Readiness

The training will be conducted in a classroom setting and can be recorded. Training materials and the recorded training sessions can be made available to staff who are unable to attend or for refresher training.

Estimated Costs

The costs for the training program are estimated to be $70,000 per year, including development of training materials and delivery of a one-day training.

ID: TO-4
Project: Incident Management Training Program with Public Safety
Timeframe: Short-Term (0 to 2 years)
Program Area: Training and Outreach, Incident Management

Description

This project will develop a training program or continue the execution of existing training program with desired enhancements to support incident response and management. The program will provide first responders, GGL operators and all other involving agency personnel a shared understanding of the requirements for safe, quick clearance of traffic incident scenes; prompt, reliable and open communication; and motorist and responder safeguards.

The traffic incident management (TIM) working group in the St. Louis metropolitan area allows law enforcement and other partners to work with GGL partners to share and discuss the incident management practices and performance measures. This project will leverage the existence of the TIM working group

to further enhance discussion and information sharing, as well as develop and provide additional training specifically for the GGL program area to supplement the courses offered by the National Traffic Incident Management Responder Training Program.

Extents

- Countywide

Stakeholders Involved

- Lead Agency: St. Charles County
- Support Agencies: City governments and MoDOT

Needs Addressed

- Improve incident management and coordination
- Identify alternate / quickest routes for emergency vehicles
- Utilize GGL ITS infrastructure to improve public safety
- Enhance evacuation procedures for large scale disasters / emergencies
- Share video images with public safety agencies /centers
- Improve emergency notification / dispatch / response times

Technology Readiness

This project is not technology-dependent.

Estimated Costs

The National Traffic Incident Management Responder Training is offered for free. The training is offered 3 to 4 times a year in the St. Louis metropolitan area . A web-based training is also offered via the National Highway Institute. The costs for establishing a GGL TIM training program are estimated to be $100,000 per year, including development of training materials and delivery of the training courses.

7. Implementation Plan

7.1 Project Costs

A multi-year work program has been developed for the GGL program. As described in Section 6.3, project implementation timeframe is categorized as short-, medium- or long-term.

- ●○○ Short Term: Estimated to be implemented within the next 2 years
- ○●○ Medium Term: Estimated to be implemented in 3 to 5 years
- ○○● Long Term: Estimated to be implemented in 6 years and beyond

Table 5 lists the recommended projects with their overall implementation timeframe priority, sequencing, and estimated capital costs and annual operations and maintenance (O&M) costs. The information in Table 5 could serve as a baseline for future Congestion Mitigation and Air Quality (CMAQ) funding applications as well.

Table 5. Project Capital and Annual O&M Costs

ID	Project	Timeframe	Capital Cost[1]	Annual O&M Cost[2]
TM-1	Automated Traffic Signal Performance Measures	●●●	$1,400,000 (70 signals)	$120,000
TM-2	Adaptive Traffic Signal Control Systems	●●●	$3,750,000 (75 signals)	$350,000
TM-3	ATMS Software Study and Procurement	●○●	$75,000 (planning study)	TBD
TM-4	Integrated Corridor Management Enhancements	○●●	$4,900,000 (49 miles)	$400,000
CO-1	Backbone Fiber Optic Communications Expansion	●●○	$1,250,000	$120,000
CO-2	Fiber Optic Connection to Municipalities for Transportation & Non-transportation Uses	●●○	$1,100,000	$100,000
IC-1	Traffic Condition Information and Video Sharing with Public Safety, Traffic Agencies and Emergency Responders	●●○	$400,000	$40,000
TI-1	Travel Information Program	●○○	$180,000	$15,000
TI-2	Third-Party Data Partnerships	●○○	$60,000 (30 centerline miles)	$5,000
AM-1	ITS and Communications Asset Management System	●●○	$75,000 (planning study)	TBD
AM-2	ITS and Communications Maintenance Program	●●●	$100,000 (planning stage)	TBD

