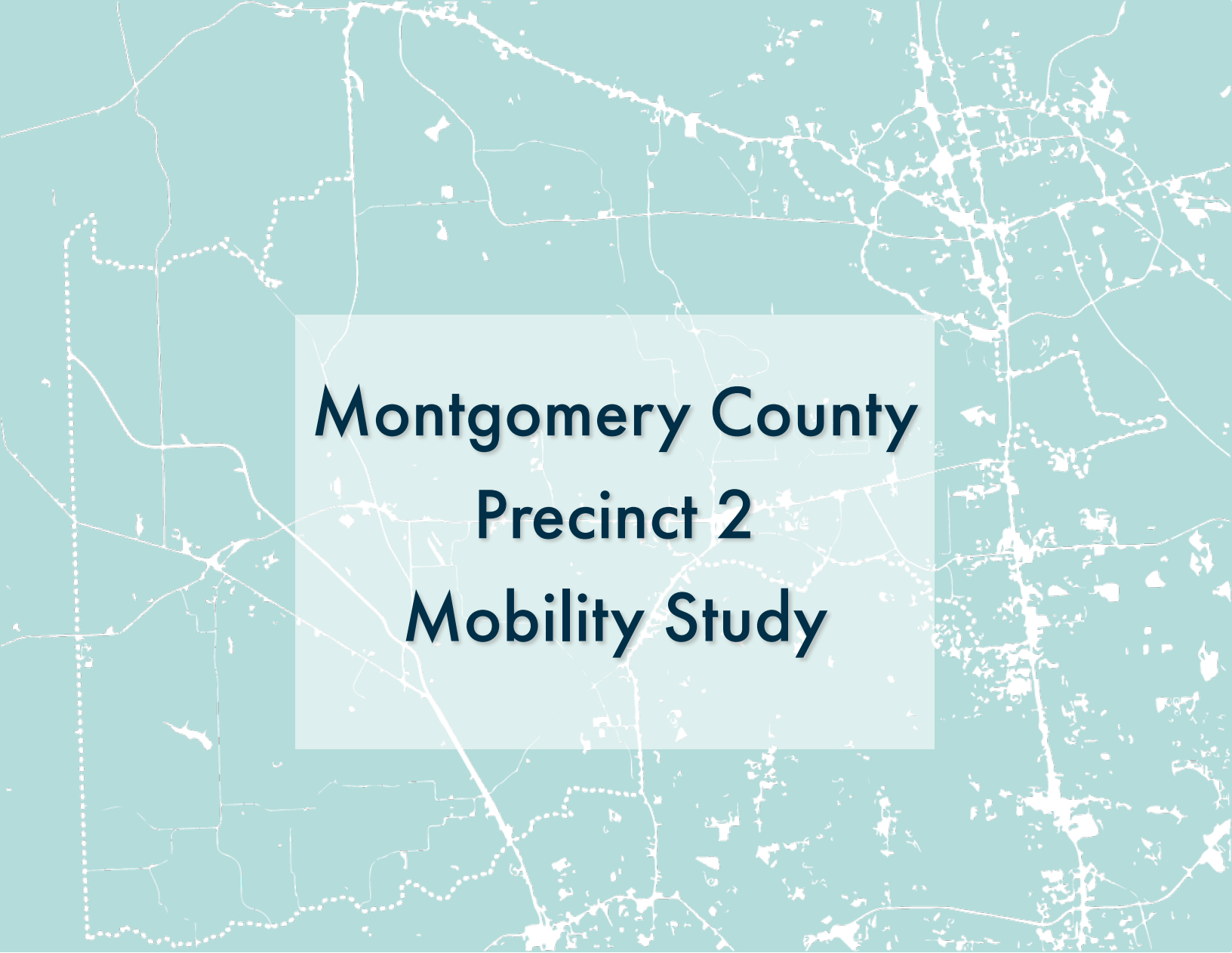


APPENDIX H

Universe of Alternatives



Montgomery County Precinct 2 Mobility Study

Appendix H Universe of Alternatives

December 2022



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I. Introduction

As a part of the Montgomery County Precinct 2 Mobility Study, multiple alternative solutions to regional mobility issues were suggested, assessed, and refined. The alternatives were made up of different combinations of mobility and safety recommendations.

Recommendations were found through analysis of existing and projected data, by identifying issues and needs, and by taking suggestions from the public and steering committees. Initial recommendations and alternatives were presented to Montgomery County Precinct 2 Commissioner's office, the steering committee, focus groups, and the public. Feedback from these groups was used to modify, add to, and remove from the list of recommendations.

II. Preliminary Recommendations

Preliminary project recommendations were made using the following:

- Priority Projects from Montgomery County Precinct 2
- Montgomery County Major Thoroughfare Plan
- Identified Issues by Study Team, Public, Focus Groups, and Steering Committee
- Identified Needs for Transit and Active Transportation
- Roadway Inventory – Maintenance Needs
- Data Analysis and Scenario Testing

In addition to the input and analysis used to develop the preliminary list of recommendations, barriers to development were also considered. In particular, existing housing and commercial developments, waterways, and protected areas of land had to be considered before recommending a new or extended roadway.

A. Scenario Development

Initial recommendations were based on a list of priority projects provided by Montgomery County and issues identified by public comments, focus groups, the steering committee, and the study team. The earliest recommendations for the project included already planned roads, additional new roadways, roadway widenings, added turn bays, signal timing updates, and roundabout or traffic signal installations. Figure II-1 shows the first incomplete set of preliminary recommendations which were presented in June 2021 at the Steering Committee Meeting #4. The steering committee meeting occurred after the first public meeting but before modeling and analysis were completed.

A large number of intersection recommendations came out of the modeling and analysis process, and many items suggested by the public were tested to see if they would make a significant improvement in delay and travel times. The models also helped to determine if roadway widening would be effective on some existing corridors.

A detailed discussion of the modeling process, analysis scenarios and alternatives, and analysis results is found in Appendix G – Data Analysis.

2. Development of Recommendations

Preliminary recommendations were further developed and expanded using the analysis results of the modeled network, roadway inventory results, and by reviewing the planned roadways in the Montgomery County Major Thoroughfare Plan, which was updated and approved in August 2021. Additional recommendations were added by further review of public and steering committee comments. The full set of preliminary recommendations for maintenance, roadways, intersections, active transportation, and transit were presented in September 2021 at the Steering Committee Meeting #5. Preliminary recommendations were separated into short-term (0-5 years), mid-term (6-10 years), and long-term (10+ years) improvements. Note that the time ranges used for later recommendations were changed to short-term (0-10 years) and long-term (10+ years).

Preliminary maintenance recommendations are found in Figure II-2.

Preliminary roadway recommendations are found in Figure II-3, Figure II-4, Figure II-5, and Figure II-6.

Preliminary intersection recommendations are found in Figure II-7, Figure II-8, and Figure II-9.

Preliminary active transportation recommendations are found in Figure II-10.

Preliminary transit recommendations are found in Figure II-11.

A. Roadways and Intersections

1. Maintenance

Safety and maintenance recommendations came from a review of crash data and the roadway inventory conducted as a part of the Montgomery County Precinct 2 Mobility study.

Corridors where a large number of crashes involving animals were recommended to add wildlife warning signs. FM 149 north of Jackson Road had a high percentage of crashes not related to intersections, so it was recommended to add rumble strips on that segment of road.

During the roadway inventory, it was noted that several locations with sharp curves lacked any warning signs, so it was recommended for those corridors to add curve warning signage. Additionally, roadways identified with pavement in poor condition have been recommended for resurfacing. A map of preliminary recommendations related to safety and maintenance is found in Figure II-2.

