



# Crosswalk/RRFB Policy

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# Overview

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- Purpose & Need
- Treatment Options
  - Signage & Striping
    - Definitions/Costs/Applications
  - RRFB (Rectangular Rapid Flashing Beacon)
    - Definitions/Costs/Applications
  - PHB (Pedestrian Hybrid Beacon)
    - Definitions/Costs/Applications
- Notional Process & Procedure
  - Request/Warrants/Installation
- Example Warrant Case Studies



# Purpose

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- Purpose of Crosswalk Policy
  - Provide a uniform set of guidelines for the installation of crosswalk treatments
    - Establish when and where crosswalk treatments are appropriate
    - Identify standards for school crosswalk signage & striping
    - Identify requirements for the installation of crosswalk treatments



# Need

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- Need for Crosswalk/RRFB Policy
  - No current policy or consistent standards
  - Approval of crosswalk treatments not uniformly applied
    - Based on anecdotal observation versus analysis
  - Too many...lose their effectiveness
    - MUTCD states “Regulatory and warning signs should be used conservatively because these signs, if used to excess, tend to lose their effectiveness.”



# Treatment Options

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- Types of Crosswalk Treatments
  - Signage and Striping
    - Markings to provide guidance for vehicles & pedestrians to and within signalized intersections and approaches to non-signalized non-stop-controlled intersections or designated crossings
  - RRFB (Rectangular Rapid Flashing Beacon)
    - Pedestrian activated warning devices to enhance pedestrian crosswalks at uncontrolled intersection crossing locations
  - PHB (Pedestrian Hybrid Beacon)
    - Special type of beacon used to warn and control traffic at un-signalized locations
    - HAWK (High-Intensity Activated crossWalk beacon)

# Crosswalk Treatments

## Signage & Striping



\$575

## RRFB



\$8,000

## PHB



\$35,000 - \$200,000

\*Costs do not include installation

# Existing Signage & Striping

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- Intersections
- Mid-Block
  - In conjunction with RRFB's/PHB's
- Within school zones



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## Existing RRFB's

- Sandcreek Dr, South of 56<sup>th</sup> Ave
- 60<sup>th</sup>/Kearney St
- 60<sup>th</sup>/Krameria St
- Holly St/65<sup>th</sup> Ave
- 72<sup>nd</sup>/Olive St
- 72<sup>nd</sup>/Niagara St
- 96<sup>th</sup>/Eagle Creek Pkwy
- Chambers Rd btwn 104th and Heartland Dr
- 104<sup>th</sup>/Revere St
- Landmark Dr/106<sup>th</sup> Ave
- Potomac St/106<sup>th</sup> Ave
- Oakland St/112<sup>th</sup> Ave
- 117<sup>th</sup>/Chambers Rd



# Existing PHB's

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- No Existing PHB's in the City
- 56th/Niagara would have been an appropriate location for one



# Notional Process & Procedure

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- Requests
  - Documents existing practice
- Warrants
  - Signage & Striping
    - Compilation of various guidelines and standards
    - Refers to CDOT's preference for School Zone Signage and Striping
  - RRFB's
    - Compilation of various guidelines and standards
  - PHB's
    - Refers to existing MUTCD warrants
- Installation
  - Documents location of existing standards



# Requests

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- Can be initiated by anyone
- Need to know time and location of perceived problem
  - Engineering will pull necessary data and run warrants
- Coordinated between Police Department and Engineering Division
  - Fire included when necessary



# Warrants

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- Based on guidelines, standards and existing practices taken from:
  - MUTCD
  - FHWA
  - CDOT Design Guide
  - CCD's Uncontrolled Pedestrian Crossing Guidelines
  - Best Practices from local municipalities
- Modified to balance standards and existing requests/concerns



# Marked Crosswalk Warrants

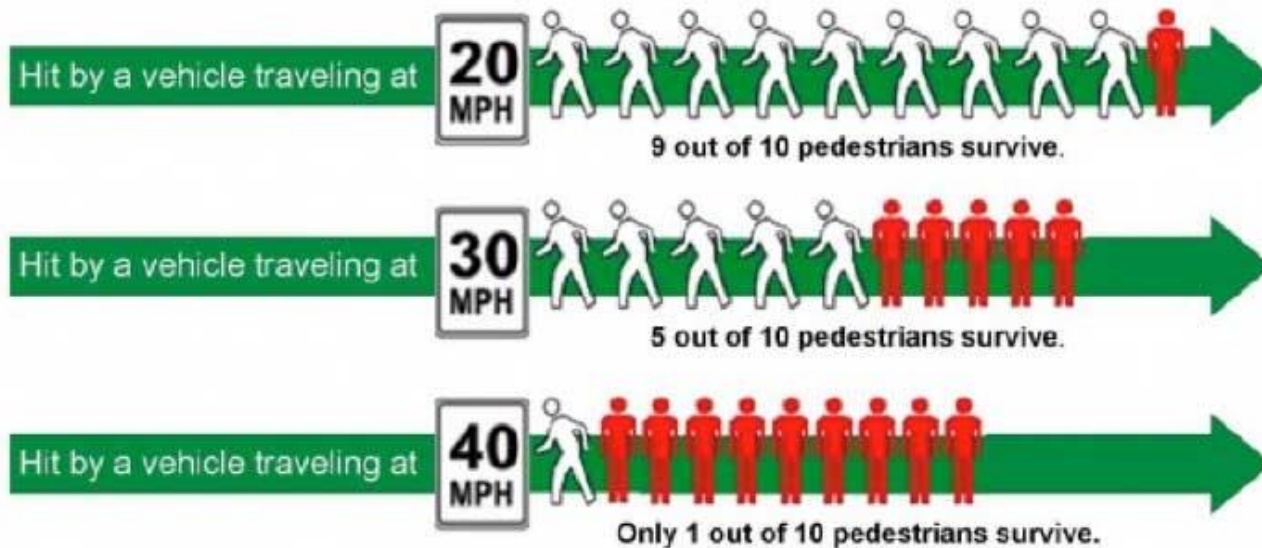
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- Marked Crosswalk Warrants (Must meet all)
  1. Speeds less than 45mph
  2. Next protected crossing more than 300 feet away
  3. Pedestrian counts and type of pedestrians
  4. Must meet vehicle stopping sight distance
  5. Must have adequate gaps in traffic for peds to cross



