TECHNICAL ADVISORY COMMITTEE

September 28, 2022
10:00 – 11:30 am
City Hall Council Chambers and via Zoom
Join Zoom Meeting
https://bloomington.zoom.us/j/82898283433?pwd=c1pkcjRtWkVJVk0rencvc2VxZ2xFQT09
Meeting ID: 828 9828 3433
Passcode: 254175
One tap mobile: +13126266799,,82898283433# US (Chicago)
Dial by your location: +1 312 626 6799 US (Chicago)
Find your local number: https://bloomington.zoom.us/u/k1McJqQkN
Clicking on the link will take you to the meeting. You will automatically receive a dial-in number if you want to use your phone for audio and not your computer microphone.

Agenda

I. Call to Order and Introductions

II. Approval of Meeting Agenda*

III. Approval of Minutes*
   a. August 10, 2022

IV. Communications from the Chair and Vice Chair

V. Reports from Officers and/or Committees

VI. Reports from the MPO Staff
   a. FHWA FY 2022/2023 Electric Vehicle (EV) Infrastructure Deployment Plans (https://www.fhwa.dot.gov/environment/nevi/ev_deployment_plans/)
   b. Bloomington Transit Discretionary Capital Grant Award (https://bloomington.in.gov/news/2022/08/25/5279)
   c. 3rd Street and Grant Street - Bicycle & Pedestrian Safety Improvements Project
   d. 2022 City of Bloomington ADA Transition Plan (https://bloomington.in.gov/accessible)

VII. Old Business
   a. BMCMPO Public Participation Plan - Final*
   b. FY 2022 - 2026 Transportation Improvement Program Amendments (TIP)
      (1) FY22 Additional IIJA Fund Applications
         (a) Rural Transit
         (b) Monroe County
         (c) City of Bloomington

VIII. New Business

a. Bloomington Transit Alternative Fuels and Infrastructure Assessment Study Presentation
b. GO Bloomington Travel Demand Management Program Presentation
c. INDOT 2 and 4-Year Pavement and Bridge Transportation Management Targets*
d. BMCMPO FY 2022 - 2026 Transportation Improvement Program (TIP) Amendments*
   (1) DES# 2000311 - SR46 Replace Superstructure at Jacks Defeat Creek WBL 6.04 Mile W of SR 37
   (2) DES# 1900331 - SR46 HMA Overlay Structural from SR 446 to W Junction of SR 135, Right-of-Way Acquisition
   (3) DES# 1900331 - SR46 HMA Overlay Structural from SR 446 to W Junction of SR 135, Construction
   (4) DES# 2001983 - SR46 Small Structure Replacement 5.05 Mile E of SR 446
   (5) DES# 1901791 - Pavement Markings at Various Locations in Seymour District

IX. Public Comment on Matters Not Included on the Agenda (non-voting items). *Limited to five minutes per speaker, and may be reduced by the committee if numerous people wish to speak.*

X. Communications from Committee Members on Matters Not Included on the Agenda (non-*voting items)*

a. Communications
b. Topic Suggestions for Future Agendas

XI. Upcoming Meetings

a. Policy Committee - October 14, 2022 at 1:30 p.m. (Hybrid)
b. Technical Advisory Committee - October 26, 2022 at 10:00 a.m. (Hybrid)
c. Citizens Advisory Committee - October 26, 2022 at 6:30 p.m. (Hybrid)

XII. Adjournment

**Action Requested / Public comment prior to vote (limited to five minutes per speaker*).
Auxiliary aids for people with disabilities are available upon request with adequate notice. Please call 812-349-3429 or e-mail human.rights@bloomington.in.gov.

TECHNICAL ADVISORY COMMITTEE

August 12, 2022
10:00 – 11:30 am
City Hall Council Chambers and via Zoom

Agenda

Members Present: Nate Nickel, Sheila McGlothlin (proxy), Tim Street, Jackie Jelen, Matt Wilhoit (proxy), Lisa Ridge (proxy), Patrick Ellis (proxy), Linnea Wellings (proxy), John Baeten, Denise Line, Cheryl Gilliland (proxy), John Connell, Lisa Salyers (proxy), Scott Robinson, Neil Kopper (proxy), Max Stier (proxy), Laura Haley (V), John Kennedy (V, non-voting)

Staff Present: Ryan Clemens, Pat Martin

I. Call to Order and Introductions
   a. Nickel called the meeting to order.

II. Approval of Meeting Agenda*
   a. *Robinson motioned to approve the Agenda. Ridge seconded. Motion passed unanimously by roll call vote (17-0).*

III. Approval of Minutes*
   a. June 29, 2022
      (1) *Robinson motioned to approve the Minutes. Connell seconded. Motion passed unanimously by roll call vote (17-0).*

IV. Communications from the Chair and Vice Chair
   a. Nickel thanked everyone for attending the TAC meeting which took place during an abnormal day and week, and that the attendance was fantastic on shorter notice (and just in general).
   b. Nickel congratulated Haley on her retirement and thanked her for her long commitment to serving on the TAC.

V. Reports from Officers and/or Committees
   a. None

VI. Reports from the MPO Staff
   a. FY 2023 - 2024 Unified Planning Work Program (UPWP)
      (1) Final Approvals, Budget, Major Tasks and Work Elements
         (a) Martin reported on the UPWP Approval Letter and budget. Robinson questioned if funds for the upcoming Metropolitan Transportation Plan (MTP) are reflected in this UPWP and if they will be allocated in the upcoming UPWP budget if not. Martin mentioned that the budget is not up-to-date yet as the MTP update is still

one-and-half to two years away, but upcoming UPWP funding for Fiscal Year 2024 and/or 2025 will hopefully be found to fund an extensive Transportation Demand Management model for the MTP. Robinson mentioned that in the past funding for the consultant for this MTP model is split locally between the City of Bloomington and Monroe County, and that both Local Public Agencies (LPA) should be looking ahead to help fund this MTP model in the next year or two.

b. FY 2022 - 2026 Transportation Improvement Program (TIP) Fund Balance
   (1) Staff reported that the BMCMPO achieved 100% fund programming for FY 2022. Staff also reported that Infrastructure Investment and Jobs Act (IIJA) funding in the amount of $983,997 was available for LPAs to apply for if they were able to allocate the funds or have a purchase order approved by no later than September 30 for an approved project in the Transportation Improvement Program (TIP). A Call For Projects was initiated returning four TIP applications which will be discussed later in the meeting.
c. SR 48 Speed Limit Improvement
   (1) Clemens reported that, in April, after analyzing crashes from 2015-2021, a safety issue along SR 48 from SR 43 to South Garrison Chapel Road seemed necessary to look into based on current conditions of the roadway. Clemens notified INDOT of the concerns, as well as those concerns of some citizens who travel the route frequently. In July, INDOT - Seymour District responded that they have reviewed the crash history, existing signage, and existing speeds for the type of roadway with regard to curve radii. The study indicated that it would be prudent to lower the 55 mph section from SR 43 to S Cave Rd to 45 mph, meaning that the entirety of SR 48 from Bloomington to Whitehall will be posted at 45 mph. The changes will be updated in the near future.
d. INDOT Electric Vehicle Infrastructure Deployment Plan Available for Review and Public Comment (https://content.govdelivery.com/accounts/INDOT/bulletins/323005a and https://www.in.gov/indot/files/INDOT-EV-Deployment-Plan_DRAFT_7-20-22.pdf)
   (1) Martin reported on the EV Deployment Plan. The Plan must be approved by September 30.

VII. Old Business – None

VIII. New Business
a. FY 2022 - 2026 Transportation Improvement Program (TIP) Amendments*
   (1) Rural Transit
      (a) Des# TBD - Four (4) Cameras with DVR Systems for Ten (10) Rural Transit Vehicles
   (2) Monroe County
      (a) Des# 1802977 - Fullerton Pike, Phase III - FY 2023 Right-of-Way Acquisition
      (b) Des# 1702957 - Vernal Pike Connector Road - FY 2023 Construction Engineering
   (3) City of Bloomington
      (a) Des# 2200020 - High Street Intersection Modernizations and Multiuse Path

Clemens presented the four TIP Applications, noting that the total amounts presented are over the BMCMPO's maximum allotment of Infrastructure Investment and Jobs Act (IIJA) funding of $983,997, and noting that fiscal constraint must be achieved. Ridge suggested

that Rural Transit should receive the $7,600 that they applied for and that Monroe County and the City of Bloomington should evenly split the remaining $976,397. Kopper said that he supports that suggestion for this round of funding. This would bring the total amounts of IIJA funding per application to the following amounts:

Rural Transit - Des# TBD: $7,600
Monroe County - Des# 1802977: $210,967; Des# 1702957: $277,232
City of Bloomington - Des# 2200020: $488,198

Robinson motioned to approve the TIP amendments as discussed (and shown above). Ridge seconded. Motion passed by roll call vote (16-0-1).

IX. Public Comment on Matters Not Included on the Agenda (non-voting items). *Limited to five minutes per speaker, and may be reduced by the committee if numerous people wish to speak.*
None

X. Communications from Committee Members on Matters Not Included on the Agenda (non-*voting items)*
   a. Communications
      (1) Kopper wants all TIP amendment application forms to be fully filled out in the future so details of the projects are known before they are presented to the committees. Clemens noted that will be a requirement under the upcoming update to the BMCMPO Complete Streets Policy.
      (2) Kennedy mentioned that the CAC has been looking to add language regarding hybrid meeting formats for all public meeting.
   b. Topic Suggestions for Future Agenda – None

XI. Upcoming Meetings
   a. Policy Committee - August 12 and September 9, 2022 at 1:30 p.m. (Hybrid)
   b. Technical Advisory Committee - September 28, 2022 at 10:00 a.m. (Hybrid)
   c. Citizens Advisory Committee - September 28, 2022 at 6:30 p.m. (Hybrid)

XII. Adjournment
   a. Nickel adjourned the meeting.

**Action Requested / Public comment prior to vote (limited to five minutes per speaker*).
Auxiliary aids for people with disabilities are available upon request with adequate notice. Please call 812-349-3429 or e-mail human.rights@bloomington.in.gov.

PROJECT	DESIGNATION
1700976	1700976
CONTRACT	BRIDGE FILE NO.
R-40337	N/A

INDIANA DEPARTMENT OF TRANSPORTATION

PEDESTRIAN IMPROVEMENTS

VARIOUS PEDESTRIAN CROSSING ENHANCEMENTS LOCATED
IN SECTIONS 28, 29, 32 & 33 T-9-N, R-1-W, BLOOMINGTON TOWNSHIP
AND SECTIONS 2, 4, 5, 8 & 16, T-8-N, R-1-W, PERRY TOWNSHIP,
CITY OF BLOOMINGTON, MONROE COUNTY, INDIANA

PROJECT NO. 1700976 P.E.
1700976 CONST.

CITY OF BLOOMINGTON
APPROVED:
BOARD OF PUBLIC WORKS

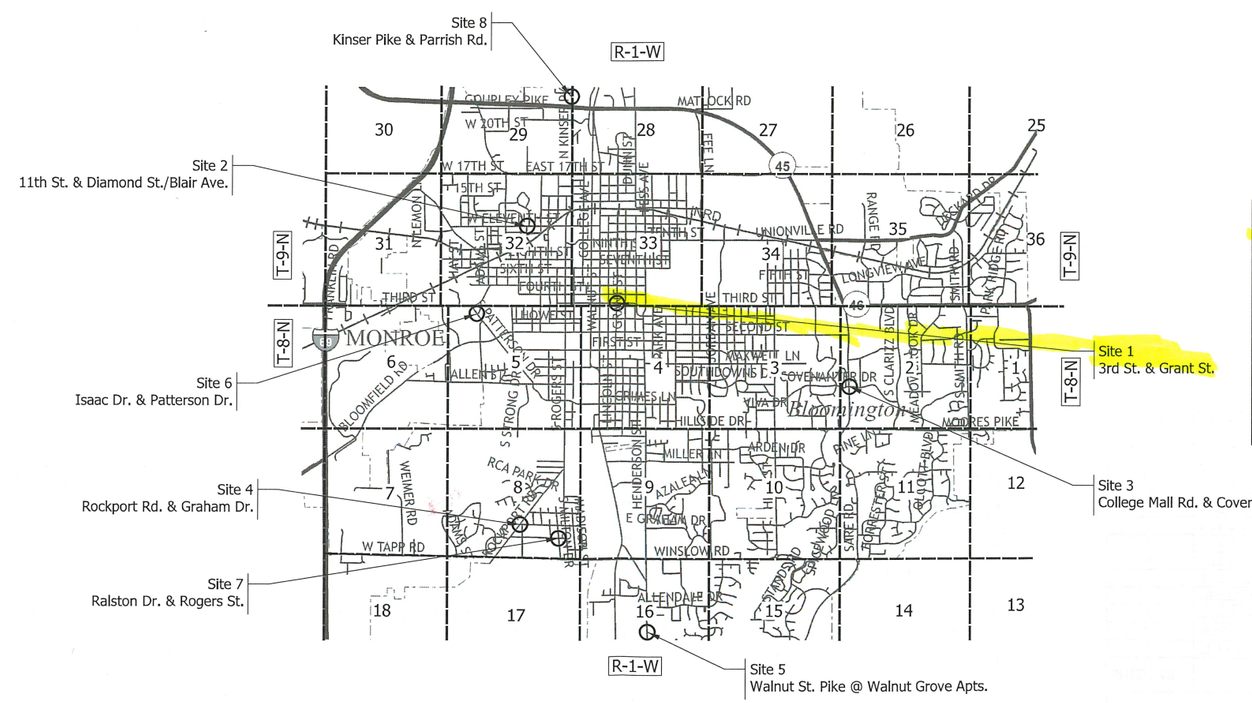
Dana Henke, President — 10·22·2021 Date

Beth Hollingsworth, Vice President — 10·22·2021 Date

Kyla Cox Deckard, Secretary — 10·22·2021 Date

APPROVED:
EMPLOYEE OF RESPONSIBLE CHARGE

Neil Kopper, PE
Senior Project Engineer — 10-26-2021 Date



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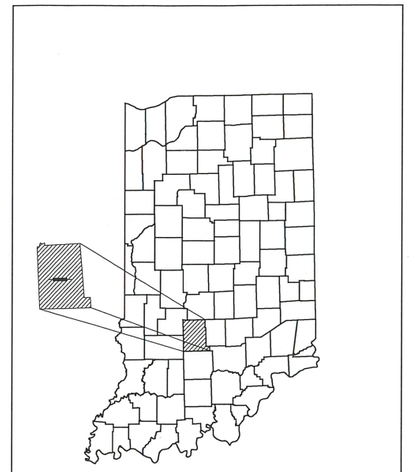

DESIGN DATA - 3rd STREET	
DESIGN SPEED	30 M.P.H.
PROJECT DESIGN CRITERIA	PARTIAL 3R
FUNCTIONAL CLASSIFICATION	MINOR ARTERIAL
RURAL/URBAN	URBAN (BUILT-UP)
TERRAIN	ROLLING
ACCESS CONTROL	NONE

DESIGN DATA - KINSER PIKE	
DESIGN SPEED	30 M.P.H.
PROJECT DESIGN CRITERIA	PARTIAL 3R
FUNCTIONAL CLASSIFICATION	MINOR COLLECTOR
RURAL/URBAN	URBAN (INTERMEDIATE)
TERRAIN	ROLLING
ACCESS CONTROL	NONE

SITE:	LOCATION:	LATITUDE:	LONGITUDE:
1	3rd Street and Grant Street	39°09'52.48"N	86°31'47.45"W
2	11th Street and Diamond Street/Blair Avenue	39°10'23.72"N	86°32'38.33"W
~~3~~	~~College Mall Road and Covenanter Drive~~	~~39°09'18.55"N~~	~~86°29'51.84"W~~
~~4~~	~~Rockport Road and Graham Drive~~	~~39°08'23.56"N~~	~~86°32'42.80"W~~
~~5~~	~~Walnut Street Pike at Walnut Grove Apartments~~	~~39°07'39.67"N~~	~~86°31'36.40"W~~
6	Isaac Drive and Patterson Drive	39°09'48.84"N	86°33'04.99"W
~~7~~	~~Ralston Drive and Rogers Street~~	~~39°08'17.89"N~~	~~86°32'18.65"W~~
~~8~~	~~Kinser Pike and Parrish Road~~	~~39°11'15.63"N~~	~~86°32'15.85"W~~

INDIANA DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS DATED 2022
TO BE USED WITH THESE PLANS

STRAND ASSOCIATES®

MARC A. RAE REGISTERED NO. 19800062 STATE OF INDIANA PROFESSIONAL ENGINEER

PLANS PREPARED BY: STRAND ASSOCIATES, INC. (812)372-9911
PHONE NUMBER
939 WASHINGTON ST., COLUMBUS, IN 47201

CERTIFIED BY: 9/27/2021 DATE

APPROVED FOR LETTING: DATE
INDIANA DEPARTMENT OF TRANSPORTATION

BRIDGE FILE NO.
N/A
DESIGNATION
1700976

SURVEY BOOK	SHEETS
ELECTRONIC	1 of 15
CONTRACT	PROJECT
R-40337	1700976

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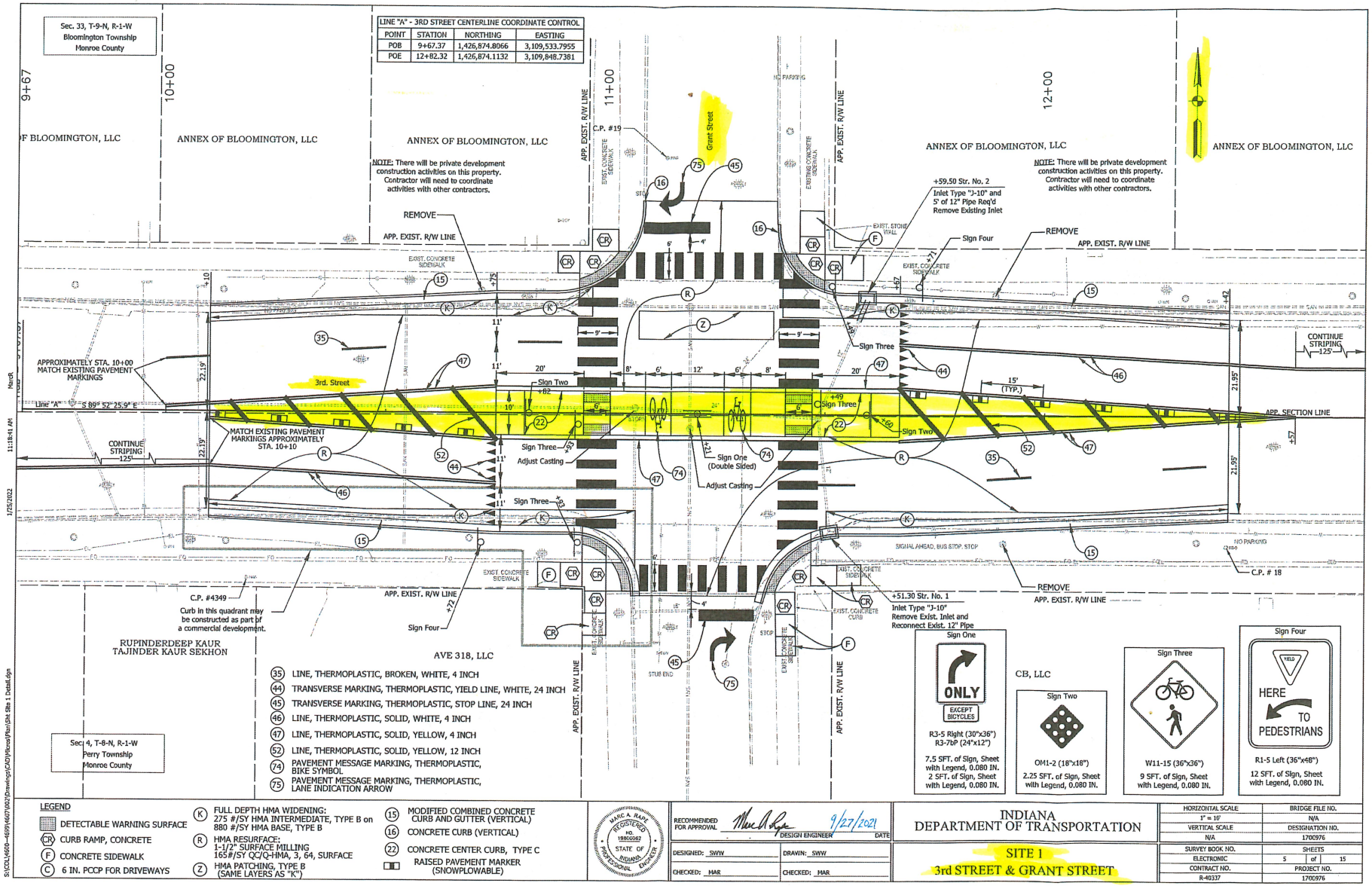
Sec. 33, T-9-N, R-1-W
Bloomington Township
Monroe County
LINE "A" - 3RD STREET CENTERLINE COORDINATE CONTROL
POINT | STATION | NORTHING | EASTING
POB | 9+67.37 | 1,426,874.8066 | 3,109,533.7955
POE | 12+82.32 | 1,426,874.1132 | 3,109,848.7381
9+67
10+00
11+00
12+00
OF BLOOMINGTON, LLC
ANNEX OF BLOOMINGTON, LLC
NOTE: There will be private development construction activities on this property. Contractor will need to coordinate activities with other contractors.
APP. EXIST. R/W LINE
EXIST. CONCRETE SIDEWALK
EXISTING CONCRETE SIDEWALK
C.P. #19
Grant Street
REMOVE
+59.50 Str. No. 2
Inlet Type "J-10" and 5' of 12" Pipe Req'd
Remove Existing Inlet
EXIST. STONE WALL
Sign Four
APPROXIMATELY STA. 10+00 MATCH EXISTING PAVEMENT MARKINGS
3rd. Street
Line "A" S 89° 52' 25.9" E
Sign Two
Sign Three
Adjust Casting
Sign One (Double Sided)
MATCH EXISTING PAVEMENT MARKINGS APPROXIMATELY STA. 10+10
CONTINUE STRIPING 125'
APP. SECTION LINE
NO PARKING
SIGNAL AHEAD, BUS STOP, STOP
C.P. # 18
C.P. #4349
Curb in this quadrant may be constructed as part of a commercial development.
RUPINDERDEEP KAUR
TAJINDER KAUR SEKHON
AVE 318, LLC
+51.30 Str. No. 1
Inlet Type "J-10"
Remove Exist. Inlet and Reconnect Exist. 12" Pipe
CB, LLC
STUB END
Sec. 4, T-8-N, R-1-W
Perry Township
Monroe County
(35) LINE, THERMOPLASTIC, BROKEN, WHITE, 4 INCH
(44) TRANSVERSE MARKING, THERMOPLASTIC, YIELD LINE, WHITE, 24 INCH
(45) TRANSVERSE MARKING, THERMOPLASTIC, STOP LINE, 24 INCH
(46) LINE, THERMOPLASTIC, SOLID, WHITE, 4 INCH
(47) LINE, THERMOPLASTIC, SOLID, YELLOW, 4 INCH
(52) LINE, THERMOPLASTIC, SOLID, YELLOW, 12 INCH
(74) PAVEMENT MESSAGE MARKING, THERMOPLASTIC, BIKE SYMBOL
(75) PAVEMENT MESSAGE MARKING, THERMOPLASTIC, LANE INDICATION ARROW
Sign One
ONLY
EXCEPT BICYCLES
R3-5 Right (30"x36")
R3-7bP (24"x12")
7.5 SFT. of Sign, Sheet with Legend, 0.080 IN.
2 SFT. of Sign, Sheet with Legend, 0.080 IN.
Sign Two
OM1-2 (18"x18")
2.25 SFT. of Sign, Sheet with Legend, 0.080 IN.
Sign Three
W11-15 (36"x36")
9 SFT. of Sign, Sheet with Legend, 0.080 IN.
Sign Four
YIELD
HERE TO PEDESTRIANS
R1-5 Left (36"x48")
12 SFT. of Sign, Sheet with Legend, 0.080 IN.
LEGEND
DETECTABLE WARNING SURFACE
(CR) CURB RAMP, CONCRETE
(F) CONCRETE SIDEWALK
(C) 6 IN. PCCP FOR DRIVEWAYS
(K) FULL DEPTH HMA WIDENING: 275 #/SY HMA INTERMEDIATE, TYPE B on 880 #/SY HMA BASE, TYPE B
(R) HMA RESURFACE: 1-1/2" SURFACE MILLING 165#/SY QC/Q-HMA, 3, 64, SURFACE
(Z) HMA PATCHING, TYPE B (SAME LAYERS AS "K")
(15) MODIFIED COMBINED CONCRETE CURB AND GUTTER (VERTICAL)
(16) CONCRETE CURB (VERTICAL)
(22) CONCRETE CENTER CURB, TYPE C
RAISED PAVEMENT MARKER (SNOWPLOWABLE)
MICHAEL A. RABE REGISTERED NO. 19810062 STATE OF INDIANA PROFESSIONAL ENGINEER
RECOMMENDED FOR APPROVAL
DESIGN ENGINEER
9/27/2021
DATE
DESIGNED: SWW
DRAWN: SWW
CHECKED: MAR
CHECKED: MAR
INDIANA DEPARTMENT OF TRANSPORTATION
SITE 1
3rd STREET & GRANT STREET
HORIZONTAL SCALE 1" = 10'
BRIDGE FILE NO. N/A
VERTICAL SCALE N/A
DESIGNATION NO. 1700976
SURVEY BOOK NO.
SHEETS ELECTRONIC 5 of 15
CONTRACT NO. R-40337
PROJECT NO. 1700976
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Introduction

Federal legislation requires the establishment of a Metropolitan Planning Organization (MPO) to conduct transportation planning in urban areas where the population exceeds 50,000 people. The basic objectives of an MPO are to encourage and promote the development of transportation systems, to embrace multiple modes of transportation, and to minimize transportation related fuel consumption and air pollution.

