6TH AVE N/BENCH –BLGS Phase II

Study Objectives

- Evaluate existing and future traffic conditions on Main Street between Airport Road and 1st Avenue
- Determine what, if any design improvements should be considered for intersection of Main Street with:
  - Bench Blvd/6th Avenue
  - 1st Ave/US 87
- Determine what, if any MetraPark events should utilize a ‘release plan’

Study area intersections

- Airport Rd
- 6th Ave/Bench Blvd
- 4th Ave
- 1st Ave/US 87

Study Baseline Assumptions

1. **Billings Bypass will be operational by 2020**
2. Inner Belt Loop operational before 2033.
3. Use existing coordinated signal timing

Data Collection

- April 2012 and again in July 2012 .
- Past traffic reports and documentation associated with the *6th Avenue North to Bench Boulevard* project.
- Field reconnaissance and observation.
- Parking information for MetraPark.

Site Observations

- Un-serviced demand at intersections due to congestion
- Heavy truck convoys cause lane blockage and spillback
- Lane choices and weaving can be challenging
- 1st Ave/US 87 intersection back up
- Very few pedestrians, except during Metra events
- Metrapark underutilizes the Main Street – Bench intersection

Traffic Projections

Projected existing traffic for **2020 and 2033 with and without bypass in-place**