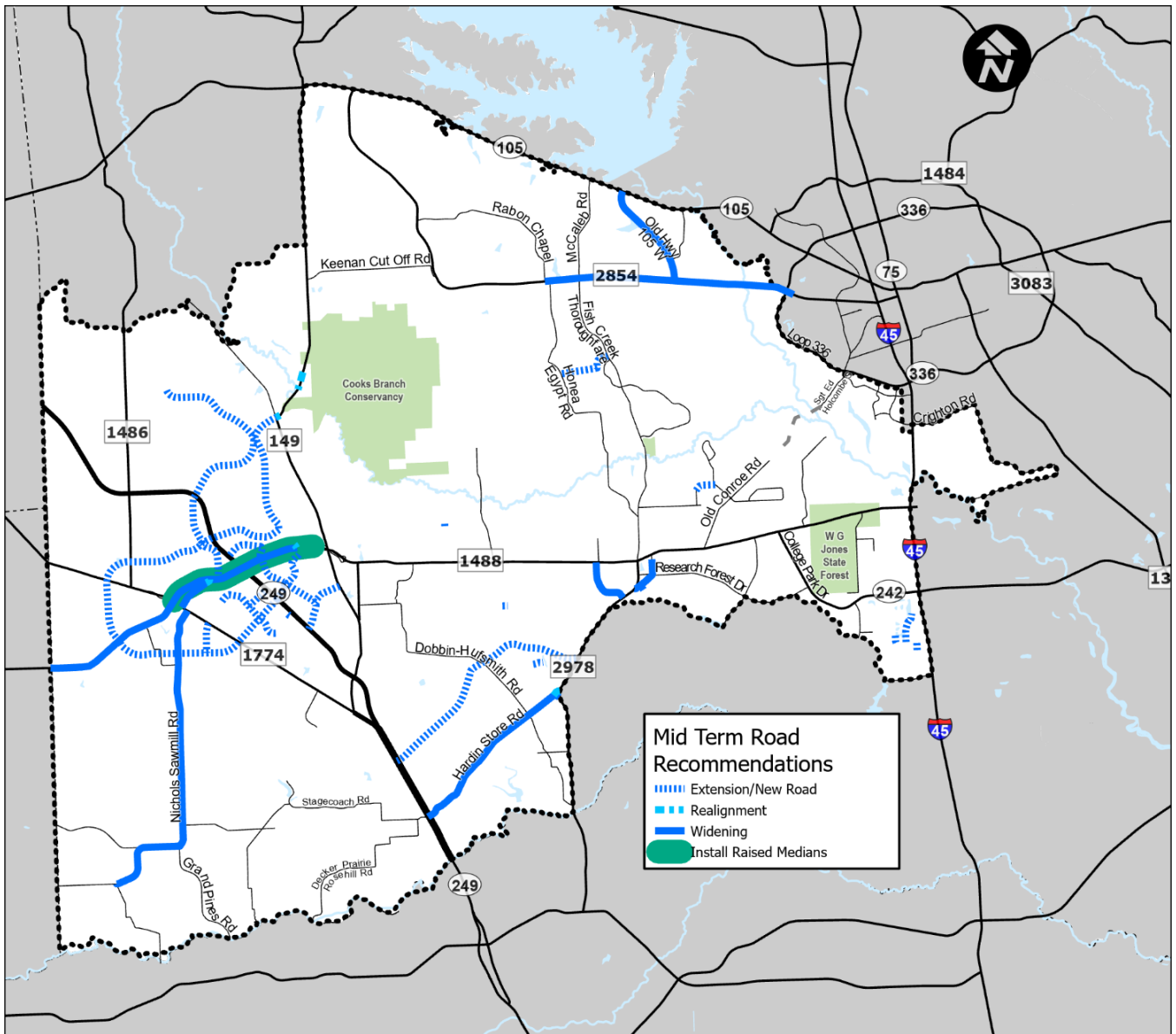


Figure II-4: Preliminary Mid-Term Road Recommendations

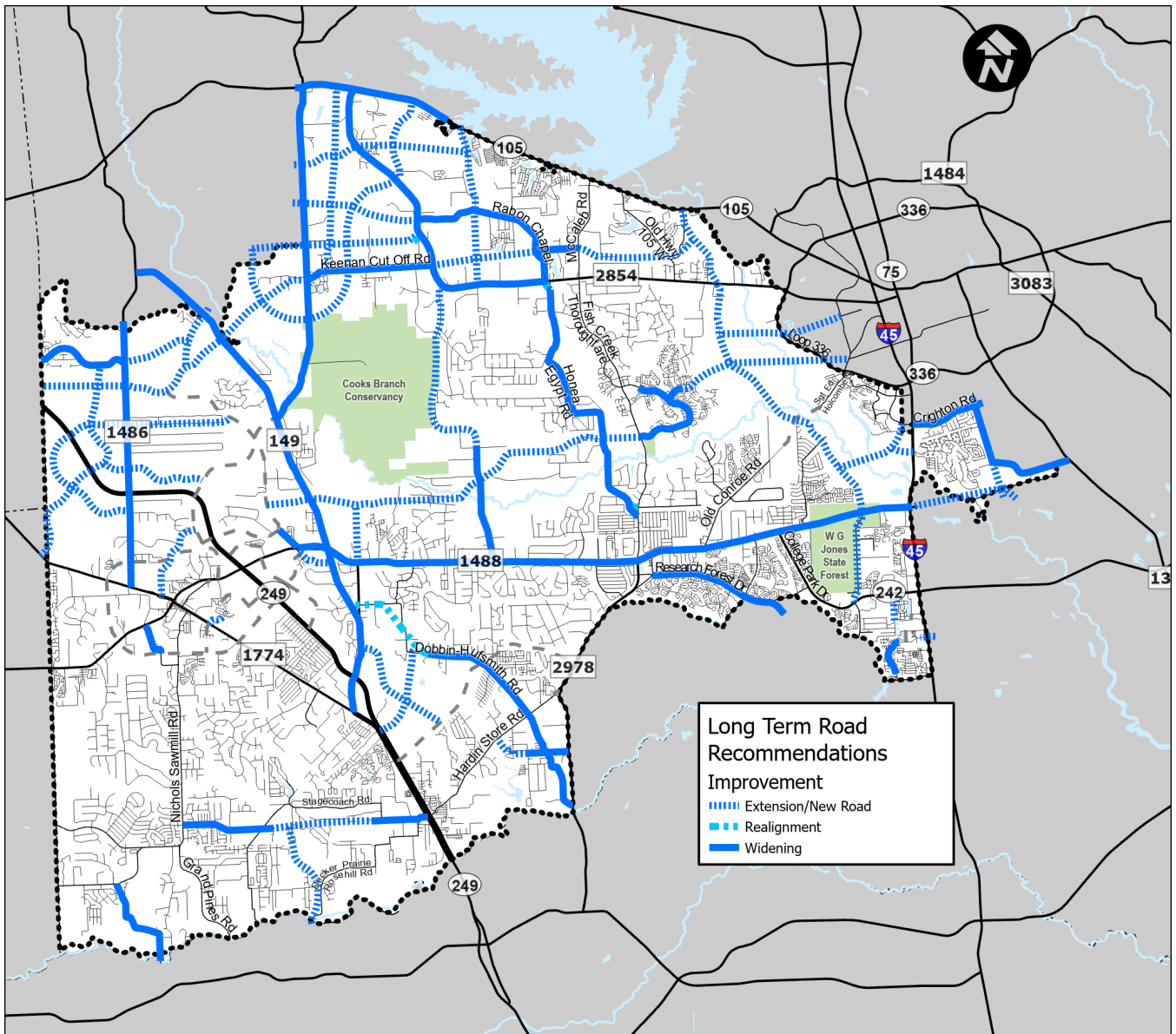


Figure II-5: Preliminary Long-Term Road Recommendations

3. Intersection

Preliminary intersection recommendations were developed from identified issues and needs, traffic and crash data analysis, field observations, and a review of planned regional development.

Preliminary intersection recommendations included improvements to intersection design (e.g. adding turn lanes), signal timing updates, changing the traffic control type (e.g. installing a traffic signal or roundabout), signing and pavement marking updates, adjusting road alignment at the intersection, installing direct connectors.

Preliminary intersection related recommendations were divided into short-term, mid-term, and long-term time ranges. A map of preliminary short-term intersection recommendations can be found in Figure II-7.

Preliminary mid-term intersection recommendations can be found in Figure II-8. Preliminary long-term intersection recommendations can be found in Figure II-9.