# Marked Crosswalk Warrants

- *Warrant 1: Is the 85th percentile speed less than 45 mph?*
  - *For speeds **30 mph** or higher, additional treatments must be considered, such as: enhanced signage/striping, pedestrian warning devices, pedestrian refuge islands, and/or rumble strips.*



# Marked Crosswalk Warrants

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- *Warrant 3: Does the pedestrian count exceed 20 pedestrians **during any two hours** of the day, where each child under 16, senior, or person with reduced mobility **counts twice**.*
  - *Typically, 20 pedestrians **per hour** are required to consider installation of a marked crosswalk (where vulnerable users count as **1.33** pedestrians)*
    - *FHWA*
    - *CDOT*
    - *City and County of Denver*
    - *City of Lakewood*



# Marked Crosswalk Warrants

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- *Warrant 5: Are adequate gaps provided?*
  - *MUTCD states:*
    - *“when the delay between occurrences of adequate gaps becomes excessive, students (pedestrians) might become impatient and endanger themselves by attempting to cross the street during an inadequate gap.”*





# School Crosswalk Signage

MUTCD 2009 EDITION – CDOT Typical School Zone Sign Order – Double Fines School Zone with Reduced Speed Limit

School Advance Crossing Assembly **	School Speed Limit Assembly with Higher Fines	"Optional" Advance School Crossing Assembly	School Crossing Assembly	End School Speed Limit and School Zone
 S1-1  W16-9P **  W16-2aP **  W16-5P ** (L/R)  W16-6P ** (L/R) <p>** choose one above</p>  R52-5	 S5-1(XX) <p>Placement at least 200 feet (or more if ≥ 30mph) before the school grounds.</p>  R2-6aP	 S1-1  W16-9P *  W16-5P * (L/R)  W16-6P * (L/R) <p>* choose one above</p> <p>"Optional" School Advance Crossing Assembly may be omitted where a School Zone (S1-1) sign is installed to identify the beginning of a school zone in advance of the School Crossing Assembly.</p>	 S1-1  W16-7PL **  W16-7PR ** <p>** choose one above</p>	 R2-1(XX)  S5-2

Red Highlighted Preferred Combinations

# RRFB Warrants

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- RRFB Warrants (must meet marked crosswalk warrants 3, 4, and 5 plus 2 RRFB warrants below)
  1. Pedestrian must cross less than 5 through lanes of traffic
  2. Minimum daily traffic volume of 3,000 vehicles per day (vpd) and maximum of 12,000 vpd

# PHB Warrants

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- Taken directly from the MUTCD
- Based on number of pedestrians, major street volume and distance a pedestrian must cross.



# Installation

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- Striped Crosswalks – Follow C3 Standards and Specifications
- RRFB's – Follow criteria in FHWA's interim approval for RRFB's (IA-21)
- PHB's – Follow criteria in MUTCD