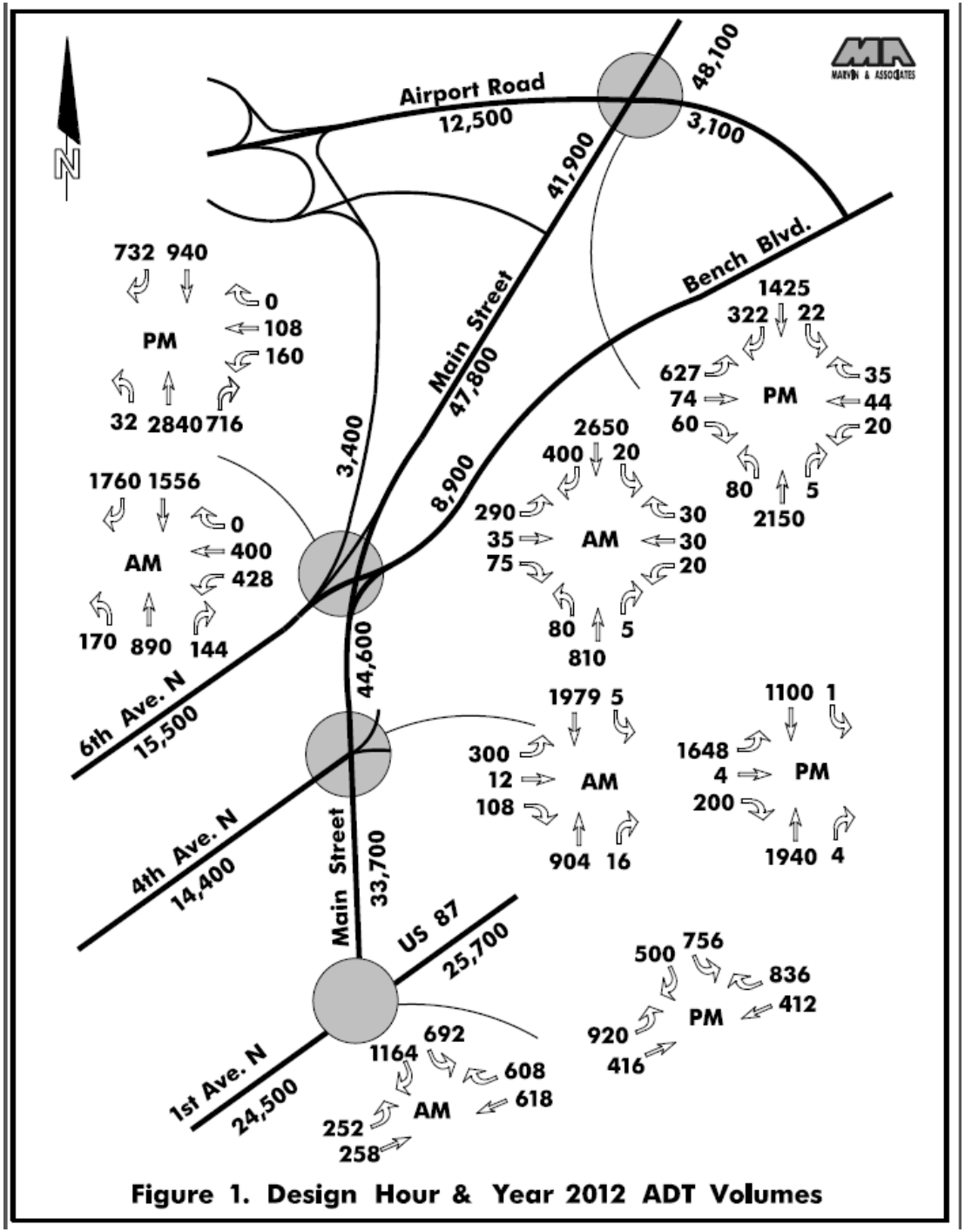


Figure 1. Design Hour & Year 2012 ADT Volumes

EXISTING (2012) TRAFFIC

2033 TRAFFIC W/ BYPASS

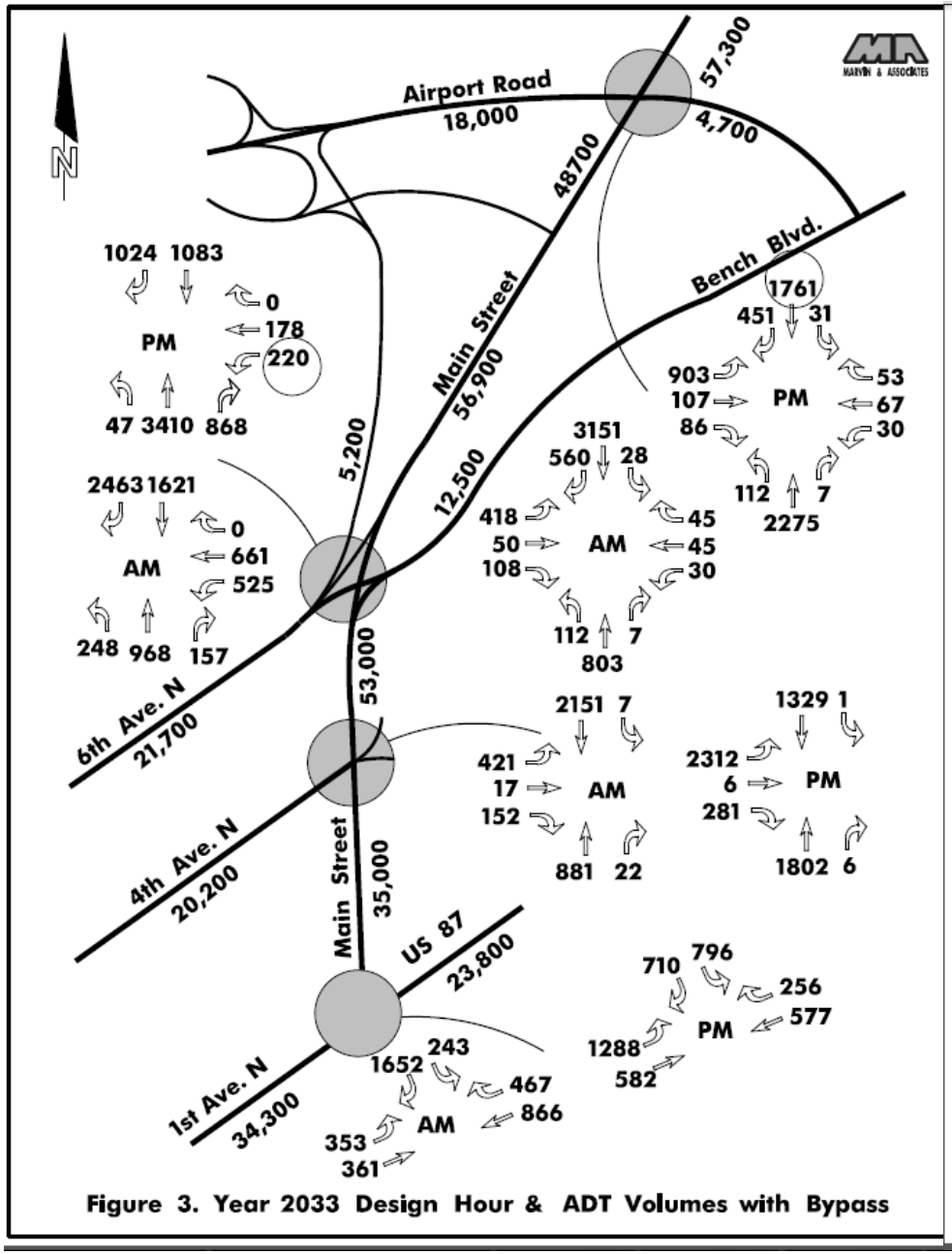


Figure 3. Year 2033 Design Hour & ADT Volumes with Bypass

2033 TRAFFIC W/OUT BYPASS

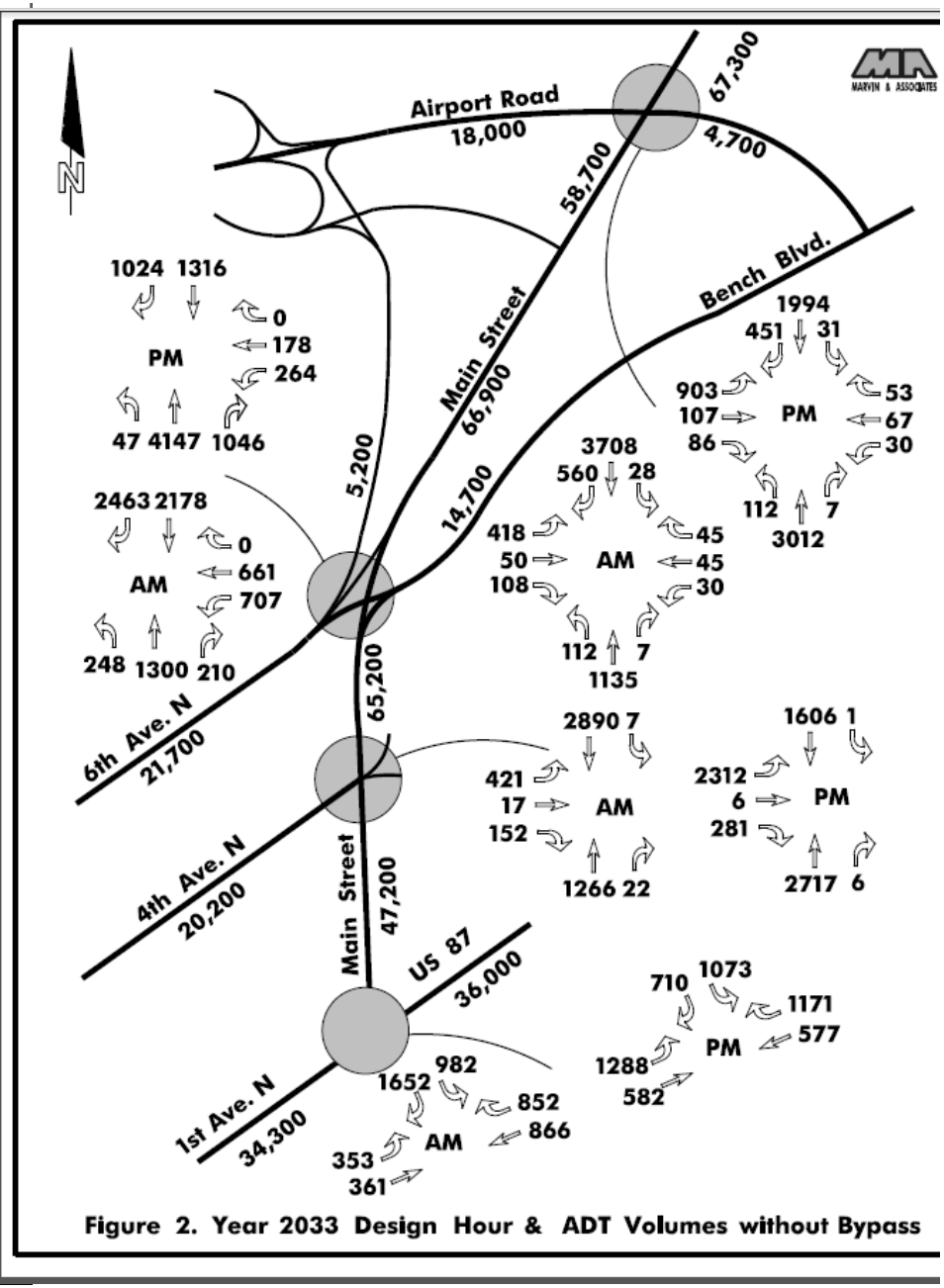


Figure 2. Year 2033 Design Hour & ADT Volumes without Bypass

Projections Summary

- In 20 years, Main Street- 4th Ave to Airport Rd
  - Increase approx . 15-20% with bypass
  - Increase approx. 40-45% without bypass
- In 20 years, Main Street- 1st Ave to 4th Ave ADT
  - increase approx 4% (1,300 vpd) with the bypass
  - increase approx 40% (13,500 vpd) without bypass
- In 20 years, Bench Blvd (along MetraPark)
  - Increase approx. 40% with bypass
  - Increase approx. 65% without bypass
- In 20 years, right-turn PM peak hr volume from US87 onto Main Street
  - decreases from 836 vph (existing) to 256 vph with the bypass
  - increases from 836 vph to 1200 vph without bypass.

EXISTING LEVEL OF SERVICE (LOS)

Intersection	Existing (2012)					
	AM Peak			PM Peak		
	Avg Delay (s/veh)	LOS	Max Queue (veh)	Avg Delay (s/veh)	LOS	Max Queue (veh)
Main St & Airport Rd	43.1	D	58	40.2	D	30
Main St & Bench Blvd/6th Ave N	17.1	B	18	8.5	A	42
Main St & 4th Ave N	11.1	B	8	200.0	F	44
Main St & 1st Ave N/Hwy 87	25.9	C	25	30.6	C	25?

2033 LEVEL OF SERVICE

Intersection	Approach	Design Year (2033) without Bypass						Design Year (2033) with Bypass					
		AM Peak			PM Peak			AM Peak			PM Peak		
		Avg Delay (s/veh)	LOS	Max Queue (veh)	Avg Delay (s/veh)	LOS	Max Queue (veh)	Avg Delay (s/veh)	LOS	Max Queue (veh)	Avg Delay (s/veh)	LOS	Max Queue (veh)
Intersection Control		*Existing Traffic Signal*						*Existing Traffic Signal*					
Main Street & Airport Road	Intersection	200.2	F	97	88.2	F	54	142.3	F	79	75.9	E	47
Intersection Control		*Existing Traffic Signal*						*Existing Traffic Signal*					
Main Street & Bench Blvd/ 6th Avenue N	Intersection	75.1	E	36	76.9	E	68	32.8	C	30	27.0	C	54
Intersection Control		*Existing Traffic Signal*						*Existing Traffic Signal*					
Main Street & 4th Avenue N	Intersection	22.3	C	15	282.2	F	74	14.8	B	10	239.2	F	74
Intersection Control		*Existing Traffic Signal*						*Existing Traffic Signal*					
Main Street & 1st Avenue N/Hwy 87	Intersection	34.2	C	36	45.3	D	29?	32.8	C	39	43.4	D	29?