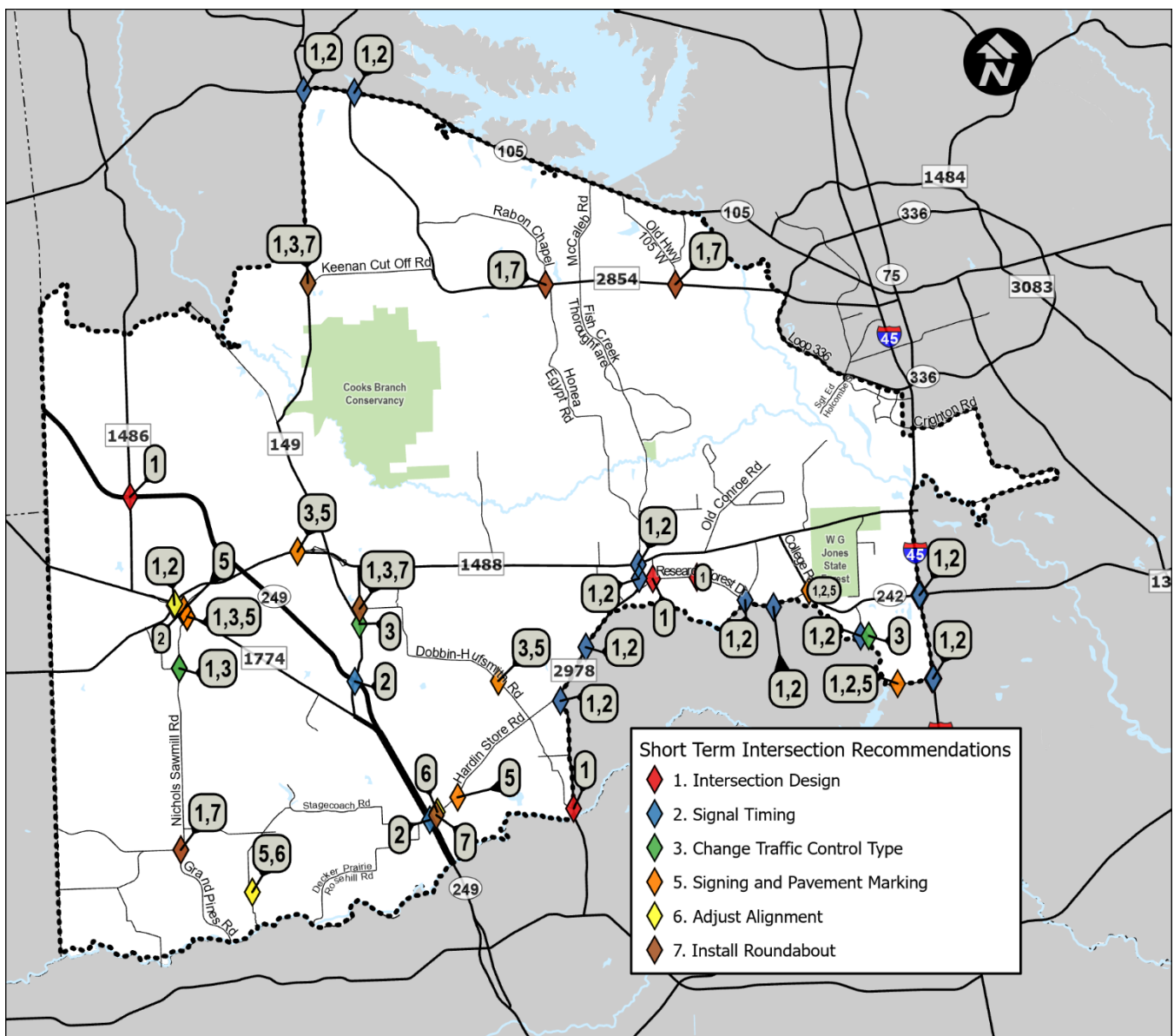


Figure II-7: Preliminary Short-Term Intersection Recommendations

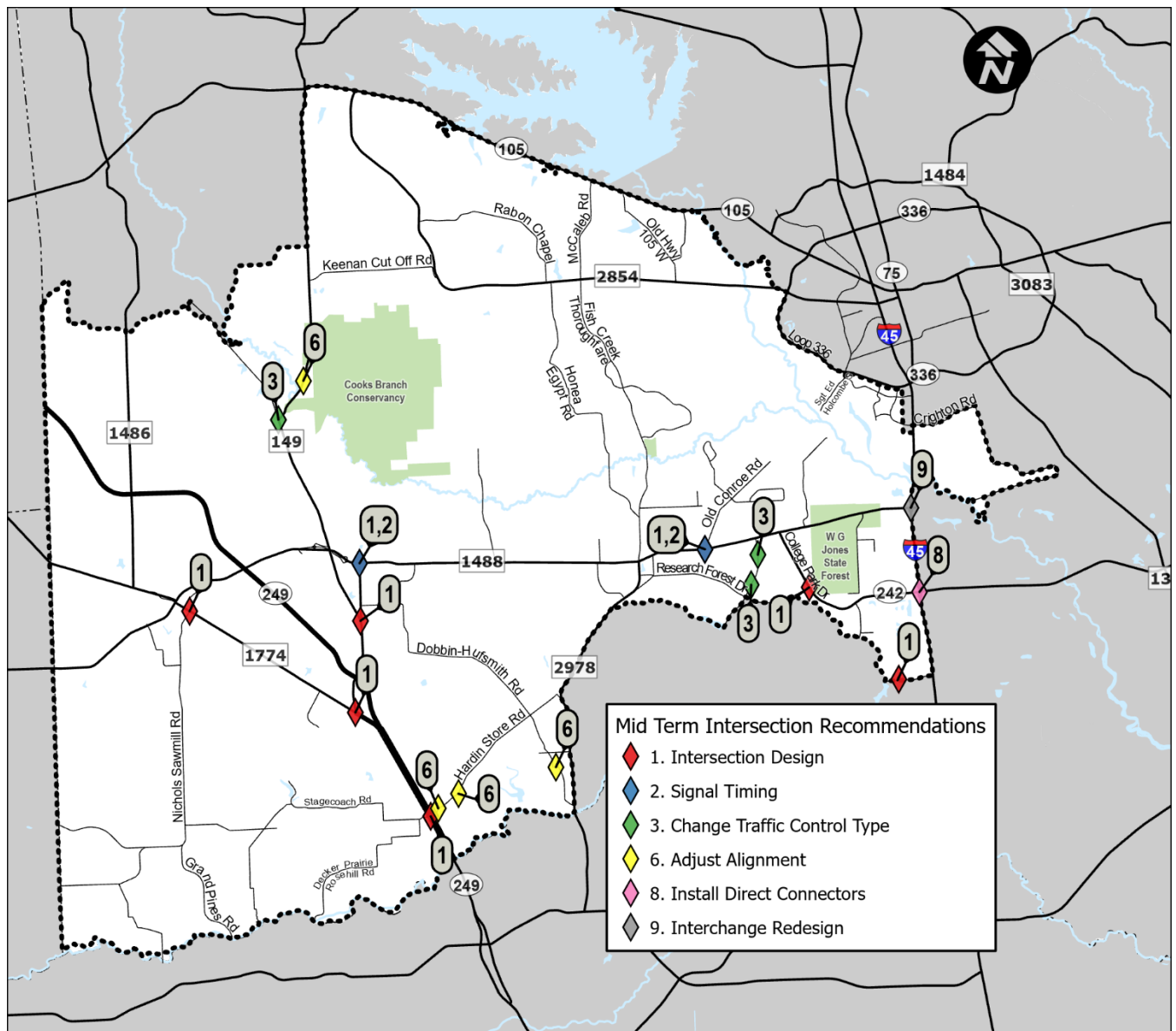


Figure II-8: Preliminary Mid-Term Intersection Recommendations

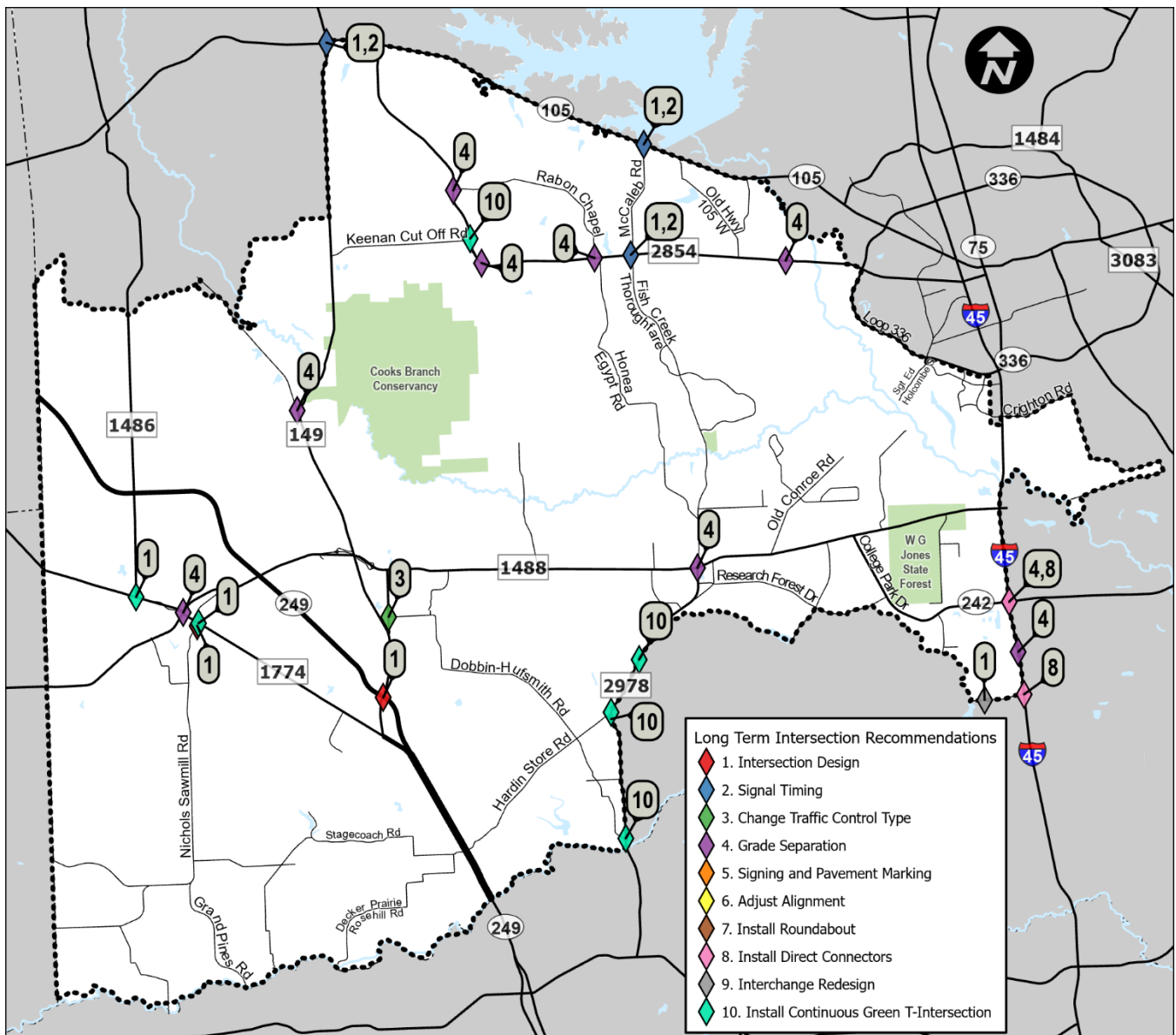


Figure II-9: Preliminary Long-Term Intersection Recommendations

B. Active Transportation

In order to develop recommendations for active transportation, which includes cycling and walking, information on the existing network of sidewalks, shared use paths, and common on-street bicycle routes was assembled. The existing network was reviewed to determine gaps in connectivity, as well as opportunities for growth. Locations of parks and other greenspaces, schools, neighborhoods, and park-and-ride facilities were looked at to help determine where it would be beneficial to provide connections for active transportation. Existing drainage and utility easements were located to find opportunities for off-street active transportation facilities that would aid in regional connectivity.

It was decided early on in the project that shared-use paths would be the ideal facility for active transportation users in the region. Shared-use paths are travel ways for walkers, runners, skaters, bicycles, scooters, other non-motorized forms of transportation, and wheelchair users (motorized or non-motorized)

that are separated from vehicular traffic. They are high-comfort facilities that are typically bi-directional. Shared-use paths can be adjacent to a road with a buffer, or they can be completely independent from the road network, instead traveling through parks, along waterways, next to railroads, or in utility easements.

Feedback from residents and stakeholders also provided suggested improvements for on street bicycle facilities such as widening shoulders, adding bicycle warning signs, and modifications to jutting curbs along Research Forest Dr.

Preliminary active transportation recommendations included installing separated shared use paths and installing share the road signing. A map of preliminary recommendations for active transportation can be found in Figure II-10.

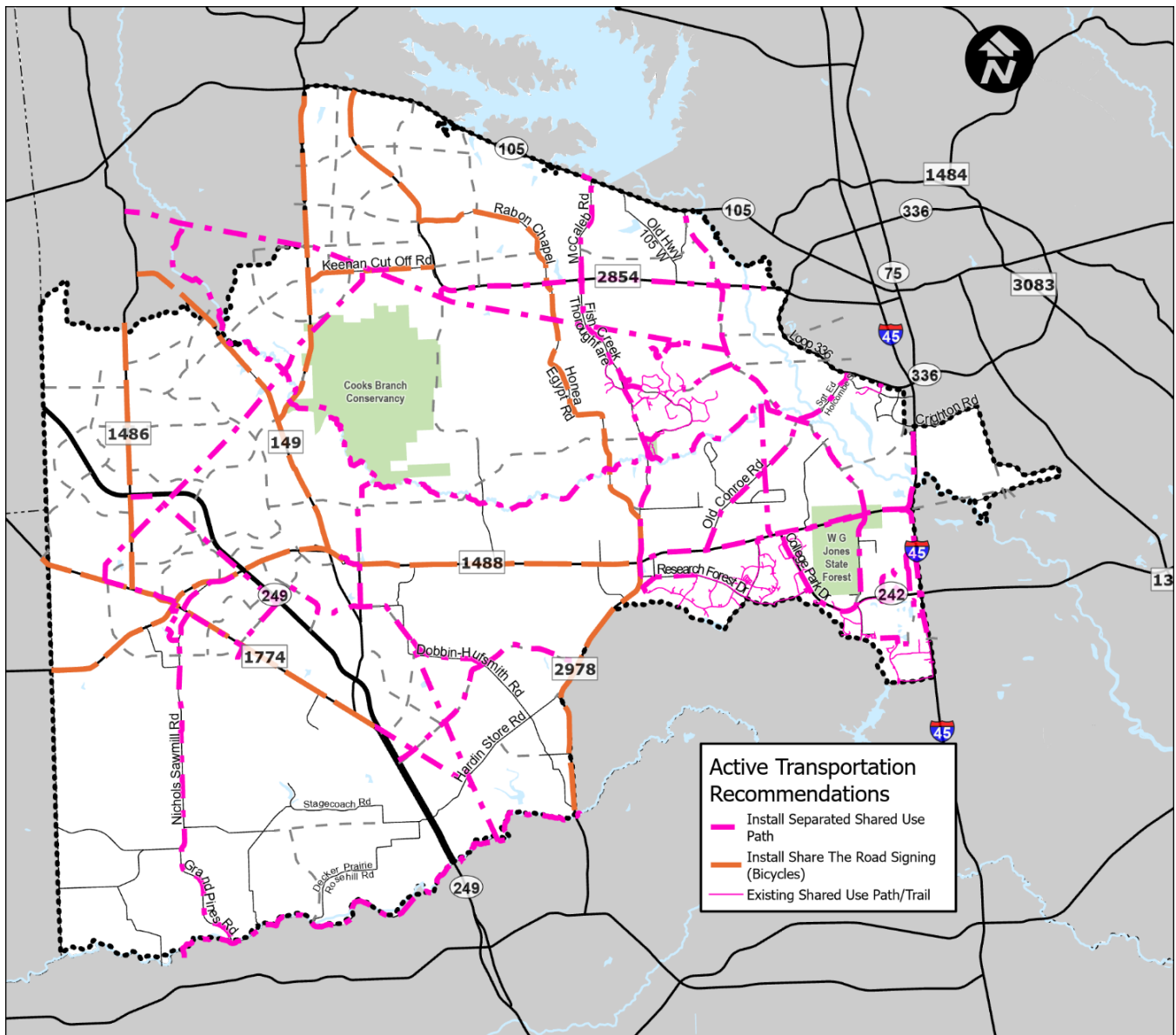


Figure II-10: Preliminary Active Transportation Recommendations

C. Transit

After gauging public interest in regional transit with the first public survey for the project, it was determined that the primary focus for transit recommendations should be on Park-and-Ride facilities and a Regional Express Route. Many initial comments from the public and focus groups requested park-and-rides as well as connections to existing regional transit.

Existing transit options in the region were identified to help determine where additional services might be needed.

1. Existing Transit Facilities

There is only one existing Park-and-Ride facility with Montgomery County Precinct 2 – the Research Forest Park & Ride located in The Woodlands on Marsico Pl just east of Gosling Rd. There are also a few other Park-and-Ride locations outside Precinct 2 in The Woodlands and Conroe.

The only other fixed route transit services available in Montgomery County are the Conroe Connection bus service in Conroe and the Town Center Trolley in The Woodlands. The Conroe Connection is located primarily outside Precinct 2. There is less than a mile of one route located in the northeast part of Precinct 2. The Town Center Trolley is located outside of Precinct 2 to the southeast.

Another existing regional transit option is the Brazos Transit District Demand & Response service, which is only available outside of urbanized areas. The Demand & Response service is a shared ride curb to curb service made by appointment.

2. Proposed Transit Facilities

Preliminary transit recommendations include 3 proposed Park-and Ride facilities and a Regional Express Route.

There is a lack of access to Park-and-Ride facilities in the majority of Precinct 2, especially the western portion. There is a lot of planned future development in addition to existing communities in the northwest region of Precinct 2, so the first proposed Park-and-Ride location is in the city of Montgomery along SH 105 near FM 149. The next proposed Park-and-Ride location is in the city of Magnolia along SH 249 near FM 1488. Growth in this area is explosive, with several new developments already underway. The final proposed Park-and-Ride location is in the Decker Prairie area along SH 249, just north of Tomball. There are a large number of existing housing developments both inside and just outside Precinct 2 that would be serviced by this location.