Indiana Governor Robert D. Orr designated the City of Bloomington Plan Commission as the MPO for the Bloomington urban area on March 4, 1982.

Locally, the Bloomington/Monroe County Metropolitan Planning Organization (MPO) fulfills the MPO mission as an intergovernmental transportation policy group that manages transportation project funding for the Bloomington/Monroe County Urbanized Area (which includes the City of Bloomington, the Town of Ellettsville, and urbanizing portions of Monroe County). The Bloomington-~~/~~Monroe County MPO is responsible for ensuring that the transportation planning program in the Urbanized Area of Monroe County incorporates consultation, cooperation, and coordination among~~between~~ the MPO, various civic organizations, and the public. MPO decisions are endorsed by a Policy Committee (PC) upon the recommendation of both the Technical Advisory Committee (TAC) and the Citizens Advisory Committee~~s~~ (CAC).

The Policy Committee (PC) consists of municipally ~~and county~~ elected officials, non-elected members, membership from the Bloomington Public Transportation Corporation, Indiana University (IU), the Indiana Department of Transportation (INDOT), and the Federal Highway Administration (FHWA), and non-elected members. The Technical Advisory Committee ~~(TAC)~~ includes state and local planners, engineers, transit operators, and other transportation-related professionals. The Citizens Advisory Committee ~~(CAC)~~ represents a broad cross-section of ~~Bloomington/Monroe County~~ community interests and of citizens who reside within the boundaries of the Metropolitan Planning Area (MPA)~~and community interests~~.

Purpose

The Public Participation Plan (the Plan) for the Bloomington~~-/~~Monroe County Metropolitan Planning Organization (MPO) has been developed pursuant to the final federal metropolitan regulations of the United States Department of Transportation (USDOT) as contained in the October 28, 1993 Federal Register and any subsequent changes herein mandated by federal legislation.

The Bloomington~~-/~~Monroe County MPO has established a set of goals for the public participation process to guide MPO staff in developing opportunities for the involvement of public officials and citizens. These goals also assist in ensuring the public participation process meets the needs of the communities involved in the transportation planning activities for the region.

The Public Participation Plan should be periodically updated and revised in order to improve continuous, comprehensive, and cooperative transportation planning (Federal 3C Process) for the ~~Bloomington/Monroe County Metropolitan Planning Organization (~~BMCMPO~~)~~. ~~The p~~Plan updates are ~~is~~ typically ~~updated~~ in response to local needs and interests or due to new state and federal requirements.

Public Participation Plan Goals

The BMCMPO Public Participation Plan ~~has been developed pursuant~~was prepared in compliance with ~~to~~ the Federal Fixing America's Surface Transportation (FAST) Act ~~Safe Accountable, Flexible, Efficient Transportation Equity Act A legacy for Users (SAFETEA-LU)~~; Title VI, 6001 (a).134 (i)(5),(A):

> *"Each metropolitan planning organization shall provide citizens, affected public agencies, representatives of transportation agency employees, freight shippers, providers of freight transportation services, private providers of transportation, representatives of users of public transit, pedestrian walkways and bicycle transportation facilities, representatives of the disabled and other interested parties with ~~-~~a reasonable opportunity to comment on the long-range transportation plan [for the Transportation Improvement Program (TIP)]"*

The Plan has been developed using the following ~~SAFETEA-LU~~FAST Act and ~~Bloomington/Monroe County~~ BMCMPO general goals:

- Provide adequate public notice and time for public review and comment at key decision points;
- Demonstrate explicit consideration and response to public input received;
- Seek out the needs and input of the public who typically are underserved by existing transportation systems;
- Provide periodic reviews of the public involvement process and participation plan in terms of their effectiveness;

- Coordinate to the maximum extent practical with statewide public involvement processes;
- Educate and raise awareness within the Metropolitan Planning Area (MPA)~~MPO's~~ boundar~~y~~ies about current and future transportation needs;
- Encourage broad public participation from all sectors of the community~~,~~ and provide the community with adequate opportunities to participate in the decision making process; and
- Foster a sense of ownership toward the transportation planning process and the resulting projects within the community.

Public Participation Mission Statement

The ~~Bloomington/Monroe County~~ BMCMPO is committed to providing Monroe County, the Town of Ellettsville, and the City of Bloomington~~, the Town of Ellettsville, and Monroe County~~ with quality transportation planning programs and services, as well as~~and~~ working to provide ~~all citizens~~ access to an efficient and safe transportation system for all citizens. Toward this goal, the ~~Bloomington/Monroe County~~ BMCMPO shall be committed to:

- ~~The~~ P~~p~~romoti~~n~~g~~on of~~ the environmental justice principles in all of its programs and policies as prescribed by the governing Environmental Justice Policy Statement~~.~~ (This involves the development of equitable programs and policies that avoid disproportionately negative effects on minority and/or low-income populations, as well as expediting the distribution of benefits from these projects.);~~.~~
- Working continuously to ensure the full and fair participation of all affected communities in the transportation planning process; and~~.~~
- Providing an equitable distribution of transportation infrastructure affecting public and environmental health, and to the development of a just public transit system.

Public Participation Plan Policy

It is the policy of the Bloomington-~~/~~Monroe County MPO to provide access to the transportation planning process so as to engage~~allow~~ the public ~~opportunity~~ to encourage comments on transportation planning activities. By doing so, the Bloomington/Monroe County MPO Policy Committee will have available to them public ideas, concerns, and suggestions on all transportation planning issues.

Two areas of primary interest for transportation planning issues and public involvement are the Long Range Transportation Plan (LRTP) and the Transportation Improvement Program (TIP). The MPO is responsible for adopting and maintaining these core MPO products. The ~~Long Range Transportation Plan (~~LRTP~~)~~ is the twenty-five-~~-~~year long range, multi-modal transportation plan for the Bloomington Urbanized Area as required by Federal Statutes (23 USC 135, Section 450.300) for the programming of Federal funds for transportation project planning and implementation of ground transportation modes (roadway, transit,~~ bicycle, and~~ pedestrian, bicycle, and other foot/hand-propelled modes of transportation~~ facilities~~). The LRTP~~long range plan~~ shall be updated as needed every five years in order to maintain the twenty year horizon, but may be amended more frequently if needed. The TIP is the ~~four~~ five-year short range capital improvement plan to implement the LRTP~~Long Range Transportation Plan~~. Project details such as timing, costs, design, phases, and funding sources are all detailed within the TIP, and, thus, provide a strategic planning document to program funding for actual transportation projects.

Additional areas of interest for transportation planning issues and public involvement exist for all programs and products of the MPO. These areas may include, but are not limited to, transportation studies, transportation grant applications (e.g. Transportation Enhancement, Safe Routes to School), design feasibility studies, MPO policies and procedures (e.g. operational bylaws), and other related programs, processes, and activities as detailed within the applicable fiscal year Unified Planning Work Program (UPWP).

Adoption Resolutions and Major Amendments Policy

The~~ Bloomington/Monroe County~~ BMCMPO shall follow to the fullest extent possible the Public Participation Plan for adoption resolutions and major amendments to the LRTP~~Long Range Transportation Plan~~ and the TIP. MPO staff shall bring all such resolutions and amendments to the Citizen~~'~~s Advisory Committee and Technical Advisory Committee prior to~~before they are~~ adopti~~on~~ed by the Policy Committee. The public shall have a minimum of 30 days for written comment on such resolutions and amendments before they may be adopted by the Policy Committee.

This section applies to the following resolutions and amendments:

- Adoption of a new Transportation Improvement Program;~~.~~
- Adoption of a new Long Range Transportation Plan;~~.~~

- Adoption of a new, or amendment to an existing, Public Participation Plan, except that the required written public comment period shall be 45 days for such action;~~.~~
- Inclusion into an adopted TIP of new capital improvement projects that meet the criteria for capacity expansion and/or the criteria for acquisition of right-of-way;~~one or more of the following criteria:~~
  - ~~capacity expansion;~~
  - ~~acquisition of right of way.~~
- Removal from an adopted TIP of an existing capital improvement project;~~.~~
- Amendments to an adopted TIP that change the total cost of an existing capital improvement project by 100% or more; and~~.~~
- Amendments to the (LRTP)~~Long Range Transportation Plan~~ that modify transportation projects identified in the Plan.

Related MPO Programs and Minor Amendments Policy

The ~~Bloomington/Monroe County~~ BMCMPO shall follow to the fullest extent possible the Public Participation Plan for related MPO program adoption resolutions and minor amendments to the ~~2030~~ Long Range Transportation Plan and the TIP. MPO staff may bring such resolutions and amendments to the Citizen's Advisory Committee and Technical Advisory Committee before proposed adoption~~they may be adopted~~ by the Policy Committee, but may only present them to the Policy Committee due to time constraints. The minimum 30-day written public comment period may also be waived for such resolutions and amendments.

This section applies to the following resolutions and amendments:

- Adoption of a new Unified Planning Work Program (UPWP);
- Inclusion into an adopted TIP of new capital improvement projects that do not meet either ~~one or more of~~ the ~~following~~ criteria for capacity expansion and/or the criteria for acquisition of right-of-way~~:~~;
  - ~~capacity expansion;~~
  - ~~acquisition of right of way.~~
- Amendments to an adopted TIP that change the total cost of an existing capital improvement project by greater than 20% but less than 100%;~~.~~
- Amendments to the Long Range Transportation Plan that modify transportation policy, document text, or other material in order to be compliant with federal, state, and/or local regulations and policy; and~~.~~
- Any other MPO product or program requiring Policy Committee approval.

Administrative Approval Policy

Certain resolutions and amendments shall only require administrative approval by the MPO Director and the MPO Policy Committee Chairperson once a Final Notice Period of three business days has transpired without any objection from any Policy Committee member (see Other Approvals for Final Notice Period). Such resolutions and amendments shall be exempt from review by the Citizen~~'~~s

Advisory Committee and Technical Advisory Committee prior to their administrative approval. Additionally, such resolutions and amendments may receive a waiver from the ~~The minimum~~ 30-~~-~~day written public comment period ~~shall also be waived for such resolutions and amendments~~. All MPO Committees shall receive a report of all such resolutions and amendments approved under these administrative procedures ~~shall be reported to all MPO Committees~~ at their next regularly scheduled meetings.

This section applies to the following resolutions and amendments:

- Modifications to the text or graphics in an adopted TIP that do not affect project costs, scopes, or schedules;~~.~~
- Amendments to an adopted TIP that change the proposed year for a phase of an existing capital improvement project;~~.~~
- Amendments to an adopted TIP that change the total cost of an existing capital improvement project by 20% or less;~~.~~
- Inclusion into an adopted TIP of new capital improvement projects that are labeled as "~~I~~illustrative" because they have not received formal approval for their expected funding source and have time-~~-~~sensitive or emergency-~~-~~related circumstances associated with the amendment; and~~.~~
- Changing "~~I~~illustrative" projects to funded projects if funds have been received and the Policy Committee has previously reviewed and acted on the project. Examples include projects funded through Transportation Alternatives Program ~~Enhancement~~ (TAP~~E~~), Highway Safety Improvement Program (HSIP), Safe Routes to School (SRTS) Program, and ~~T~~transit capital improvement projects into new capital improvement projects provided that the formal funding awards have~~s~~ subsequently been received. All new "~~I~~illustrative" projects that seek formal funding must be amended into the TIP using the procedures provided under the Major Amendments Policy.

Other Approvals

Three other approval types are provided for the MPO:

- Change Orders: The MPO staff~~Director~~ may approve Change Orders to projects in an adopted TIP subject to the procedures of the BMCMPO Change Order Policy;~~.~~
- Special Votes: The Policy Committee may conduct special votes using mail, fax, or e-mail in the event of a time-sensitive business item, subject to the procedures of the BMCMPO Operational Bylaws; and~~.~~
- Final Notice Period: MPO s~~S~~taff shall issue a "Final Notice Period" by email to all Policy Committee members for eligible administrative approval requests. The message shall contain "Final Notice Period" in the subject line, details on the nature of the request, the response requested (objection only), the deadline to respond, and detail the minor amendment process to be taken if any objection is received by BMCMPO staff. The Policy Committee~~s~~ will have three business days ~~to respond~~ for response from the time the Final Notice Period ~~is~~ issu~~anceed~~. The MPO staff and the MPO Chairperson may approve a request ~~O~~once the Final Notice

Period has ~~trans~~expired and no objections have been received~~, the request may be approved by the MPO Director and MPO Policy Committee Chairperson~~. If ~~an objection is received by~~ any member ~~from~~of the Policy Committee objects, then the amendment will be put forth for consideration at the next Policy Committee meeting and ~~follow~~ the Minor Amendments Policy process will be followed.

Such approvals shall not be subject to public comment period requirements, but the MPO staff shall ~~be~~ report~~ed~~ the approvals to all MPO Committees at their next regularly scheduled meeting.

General Provisions

When required under these procedures, the written public comment period for resolutions and amendments shall begin on the first date of the legal public notice published in the local newspaper(s), provided no substantive changes have occurred to the advertised resolutions and amendments by the time the Policy Committee takes formal action. If substantive changes occur, then the MPOP staff shall provide an additional 30~~-~~-day written public comment period ~~shall be provided~~. The MPO staff may use ~~A~~additional public notification methods ~~may be used~~ to supplement the required legal notice.

At minimum, the public shall always have the opportunity for comment on any MPO topic, agenda item, or other relevant transportation issue. This may occur during any MPO Committee meeting as governed by the Operational Bylaws of the BMCMPO. The public, MPO staff, MPO Committees, and related BMCMPO partner agencies shall mutually respect all comments conveyed and shall always conduct themselves in a professional manner. The MPO staff will make ~~A~~all information related to any MPO activity ~~will be~~ accessible to anyone and available upon request.

Environmental Justice Policy ~~(EJ)~~

Under the 1993 Federal Transit Act, metropolitan planning processes must be in compliance with Title VI of the 1964 Civil Rights Act. The 1994 Presidential Executive Order (12898) directed every Federal agency to make environmental justice a part of its mission by identifying and addressing the effects of all policies, programs, and projects on low income/minority~~/ low income~~ populations. This Order provided further clarification of Title VI. The USDOT (United States Department of Transportation) Final Order on ~~E~~environmental ~~J~~justice specifically require~~d~~ that "procedures shall be established, or expanded as necessary, to provide meaningful opportunities for public involvement by members of minorities and low-income populations during the planning and development of programs, policies, and activities."

The fundamental principles of environmental justice are:

- To avoid, minimize, or remedy disproportionately high and adverse human health and environmental (including social and economic) effects of

policies, programs, and projects on all living and non-living things, regardless of perceived or real economic, social, or ecological status;~~.~~
- To ensure the full and fair participation of all affected communities in the transportation decision making process; and~~.~~
- To prevent the denial of, reduction in, or significant delays in, the receipt of project benefits by all populations regardless of perceived or real economic, social, or ecological status.

Specific to transportation planning, applying these environmental justice principles involves:

- Maintaining equity in programs and policies by balancing the benefits and negative results of transportation projects in all communities;~~.~~
- Closely examining the scope of proposed transportation programs and projects; and~~.~~
- Keeping programs flexible, and seeking the input of affected communities in developing project options.

By applying the following guidelines, the ~~Bloomington/ Monroe County~~ BMCMPO further complies with Title VI, EO 12898 and the DOT Order to Address Environmental Justice in Minority and Low Income Populations. These criteria are intended to provide guidance for the ~~Bloomington/Monroe County~~ BMCMPO transportation planning activities, and to promote a common understanding of the concept of environmental justice.

Six Environmental Justice Principles for Transportation Planning

1. *Making Environmental Justice a Priority* - The ~~Bloomington/Monroe County~~ BMCMPO is committed to following the spirit, as well as the letter of the Order (DOT Order to Address Environmental Justice in Minority Populations and Low Income Populations), throughout all of its projects and activities. The MPO will require that all ~~Bloomington/Monroe County~~BMCMPO transportation planning partners (i.e. INDOT, Bloomington Transit, Indiana University Campus Bus) do so as well.

2. *Increasing Meaningful Public Participation* - The ~~Bloomington/Monroe County~~ BMCMPO will continuously work to develop public participation that will:

    - Be thorough and fully inclusive, involving all relevant stakeholders and communities. The MPO ~~seeks to~~ involves the broadest cross-section of the community in the transportation planning process, based on geographic distribution, sex, race, socioeconomic status, and interests (environmental, neighborhood, etc.);~~.~~
    - Adapt and tailor programs to specific populations and situations, taking in to account a wide range of differences;~~.~~
    - Reach out to communities that have not traditionally been involved in transportation planning, particularly low income and minority communities;~~.~~

- Provide opportunities to members of affected communities to influence project decisions by proactively soliciting their input;~~,~~
- Have opportunities for public input throughout the project development process (from project selection, design and implementation); and~~,~~
- Develop and maintain a Public Involvement Process that is transparent and open in its methods.

3. *Maintaining Project Flexibility* - In implementing environmental justice practices, the ~~Bloomington/Monroe County~~ BMCMPO will tailor its methods to reflect the unique issues and populations affected by each policy, program, or project. The MPO will work with members of affected communities~~,~~ and all stakeholders to encourage input and develop project options that meet transportation goals as well as community needs.

4. *Promoting Project Equity* - In developing programs and policies, the Bloomington/Monroe County MPO will work continuously to balance the benefits and negative results of transportation projects in all communities. Programs will not result in disproportionate negative impacts solely on low-income or minority communities.

5. *Utilizing Rigorous Demographic Analysis* - In order to address potential environmental justice issues, low income and/or minority populations ~~must be~~will receive identifi~~ed~~cation through demographic (U.S. Bureau of the ~~c~~Census) data and then mapped. To identify and map potential low-income and/or minority populations, the ~~Bloomington/Monroe County~~ BMCMPO will:

   - ~~Be quantitative in P~~presenting quantitative data wherever possible;~~.~~
   - Use community profile information (as defined in the National Environmental Policy Act of 1969-NEPA) whenever possible;~~.~~
   - Provide thorough documentation of information sources; and~~.~~
   - Use flexible methods of gathering information, designed to address specific population(s).

6. *Developing Effective Conflict Resolution Methods* - If conflicting interests and issues arise during a project, an appropriate resolution process will follow a process respectful to the desires and wishes of stakeholders and communities, and a process that is flexible in nature designed to address the specific needs of affected communities.~~be developed. This process will be:~~

   - ~~Respectful to the desires and wishes of stakeholders and communities.~~
   - ~~Flexible in nature, and designed to address the specific needs of affected communities.~~

Public Participation Plan

Public Education

Successful and meaningful public participation must ensure~~can only be assured through~~ a public education effort where the issues and complexities of transportation planning involve ~~can be~~ simple~~y~~ explainationsed and open~~ly~~ discussionsed. Public education will take place ~~through utilizing~~using the MPO website, public workshops, and various media outlets. By increasing publicity and awareness for the MPO and its activities, more citizens will become educated about transportation issues.

Visualization

The MPO shall employ visualization techniques to depict metropolitan Long Range Transportation Plan, the Transportation Improvement Program, and other significant MPO related projects to improve comprehension of these often complex transportation related projects and further promote successful and meaningful public participation. Techniques may include, but are not limited to, one or more of the following:

- 3D Renderings;
- 2D Overlays;
- Maps;
- GIS; and
- Engineering Designs.

Website

The MPO staff will develop and maintain a home page for the MPO on the World Wide Web. This home page may consist of historical information regarding transportation planning in the city and county, published documents, draft documents for review, reports and links to related internet sites, as well as MPO staff member contact information.

At a minimum, the content of this page will include:

- The BMCMPO~~Bloomington /Monroe County Year 2030~~ Metropolitan Transportation Plan;
- The most recent BMCMPO Transportation Improvement Program~~Plan~~;
- The most recent BMCMPO Unified Planning Work Program (UPWP);
- The Policy Committee(PC); Technical Advisory Committee (TAC), and Citizens Advisory Committee (CAC) ~~M~~meeting ~~S~~schedules;
- The ~~A~~agendas for upcoming Policy Committee (PC), Technical Advisory Committee (TAC), and Citizens Advisory Committee (CAC) meetings; and~~.~~
- Archives of minutes from previous Policy Committee (PC), Technical Advisory Committee (TAC), and Citizens Advisory Committee (CAC) meetings.

Committee Meetings

The MPO committees (Policy Committee (PC), Technical Advisory Committee (TAC), and Citizens Advisory Committee (CAC)) have regularly scheduled meetings that are open to the public. MPO staff will annually develop a schedule of meeting dates for each committee, consisting of monthly meeting times, dates and places. The meeting schedule is available from the website or by request. The meeting schedules and agendas are available on the MPO website (http://bloomington.in.gov/mpo) or by request.