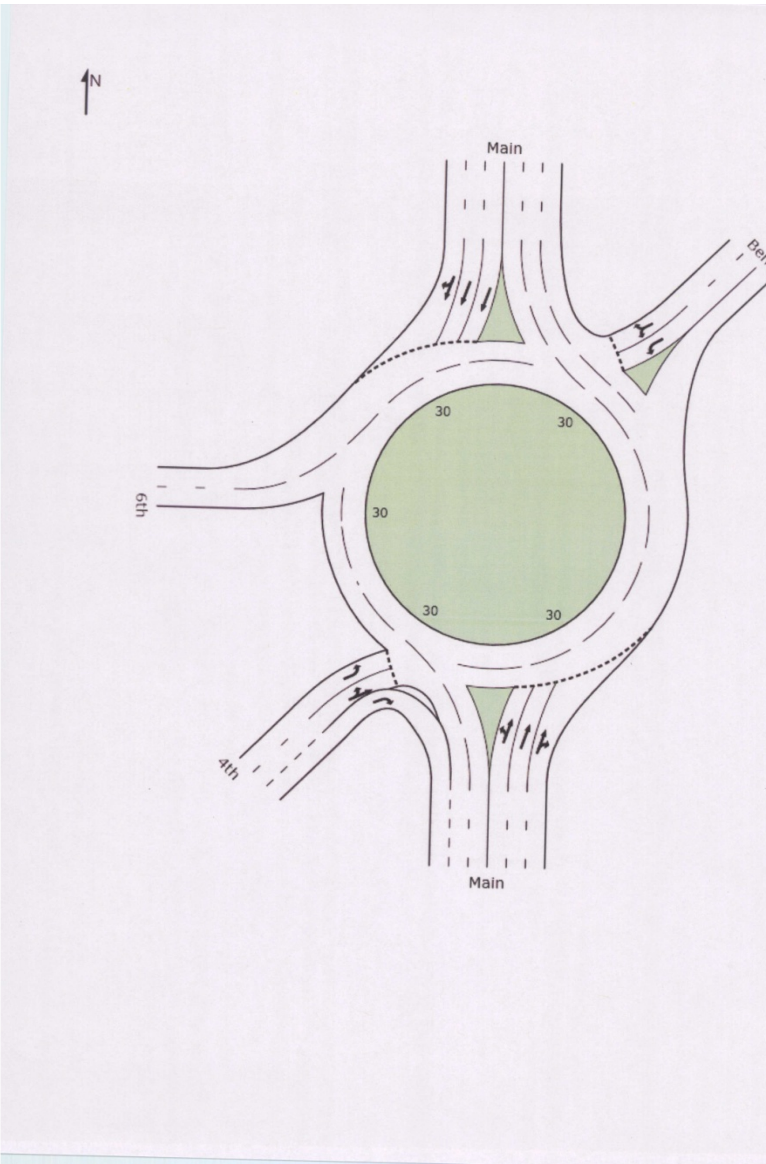
6th Avenue/Bench Blvd – Main Intersection

ALTERNATIVES:

1. **No-build** – this option would perpetuate existing conditions.
2. **Roundabout** –construct a multilane roundabout
3. **Combine 4th Avenue and 6th Avenue** –join 4th Avenue to 6th Avenue and Bench Blvd.
4. **Signalized Intersection Improved** – construct improvements to the existing intersection
5. **Overpass** – extend Bench Blvd over Main Street with or without ramps onto 6th Ave and Main St
6. **Underpass** - underpass w/ 1-lane off-ramp to Main & 1-lane off-ramp to Bench
7. **4th Avenue Flyover** – connect 4th Avenue to Main Street via a flyover. and 4th Ave to Bench Blvd via a one-lane structure

1. No-Build

2. Roundabout

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 23:10:12                  MAIN+6TH+BENCH 2033                           152
 E    (m)   11.00    5.4   11.0   11.0      TIME PERIOD      min      90
 L'   (m)   30.0    30.0   30.00  30.0      TIME SLICE       min      15
 V    (m)   10.00    4.20  10.00  10.00     RESULTS PERIOD  min  15  75
 RAD  (m)   25.00   25.00  25.00  25.00     TIME COST       $/hr  15.00
 PHI  (d)   20.00   20.00  20.00  20.00     FLOW PERIOD      min  15  75
 DIA  (m)   54.00   64.00  54.00  64.00     FLOW TYPE     pcu/veh    VEH
 GRAD SEP       0       0      0      0     FLOW PEAK    am/op/pm     AM

 LEG NAME  PCU   VEH TURNS (1st exit, 2nd..U) FLOF CL   FLOW RATIO       FLOW TIME
NORTH      1.02     0 1621      0   0         1.00 50 0.75 1.125 0.75 15 45 75
WEST       1.02     0    0      0   0         1.00 50 0.75 1.125 0.75 15 45 75
SOUTH      1.02     0  968    248   0         1.00 50 0.75 1.125 0.75 15 45 75
EAST       1.02     0  661    525   0         1.00 50 0.75 1.125 0.75 15 45 75

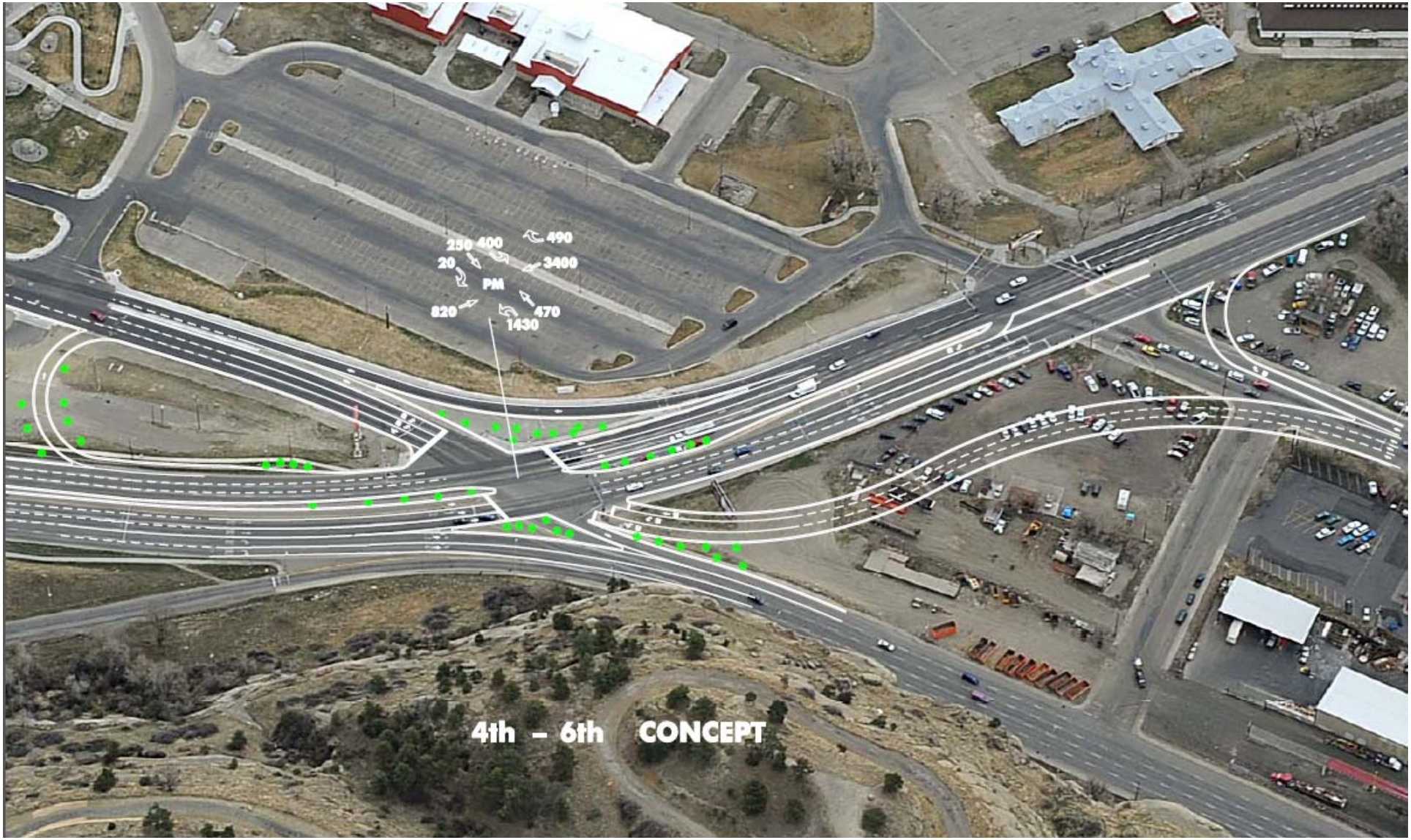
                              MODE 2
 FLOW        veh     1621      0   1216   1186          AVEDEL  s  14.7
 CAPACITY    veh     2060    474   3383   2365          LOS   SIG     B
 AVE DELAY  mins     0.35   0.13   0.16   0.18          LOS UNSIG     B
 MAX DELAY  mins     0.57   0.13   0.17   0.21
 AVE QUEUE   veh        6      0      1      1          VEHIC HRS  16.5
 MAX QUEUE   veh       11      0      1      1          COST    $   247
F1mode  F2direct  F3peak  CtrlF3rev  F4fact F6stats  F8econ  F9prnt  F10run Es
```