ID	Project	Timeframe	Capital Cost[1]	Annual O&M Cost[2]
DM-1	Road Weather Information Stations at Strategic Locations	●●○	$990,000	$90,000
DM-2	GGL Performance Management and Reporting System	●●●	$3,000,000	$300,000
CV-1	Smart Corridor	●●○	$4,670,000	$500,000
SC-1	Smart City Committee/Task Force	●○○	N/A	N/A
CM-1	Smart Work Zones	●○○	$0 (assume renting from vendors)	$750,000 (rental costs)
TO-1	Communication and Outreach Program	●○○	$45,000	$25,000
TO-2	GGL Data and System Operations Training Program	●○○	$100,000	$100,000
TO-3	GGL Maintenance Training Program	●○○	$70,000	$70,000
TO-4	Incident Management Training Program with Public Safety	●○○	$100,000	$100,000

Notes:

[1] Planning level estimates include equipment/devices, survey, design, construction and construction phase services with deployments

[2] Planning level estimates include staffing, maintenance equipment, preventive maintenance, and break-fix maintenance

7.2 Procurement Strategies

Various forms of procurement for the recommended projects have been considered and discussed. A logical bundling of projects that provides the highest likelihood of funding applications as well as competitive bidding has been proposed. The majority of the recommended projects are eligible for CMAQ funds. In terms of bundling procurement through CMAQ applications in the most logical and orderly fashion, the following procurements as presented in Table 6 are recommended to encompass an annual application of $2 million to $3 million CMAQ funds. The estimated annual O&M cost for each project is also included in Table 6 for reference. More detailed O&M costs as well as how they are projected for the next five years and beyond are presented in Section 7.3.

Table 6. Recommended CMAQ Application Bundles

Bundle	Program Area	Project	Project Extent	Project Capital Cost	Total Bundle Cost	Annual O&M Cost
1	Traffic Management	Automated Traffic Signal Performance Measures	27 signals on 2 corridors	$540,000	$2,797,560	$46,286
		Adaptive Traffic Signal Control System	16 signals	$800,000		$74,667
		ATMS Software Study	Countywide	$75,000		$0
	Communications Infrastructure	Backbone Fiber Optic Communications Expansion	11.5 miles of new fiber in existing MoDOT conduit	$485,760		$46,633
		Fiber Optic Connection to Municipalities	3 miles of new fiber and conduit	$316,800		$28,800
	Traveler Information	GGL Travel Information Program	Website and mobile app development	$180,000		$15,000
	Interagency Coordination and Asset Sharing	Traffic Condition Information and Video Sharing with Public Safety, Traffic Agencies and Emergency Responders	Countywide	$400,000		$40,000
2	Traffic Management	Automated Traffic Signal Performance Measures	43 signals on 3 corridors	$860,000	$2,792,152	$73,714
		Adaptive Traffic Signal Control System	14 signals	$700,000		$65,333
	Communications Infrastructure	Backbone Fiber Optic Communications Expansion	3 miles of new fiber and conduit	$396,000		$38,016
		Fiber Optic Connection to Municipalities	3.4 miles of new fiber and conduit	$361,152		$32,832
	Traveler Information	Third-Party Data Partnerships	Data covering 30 centerline miles	$60,000		$5,000
	Asset Management	ITS and Communications Maintenance Program Planning Study	Countywide	$100,000		$0
	Training and Outreach	Communication and Outreach Program	Develop and execute the program	$45,000		$0
		GGL Data and System Operations Training Program	Develop the program and execute the training	$100,000		$0
		GGL Maintenance Training Program	Develop the program and execute the training	$70,000		$0
		Incident Management Training Program with Public Safety	Develop the program and execute the training	$100,000		$0