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# Example Warrant Studies

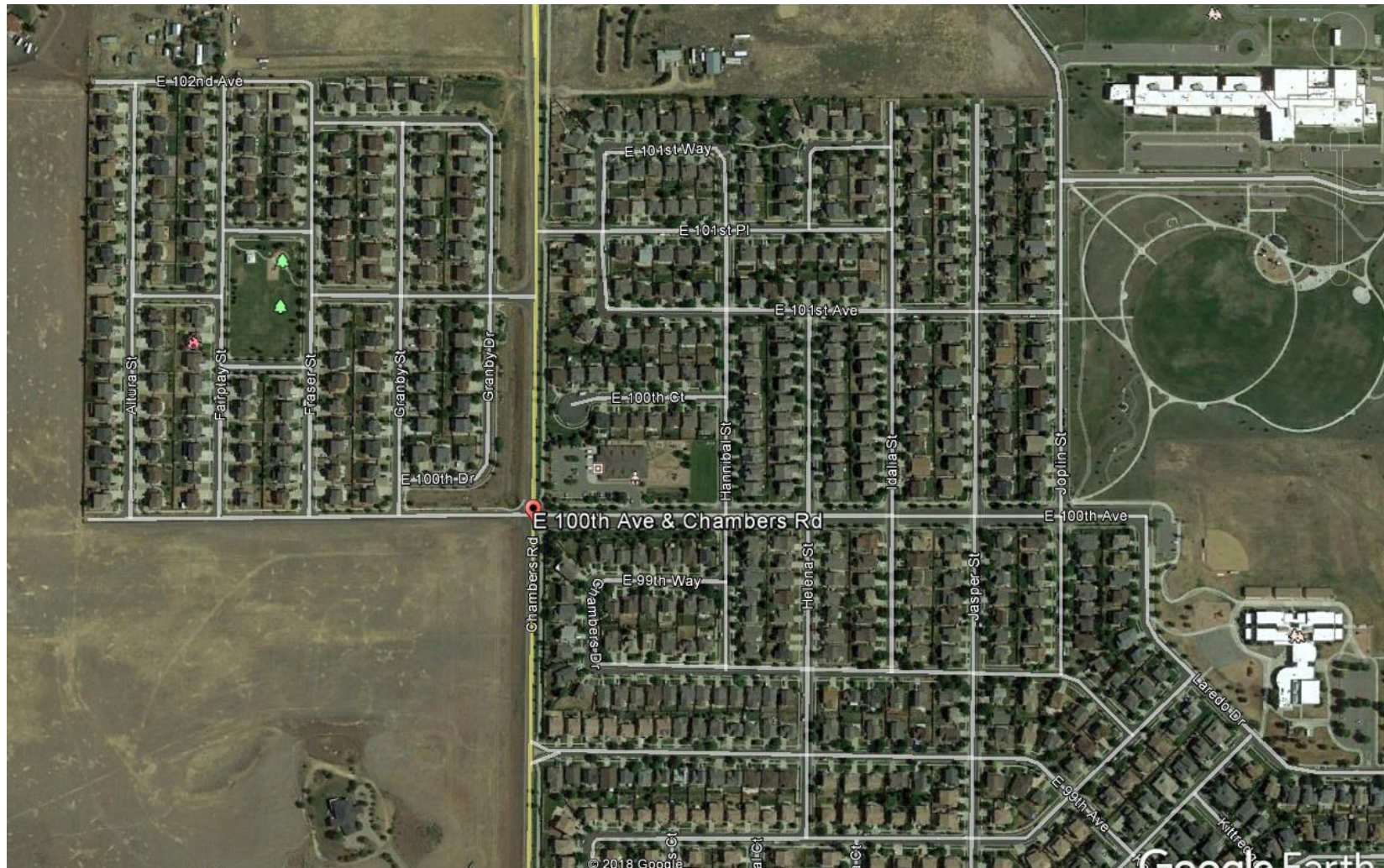
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- Chambers / 100<sup>th</sup>
- Landmark / Parkside
- Landmark / 103<sup>rd</sup>
- Reunion Parkway / 105<sup>th</sup>
- Walden / 104<sup>th</sup>
- Revere / 104<sup>th</sup>
- HWY 2 / 67<sup>th</sup>





# Example: Chambers/100<sup>th</sup>





# Example: Chambers 100<sup>th</sup>



# Example: Chambers/100th

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- Marked Crosswalk Warrants (must meet all)
  - Warrant 1: 85<sup>th</sup> Percentile speeds **Yes**
  - Warrant 2: Next protected crossing **Yes**
  - Warrant 3: Volume of pedestrians **Yes**
  - Warrant 4: Stopping sight distance **Yes**
  - Warrant 5: Adequate gaps **Yes**

