Y2-107 Robison Park-Weed Lake [METC] (Clear Spring) 345kV

Generation Interconnection

Network Impacts

The Queue Project #Y2-107 was studied as a 200.0MW (Capacity 26.0MW) injection as a tap of the Robison Park – Weed Lake 345 kV line in the AEP area. Project #Y2-107 was evaluated for compliance with reliability criteria for summer peak conditions in 2016. Potential network impacts were as follows:

The impact of the proposed generating facility on the AEP System was assessed for adherence with applicable reliability criteria. AEP planning criteria require that the transmission system meet performance parameters prescribed in the AEP FERC Form 715[1] and Connection Requirements for AEP Transmission System[2]. Therefore, these criteria were used to assess the impact of the proposed facility on the AEP System. Y2-107 was studied as a 200 MW (26 MW capacity) wind generating facility consistent with the interconnection application. Project #Y2-107 was evaluated for compliance with reliability criteria for summer peak conditions in 2016.

Option #1 Robison Park (AEP) – Weed Lake(-Argenta) (METC) 345 kV line

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

No problems were identified.

Multiple Facility Contingency

(Double Circuit Tower Line contingencies only for the full energy output. Stuck breaker and bus fault contingencies will be performed for the Impact Study)

No problems were identified.

Short Circuit

No problems identified

Light Load Analysis

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1 https://www.aep.com/about/codeofconduct/oasis/transmissionstudies/GuideLines/2012%20AEP%20PJM%20FERC%20715_Final_Part%204.pdf

2 https://www.aep.com/about/codeofconduct/OASIS/TransmissionStudies/Requirements/AEP_Interconnection_Requirements_rev0.pdf

Light Load Studies will be conducted during later study phases (applicable to wind, coal, nuclear, and pumped storage projects).

Stability Analysis

Stability analysis will be performed as part of the Impact Study.

Normal System (2016 Summer Conditions Full Output)

PJM identified overloads:

- No problem identified

AEP identified overloads:

- The EAST LIMA – NEW LIBERTY 138 KV line (from bus 242989 to bus 243057 ckt 1) Overloads from 99% to 103.3% of its normal rating 150MVA for non-contingency condition.
    - The 336.4 ~30/7 ACSR conductor section 2 is the limiting element.
        - The overload on this line will expose project Y2-107 to curtailment for summer peak conditions. The IC can choose to upgrade the 138 kV line to mitigate the overload.
        - If the IC chooses to upgrade the 138 kV line instead of generation curtailment a sag check will be required for the 336.4 30/7 ACSR Conductor Section2 to determine if the line section can be operated above its normal rating of 150MVA. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 25.96 miles section of the line would need to be rebuilt.
- The EAST LIMA – NORTH WOODCOCK 138 KV line (from bus 242989 to bus 243067 ckt 1) Overloads from 96.2% to 101.1% of its normal rating 167MVA for non-contingency condition.
    - The 397.5 ~30/7 ACSR conductor section 1 is the limiting element.
        - The overload on this line will expose project Y2-107 to curtailment for summer peak conditions. The IC can choose to upgrade the 138 kV line to mitigate the overload.

- The GRABIL OHIO POWER – ROBISON PARK 138 KV line (from bus 243014 to bus 243366 ckt 1) Overloads from 99.4% to 103.9% of its normal rating 223MVA for non-contingency condition.

    - The 636 26/7 ACSR conductor section 2 is the limiting element.

        - The overload on this line will expose project Y2-107 to curtailment for summer peak conditions. The IC can choose to upgrade the 138 kV line to mitigate the overload.

    - If the IC chooses to upgrade the 138 kV line instead of generation curtailment a sag check will be required for the 636 ~26/7 ACSR Conductor Section2 to determine if the line section can be operated above its normal rating of 223MVA. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 21 miles section of the line would need to be rebuilt.

- The GRABIL OHIO POWER – SOUTH HICKSVILLE 138 KV line (from bus 243014 to bus 243086 ckt 1) Overloads from 95.7% to 100.3% of its normal rating 223MVA for non-contingency condition.

    - The 636 26/7 ACSR conductor section 1 is the limiting element.

        - The overload on this line will expose project Y2-107 to curtailment for summer peak conditions. The IC can choose to upgrade the 138 kV line to mitigate the overload.

        - If the IC chooses to upgrade the 138 kV line instead of generation curtailment a sag check will be required for the 636 ~26/7 ACSR Conductor Section1 to determine if the line section can be operated above its normal rating of 223MVA. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 14 miles section of the line would need to be rebuilt.

- The LOCKWOOD ROAD – SOUTH HICKSVILLE 138 KV line (from bus 243029 to bus 243086 ckt 1) Overloads from 94.0% to 100.3% of its normal rating 223MVA for non-contingency condition.

    - The 636 26/7 ACSR conductor section 1 is the limiting element.

        - The overload on this line will expose project Y2-107 to curtailment for summer peak conditions. The IC can choose to upgrade the 138 kV line to mitigate the overload.

- If the IC chooses to upgrade the 138 kV line instead of generation curtailment a sag check will be required for the 636 ~26/7 ACSR Conductor Section1 to determine if the line section can be operated above its normal rating of 223MVA. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 12 miles section of the line would need to be rebuilt.

Single Contingency (2016 Summer Conditions Full Output)

- No problem identified

Multiple Contingency (2016 Summer Conditions Full Output)

PJM identified overloads:

- No problem identified

AEP identified overloads:

1. The FOSTORIA CENTRAL – WEST END FOSTORIA 138 KV line (from bus 243006 to bus 243137 ckt 1) Overloads from 91.4% to 102.9% of its emergency rating 296MVA for the line fault with failed breaker contingency outage of CONTINGENCY DESRIPTION (517_C2).

   Contingency '517_C2'
   Open branch from bus 242936 to bus 913440 ckt 1 / 242936 05FOSTOR 345 913440 Y2-069 TAP 345 1
   Open branch from bus 238889 to bus 242936 ckt 1 / 238889 02LEMOYN 345 242936 05FOSTOR 345 1
   END

   - The 1033.5 ~45/7 ACSR conductor section 1 is the limiting element.

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

PJM identified overloads:

2. The ROBISON PARK 345/138 KV transformer (from bus 243231 to bus 243366 ckt 5) loads from 102.15% to 102.48% (DC power flow) of its emergency rating (818MVA) for

the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('6692_C2_05E LIMA 345-M'). This project contributes approximately 16.61 MW to the thermal violation.

```
CONTINGENCY '6692_C2_05E LIMA 345-M'
 OPEN BRANCH FROM BUS 242935 TO BUS 247503 CKT 1                 /
242935 05E LIMA 345 247503 05T130_C 345 1
OPEN BRANCH FROM BUS 242935 TO BUS 242989 CKT 2                 /
242935 05E LIMA 345 242989 05E LIMA 138 2
END
```

- The ROBISON PARK 345/138 kV transformer and the Robison Park Sub conductor 2-1700 MCM AAC low side risers are the limiting elements.

Please refer to Appendix 1 for a table containing the generators having contribution to this flowgate.

3. The MADDOX-T130 C 345 kV line (from bus 246929 to bus 247503 ckt 1) loads from 101.15% to 101.36% (DC power flow) of its emergency rating (1400 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('2906_C2_05MARYSV 765-A1'). This project contributes approximately 17.66 MW to the thermal violation.

```
CONTINGENCY '2906_C2_05MARYSV 765-A1'
OPEN BRANCH FROM BUS 242926 TO BUS 242928 CKT 1                 /
242926 05MALIS 765 242928 05MARYSV 765 1
 OPEN BRANCH FROM BUS 242928 TO BUS 242939 CKT 1                /
242928 05MARYSV 765 242939 05MARYSV 345 1
OPEN BRANCH FROM BUS 239133 TO BUS 242939 CKT 1                 /
239133 02TANGY 345 242939 05MARYSV 345 1
END
```

Please refer to Appendix 2 for a table containing the generators having contribution to this flowgate.

- The 1275 ACSR/PE ~54/19 East Lima – Maddox 345 kV line conductor section 1 and the Sub conductor 2156 ACSR ~84/19 STD East Lima risers are the limiting elements.

4. The BENTON 345/138 kV transformer (from bus 243212 to bus 243250 ckt 1) loads from 142.63% to 142.92% (DC power flow) of its emergency rating (564 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('7027_C2_05COOK 345-N_MOAB'). This project contributes approximately 10.2 MW to the thermal violation.

CONTINGENCY '7027_C2_05COOK 345-N_MOAB'
OPEN BRANCH FROM BUS 243212 TO BUS 243215 CKT 1 / 243212 05BENTON 345 243215 05COOK 345 1
OPEN BRANCH FROM BUS 243215 TO BUS 247502 CKT 2 / 243215 05COOK 345 247502 05T094 345 2
END

- The Benton 345/138 kV transformer and the Benton Harbor relay compliance trip are the limiting element.

Please refer to Appendix 5 for a table containing the generators having contribution to this flowgate.

5. The LEMOYNE-DAVIS BESSE 345 kV line (from bus 238889 to bus 238654 ckt 1) loads from 114.37% to 114.54% (DC power flow) of its emergency rating (1684 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('C2-BRK-WR117'). This project contributes approximately 17.25 MW to the thermal violation.

CONTINGENCY 'C2-BRK-WR117' /* DAVIS-BESSE BK-34561 345
REMOVE MACHINE 1 FROM BUS 238670 /* 02DVBSG1 25.00
DISCONNECT BUS 238670 /* 02DVBSG1 25.00
DISCONNECT BRANCH FROM BUS 238654 TO BUS 238563 CKT 1 /* 02DAV-BE 345.00 02BAY SH 345.00
END

Please refer to Appendix 4 for a table containing the generators having contribution to this flowgate.

6. The 05BENTON 345/138 kV transformer (from bus 243212 to bus 243250 ckt 1) loads from 142.63% to 142.92% (DC power flow) of its emergency rating (564 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('7027_C2_05COOK 345-N_MOAB'). This project contributes approximately 10.2 MW to the thermal violation.

CONTINGENCY '7027_C2_05COOK 345-N_MOAB'
OPEN BRANCH FROM BUS 243212 TO BUS 243215 CKT 1 / 243212 05BENTON 345 243215 05COOK 345 1
OPEN BRANCH FROM BUS 243215 TO BUS 247502 CKT 2 / 243215 05COOK 345 247502 05T094 345 2
END

Please refer to Appendix 6 for a table containing the generators having contribution to this flowgate.

7. The Beaver-Avon 345 kV line (from bus 238569 to bus 238551 ckt 1) loads from 147.34% to 147.5% (DC power flow) of its emergency rating (1030 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('C2-BRK-CR017'). This project contributes approximately 10.43 MW to the thermal violation.

```
CONTINGENCY 'C2-BRK-CR017'                              /* BEAVER
345KV BRK NEW
DISCONNECT BRANCH FROM BUS 238569 TO BUS 238551 CKT 2
/* 02BEAVER 345.00 02AVON 345.00
DISCONNECT BRANCH FROM BUS 238569 TO BUS 238570 CKT 2
/* 02BEAVER 345.00 02BEAVER 138.00
  END
```

Please refer to Appendix 7 for a table containing the generators having contribution to this flowgate.

8. The Monroe-Y1-069 TAP 345 kV line (from bus 264612 to bus 913450 ckt 1) loads from 154.76% to 156.29% (DC power flow) of its emergency rating (1494 MVA) for the tower line contingency outage of CONTINGENCY DESCRIPTION ('C5-TWL-WR021'). This project contributes approximately 23.07 MW to the thermal violation.

```
CONTINGENCY 'C5-TWL-WR021'                              /* ALLEN JCT-
MAJESTIC-MONROE 345KV & LEYMONE-MAJESTIC 345KV
DISCONNECT BRANCH FROM BUS 238530 TO BUS 264594 CKT 1
/* 02ALLEN 345.00 19LULU 345.00
        DISCONNECT BRANCH FROM BUS 264594 TO BUS 264839 CKT 1
/* 19LULU 345.00 19MILAN 345.00
DISCONNECT BRANCH FROM BUS 264594 TO BUS 264613 CKT 1
/* 19LULU 345.00 19MON34 345.00
DISCONNECT BRANCH FROM BUS 238889 TO BUS 264599 CKT 1
/* 02LEMOYN 345.00 19MAJTC 345.00
END
```

Please refer to Appendix 8 for a table containing the generators having contribution to this flowgate.

9. The 02BEAVER-02CARLIL 345 kV line (from bus 238569 to bus 238607 ckt 1) loads from 171.25% to 171.45% (DC power flow) of its emergency rating (1030 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('C2-BRK-NR125'). This project contributes approximately 12.5 MW to the thermal violation.

```
CONTINGENCY 'C2-BRK-NR125'                    /* BREAKER
FAILURE ON S145 BREAKER AT AVON 345KV
    DISCONNECT BRANCH FROM BUS 238569 TO BUS 238551 CKT 1
/* 02BEAVER 345.00 02AVON 345.00
    DISCONNECT BRANCH FROM BUS 238569 TO BUS 238551 CKT 2      /
    * 02BEAVER 345.00 02AVON 345.00
     END
```

Please refer to Appendix 9 for a table containing the generators having contribution to this flowgate.