Bundle	Program Area	Project	Project Extent	Project Capital Cost	Total Bundle Cost	Annual O&M Cost
3	Traffic Management	Adaptive Traffic Signal Control System	14 signals	$700,000	$2,773,800	$65,333
		Integrated Corridor Management Enhancements	10 miles of ICM corridor	$1,000,000		$81,633
	Communications Infrastructure	Backbone Fiber Optic Communications Expansion	2.7 miles of new fiber and conduit	$356,400		$34,214
		Fiber Optic Connection to Municipalities	4 miles of new fiber and conduit	$422,400		$38,400
	Training and Outreach	Communication and Outreach Program	Execute outreach and communication activities	$25,000		$0
		GGL Data and System Operations Training Program	Execute training	$100,000		$0
		GGL Maintenance Training Program	Execute training	$70,000		$0
		Incident Management Training Program with Public Safety	Execute training	$100,000		$0
4	Traffic Management	Adaptive Traffic Signal Control System	17 signals	$850,000	$2,645,000	$79,333
		Integrated Corridor Management Enhancements	15 miles of ICM corridor	$1,500,000		$122,449
	Training and Outreach	Communication and Outreach Program	Execute outreach and communication activities	$25,000		$0
		GGL Data and System Operations Training Program	Execute training	$100,000		$0
		GGL Maintenance Training Program	Execute training	$70,000		$0
		Incident Management Training Program with Public Safety	Execute training	$100,000		$0

Bundle	Program Area	Project	Project Extent	Project Capital Cost	Total Bundle Cost	Annual O&M Cost
5	Traffic Management	Adaptive Traffic Signal Control System	14 signals	$700,000	$2,495,000	$65,333
		Integrated Corridor Management Enhancements	15 miles of ICM corridor	$1,500,000		$122,449
	Training and Outreach	Communication and Outreach Program	Execute outreach and communication activities	$25,000		$0
		GGL Data and System Operations Training Program	Execute training	$100,000		$0
		GGL Maintenance Training Program	Execute training	$70,000		$0
		Incident Management Training Program with Public Safety	Execute training	$100,000		$0
Future*	Traffic Management	ATMS Software Procurement	Countywide	$5,000,000	$8,900,000	$500,000
		Integrated Corridor Management Enhancements	9 miles of ICM corridor	$900,000		$73,469
	Data Management	GGL Performance Management and Reporting System	Countywide	$3,000,000		$300,000

Notes:

* Projects listed under "Future" will likely be broken into multiple CMAQ applications.

Five of the recommended projects may not be eligible for CMAQ funding. Those projects are listed in Table 7, with estimated capital costs and recommendations on potential funding sources and deployment considerations.

Table 7. Other Projects and Deployment Considerations

ID	Project	Capital Cost	Annual O&M Cost	Deployment Consideration
AM-1	ITS and Communications Asset Management System Study	$75,000	$0	Recommend conducting the study in 2020-2021.
DM-1	Road Weather Information Stations at Strategic Locations	$990,000	$90,000	9 locations are identified. Recommend deploying 2 to 3 sites per year.
CV-1	Smart Corridor	$4,670,000	$500,000	Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) grant is a potential funding source.
SC-1	Smart City Committee/Task Force	$0	$0	Recommend establishing this committee/task force in 2020 to guide the planning and deployment of the Smart Corridor project and future emerging technology projects.
CM-1	Smart Work Zones	$0	$750,000	A smart work zone system can be rented by construction contractors. Costs are typically included in the construction projects.
	TOTAL	**$5,735,000**	**$1,340,000**	

7.3 Operations and Maintenance

The estimated annual O&M costs for projects in each procurement bundle and the total annual O&M costs for each bundle are shown in Table 8. Table 8 also includes accumulated annual O&M costs upon successful implementation of each subsequent bundle of projects. The estimated total O&M costs upon implementation of the 20 projects recommended in this feasibility study are approximately $3.300,000 annually.