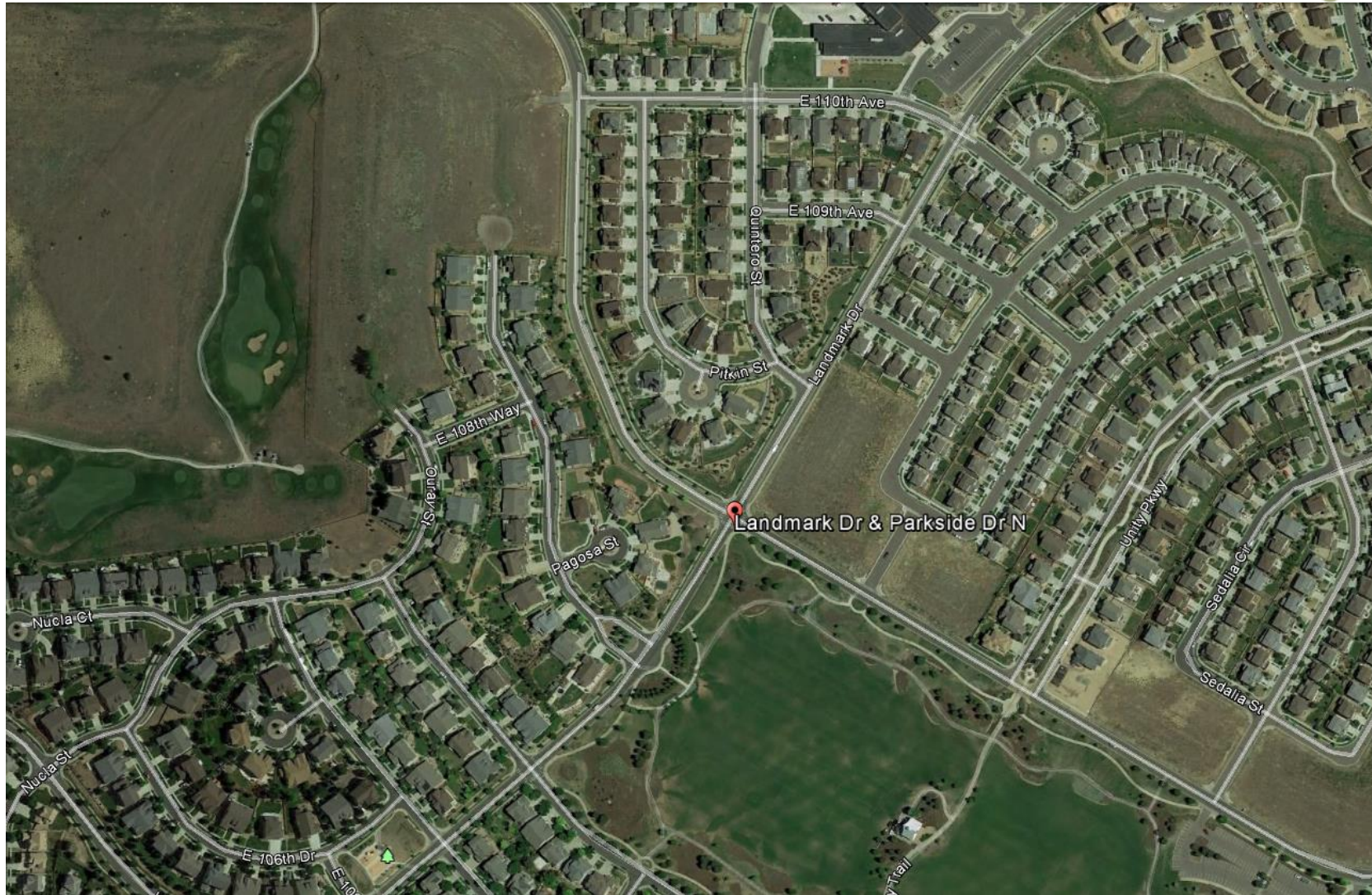
## RRFB Warrants (must meet all plus 1-3 above)

- Warrant 1: Number of travel lanes **Yes**
- Warrant 2: Daily traffic volume **Yes**