The public is actively encouraged to attend MPO committee meetings and to be involved in the transportation planning process. Please refer to the BMCMPO website, the BMCMPO Operational Bylaws, or contact theBMCMPO at (812) 349-3423 for information about these committees.Meeting agendas for each of the three MPO committees are published online at http://bloomington.in.gov/mpo .

Public Meetings and Workshops

The MPO will regularly conduct 1-2 rounds of additionalmultiple workshops and/or public information meetings, timed to coincide with important milestones in the development of the regular update of the Long Range Transportation Plan. The MPO will try to hold these meetings at various locations throughout the urbanized area and endeavor to enable remote participation for members of the public who cannot attend in person. The purpose of these workshops will be to support development and public review of the Long Range Transportation Plan. The MPO will additionallyalso conduct 1-2 rounds interagency coordination workshops, timed to coincide with the preparation for annual development of the Transportation Improvement Program. This coordination will provide the technical support needed in the preparation of the TIP for public comment and review through the Ccommittee Mmeeting process.

Media Participation/Public Notification

The MPO staff may provide the major newspapers in the Bloomington urbanized area (the Herald Times and the Indiana Daily Student) with timely notice regarding the adoption of the LRTPLong Range Transportation Plan and TIP. In addition tThe MPO staff, in conjunction with the City of Bloomington, may issue press releases about other related MPO activities on a case by case basis. All press releases will include information on the meeting date(s) and time(s) for the MPO committees, announcements for public meetings/workshops to discuss the MPO's transportation planning documents, and other pertinent information.

The Bloomington MPO staff may announce† committee and public meeting/workshop information in the following media outlets:

- The Bloomington Herald--Times (in the On the Agenda section);
- The Indiana Daily Student;
- Radio Public Service Announcements (as needed)- on B97, WHFB, WFIU, or other similar outlets;

- Television Public Service Announcement (as needed)~~-~~ on B-CATS;
- On the MPO website - http://bloomington.in.gov/mpo;~~.~~
- At the Monroe County Library (Bloomington and Ellettsville); and
- At the Showers Center City Hall

~~†~~Please note that press releases do not guarantee that any of the media agencies listed will actually publish or announce the press release unless the MPO pays for advertising. Typically, the MPO does not have funding available to pay for advertising and relies on these media outlets to make these announcements in a timely manner. Some instances may warrant the need to pay for advertising for public notification.

Individuals with Disabilities

All of the meeting rooms at City Hall are accessible by ADA standards.

Upon request, any MPO documents can be made available in alternative formats to individuals with disabilities. Please contact the City of Bloomington Legal Department at (812) 349-3426 or the City of Bloomington Community and Family Resources Department at (812) 349-3430 for information on sign language interpreters or Braille translations.

Individuals with disabilities who need accommodations to participate in committee meetings or public hearings, should contact the City of Bloomington Facilities Manager at (812) 349-3410.

Getting in Touch - Comments

Public comment can be submitted in several ways:

- By attending meetings and workshops;
- By visiting the City of Bloomington Planning and Transportation Department located at ~~office:~~ 401 North Morton Street; Suite 136~~0~~; Showers Center City Hall;
- By phone at (812) 349-3423;
- By ~~F~~fax at (812) 349-3535
- By US Postal Service: Attention: MPO Director; Showers Center City Hall; 401 N~~.~~ Morton St.; Bloomington, IN 47402; and~~,~~
- By ~~E~~email~~:~~ at mpo@bloomington.in.gov.

Measuring Public Outreach

In order to evaluate the quality of input and participation generated through the Public Participation technique(s) used, the ~~Bloomington/ Monroe County~~ BMCMPO has developed a set of performance objectives: accessibility, diversity, outreach, and impact.

Accessibility

- The MPO will hold public workshops and/or meetings will be held in all those areas/communities affected by a proposed project.
- ~~One hundred percent of~~All meeting locations must be accessible by mass transit.
- All meetings must be accessible under the requirements of the Americans with Disabilities Act (ADA).

Diversity

- The demographic composition of the Citizens Advisory Committee (age, ethnicity, geographic location, disability, and socio-economic level) should roughly mirror the demographics of the Bloomington urbanized area.
- The participation of low income and minority populations at MPO meetings will be encouraged to the maximum extent possible.

Outreach

- The MPO staff and MPO ~~C~~committee ~~M~~members are encouraged to participate in potential outreach activities (e.g. other committees, workshops, and meetings) to increase public awareness of the MPO.
- The MPO should send out press releases of all of its activities.
- When appropriate, the MPO will participate in radio and/or TV spots to extend public outreach.

Impact

- ~~One hundred percent of~~All written comments received as part of a written public comment period will be reviewed and communicated to transportation decision makers.
- One hundred percent of written comments received as part of a written public comment period will be acknowledged so that citizens are confident that their comments were taken into consideration in the MPO decision making.

Appendix A

Bloomington/Monroe County MPO Committees

Please refer to the BMCMPO website, the BMCMPO Operational Bylaws, or contact the BMCMPO for information on these committees.

Core Transportation Planning Documents

SAFETEA-LUThe FAST Act continues the requirements of the development of a Long Range Transportation Plan (LRTP) and a Transportation Improvement ProgramPlan (TIP) by each MPO. andand the FAST Act further requires thatthat the incorporation of these documents be incorporated into a statewide plan and program of projects. The annual Unified Planning Work Program (UPWP) outlines and documents Documentation of the MPO planning process is developed annually and outlined in the Unified Planning Work Program (UPWP).

Long Range Transportation Plan (LRTP)

The BMCMPOBloomington/Monroe County Year 2030 Long Range Transportation Plan, also known as the Metropolitan Transportation Plan, is a comprehensive multimodal transportation plan for the Metropolitan Planning Area (MPA) of Monroe County. Transportation projects (including but not limited to major roadways, transit, and other multimodal facilities) proposed by the plan provide a guideline of future transportation investments over a long-term planning horizon. The plan undergoes reviews and updateswill be reviewed and updated every three to five years to confirm its consistency with current and forecasted transportation and land use trends. The transportation plan reflects environmental and intermodal considerations and provides a financially constrained vision of future transportation investments.

Transportation Improvement ProgramPlan (TIP)

The TIP is a short-term document covering four (4)three to five fiscal years with annual updates or as needed, and is updated annually. The TIP includes a list of priority projects to be carried out in each of the 4 yearsidentified program years. The TIP serves as a strategic management tool to accomplish the goals of the Metropolitan Transportation Plan (MTP).; therefore tThe TIP projects must therefore have be consistencyt with the MTPPlan. The TIP lists all roadway, transit and intermodal projects planned to receive federal, state and local funding. The TIP organizes projects are organized by the local public agency implementing the project and by the year the project is proposed to take place. The TIP must additionally achieve annual fiscal constraintalso be financially constrained by year and include only those projects for which funding has beenwith identified funding sources. The MPO develops the TIP financial plan for the TIP is developed by the MPO in cooperation with local and state transportation agencies as well as transit operators. After adoption of tThe TIP by the Policy Committee, the Bloomington/Monroe County MPO TIP becomes part of the Statewide Transportation Improvement Program (STIP)after adoption by the Policy Committee. The aAdoption of the TIP by the Policy Committee is a reaffirmation of the MTPTransportation Plan. If at the time of adoption the TIP

does not agree with the MTP~~Transportation Plan~~, amendment of the MTP~~Transportation Plan~~ will become necessary for the adoption of the proposed TIP to achieve concurrence~~occur~~.

Unified Planning Work Program (UPWP)

The UPWP guides the MPO and summarizes transportation planning activities for the various agencies and interests in the Bloomington urbanized area. It shows ~~what~~the agency responsible ~~will do~~for specific planning studies, ~~when the~~a work completion schedule ~~will be completed~~, allocated resources, and ~~what~~ the final products ~~and resources will be~~. The UPWP also serves as a program budget and includes anticipated financial resources and expenditure information for ~~the~~individual fiscal years ~~covered~~. The UPWP is updated annually, and is sent to state and federal agencies for review and approval.

Project List FY 2022-2026

RURAL TRANSIT

Rural Transit Operation Assistance [BLO-22-010 (1802840), BLO-23-010 (1802841), BLO-24-010 (1802842), BLO-25-010 (1802843), BLO-26-010 (1802844)]						
Funding Source	**2022**	**2023**	**2024**	**2025**	**2026**	**Total***
5311	$875,524	$910,545	$946,967	$984,845	$1,024,239	$4,742,120
Local Match & PMTF	$312,096	$324,579	$337,563	$351,065	$365,108	$1,690,411
Local Fares & In-Kind	$563,428	$585,965	$609,403	$633,780	$659,131	$3,051,707
Totals	$1,751,048	$1,821,089	$1,893,933	$1,969,690	$2,048,478	$9,484,238
*Estimated Total Project Cost (23 CFR 450.218(i)(2); 23 CFR 450.326(g)(2))						

Four Cameras with DVR Systems for ten Rural Transit Vehicles [Des#: TBD]						
Funding Source	**2022**	**2023**	**2024**	**2025**	**2026**	**Total***
IIJA		$7,600				$7,600
Local Match		$1,900				$1,900
Totals	$0	$9,500	$0	$0	$0	$9,500
*Estimated Total Project Cost (23 CFR 450.218(i)(2); 23 CFR 450.326(g)(2))						

Fullerton Pike/Gordon Pike/Rhorer Road, Phase III [1802977]

Project Phase	Fiscal Year	Federal Source	Federal Funding	Local Match	Total*
PE	2022	Local		$377,000	$377,000
	2023	Local		$100,000	$100,000
	2024	Local		$10,000	$10,000
RW	2023	STP	$421,934	$286,266	$919,167
		IIJA	$210,967		
CE	2024	Local		$1,500,000	$1,500,000
CN	2024	STP	$2,750,133	$12,125,485	$14,875,618
Totals			$3,383,034	$14,398,751	$17,781,785

*Estimated Total Project Cost (23 CFR 450.218(i)(2); 23 CFR 450.326(g)(2))

Fullerton Pike, Phase III Bridge [2001721] (Kinned with 1802977)

Project Phase	Fiscal Year	Federal Source	Federal Funding	Local Match	Total
		BR			

Karst Farm Greenway - Connector Trail [1900405]

Project Phase	Fiscal Year	Federal Source	Federal Funding	Local Match	Total*
PE	2022	Local		$213,400	$213,400
RW	2023	Local		$270,000	$270,000
CE	2024	Local		$114,000	$114,000
CN	2024	TAP	$155,801	$758,199	$914,000
Totals			$155,801	$1,355,599	$1,511,400

*Estimated Total Project Cost (23 CFR 450.218(i)(2); 23 CFR 450.326(g)(2))

Pedestrian Trail Crossing Improvements [1900493]

Project Phase	Fiscal Year	Federal Source	Federal Funding	Local Match	Total*
PE	2022	Local		$20,000	$20,000
CN	2024	HSIP	$88,184	$9,800	$97,984
Totals			$88,184	$29,800	$117,984

*Estimated Total Project Cost (23 CFR 450.218(i)(2); 23 CFR 450.326(g)(2))

Crosswalk Safety Improvements Project (FY25) [2200014]

Project Phase	Fiscal Year	Federal Source	Federal Funding	Local Match	Total*
PE	2023	Section 164	$70,571	$29,429	$100,000
CE	2025	HSIP	$66,255	$7,745	$74,000
CN	2025	HSIP	$364,540	$55,000	$419,540
CN	2025	Section 164	$110,460		$110,460
Totals			$611,826	$92,174	$704,000
*Estimated Total Project Cost (23 CFR 450.218(i)(2); 23 CFR 450.326(g)(2))					

Downtown Curb Ramps Phase 3 [1900403]

Project Phase	Fiscal Year	Federal Source	Federal Funding	Local Match	Total*
CE	2023	HSIP	$61,393	$6,822	$68,215
CN	2023	HSIP	$369,402	$45,477	$414,879
		Section 164	$39,889		$39,889
Totals			$470,684	$52,299	$522,983
*Estimated Total Project Cost (23 CFR 450.218(i)(2); 23 CFR 450.326(g)(2))					

Downtown Curb Ramps Phase 4 [2200021]

Project Phase	Fiscal Year	Federal Source	Federal Funding	Local Match	Total*
PE	2024	Section 164	$110,460	$4,540	$115,000
CE	2026	HSIP	$66,255	$7,745	$74,000
CN	2026	HSIP	$364,540	$55,000	$419,540
CN		Section 164	$110,460		$110,460
Totals			$651,715	$67,285	$719,000
*Estimated Total Project Cost (23 CFR 450.218(i)(2); 23 CFR 450.326(g)(2))					

High Street Intersection Modernizations and Multiuse Path [2200020]

Project Phase	Fiscal Year	Federal Source	Federal Funding	Local Match	Total*
PE	2023	IIJA	$488,198	$311,802	$800,000
RW	2024	STP	$242,110	$857,890	$1,100,000
CE	2026	Local		$640,000	$640,000
CN	2026	STP	$2,992,243	$2,638,244	$5,800,000
CN	2026	TAP	$169,513		
Totals			$3,892,064	$4,447,936	$8,340,000
*Estimated Total Project Cost (23 CFR 450.218(i)(2); 23 CFR 450.326(g)(2))					

Bloomington Transit

ALTERNATIVE FUELS AND INFRASTRUCTURE ASSESSMENT STUDY

Prepared by: WSP
Presented: June 22th, 2022

wsp

Agenda

01 | Introduction

02 | Fuel/Technology Findings

03 | Cost Analysis

04 | Facilities

05 | Recommendations and Next Steps

INTRODUCTION

BACKGROUND

Objective

Building upon initial Feasibility analysis and comparison study of three alternative fuel bus technologies:

1. Compressed Natural Gas (Omitted from deep-dive analysis)
2. **Battery-Electric**
3. **Hydrogen Fuel Cell**

BPTC Fleet Summary

- 42 buses
- Peak vehicle requirement of 29 buses
- 30', 35', and 40' low floor buses (fixed route)
- Two battery-electric, 35’ BEBs and chargers
- Funding for 8 additional BEBs and charging stations
- Planning to expand up to 8 60’ buses
- Long-term plan to expand 10 additional 40’ BEBs

Facility Background

- Facility is **shared with University Campus** Bus service
- The University owns the land
- BPTC owns the facilities and structures
- Site is near capacity
- **Adjacent land available to be purchased**

Initial Analysis Results Summary

Metric	CNG	BEB	FCEB		
			Delivered	On-site Production	
			Liquid	SMR	Electrolysis
Vehicle Range	✓				
Physical Space Requirements	✓	✓	✓		
Fueling/Charging Time			✓	✓	✓
Fuel Availability		✓		✓	✓
Energy Requirements	✓		✓		
Lifecycle GHG Emissions		✓			
Tailpipe Emissions		✓	✓	✓	✓
Community Acceptance		✓			
Vehicle Cost	✓				
Infrastructure Capital Costs***	✓	✓	✓		
O&M Costs	✓				
Financial Incentives		✓	✓	✓	✓
No Fatal Flaws	✓	✓	✓	✓	✓

TECHNOLOGY DEEPER DIVE

UPDATES TO THE PREVIOUS REPORT

Battery-Electric Bus

- Bus Size-Specific Efficiency (Based on Pilot Data)
- Typical and Conservative Scenarios
- Near, Mid, and Long-Term Energy Needs
- 100% ZE Fleet Strategies

Fuel Cell Electric Truck

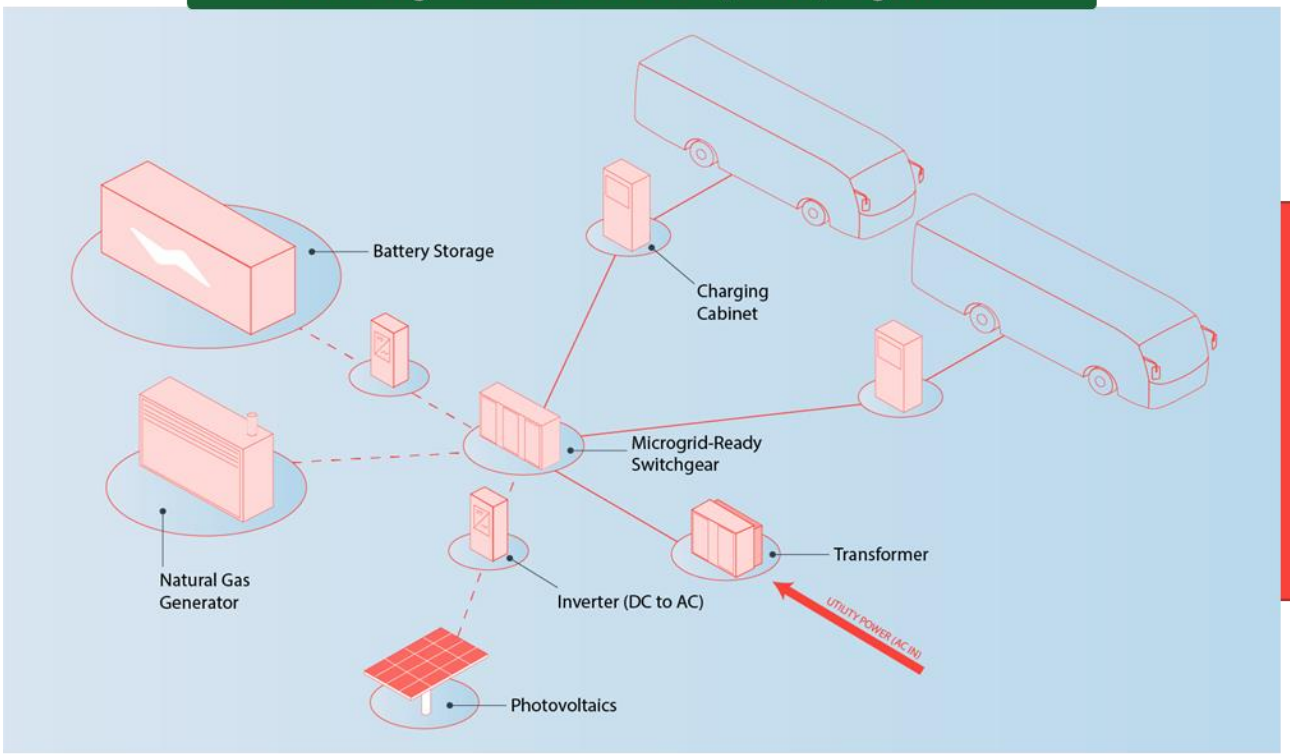
- Bus to Block Assignments
- Altoona based Central Business District (CBD), and Arterial (ART) efficiencies
- Updated Daily Fuel Requirements

Cost Analysis

- Refined Infrastructure Cost Estimates
- Refined Fuel Cost Estimates
- Lifecycle Cost Estimates

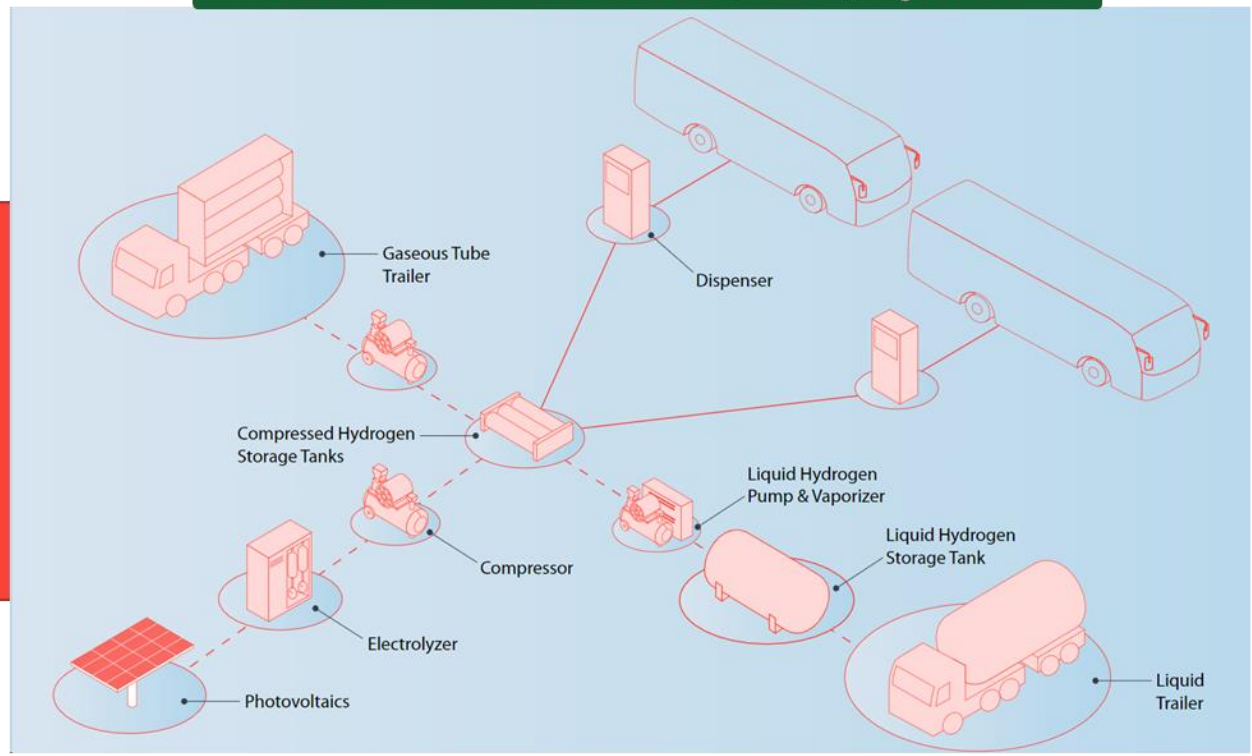
FUEL/TECHNOLOGIES

Battery-Electric Bus (BEB) System



- Electric Vehicle
- Zero Tailpipe Emissions
- Long Refuel Time
- Short Range
- More Efficient
- Less Well-to-Wheel Emissions

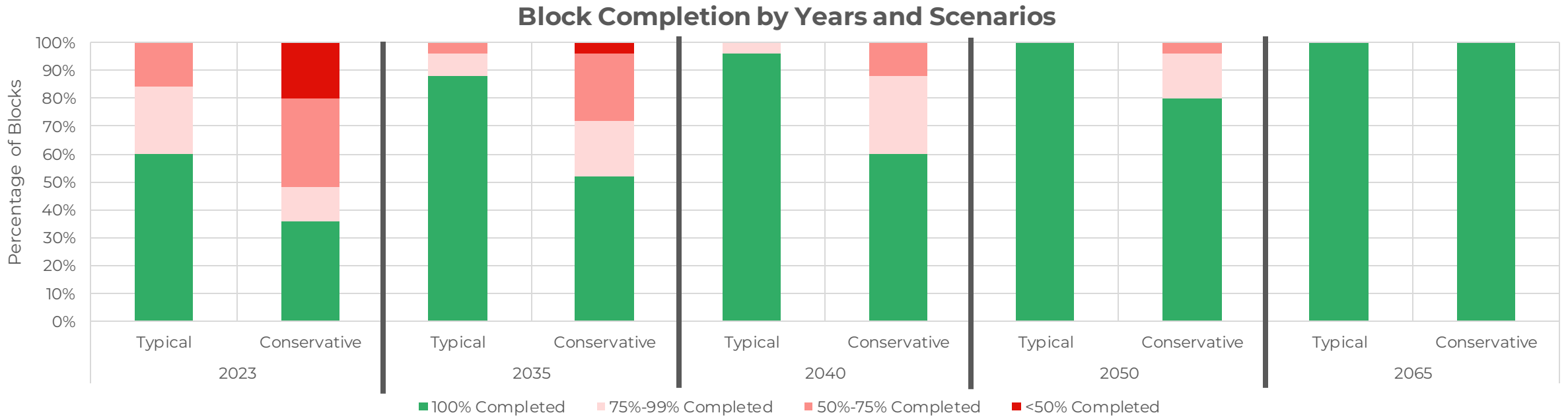
Fuel Cell Electric Bus (FCEB) System



- Electric Vehicle
- Zero Tailpipe Emissions
- Short Refuel Time
- Long Range
- Less Efficient
- More Well-to-Wheel Emissions

BATTERY-ELECTRIC BUSES

SERVICE COMPLETION



- In 2023, approximately 60% of the service blocks can be completed with BEBs in the typical scenario. The number goes down to 36% in extreme conditions (conservative scenario), such as during the coldest day of winter.
- In typical operating conditions, no blocks are less than 50% completed. These blocks might be able to be completed with strategic electrification phasing and service changes, without additional BEBs needed.
- The block completion rate will improve over the years, with 88%, 96%, and 100% of all service blocks being able to be completed by BEBs in typical condition in 2035, 2040, and 2050, respectively*.