10. The 02BEAVER-02CARLIL 345 kV line (from bus 238569 to bus 238607 ckt 1) loads from 171.26% to 171.45% (DC power flow) of its emergency rating (1030 MVA) for the tower line contingency outage of CONTINGENCY DESCRIPTION ('C5-TWL-NR054'). This project contributes approximately 12.5 MW to the thermal violation.

```
CONTINGENCY 'C5-TWL-NR054'                    /* AVON-
BEAVER #1 AND #2 345KV LINE OUTAGES
DISCONNECT BRANCH FROM BUS 238551 TO BUS 238569 CKT 1
/* 02AVON 345.00 02BEAVER 345.00
DISCONNECT BRANCH FROM BUS 238551 TO BUS 238569 CKT 2
/* 02AVON 345.00 02BEAVER 345.00
 END
```

Please refer to Appendix 10 for a table containing the generators having contribution to this flowgate.

11. The 02BEAVER-02AVON 345 kV line (from bus 238569 to bus 238551 ckt 2) loads from 192.46% to 192.68% (DC power flow) of its emergency rating (1030 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('C2-BRK-CR016'). This project contributes approximately 13.93 MW to the thermal violation.

```
CONTINGENCY 'C2-BRK-CR016'                    /* BEAVER 345KV
BRK B-121
    DISCONNECT BRANCH FROM BUS 238569 TO BUS 238551 CKT 1
    /* 02BEAVER 345.00 02AVON 345.00
    DISCONNECT BRANCH FROM BUS 238569 TO BUS 238607 CKT 1
    /* 02BEAVER 345.00 02CARLIL 345.00
    END
```

Please refer to Appendix 11 for a table containing the generators having contribution to this flowgate.

AEP identified overloads:

- The MADDOX – T-130 C 345 kV line (from bus 246929 to bus 247503 ckt 1) Overloads from 154.4% to 157.5% of its normal rating 897MVA for the single line contingency outage of CONTINGENCY DESRIPTION (7441_B2_TOR100545).

  Contingency '7441_B2_TOR100545'
  Open branch from bus 242928 to bus 299951 ckt 1 / 242928 05MARYSV 765 299951 05SOREN 765 1
  END

  - The 1275 ~54/19 ACSR/PE East Lima – Maddox 345 kV line conductor section 1 and the sub conductor 2 2156 ACSR ~84/19 STD East Lima risers are the limiting elements.

    - The overload on this line will expose project Y2-107 to curtailment for summer peak conditions. The IC can choose to upgrade the 345 kV line to mitigate the overload.
      If the IC chooses to upgrade the line a sag study will be required for the 1275 ACSR/PE ~54/19 conductor section 1 to determine if the line section can be operated above its emergency rating of 1400 MVA. The results of the sag study could prove that no additional upgrade is necessary, that some upgrades on the circuit are necessary, or that the 8 miles of the Maddox – T-130 345 kV line would need to rebuild and also need to replace the East Lima Risers.

- The EAST LIMA – NEW LIBERTY 138 KV line (from bus 242989 to bus 243057 ckt 1) Overloads from 101.6% to 107.3% of its emergency rating 219MVA for single line contingency outage of CONTINGENCY DESRIPTION (724_B2_TOR581_woMOP).

  Contingency '7249_B2_TOR601761'
  Open branch from bus 243250 to bus 243396 ckt 1 / 243250 05BENTON 138 243396 05WESTST 138 1
  Open branch from bus 243307 to bus 243396 ckt 1 / 243307 05HARTFO 138 243396 05WESTST 138 1
  Open branch from bus 243396 to bus 246497 ckt 1 / 243396 05WESTST 138 246497 WEST ST 12.0 1
  END

  - The 336.4 30/7 ACSR conductor section 2 and 397.5 30/7 ACSR conductor section 1 are the limiting elements.

- The overload on this line will expose project Y2-107 to curtailment for summer peak conditions. The IC can choose to upgrade the 138 kV line to mitigate the overload.

- If the IC chooses to upgrade the 138 kV line a sag check will be required for the 336.4 30/7 conductor section 2 and the 397.5 30/7 ACSR Conductor Section 1 to determine if the line section can be operated above its normal rating of 219MVA. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 25.96 miles section of the lines would need to be rebuilt.

- The EAST LIMA – NORTH WOODCOCK 138 KV line (from bus 242989 to bus 243067 ckt 1) Overloads from 115.7% to 121.8% of its emergency rating 205MVA for the single line contingency outage of CONTINGENCY DESRIPTION (724_B2_TOR581_woMOP).

  Contingency '7249_B2_TOR601761'
  Open branch from bus 243250 to bus 243396 ckt 1 / 243250 05BENTON 138 243396 05WESTST 138 1
  Open branch from bus 243307 to bus 243396 ckt 1 / 243307 05HARTFO 138 243396 05WESTST 138 1
  Open branch from bus 243396 to bus 246497 ckt 1 / 243396 05WESTST 138 246497 WEST ST 12.0 1
  END

  - The 397.5 30/7 ACSR conductor section 1 is the limiting element.

    - The overload on this line will expose project Y2-107 to curtailment for summer peak conditions. The IC can choose to upgrade the 138 kV line to mitigate the overload.

- The NORTH FINDLAY – NORTH WOODCOCK 138 KV line (from bus 243059 to bus 243067 ckt 1) Overloads from 127.6% to 135.0% of its emergency rating 167MVA for the single line contingency outage of CONTINGENCY DESRIPTION (724_B2_TOR581_woMOP).

  Contingency '7249_B2_TOR601761'
  Open branch from bus 243250 to bus 243396 ckt 1 / 243250 05BENTON 138 243396 05WESTST 138 1
  Open branch from bus 243307 to bus 243396 ckt 1 / 243307 05HARTFO 138 243396 05WESTST 138 1
  Open branch from bus 243396 to bus 246497 ckt 1 / 243396 05WESTST 138 246497 WEST ST 12.0 1
  END

- The 397.5 30/7 ACSR conductor section 1 and the 556.5 26/7 conductor section 2 are the limiting elements.

    - The overload on this line will expose project Y2-107 to curtailment for summer peak conditions. The IC can choose to upgrade the 138 kV line to mitigate the overload.

    - If the IC chooses to upgrade the 138 kV line a sag check will be required for the 397.5 ~ 30/7 ACSR conductor section 1 and the 556.5 ~ 26/7 conductor section 2 to determine if the line section can be operated above its emergency rating of 167MVA. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 18 miles section of the line would need to be rebuilt.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. "Network Impacts", initially caused by the addition of this project generation)

1. The Mitigation plan for the overload of the Fostoria Central – West End Fostoria 138 kV line:

- The 1033.5 ~ 45/7 ACSR conductor section 1 is the limiting element.

    - A sag study will be required for the 1033.5 45/7 ACSR conductor section 1 to determine if the line section can be operated above its emergency rating of 296MVA. The results of the sag study could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 1.54 miles section of the line would need to be rebuilt.

        - **Estimated cost for the sag study (2013 Dollar): $6,160.**

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

2. Mitigation plan for the overload of the Robison Park 345/138 kV transformer:

- The ROBISON PARK 345/138 kV transformer and the Robison Park Sub conductor 2-1700 MCM AAC low side risers are the limiting elements.

    - Replace the Robison Park 345/138 kV transformer.

- **Estimated cost (2013 Dollars): $6,000,000.**

- Replace the Robison Park low side Risers.
  - **Estimated cost (2013 Dollars): $300,000.**

3. Mitigation plan for the overload of the Maddox – T130 C 345 kV line:

- The 1275 ACSR/PE ~54/19 East Lima – Maddox 345 kV line conductor section 1 and the Sub conductor 2156 ACSR 84/19 STD East Lima risers are the limiting elements.

  - A sag study will be required for the 1275 ACSR/PE ~54/19 conductor section 1 to determine if the line section can be operated above its emergency rating of 1400 MVA. The results of the sag study could prove that no additional upgrade is necessary, that some upgrades on the circuit are necessary, or that the 8 miles of the Maddox – T-130 345 kV line would need to rebuild.
    - **Estimated cost for the sag study (2013 Dollars): $32,000.**

  - Replace the East Lima risers.
    - **Estimated Cost (2013 Dollars): $300,000.**

4&6. The mitigation plan for the overload of the Benton 345/138 kV transformer:

- The Benton 345/138 kV transformer and the Benton Harbor relay compliance trip are the limiting elements.

  - Replace the Benton 345/138 kV transformer.
    - **Estimated cost (2013 Dollars): $6,000,000.**

  - A engineering study need to be conducted to determine if the Benton Harbor relay thermal limit settings can be adjusted to mitigate the overload. A new relay package will be required if the relay thermal settings can't be adjusted.
    - **Estimated cost (2013 Dollars) for the relay package: $300,000.**

4.

5. The mitigation plan for the overload of the Lemoyne-Davis Besse 345 kV line:

   Construct a Davis Besse-Lemoyne #2 345kV line, on the open side of the existing towers (21.5 miles). Modify Davis Besse and Lemoyne substations accordingly. This upgrade requires expansion of the existing fence line at the Davis Besse power plant substation. This work will require the Ohio Power Siting Board's approval prior to starting construction. Further evaluation will be performed in the System Impact Study phase to determine if expanding the fence line requires obtaining property rights. Please note that there is no guarantee that FirstEnergy can obtain said rights via negotiation. Estimated cost w/ tax: $16,756,700;

Estimated cost w/o tax: **$13,406,300**; Estimated time: 32 months

6.
7. The mitigation plan for the overload of the Beaver-Avon 345 kV line:

   Replace the Beaver #1 345kV line wave trap with a 3000A rating at Avon. Estimated cost w/ tax: $88,900; Estimated cost w/o tax: **$71,100**; Estimated time: 8 mos
   Replace the Avon #1 345kV line wave trap with a 3000A rating at Beaver. Estimated cost w/ tax: $84,800; Estimated cost w/o tax: **$67,800**; Estimated time: 8 mos

8. The mitigation plan for the the overload on the Monroe-Y1-069 TAP 345 kV line:

   Loop the Lemoyne-Majestic 345kV tie-line between FE and ITC into ITC's Monroe substation. Relay setting and nameplate changes at Lemoyne substation. Estimated cost w/ tax: $27,200; Estimated cost w/o tax: **$21,700**; Estimated time: 4 months
   Note from ATSI: ITC would need to comment on the feasibility and cost of this proposed project. It would seem to require 3.1 miles of new double-circuit 345kV to loop the line into Monroe sub, as well as substation modifications. No reinforcement from ITC is required at this time. This violation will be further analyzed and co-ordinated with ITC in the Impact Study phase if interconnection option #1 is selected.

9, 10. The mitigation plan for the overload on the Beaver-Carlisle 345 kV line:

   Replace a wave trap at Beaver substation. The total cost for this work is **$73,400** and taxes are $17,600 for a grand total of $91,000

12. The mitigation plan for the overload on the Beaver-Avon 345 kV line:

   Move the Avon #1 345 kV line termination to the new Avon #2 row of circuit breakers. Relocate existing breaker B161 in order to complete the breaker and a half string. Estimated cost w/ tax: $1,083,100; Estimated cost w/o tax: **$866,500**; Estimated time: 16 mos

Delivery of Energy Portion of Interconnection Request

(PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.
Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission

Interconnection Request, a subsequent analysis will be performed, which will study all overload conditions associated with the overloaded element(s) identified.)

1. The 19MON12-Y1-069 TAP 345 kV line (from bus 264612 to bus 913450 ckt 1) loads from 104.71% to 104.89% (DC power flow) of its normal rating (1262 MVA) for non-contingency condition. This project contributes approximately 13.56 MW to the thermal violation.

2. The T-130 C-E LIMA 345 kV line (from bus 247503 to bus 242935 ckt 1) loads from 117.85% to 118.07% (DC power flow) of its emergency rating (1177 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('B_TRAN_SY_105'). This project contributes approximately 16.3 MW to the thermal violation.

```
CONTINGENCY 'B_TRAN_SY_105'                              /* TRAN 05MARYSV
765 TO 05MARYSV 345 CK 1
DISCONNECT BRANCH FROM BUS 242928 TO BUS 242939 CKT 1          /*
05MARYSV 765.00 05MARYSV 345.00
 DISCONNECT BRANCH FROM BUS 242939 TO BUS 239133 CKT 1          /*
05MARYSV 345.00 02TANGY 345.00
 END
```

Option #2 Collingwood (AEP) – Hiple (NIPSCO) 345 kV line

Generator Deliverability
(Single or N-1 contingencies for the Capacity portion only of the interconnection)

No problems were identified.

Multiple Facility Contingency
(Double Circuit Tower Line contingencies only for the full energy output. Stuck breaker and bus fault contingencies will be performed for the Impact Study)

No problems were identified.

Short Circuit

No problems identified

Light Load Analysis

Light Load Studies will be conducted during later study phases (applicable to wind, coal, nuclear, and pumped storage projects).

Stability Analysis

Stability analysis will be performed as part of the Impact Study.