The Regional Express Route was developed by identifying major destinations in the region, including large cities, medical facilities, and commercial developments. The chosen route connects several existing and proposed Park-and-Ride facilities, the cities of Montgomery, Conroe, Shenandoah, The Woodlands, and Magnolia, and follows major corridors with significant amounts of commercial and residential development in a loop. The route uses existing corridors along SH 105, IH 45N, SH 242, FM 1488, and FM 149 as well as some proposed new roads between FM 149 and FM 1488. The proposed route is conceptual only and should be modified based on demand. It could operate both clockwise and counterclockwise, and stops can be added as demand arises

The preliminary transit recommendations have largely remained unchanged throughout the refinement process. This is due to a lack of feedback with suggested additions, modifications, removals, or other changes. A map of transit recommendations can be found in Figure II-11.

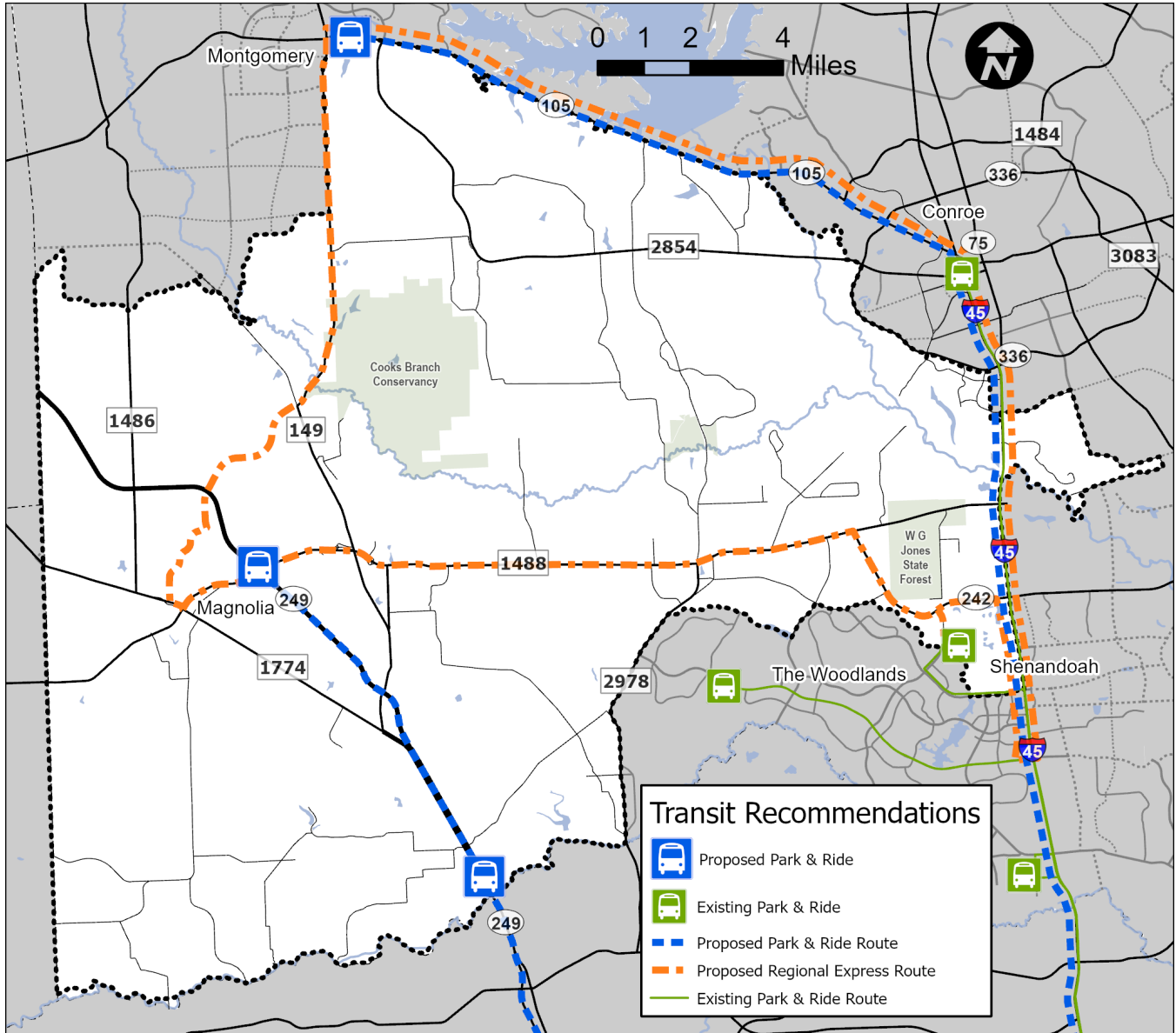


Figure II-11: Transit Recommendations

III. Alternatives Refinement

Recommendations alternatives were refined through an iterative process of presenting the latest recommendations to different groups, receiving feedback, and making updates based on comments. The majority of changes to the preliminary recommendations were related to roadway and intersection improvements, however there were several comments related to bicycle issues and some related to safety and maintenance.

After the preliminary recommendations were developed and shared with during Steering Committee #5, different alternatives of roadway recommendations were presented to the Steering Committee during Meeting #6, and the Steering Committee was asked to make their preferred selection to move forward. A modified version of Alternative 1 was selected, and modifications were made after each subsequent steering committee, focus group, and public meeting.

The following sections outline the presented alternatives and changes made to the recommendations throughout the refinement process.

A. Steering Committee Meeting #6

Three alternatives were presented at the 6th steering committee meeting.

- Alternative 1 (see Figure III-1)
 - Description:
 - Existing roadway network + MP2 recommendations
 - Adds:
 - New roads: 245 miles
 - Widens existing roads
 - Extends existing roads
 - Benefits:
 - Improves connectivity
 - Improves safety
 - Distributes traffic
 - Provides alternative routes
 - Cons:
 - Roads located in floodplains
- Alternative 2 (see Figure III-2)
 - Description:
 - New Roads: 208 miles
 - Removes New Road 11 (Mansions Way extension) from FM 2854 to FM 1488
 - Removes Woodforest/Corrolla (Pal-Metta) extension from Superior to FM 149
 - Removes Spur 149 extension from FM 1488 to Woodforest/Corrolla
 - Remove Superior extension from Woodforest/Corrolla to Grand Lake Estates.
 - Benefits:
 - Provides alternative route from Woodforest.

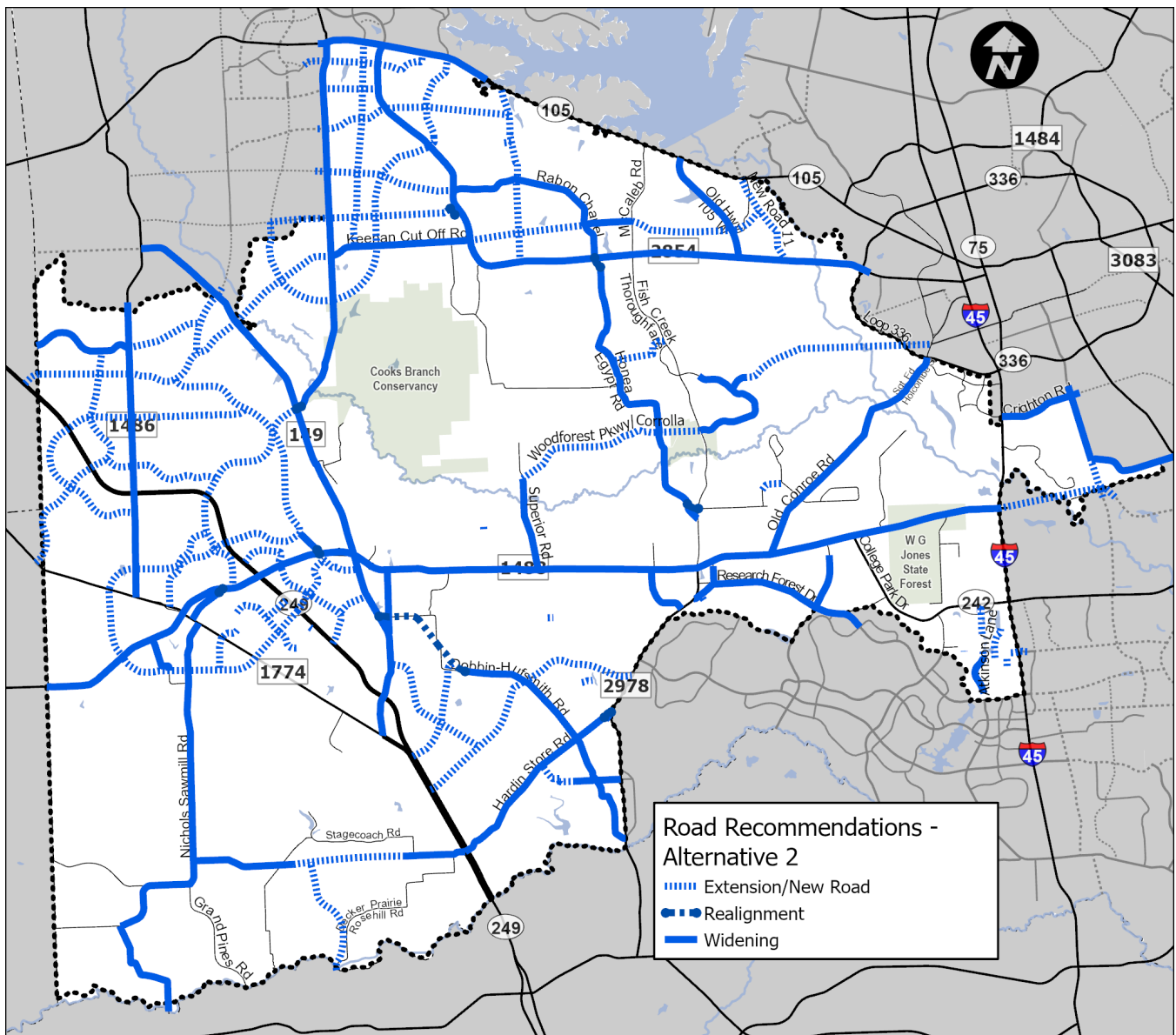


Figure III-2: Alternative 2 Roadway Recommendations

- Alternative 3 (see Figure III-3)
 - Description:
 - New Roads: 221 miles
 - Changes from Alternative 2
 - Adds New Road 11 (Mansions Blvd. extension) from FM 2854 to Old Conroe Road.
 - Extend Superior Road from Woodforest/Corrolla to Grand Lakes Estates Drive.
 - Benefits: Relative to Alternative 2
 - Distributes traffic to Woodforest/Gladstell north to SH 105 and south to Old Conroe
 - Superior extension increases safety for residents by providing an alternative route.
 - Provides alternative route to FM 1488.
 - Cons: Relative to Alternative 1

- Increase congestion on Old Conroe from New Road 11 to FM 1488
- Increase congestion on FM 1488 from Old Conroe Road to Mansions Blvd.
- Adds 5 miles to trip from Old Conroe Rd. to IH-45 at FM 1488