```
 23:10:12                  MAIN+6TH+BENCH 2033                           151
 E    (m)   11.00    5.4   11.0   11.0      TIME PERIOD      min      90
 L'   (m)   30.0    30.0   30.00  30.0      TIME SLICE       min      15
 V    (m)   10.00    4.20  10.00  10.00     RESULTS PERIOD  min  15  75
 RAD  (m)   25.00   25.00  25.00  25.00     TIME COST       $/hr  15.00
 PHI  (d)   20.00   20.00  20.00  20.00     FLOW PERIOD      min  15  75
 DIA  (m)   54.00   64.00  54.00  64.00     FLOW TYPE     pcu/veh    VEH
 GRAD SEP       0       0      0      0     FLOW PEAK    am/op/pm     PM

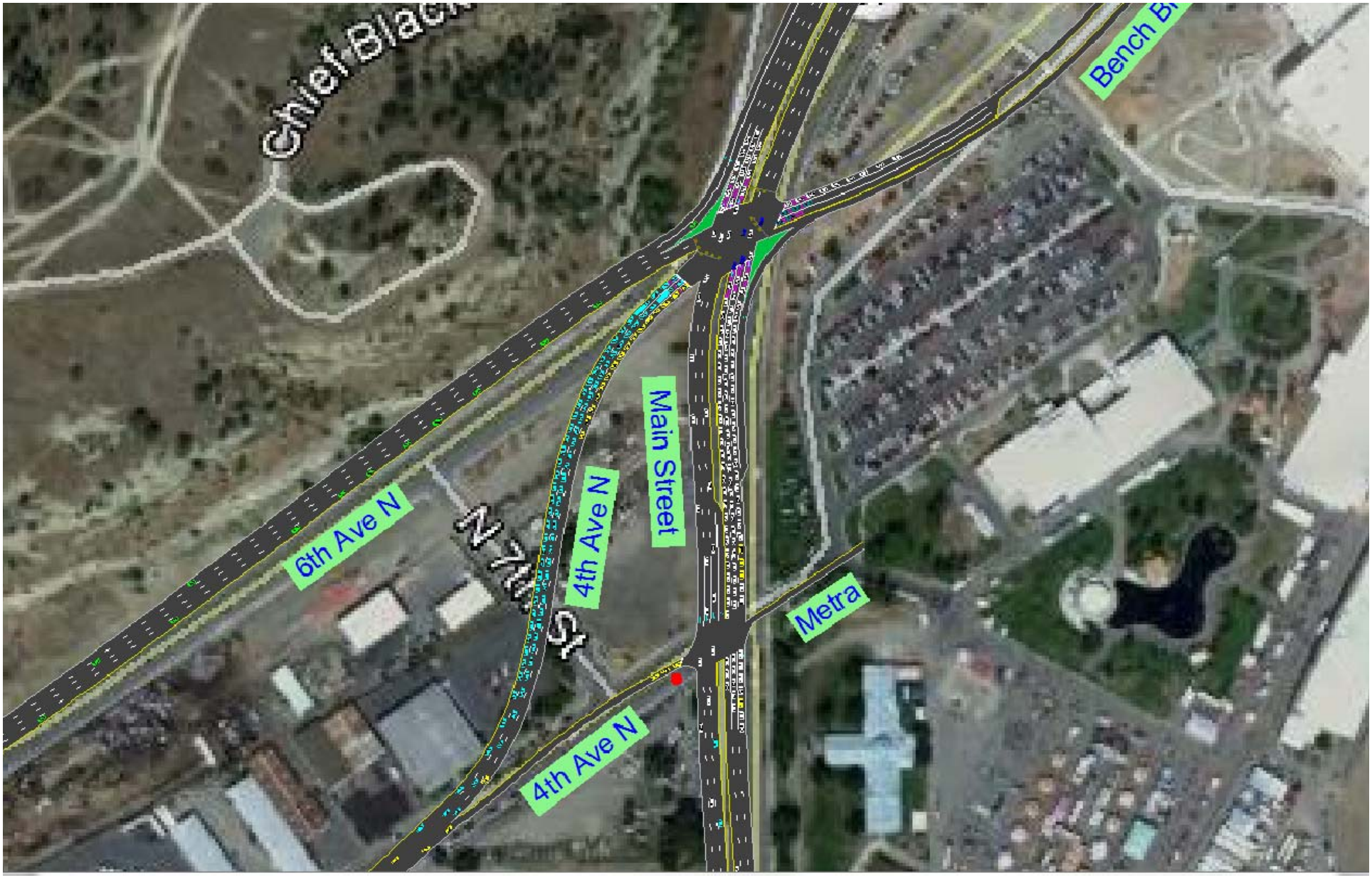
 LEG NAME  PCU   VEH TURNS (1st exit, 2nd..U) FLOF CL   FLOW RATIO       FLOW TIME
NORTH      1.02     0 1083      0   0         1.00 85 0.75 1.125 0.75 15 45 75
WEST       1.02     0    0      0   0         1.00 85 0.75 1.125 0.75 15 45 75
SOUTH      1.02     0 3410     47   0         1.00 85 0.75 1.125 0.75 15 45 75
EAST       1.02     0  178    220   0         1.00 85 0.75 1.125 0.75 15 45 75