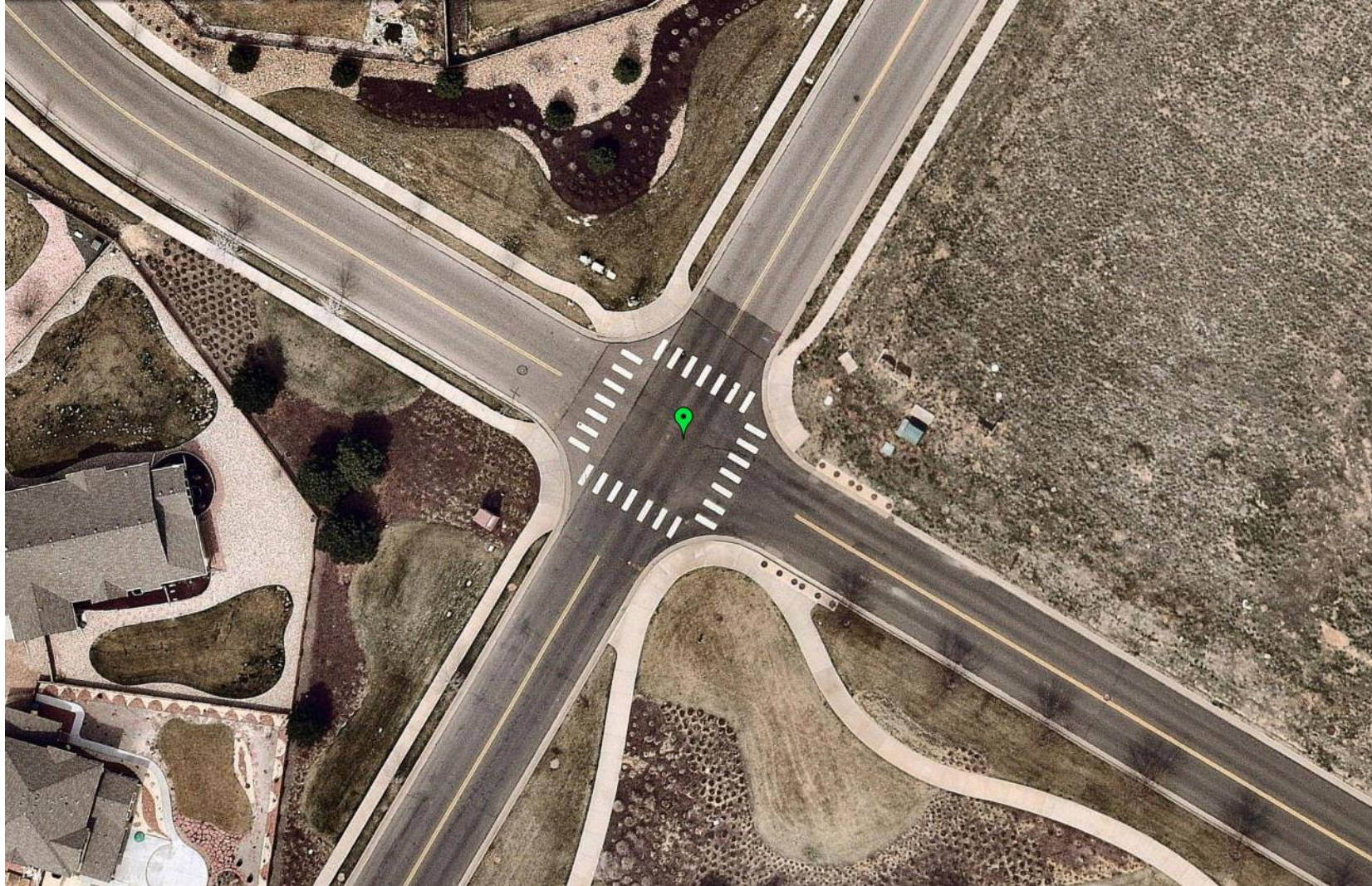


# Example: Landmark/Parkside N





# Example: Landmark/Parkside N



# Example: Landmark/Parkside N

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  - Warrant 1: 85<sup>th</sup> Percentile speeds **Yes**
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  - Warrant 3: Volume of pedestrians **No**
  - Warrant 4: Stopping sight distance **Yes**
  - Warrant 5: Adequate gaps **Yes**

## RRFB Warrants (must meet all plus 1-3 above)

- Warrant 1: Number of travel lanes **Yes**
- Warrant 2: Daily traffic volume **No**









# Example: Landmark/103rd

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# Example: Landmark/103rd

- Marked Crosswalk Warrants (must meet all)

- Warrant 1: 85<sup>th</sup> Percentile speeds **Yes**
- Warrant 2: Next protected crossing **Yes**
- Warrant 3: Volume of pedestrians **TBD**
- Warrant 4: Stopping sight distance **Yes**
- Warrant 5: Adequate gaps **TBD**

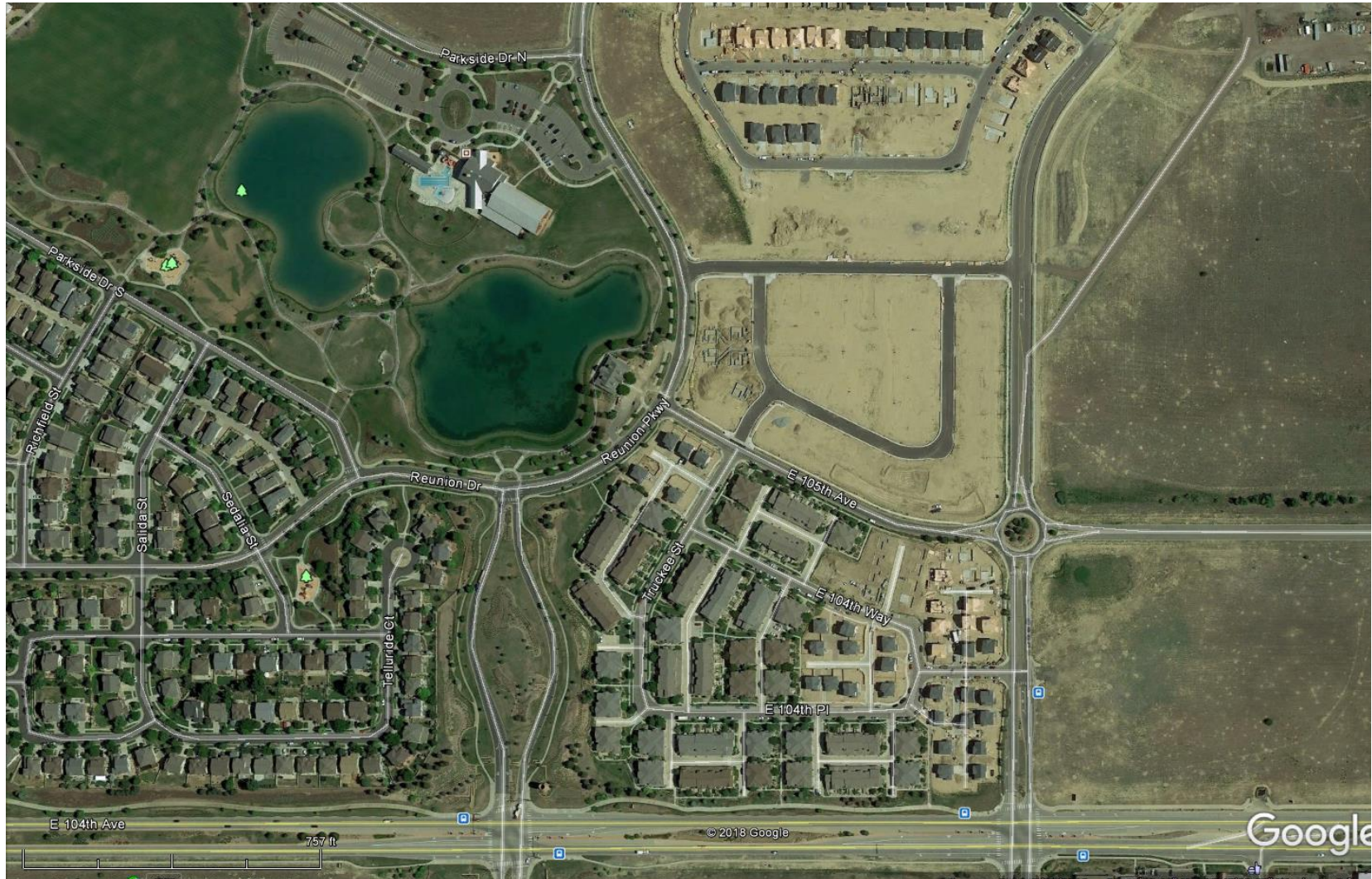
## RRFB Warrants (must meet all plus 1-3 above)