Assumptions:
- 2.5% annual cumulative range growth (conservative assumption)
- **Typical scenario:** during average operating conditions
  - 35-foot bus: Annual average of pilot BEBs efficiency (2.17 kWh/mile)
  - 40-foot bus: Market Average (2.12 kWh/mile)
- **Conservative scenario:** during extreme weather condition
  - 35-foot bus: Average of the maximum efficiency of pilot BEBs (3.3 kWh/mile or 1.5x typical efficiency)
  - 40-foot bus: 1.5x typical efficiency (3.23 kWh/mile)

* Appendix A provides a detailed illustration on the block completion improvement over the years

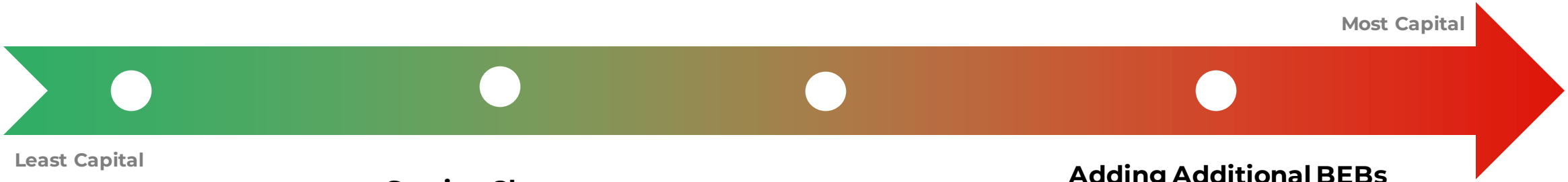
STRATEGIES FOR FAILING BLOCKS:

Strategic Phasing

Allowing for technology to mature

Utilizing Bus with Better Efficiency

(i.e., specific models, 40-foot buses)



Service Changes

(i.e., Block splitting to be completed by existing spare vehicles)

Adding Additional BEBs

Block Splitting to be completed by additional BEBs

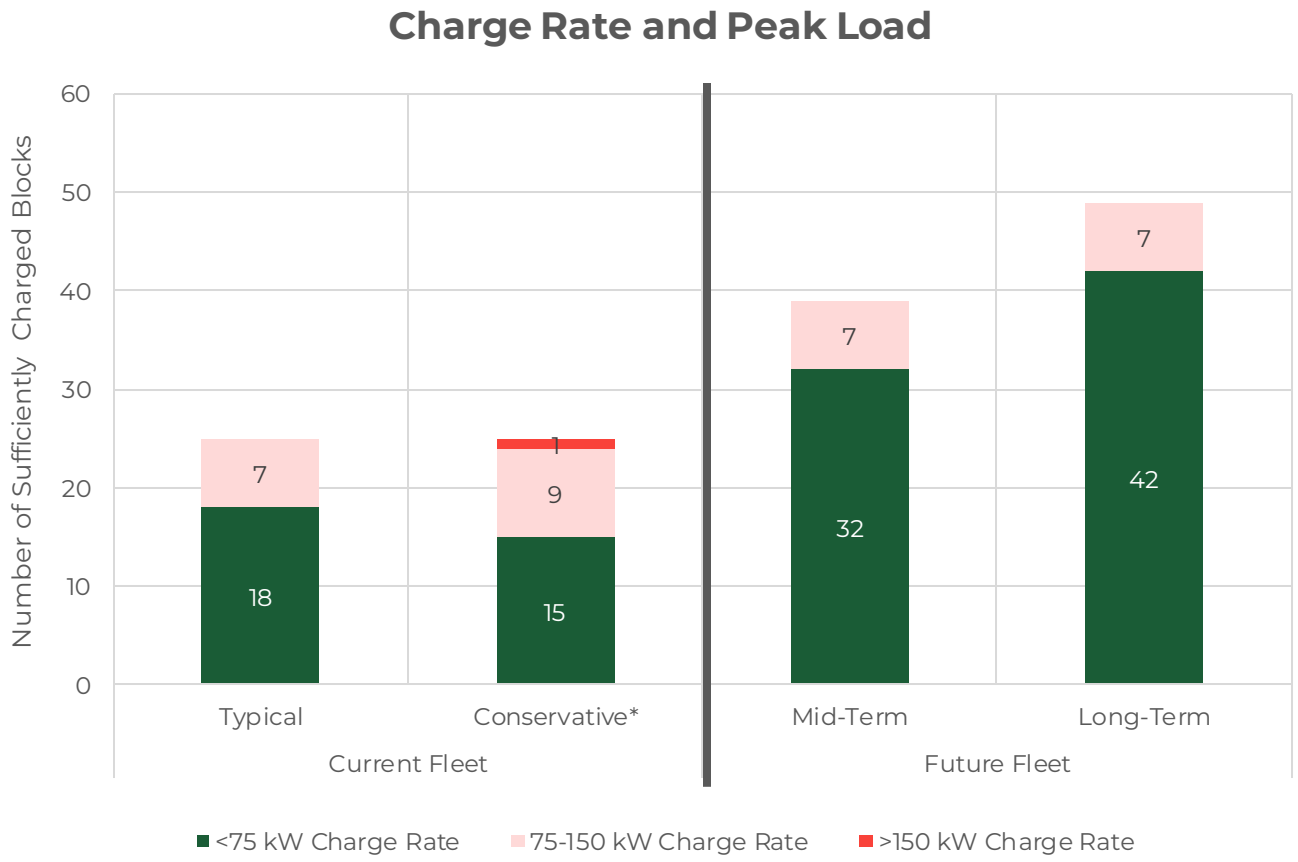
Fuel Cell Technology

Longer range, with additional fueling infrastructure needs

Opportunity Charging

Fast chargers at layover locations. Requires additional infrastructure and higher fuel cost

ENERGY REQUIREMENT



Assumptions:
- New vehicles will be assigned to blocks that can be sufficiently charged with 75 kW charge rate
- Vehicles would be able to receive the needed kWh to complete service

Charge Rate

- **18 blocks** can be sufficiently charged at **75 kW** charge rate
- **Seven blocks** can be sufficiently charged at **75-150 kW** charge rate
- In the conservative scenario, **one block** needs at least **156 kW** charge rate to be sufficiently charged. Strategic phasing may mitigate issue if efficiencies improve

Number of Chargers Needed & Peak Load

- BEBs typically require large utility upgrades to the site and higher daily power consumption for charging
- The use of a charge management system (CMS) is essential to reduce the peak demand and chargers needed

Charger Needs			
	# 150 kW DC Charger**	# 300 kW DC Charger	Max. Peak Load
Current	13	1	2.25 MW
Mid-Term	20	1	3.30 MW
Long-Term	24	1	3.90 MW

*Conservative scenario is provided as a comparison. However, future fleet numbers are based on typical operation

**Assuming 1:2 charger to dispenser ratio. Actual number of charger will vary based on the chosen charger rate and configuration after taking into consideration site limitations

100% BEB FLEET GOAL OPTIONS

A

2035

88% blocks can be completed

To complete failing blocks:

- **Better efficiency** (i.e., other models or 40-foot buses)
- **Block splitting**

B

2040

95% blocks can be completed

To complete failing blocks:

Block splitting

C

2050

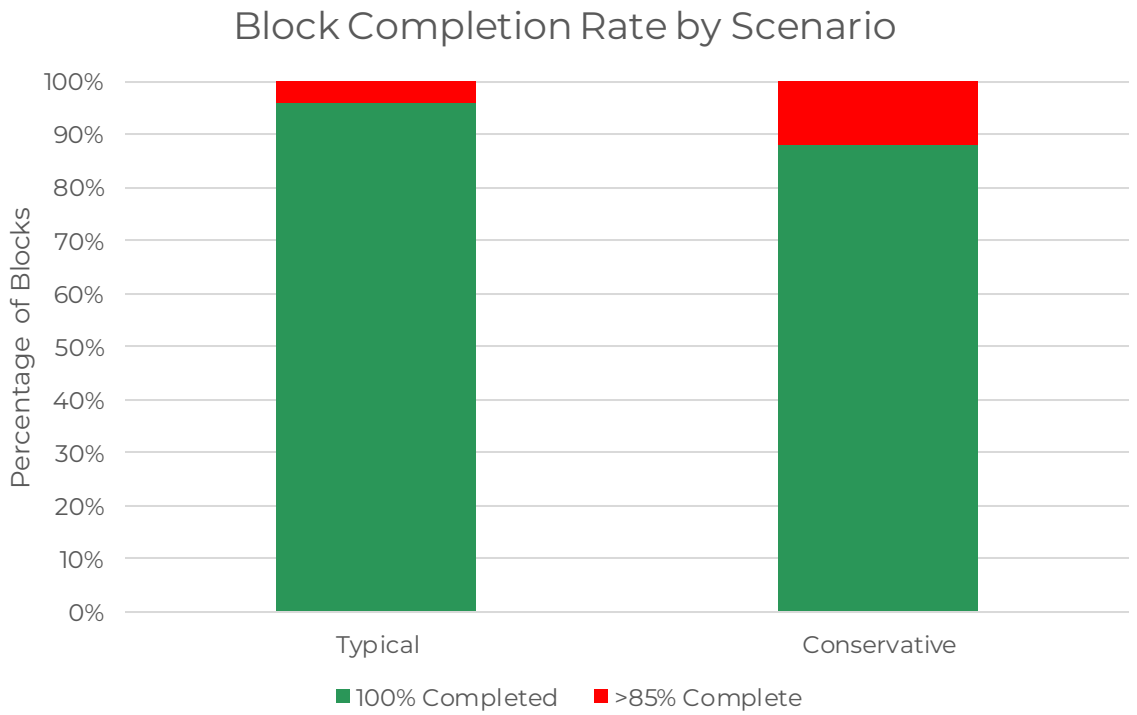
All blocks can be completed

FUEL CELL ELECTRIC BUSES

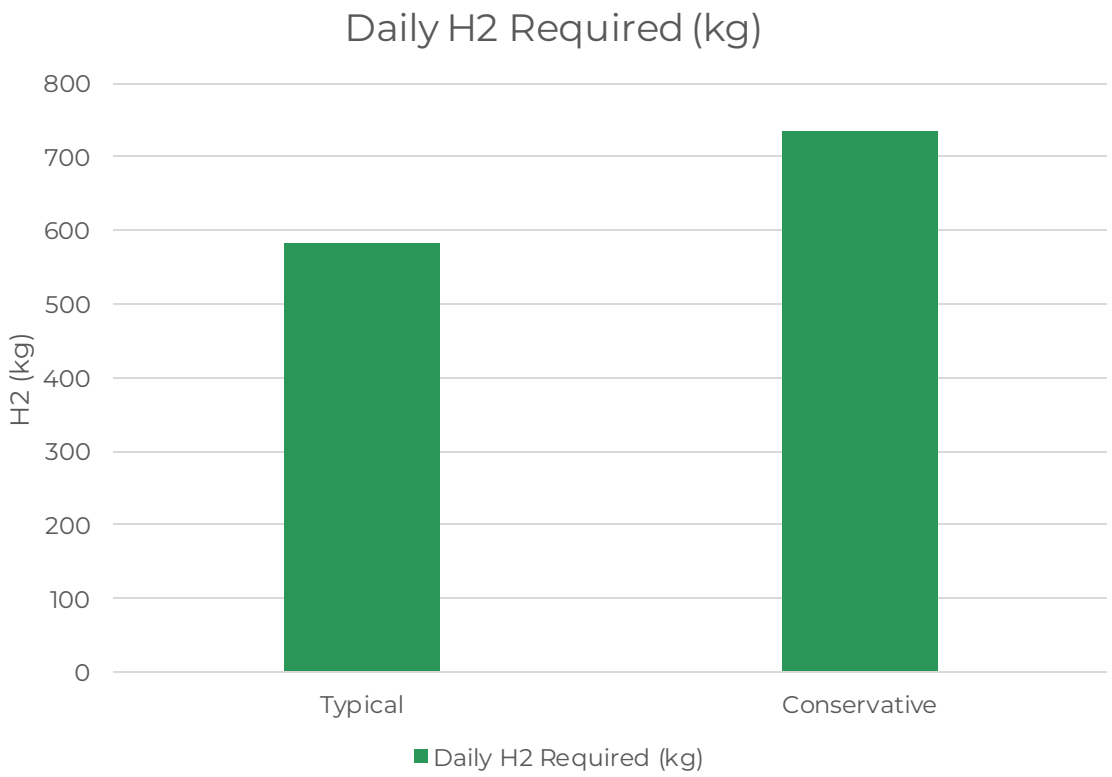
SERVICE COMPLETION

Assumptions:
- Only 3 models of FCEB are currently available on the market
- NF XE40 was used to model 40' FCEB vehicles.
- ENC Access-FC was used to model 35' vehicles. This vehicle is currently made in a 40' configuration, but the manufacturer offers a 35' vehicle.
- **Typical Scenario:** during average operating condition
  - 35-foot bus: Altoona CBD efficiency of 6.81 mi/kg, useable tank of 45 kg
  - 40-foot bus: Altoona CBD efficiency of 6.92 mi/kg, useable tank of 36 kg
- **Conservative scenario:** during extreme weather condition
  - 35-foot bus: Altoona ART efficiency of 5.58 mi/kg, useable tank of 45 kg
  - 40-foot bus: Altoona COM efficiency of 5.34 mi/kg, useable tank of 36 kg

- Under both typical and conservative scenarios, more than 85% of blocks can be completed with FCEB technology. A few of the longest routes cannot be completed by existing FCEB technology.
- Technology improvements are expected, and these few outstanding blocks may be able to be completed by this technology with 5-10 years of advancement.



ENERGY REQUIREMENT



Fueling Requirements:
- **Typical Scenario:** 582 kg/day
- **Conservative scenario:** 735 kg/day
- Hydrogen fuel is measured in kg of compressed gas
- FCEBs require 8 minutes to fuel to completion

Infrastructure Requirements:
- Hydrogen fueling infrastructure should be sized for a conservative scenario to provide for operational resiliency.
- Compressed liquid hydrogen storage is recommended, to increase the amount of fuel storage in a smaller footprint.
- Today's compressed liquid fuel storage tanks can store 4,500 kg of fuel, or approximately one week of fuel under conservative conditions

PHYSICAL SPACE REQUIREMENTS

- H2 will require ventilation upgrades to indoor maintenance bays
- Required space varies depending on several factors including existing facility layout, and fuel delivery vs on-site production, etc.
- On-site hydrogen production relatively requires most space for the production equipment and storage.
- The NFPA requires large setbacks from air intakes, property lines, diesel fuel storage, and other on-site buildings or equipment.

PHYSICAL SPACE REQUIREMENTS

Fuel Storage

Hydrogen fuel requires on-site storage regardless of production or delivery method

SMR

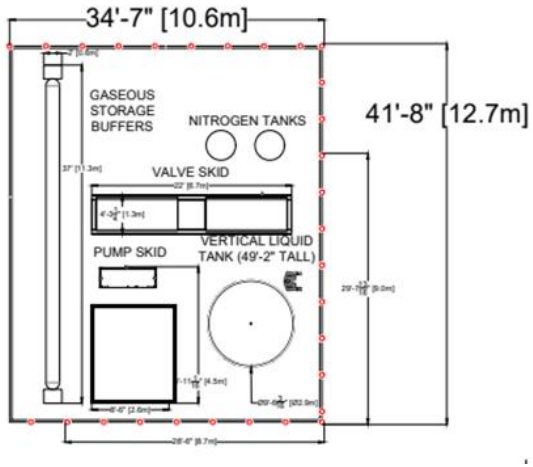
Steam Methane Reformation is the process of splitting hydrogen ions from natural gas (methane)

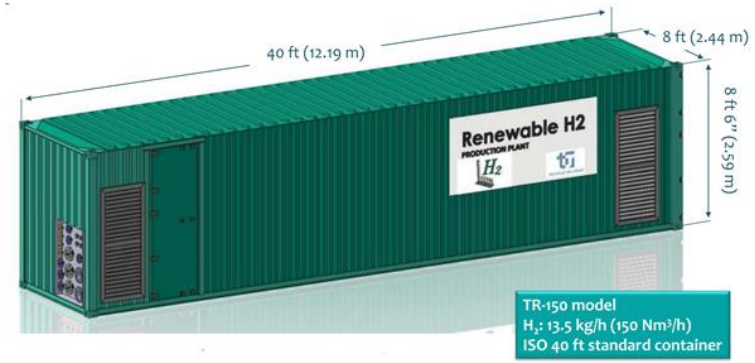
Small scale on-site SMR equipment is available for transit applications, but requires additional footprint and capital cost.

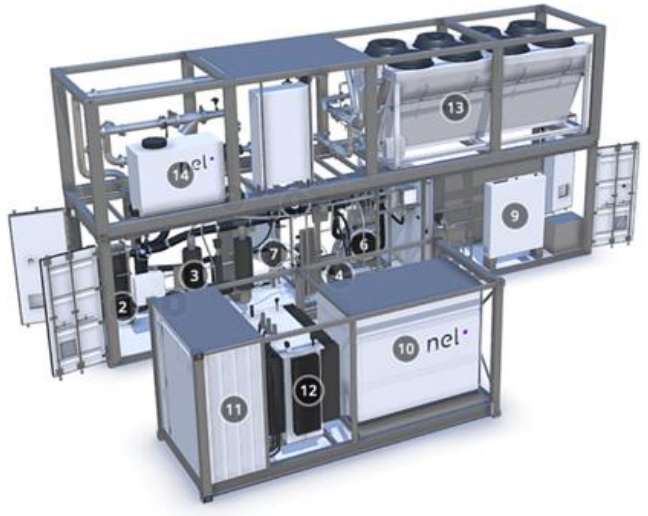
Electrolysis

Hydrogen atoms are split from water using electricity

On-site production equipment is available, but comes with a large footprint and capital cost







100% FCEB FLEET GOAL OPTIONS

2022

85% of blocks can be completed under conservative modeling scenarios

To complete failed blocks, midday re-fueling, which requires under 10 minutes, is recommended.

2035

It is expected that all blocks can be completed.

COST ANALYSIS

CAPITAL COSTS

Metric	BEB	FCEB		
		Delivered	On-site Production	
		Liquid	SMR	Electrolysis
Infrastructure Capital Costs	$2.0M	$8.3M	$10.7M	$12.1M
40' Bus Unit Cost	$1.1M	$1.4M	$1.4M	$1.4M
35' Bus Unit Cost	$1.1M	$1.2M	$1.2M	$1.2M
Total Vehicle Capital Costs	$46.2M	$54.3M	$54.3M	$54.3M
Total Capital Costs	**$48.2M**	**$62.6M**	**$65.0M**	**$66.4M**

- The infrastructure cost estimates do not include facility or utility upgrades since they vary greatly between transit agencies
- Twenty-five 150kW charging cabinets and one DC fast-charger were used in the BEB infrastructure cost estimate
- The FCEB infrastructure for both delivery and on-site production includes the cost of storage and dispensers
- The existing four 30-ft and 25-ft vehicles are assumed to be replaced with 35-ft BEBs and FCEBs

MAINTENANCE COSTS

Metric	BEB	FCEB		
		Delivered	On-site Production	
		Liquid	SMR	Electrolysis
Average Maintenance Cost	$1.70/mi	$1.03/mi	$1.36/mi	$1.05/mi
Annual Total	$1.19M	$0.74M	$0.96M	$0.75M
Lifetime Total*	**$14.3M**	**$8.87M**	**$11.5M**	**$9.03M**

- The estimated annual and lifetime maintenance costs only considers the weekday service vehicles
- The average maintenance cost is higher for both BEBs and FCEBs when compared to BPTC's existing cost of approximately $0.92/mi**

*Includes tire service cost

**In BPTC's 2021 Operating Expenses report, the vehicle operations and vehicle maintenance costs under the Materials and Supplies category were added and divided by the fleet's total annual vehicle miles to calculate the existing O&M cost per mile

FUEL COSTS

Metric	BEB	FCEB	
		Delivered	On-site Production
$/Unit of Fuel	$0.19/kWh	$8.00/kg	$5.00/kg
$/Mile	$0.48	$0.90	$0.56
Annual Total – Typical Scenario	$0.49M	$1.46M	$0.91M
Annual Total – Conservative Scenario	$0.74M	$1.84M	$1.48M
Lifetime Total – Typical Scenario	**$5.9M**	**$17.5M**	**$10.9M**
Lifetime Total – Conservative Scenario	**$8.9M**	**$22.1M**	**$13.8M**

- The estimated fuel costs only considers the weekday service vehicles
- Fuel costs vary depending on the typical and conservative scenarios for both BEB and FCEBs

TOTAL ESTIMATED LIFECYCLE COSTS

Metric	BEB	FCEB		
		Delivered	On-site Production	
		Liquid	SMR	Electrolysis
Estimated Lifecycle Costs – Typical Scenario	$68.4M	$89.0M	$87.4M	$86.3M
Estimated Lifecycle Costs – Conservative Scenario	$71.4M	$93.6M	$90.3M	$89.2M

- The estimated lifecycle costs includes the capital, O&M, and fuel costs
- The cost estimates do not include the agency's planned expansion
- Although not all vehicles were able to meet the existing block requirements, additional vehicles were not added to the lifecycle cost estimates