                              MODE 2
 FLOW        veh     1083      0   3457    398          AVEDEL  s 137.0
 CAPACITY    veh     2775    727   3180    548          LOS   SIG     F
 AVE DELAY  mins     0.17   0.13   3.14   0.58          LOS UNSIG     F
 MAX DELAY  mins     0.18   0.13   6.46   0.92
 AVE QUEUE   veh        1      0    213      3          VEHIC HRS 187.9
 MAX QUEUE   veh        1      0    334      5          COST    $  2819
F1mode  F2direct  F3peak  CtrlF3rev  F4fact F6stats  F8econ  F9prnt  F10run Esc
```

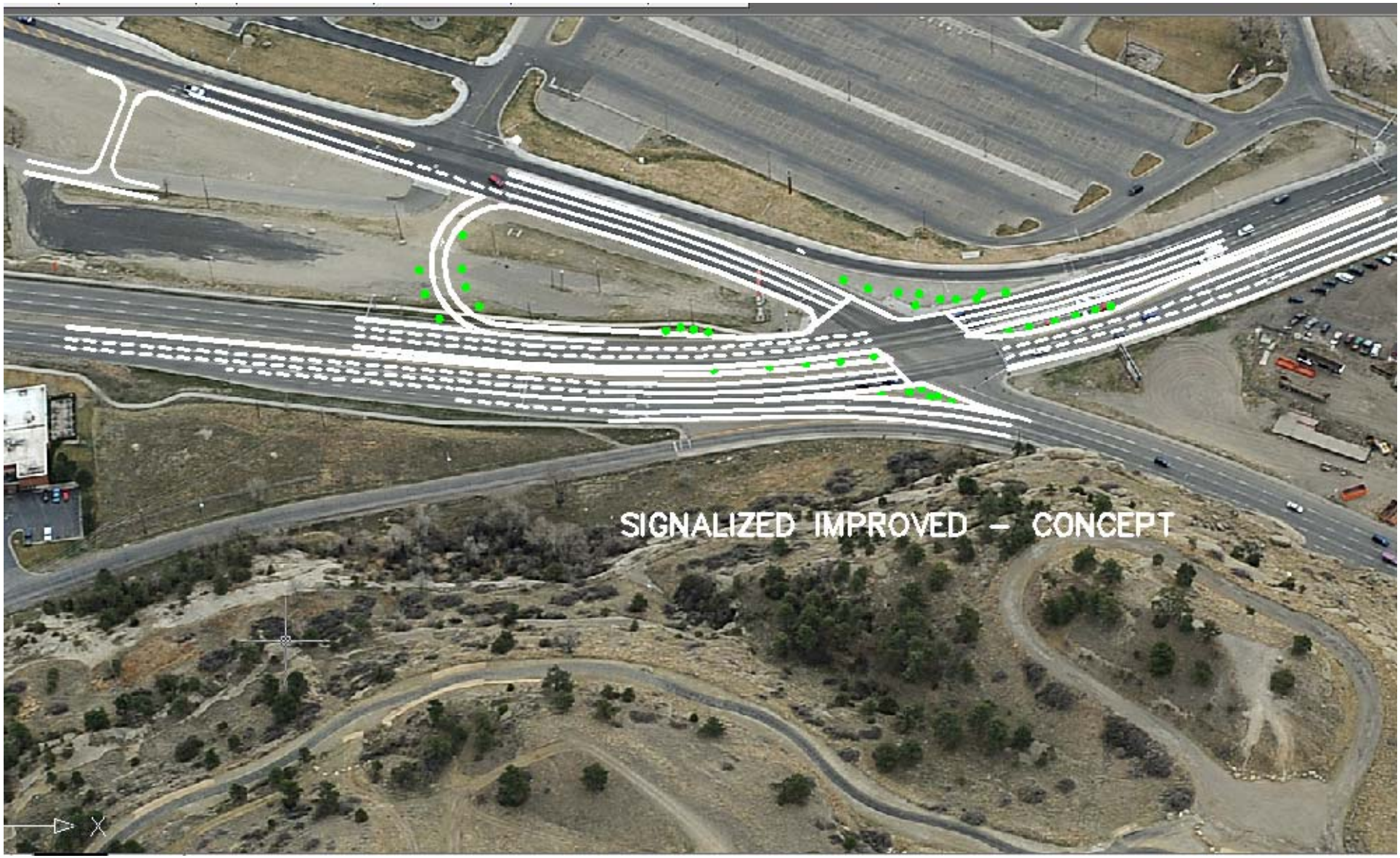
3. Combine 4th and 6th Avenue (at-grade)



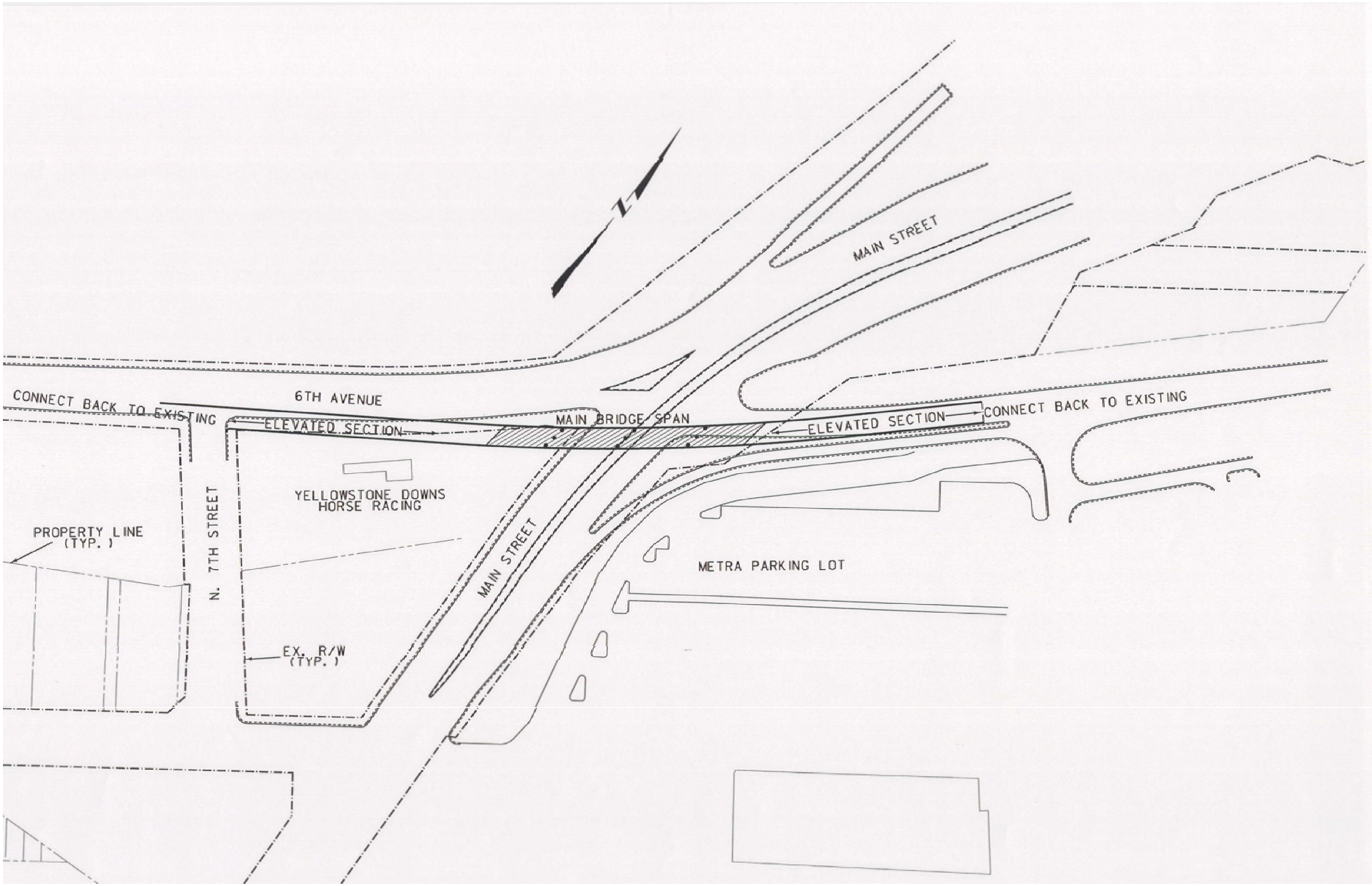
4th and 6th Avenue (at-grade) snapshot



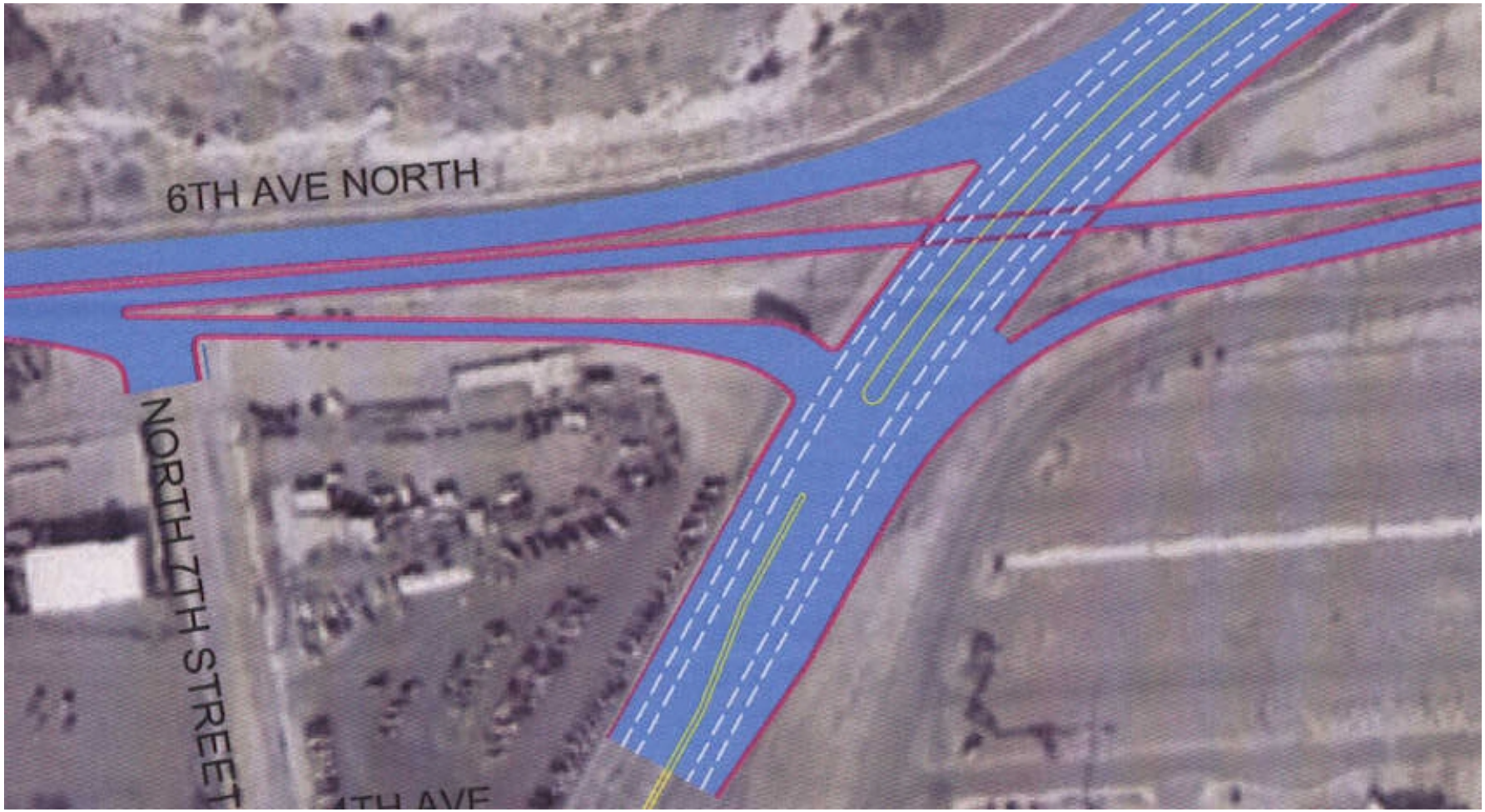
4. Signalized Intersection Improved



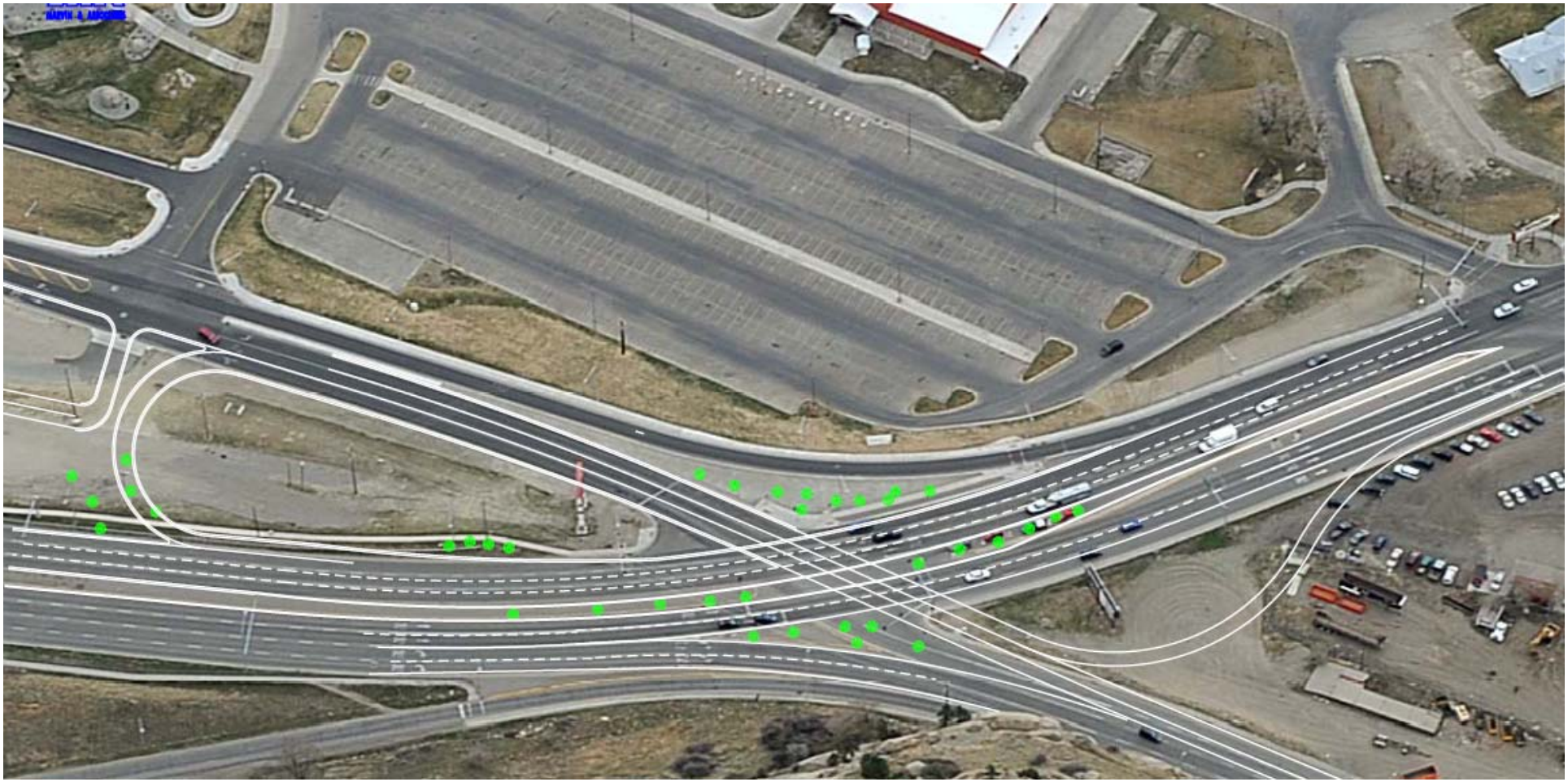
5. Overpass (by others)



6. Underpass (by others)



Overpass and Underpass

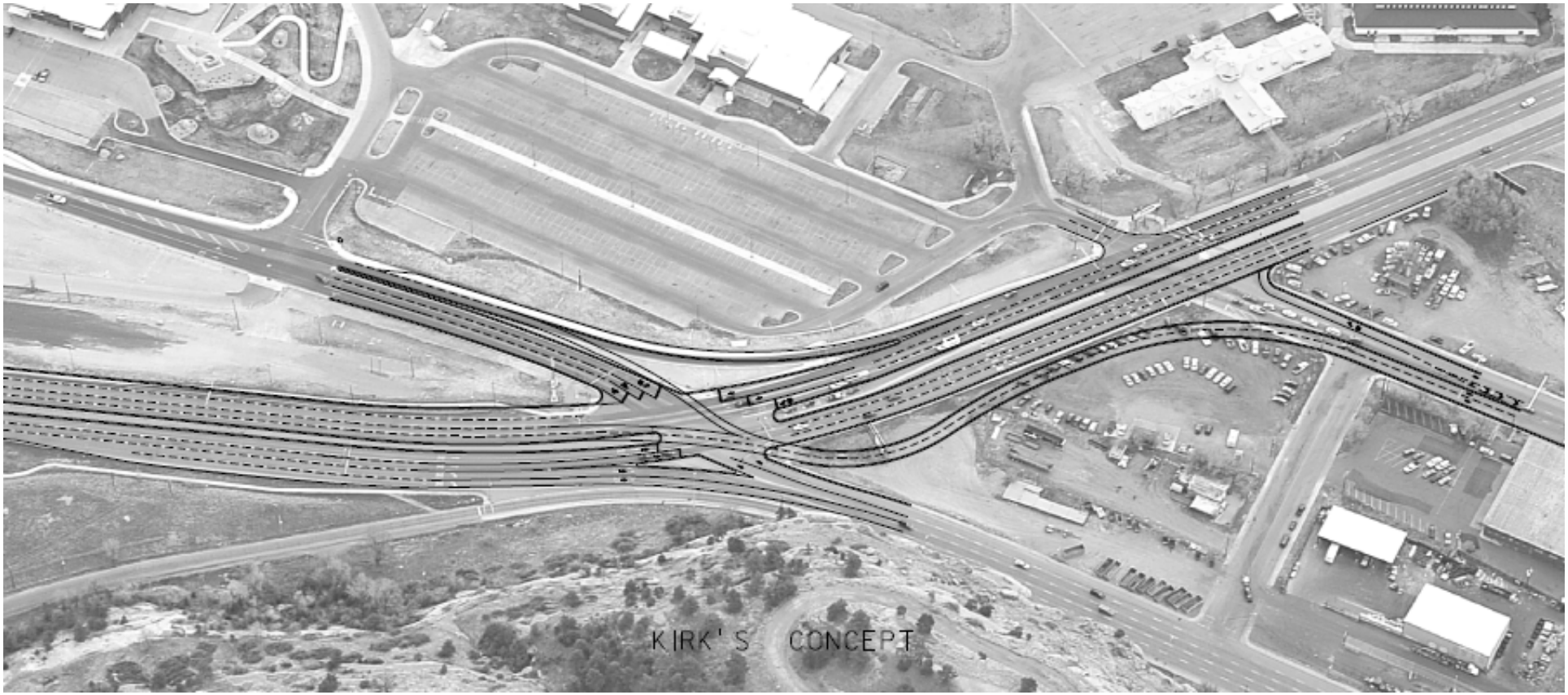


Concerns with Under/Overpass

- Weaving to make left-turn at US87
- Utilities – underpass and oil line
- Costs – structures are expensive
- Traffic Impacts during construction

Rendering of Bridge

7. 4th Avenue Flyover



Decision Matrix
6th Ave/Bench Blvd-Main Street

Criteria - Construction Impacts	Do-Nothing	Modify Existing Signal	Roundabout	Underpass	Overpass	4th Ave Flyover	Combine 4th and 6th
Mobility	+	-	-	-	+	-	-
Utilities	+	+	-	-	+	+	-
Right of Way	+	+	-	-	-	-	-
Socio Economic	+	+	-	-	-	-	-
Environmental	+	+	+	+	+	+	-