- Warrant 1: Number of travel lanes **Yes**
- Warrant 2: Daily traffic volume **Yes**





# Example: Reunion Pkwy/105th





# Example: Reunion Pkwy/105th



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# Example: Reunion Pkwy/105th

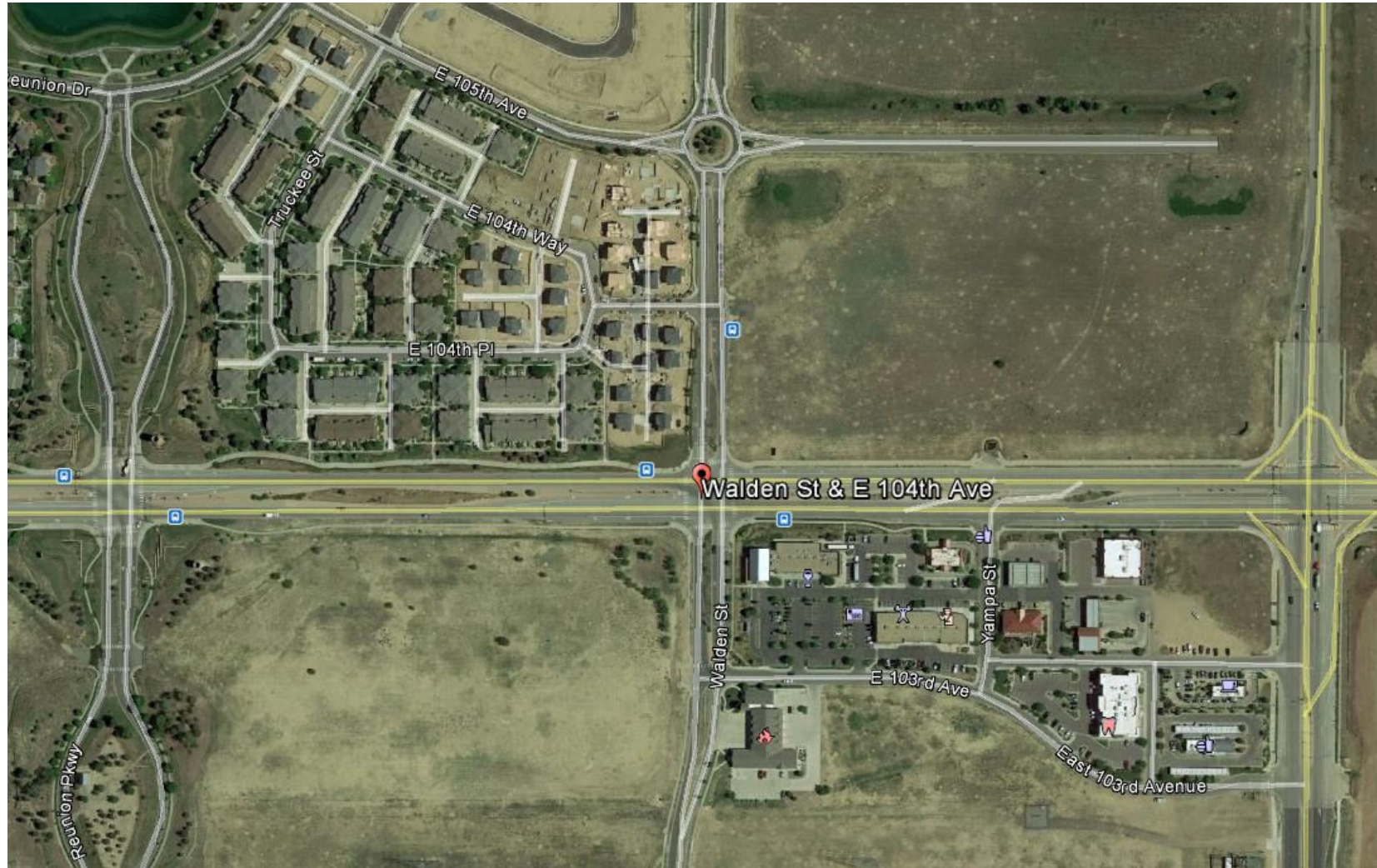
- Marked Crosswalk Warrants (must meet all)
  - Warrant 1: 85<sup>th</sup> Percentile speeds **TBD**
  - Warrant 2: Next protected crossing **Yes**
  - Warrant 3: Volume of pedestrians **No**
  - Warrant 4: Stopping sight distance **Yes**
  - Warrant 5: Adequate gaps **Yes**