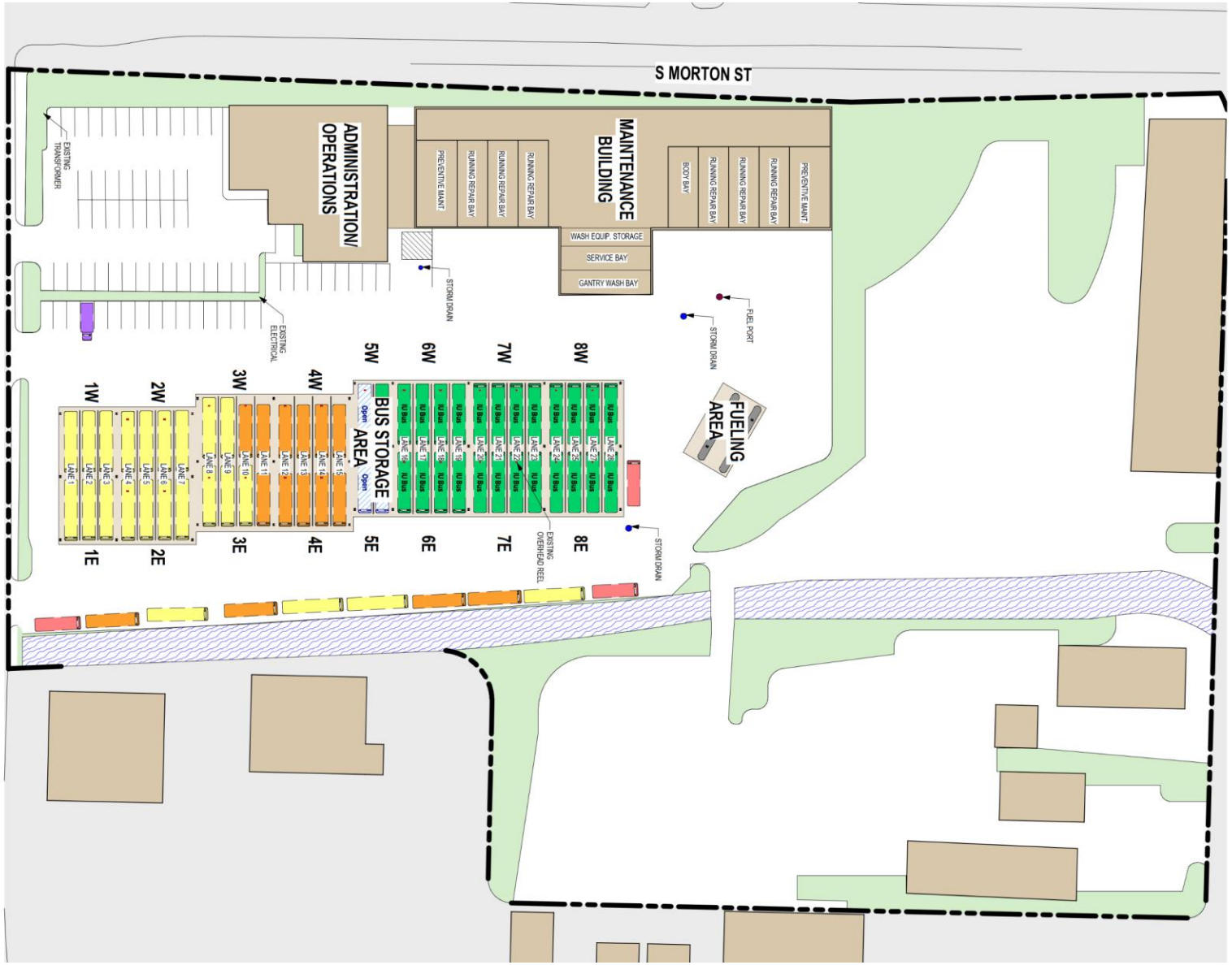
FACILITIES

EXISTING SITE LAYOUT

EXISTING SITE LAYOUT

POTENTIAL SITE EXPANSION

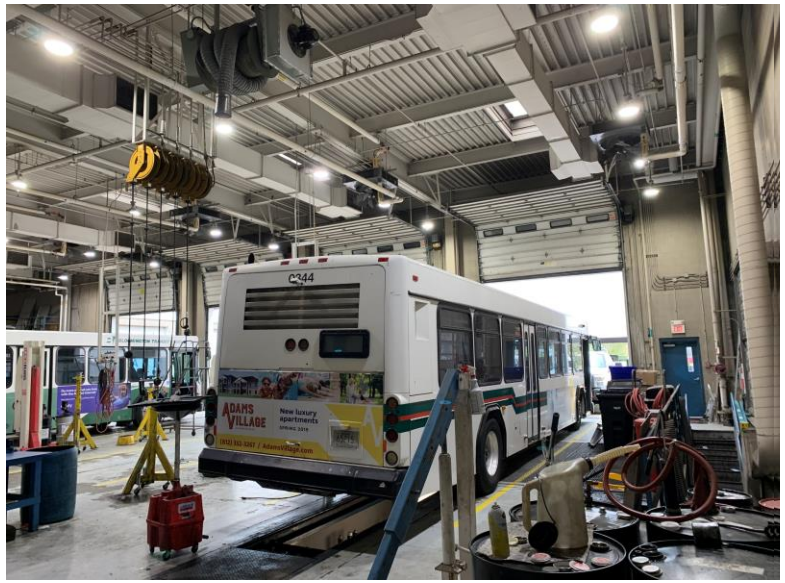
POTENTIAL SITE EXPANSION

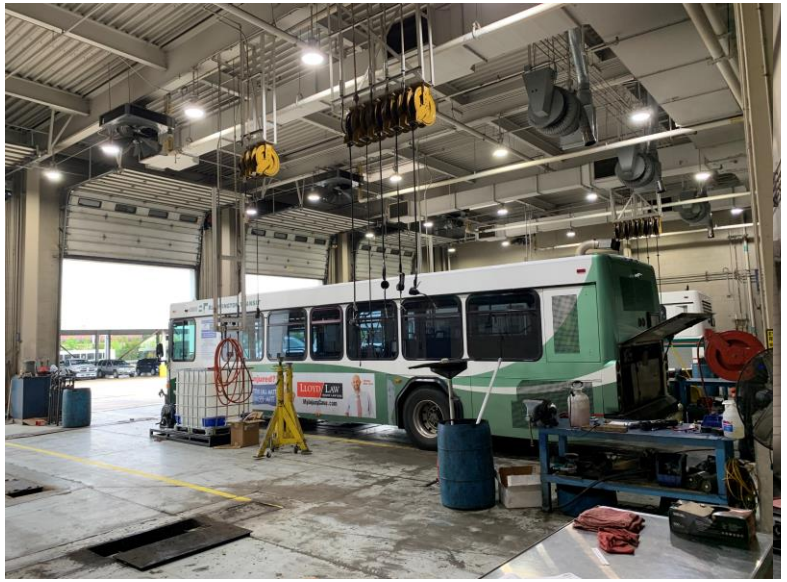


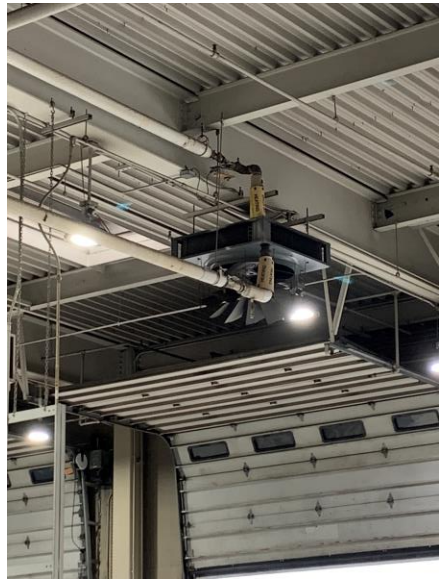
TRANSFER CENTER

TRANSFER CENTER

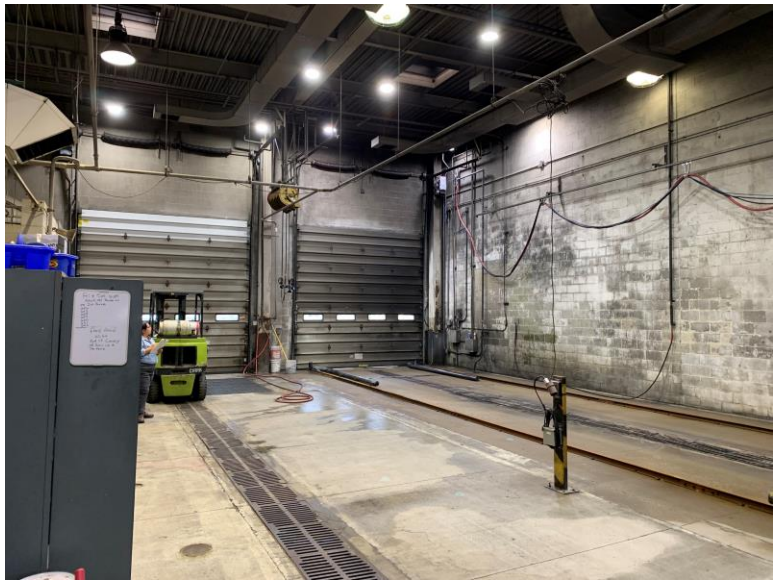
MAINTENANCE AREAS







WASH BAYS



FUEL ISLAND

PARKING CANOPY

EXISTING AND PROJECTED FLEETS

EXISTING FLEET		PROJECTED FLEET	
40’ BUS	23	40’ BUS	42
35’ BUS	15	35’ BUS	15
30’ BUS	3	30’ BUS	3
>30’ Bus	1	60 BUS	6
TOTAL	42	TOTAL	66

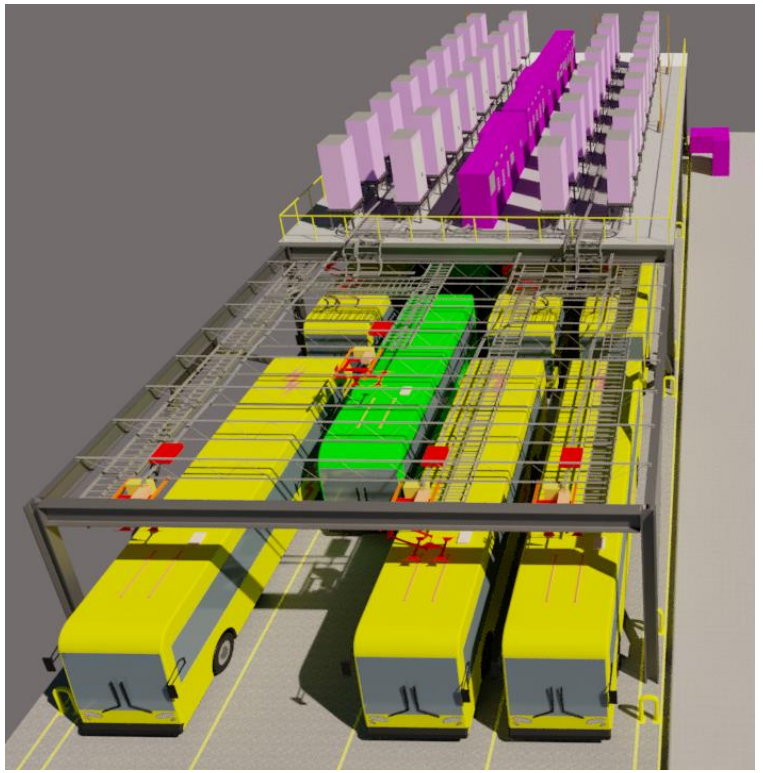
- 25 IU buses also share the site but are not part of this study

- Concepts were developed to accommodate 40’ buses and artics to allow for potential fleet makeup changes and provide maximum flexibility

BATTERY ELECTRIC BUSES

Battery-Electric Bus Assumptions

- Depot BEB Charging via 2:1 charger-to-dispenser ratio @ 150 kW
- Plug-in or Pantograph can be supported by the overhead design
- All future charger infrastructure will be mounted overhead on platforms
  - *Existing site is extremely constrained and cannot support ground mounted infrastructure*
  - *The site is adjacent to a stream which has had a recent flooding event*
  - *Elevated designs maximize resiliency and maximize site capacity*
- Potential transit center Charging via dedicated 450 kW overhead pantograph positions
  - *Plug in not recommended due to public access*
  - *Induction not recommended due to lack of standard*



BATTERY ELECTRIC BUSES

BEB Load Requirements

Battery Electric Bus (BEB) Power Requirements

Charge curve factor applied: 135

Assumed Charger Size (kW): 150 Plug-in or pantograph

A	B	F	G	H	I	J	K	O	P
			(F x 25%)	(F - G)	(H / 150)	(A x H)	(B x H)	(A x 150)	(B x 150)
		Battery Size kWh	Safety Factor 25% SOC	Max Charge Needed kWh	Hours to Charge	Max Power Needed (kWh)		Max kW	
Fleet	Exist	Max Fleet				Exist	Max Fleet	Exist	Max Fleet
40-foot BEB	42	60	440	110	330	2.444	13,860	19,800	6,300	9,000
60-foot BEB	0	6	660	165	495	3.667	-	2,970	-	900
Subtotal	**42**	**66**					**13,860**	**22,770**	**6,300**	**9,900**

Less Spares:	0%	6,300	9,900
Less 50% for 2:1 chargers		3,150	4,950
TOTAL LOAD NEEDED		**3.15mW**	**4.95mW**

BATTERY ELECTRIC BUSES

EXISTING FLEET – NO EXPANSION

- Can meet existing fleet needs
- No room for fleet growth
- IU fleet cannot be electrified in place
- Difficult to phase due to lack of bus parking and construction laydown spacing

BATTERY ELECTRIC BUSES

PROJECTED FLEET – EXPANDED SITE

- Can meet full projected fleet needs
- Offers space if IU electrifies
- Simplifies transition phasing with added property

BATTERY ELECTRIC BUSES

PROJECTED FLEET – EXPANDED SITE (FULLY ISOLATED)

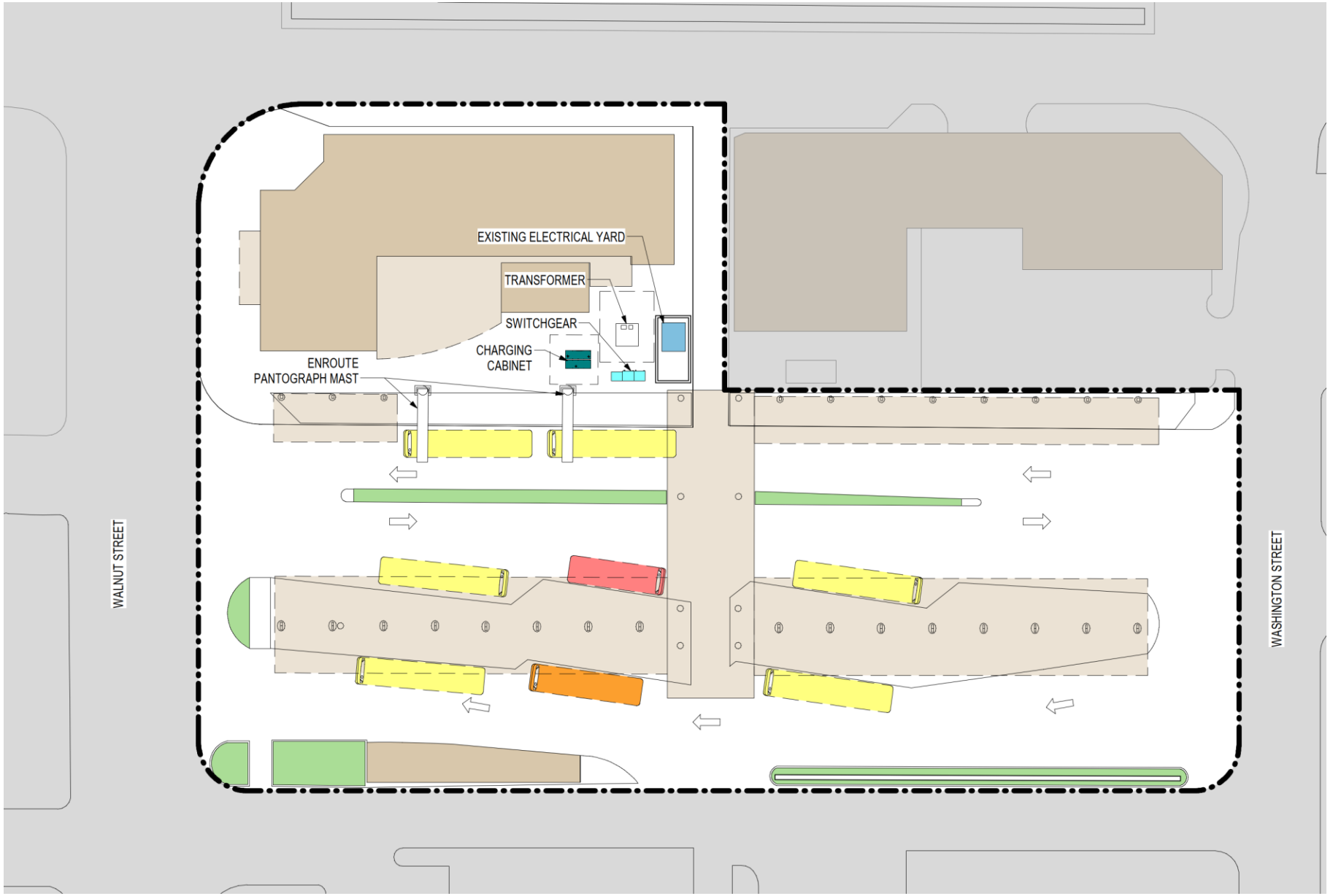
- Can meet full projected fleet needs
- Offers space if IU electrifies
- Simplest transition phasing as existing parking is never disturbed
- Increases design complexity and costs with distribution of power across the stream
- Stream crossing not designed for buses

BATTERY ELECTRIC BUSES

PROJECTED FLEET – EXPANDED SITE (FULLY ISOLATED)

- Can meet full projected fleet needs
- Offers space if IU electrifies
- Simplest transition phasing as existing parking is never disturbed
- Increases design complexity and costs with distribution of power across the stream
- Stream crossing not designed for buses

TRANSFER CENTER - BEB

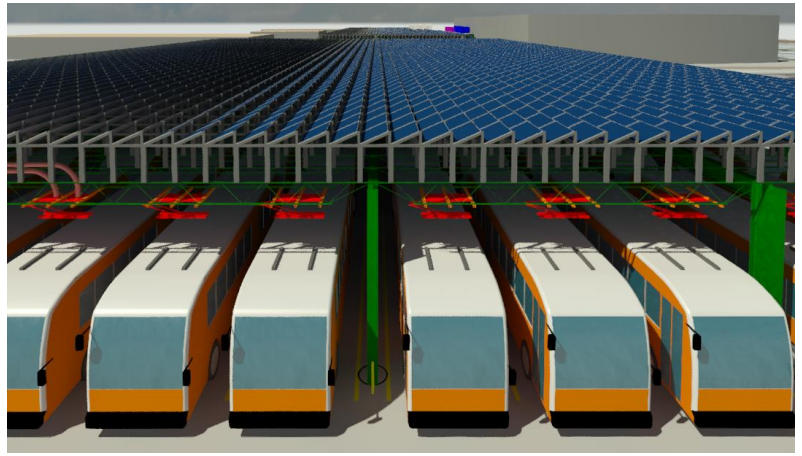


- Utilize overhead pantographs: limits public access and no driver interaction required
- Charge at 450 kW to achieve “fast” range extension
- Deploy adjacent to facility to avoid trenching
- Canopy likely must be shortened to allow for pantograph

BATTERY ELECTRIC BUSES

Findings & Recommendations

- Ground-mounted charging is not viable due to site constraints and lack of resilience
- Existing parking canopy does not support overhead charging equipment and should be removed
- Existing fleet can be charged within the existing site footprint
  - **Not inclusive of the IU Fleet*
- The projected fleet cannot be charged within the existing site
  - *Adjacent site required for fleet expansion*
- **BPTC should consider acquiring the adjacent site to allow for fleet growth and to ease the transition process**



HYDROGEN FUEL CELL ELECTRIC BUSES

HFCEB and Natural Gas Assumptions

- Hydrogen Supply Options
  - *Delivery of liquid hydrogen*
  - *On-site production of hydrogen via:*
    - Steam Methane Reformer (SMR)
    - Hydro-electrolysis
- Utilize existing fuel and service island if possible
  - *Maintains single circulation and service pattern*
- Minimize piping from storage
- Gases cannot be piped across the existing stream divide
- Existing canopies should accept lighter than air fuels with minimal modifications

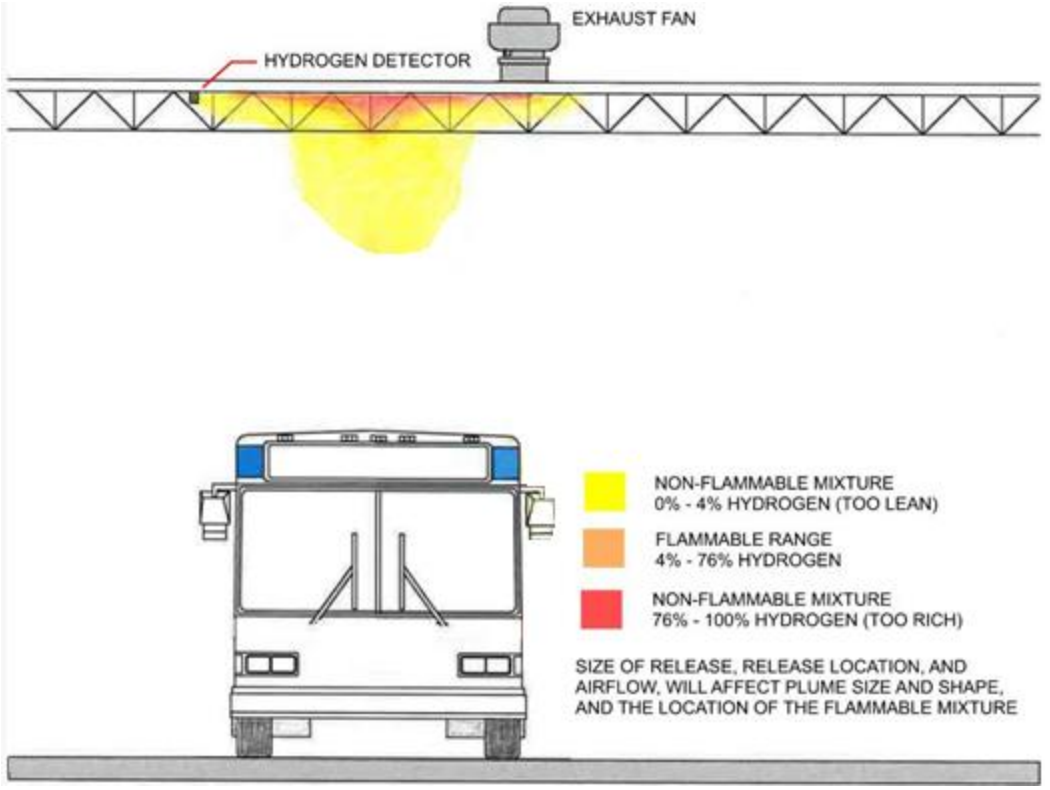
Note concepts for NG storage were not developed as they fit within the same or reduced footprint as liquid hydrogen requirements

HYDROGEN FUEL CELL ELECTRIC BUSES

HFCEB Impacts

Maintenance Facility Requirements:

- No open flame heating systems
- Noncombustible walls + ceilings
- Standby power for safety systems
- Defuel required to service Hydrogen system components
- Hydrogen / NG detection systems
- Mechanical exhaust ventilation
- Electrical designation of vehicle repair spaces
- Automatic fire suppression