Pedestrians	+	+	-	+	+	-	-
MetraPark	+	+	-	-	+	+	-
Transit	+	+	-	-	+	+	+
Emergency Services	+	+	-	-	+	+	+

Decision Matrix
6th Ave/Bench Blvd-Main Street

Criteria – Environmental	**Do-Nothing**	**Modify Existing Signal**	**Rdbt**	**Underpass**	**Overpass**	**4th Ave Flyover**	**Combine 4th and 6th**
Viewshed	+	+	+	+	-	-	+
Displacement of property	+	+	-	-	-	-	-
Natural Resources	+	+	-	-	-	-	-
Noise	-	-	-	-	-	+	-
Business	-	-	-	+	+	+	-
Primary Concern	congestion	congestion	Land Req't	Land Req't	View	View	Land Req't

Decision Matrix
6th Ave/Bench Blvd-Main Street

Criteria – Transportation System	Do-Nothing	Modify Existing Signal	Rdbt	Underpass	Overpass	4th Ave Flyover	Combine 4th & 6th
Level of Service	C	C	F	A*	A*	B	F
Motorist Delay	-	-	-	+	+	+	-
Mobility	-	-	+	+	+	+	-
Safety	-	+	+	+	+	+	-
Traffic Patterns	+	+	-	-	-	+	+
Future Capacity	-	-	-	+	+	+	-
Emissions	-	-	+	+	+	+	-
Pedestrians	-	-	-	+	+	-	-
Local Planning	-	-	-	+	+	+	-
MetraPark	-	-	-	+	+	-	-
Primary Concern	Capacity	Cost vs Benefit	Capacity	Weaving on Main	Weaving on Main	Structure placement	Capacity

* don't forget about 4th Ave; it will remain congested

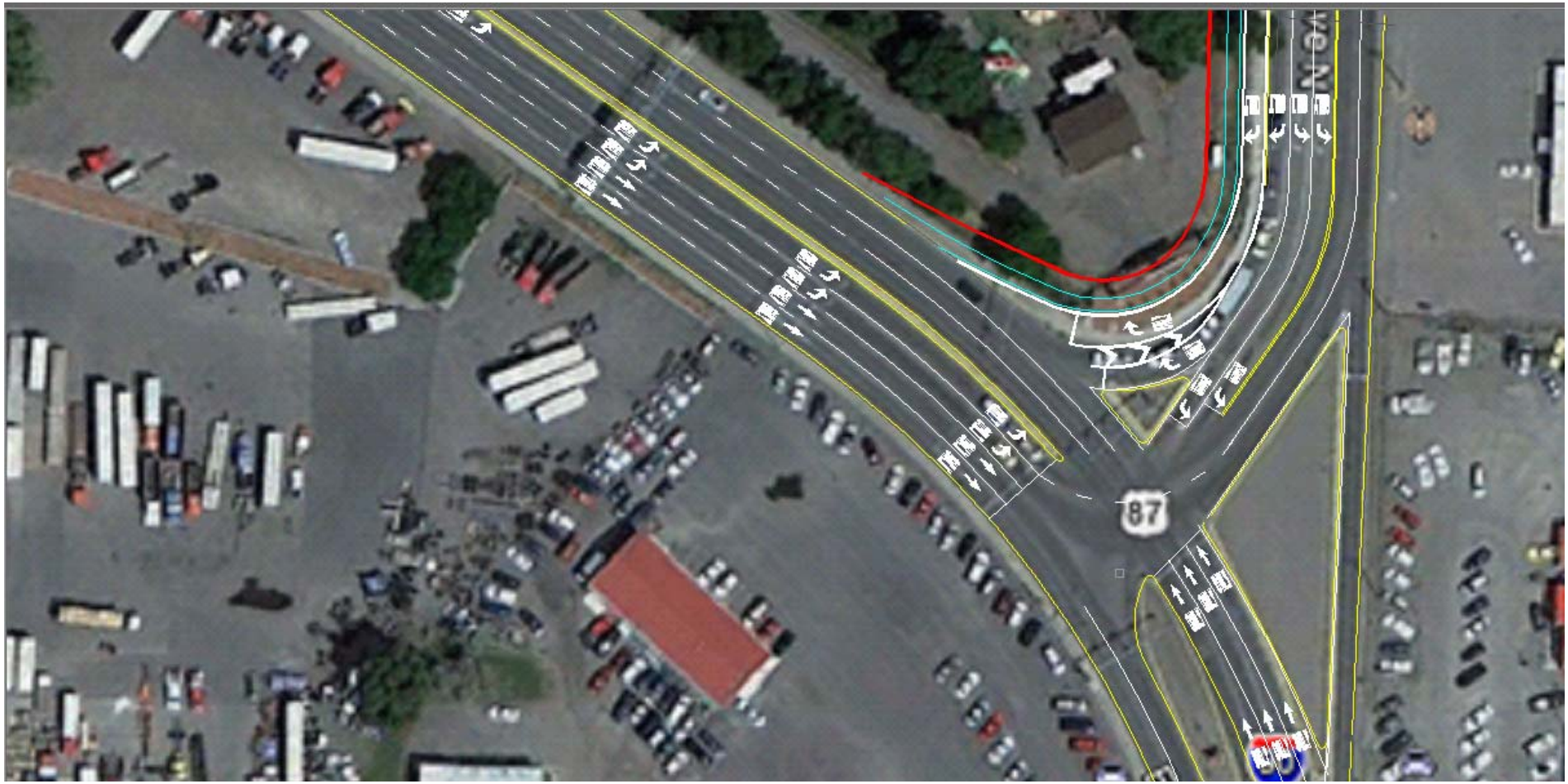
Costs

Criteria – Costs	Do-Nothing	Modify Existing Signal	Rdbt	Underpass	Overpass	4th Ave Flyover	Combine 4th and 6th
Construction – CN +CE	+	+	-	-	-	-	-
Utilities	+	+	-	-	-	-	-
Right-of-Way ($15/ft)	+	+	-	-	-	-	-
Traffic Control	+	+	-	-	-	-	-
Fuel Consumption per year (no infl)	-	-	+	+	+	+	-
Economic	-	-	-	+	+	+	-