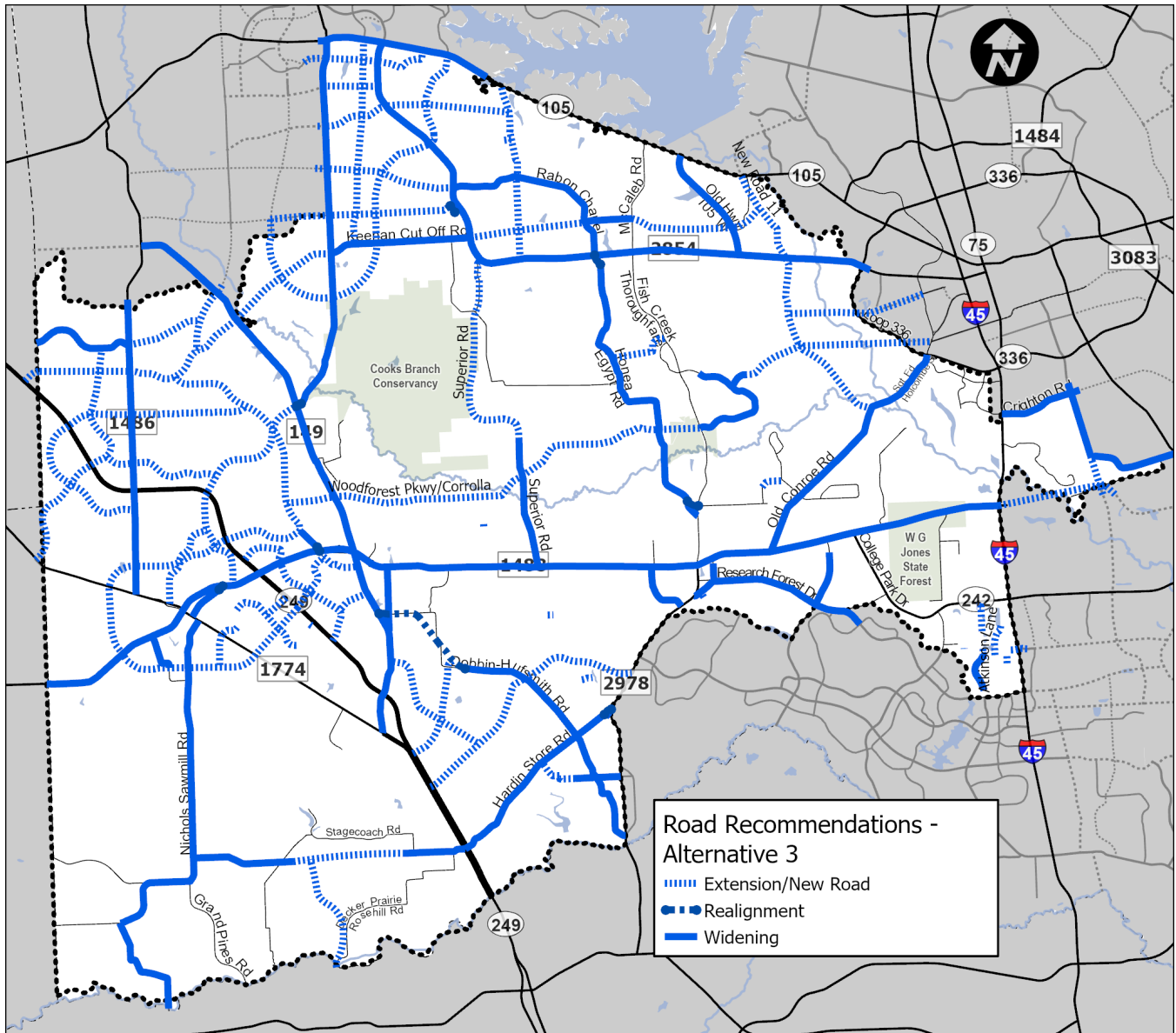


Figure III-3: Alternative 3 Roadway Recommendations

During Steering Committee Meeting #6, a hybrid of all 3 presented alternatives was selected by the steering committee with additional modifications (see Figure III-4).

- Alternative Selected by Steering Committee:
 - Benefits:
 - Improves resiliency for central study area.
 - Improves connectivity to Conroe
 - Improves connectivity in Montgomery and Magnolia areas
 - Improves roadway network
 - Provides alternative to FM 2854.

- Cons:
 - No alternative route for FM 1488.
 - Increase congestion on Old Conroe from New Road 11 to FM 1488
 - Increase congestion on FM 1488 from Old Conroe Road to Mansions Blvd.
 - No new N/S roads

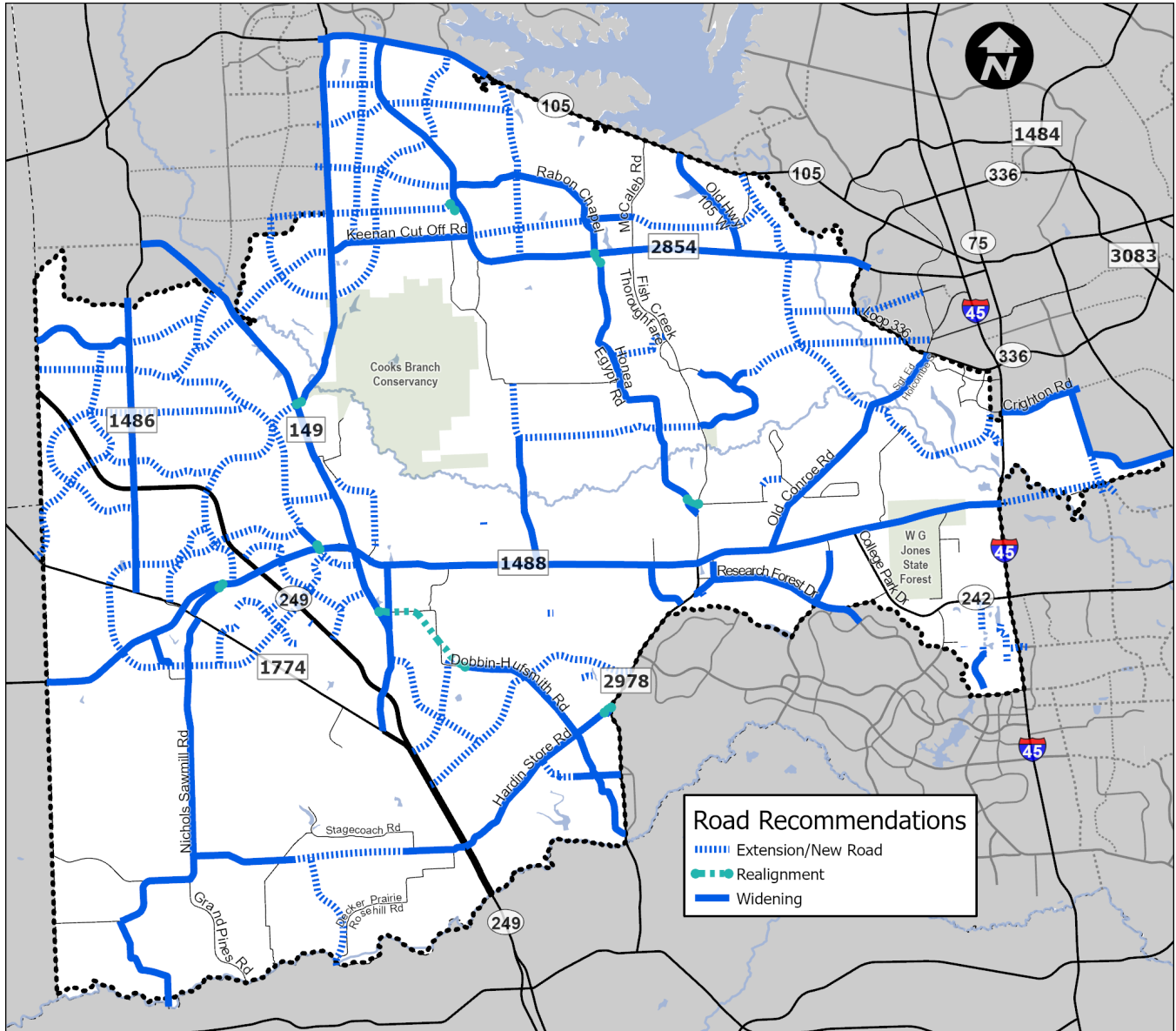


Figure III-4: Selected Alternative from Steering Committee Meeting #6

B. Steering Committee Meeting #7

After Steering Committee Meeting #6 and additional focus group meetings, changes to the chosen alternative were made.

- Alternative 1 Changes after Steering Committee Meeting #6 (see Figure III-5).
 - Removed:
 - Superior Road Extension
 - Woodforest Pkwy/Corrolla – extension west to FM 149
 - Spur 149 – Extension north from FM 1488
 - Atkinson Road
 - Realigned:
 - Woodforest/Corrolla - from Honea Egypt to Superior
 - New Road 11 and 8

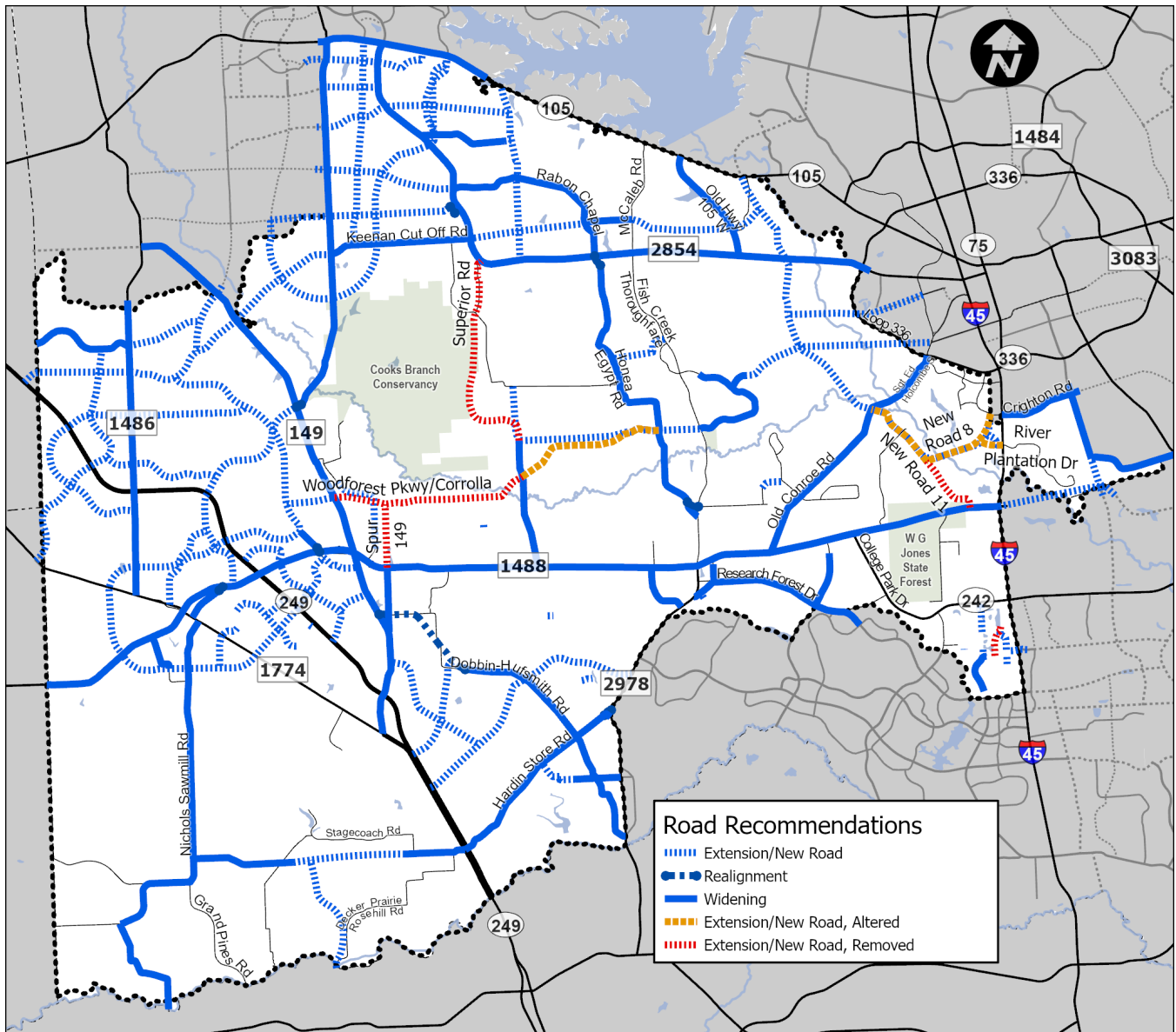


Figure III-5: Alternative 1 Modifications after Steering Committee Meeting #6

- Modifications After Stakeholder Meetings (see Figure III-6)
 - Added:
 - Freeport Drive
 - Keenan Cut-Off connection to SH 249
 - Extension of Mail Route Road to Pine Lakes