Normal System (2016 Summer Conditions Full Output)

PJM identified overloads:

- No problem identified

AEP identified overloads:

- The EAST LIMA – NEW LIBERTY 138 KV line (from bus 242989 to bus 243057 ckt 1) Overloads from 99% to 103.7% of its normal rating 150MVA for non-contingency condition.
    - The 336.4 30/7 ACSR conductor section 2 is the limiting element.
- The EAST LIMA – NORTH WOODCOCK 138 KV line (from bus 242989 to bus 243067 ckt 1) Overloads from 96.2% to 101.5% of its normal rating 167MVA for non-contingency condition.
    - The 397.5 30/7 ACSR conductor section 1 is the limiting element.
- The GRABIL OHIO POWER – ROBISON PARK 138 KV line (from bus 243014 to bus 243366 ckt 1) Overloads from 99.4% to 104.5% of its normal rating 223MVA for non-contingency condition.
    - The 636 26/7 ACSR conductor section 2 is the limiting element.
- The GRABIL OHIO POWER – SOUTH HICKSVILLE 138 KV line (from bus 243014 to bus 243086 ckt 1) Overloads from 95.7% to 100.8% of its normal rating 223MVA for non-contingency condition.
    - The 636 26/7 ACSR conductor section 1 is the limiting element.
- The LOCKWOOD ROAD – SOUTH HICKSVILLE 138 KV line (from bus 243029 to bus 243086 ckt 1) Overloads from 94.0% to 101.0% of its normal rating 223MVA for non-contingency condition.
    - The 636 26/7 ACSR conductor section 1 is the limiting element.

Multiple Contingency (2016 Summer Conditions Full Output)

PJM identified overloads:

- No problem identified

AEP identified overloads:

- The FOSTORAI CENTRAL – WEST END FOSTORIA 138 KV line (from bus 243006 to bus 243137 ckt 1) Overloads from 91.4% to 102.9% of its emergency rating 296MVA for the line fault with failed breaker contingency outage of CONTINGENCY DESRIPTION (517_C2).

  Contingency '517_C2'
  Open branch from bus 242936 to bus 913440 ckt 1 / 242936 05FOSTOR 345 913440 Y2-069 TAP 345 1
  Open branch from bus 238889 to bus 242936 ckt 1 / 238889 02LEMOYN 345 242936 05FOSTOR 345 1
  END

  - The 1033.5 45/7 ACSR conductor section 1 is the limiting element.

Contribution to Previously Identified Overloads
(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

1. The 05ROB PK 345/138 kV transformer (from bus 243231 to bus 243366 ckt 5) loads from 102.15% to 102.46% (DC power flow) of its emergency rating (818 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('6692_C2_05E LIMA 345-M'). This project contributes approximately 15.43 MW to the thermal violation.

CONTINGENCY '6692_C2_05E LIMA 345-M'
OPEN BRANCH FROM BUS 242935 TO BUS 247503 CKT 1 / 242935 05E LIMA 345 247503 05T130_C 345 1
OPEN BRANCH FROM BUS 242935 TO BUS 242989 CKT 2 / 242935 05E LIMA 345 242989 05E LIMA 138 2
END

Please refer to Appendix 1 for a table containing the generators having contribution to this flowgate.

2. The 05MADDOX-T-130 C 345 kV line (from bus 246929 to bus 247503 ckt 1) loads from 101.16% to 101.39% (DC power flow) of its emergency rating (1400 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('2906_C2_05MARYSV 765-A1'). This project contributes approximately 19.96 MW to the thermal violation.

CONTINGENCY '2906_C2_05MARYSV 765-A1'
OPEN BRANCH FROM BUS 242926 TO BUS 242928 CKT 1 / 242926 05MALIS 765 242928 05MARYSV 765 1

OPEN BRANCH FROM BUS 242928 TO BUS 242939 CKT 1 / 242928 05MARYSV 765 242939 05MARYSV 345 1
OPEN BRANCH FROM BUS 239133 TO BUS 242939 CKT 1 / 239133 02TANGY 345 242939 05MARYSV 345 1
END

Please refer to Appendix 2 for a table containing the generators having contribution to this flowgate.

3. The 05SOREN 765/345 kV transformer (from bus 243232 to bus 299951 ckt 1) loads from 100.66% to 101.94% (DC power flow) of its emergency rating (3040 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('2904_C2'). This project contributes approximately 40.08 MW to the thermal violation.

CONTINGENCY '2904_C2'
OPEN BRANCH FROM BUS 243206 TO BUS 299951 CKT 1 / 243206 05DUMONT 765 242928 05SOREN 765 1
OPEN BRANCH FROM BUS 242922 TO BUS 242928 CKT 1 / 242922 05FLTLCK 765 242928 05MARYSV 765 1
END

Please refer to Appendix 3 for a table containing the generators having contribution to this flowgate.

4. The 05SOREN-05MARYSV 765 kV line (from bus 299951 to bus 242928 ckt 1) loads from 124.84% to 125.02% (DC power flow) of its emergency rating (4465 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('709_C2_05HANG R 765-D2'). This project contributes approximately 51.36 MW to the thermal violation.

CONTINGENCY '709_C2_05HANG R 765-D2'
OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1
END

Please refer to Appendix 4 for a table containing the generators having contribution to this flowgate.

5. The 05SOREN-05MARYSV 765 kV line (from bus 299951 to bus 242928 ckt 1) loads from 128.35% to 128.53% (DC power flow) of its emergency rating (4465 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('6189_C2_05HANG R 765-D1'). This project contributes approximately 51.36 MW to the thermal violation.

CONTINGENCY '6189_C2_05HANG R 765-D1'

OPEN BRANCH FROM BUS 242921 TO BUS 242924 CKT 1 / 242921 05CORNU 765 242924 05HANG R 765 1
OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1
END

Please refer to Appendix 5 for a table containing the generators having contribution to this flowgate.

6. The 05SOREN-05MARYSV 765 kV line (from bus 299951 to bus 242928 ckt 1) loads from 133.86% to 134.06% (DC power flow) of its emergency rating (4465 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('2932_C2_05JEFRSO 765-A2'). This project contributes approximately 54.27 MW to the thermal violation.

CONTINGENCY '2932_C2_05JEFRSO 765-A2'
OPEN BRANCH FROM BUS 242924 TO BUS 243208 CKT 1 / 242924 05HANG R 765 243208 05JEFRSO 765 1
OPEN BRANCH FROM BUS 243208 TO BUS 248000 CKT 1 / 243208 05JEFRSO 765 248000 06CLIFTY 345 1
END

Please refer to Appendix 6 for a table containing the generators having contribution to this flowgate.

7. The 02BEAVER-02AVON 345 kV line (from bus 238569 to bus 238551 ckt 2) loads from 192.46% to 192.64% (DC power flow) of its emergency rating (1030 MVA) for the line fault with failed breaker contingency outage of CONTINGENCY DESCRIPTION ('C2-BRK-CR016'). This project contributes approximately 11.49 MW to the thermal violation.

CONTINGENCY 'C2-BRK-CR016' /* BEAVER 345KV BRK B-121
DISCONNECT BRANCH FROM BUS 238569 TO BUS 238551 CKT 1 /* 02BEAVER 345.00 02AVON 345.00
DISCONNECT BRANCH FROM BUS 238569 TO BUS 238607 CKT 1 /* 02BEAVER 345.00 02CARLIL 345.00
END

Please refer to Appendix 7 for a table containing the generators having contribution to this flowgate.

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

None

Contribution to Previously Identified System Reinforcements

(Overloads initially caused by prior Queue positions with additional contribution to overloading by this project. This project may have a % allocation cost responsibility which will be calculated and reported for the Impact Study)

(Summary form of Cost allocation for transmission lines and transformers will be inserted here if any)

None

Delivery of Energy Portion of Interconnection Request

(PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed, which will study all overload conditions associated with the overloaded element(s) identified.)

1. The T-130 C-05E LIMA 345 kV line (from bus 247503 to bus 242935 ckt 1) loads from 117.85% to 118.11% (DC power flow) of its emergency rating (1177 MVA) for the single line contingency outage of CONTINGENCY DESCRIPTION ('B_TRAN_SY_105'). This project contributes approximately 18.43 MW to the thermal violation.

```
CONTINGENCY 'B_TRAN_SY_105'                    /* TRAN 05MARYSV 765 TO
05MARYSV 345 CK 1
  DISCONNECT BRANCH FROM BUS 242928 TO BUS 242939 CKT 1        /*
05MARYSV 765.00 05MARYSV 345.00
  DISCONNECT BRANCH FROM BUS 242939 TO BUS 239133 CKT 1        /*
05MARYSV 345.00 02TANGY 345.00
  END
```

Option #1

Appendix 1

Bus Number	Bus Name	Full Contribution
246936	05BLCK-1_C	.62
247927	05BLCK-1_E	12.17
246937	05BLCK-2_C	.62
247928	05BLCK-2_E	12.17
246938	05BLCK-3_C	.63
247929	05BLCK-3_E	12.38
242933	05CONVOY	1.4
247537	S-072 C	7.87
247904	S-072 E	31.48
247503	T-130 C	7.87
247906	T-130 E	31.48
907111	X1-040 C	3.61
907112	X1-040 E	24.17
LTF	X2-042	4.9
LTF	X3-097	6.42
LTF	X3-098	6.09
LTF	X4-041	6.02
LTF	Y1-002	9.57
LTF	Y2-007	6.28
LTF	Y2-008	5.47
LTF	Y2-056	6.48
LTF	Y2-068	32.24
LTF	Y2-082	20.05
914491	Y2-107 C OP1	2.16
914492	Y2-107 E OP1	14.45

Appendix 2

Bus Number	Bus Name	Full Contribution
246936	05BLCK-1_C	2.56
247927	05BLCK-1_E	50.33
246937	05BLCK-2_C	2.56
247928	05BLCK-2_E	50.33
246938	05BLCK-3_C	2.6
247929	05BLCK-3_E	51.2
242933	05CONVOY	4.84
246427	BERRIENS	.38
246431	BUCHANAN	.22
246397	ELKHARTH	.25
246536	MOTTVILL	.1
247500	R-003 C	1.78
247900	R-003 E	7.1
884780	S-058 C	33.79
884781	S-058 E	111.41
247537	S-072 C	32.54
247904	S-072 E	130.17
246416	TWBRANCH	.28
LTF	V3-012	10.96
894581	V3-015 C	2.53
894582	V3-015 E	16.93
247547	V4-016 C	1.45
247923	V4-016 E	9.67
903281	W3-024 C	1.5
903282	W3-024 E	10.07
907111	X1-040 C	4.67
907112	X1-040 E	31.26
LTF	X2-042	19.78
909181	X2-052	34.92
900404	X3-028 C	99.54
LTF	X3-096	16.82
LTF	X3-097	23.86
LTF	X3-098	22.61
LTF	X4-041	22.34
LTF	Y1-002	35.1
LTF	Y1-004	10.59
LTF	Y2-004	11.69
LTF	Y2-005	11.69
LTF	Y2-006	10.44
LTF	Y2-007	23.38
LTF	Y2-008	20.99

LTF	Y2-056	23.88
LTF	Y2-068	119.71
LTF	Y2-082	61.5
914491	Y2-107 C OP1	2.3
914492	Y2-107 E OP1	15.37

Appendix 3

Bus Number	Bus Name	Full Contribution
243440	05CKG1	3.74
243441	05CKG2	3.51
247528	05COVRT1	28.75
247529	05COVRT2	28.75
247530	05COVRT3	28.75
247531	05COVRT4	17.26
247532	05COVRT5	17.26
247533	05COVRT6	17.26
243225	05KEYSTN	1.29
246427	BERRIENS	1.06
246431	BUCHANAN	.61
274670	CRAWF;7G	14.03
274671	CRAWF;7Y	14.02
274672	CRAWF;8U	42.14
274751	CRETE;1U	.24
274752	CRETE;2U	.24
274753	CRETE;3U	.24
274754	CRETE;4U	.24
246397	ELKHARTH	.62
274673	FISK ;9U	43.14
246422	MAYFLWER	.02
246536	MOTTVILL	.26
293061	N-015 E	15.63
293655	O-023 E	31.02
290021	O-050 E	20.59
293645	O22E	31.02
294392	P-010 E	19.86
882311	Q-066	.28
882331	Q-067B	.45
247500	R-003 C	5.02
247900	R-003 E	20.07
296827	R-079 C1	3.84
296741	R-079 C2	3.84
296828	R-079 E1	15.36
296740	R-079 E2	15.36
290294	S-036 C1	4.64
290295	S-036 E1	18.56
290298	S-037 C1	4.64
290299	S-037 E1	18.56
884780	S-058 C	92.78
884781	S-058 E	305.9

884891	S-062 C1	4.4
884901	S-062 C2	4.37
884911	S-062 C3	4.4
884892	S-062 E1	17.6
884902	S-062 E2	17.63
884912	S-062 E3	17.6
247536	S-071 C	3.55
247903	S-071 E	14.18
274793	SECHI;0U	.12
274794	SECHI;1U	.12
274795	SECHI;2U	.12
274792	SECHI;9U	.12
274679	SLINE;3U	26.63
274680	SLINE;4U	43.06
885861	T-074 1	1.02
885862	T-074 2	1.02
247521	T-131 C	3.96
247907	T-131 E	15.84
274861	TCROP;1U	13.18
274862	TCROP;2U	25.59
246416	TWBRANCH	.76
887641	U1-049 C	1.72
887642	U1-049 E	11.53
247538	U2-062 C	3.22
247912	U2-062 E	21.59
247508	U2-090 C	3.56
247915	U2-090 E	23.8
247510	U3-002 C	.09
247931	U3-002 E	24.5
890570	U3-026 C1	32.6
890571	U3-026 C2	32.6
891221	U4-038 C	1.86
891222	U4-038 E	12.46
891231	U4-039 C1	2.97
891241	U4-039 C2	2.97
891251	U4-039 C3	2.97
891261	U4-039 C4	2.97
891232	U4-039 E1	19.9
891242	U4-039 E2	19.9
891252	U4-039 E3	19.9
891262	U4-039 E4	19.9
892051	V1-022 1	24.88
892061	V1-022 2	24.88
247543	V3-007 C	3.56