## RRFB Warrants (must meet all plus 1-3 above)

- Warrant 1: Number of travel lanes **Yes**
- Warrant 2: Daily traffic volume **TBD**

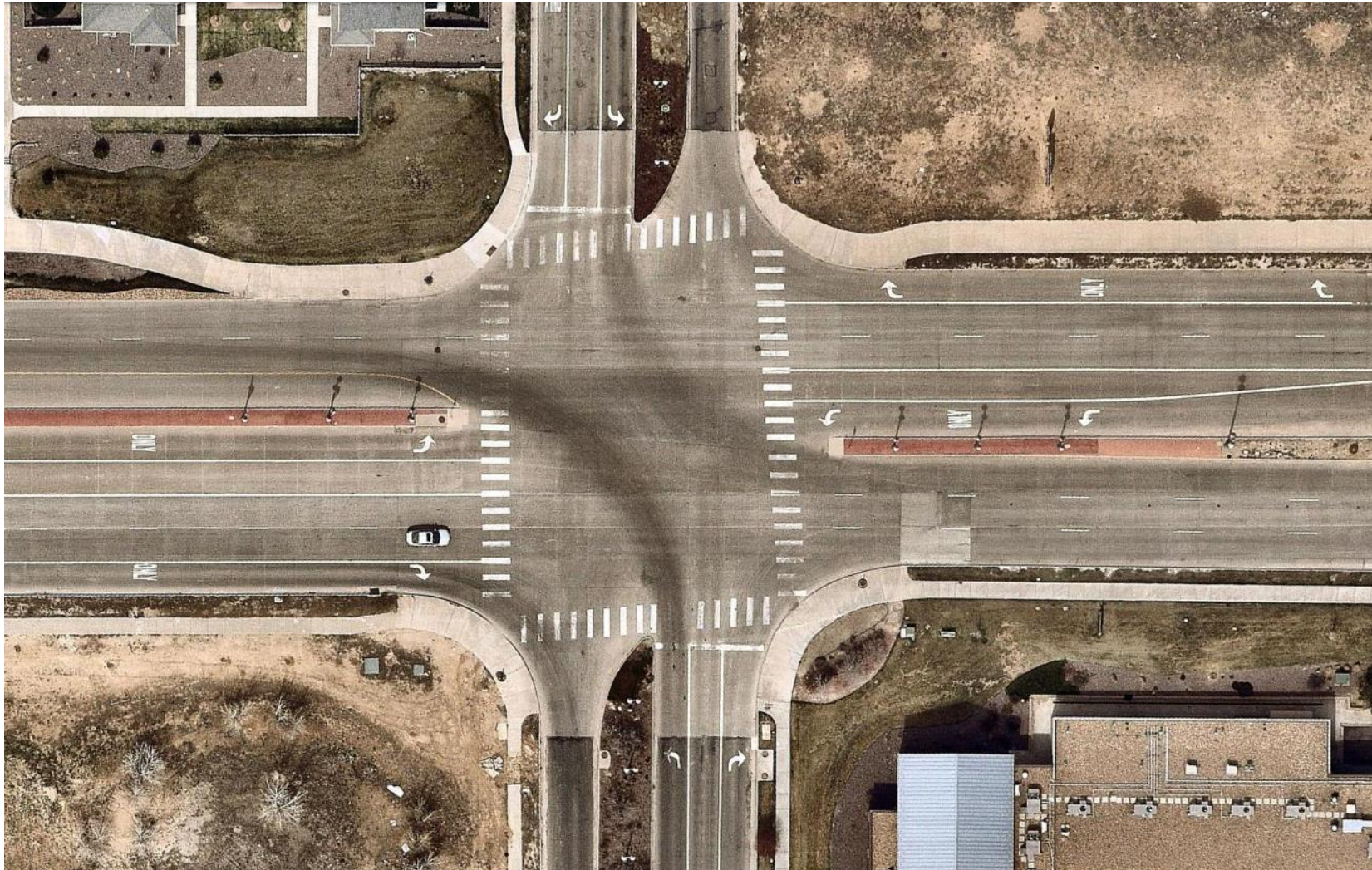


# Example: 104<sup>th</sup>/Walden St





# Example: 104<sup>th</sup>/Walden St



# Example: 104<sup>th</sup>/Walden St

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- Marked Crosswalk Warrants (must meet all)

- |   |            |
|---|------------|
| • Warrant 1: 85 <sup>th</sup> Percentile speeds | <b>No</b>  |
| • Warrant 2: Next protected crossing            | <b>Yes</b> |
| • Warrant 3: Volume of pedestrians              | <b>TBD</b> |
| • Warrant 4: Stopping sight distance            | <b>Yes</b> |
| • Warrant 5: Adequate gaps                      | <b>TBD</b> |