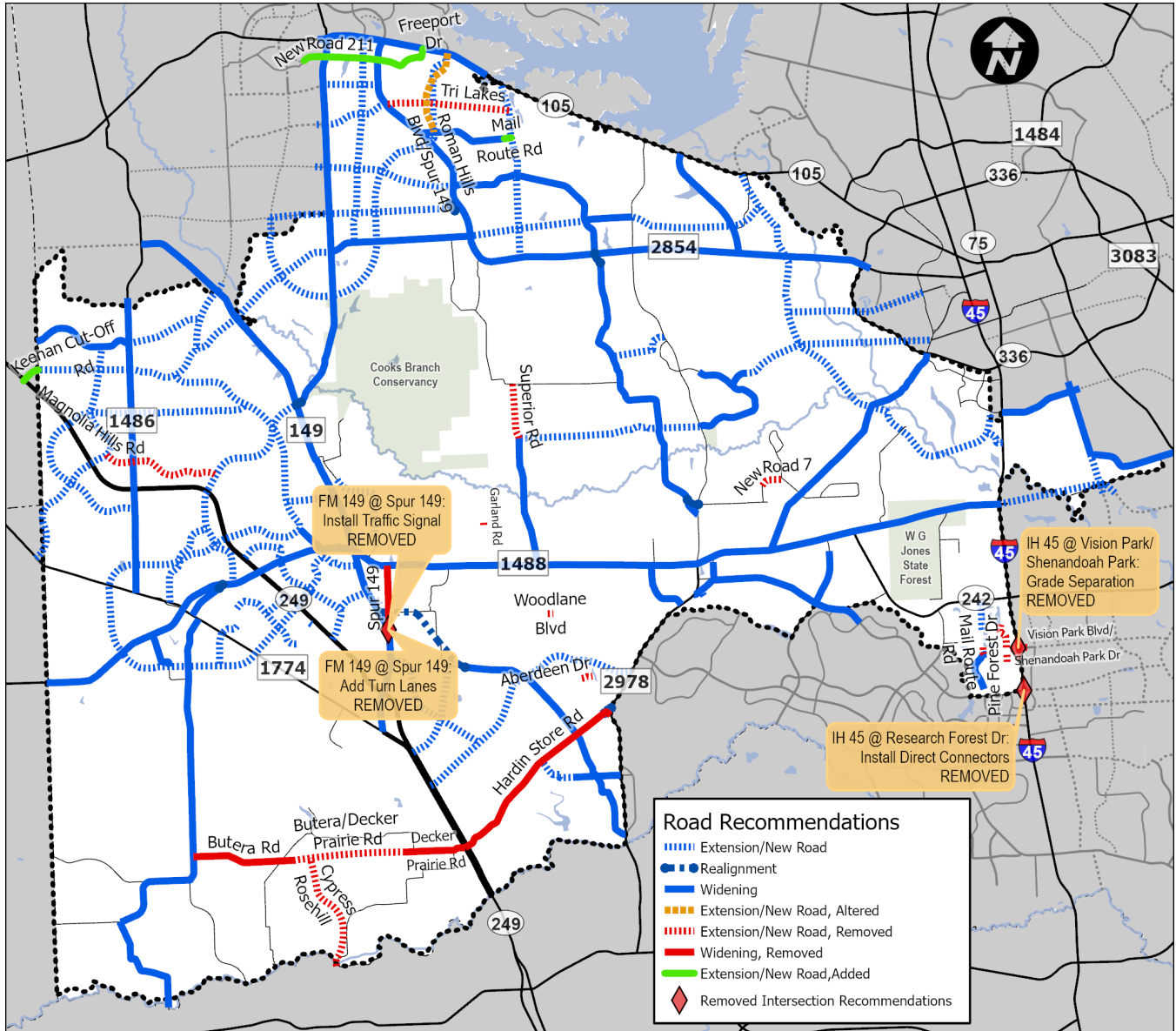


Figure III-6: Modifications after Focus Group Meetings

C. Steering Committee Meeting #8

Public Meeting #2 occurred before Steering Committee Meeting #8, and a survey and interactive comment map for proposed recommendations was provided to receive feedback from the public. Additional changes were made to the recommendations based on input from the public.

- Modifications after Public Meeting #2 (see Figure III-7)
 - Added:
 - ADA Compliant Pedestrian Crosswalk Button: FM 1488 at Carriage Hills Blvd.
 - Improve Signal Timing: SH 249 at Woodtrace Blvd.
 - Install Safety Lighting: Grand Pines Rd. at Mueschke Rd.
 - Removed:
 - Grade Separation: FM 2854 at Superior Rd
 - Roads:
 - Magnolia Ridge
 - Tree Farm Road
 - Little Thorn Lane
 - S. Alden Bridge
 - Widening: Grogans Mill
- Resulting Network:
 - Existing Roadway Network + MP2
 - Recommendations
 - Adds:
 - New Roads/Extensions - 137.9 miles
 - Road Widenings - 151.8 miles
 - Realignments - 3.6 miles
 - Intersection Improvements – 131
 - Benefits
 - Improves connectivity
 - Improves safety
 - Distributes traffic
 - Provides route alternatives.
 - Mitigates congestion
 - Public approved plan

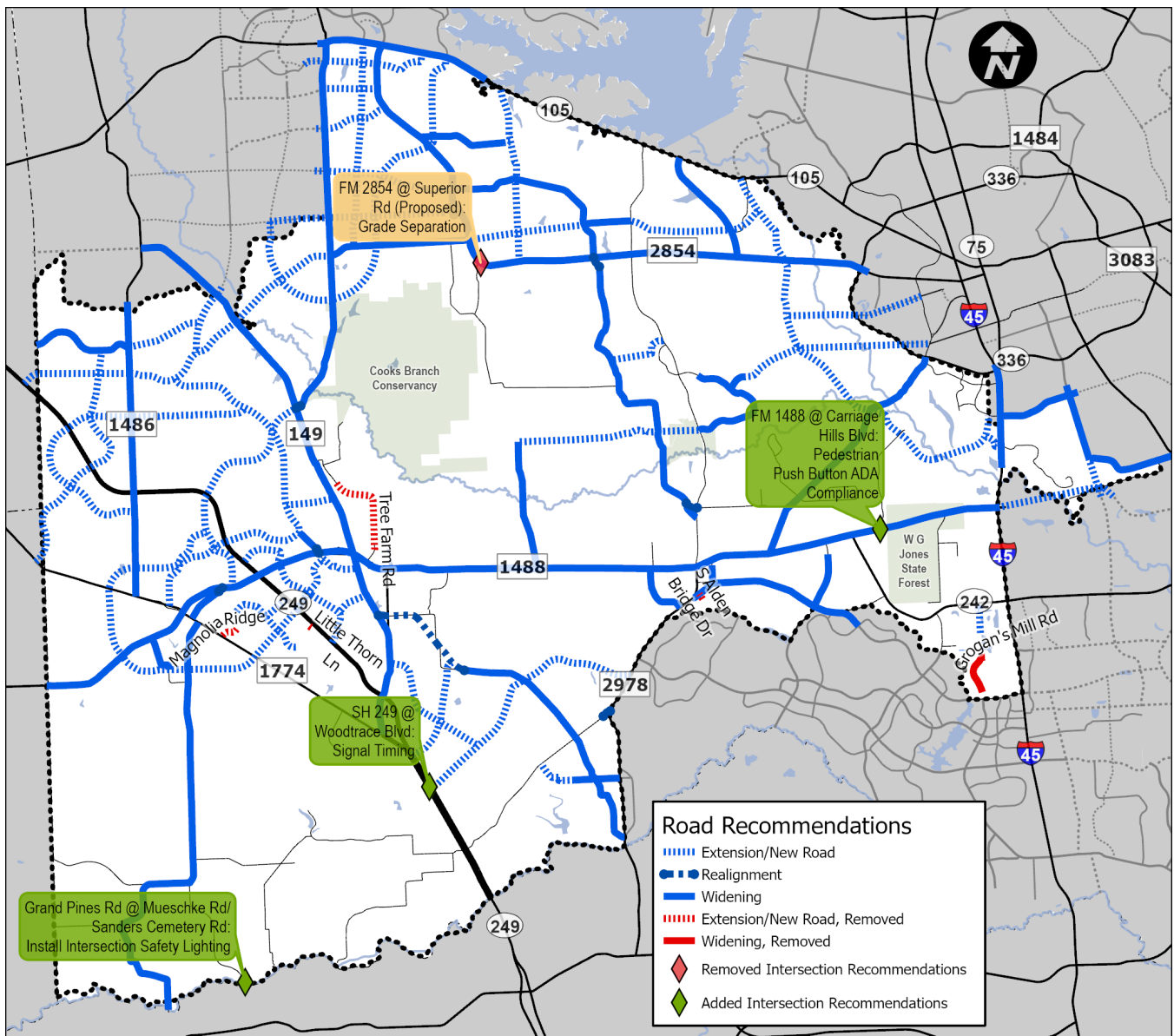


Figure III-7: Recommendation Updates after Public Meeting #2

IV. Eliminated Recommendations

Figure IV-1 shows a map of all removed roadway and intersection recommendations over the course of the project from the preliminary recommendations. Some items were removed or modified because all or part of the recommendation has already been implemented, and some were removed because a new barrier was formed in a previously unobstructed area, typically in the form of a planned commercial or residential development. Other recommendations were removed or modified based on input we received from the Precinct 2 Commissioner's office, the steering committee, or public comments.