247919	V3-007 E	23.8
247544	V3-008 C	3.56
247920	V3-008 E	23.8
247545	V3-009 C	3.56
247921	V3-009 E	23.8
LTF	V3-012	34.3
894581	V3-015 C	8.95
894582	V3-015 E	59.92
894781	V3-053 C	3.07
894782	V3-053 E	20.58
247547	V4-016 C	3.95
247923	V4-016 E	26.44
900261	V4-033 C1	2.58
900271	V4-033 C2	2.58
900262	V4-033 E1	17.27
900272	V4-033 E2	17.27
903281	W3-024 C	4.7
903282	W3-024 E	31.48
903432	W3-046	6.98
903442	W3-046	6.46
903452	W3-046	6.98
903462	W3-046	6.46
905252	W4-033 E1	.61
905262	W4-033 E2	.2
905491	W4-086	.27
905501	W4-087	.49
907021	X1-020 C	17.99
907022	X1-020 E	120.43
907111	X1-040 C	9.38
907112	X1-040 E	62.76
907121	X1-042	.01
907141	X1-045	.39
907432	X1-099 E	.49
909041	X2-019 C	22.8
LTF	X2-042	67.37
909181	X2-052	98.37
910541	X3-005 C	.51
910542	X3-005 E	.83
LTF	X3-020	20.44
LTF	X3-021	57.14
910711	X3-045 1	2.08
910721	X3-045 2	2.06
LTF	X3-096	49.17
LTF	X3-097	69.72

LTF	X3-098	66.09
LTF	X4-029D	22.42
LTF	X4-041	65.29
LTF	Y1-002	96.25
LTF	Y1-004	33.52
913011	Y1-005 1	23.03
913021	Y1-005 2	23.03
LTF	Y1-007	23.28
LTF	Y1-041	22.42
913522	Y1-078 E	2.64
LTF	Y2-004	33.8
LTF	Y2-005	33.8
LTF	Y2-006	34.74
LTF	Y2-007	67.59
LTF	Y2-008	67.69
LTF	Y2-033	17.9
LTF	Y2-040	57.14
LTF	Y2-049	46.93
LTF	Y2-056	67.26
LTF	Y2-068	349.86
LTF	Y2-069	19.43
LTF	Y2-070	19.43
LTF	Y2-071	19.43
LTF	Y2-072	19.43
LTF	Y2-082	189.85
914461	Y2-103	45.66
914491	Y2-107 C OP1	4.81
914492	Y2-107 E OP1	32.16

Appendix 4

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	-26.91
238554	02AVONG7	-18.32
238555	02AVONG9	-145.25
238564	02BAYSG1	.56
238565	02BAYSG2	24.18
238566	02BAYSG3	24.88
238567	02BAYSG4	37.67
238568	02BAYSHO	.07
238885	02LEMOG1	.98
238886	02LEMOG2	.98
238887	02LEMOG3	.98
238888	02LEMOG4	.98
238995	02NCUNTD	-.39
239006	02NILEG1	-8.
239007	02NILEG2	-7.93
239022	02NWCAG3	-5.85
239023	02NWCAG4	-5.92
239024	02NWCAG5	-9.02
239202	02STRYCT	.08
247927	05BLCK-1_E	8.07
247928	05BLCK-2_E	8.07
247929	05BLCK-3_E	8.21
247528	05COVRT1	19.32
247529	05COVRT2	19.32
247530	05COVRT3	19.32
247531	05COVRT4	11.59
247532	05COVRT5	11.59
247533	05COVRT6	11.59
246427	BERRIENS	.53
240950	BG5	.11
246431	BUCHANAN	.29
246397	ELKHARTH	.27
274673	FISK ;9U	19.97
246536	MOTTVILL	.12
882311	Q-066	.13
247500	R-003 C	1.66
247900	R-003 E	6.62
247901	R-048 E	3.6
247517	R-049 C	2.5
247902	R-049 E	10.01
290294	S-036 C1	2.16

290295	S-036 E1	8.63
290298	S-037 C1	2.16
290299	S-037 E1	8.63
247537	S-072 C	5.22
247904	S-072 E	20.87
247520	S-073 C	3.41
247905	S-073 E	13.64
274679	SLINE;3U	12.3
274680	SLINE;4U	19.88
247503	T-130 C	5.28
247906	T-130 E	21.12
247521	T-131 C	2.46
247907	T-131 E	9.85
246416	TWBRANCH	.34
887641	U1-049 C	.8
887642	U1-049 E	5.36
247522	U1-059 C	.62
247909	U1-059 E	4.16
247505	U1-060 C	1.76
247910	U1-060 E	11.78
889031	U2-028A_AT1	23.95
247911	U2-041 E	18.22
247540	U2-072 C	2.72
247914	U2-072 E	18.22
299984	U3-029 E	-.76
299989	U3-030 E	-.35
891141	U4-028 C	1.45
891142	U4-028 E	9.71
891151	U4-029 C	1.45
891152	U4-029 E	9.71
892021	V1-011 C	1.12
892022	V1-011 E	7.49
892031	V1-012 C	1.68
892032	V1-012 E	11.23
893021	V2-006 C	2.41
893022	V2-006 E	16.13
LTF	V3-012	22.5
894641	V3-028 C	.53
894642	V3-028 E	.87
247548	V4-010 C	2.9
247932	V4-010 E	19.42
900041	V4-011	.43
247546	V4-015 C	1.28
247922	V4-015 E	8.49

247547	V4-016 C	1.94
247923	V4-016 E	12.99
901161	W1-056 C	.2
901162	W1-056 E	1.34
901221	W1-072A_AT5	11.05
902141	W2-001 C	1.26
902142	W2-001 E	8.51
902151	W2-007 C	1.61
902152	W2-007 E	10.75
903231	W3-005 C	7.81
903232	W3-005 E	52.25
903281	W3-024 C	1.29
903282	W3-024 E	8.62
903611	W3-085 C	1.88
903612	W3-085 E	12.61
903621	W3-088 C OP1	1.99
903622	W3-088 E OP1	13.35
905501	W4-087	.23
907111	X1-040 C	3.33
907112	X1-040 E	22.27
LTF	X2-042	32.14
909181	X2-052	44.93
909201	X2-058 C	2.82
909202	X2-058 E	18.94
910501	X3-001 C	.09
910502	X3-001 E	.15
910541	X3-005 C	.24
910542	X3-005 E	.38
LTF	X3-020	10.86
LTF	X3-021	113.2
910601	X3-023 C OP1	.59
910602	X3-023 E OP1	3.97
910621	X3-030 C	2.21
910622	X3-030 E	14.79
910631	X3-031 C OP1	1.59
910632	X3-031 E OP1	10.65
LTF	X3-096	26.12
LTF	X3-097	37.03
LTF	X3-098	35.1
LTF	X4-029D	11.15
LTF	X4-041	34.68
LTF	Y1-002	44.53
LTF	Y1-004	24.64
LTF	Y1-007	17.11

913211	Y1-030 C OP1	1.26
913212	Y1-030 E OP1	8.45
LTF	Y1-041	11.15
913441	Y1-069 OP1	138.34
LTF	Y2-004	17.69
LTF	Y2-005	17.69
LTF	Y2-006	17.11
LTF	Y2-007	35.38
LTF	Y2-008	34.35
LTF	Y2-033	14.64
LTF	Y2-040	113.2
LTF	Y2-049	92.96
LTF	Y2-056	33.44
LTF	Y2-068	185.83
LTF	Y2-069	23.96
LTF	Y2-070	23.96
LTF	Y2-071	23.96
LTF	Y2-072	23.96
LTF	Y2-082	129.02
914491	Y2-107 C OP1	2.24
914492	Y2-107 E OP1	15.

Appendix 5

Bus Number	Bus Name	Full Contribution
247528	05COVRT1	46.41
247529	05COVRT2	46.41
247530	05COVRT3	46.41
247531	05COVRT4	27.85
247532	05COVRT5	27.85
247533	05COVRT6	27.85
246427	BERRIENS	-1.71
246431	BUCHANAN	-.46
246536	MOTTVILL	-.14
246416	TWBRANCH	-.25
LTF	V4-050	4.67
LTF	X3-021	75.96
913441	Y1-069 OP1	35.23
LTF	Y2-040	75.96
LTF	Y2-044	4.68
LTF	Y2-049	62.38
LTF	Y2-069	24.47
LTF	Y2-070	24.47
LTF	Y2-071	24.47
LTF	Y2-072	24.47
LTF	Y2-082	303.6
914491	Y2-107 C OP1	1.33
914492	Y2-107 E OP1	8.88

Appendix 6

Bus Number	Bus Name	Full Contribution
247528	05COVRT1	46.41
247529	05COVRT2	46.41
247530	05COVRT3	46.41
247531	05COVRT4	27.85
247532	05COVRT5	27.85
247533	05COVRT6	27.85
246427	BERRIENS	-1.71
246431	BUCHANAN	-.46
246536	MOTTVILL	-.14
246416	TWBRANCH	-.25
LTF	V4-050	4.67
LTF	X3-021	75.96
913441	Y1-069 OP1	35.23
LTF	Y2-040	75.96
LTF	Y2-044	4.68
LTF	Y2-049	62.38
LTF	Y2-069	24.47
LTF	Y2-070	24.47
LTF	Y2-071	24.47
LTF	Y2-072	24.47
LTF	Y2-082	303.6
914491	Y2-107 C OP1	1.33
914492	Y2-107 E OP1	8.88

Appendix 7

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	-29.38
238554	02AVONG7	-25.91
238555	02AVONG9	-296.83
238564	02BAYSG1	.43
238565	02BAYSG2	18.29
238566	02BAYSG3	18.82
238567	02BAYSG4	28.49
238568	02BAYSHO	.05
238571	02BEAVGA	.2
238572	02BEAVGB	.2
238670	02DVBSG1	3.72
238888	02LEMOG4	.47
239006	02NILEG1	-6.2
239007	02NILEG2	-6.14
239171	02WLORG-2	.61
239172	02WLORG-3	.61
239173	02WLORG-4	.61
239174	02WLORG-5	.61
239175	02WLORG-6	.3
247927	05BLCK-1_E	4.96
247928	05BLCK-2_E	4.96
247929	05BLCK-3_E	5.04
247528	05COVRT1	11.65
247529	05COVRT2	11.65
247530	05COVRT3	11.65
247531	05COVRT4	6.99
247532	05COVRT5	6.99
247533	05COVRT6	6.99
247901	R-048 E	2.18
247517	R-049 C	1.54
247902	R-049 E	6.14
884780	S-058 C	26.27
884781	S-058 E	86.62
247537	S-072 C	3.2
247904	S-072 E	12.82
247520	S-073 C	2.1
247905	S-073 E	8.38
247503	T-130 C	3.24
247906	T-130 E	12.97
247521	T-131 C	1.51
247907	T-131 E	6.04

247522	U1-059 C	.42
247909	U1-059 E	2.8
247505	U1-060 C	1.14
247910	U1-060 E	7.64
889031	U2-028A_AT1	17.83
299984	U3-029 E	-.6
299989	U3-030 E	-.27
247542	U4-001 C	1.63
247918	U4-001 E	10.9
891141	U4-028 C	1.19
891142	U4-028 E	7.98
891151	U4-029 C	1.19
891152	U4-029 E	7.98
892021	V1-011 C	.69
892022	V1-011 E	4.6
892031	V1-012 C	1.03
892032	V1-012 E	6.91
893001	V2-001 C	.73
893002	V2-001 E	5.17
893021	V2-006 C	1.45
893022	V2-006 E	9.67
833193	V2-042AC1OP1	1.34
833194	V2-042AE1OP1	8.97
LTF	V3-012	16.12
247548	V4-010 C	2.54
247932	V4-010 E	17.
900041	V4-011	.28
247546	V4-015 C	.84
247922	V4-015 E	5.58
901161	W1-056 C	.13
901162	W1-056 E	.9
901221	W1-072A_AT5	5.26
902141	W2-001 C	.83
902142	W2-001 E	5.59
902151	W2-007 C	.96
902152	W2-007 E	6.45
903231	W3-005 C	5.05
903232	W3-005 E	33.8
903511	W3-059A_AT6	2.23
903512	W3-059A_AT6	14.89
903611	W3-085 C	1.78
903612	W3-085 E	11.97
907041	X1-027A C1	3.86
907044	X1-027A C2	3.86

907046	X1-027A C3	3.86
907048	X1-027A C4	3.86
907042	X1-027A E1	25.81
907045	X1-027A E2	25.81
907047	X1-027A E3	25.81
907049	X1-027A E4	25.81
LTF	X2-042	22.3
909201	X2-058 C	1.87
909202	X2-058 E	12.56
910501	X3-001 C	.06
910502	X3-001 E	.1
LTF	X3-020	6.68
LTF	X3-021	69.06
910601	X3-023 C OP1	.57
910602	X3-023 E OP1	3.81
910631	X3-031 C OP1	.99
910632	X3-031 E OP1	6.64
LTF	X3-096	16.06
LTF	X3-097	22.77
LTF	X3-098	21.58
LTF	X4-029D	6.83
LTF	X4-041	21.32
LTF	Y1-002	27.26
LTF	Y1-004	17.89
LTF	Y1-007	12.42
913211	Y1-030 C OP1	.89
913212	Y1-030 E OP1	5.97
LTF	Y1-041	6.83
913441	Y1-069 OP1	99.8
LTF	Y2-004	10.87
LTF	Y2-005	10.87
LTF	Y2-006	10.61
LTF	Y2-007	21.74
LTF	Y2-008	21.27
LTF	Y2-033	8.95
LTF	Y2-040	69.06
LTF	Y2-049	56.72
LTF	Y2-056	20.48
LTF	Y2-068	114.26
LTF	Y2-069	14.42
LTF	Y2-070	14.42
LTF	Y2-071	14.42
LTF	Y2-072	14.42
LTF	Y2-082	77.9