O & M	-	-	+	+	+	+	-

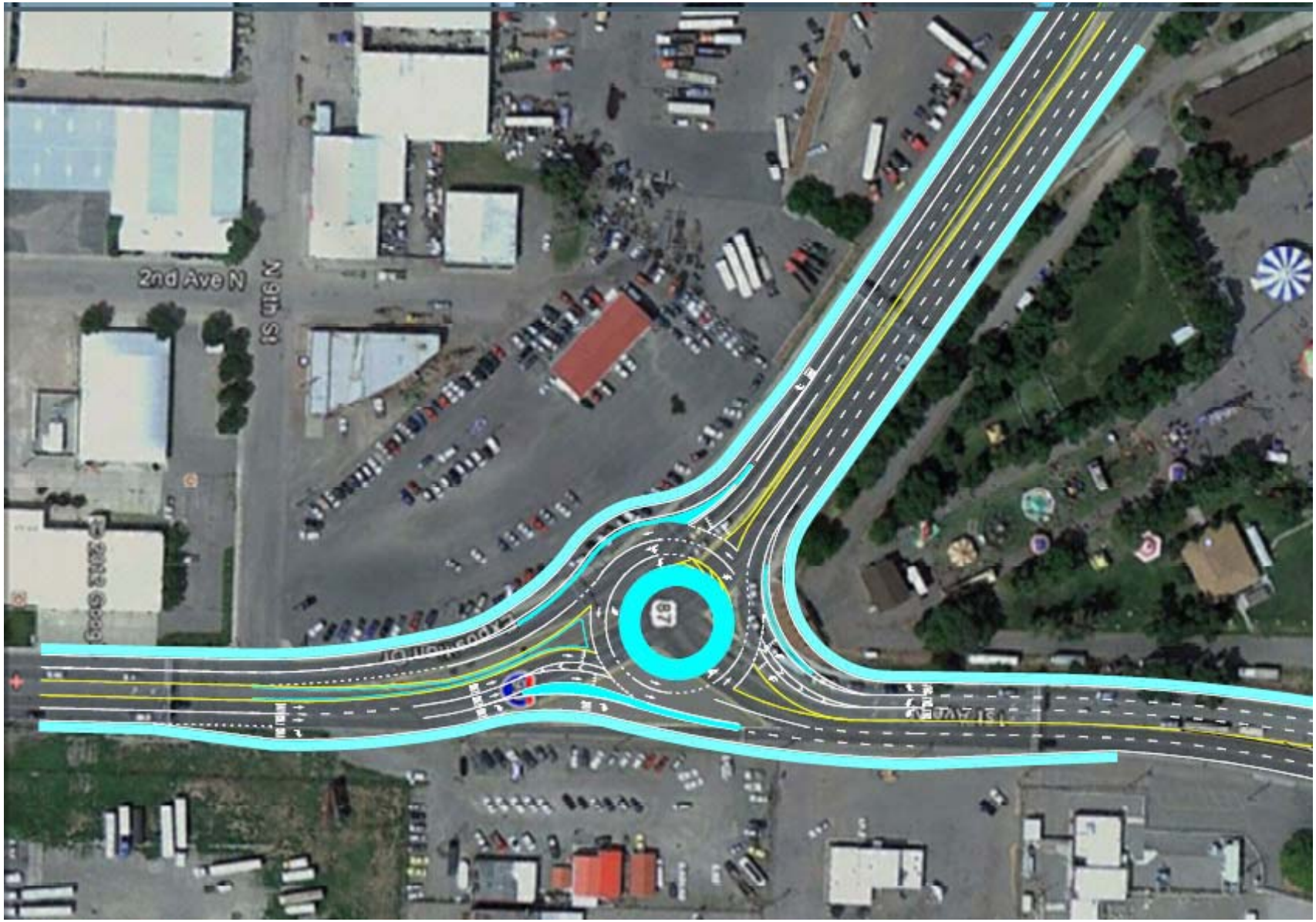
1st Avenue/Main/US 87 Intersection

Right-turn slip lane

Dual Right-turn lane



Roundabout

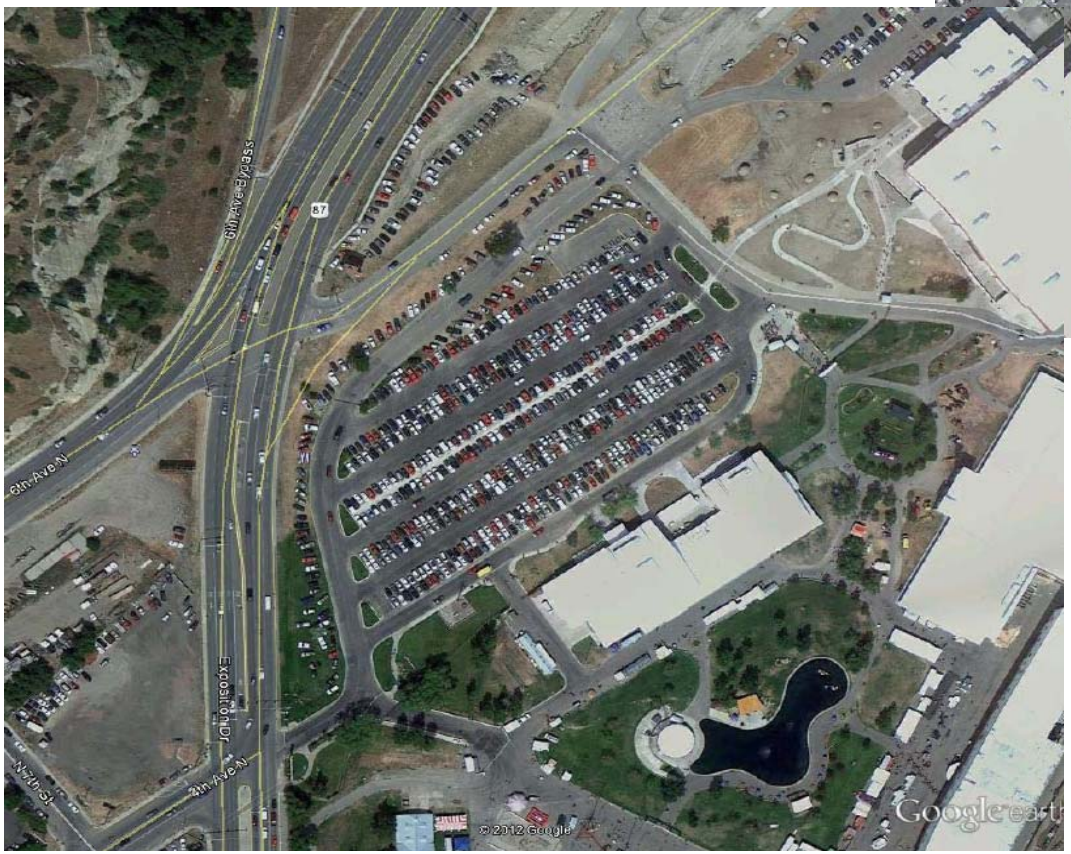


1st Avenue/Main/US 87 Intersection - LOS Results

Intersection	Existing (2012)						Design Year (2033) with Bypass					
	AM Peak			PM Peak			AM Peak			PM Peak		
	Avg Delay (s/veh)	LOS	Max Queue (veh)	Avg Delay (s/veh)	LOS	Max Queue (veh)	Avg Delay (s/veh)	LOS	Max Queue (veh)	Avg Delay (s/veh)	LOS	Max Queue (veh)
	Existing Traffic Signal						*Existing Traffic Signal*					
Main Street & 1st Avenue N/Hwy 87	25.9	C	25	30.6	C	18	32.8	C	39	43.4	D	29
							Option 1: Elim outside NB Thru/Add WB free right					
							33.3	C	39	60.6	E	52
							Option 2: Add WB dual right					
							31.0	C	39	73.5	E	29
							Option 3: Roundabout					
							10.6	B	1	15.0	C	6

MetraPark

When is ‘release plan’ needed?



MetraPark Release Plan - Assumptions

- Event is coincident with average PM peak hour
- 2.5 occupants/vehicle
- Release occurs over a 1-hour period
- 50% of release traffic will enter through Bench/6th Ave/Main intersection for SB travel on Main or WB travel on 6th Ave
- Seating capacity of arena is 12,000 people, including 10,000 in regular seating and another 2,000 available floor seating

MetraPark Release Plan - Results

Release plan is required when an event yields 6000 (50% total capacity of arena) attendees and the event has a distinct ‘end’.

CONCLUSIONS