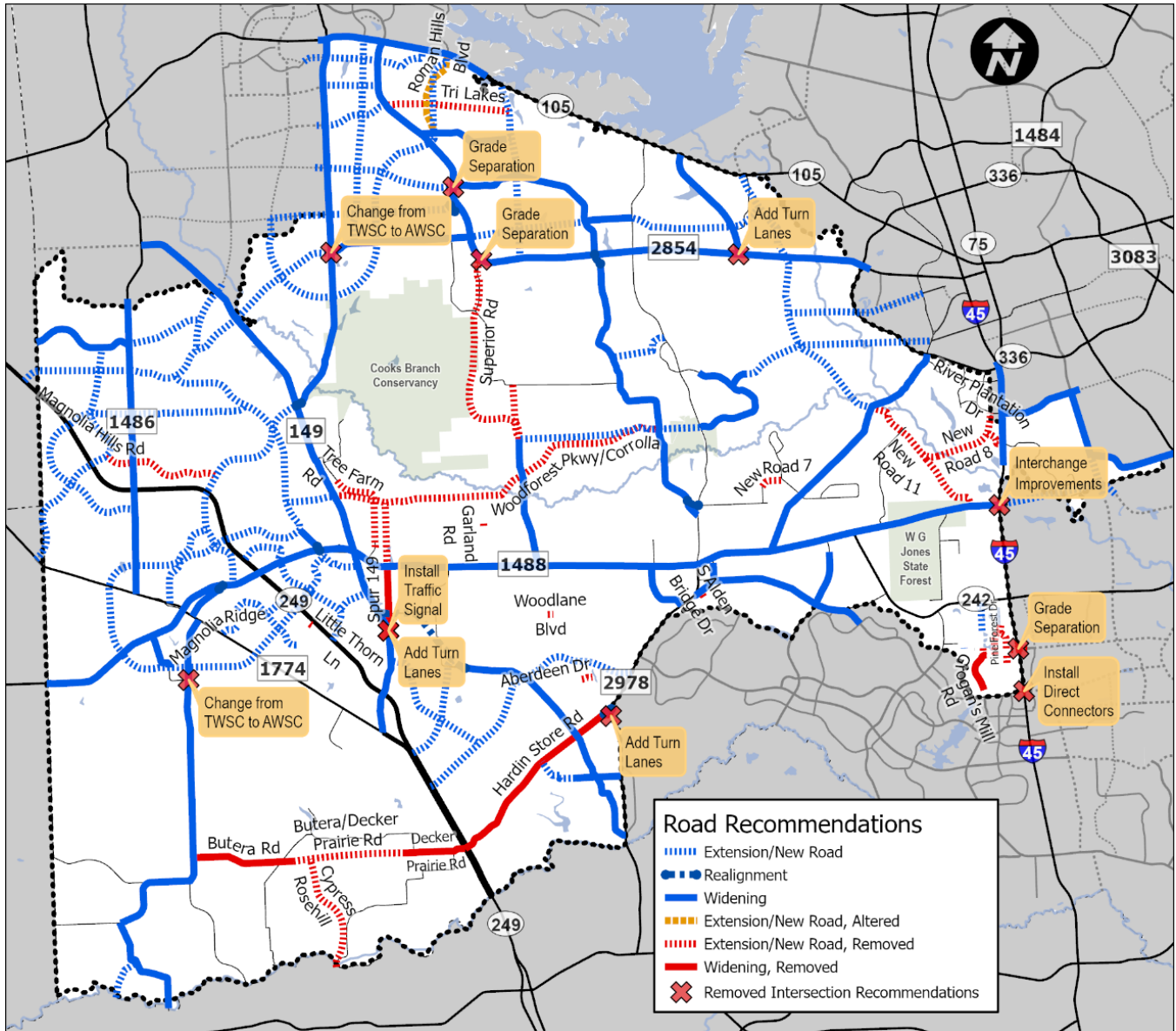


Figure IV-1: Removed Recommendations

V. Final Recommendations

The final recommendations for Montgomery County Precinct 2 Mobility Study after completing the alternatives refinement process are presented below. Detailed maps and project listings for recommendations can be found in APPENDIX A.

Each of these recommendations have been given Short-Term (0-10 years) or Long-Term (11+ years) time frames. Safety and Maintenance recommendations are considered a subset of the Short-Term recommendations from 0-1 year.

A. Roadway Recommendations

1. Safety & Maintenance

Safety and maintenance recommendations include replacing or adding warning signs, installing raised medians, installing street lighting, resurfacing roads, installing rumble strips, and restriping roads. An overview map showing the final safety and maintenance recommendations for Precinct 2 is found in Figure V-1. Safety & Maintenance recommendations cover **255 miles** of road in Precinct 2.

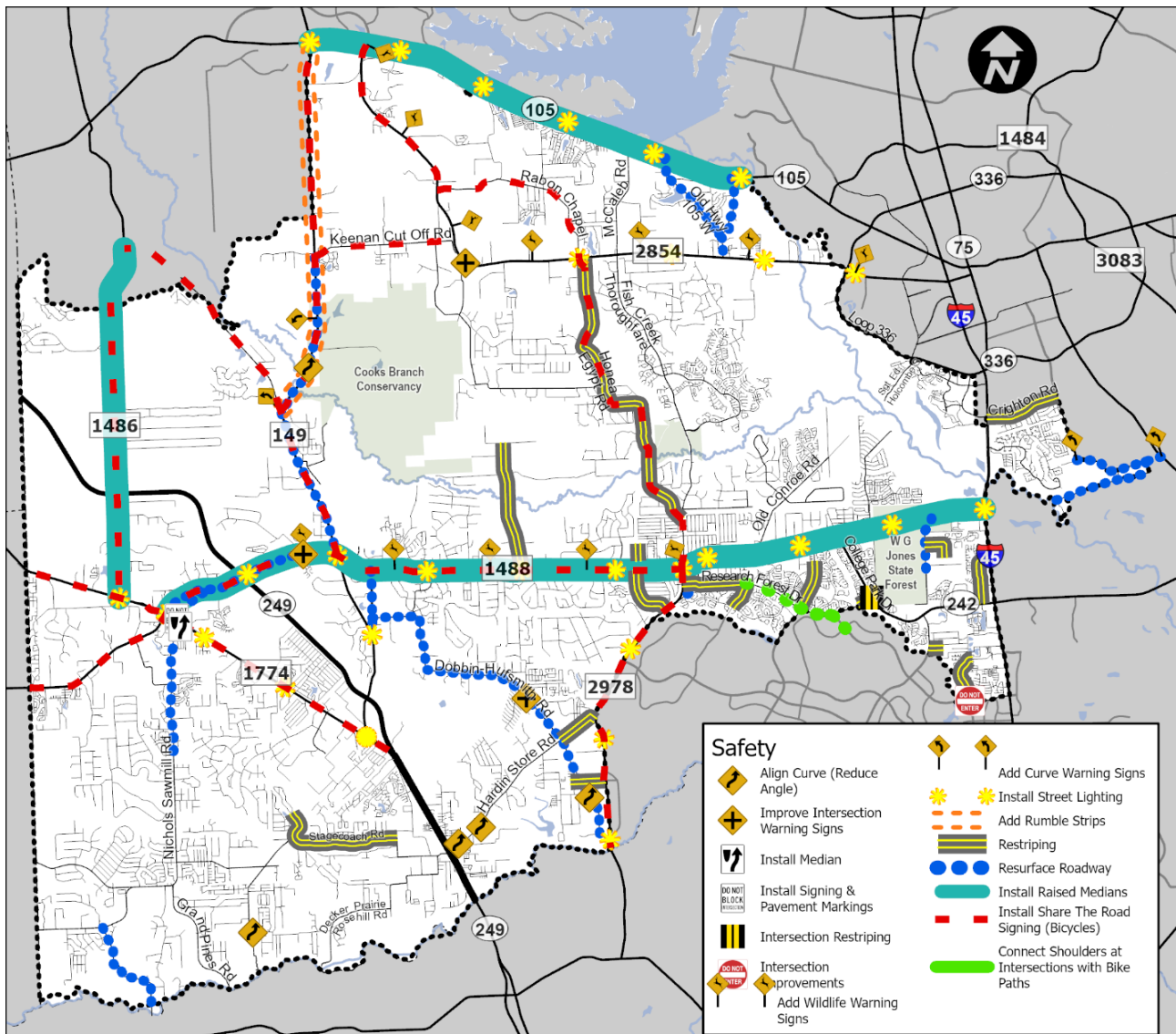


Figure V-1: Safety and Maintenance Recommendations

2. Extensions/New Roads, Widening, and Realignments

Figure V-2 shows a map of the final Short-Term roadway recommendations, including roadway extensions, new roadways, roadway widening, and corridor signal timing. **Short-Term** widening and new/extended roadway recommendations include a total of **91.6 miles**. There are proposed **56.5 miles of widening**, **34.5 miles of extended/new roadways**, and **0.5 miles of roadway realignment**.

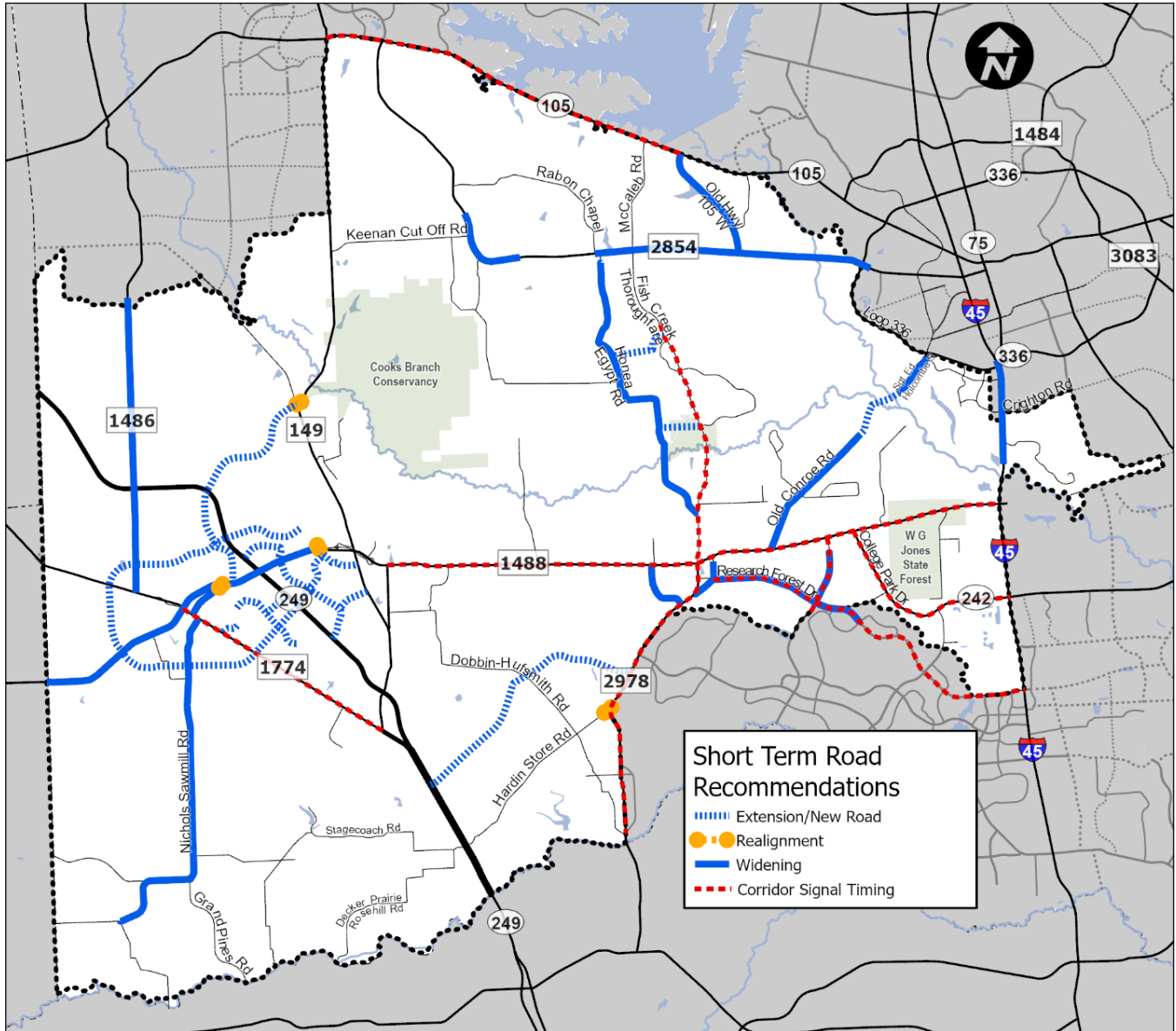


Figure V-2: Final Short-Term Roadway Recommendations

There are 192.1 miles of Long-Term roadway recommendations. 94.9 miles are for extensions and new roads, 94.1 miles are of widening, and there are 3.1 miles of roadway realignment. A map of the final long-term roadway recommendations is found in Figure V-3.