Table 8. Estimated O&M Costs by Project and Procurement Bundle

Bundle	Project	Annual Project O&M Cost	Annual Bundle O&M Cost	Accumulated Annual O&M Cost
1	Automated Traffic Signal Performance Measures	$46,286	$251,385	$251,385
	Adaptive Traffic Signal Control System	$74,667		
	ATMS Software Study	$0		
	Backbone Fiber Optic Communications Expansion	$46,633		
	Fiber Optic Connection to Municipalities	$28,800		
	GGL Travel Information Program	$15,000		
	Traffic Condition Information and Video Sharing with Public Safety, Traffic Agencies and Emergency Responders	$40,000		
2	Automated Traffic Signal Performance Measures	$73,714	$214,896	$466,281
	Adaptive Traffic Signal Control System	$65,333		
	Backbone Fiber Optic Communications Expansion	$38,016		
	Fiber Optic Connection to Municipalities	$32,832		
	Third-Party Data Partnerships	$5,000		
	ITS and Communications Maintenance Program Planning Study	$0		
	Communication and Outreach Program	$0		
	GGL Data and System Operations Training Program	$0		
	GGL Maintenance Training Program	$0		
	Incident Management Training Program with Public Safety	$0		
3	Adaptive Traffic Signal Control System	$65,333	$219,580	$685,861
	Integrated Corridor Management Enhancements	$81,633		
	Backbone Fiber Optic Communications Expansion	$34,214		
	Fiber Optic Connection to Municipalities	$38,400		
	Communication and Outreach Program	$0		
	GGL Data and System Operations Training Program	$0		
	GGL Maintenance Training Program	$0		
	Incident Management Training Program with Public Safety	$0		
4	Adaptive Traffic Signal Control System	$79,333	$201,782	$887,644
	Integrated Corridor Management Enhancements	$122,449		
	Communication and Outreach Program	$0		
	GGL Data and System Operations Training Program	$0		
	GGL Maintenance Training Program	$0		
	Incident Management Training Program with Public Safety	$0		
5	Adaptive Traffic Signal Control System	$65,333	$187,782	$1,075,426
	Integrated Corridor Management Enhancements	$122,449		
	Communication and Outreach Program	$0		
	GGL Data and System Operations Training Program	$0		
	GGL Maintenance Training Program	$0		
	Incident Management Training Program with Public Safety	$0		
Future	ATMS Software Procurement	$500,000	$873,469	$1,948,895
	Integrated Corridor Management Enhancements	$73,469		
	GGL Performance Management and Reporting System	$300,000		
	Other Non-CMAQ Projects (as listed in Table 7)	$1,340,000	$1,340,000	$3,288,895
	Total Annual O&M Costs Upon System Build-out			**$3,288,895**

St. Louis Regional ITS Architecture

Project Consistency Statement

The St. Louis Regional Architecture provides the framework for the planning and development of Intelligent Transportation System (ITS) projects that improve the safety, mobility and efficiency of travel in the region.

Key components of existing infrastructure and examples of ITS projects include travel operation centers, traffic flow detection, closed-circuit television cameras, dynamic message signs, road weather information systems, central computerized traffic signal control systems, and fiber optic communications, along with real-time information available via dedicated agency web sites.

Before funding agreements with the Missouri Department of Transportation or Illinois Department of Transportation are developed, the Stakeholders for each project containing ITS elements must have a completed **Project Consistency Statement** that identifies how the project will be consistent with the St. Louis Regional ITS Architecture. Each Statement will be reviewed by East-West Gateway staff.

Please complete the following form to document your project's consistency with the Regional ITS Architecture. View the most current version of the Regional ITS Architecture here: http://www.ewgateway.org/transportation-planning/transportation-systems-management-operations/intelligent-transportation-system.

If you have questions or need guidance in completing this Statement, please contact:

- Lubna Shoaib: Lubna.Shoaib@ewgateway.org

Your Name: Jacob Becher	**Your Agency:** St. Charles County
Your phone #: 636-949-7500 x7230	**Your e-mail:** JBecher@sccmo.org
Your Project Name: St. Charles County Fiber Interconnect	
Related Project Name in the Regional ITS Architecture: Automated Traffic Signal Performance Measures *(Note that your project may not have the same name or scope as the projects in the ITS Architecture. Choose the project(s) in the Architecture that most closely resemble the services you plan to deploy.)*	
Brief Project Description: The 2020 St. Charles County Gateway Green Light Feasibility Study identified need to expand fiber optic network and need to improve communications network redundancy and self-healing as top priorities for the County. Two key program areas addressed by this project are the backbone fiber optic communications expansion and the fiber optic connections to municipalities for transportation and essential services uses. This project will serve to provide fiber interconnect to 15 existing and one future traffic signal along various roadways through St. Charles County. The new high speed fiber backbone will improve communications to traffic signals for real-time traffic management, and provide far greater bandwith for data flows, which combined, will allow the County to improve traffic signal operations.	
Project TIP Code:	

Mark the Current Project Status:

- [x] **In Planning**
- [ ] **In Design**
- [ ] **In Development or Procurement**
- [ ] **Deployed**

1. STAKEHOLDERS

Review the St. Louis Regional ITS Architecture and your project documents to identify the Stakeholders participating in this project.

a. Who is the lead Stakeholder for this project?

St. Charles County

b. Are there other project Stakeholders? If so, please list them:

c. Are there any differences in the Stakeholders listed in the ITS Architecture and in your project plans? If so, please list them. (*Examples may be additional Stakeholders, or a Stakeholder identified in the Architecture who will not participate in the project.)*

None.

2. SYSTEM ELEMENTS

Review the St. Louis Regional ITS Architecture and project documents to identify the ITS elements to be used in this project.

a. List the types of ITS equipment developed or purchased as part of this project.

Fiber Optic Interconnect
Industrial Ethernet Switches
CCTV Cameras

b. List the types of **existing** ITS equipment that will interface and exchange data with new equipment in this project. *(Examples are the Gateway Guide Traffic Operations Center or City of St. Louis Traffic Management Center.)*

St. Charles County/ Gateway Green Light TMC
St. Charles County/ Gateway Green Light ATMS
MoDOT TMC
MoDOT ATMS

3. SYSTEM DESIGN

Describe your agency's commitment to consider all applicable subsystems and information flows from the regional architecture in the project development process.

a. Submit documentation of all Architecture information flows for this project to this Statement, or provide a web address or addresses below where they can be viewed. *(Note that this may be the page, or pages, on the St. Louis Regional ITS Architecture web site that describes your project.)*

https://www.ewgateway.org/ewg-content/trans/its/2021-Update/html/if/ctx104.htm
https://www.ewgateway.org/ewg-content/trans/its/2021-Update/html/if/ctx39.htm
https://www.ewgateway.org/ewg-content/trans/its/2021-Update/html/if/ctx13.htm

b. If there are information flows listed in the St. Louis Regional ITS Architecture for your project that you do not plan to use, please identify them and explain why. *(Example reasons are that the project will only deploy a part of a project as identified in the Architecture, or that some flows will be deployed in a later project phase.)*

St Charles County Traffic Operations Center current asset restrictions Fire and Rescue Centers (County and Local)
St Charles County Traffic Operations Center emergency routes Fire and Rescue Centers (County and Local)
St Charles County Traffic Operations Center emergency traffic control Fire and Rescue Centers (County and Local)
St Charles County Traffic Operations Center road network conditions Fire and Rescue Centers (County and Local)
St Charles County Traffic Operations Center roadway maintenance Fire and Rescue Centers (County and Local)
St Charles County Traffic Operations Center work zone information Fire and Rescue Centers (County and Local)

4. FUTURE INTEGRATION

Your responses in this section should address how your project addresses potential future integration and ensures interoperability of the project's equipment with other ITS in the region.

a. List any opportunities for integration with other existing or planned ITS that are not part of this project but may benefit the Region in the future. *(Examples are sharing information collected by the current project with a maintenance center or emergency center.)*

This project provides the essential high speed communications backbone for backhaul of large amounts of data now produced by the ITS universe that exists and will be expanded by St. Charles County. The data being shared includes live traffic, weather information, signal timing and operations, travel time, and network status.