1. Main Street operates pretty well the majority of the time.
2. Traffic will increase slightly until 2020 (Billings Bypass is operational).
3. When bypass opens, traffic will drop very quickly on Main Street and US 87.
4. After initial drop, traffic will gradually increase so by 2033 they are nearly the same as 2020 levels before bypass opened.
5. Although 2033 conditions are likely to produce more delay and queue potential of vehicles, the intersections appear to operate within acceptable LOS.
6. The 6th Ave/Bench and 1st Ave/US 87 intersections will continue to operate well, with congestion similar to existing conditions through year 2033.
7. The addition of another lane to Main Street demonstrates very little benefit.
8. The intersection of Airport Road and Main Street appears most likely to become saturated.
9. The Flyover concept at 6th/Bench-Main has a significant amount of merit for a future project, particularly from an emissions standpoint.
10. A noise analysis is likely justified with any major improvements.
11. Development per BIRD and EBURD could significantly change traffic conditions. Suggest reassessing after development plans are better known (2013)

Recommendation

Main St/Bench Blvd-Main St. intersection

- Option 1 – DO NOTHING (reassess options after Bypass is open)
- Option 2 – Flyover (long term-bang for the buck)

1st Ave/US 87 – Main St intersection

- Option 1 – DO NOTHING
- Option 2 – Right-turn slip lane (interim until 2020)