914491	Y2-107 C OP1	1.36
914492	Y2-107 E OP1	9.07

Appendix 8

Bus Number	Bus Name	Full Contribution
238554	02AVONG7	-8.26
238555	02AVONG9	-63.22
238565	02BAYSG2	-27.35
238566	02BAYSG3	-28.14
238567	02BAYSG4	-42.61
247528	05COVRT1	32.69
247529	05COVRT2	32.69
247530	05COVRT3	32.69
247531	05COVRT4	19.62
247532	05COVRT5	19.62
247533	05COVRT6	19.62
246427	BERRIENS	.7
246431	BUCHANAN	.36
274670	CRAWF;7G	6.95
274671	CRAWF;7Y	6.95
274672	CRAWF;8U	20.88
246397	ELKHARTH	.31
274673	FISK ;9U	21.37
246536	MOTTVILL	.14
293061	N-015 E	7.71
294392	P-010 E	9.79
882311	Q-066	.14
882331	Q-067B	.22
290294	S-036 C1	2.3
290295	S-036 E1	9.2
290298	S-037 C1	2.3
290299	S-037 E1	9.2
884780	S-058 C	44.98
884781	S-058 E	148.31
884891	S-062 C1	2.18
884901	S-062 C2	2.16
884911	S-062 C3	2.18
884892	S-062 E1	8.71
884902	S-062 E2	8.72
884912	S-062 E3	8.71
274679	SLINE;3U	13.23
274680	SLINE;4U	21.4
246416	TWBRANCH	.4
887641	U1-049 C	.85
887642	U1-049 E	5.72
890570	U3-026 C1	15.81

890571	U3-026 C2	15.81
892051	V1-022 1	12.28
892061	V1-022 2	12.28
LTF	V3-012	12.47
247547	V4-016 C	2.53
247923	V4-016 E	16.91
905252	W4-033 E1	.3
905262	W4-033 E2	.1
905501	W4-087	.25
907121	X1-042	.01
907141	X1-045	.19
907432	X1-099 E	.24
LTF	X2-042	20.72
909181	X2-052	51.74
910541	X3-005 C	.25
910542	X3-005 E	.41
LTF	X3-020	9.19
LTF	X3-021	290.45
910711	X3-045 1	1.03
LTF	X3-096	22.12
LTF	X3-097	31.36
LTF	X3-098	29.73
LTF	X4-029D	11.54
LTF	X4-041	29.37
LTF	Y1-002	47.33
LTF	Y1-004	11.42
913011	Y1-005 1	11.39
913021	Y1-005 2	11.39
LTF	Y1-041	11.54
913522	Y1-078 E	1.31
LTF	Y2-004	15.27
LTF	Y2-005	15.27
LTF	Y2-006	11.28
LTF	Y2-007	30.53
LTF	Y2-008	23.85
LTF	Y2-040	290.45
LTF	Y2-044	13.59
LTF	Y2-049	238.52
LTF	Y2-056	34.62
LTF	Y2-068	157.37
LTF	Y2-069	53.32
LTF	Y2-070	53.32
LTF	Y2-071	53.32
LTF	Y2-072	53.32

LTF	Y2-082	214.44
914461	Y2-103	1.19
914491	Y2-107 C OP1	3.
914492	Y2-107 E OP1	20.07

Appendix 9

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	-17.99
238554	02AVONG7	-6.66
238555	02AVONG9	-47.65
238564	02BAYSG1	.54
238565	02BAYSG2	23.18
238566	02BAYSG3	23.85
238567	02BAYSG4	36.11
238568	02BAYSHO	.06
238571	02BEAVGA	.32
238572	02BEAVGB	.32
238670	02DVBSG1	4.77
238888	02LEMOG4	.59
238995	02NCUNTD	-.34
239006	02NILEG1	-6.91
239007	02NILEG2	-6.84
239022	02NWCAG3	-5.14
239023	02NWCAG4	-5.2
239024	02NWCAG5	-7.89
239171	02WLORG-2	.8
239172	02WLORG-3	.8
239173	02WLORG-4	.8
239174	02WLORG-5	.8
239175	02WLORG-6	.48
247927	05BLCK-1_E	5.9
247928	05BLCK-2_E	5.9
247929	05BLCK-3_E	6.
247528	05COVRT1	14.07
247529	05COVRT2	14.07
247530	05COVRT3	14.07
247531	05COVRT4	8.44
247532	05COVRT5	8.44
247533	05COVRT6	8.44
246427	BERRIENS	.38
246431	BUCHANAN	.21
246397	ELKHARTH	.2
246536	MOTTVILL	.08
247901	R-048 E	2.61
247517	R-049 C	1.82
247902	R-049 E	7.29
884780	S-058 C	30.23
884781	S-058 E	99.66

247537	S-072 C	3.82
247904	S-072 E	15.26
247520	S-073 C	2.49
247905	S-073 E	9.97
247503	T-130 C	3.87
247906	T-130 E	15.47
247521	T-131 C	1.79
247907	T-131 E	7.16
246416	TWBRANCH	.24
247522	U1-059 C	.5
247909	U1-059 E	3.35
247505	U1-060 C	1.35
247910	U1-060 E	9.08
889031	U2-028A_AT1	22.6
247911	U2-041 E	13.18
247540	U2-072 C	1.97
247914	U2-072 E	13.18
299984	U3-029 E	-.66
299989	U3-030 E	-.3
247542	U4-001 C	1.86
247918	U4-001 E	12.41
891141	U4-028 C	1.46
891142	U4-028 E	9.76
891151	U4-029 C	1.46
891152	U4-029 E	9.76
892021	V1-011 C	.82
892022	V1-011 E	5.48
892031	V1-012 C	1.23
892032	V1-012 E	8.22
893001	V2-001 C	.83
893002	V2-001 E	5.94
893021	V2-006 C	1.77
893022	V2-006 E	11.85
833193	V2-042AC1OP1	1.49
833194	V2-042AE1OP1	9.99
LTF	V3-012	17.64
894641	V3-028 C	.38
894642	V3-028 E	.63
247548	V4-010 C	3.13
247932	V4-010 E	20.92
900041	V4-011	.34
247546	V4-015 C	1.04
247922	V4-015 E	6.92
247547	V4-016 C	1.39

247923	V4-016 E	9.32
901161	W1-056 C	.16
901162	W1-056 E	1.06
901221	W1-072A_AT5	6.68
902141	W2-001 C	1.03
902142	W2-001 E	6.93
902151	W2-007 C	1.18
902152	W2-007 E	7.9
903231	W3-005 C	6.13
903232	W3-005 E	41.03
903511	W3-059A_AT6	2.66
903512	W3-059A_AT6	17.78
LTF	W3-083	6.1
903611	W3-085 C	2.11
903612	W3-085 E	14.14
903621	W3-088 C OP1	1.46
903622	W3-088 E OP1	9.75
907041	X1-027A C1	4.99
907044	X1-027A C2	4.99
907046	X1-027A C3	4.99
907048	X1-027A C4	4.99
907042	X1-027A E1	33.43
907045	X1-027A E2	33.43
907047	X1-027A E3	33.43
907049	X1-027A E4	33.43
907111	X1-040 C	2.38
907112	X1-040 E	15.92
LTF	X2-042	25.29
909201	X2-058 C	2.32
909202	X2-058 E	15.56
910501	X3-001 C	.07
910502	X3-001 E	.12
LTF	X3-020	7.44
LTF	X3-021	86.87
910601	X3-023 C OP1	.67
910602	X3-023 E OP1	4.48
910621	X3-030 C	1.6
910622	X3-030 E	10.72
910631	X3-031 C OP1	1.17
910632	X3-031 E OP1	7.84
LTF	X3-096	17.91
LTF	X3-097	25.39
LTF	X3-098	24.07
LTF	X4-029D	7.81

LTF	X4-041	23.78
LTF	Y1-002	31.47
LTF	Y1-004	19.31
LTF	Y1-007	13.41
913211	Y1-030 C OP1	1.07
913212	Y1-030 E OP1	7.15
LTF	Y1-041	7.81
913441	Y1-069 OP1	126.45
LTF	Y2-004	12.13
LTF	Y2-005	12.13
LTF	Y2-006	11.71
LTF	Y2-007	24.27
LTF	Y2-008	23.51
LTF	Y2-033	9.24
LTF	Y2-040	86.87
LTF	Y2-049	71.34
LTF	Y2-056	23.43
LTF	Y2-068	127.41
LTF	Y2-069	17.92
LTF	Y2-070	17.92
LTF	Y2-071	17.92
LTF	Y2-072	17.92
LTF	Y2-082	93.79
914491	Y2-107 C OP1	1.63
914492	Y2-107 E OP1	10.88

Appendix 10

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	-17.99
238554	02AVONG7	-6.66
238555	02AVONG9	-47.65
238564	02BAYSG1	.54
238565	02BAYSG2	23.18
238566	02BAYSG3	23.85
238567	02BAYSG4	36.11
238568	02BAYSHO	.06
238571	02BEAVGA	.32
238572	02BEAVGB	.32
238670	02DVBSG1	4.77
238888	02LEMOG4	.59
238995	02NCUNTD	-.34
239006	02NILEG1	-6.91
239007	02NILEG2	-6.84
239022	02NWCAG3	-5.14
239023	02NWCAG4	-5.2
239024	02NWCAG5	-7.89
239171	02WLORG-2	.8
239172	02WLORG-3	.8
239173	02WLORG-4	.8
239174	02WLORG-5	.8
239175	02WLORG-6	.48
247927	05BLCK-1_E	5.9
247928	05BLCK-2_E	5.9
247929	05BLCK-3_E	6.
247528	05COVRT1	14.07
247529	05COVRT2	14.07
247530	05COVRT3	14.07
247531	05COVRT4	8.44
247532	05COVRT5	8.44
247533	05COVRT6	8.44
246427	BERRIENS	.38
246431	BUCHANAN	.21
246397	ELKHARTH	.2
246536	MOTTVILL	.08
247901	R-048 E	2.61
247517	R-049 C	1.82
247902	R-049 E	7.29
884780	S-058 C	30.23
884781	S-058 E	99.66

247537	S-072 C	3.82
247904	S-072 E	15.26
247520	S-073 C	2.49
247905	S-073 E	9.97
247503	T-130 C	3.87
247906	T-130 E	15.47
247521	T-131 C	1.79
247907	T-131 E	7.16
246416	TWBRANCH	.24
247522	U1-059 C	.5
247909	U1-059 E	3.35
247505	U1-060 C	1.35
247910	U1-060 E	9.08
889031	U2-028A_AT1	22.6
247911	U2-041 E	13.18
247540	U2-072 C	1.97
247914	U2-072 E	13.18
299984	U3-029 E	-.66
299989	U3-030 E	-.3
247542	U4-001 C	1.86
247918	U4-001 E	12.41
891141	U4-028 C	1.46
891142	U4-028 E	9.76
891151	U4-029 C	1.46
891152	U4-029 E	9.76
892021	V1-011 C	.82
892022	V1-011 E	5.48
892031	V1-012 C	1.23
892032	V1-012 E	8.22
893001	V2-001 C	.83
893002	V2-001 E	5.94
893021	V2-006 C	1.77
893022	V2-006 E	11.85
833193	V2-042AC1OP1	1.49
833194	V2-042AE1OP1	9.99
LTF	V3-012	17.64
894641	V3-028 C	.38
894642	V3-028 E	.63
247548	V4-010 C	3.13
247932	V4-010 E	20.92
900041	V4-011	.34
247546	V4-015 C	1.04
247922	V4-015 E	6.92
247547	V4-016 C	1.39

247923	V4-016 E	9.32
901161	W1-056 C	.16
901162	W1-056 E	1.06
901221	W1-072A_AT5	6.68
902141	W2-001 C	1.03
902142	W2-001 E	6.93
902151	W2-007 C	1.18
902152	W2-007 E	7.9
903231	W3-005 C	6.13
903232	W3-005 E	41.03
903511	W3-059A_AT6	2.66
903512	W3-059A_AT6	17.78
LTF	W3-083	6.1
903611	W3-085 C	2.11
903612	W3-085 E	14.14
903621	W3-088 C OP1	1.46
903622	W3-088 E OP1	9.75
907041	X1-027A C1	4.99
907044	X1-027A C2	4.99
907046	X1-027A C3	4.99
907048	X1-027A C4	4.99
907042	X1-027A E1	33.43
907045	X1-027A E2	33.43
907047	X1-027A E3	33.43
907049	X1-027A E4	33.43
907111	X1-040 C	2.38
907112	X1-040 E	15.92
LTF	X2-042	25.29
909201	X2-058 C	2.32
909202	X2-058 E	15.56
910501	X3-001 C	.07
910502	X3-001 E	.12
LTF	X3-020	7.44
LTF	X3-021	86.87
910601	X3-023 C OP1	.67
910602	X3-023 E OP1	4.48
910621	X3-030 C	1.6
910622	X3-030 E	10.72
910631	X3-031 C OP1	1.17
910632	X3-031 E OP1	7.84
LTF	X3-096	17.91
LTF	X3-097	25.39
LTF	X3-098	24.07
LTF	X4-029D	7.81