HYDROGEN FUEL CELL ELECTRIC BUSES

EXISTING FLEET – NO SITE EXPANSION

- Inadequate space for hydrogen storage and dispensing equipment
- Does not meet hydrogen storage and setback requirements

HYDROGEN FUEL CELL ELECTRIC BUSES

PROJECTED FLEET – EXPANDED SITE

- Ample space for hydrogen storage and dispensing equipment
- Meets hydrogen storage and setback requirements
- Allows existing fuel lanes to be utilized for both fleets during transition

HYDROGEN FUEL CELL ELECTRIC BUSES

PROJECTED FLEET – EXPANDED SITE (FULLY ISOLATED)

- Ample space for hydrogen storage and dispensing equipment
- Meets hydrogen storage and setback requirements
- Allows existing fuel lanes to be utilized for both fleets during transition

HYDROGEN FUEL CELL ELECTRIC BUSES

PROJECTED FLEET – EXPANDED SITE w/ STEAM METHANE REFORM GENERATION

- Requires a second fueling island – piping hydrogen across the stream not ideal
- Dual fueling service needs during transition difficult
- Capital costs extremely high upfront

HYDROGEN FUEL CELL ELECTRIC BUSES

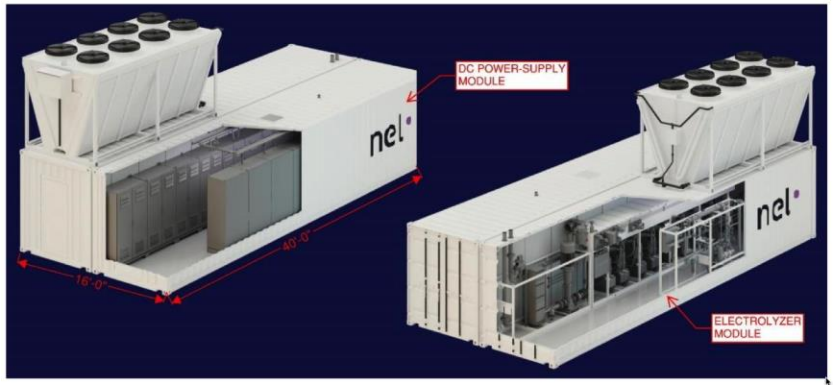
PROJECTED FLEET – EXPANDED SITE w/ HYDRO-ELECTROLYSIS GENERATION

- Ample space for hydrogen storage and dispensing equipment
- Meets hydrogen storage and setback requirements
- Allows existing fuel lanes to be utilized for both fleets during transition

HYDROGEN FUEL CELL ELECTRIC BUSES / NATURAL GAS

Findings & Recommendations

- Hydrogen fueling requires site expansion
- Liquid hydrogen delivery is the most feasible option to maintain efficient site circulation and operations
- On-site generated hydrogen cannot be efficiently piped to the existing fuel island
- Locating a new hydrogen fueling / service lanes in the expanded site across the stream introduces a chokepoint and requires multiple service patterns during transition
- Existing maintenance facility and wash bays needs extensive upgrades to ventilation, heating, lighting, and monitor / alarming systems to accept either lighter than air fuel –natural gas or hydrogen
- Difficult to retrofit the facility during continued operations
- **Hydrogen fueling is feasible but poses major operational challenges**



KEY FINDINGS

KEY FINDINGS

Battery Electric Bus

- Provide the least-cost option with the least lifecycle emissions, but will take the longest to transition
- Currently, 60% of the blocks can be completed in typical condition.
- Based on technology forecast, by 2050, all blocks can be completed by BEB
- Charge Management System will be key in reducing the number of chargers needed and peak load

Fuel Cell Electric Bus

- FCEBs are viable under multiple fueling scenarios, including on-site production. However large on-site electrolysis is extremely nascent and SMR produces GHG emissions on-site
- Currently, 95% of blocks can be completed in typical conditions.
- Based on technology forecast, by 2035 all blocks can be completed by FCEBs.
- Fueling infrastructure to support these vehicles requires a large on-site footprint and high upfront capital cost.

Cost Analysis

- On-site production of hydrogen has higher initial capital costs but a lower lifecycle cost when compared to hydrogen delivery
- Overall, BEBs have a lower lifecycle cost estimate when compared FCEBs

NEXT STEPS

RECOMMENDATIONS & NEXT STEPS

1. BPTC should consider transition timeline goals when determining best-fit technology

2. **Recommend continuing to pursue a BEB technology, however, a small-scale FCEB pilot may uncover BPTC's preferences**

3. Once fuel-type is determined, begin detailed design and conversations with key stakeholders (OEMs, utility/fuel supplier, etc.)

Questions?

wsp

Bloomington Transit

APPENDICES

APPENDIX A – BEB TECHNOLOGY FORECAST

APPENDIX B: ALTERNATIVE FUELS AND INFRASTRUCTURE ASSESSMENT STUDY

Bloomington Transit

ALTERNATIVE FUELS AND INFRASTRUCTURE ASSESSMENT STUDY

Task 2.1: Summary-Level Comparison of Battery-Electric, CNG, and Hydrogen

Prepared by: WSP
Submitted: March 25th, 2022

wsp

OUTLINE

01 | **Introduction**
(Background, Evaluation Categories)

02 | **Fuel/Technology Findings**
(Compressed Natural Gas, Battery-Electric, Fuel-Cell Electric)

03 | **Metrics Evaluation**
(Operational Impact, Social/Environmental Impact, Financial Impact)

04 | **Key Findings & Feasibility Assessment**
(Comparison Summary, Key Findings, Feasibility, Items for Consideration)

INTRODUCTION

INTRODUCTION

Objective

Prepare a feasibility analysis and initial comparison study of three alternative fuel bus technologies, compressed natural gas, battery-electric, and hydrogen fuel cell. Identify any fatal flaws with each technology as it relates to Bloomington Public Transportation Corporation (BPTC) operations, facilities, and sustainability goals.

Study Background

The BPTC is the entity of local government responsible for the provision of public transit services in the Bloomington Urbanized area. The BPTC operates two services, Bloomington Transit fixed route bus service and BT Access specialized van service for persons with disabilities.

The BPTC is at a crossroads on which alternative fuels could be used for future fleet and facilities. The resulting report of this assessment will provide BPTC policymakers the information needed to make sound decisions and guide next steps. The report will also document the competing alternative fuel technologies and the benefits and challenges, making sure a record is available for future reference.

Purpose and Assumptions

This initial summary-level assessment is provided to guide BPTC in selecting their future bus technology, which will be further evaluated in future tasks. This allows for a more strategic use of the alternative fuels planning budget.

Source: Bloomington Transit

BACKGROUND

Transit Fleet Background

BPTC fixed route service consists of 42 transit buses and has a peak vehicle requirement of 29 buses. The fixed route vehicle fleet consists of a mix of 30, 35, and 40-foot low floor buses with model years ranging from 2003 to 2021. Two 35-foot battery-electric buses (BEBs) have recently been acquired along with overnight charging stations located at the Grimes Lane administrative and maintenance facility. BPTC has approved 5339 apportionments for eight more BEBs and charging stations including a recent FY 2021 Low-No apportionment.

Source: Bloomington Transit

Facility Background

The Grimes Lane administrative and maintenance facility is a shared facility with the Indiana University Campus Bus service. The University owns the lands upon which the facility is sited and BPTC owns the facilities and structures. The existing admin/maintenance facility site is at or near capacity in terms of bus storage and operations.

Source: Bloomington Transit

PRELIMINARY TECHNOLOGY EVALUATION

Evaluation Methodology

To determine the feasibility of the three bus technologies considered, each was evaluated across three categories which include, 1) Operational Impacts, 2) Social and Environmental Impacts, and 3) Estimated Lifecycle Costs. Qualitative and quantitative metrics were provided to support the BPTC in selecting their best-fit bus technology.

The focus of this assessment was to identify any fatal flaws which would preclude the technology from successful deployment within BPTC's service network. As an initial feasibility study, many of the inputs and assumptions represent national trends; however, several metrics drew upon data specific to the BPTC's service and region. Specifically, the BPTC's GTFS service feed was used to compare bus range to service needs as well as annual fuel consumption, and the service region was evaluated for fuel availability.

Each of the evaluation categories are described in the following section. To further support the BPTC in selecting which bus technology best aligns with their needs and goals. This report will be followed with a guided Multi-Objective Decision Making Analysis (MODA), in which each metric will be provided a weighted value by the BPTC.

Evaluation Categories

1. **Operational Impact**
2. **Social & Environmental Impact**
3. **Estimated Lifecycle Costs**

EVALUATION CATEGORIES

Operational Impact

- **Vehicle Range:** The range of the fuel/technology type
- **Physical Space Requirements:** The scale of the space required to accommodate new infrastructure
- **Fueling or Charging Time:** The time it takes to fully fuel or charge the vehicle
- **Daily Energy Requirements:** The energy requirements to accommodate the vehicle type
- **Fuel:** Accessibility to fuel

Social/Environmental Impact

- **Lifecycle Greenhouse Gas (GHG) Emissions:** A measure of the cradle-to-grave GHG emissions of a fuel type
- **Local Air Quality:** A measure of tailpipe emissions, categorized by six pollutants: CO, Nitrogen Oxides, PM10, PM2.5, VOCs, and Sulfur Oxides
- **Community Acceptance:** Communities' general perception and acceptance of the specified vehicle type

Estimated Lifecycle Costs

- **Vehicle Capital Costs:** The purchase price of a vehicle
- **Infrastructure Capital Costs:** The capital costs of infrastructure to support 40 vehicles of the fuel/technology at BPTC's Grimes Lance facility
- **Operating and Maintenance Costs:** The cost per mile to operate and maintain a vehicle, inclusive of "fuel costs" and preventative maintenance costs.
- **Financial Incentives:** The availability of competitive grants and other funding.

FUEL/TECHNOLOGY FINDINGS

FUEL/TECHNOLOGIES OVERVIEW

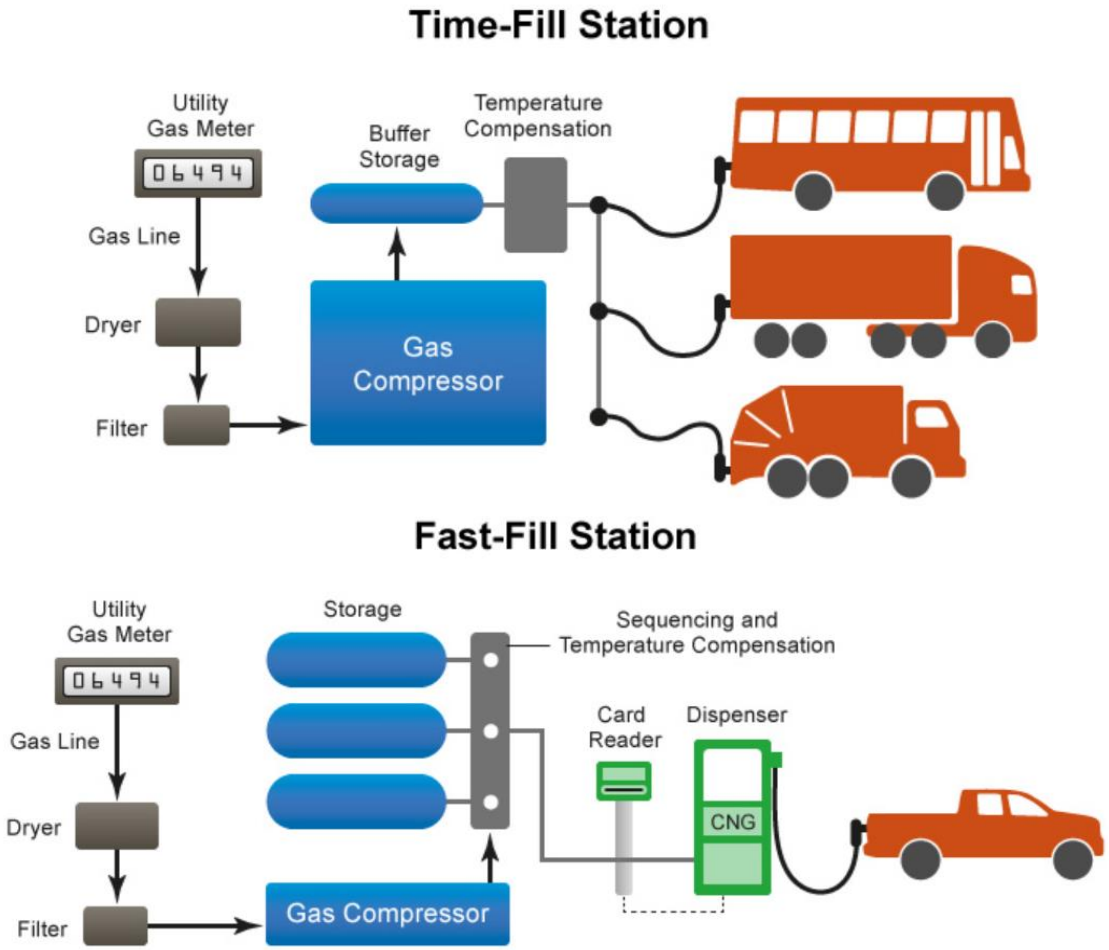
Compressed Natural Gas Buses

CNG is a cleaner burning fossil fuel alternative to diesel-powered vehicles with a more stable and less expensive price tag. These vehicles emit 90% less NOx and soot emissions, are easier and cleaner to maintain, as well as feature quieter operations and equal driving range, speed, and acceleration rates as compared to diesel buses.

CNG buses can be fueled by either fast-fill stations, time-fill stations or a combination of both. Fast-fill stations receive gas from a local gas utility and compress it to storage pressure (~4500-5000 PSI) to allow for rapid fueling similar to diesel. Time-fill stations also receive gas from the local gas utility, but utilize a much larger compressor and smaller storage for refueling during vehicle down time (~6-10) hours depending on service needs). Though fast-fill stations provide more rapid refueling, they also require more equipment and energy to operate, thus are the more expensive option. Some agencies opt for a hybrid approach which primarily uses time-fill stations, but maintain a small amount of extra storage for occasional fast-fill needs.

CNG is a *lighter-than-air gas* which may require upgrades to maintenance facilities that address ventilation and safety oversight.

CNG is readily available in just about every city or urban neighborhood almost anywhere in USA.



Source: U.S. Department of Energy

COMPRESSED NATURAL GAS BUS (CNG)

Operational Impact

- **Vehicle Range**
  - 345-400 for 40’ buses
- **Physical Space Requirements**
  - ~ 60’x50’
- **Fueling Time**
  - Fast Fill: 4-5 minutes
  - Time Fill: ~6-10 hours
- **Daily Energy Requirements**
  - Low when compared to BEBs and on-site production of FCEBs
- **Fuel Availability**
  - There are 3 local CNG suppliers: Northville NG Fuels, KAKCO CNG Fuel, and Love's Trillium. Fast fuel public fueling stations available in Indianapolis and surrounding area but not in Bloomington (American Natural Gas; JEM Energy; CNG Source Fueling; Crown Clean Fuels).

Social Equity/Environmental Impact

- **Lifecycle GHG Emissions**
  - *506.3K kgCO2e*
- **Local Air Quality**
  - *VOC= 18 kg; CO= 677 kg; NOx= 18 kg; PM10 = 2 kg; PM2.5 = 2 kg; SOX = 4 kg*
- **Community Acceptance**
  - *Mayor pushing for landfill biogas conversion to CNG and transition bus fleet to CNG; on average CNG bus operates 10 decibels lower than diesel. However, communities tend to disapprove of CNG since it creates tailpipe emissions.*

Costs

- **Vehicle Capital Costs**
  - 40’ = ~$500k (includes estimated cost for vehicle add-ons)
- **Infrastructure Capital Costs**
  - ~$2.4M for fuel tanks, station and dispensers
- **Operating and Maintenance Costs**
  - O&M Cost: ~$0.44/mi
  - Fuel Cost: ~$2.21/GGE or $0.44/mi*
  - Total: ~$0.88/mi
- **Financial Incentives**
  - Alternative Fuel Vehicle Inspection & Maintenance Inspection
  - Compressed Natural Gas Tax Credit;
  - Idle Reduction and Natural Gas Vehicle Weight Exemption
  - Volkswagen Environmental Mitigation Trust - Medium & Heavy-Duty Grant Program
  - Special Fuel Tax Exemption - exempt from state gross retail tax

* Used conversion factor 1DGE=1.136GGE and assumes 5.7mi/DGE

FUEL/TECHNOLOGIES

Battery-Electric Buses

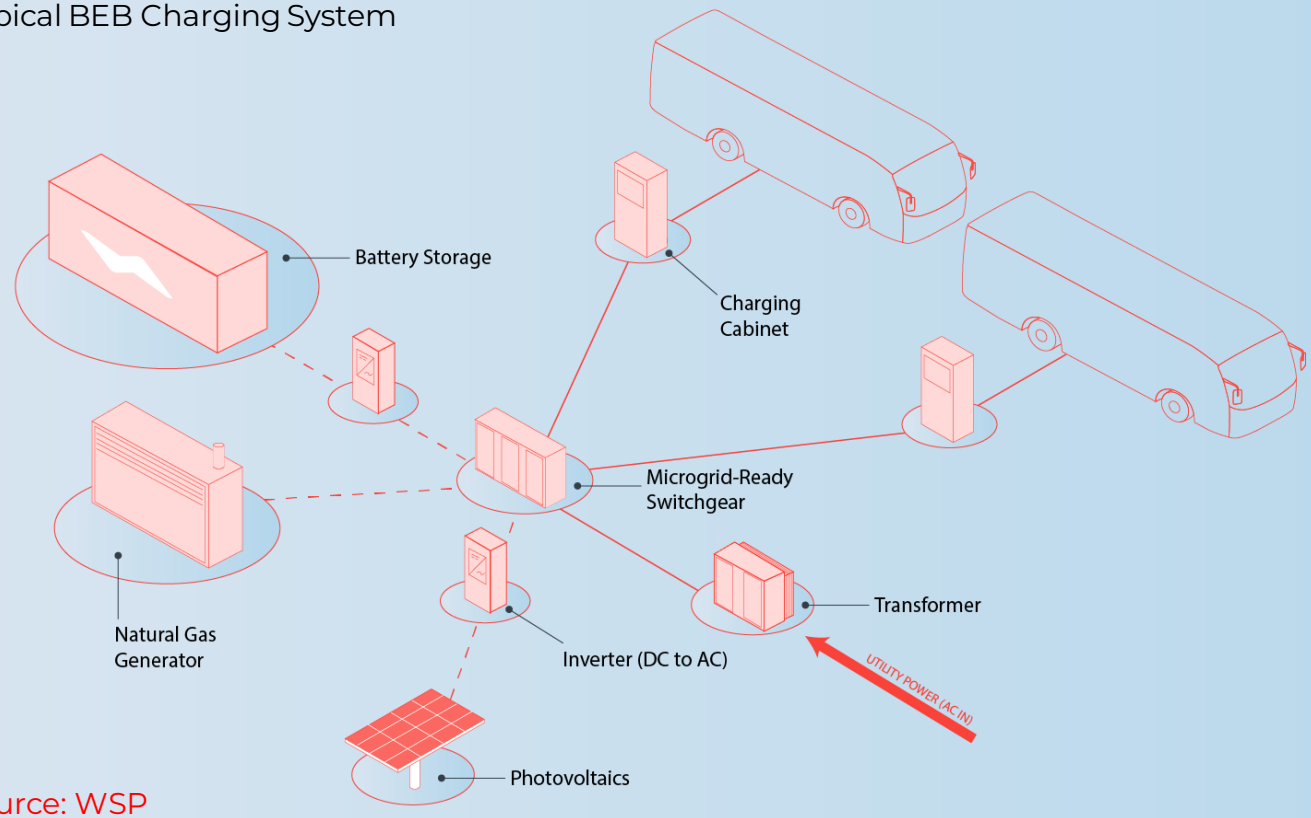
BEBs provide many environmental benefits to the community and region, as well as life-cycle cost savings to the operating agency. However, BEBs currently lack the range capabilities of other bus types.

The performance of a BEB is typically measured by the range and efficiency of the vehicle. A BEB's efficiency is expressed in kilowatt-hours per mile and can be highly variable depending on a myriad of factors, including regional climate and weather conditions, geographical topography, road sinuosity, ridership, battery health, operator driving style, and traveling speeds.

Electricity is stored in rechargeable battery packs that power an electric motor. Though larger batteries offer greater range, they also increase the weight of the BEB and reduce the efficiency. This fuel/technology would require additional infrastructure, including charging and electrical equipment.

Due to the nascency of the technology, the understanding of the staffing and training needs for both the vehicle and charging equipment is still developing. Vehicle OEMs and several charger OEMs provide training to help the transition from ICE to BEB technology.

Typical BEB Charging System



Source: WSP

BATTERY-ELECTRIC BUS (BEB)

Operational Impact

- **Average Vehicle Range (Advertised):**
  - 30' : 165 miles
  - 35' : 197 miles
  - 40' : 212 miles
- **Physical Space Requirements:**
  - Will vary based on depot layout and chargers' configuration
- **Fueling or Charging Time*:**
  - Varies based on each model acceptance rate and battery size
  - Ranging from 1.4 hours to 5 hours
  - Average of 2-3 hours
- **Daily Energy Requirements:**
  - Daily energy consumption = 11.675 MWh (assuming peak fleet daily mileage of 4670 miles)
  - Additional peak demand of 3 MW**
  - Increasing charger-to-dispenser ratio and using charge management software (CMS) can decrease the number of chargers and peak power demand
- **Fuel Availability**
  - Electricity is available as long as the site has the required equipment and enough capacity

Costs

- **Average Vehicle Capital Costs**
  - 30' : $874 K
  - 35' : $1.1 M
  - 40' : $1.1 M
- **Infrastructure Capital Costs**
  - 20 Cabinets = $2.77 M
  - Excluding costs for site preparation, utility upgrades, and other structural construction costs if BPTC prefers overhead structure
- **Operating and Maintenance Costs**
  - O&M Cost = $1.77/mile
  - Fuel Cost = $0.31/mile***
  - *Total = $ 2.08/mile*
- **Financial Incentives:** Increasing grant and fundings for ZE vehicles and related infrastructures on the federal level

Social/Environmental Impact

- **Lifecycle GHG Emissions:** 506.3K kgCO2e
- **Local Air Quality:** Nothing from tailpipe (see Appendix B).
- **Community Acceptance:** Increasing acceptance for BEB

* Based on advertised maximum acceptance rate for plug-in chargers of the bus models. Assuming buses are charging from 0-100%
** Assuming 1:2 charger to dispensers ratio, 150 kW, 20 cabinets charging simultaneously
*** If the facility falls into High Load Factor rate structure, the fuel cost will double due to the 4x higher demand charge

FUEL/TECHNOLOGIES

Hydrogen Fuel Cell Electric Buses

Fuel cell electric buses (FCEBs) are electric vehicles that use compressed hydrogen as fuel to create electricity through a fuel cell. This electricity then powers an electric drivetrain in the vehicle. These vehicles share many of the same capabilities as BEBs such as zero harmful tailpipe emissions, near silent operations, and regenerative braking (a method of capturing kinetic energy when stopping to supply additional power to the battery).