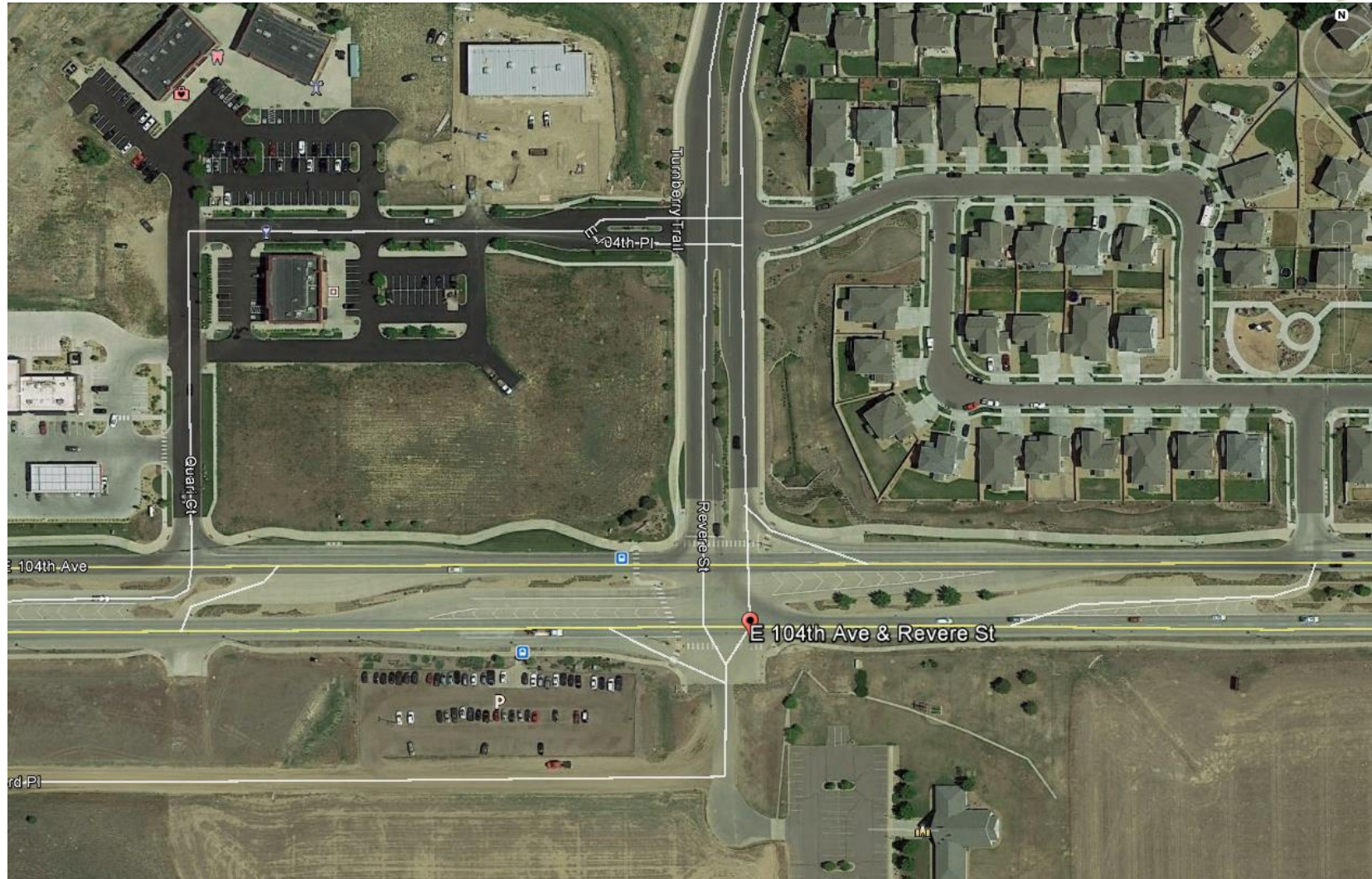
## RRFB Warrants (must meet all plus 1-3 above)

- |                                     |            |
|-------------------------------------|------------|
| • Warrant 1: Number of travel lanes | <b>Yes</b> |
| • Warrant 2: Daily traffic volume   | <b>No</b>  |





# 104<sup>th</sup> Ave & Revere St





# 104<sup>th</sup> Ave & Revere St





# Example: Hwy 2/67<sup>th</sup> Ave





# Example: Hwy 2/67<sup>th</sup> Ave





## Example: Hwy 2/67<sup>th</sup> Ave

- Marked Crosswalk Warrants (must meet all)

- |   |            |
|---|------------|
| • Warrant 1: 85 <sup>th</sup> Percentile speeds | <b>No</b>  |
| • Warrant 2: Next protected crossing            | <b>Yes</b> |
| • Warrant 3: Volume of pedestrians              | <b>TBD</b> |
| • Warrant 4: Stopping sight distance            | <b>Yes</b> |
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### RRFB Warrants (must meet all plus 1-3 above)

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|-------------------------------------|------------|
| • Warrant 1: Number of travel lanes | <b>Yes</b> |
| • Warrant 2: Daily traffic volume   | <b>No</b>  |





# Questions & Discussion

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# Questions & Discussion

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# School Flashers

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