LTF	X4-041	23.78
LTF	Y1-002	31.47
LTF	Y1-004	19.32
LTF	Y1-007	13.41
913211	Y1-030 C OP1	1.07
913212	Y1-030 E OP1	7.15
LTF	Y1-041	7.81
913441	Y1-069 OP1	126.45
LTF	Y2-004	12.13
LTF	Y2-005	12.13
LTF	Y2-006	11.71
LTF	Y2-007	24.27
LTF	Y2-008	23.51
LTF	Y2-033	9.24
LTF	Y2-040	86.87
LTF	Y2-049	71.34
LTF	Y2-056	23.43
LTF	Y2-068	127.42
LTF	Y2-069	17.92
LTF	Y2-070	17.92
LTF	Y2-071	17.92
LTF	Y2-072	17.92
LTF	Y2-082	93.79
914491	Y2-107 C OP1	1.63
914492	Y2-107 E OP1	10.88

Appendix 11

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	-31.32
238554	02AVONG7	-23.22
238555	02AVONG9	-255.11
238564	02BAYSG1	.58
238565	02BAYSG2	25.03
238566	02BAYSG3	25.75
238567	02BAYSG4	38.99
238568	02BAYSHO	.07
238571	02BEAVGA	.35
238572	02BEAVGB	.35
238670	02DVBSG1	5.08
238888	02LEMOG4	.64
238995	02NCUNTD	-.39
239006	02NILEG1	-8.06
239007	02NILEG2	-7.99
239022	02NWCAG3	-5.93
239023	02NWCAG4	-5.99
239024	02NWCAG5	-9.16
239171	02WLORG-2	.83
239172	02WLORG-3	.83
239173	02WLORG-4	.83
239174	02WLORG-5	.83
239175	02WLORG-6	.52
247927	05BLCK-1_E	6.61
247928	05BLCK-2_E	6.61
247929	05BLCK-3_E	6.72
247528	05COVRT1	15.6
247529	05COVRT2	15.6
247530	05COVRT3	15.6
247531	05COVRT4	9.36
247532	05COVRT5	9.36
247533	05COVRT6	9.36
254007	15ELRMA1	-4.88
254008	15ELRMA2	-4.99
246427	BERRIENS	.43
246431	BUCHANAN	.23
246397	ELKHARTH	.22
246536	MOTTVILL	.1
247500	R-003 C	1.34
247900	R-003 E	5.35
247901	R-048 E	2.91

247517	R-049 C	2.04
247902	R-049 E	8.18
247537	S-072 C	4.27
247904	S-072 E	17.08
247520	S-073 C	2.79
247905	S-073 E	11.17
274679	SLINE;3U	.2
274680	SLINE;4U	.32
247503	T-130 C	4.33
247906	T-130 E	17.3
247521	T-131 C	2.01
247907	T-131 E	8.04
246416	TWBRANCH	.28
247522	U1-059 C	.56
247909	U1-059 E	3.75
247505	U1-060 C	1.52
247910	U1-060 E	10.2
889031	U2-028A_AT1	24.4
247911	U2-041 E	15.02
247540	U2-072 C	2.24
247914	U2-072 E	15.02
299984	U3-029 E	-.77
299989	U3-030 E	-.35
247542	U4-001 C	2.18
247918	U4-001 E	14.61
891141	U4-028 C	1.62
891142	U4-028 E	10.85
891151	U4-029 C	1.62
891152	U4-029 E	10.85
892021	V1-011 C	.92
892022	V1-011 E	6.14
892031	V1-012 C	1.38
892032	V1-012 E	9.2
893001	V2-001 C	.97
893002	V2-001 E	6.95
893021	V2-006 C	1.95
893022	V2-006 E	13.04
833193	V2-042AC1OP1	1.78
833194	V2-042AE1OP1	11.91
LTF	V3-012	20.8
894641	V3-028 C	.44
894642	V3-028 E	.71
247548	V4-010 C	3.46
247932	V4-010 E	23.18

900041	V4-011	.38
247546	V4-015 C	1.14
247922	V4-015 E	7.58
247547	V4-016 C	1.57
247923	V4-016 E	10.48
901161	W1-056 C	.18
901162	W1-056 E	1.19
901221	W1-072A_AT5	7.18
902141	W2-001 C	1.13
902142	W2-001 E	7.6
902151	W2-007 C	1.3
902152	W2-007 E	8.7
903231	W3-005 C	6.81
903232	W3-005 E	45.57
903281	W3-024 C	1.04
903282	W3-024 E	6.96
903511	W3-059A_AT6	3.06
903512	W3-059A_AT6	20.42
LTF	W3-083	6.91
903611	W3-085 C	2.41
903612	W3-085 E	16.17
903621	W3-088 C OP1	1.65
903622	W3-088 E OP1	11.03
907041	X1-027A C1	5.26
907044	X1-027A C2	5.26
907046	X1-027A C3	5.26
907048	X1-027A C4	5.26
907042	X1-027A E1	35.22
907045	X1-027A E2	35.22
907047	X1-027A E3	35.22
907049	X1-027A E4	35.22
907111	X1-040 C	2.69
907112	X1-040 E	17.99
LTF	X2-042	29.17
909181	X2-052	36.21
909201	X2-058 C	2.54
909202	X2-058 E	17.06
910501	X3-001 C	.08
910502	X3-001 E	.13
LTF	X3-020	8.67
LTF	X3-021	93.97
910601	X3-023 C OP1	.77
910602	X3-023 E OP1	5.14
910621	X3-030 C	1.83

910622	X3-030 E	12.22
910631	X3-031 C OP1	1.32
910632	X3-031 E OP1	8.82
LTF	X3-096	20.85
LTF	X3-097	29.56
LTF	X3-098	28.02
LTF	X4-029D	8.95
LTF	X4-041	27.69
LTF	Y1-002	35.87
LTF	Y1-004	22.97
LTF	Y1-007	15.95
913211	Y1-030 C OP1	1.2
913212	Y1-030 E OP1	8.03
LTF	Y1-041	8.95
913441	Y1-069 OP1	136.14
LTF	Y2-004	14.12
LTF	Y2-005	14.12
LTF	Y2-006	13.72
LTF	Y2-007	28.24
LTF	Y2-008	27.53
LTF	Y2-030	6.48
LTF	Y2-031	6.48
LTF	Y2-032	6.48
LTF	Y2-033	11.28
LTF	Y2-040	93.97
LTF	Y2-049	77.17
LTF	Y2-056	26.85
LTF	Y2-068	148.34
LTF	Y2-069	19.53
LTF	Y2-070	19.53
LTF	Y2-071	19.53
LTF	Y2-072	19.53
LTF	Y2-082	104.18
914491	Y2-107 C OP1	1.81
914492	Y2-107 E OP1	12.12

Option #2

Appendix 1

Bus Number	Bus Name	Full Contribution
246936	05BLCK-1_C	.62
247927	05BLCK-1_E	12.17
246937	05BLCK-2_C	.62
247928	05BLCK-2_E	12.17
246938	05BLCK-3_C	.63
247929	05BLCK-3_E	12.38
242933	05CONVOY	1.4
247537	S-072 C	7.87
247904	S-072 E	31.48
247503	T-130 C	7.87
247906	T-130 E	31.48
907111	X1-040 C	3.61
907112	X1-040 E	24.17
LTF	X2-042	4.9
LTF	X3-097	6.42
LTF	X3-098	6.09
LTF	X4-041	6.02
LTF	Y1-002	9.57
LTF	Y2-007	6.28
LTF	Y2-008	5.47
LTF	Y2-056	6.48
LTF	Y2-068	32.24
LTF	Y2-082	20.05
914491	Y2-107 C OP2	2.01
914492	Y2-107 E OP2	13.43

Appendix 2

Bus Number	Bus Name	Full Contribution
246936	05BLCK-1_C	2.56
247927	05BLCK-1_E	50.33
246937	05BLCK-2_C	2.56
247928	05BLCK-2_E	50.33
246938	05BLCK-3_C	2.6
247929	05BLCK-3_E	51.2
242933	05CONVOY	4.84
246427	BERRIENS	.38
246431	BUCHANAN	.22
246397	ELKHARTH	.25
246536	MOTTVILL	.1
247500	R-003 C	1.78
247900	R-003 E	7.1
884780	S-058 C	33.79
884781	S-058 E	111.41
247537	S-072 C	32.54
247904	S-072 E	130.17
246416	TWBRANCH	.28
LTF	V3-012	10.96
894581	V3-015 C	2.53
894582	V3-015 E	16.93
247547	V4-016 C	1.45
247923	V4-016 E	9.67
903281	W3-024 C	1.5
903282	W3-024 E	10.07
907111	X1-040 C	4.67
907112	X1-040 E	31.26
LTF	X2-042	19.78
909181	X2-052	34.92
900404	X3-028 C	99.54
LTF	X3-096	16.82
LTF	X3-097	23.86
LTF	X3-098	22.61
LTF	X4-041	22.34
LTF	Y1-002	35.1
LTF	Y1-004	10.59
LTF	Y2-004	11.69
LTF	Y2-005	11.69
LTF	Y2-006	10.44
LTF	Y2-007	23.38
LTF	Y2-008	20.99

LTF	Y2-056	23.88
LTF	Y2-068	119.71
LTF	Y2-082	61.5
914491	Y2-107 C OP2	2.6
914492	Y2-107 E OP2	17.37

Appendix 3

Bus Number	Bus Name	Full Contribution
243440	05CKG1	3.74
243441	05CKG2	3.51
247528	05COVRT1	28.75
247529	05COVRT2	28.75
247530	05COVRT3	28.75
247531	05COVRT4	17.26
247532	05COVRT5	17.26
247533	05COVRT6	17.26
243225	05KEYSTN	1.29
246427	BERRIENS	1.06
246431	BUCHANAN	.61
274670	CRAWF;7G	14.03
274671	CRAWF;7Y	14.02
274672	CRAWF;8U	42.14
274751	CRETE;1U	.24
274752	CRETE;2U	.24
274753	CRETE;3U	.24
274754	CRETE;4U	.24
246397	ELKHARTH	.62
274673	FISK ;9U	43.14
246422	MAYFLWER	.02
246536	MOTTVILL	.26
293061	N-015 E	15.63
293655	O-023 E	31.02
290021	O-050 E	20.59
293645	O22E	31.02
294392	P-010 E	19.86
882311	Q-066	.28
882331	Q-067B	.45
247500	R-003 C	5.02
247900	R-003 E	20.07
296827	R-079 C1	3.84
296741	R-079 C2	3.84
296828	R-079 E1	15.36
296740	R-079 E2	15.36
290294	S-036 C1	4.64
290295	S-036 E1	18.56
290298	S-037 C1	4.64
290299	S-037 E1	18.56
884780	S-058 C	92.78
884781	S-058 E	305.9

884891	S-062 C1	4.4
884901	S-062 C2	4.37
884911	S-062 C3	4.4
884892	S-062 E1	17.6
884902	S-062 E2	17.63
884912	S-062 E3	17.6
247536	S-071 C	3.55
247903	S-071 E	14.18
274793	SECHI;0U	.12
274794	SECHI;1U	.12
274795	SECHI;2U	.12
274792	SECHI;9U	.12
274679	SLINE;3U	26.63
274680	SLINE;4U	43.06
885861	T-074 1	1.02
885862	T-074 2	1.02
247521	T-131 C	3.96
247907	T-131 E	15.84
274861	TCROP;1U	13.18
274862	TCROP;2U	25.59
246416	TWBRANCH	.76
887641	U1-049 C	1.72
887642	U1-049 E	11.53
247538	U2-062 C	3.22
247912	U2-062 E	21.59
247508	U2-090 C	3.56
247915	U2-090 E	23.8
247510	U3-002 C	.09
247931	U3-002 E	24.5
890570	U3-026 C1	32.6
890571	U3-026 C2	32.6
891221	U4-038 C	1.86
891222	U4-038 E	12.46
891231	U4-039 C1	2.97
891241	U4-039 C2	2.97
891251	U4-039 C3	2.97
891261	U4-039 C4	2.97
891232	U4-039 E1	19.9
891242	U4-039 E2	19.9
891252	U4-039 E3	19.9
891262	U4-039 E4	19.9
892051	V1-022 1	24.88
892061	V1-022 2	24.88
247543	V3-007 C	3.56

247919	V3-007 E	23.8
247544	V3-008 C	3.56
247920	V3-008 E	23.8
247545	V3-009 C	3.56
247921	V3-009 E	23.8
LTF	V3-012	34.3
894581	V3-015 C	8.95
894582	V3-015 E	59.92
894781	V3-053 C	3.07
894782	V3-053 E	20.58
247547	V4-016 C	3.95
247923	V4-016 E	26.44
900261	V4-033 C1	2.58
900271	V4-033 C2	2.58
900262	V4-033 E1	17.27
900272	V4-033 E2	17.27
903281	W3-024 C	4.7
903282	W3-024 E	31.48
903432	W3-046	6.98
903442	W3-046	6.46
903452	W3-046	6.98
903462	W3-046	6.46
905252	W4-033 E1	.61
905262	W4-033 E2	.2
905491	W4-086	.27
905501	W4-087	.49
907021	X1-020 C	17.99
907022	X1-020 E	120.43
907111	X1-040 C	9.38
907112	X1-040 E	62.76
907121	X1-042	.01
907141	X1-045	.39
907432	X1-099 E	.49
909041	X2-019 C	22.8
LTF	X2-042	67.37
909181	X2-052	98.37
910541	X3-005 C	.51
910542	X3-005 E	.83
LTF	X3-020	20.44
LTF	X3-021	57.14
910711	X3-045 1	2.08
910721	X3-045 2	2.06
LTF	X3-096	49.17
LTF	X3-097	69.72