Hydrogen fuel is currently produced either by steam methane reformation (SMR) or electrolysis. SMR produces hydrogen by using heat and water to separate hydrogen molecules from methane, which results in the release of greenhouse gases. Electrolysis, on the other hand, uses electricity to split water into hydrogen and oxygen.

Transit agencies can produce hydrogen on-site via these two methods or they can have it delivered. There are currently three hydrogen fuel suppliers within a 1000-mile radius of BPTC that can provide liquid hydrogen delivery.

Hydrogen Plant Locations Relative to BPTC

Source: Google Maps

FUEL-CELL ELECTRIC BUS (FCEB)

Operational Impact

- **Vehicle Range**
  - Up to 300 – 350 miles for 40' buses
- **Physical Space Requirements**
  - Off-site Production/on-site Liquid Hydrogen Storage
    - Full System: ~40'x60' (Includes compression, storage, dispensing, and safety buffer)
  - On-site Production
    - 50'x130'
- **Fueling or Charging Time**
  - <15 minutes
- **Daily Energy Requirements**
  - Liquid Storage: ~ 2.5 kWh per kilogram (kg)
  - On-site production: ~6 kWh/kg for SMR and ~50 kWh/kg for electrolysis
- **Fuel Availability**
  - Liquid Hydrogen Delivery: There are three hydrogen plants that can deliver to Indiana. AC Transit has not missed a single delivery in a year. However, some agencies have expressed concerns regarding uncertainty with hydrogen fuel costs.
  - On-site Production: Transit agencies that have on-site hydrogen production have experienced downtime in utility outages and require an on-site backup liquid hydrogen supply

Social Equity/Environmental Impact

- **Lifecycle GHG Emissions:**
  - On-Site Production (ton CO2e):
    - Electrolysis: 1.35K
    - SMR: 0.81K
  - Hydrogen Delivery:
    - Electrolysis: 1.45K
    - SMR: 0.91K
- **Local Air Quality:** No tailpipe emissions
- **Community Acceptance:** Communities are generally more cautious with the installation of new hydrogen storage, and on-site production near their community due to the risk of hydrogen seepage and combustion.

Costs

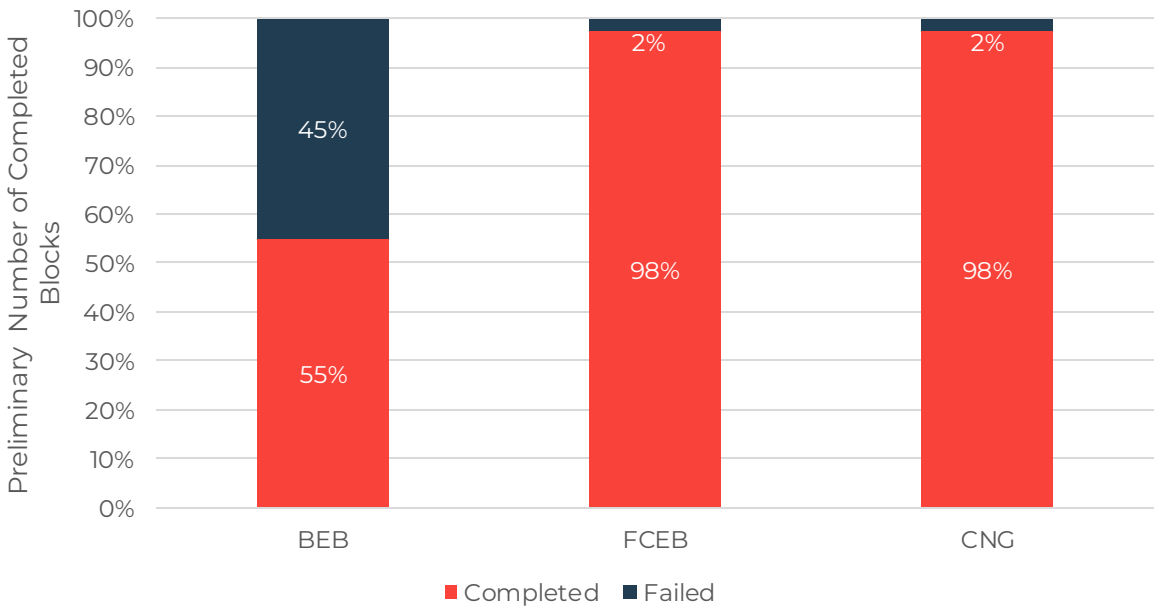
- **Vehicle Capital Costs**
  - 40': ~1.3M (includes estimated cost for vehicle add-ons)
- **Infrastructure Capital Costs****
  - Liquid Delivery
    - Full System: ~$3.8-$4.7M
    - Lighter than air facility upgrades: ~$2.0M
  - On-site Production (SMR)
    - $10M (does not include storage)
    - Lighter than air facility upgrades: ~$2.0M
  - On-site Production (Electrolysis)
    - Electrolysis (1000kg): $8.3M
    - Additional Liquid Storage: $3.8M
    - Lighter than air facility upgrades: ~$2.0M
- **Operating and Maintenance Costs*****
  - Off-site Production:
    - O&M Cost: ~$1.03/mi
    - Fuel Cost: ~$8.00/kg or ~$1.00/mile (assuming 8mi/kg)
    - Total: $2.03/mi
  - On-site Production
    - O&M Cost
      - Electrolysis: ~$1.05/mi
      - SMR: ~$1.36/mi
    - Fuel Cost: ~$5.00/kg or $0.63/mi
    - Total
      - Electrolysis: ~$1.68/mi
      - SMR: $1.99/mi
- **Financial Incentives**
  - Section 5339: Bus and Bus Facilities Formula Funds Grant
  - Section 5339(c): Low or No Emission Vehicle Program

* The lifecycle GHG emissions for gaseous hydrogen was used for this analysis
** Does not include cost of facility upgrades
***Includes fuel cost per mile. Uses an estimated $8/kg for off-site production of hydrogen fuel and $5/kg for on-site production

METRICS EVALUATION

OPERATIONAL IMPACT

Vehicle Range



- Based on the vehicle range* almost all blocks can be completed by either fuel cell or CNG technology without refueling
- Strategies can be explored to mitigate BEB failing blocks, such as on-route charging and strategic transition phasing

Metric	CNG	BEB	FCEB
40' bus range (miles)	345 – 400	133-212	300 – 350
Score	**High**	Low	Medium

Physical Space Requirements

- All fuels will need facility upgrades
- Required space varies depending on several factors including existing facility layout, charger configuration, and fuel delivery vs on-site production, etc.
- On-site hydrogen production relatively requires most space for the production equipment and storage

Metric	CNG	BEB	FCEB	
			Delivery	On-site
Physical Space Requirement	**Medium**	**Medium**	**Medium**	High

OPERATIONAL IMPACT

Fueling or Charging Time

- Varies on the type of fueling/charging configuration
- For CNG, fast-fill fueling can take a few minutes while time-fill can take several hours
- Based on BPTC's service requirements, BEBs will require between 1-5 hours to recharge. Actual charging time can vary depending on vehicle's acceptance rate, battery size, and state of charge.

Metric	CNG	BEB	FCEB
Fueling/Charge Time (hrs:min)	0:04 – 0:05 / Multiple Hours	2:00 – 3:00	<0:15
Score	Medium*	High	Low

*Average between time-fill and fast-fill was used

Energy Requirements

- BEBs typically require large utility upgrades to the site and higher daily power consumption for charging
- On-site production of hydrogen via electrolysis requires more energy than on-site production via SMR, liquid hydrogen delivery, and CNG

Metric	CNG	BEB	FCEB		
			Delivery	On-site Production	
			Liquid	SMR	Electrolysis
Energy Requirements	**Low**	High	**Low**	Medium	Medium

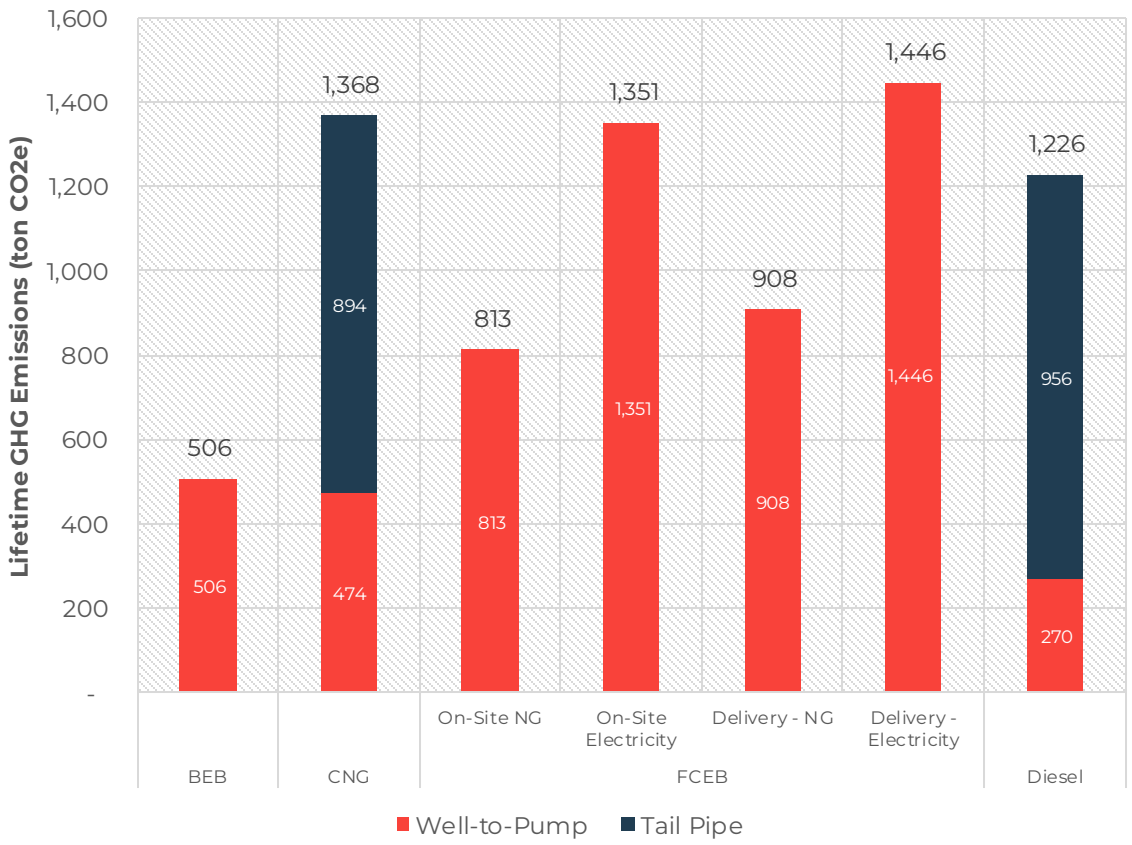
Fuel Availability

- BEBs will be charged with the site's utility power
- On-site hydrogen production will allow for hydrogen to be available at any time
- Odd-site production of hydrogen is dependent on fuel suppliers meeting their scheduled deliveries
- CNG is readily available and typically accessed via pipelines

Metric	CNG	BEB	FCEB	
			Delivery	on-site
Fuel Availability	Medium	**High**	Medium	**High**

SOCIAL/ENVIRONMENTAL IMPACT

Lifecycle GHG Emissions*



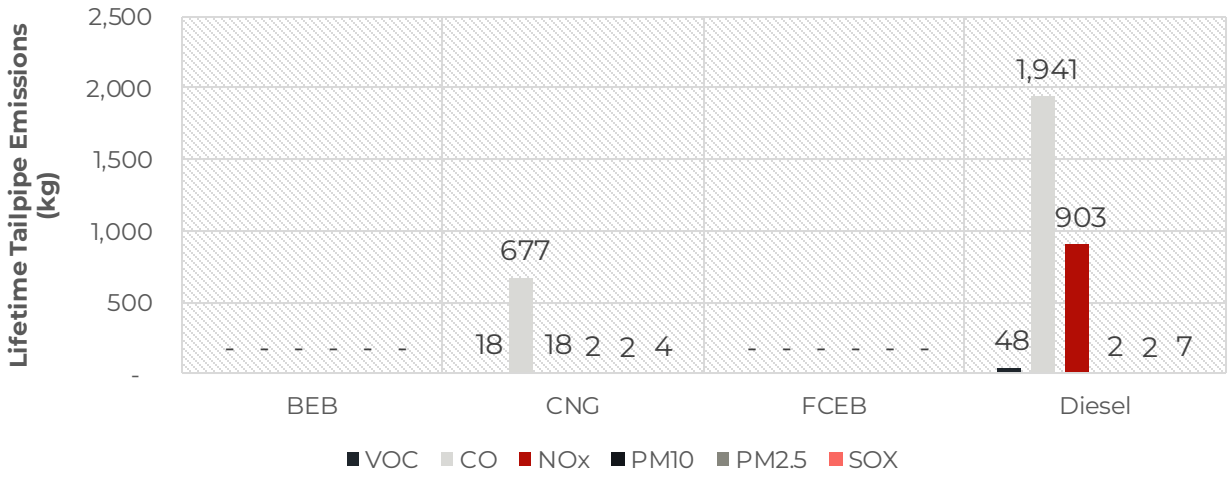
- **BEB** has the **least lifecycle GHG emissions in total**. Upstream emissions can be reduced if the grid mix becomes cleaner
- **CNG bus and hydrogen produced from electricity** have **higher total emissions** compared to diesel because the **higher upstream emissions**
- Despite not having any tailpipe emissions, **FCEB has substantial upstream emissions,** either from natural gas SMR or from electricity generation that mostly comes from fossil fuels

Metric	CNG	BEB	FCEB (Gaseous Hydrogen)			
			On-Site		Delivered	
			Natural Gas	Electricity	Natural Gas	Electricity
Lifecycle GHG (ton CO2e)	1.37	0.51	0.81	1.35	0.91	1.45
Score	High	**Low**	Medium	High	Medium	High

*Note: GHG emissions based on current regional grid fuel mix and does not consider future shifts to renewable energy which will significantly lower emissions.

SOCIAL/ENVIRONMENTAL IMPACT

Local Air Quality*



- **BEB** and **FCEB** have NO tailpipe emissions
  - However, fuel cell produced through electrolysis has the highest upstream NOx, PM10, PM2.5, and SOx emissions (see Appendix C)
- **CNG** bus has significantly lower emissions compared to diesel
  - However, CNG has the highest VOC and CO upstream emissions (see Appendix C)

Metric	CNG	BEB	FCEB (Gaseous Hydrogen)			
			On-Site		Delivered	
			Natural Gas	Electricity	Natural Gas	Electricity
Tailpipe Emissions (kg)	721	0	0	0	0	0
Score	High	Low	Low	Low	Low	Low

Community Acceptance

- BEBs are widely accepted by communities and supported in terms of sustainability initiatives
- Communities are generally more cautious around FCEBs due to the risk of hydrogen seepage and combustion
- CNG creates tailpipe emissions and therefore receives the lowest score

Metric	CNG	BEB	FCEB	
			Delivery	On-site
Community Acceptance	Low	**High**	Medium	Low

ESTIMATED LIFECYCLE COSTS*

Vehicle Capital Costs

- CNG vehicles have been on the market much longer than BEBs and FCEBs
- The cost of BEBs and FCEBs are expected to decrease as technology advances

Metric	CNG	BEB	FCEB
40' bus cost	$500K	$1.1M	$1.3M
Score	Low	High	High

Infrastructure Capital Costs

- The infrastructure capital costs for CNG, liquid hydrogen delivery, and BEBs range between approximately $2.5M - $5M
- On-site production of FCEBs have much higher capital costs at approximately $12M
- These estimates do not include facility or utility upgrades since they vary greatly between transit agencies

Metric	CNG	BEB	FCEB		
			Delivered	On-site Production	
			Liquid	SMR	Electrolysis
Infrastructure Capital Costs	$2.4M	$2.8M	$4.7M	$10M	$12.1M
Score	Medium	Medium	Medium	High	High

Operating & Maintenance Costs

- CNG vehicles have the lowest O&M costs when compared o BEBs and FCEBs
- The cost of hydrogen and electricity are also expected to decrease in the upcoming years

Metric	CNG	BEB	FCEB		
			Delivered	On-site Production	
			Liquid	SMR	Electrolysis
O&M Costs**	$0.88/mi	$2.08/mi	$2.03/mi	$1.99/mi	$1.68/mi
Score	**Low**	High	High	High	Medium

**Includes fuel cost

Financial Incentives

- There are several federal incentives for implementing BEBs and FCEBs since the country is moving towards net zero emissions
- In the state of Indiana, there are more CNG incentives than BEBs and FCEBs

Metric	CNG	BEB	FCEB
Financial Incentives	Medium	High	High

KEY FINDINGS & PRELIMINARY RECOMMENDATIONS

COMPARISON SUMMARY

Metric	CNG	BEB	FCEB		
			Delivered	On-site Production	
			Liquid	SMR	Electrolysis
Vehicle Range	**High**	Low	Medium	Medium	Medium
Physical Space Requirements	**Medium**	**Medium**	**Medium**	High	High
Fueling/Charging Time	Medium*	High	**Low**	**Low**	**Low**
Fuel Availability	Medium	**High**	Medium	**High**	**High**
Energy Requirements	**Low**	High	**Low**	Medium	Medium
Lifecycle GHG Emissions	High	**Low**	Medium/High**	Medium**	High**
Tailpipe Emissions	High	**Low**	**Low**	**Low**	**Low**
Community Acceptance	Low	**High**	Medium	Medium	Medium
Vehicle Cost	**Low**	High	High	High	High
Infrastructure Capital Costs* **	**Medium**	**Medium**	**Medium**	High	High
O&M Costs	**Low**	High	High	High	Medium
Financial Incentives	Medium	**High**	**High**	**High**	**High**

* Average between time-fill and fast-fill was used in this comparison analysis
** The lifecycle GHG emissions for gaseous hydrogen was used for this analysis
** Does not include cost of facility or utility upgrades

KEY FINDINGS*

Operational Impact

FCEB and CNG buses have an operational advantage due to the longer vehicle ranges. All three technologies have adequate time to refuel / recharge based on BPTC's service schedule. BEBs fall short of ~55% of the BPTC's block distances, but mitigations strategies such as strategic transition phasing and opportunity charging may supplement shortfalls.

Social/Environmental Impact

Battery-electric buses provide greater social and environmental benefits compared to other fuels due to lower lifetime GHG emissions, zero tailpipe emissions, and high community acceptance. FCEBs produce zero tailpipe emissions, however, most of the hydrogen produced in the U.S. is made via SMR which produces upstream emissions. CNG is a fossil fuel, thus has the lowest score in this category.

Financial Impact

CNG buses currently are the most affordable technology due to lower vehicle, infrastructure, and O&M costs, although, federal grants may preclude this technology in the near future. BEBs have the lowest costs in the zero-emission category, however FCEBs are expected to become more affordable as the technology matures. On-site production of hydrogen fuel may recover some of the FCEB operating costs, however, these technologies are relatively nascent, thus unpredictable and expensive.

*Based on scores applied to the metrics: 1 = Technology with the worst performance, 2 = Medium performance, 3 = Best performance

CONCLUSION & NEXT STEPS

1. No fatal flaws identified for any of the technologies. Successful implementation of FCEBs and CNG may require procurement of adjacent property, which is not considered in the financial calculations.

2. Zero-emissions goals and timelines should be considered in technology selection

3. Assessment of available space for infrastructure and Multi-Objective Decision Making Analysis (MODA) is recommended as a next step

4. Technology deep-deep dive including refined costs, site design recommendations, and service recommendations to follow selection of preferred technology

MODA INPUT

Evaluation Category	Evaluation Metric	Description	Rating (1-5)
Operational Impact	Vehicle Range	The range of the fuel/technology type.	
	Physical Space Requirements	The scale of the space required to accommodate new infrastructure	
	Fueling or Charging Time	The time it takes to fully fuel or charge the vehicle.	
	Energy Requirements	The energy required to accommodate the vehicle type	
	Disaster Resiliency	The possibility of operating the service during disasters	
Social Equity/ Environmental Impact	Life cycle GHG Emissions	A measure of GHG emissions.	
	Elimination of Fossil Fuel Vehicles by 2035	Whether or not the fuel/technology will result in an elimination of fossil fuel vehicles by 2035	
	Local Air Quality	A measure of tailpipe emissions, categorized by six pollutants: CO, Nitrogen Oxides, PM10, PM2.5, VOCs, and Sulfur Oxides	
	Community Acceptance	Communities' general perception and acceptance of the specified vehicle type	
Lifecycle Costs	Vehicle Capital Costs	The purchase price of a vehicle	
	Infrastructure Capital Costs	The capital costs of infrastructure to support 40 vehicles of the fuel/technology at BPTC's Grimes Lance facility	
	Lifetime Operating and Maintenance Costs	The annual costs to operate and maintain a vehicle, inclusive of "fuel costs", preventative maintenance, retirement, and overhaul costs.	
	Financial Incentives	The availability of competitive grants and other funding.	
Availability	Fuel	Accessibility to fuel	
	Technology	Technological availability such as available vehicle components	
	Training	Accessibility to operation and maintenance training	

APPENDIX

APPENDIX A - LIST OF ASSUMPTIONS FOR EMISSIONS CALCULATION

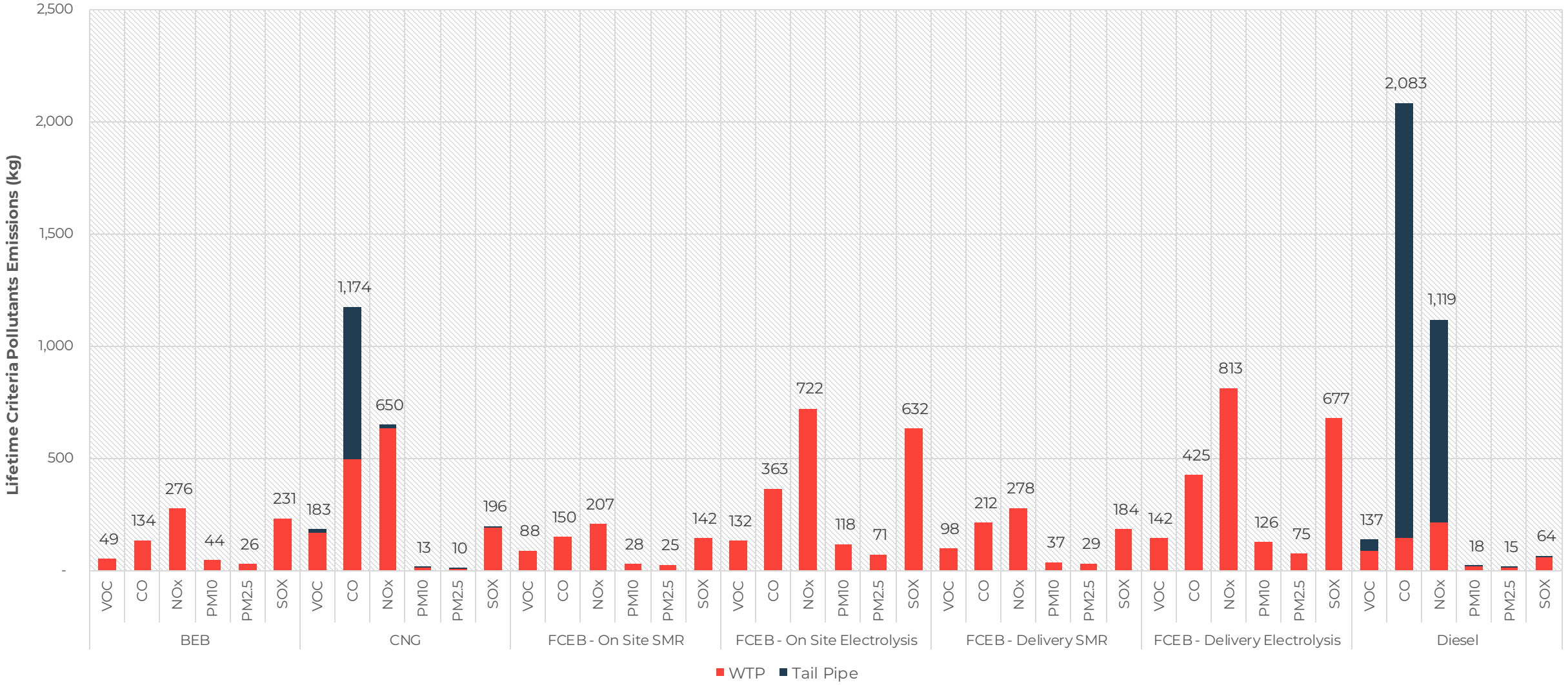
	Unit	CNG	BEB	FCEB	Notes
Vehicle Useful Life	Years	12			
Annual VMT	Miles	37,623			Based on average block distance assuming 261 days of service
Average Fuel Use	MPDGE	3.9	14.8	7.4	Number is sourced from peer agencies
Upstream Fuel Pathways		North America CNG Mix	Electricity: PJM Mix (Former RFC)	For Pathways that use Electricity: PJM Mix	Pathway as defined by GREET Model