5. INTERAGENCY AGREEMENTS

Your responses in this section should express your agency's commitment to developing operating agreements between the stakeholders to ensure the successful ongoing operation and usage of the project.

a. List the stakeholders that will participate in the **operation** phase of this project:

St. Charles County
City of O'Fallon
City of St. Peters
City of St. Charles
City of Cottleville
City of Dardenne Prairie
MoDOT

b. Will there be operating agreements among the stakeholders listed in 5a?

☑ **Yes**

☐ **No**

c. If you answered **No** to the previous question, explain why there will not be operating agreements. *(Example reasons may be that an existing agreement covers operations or that only one agency is involved in the project, so no agreements are needed.)*

6. STANDARDS

Your responses in this section should provide assurance that the project will use the appropriate standards and protocols for information exchange.

a. List the standards identified in the St. Louis Regional ITS Architecture applicable for this project.

Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communications (MS/ETMCC) Global Object Definitions Object Definitions for Actuated Traffic Signal Controller (ASC) Units Data Element Definitions for Transportation Sensor Systems (TSS) Field Management Stations (FMS) - Part 1: Object Definitions for Signal System Masters Object Definitions for Conflict Monitor Units (CMU) NTCIP Center-to-Center Standards Group NTCIP Center-to-Field Standards Group

b. Will you incorporate the standards listed in 6a into the project design and procurement documents?

- [x] **Yes, all of them**
- [ ] **Some of them**
- [ ] **No, none of them**

c. If you answered the previous question "some" or "none," list the standards for this project that will not be incorporated into the design and procurement documents, and briefly explain why each is not being used. *(An example reason is that the Architecture contains multiple standards that apply to an information exchange, and only one of those standards will be used.)*

7. PERFORMANCE MEASUREMENT

In this section you should provide assurance that your project has clearly defined performance measures and a plan for evaluating project progress and success.

a. Submit the Performance Reporting Plan for this project with this Statement, or provide a web address below where it can be viewed:

Performance Reports will be shared after deployment.

If you attached a Performance Reporting Plan, please skip forward to Section 8. *If you did not attach a Performance Reporting Plan, continue with Section 7.*

b. List the performance measures you will use to evaluate the progress and performance of this project:

Travel Speed
Travel Time
Buffer Index
Planning Time Index

c. How will the project report its performance? To whom and how frequently will the performance be reported?

The Gateway Green Light Board will be presented with annual performance summary.

d. Will the data be stored or archived by the collecting agency?

- [x] **Yes**
- [ ] **No**
- [ ] **Not Applicable**

e. Will the devices and the data generated by the project be validated and periodically evaluated?

- [x] **Yes**
- [ ] **No**
- [ ] **Not Applicable**

f. Please elaborate on how data will be validated, shared, stored, and/or archived. If the project does not plan to validate, share, or store data, please explain why.

A pre and post implementation study will be used to compare accuracy of generated data. Third party hosted software and databases will be made available for access to all generated data.

8. OPERATIONS AND MAINTENANCE

Your responses in this section should provide assurance that the project has a plan for operating and maintaining the systems it deploys.

a. Submit the Operations and Maintenance Plan for this project to this Statement, or provide a web address below where it can be viewed:

Local Agency, GGL Operator, and On-Call Contractor

If you attached an Operations and Maintenance Plan, please skip forward to Section 9. *If you did not attach an Operations and Maintenance Plan, continue Section 8.*

b. What is the estimated annual cost, in dollars, for the project's operation and maintenance?

$ 25,000.00

c. Briefly describe the staffing and technical resources required for the operation and maintenance of your project.

Maintaining agency has necessary staff to accommodate demands of the system.

d. Briefly describe how the project will meet its needs for resources.

Adequate maintenance and operations funds are available at the agency.

9. OTHER INFORMATION

Please use this section to provide additional information and clarification regarding your project's ITS architecture compliance.

a. Submit additional documents for this project, or provide the web addresses where they can be viewed below:

None.

b. Please provide any other comments you would like to share about your ITS project.

None.