LTF	X3-098	66.09
LTF	X4-029D	22.42
LTF	X4-041	65.29
LTF	Y1-002	96.25
LTF	Y1-004	33.52
913011	Y1-005 1	23.03
913021	Y1-005 2	23.03
LTF	Y1-007	23.28
LTF	Y1-041	22.42
913522	Y1-078 E	2.64
LTF	Y2-004	33.8
LTF	Y2-005	33.8
LTF	Y2-006	34.74
LTF	Y2-007	67.59
LTF	Y2-008	67.69
LTF	Y2-033	17.9
LTF	Y2-040	57.14
LTF	Y2-049	46.93
LTF	Y2-056	67.26
LTF	Y2-068	349.86
LTF	Y2-069	19.43
LTF	Y2-070	19.43
LTF	Y2-071	19.43
LTF	Y2-072	19.43
LTF	Y2-082	189.85
914461	Y2-103	45.66
914491	Y2-107 C OP2	5.21
914492	Y2-107 E OP2	34.87

Appendix 4

Bus Number	Bus Name	Full Contribution
243440	05CKG1	6.93
243441	05CKG2	7.38
246427	BERRIENS	1.88
246431	BUCHANAN	1.09
274865	CAYUG;1U C1	7.4
274863	CAYUG;1U E1	29.6
274866	CAYUG;2U C2	7.4
274864	CAYUG;2U E2	29.6
292535	CE23CL12	.98
292536	CE23EL12	3.93
274670	CRAWF;7G	27.65
274671	CRAWF;7Y	27.65
274672	CRAWF;8U	82.99
274849	CRESC;1U	13.06
294702	CRESC;2U	11.51
246397	ELKHARTH	1.
274673	FISK ;9U	84.89
990700	FREEPT_G	15.48
299901	K-002 E	15.34
274770	LINC G1	.45
274771	LINC G2	.45
274772	LINC G3	.45
274773	LINC G4	.45
274774	LINC G5	.45
274775	LINC G6	.45
274776	LINC G7	.45
274777	LINC G8	.45
274850	M HIL;RU	12.37
246422	MAYFLWER	.04
246536	MOTTVILL	.41
293061	N-015 E	30.98
293120	N-021 C	.29
293121	N-021 E	1.18
293130	N-022 C	.54
293131	N-022 E	2.16
293140	N-023 C	.54
293141	N-023 E	2.16
293150	N-024 C	.54
293151	N-024 E	2.16
293160	N-025 C	.54
293161	N-025 E	2.16

293190	O-003 C	.44
293191	O-003 E	1.52
293655	O-023 E	61.45
293665	O-024 E	19.46
293667	O-024 E	38.57
290007	O-033 E	3.93
293771	O-035 E	14.39
290021	O-050 E	40.78
293645	O22E	61.45
294392	P-010 E	39.34
290051	P-014 E	15.71
290053	P-026 E	3.93
294700	P-040 C	.96
294701	P-040 E	3.84
294763	P-046 E	19.34
290108	Q-057 E	47.62
882311	Q-066	.55
882331	Q-067B	.89
295990	R-016 C1	3.05
295992	R-016 C2	3.05
295991	R-016 E1	12.18
295993	R-016 E2	12.18
296308	R-030 C1	8.01
296271	R-030 C2	8.01
296125	R-030 C3	8.11
296309	R-030 E1	32.04
296272	R-030 E2	32.04
296128	R-030 E3	32.43
296827	R-079 C1	7.59
296741	R-079 C2	7.59
296828	R-079 E1	30.35
296740	R-079 E2	30.35
290294	S-036 C1	9.13
290295	S-036 E1	36.53
290298	S-037 C1	9.13
290299	S-037 E1	36.53
884780	S-058 C	192.
884781	S-058 E	633.06
884891	S-062 C1	8.72
884901	S-062 C2	8.66
884911	S-062 C3	8.72
884892	S-062 E1	34.87
884902	S-062 E2	34.92
884912	S-062 E3	34.87

274793	SECHI;0U	.24
274794	SECHI;1U	.24
274795	SECHI;2U	.24
274792	SECHI;9U	.24
274679	SLINE;3U	51.81
274680	SLINE;4U	83.66
885861	T-074 1	2.03
885862	T-074 2	2.03
885961	T-099 C	4.89
885962	T-099 E	19.58
886001	T-105 C	17.27
886002	T-105 E	69.06
886211	T-143 C1	6.06
886221	T-143 C2	6.06
886212	T-143 E1	24.23
886222	T-143 E2	24.23
886261	T-148 C	4.89
886262	T-148 E	19.58
274861	TCROP;1U	26.12
274862	TCROP;2U	50.7
246416	TWBRANCH	1.28
887641	U1-049 C	3.39
887642	U1-049 E	22.7
890511	U3-021 1	12.37
890521	U3-021 2	12.37
890570	U3-026 C1	67.48
890571	U3-026 C2	67.48
890561	U3-031	.25
891231	U4-039 C1	5.2
891241	U4-039 C2	5.2
891251	U4-039 C3	5.2
891261	U4-039 C4	5.2
891232	U4-039 E1	34.79
891242	U4-039 E2	34.79
891252	U4-039 E3	34.79
891262	U4-039 E4	34.79
892051	V1-022 1	49.62
892061	V1-022 2	49.62
LTF	V3-012	57.51
894581	V3-015 C	9.75
894582	V3-015 E	65.27
247547	V4-016 C	6.79
247923	V4-016 E	45.44
900371	V4-046	4.84

900381	V4-047	4.84
902491	W2-079 C	1.8
902492	W2-079 E	2.94
903281	W3-024 C	5.37
903282	W3-024 E	35.96
903432	W3-046	13.83
903442	W3-046	12.8
903452	W3-046	13.83
903462	W3-046	12.8
LTF	W3-083	33.74
903791	W3-132 C	1.81
903792	W3-132 E	2.93
905252	W4-033 E1	1.2
905262	W4-033 E2	.4
905491	W4-086	.54
905501	W4-087	.97
907021	X1-020 C	53.51
907022	X1-020 E	358.12
907111	X1-040 C	12.02
907112	X1-040 E	80.43
907141	X1-045	.78
907361	X1-087	4.62
907432	X1-099 E	.96
909041	X2-019 C	45.2
LTF	X2-042	116.74
909181	X2-052	186.49
910541	X3-005 C	1.
910542	X3-005 E	1.63
LTF	X3-020	39.08
LTF	X3-021	99.11
910711	X3-045 1	4.14
910721	X3-045 2	4.08
LTF	X3-096	94.02
LTF	X3-097	133.32
LTF	X3-098	126.37
LTF	X4-029D	44.11
LTF	X4-041	124.85
LTF	Y1-002	180.46
LTF	Y1-004	52.26
913011	Y1-005 1	45.67
913021	Y1-005 2	45.67
LTF	Y1-007	36.29
LTF	Y1-041	44.11
913522	Y1-078 E	5.2

LTF	Y2-004	64.68
LTF	Y2-005	64.68
LTF	Y2-006	57.66
LTF	Y2-007	129.37
LTF	Y2-008	117.05
LTF	Y2-033	27.84
LTF	Y2-040	99.11
LTF	Y2-049	81.39
LTF	Y2-056	132.34
LTF	Y2-068	669.
LTF	Y2-069	33.28
LTF	Y2-070	33.28
LTF	Y2-071	33.28
LTF	Y2-072	33.28
LTF	Y2-082	335.73
914461	Y2-103	90.4
914491	Y2-107 C OP2	6.68
914492	Y2-107 E OP2	44.68

Appendix 5

Bus Number	Bus Name	Full Contribution
243440	05CKG1	6.93
243441	05CKG2	7.38
246427	BERRIENS	1.88
246431	BUCHANAN	1.09
274865	CAYUG;1U C1	7.4
274863	CAYUG;1U E1	29.6
274866	CAYUG;2U C2	7.4
274864	CAYUG;2U E2	29.6
292535	CE23CL12	.98
292536	CE23EL12	3.93
274670	CRAWF;7G	27.65
274671	CRAWF;7Y	27.65
274672	CRAWF;8U	82.99
274849	CRESC;1U	13.06
294702	CRESC;2U	11.51
246397	ELKHARTH	1.
274673	FISK ;9U	84.89
990700	FREEPT_G	15.48
299901	K-002 E	15.34
274770	LINC G1	.45
274771	LINC G2	.45
274772	LINC G3	.45
274773	LINC G4	.45
274774	LINC G5	.45
274775	LINC G6	.45
274776	LINC G7	.45
274777	LINC G8	.45
274850	M HIL;RU	12.37
246422	MAYFLWER	.04
246536	MOTTVILL	.41
293061	N-015 E	30.98
293120	N-021 C	.29
293121	N-021 E	1.18
293130	N-022 C	.54
293131	N-022 E	2.16
293140	N-023 C	.54
293141	N-023 E	2.16
293150	N-024 C	.54
293151	N-024 E	2.16
293160	N-025 C	.54
293161	N-025 E	2.16

293190	O-003 C	.44
293191	O-003 E	1.52
293655	O-023 E	61.45
293665	O-024 E	19.46
293667	O-024 E	38.57
290007	O-033 E	3.93
293771	O-035 E	14.39
290021	O-050 E	40.78
293645	O22E	61.45
294392	P-010 E	39.34
290051	P-014 E	15.71
290053	P-026 E	3.93
294700	P-040 C	.96
294701	P-040 E	3.84
294763	P-046 E	19.34
290108	Q-057 E	47.62
882311	Q-066	.55
882331	Q-067B	.89
295990	R-016 C1	3.05
295992	R-016 C2	3.05
295991	R-016 E1	12.18
295993	R-016 E2	12.18
296308	R-030 C1	8.01
296271	R-030 C2	8.01
296125	R-030 C3	8.11
296309	R-030 E1	32.04
296272	R-030 E2	32.04
296128	R-030 E3	32.43
296827	R-079 C1	7.59
296741	R-079 C2	7.59
296828	R-079 E1	30.35
296740	R-079 E2	30.35
290294	S-036 C1	9.13
290295	S-036 E1	36.53
290298	S-037 C1	9.13
290299	S-037 E1	36.53
884780	S-058 C	192.
884781	S-058 E	633.06
884891	S-062 C1	8.72
884901	S-062 C2	8.66
884911	S-062 C3	8.72
884892	S-062 E1	34.87
884902	S-062 E2	34.92
884912	S-062 E3	34.87

274793	SECHI;0U	.24
274794	SECHI;1U	.24
274795	SECHI;2U	.24
274792	SECHI;9U	.24
274679	SLINE;3U	51.81
274680	SLINE;4U	83.66
885861	T-074 1	2.03
885862	T-074 2	2.03
885961	T-099 C	4.89
885962	T-099 E	19.58
886001	T-105 C	17.27
886002	T-105 E	69.06
886211	T-143 C1	6.06
886221	T-143 C2	6.06
886212	T-143 E1	24.23
886222	T-143 E2	24.23
886261	T-148 C	4.89
886262	T-148 E	19.58
274861	TCROP;1U	26.12
274862	TCROP;2U	50.7
246416	TWBRANCH	1.28
887641	U1-049 C	3.39
887642	U1-049 E	22.7
890511	U3-021 1	12.37
890521	U3-021 2	12.37
890570	U3-026 C1	67.48
890571	U3-026 C2	67.48
890561	U3-031	.25
891231	U4-039 C1	5.2
891241	U4-039 C2	5.2
891251	U4-039 C3	5.2
891261	U4-039 C4	5.2
891232	U4-039 E1	34.79
891242	U4-039 E2	34.79
891252	U4-039 E3	34.79
891262	U4-039 E4	34.79
892051	V1-022 1	49.62
892061	V1-022 2	49.62
LTF	V3-012	57.51
894581	V3-015 C	9.75
894582	V3-015 E	65.27
247547	V4-016 C	6.79
247923	V4-016 E	45.44
900371	V4-046	4.84

900381	V4-047	4.84
902491	W2-079 C	1.8
902492	W2-079 E	2.94
903281	W3-024 C	5.37
903282	W3-024 E	35.96
903432	W3-046	13.83
903442	W3-046	12.8
903452	W3-046	13.83
903462	W3-046	12.8
LTF	W3-083	33.74
903791	W3-132 C	1.81
903792	W3-132 E	2.93
905252	W4-033 E1	1.2
905262	W4-033 E2	.4
905491	W4-086	.54
905501	W4-087	.97
907021	X1-020 C	53.51
907022	X1-020 E	358.12
907111	X1-040 C	12.02
907112	X1-040 E	80.43
907141	X1-045	.78
907361	X1-087	4.62
907432	X1-099 E	.96
909041	X2-019 C	45.2
LTF	X2-042	116.74
909181	X2-052	186.49
910541	X3-005 C	1.
910542	X3-005 E	1.63
LTF	X3-020	39.08
LTF	X3-021	99.11
910711	X3-045 1	4.14
910721	X3-045 2	4.08
LTF	X3-096	94.02
LTF	X3-097	133.32
LTF	X3-098	126.37
LTF	X4-029D	44.11
LTF	X4-041	124.85
LTF	Y1-002	180.46
LTF	Y1-004	52.26
913011	Y1-005 1	45.67
913021	Y1-005 2	45.67
LTF	Y1-007	36.29
LTF	Y1-041	44.11
913522	Y1-078 E	5.2