APPENDIX B – GHG EMISSIONS AND CRITERIA POLLUTANTS

Emissions	BEB		CNG		FCEB								Diesel	
					On-Site Production				Delivery					
					Natural Gas		Electricity		Natural Gas		Electricity			
	WTP	Tail Pipe	WTP	Tail Pipe	WTP	Tail Pipe	WTP	Tail Pipe	WTP	Tail Pipe	WTP	Tail Pipe	WTP	Tail Pipe
GHG-20*	1.1214	0	1.0491	1.9802	1.8002	0	2.9915	0	2.0109	0	3.2022	0	0.5978	2.1179
VOC	1.10E-04	0	3.66E-04	3.98E-05	1.94E-04	0	2.92E-04	0	2.17E-04	0	3.15E-04	0	1.97E-04	1.06E-04
CO	2.97E-04	0	0.0011	0.0015	3.31E-04	0	8.05E-04	0	4.69E-04	0	9.42E-04	0	3.14E-04	0.0043
NOx	6.10E-04	0	0.0014	3.93E-05	4.58E-04	0	0.0016	0	6.17E-04	0	0.0018	0	4.78E-04	0.002
PM10	9.77E-05	0	2.38E-05	4.49E-06	6.30E-05	0	2.61E-04	0	8.16E-05	0	2.80E-04	0	3.49E-05	4.47E-06
PM2.5	5.86E-05	0	1.82E-05	3.97E-06	5.51E-05	0	1.56E-04	0	6.49E-05	0	1.66E-04	0	2.96E-05	4.11E-06
SOX	5.12E-04	0	4.26E-04	8.92E-06	3.15E-04	0	0.0014	0	4.07E-04	0	0.0015	0	1.27E-04	1.46E-05

* GHG-20 is in kgCO2e and inclusive of CO2, CH4, and N2O

APPENDIX C – LIFETIME CRITERIA POLLUTANT EMISSIONS



MPO Policy Committee

Presented by Jeff Jackson, Transportation Demand Manager, ESD - September 9, 2022

GO BLOOMINGTON
MOBILITY OPTIONS FOR A BETTER COMMUTE

CITY OF BLOOMINGTON

Transportation Demand Management

- The Transportation Demand Management (TDM) Plan was prepared in May 2020 – **The TDM Mission is reduce the number of single occupant vehicles (SOV)** operating within Bloomington.
- **Reducing SOV's will decrease carbon emissions, relieve traffic congestion, and increase parking capacity**
- The Transportation Demand Manager was hired on November 1, 2021
- Jeff Jackson's background
- Three competitive selection processes were completed to hire contractors to brand the TDM program, develop the website with a software matching platform.
- Budget funds were encumbered prior to the end of the 2021 calendar year

Branding – Q1

- The Affirm Agency recommended several logo names, designs and taglines.
- **Go Bloomington** was selected as the new TDM brand
- The selected tagline is **Mobility Options for a Better Commute**

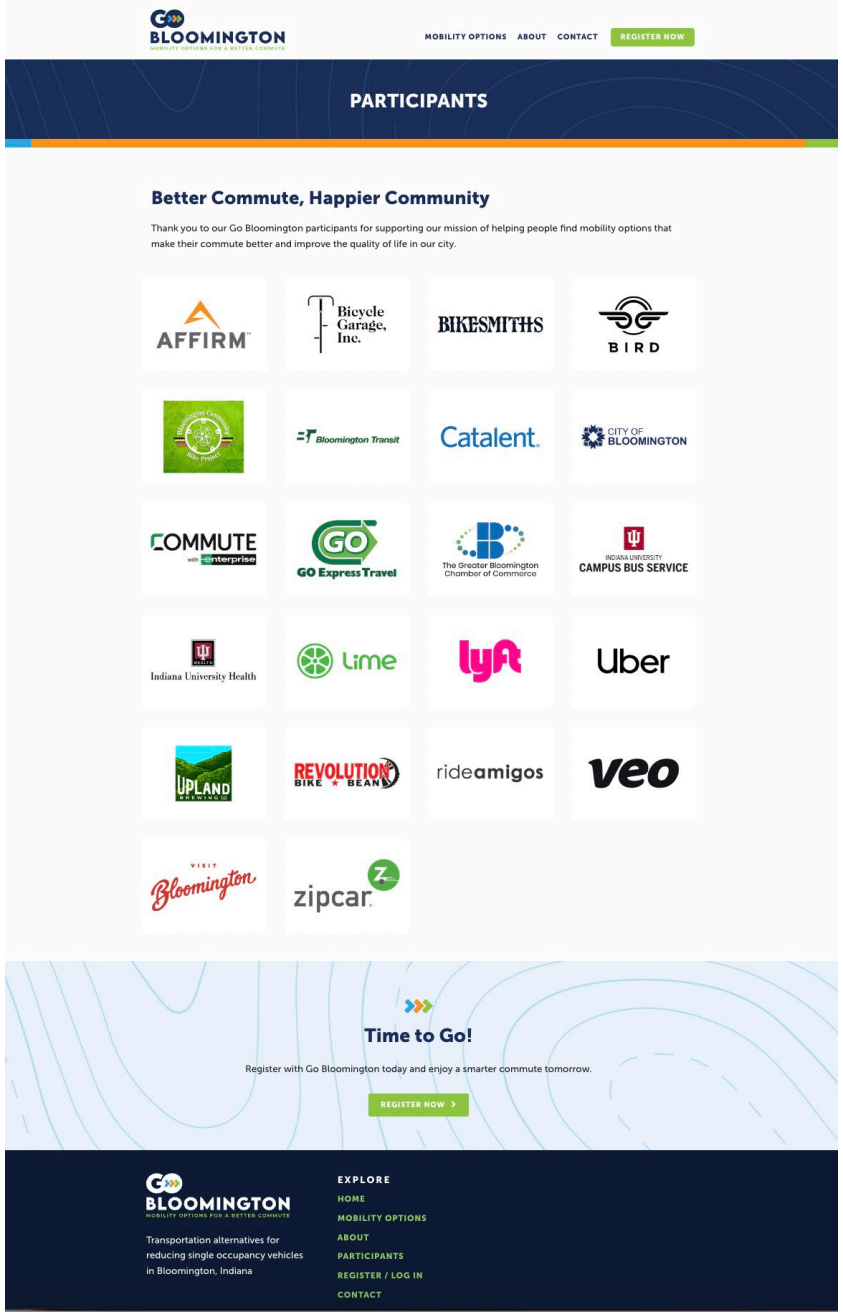
Website Development – Q2

- The Affirm Agency was hired to design, develop, and implement the new website
- GoBloomington.org **is the new domain name**
- Ride Amigos has local DNA and was hired to integrate their software matching program into the website

Marketing Plan – Q3 & Q4

- The Affirm Agency designed, developed and is implementing the marketing plan
- The marketing plan includes the following components; BT exterior bus ads, banners within the street right -of-way, banners within the B -Line right -of-way, utility bill leaflet, rack cards, posters, online advertising including pay -per-clicks ads, and social media
- Social media platforms to include Facebook, Instagram and LinkedIn
- **The formal launch occurred on September 6, 2022 at 2:00 p.m. in front of City Hall**

Employer, Business, and Community Participants



Federal Funding Opportunities

- Federal Transit Administration (FTA) – Bloomington Transit (BT) is this areas designated recipient of federal funding. Go Bloomington is required to submit all FTA grants through BT

- Federal Highway Administration (FHWA) – The new Infrastructure Bill includes **Carbon Reduction Formula Funding**. **TDM programs are specifically eligible for these funds.** The vast majority of TDM's are located in urbanized, non-attainment areas and therefor are funded by Congestion Mitigation Air Quality (CMAQ) grants. Go Bloomington is not eligible for CMAQ funding because Bloomington is not a non-attainment area. **This funding source is the only other federal funding opportunity designed specifically for TDM's such as Go Bloomington.**

Budget and Federal Funding Request

- **2023 - Proposed Budget** - as of August 25, 2022

General Fund	$68,871	(Local)
LIT	$160,000	(Local)
ARPA	$89,500	(Federal)
TOTAL	**$318,371**	

- **Carbon Reduction Formula Funding Request** **Amount**

20%	$45,774	(Local)
80%	**$183,097**	**(Federal)**
100%	$228,871	

GO BLOOMINGTON
MOBILITY OPTIONS FOR A BETTER COMMUTE

CITY OF BLOOMINGTON

Questions ?

Thank You !

INDIANA DEPARTMENT OF TRANSPORTATION

100 North Senate Avenue
Room N758
Indianapolis, Indiana 46204

PHONE: (855) 463-6848

Eric Holcomb, Governor
Michael Smith, Commissioner

August 25, 2022

To: Anderson MCCOG, Bloomington BMCMPO, Cincinnati OKI, Columbus CAMPO, Evansville EMPO, Fort Wayne NIRCC, Indianapolis IMPO, Kokomo KHCGCC, Lafayette TPAPC, Louisville KIPDA, Muncie DMMPC, Northwest Indiana NIRPC, South Bend MCAG, Terre Haute THAMPO

Subject: INDOT's 2- and 4-Year Pavement and Bridge Transportation Performance Management Targets

The Indiana Department of Transportation (INDOT), pursuant to 23 CFR 490, has established new 2- and 4-year infrastructure targets.

These are:

Measure	2 Yr Target (2024)	4 Yr Target (2026)
Percentage of NHS Bridges Classified as in Good Condition	49.0%	47.5%
Percentage of NHS Bridges Classified as in Poor Condition	3.0%	3.0%
Percentage of Pavements of the Interstate System in Good Condition	60.0%	62.0%
Percentage of Pavements of the Interstate System in Poor Condition	1.0%	1.0%
Percentage of Pavements of the Non-Interstate NHS in Good Condition	50.0%	48.0%
Percentage of Pavements of the Non-Interstate NHS in Poor Condition	1.5%	1.5%

MPO's have 180 days from the date of this memo to formally support INDOT's targets or establish their own. Please send us your resolutions as you get them.

Please contact Todd Shields with any questions (tshields@indot.in.gov).

Thank you.

Louis Feagans Jr

Louis Feagans
Managing Director of Asset Management
Indiana Department of Transportation

INDOT New Infrastructure Target Update

Todd Shields

August 25, 2022

NextLevel INDIANA

New Transportation Asset Management Plan (TAMP)

- A new TAMP must be submitted and certified every 4 years
- INDOT's new TAMP was submitted June 24
- Status – Approved August 22

Transportation Performance Management (TPM)

- 4 year performance period
  - Baseline Performance Period (BPP)
    - Beginning of the 4 year period, where we set our 2 and 4 year targets
  - Mid Performance Period
    - 2 year period
    - We may change our 4 year target at this point
  - Full Performance Period (FPP)
    - Final report on how we did on our 4 year target

- The Performance Management Form will open for both BPP and FPP September 1, INDOT has until October 1 to submit.

INDOT's Target Setting Approach

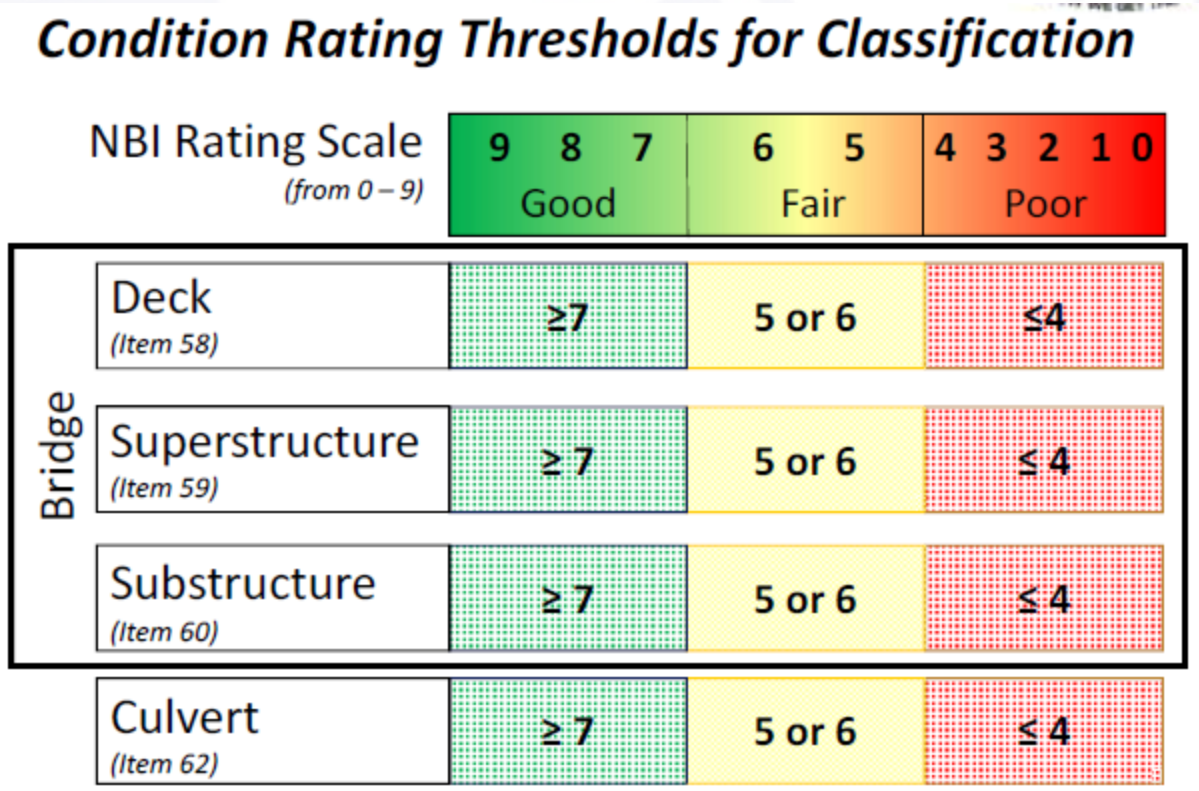
- We have a 5 year committed program
  - We know what projects we will be doing over the 4 year performance period
- We are continually improving our dTIMS modeling
  - Both Pavement and Bridge can model using TPM metrics
- We have our FHWA bridge and pavement conditions for data year 2021
- Our aim is to set realistic but achievable targets
  - FHWA advises *against* "aspirational" targets
  - There are really no "penalties" for not meeting a target
  - HOWEVER there are penalties if we are:
    - >5.0% Poor for Interstate Pavement
    - >10.0% Poor NHS Bridges over a 3 year period

Bridge

- How are conditions calculated?
- 3 components:
  - Deck
  - Superstructure
  - Substructure

  OR

- 1 component:
  - Culvert (if a bridge culvert)



Bridge

- 3 components:
  - Deck
  - Superstructure
  - Substructure

Condition Rating Thresholds for Classification

	NBI Rating Scale (from 0 – 9)	9 8 7 Good	6 5 Fair	4 3 2 1 0 Poor
Bridge	Deck (Item 58)	≥7	5 or 6	≤4
	Superstructure (Item 59)	≥ 7	5 or 6	≤ 4
	Substructure (Item 60)	≥ 7	5 or 6	≤ 4
	Culvert (Item 62)	≥ 7	5 or 6	≤ 4

- If all 3 are “good”, the bridge is “good”
- If any 1 is “poor”, the bridge is “poor”
- All bridges are weighted to deck area
  - A very large bridge can actually move the needle one way or the other

NextLevel INDIANA

Proposed Bridge Targets

						OLD 2018-2022		NEW 2022-2024	
Measure	**2017**	**2018**	**2019**	**2020**	**2021****	**2 Yr Target**	**4 Yr Target**	2 Yr Target	4 Yr Target
Percentage of NHS Bridges Classified as in Good Condition	50.0%	49.7%	48.0%	49.9%	50.5%	48.3%	47.2%	49.0%	47.5%
Percentage of NHS Bridges Classified as in Poor Condition	2.3%	2.0%	2.6%	1.9%	2.3%	2.6%	3.1%	3.0%	3.0%

Pavement

- How are conditions calculated?
- 3 components (HMA or PCCP):
  - Roughness (IRI)
  - Rutting (HMA) or Faulting (PCCP)
  - Cracking

  OR

- 2 components (CRCP):
  - Roughness (IRI)
  - Cracking

Pavement Condition Thresholds

	Good	Fair	Poor
IRI (inches/mile)	<95	95-170	>170
Rutting (inches)	<0.20	0.20-0.40	>0.40
Faulting (inches)	<0.10	0.10-0.15	>0.15
Cracking (%)	<5	5-20 (asphalt) 5-15 (JCP) 5-10 (CRCP)	>20 (asphalt) >15 (JCP) >10 (CRCP)

NextLevel INDIANA

Pavement

- 3 components (HMA or PCCP):
  - Roughness (IRI)
  - Rutting (HMA) or Faulting (PCCP)
  - Cracking

- If all 3 are “good”, the pavement is “good”
- If 2 or more are “poor”, the pavement is “poor”
  - This is why our TPM “Poor” numbers are always so low
  - Cannot correlate TPM metric to INDOT’s KPI (IRI)

Pavement Condition Thresholds

	Good	Fair	Poor
IRI (inches/mile)	<95	95-170	>170
Rutting (inches)	<0.20	0.20-0.40	>0.40
Faulting (inches)	<0.10	0.10-0.15	>0.15
Cracking (%)	<5	5-20 (asphalt) 5-15 (JCP) 5-10 (CRCP)	>20 (asphalt) >15 (JCP) >10 (CRCP)

NextLevel INDIANA

Proposed Pavement Targets

							OLD 2018-2022		NEW 2022-2024	
Performance Measure	**2016**	**2017**	**2018**	**2019**	**2020**	**2021 Report Card**	**2 Yr Target**	**4 Yr Target**	2 Yr Target	4 Yr Target
Percentage of Pavements of the Interstate System in Good Condition	69.62%	73.60%	67.30%	56.50%	70.10%	73.2%		50.0%	60.0%	62.0%
Percentage of Pavements of the Interstate System in Poor Condition	0.26%	0.40%	0.20%	0.50%	0.30%	0.4%		0.8%	1.0%	1.0%
Percentage of Pavements of the Non-Interstate NHS in Good Condition	40.81%	44.30%	43.90%	44.80%	54.20%	61.0%	78.7%	40.0%	50.0%	48.0%
Percentage of Pavements of the Non-Interstate NHS in Poor Condition	4.22%	2.30%	1.90%	0.90%	0.70%	0.4%	3.1%	3.1%	1.5%	1.5%

What's Next from the TPM Universe?

- INDOT's annual TAMP consistency determination was July 20
  - That was the last one for "old" TAMP
- Begin implementation of new TAMP, approved August 22, 2022
- Next round of Performance Reporting (PMF) is October 2022
  - For Data Year 2021
  - This is the final year of the initial 4 year reporting period
  - INDOT will enter new 2 and 4 year targets for next performance period

- INDOT will send a letter formalizing these.
- MPO's have 180 days from date of letter to formally support INDOT's PM 2 targets or establish their own
- Other PM3 Targets Status

NextLevel INDIANA

Questions???

Todd Shields

Indiana Department of Transportation

tshields@indot.in.gov

STIP AMENDMENT and/or MODIFICATION REQUEST

Amendment
Modification
Grouped Project

Date: Aug 2022

Requestor: INDOT

Sponsor	DES	Route	Work Type	Location	County	District	Miles	Federal Category	Asset Program - (State Projects Only)	Phase	Federal	Match	2022	2023	2024	2025	Remarks	Letting Date	MPO
INDOT	**1902020**	Various	Traffic Signal Visibility Improvements	Signal visibility at various intersections in Monroe County	Monroe	Seymour	0	STP	Safety	CN	$500,000	$250,000		$750,000			Increase FY 23 CN funds		BMCMPO
INDOT	**1900098**	SR 46	Replace Superstructure	At Jacks Defeat Creek WBL6.04 Mi W of SR 37	Monroe	Seymour	0	NHS	Bridge	RW	$44,000	$11,000		$55,000			Move RW from FY 22 to FY23		BMCMPO
INDOT	**2000311**	SR 46	Replace Superstructure	over Jacks Defeat Creek EB 4.83 mi W of SR 37	Monroe	Seymour	0	NHS	Bridge	CN	$568,768	$142,192			$710,960		Add project to TIP		BMCMPO
INDOT	**1900331**	SR 46	HMA Overlay, Structural	SR 446 to W jct SR 135	Monroe Brown	Seymour	15.24	NHS	Roadway	RW	$60,000	$15,000		$75,000			Add RW in TIP		BMCMPO
INDOT	**2001983**	SR 46	Small Structure Replacement	5.05 mile E of SR 446	Monroe	Seymour	0	NHS	Bridge	RW	$16,000	$4,000			$20,000		Add RW to TIP		BMCMPO
INDOT	**1900331**	SR 46	HMA Overlay, Structural	SR 446 to W jct SR 135	Monroe Brown	Seymour	15.24	NHS	Roadway	CN	$12,661,386	$3,165,347				$15,826,733	Add CN to TIP		BMCMPO
INDOT	**2100808**	SR 48	Small Structure Replacement	Over Unnamed Ditch, 2.34 miles E of SR 43	Monroe	Seymour	0	STP	Bridge	PE	$162,640	$40,660		$203,300			Increase PE		BMCMPO
INDOT	**1901791**	Various	Pavement Markings	Various Locations in Seymour District	Various	Seymour	0	HSIP	Safety	CN	$441,000	$49,000			$490,000		Add CN to TIP		BMCMPO