LTF	Y2-004	64.68
LTF	Y2-005	64.68
LTF	Y2-006	57.66
LTF	Y2-007	129.37
LTF	Y2-008	117.05
LTF	Y2-033	27.84
LTF	Y2-040	99.11
LTF	Y2-049	81.39
LTF	Y2-056	132.34
LTF	Y2-068	669.
LTF	Y2-069	33.28
LTF	Y2-070	33.28
LTF	Y2-071	33.28
LTF	Y2-072	33.28
LTF	Y2-082	335.73
914461	Y2-103	90.4
914491	Y2-107 C OP2	6.68
914492	Y2-107 E OP2	44.68

Appendix 6

Bus Number	Bus Name	Full Contribution
243440	05CKG1	7.43
243441	05CKG2	7.93
246427	BERRIENS	2.02
246431	BUCHANAN	1.17
274865	CAYUG;1U C1	8.
274863	CAYUG;1U E1	32.
274866	CAYUG;2U C2	8.
274864	CAYUG;2U E2	32.
292535	CE23CL12	1.06
292536	CE23EL12	4.23
274670	CRAWF;7G	29.78
274671	CRAWF;7Y	29.78
274672	CRAWF;8U	89.38
274849	CRESC;1U	14.09
294702	CRESC;2U	12.42
246397	ELKHARTH	1.06
274673	FISK ;9U	91.43
990700	FREEPT_G	16.67
299901	K-002 E	16.52
274770	LINC G1	.49
274771	LINC G2	.49
274772	LINC G3	.49
274773	LINC G4	.49
274774	LINC G5	.49
274775	LINC G6	.49
274776	LINC G7	.49
274777	LINC G8	.49
274850	M HIL;RU	13.32
246422	MAYFLWER	.04
246536	MOTTVILL	.44
293061	N-015 E	33.37
293120	N-021 C	.32
293121	N-021 E	1.27
293130	N-022 C	.58
293131	N-022 E	2.33
293140	N-023 C	.58
293141	N-023 E	2.33
293150	N-024 C	.58
293151	N-024 E	2.33
293160	N-025 C	.58
293161	N-025 E	2.33

293190	O-003 C	.48
293191	O-003 E	1.64
293655	O-023 E	66.22
293665	O-024 E	21.06
293667	O-024 E	41.74
290007	O-033 E	4.23
293771	O-035 E	15.53
290021	O-050 E	43.94
293645	O22E	66.22
294392	P-010 E	42.38
294401	P-011 E1	20.5
294410	P-011 E2	20.5
290051	P-014 E	16.91
290053	P-026 E	4.23
294700	P-040 C	1.04
294701	P-040 E	4.14
294763	P-046 E	20.82
290089	Q-039 C	7.24
290090	Q-039 E	18.61
290108	Q-057 E	51.29
882311	Q-066	.59
882331	Q-067B	.96
295990	R-016 C1	3.28
295992	R-016 C2	3.28
295991	R-016 E1	13.12
295993	R-016 E2	13.12
296308	R-030 C1	8.67
296271	R-030 C2	8.67
296125	R-030 C3	8.77
296309	R-030 E1	34.68
296272	R-030 E2	34.68
296128	R-030 E3	35.09
296827	R-079 C1	8.18
296741	R-079 C2	8.18
296828	R-079 E1	32.71
296740	R-079 E2	32.71
290294	S-036 C1	9.83
290295	S-036 E1	39.34
290298	S-037 C1	9.83
290299	S-037 E1	39.34
884780	S-058 C	206.75
884781	S-058 E	681.67
884891	S-062 C1	9.39
884901	S-062 C2	9.33

884911	S-062 C3	9.39
884892	S-062 E1	37.55
884902	S-062 E2	37.61
884912	S-062 E3	37.55
274793	SECHI;0U	.26
274794	SECHI;1U	.26
274795	SECHI;2U	.26
274792	SECHI;9U	.26
274679	SLINE;3U	55.77
274680	SLINE;4U	90.06
885861	T-074 1	2.19
885862	T-074 2	2.19
885961	T-099 C	5.27
885962	T-099 E	21.08
886001	T-105 C	18.66
886002	T-105 E	74.66
886211	T-143 C1	6.54
886221	T-143 C2	6.54
886212	T-143 E1	26.14
886222	T-143 E2	26.14
886261	T-148 C	5.27
886262	T-148 E	21.08
274861	TCROP;1U	28.14
274862	TCROP;2U	54.63
246416	TWBRANCH	1.37
887641	U1-049 C	3.65
887642	U1-049 E	24.45
890511	U3-021 1	13.32
890521	U3-021 2	13.32
890570	U3-026 C1	72.66
890571	U3-026 C2	72.66
890561	U3-031	.27
891231	U4-039 C1	6.27
891241	U4-039 C2	6.27
891251	U4-039 C3	6.27
891261	U4-039 C4	6.27
891232	U4-039 E1	41.97
891242	U4-039 E2	41.97
891252	U4-039 E3	41.97
891262	U4-039 E4	41.97
892051	V1-022 1	53.44
892061	V1-022 2	53.44
LTF	V3-012	57.32
247547	V4-016 C	7.27

247923	V4-016 E	48.62
900371	V4-046	5.21
900381	V4-047	5.21
902491	W2-079 C	1.94
902492	W2-079 E	3.16
903281	W3-024 C	5.62
903282	W3-024 E	37.66
903432	W3-046	14.9
903442	W3-046	13.8
903452	W3-046	14.9
903462	W3-046	13.8
LTF	W3-083	36.27
903791	W3-132 C	1.94
903792	W3-132 E	3.15
905252	W4-033 E1	1.3
905262	W4-033 E2	.43
905491	W4-086	.58
905501	W4-087	1.04
907021	X1-020 C	60.1
907022	X1-020 E	402.2
907111	X1-040 C	12.7
907112	X1-040 E	84.98
907141	X1-045	.84
907361	X1-087	4.98
907432	X1-099 E	1.04
909041	X2-019 C	48.68
LTF	X2-042	119.18
909181	X2-052	200.31
910541	X3-005 C	1.07
910542	X3-005 E	1.75
LTF	X3-020	42.37
LTF	X3-021	105.51
910711	X3-045 1	4.46
910721	X3-045 2	4.4
LTF	X3-096	101.92
LTF	X3-097	144.52
LTF	X3-098	136.99
LTF	X4-029D	47.3
LTF	X4-041	135.34
LTF	Y1-002	193.52
LTF	Y1-004	49.74
913011	Y1-005 1	49.18
913021	Y1-005 2	49.18
LTF	Y1-007	34.54

LTF	Y1-041	47.3
913522	Y1-078 E	5.6
LTF	Y2-004	70.34
LTF	Y2-005	70.34
LTF	Y2-006	59.23
LTF	Y2-007	140.68
LTF	Y2-008	119.94
LTF	Y2-033	26.57
LTF	Y2-040	105.51
LTF	Y2-049	86.64
LTF	Y2-056	141.9
LTF	Y2-068	725.19
LTF	Y2-069	35.44
LTF	Y2-070	35.44
LTF	Y2-071	35.44
LTF	Y2-072	35.44
LTF	Y2-082	358.14
914461	Y2-103	97.35
914491	Y2-107 C OP2	7.05
914492	Y2-107 E OP2	47.21

Appendix 7

Bus Number	Bus Name	Full Contribution
238545	02ASHTG5	-31.32
238554	02AVONG7	-23.22
238555	02AVONG9	-255.11
238564	02BAYSG1	.58
238565	02BAYSG2	25.03
238566	02BAYSG3	25.75
238567	02BAYSG4	38.99
238568	02BAYSHO	.07
238571	02BEAVGA	.35
238572	02BEAVGB	.35
238670	02DVBSG1	5.08
238888	02LEMOG4	.64
238995	02NCUNTD	-.39
239006	02NILEG1	-8.06
239007	02NILEG2	-7.99
239022	02NWCAG3	-5.93
239023	02NWCAG4	-5.99
239024	02NWCAG5	-9.16
239171	02WLORG-2	.83
239172	02WLORG-3	.83
239173	02WLORG-4	.83
239174	02WLORG-5	.83
239175	02WLORG-6	.52
247927	05BLCK-1_E	6.61
247928	05BLCK-2_E	6.61
247929	05BLCK-3_E	6.72
247528	05COVRT1	15.6
247529	05COVRT2	15.6
247530	05COVRT3	15.6
247531	05COVRT4	9.36
247532	05COVRT5	9.36
247533	05COVRT6	9.36
254007	15ELRMA1	-4.88
254008	15ELRMA2	-4.99
246427	BERRIENS	.43
246431	BUCHANAN	.23
246397	ELKHARTH	.22
246536	MOTTVILL	.1
247500	R-003 C	1.34
247900	R-003 E	5.35
247901	R-048 E	2.91

247517	R-049 C	2.04
247902	R-049 E	8.18
247537	S-072 C	4.27
247904	S-072 E	17.08
247520	S-073 C	2.79
247905	S-073 E	11.17
274679	SLINE;3U	.2
274680	SLINE;4U	.32
247503	T-130 C	4.33
247906	T-130 E	17.3
247521	T-131 C	2.01
247907	T-131 E	8.04
246416	TWBRANCH	.28
247522	U1-059 C	.56
247909	U1-059 E	3.75
247505	U1-060 C	1.52
247910	U1-060 E	10.2
889031	U2-028A_AT1	24.4
247911	U2-041 E	15.02
247540	U2-072 C	2.24
247914	U2-072 E	15.02
299984	U3-029 E	-.77
299989	U3-030 E	-.35
247542	U4-001 C	2.18
247918	U4-001 E	14.61
891141	U4-028 C	1.62
891142	U4-028 E	10.85
891151	U4-029 C	1.62
891152	U4-029 E	10.85
892021	V1-011 C	.92
892022	V1-011 E	6.14
892031	V1-012 C	1.38
892032	V1-012 E	9.2
893001	V2-001 C	.97
893002	V2-001 E	6.95
893021	V2-006 C	1.95
893022	V2-006 E	13.04
833193	V2-042AC1OP1	1.78
833194	V2-042AE1OP1	11.91
LTF	V3-012	20.8
894641	V3-028 C	.44
894642	V3-028 E	.71
247548	V4-010 C	3.46
247932	V4-010 E	23.18

900041	V4-011	.38
247546	V4-015 C	1.14
247922	V4-015 E	7.58
247547	V4-016 C	1.57
247923	V4-016 E	10.48
901161	W1-056 C	.18
901162	W1-056 E	1.19
901221	W1-072A_AT5	7.18
902141	W2-001 C	1.13
902142	W2-001 E	7.6
902151	W2-007 C	1.3
902152	W2-007 E	8.7
903231	W3-005 C	6.81
903232	W3-005 E	45.57
903281	W3-024 C	1.04
903282	W3-024 E	6.96
903511	W3-059A_AT6	3.06
903512	W3-059A_AT6	20.42
LTF	W3-083	6.91
903611	W3-085 C	2.41
903612	W3-085 E	16.17
903621	W3-088 C OP1	1.65
903622	W3-088 E OP1	11.03
907041	X1-027A C1	5.26
907044	X1-027A C2	5.26
907046	X1-027A C3	5.26
907048	X1-027A C4	5.26
907042	X1-027A E1	35.22
907045	X1-027A E2	35.22
907047	X1-027A E3	35.22
907049	X1-027A E4	35.22
907111	X1-040 C	2.69
907112	X1-040 E	17.99
LTF	X2-042	29.17
909181	X2-052	36.21
909201	X2-058 C	2.54
909202	X2-058 E	17.06
910501	X3-001 C	.08
910502	X3-001 E	.13
LTF	X3-020	8.67
LTF	X3-021	93.97
910601	X3-023 C OP1	.77
910602	X3-023 E OP1	5.14
910621	X3-030 C	1.83

910622	X3-030 E	12.22
910631	X3-031 C OP1	1.32
910632	X3-031 E OP1	8.82
LTF	X3-096	20.85
LTF	X3-097	29.56
LTF	X3-098	28.02
LTF	X4-029D	8.95
LTF	X4-041	27.69
LTF	Y1-002	35.87
LTF	Y1-004	22.97
LTF	Y1-007	15.95
913211	Y1-030 C OP1	1.2
913212	Y1-030 E OP1	8.03
LTF	Y1-041	8.95
913441	Y1-069 OP1	136.14
LTF	Y2-004	14.12
LTF	Y2-005	14.12
LTF	Y2-006	13.72
LTF	Y2-007	28.24
LTF	Y2-008	27.53
LTF	Y2-030	6.48
LTF	Y2-031	6.48
LTF	Y2-032	6.48
LTF	Y2-033	11.28
LTF	Y2-040	93.97
LTF	Y2-049	77.17
LTF	Y2-056	26.85
LTF	Y2-068	148.34
LTF	Y2-069	19.53
LTF	Y2-070	19.53
LTF	Y2-071	19.53
LTF	Y2-072	19.53
LTF	Y2-082	104.18
914491	Y2-107 C OP2	1.49
914492	Y2-107 E OP2	9.99