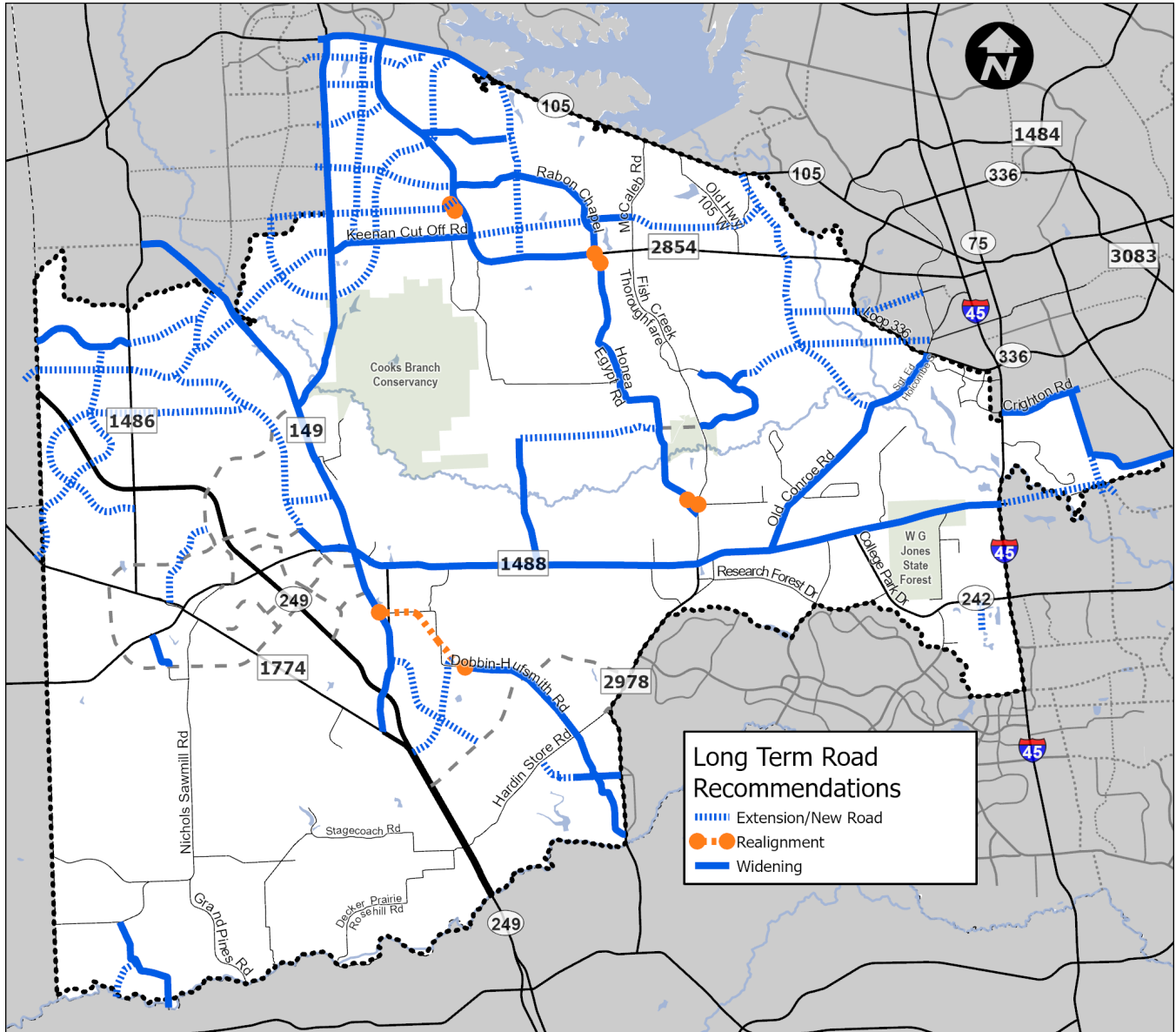


Figure V-3: Final Long-Term Roadway Recommendations

B. Intersection Recommendations

Final intersection recommendations include adding turn lanes, changing traffic control type (signals, all-way stops, or roundabouts), signal timing improvements, upgrading signing and pavement markings, construction of grade separations, and many others.

There are **137 total intersection recommendations** for Precinct 2. **108 are Short-Term** and **29 are Long-Term**. Figure V-5 shows an overview map of final Short-Term intersection recommendations, and Figure V-6 show final Long-Term recommendations. A combined map of final recommendations can be found in Figure V-7.

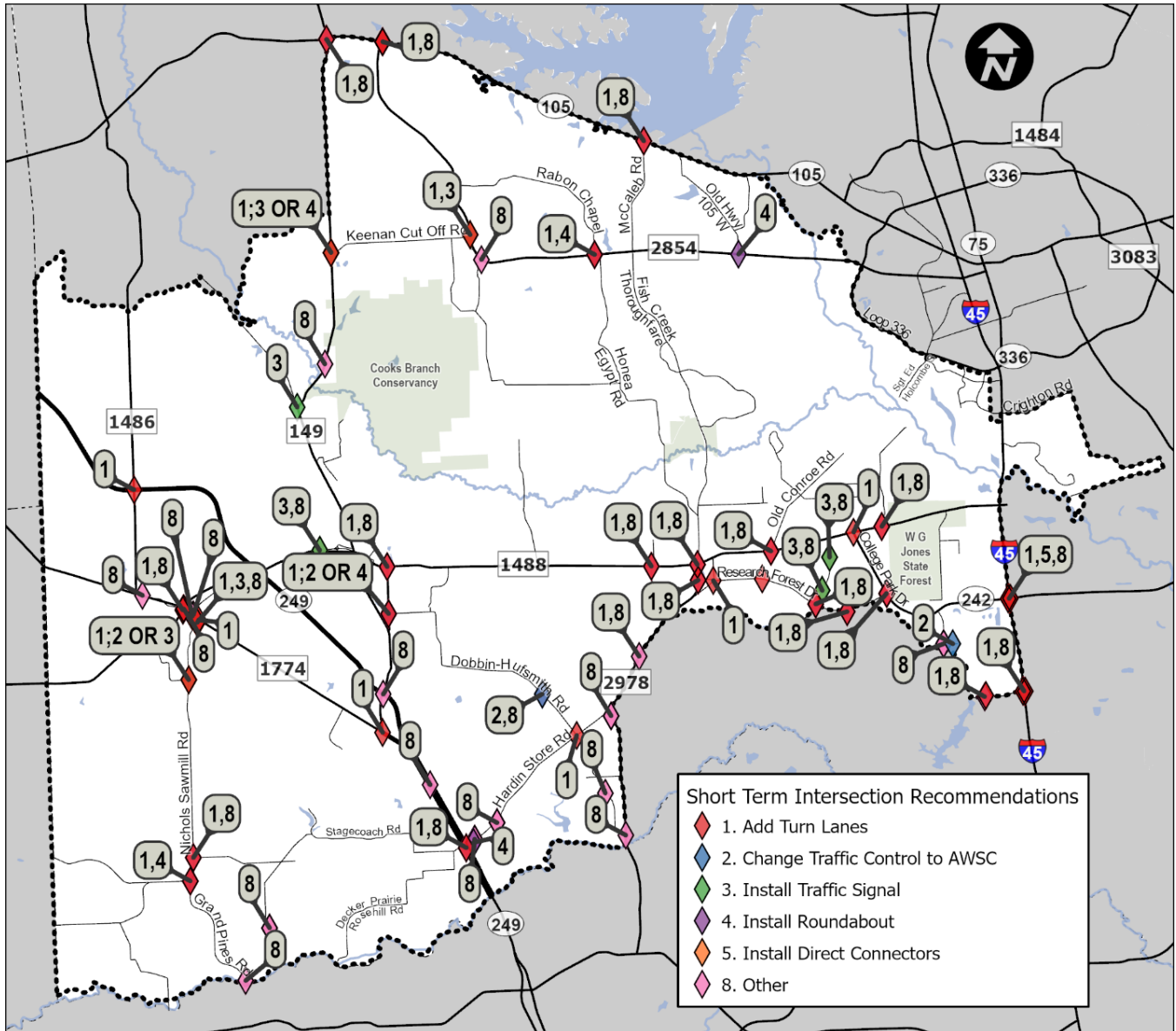


Figure V-5: Final Short-Term Intersection Recommendations

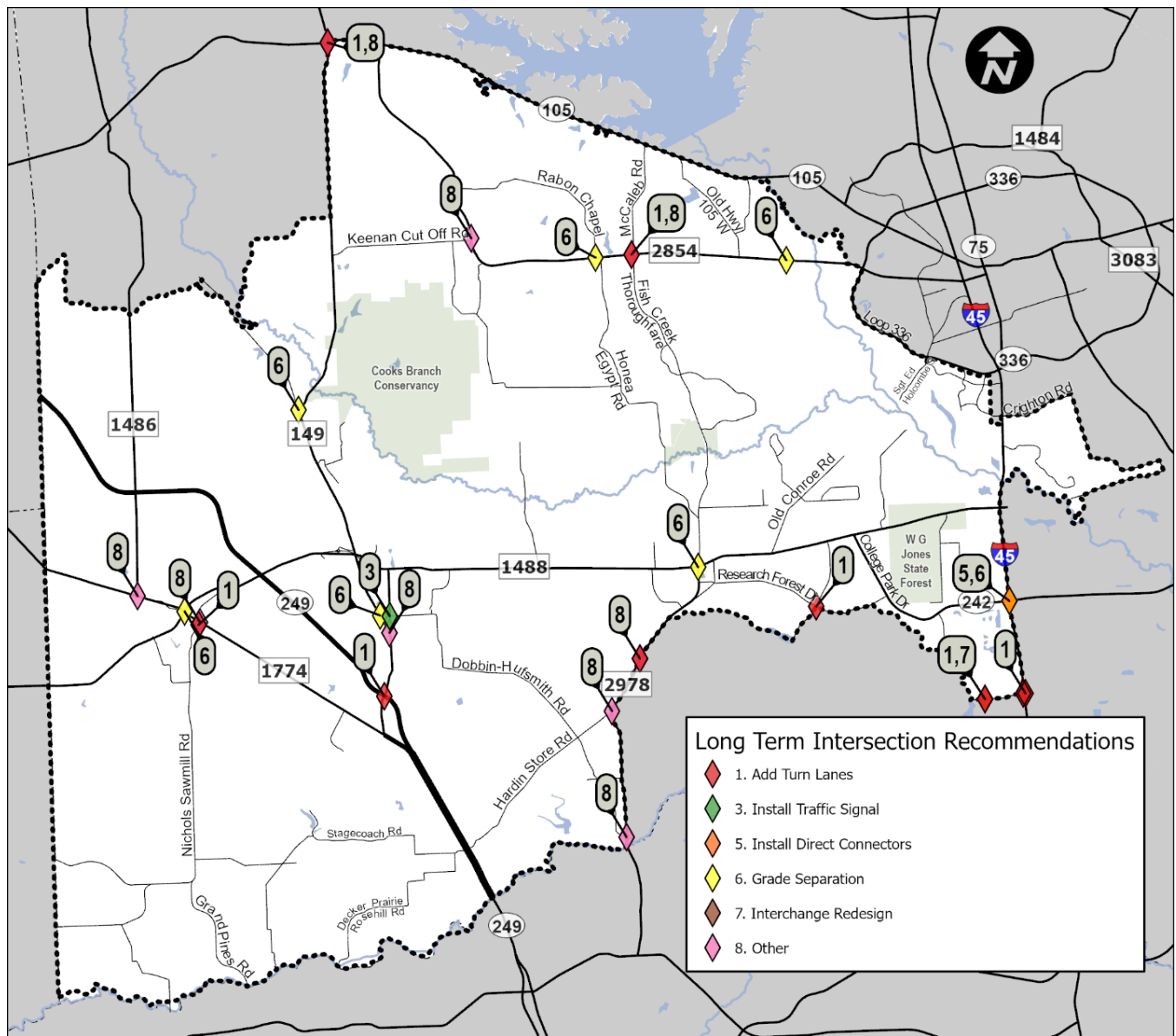


Figure V-6: Final Long-Term Intersection Recommendations

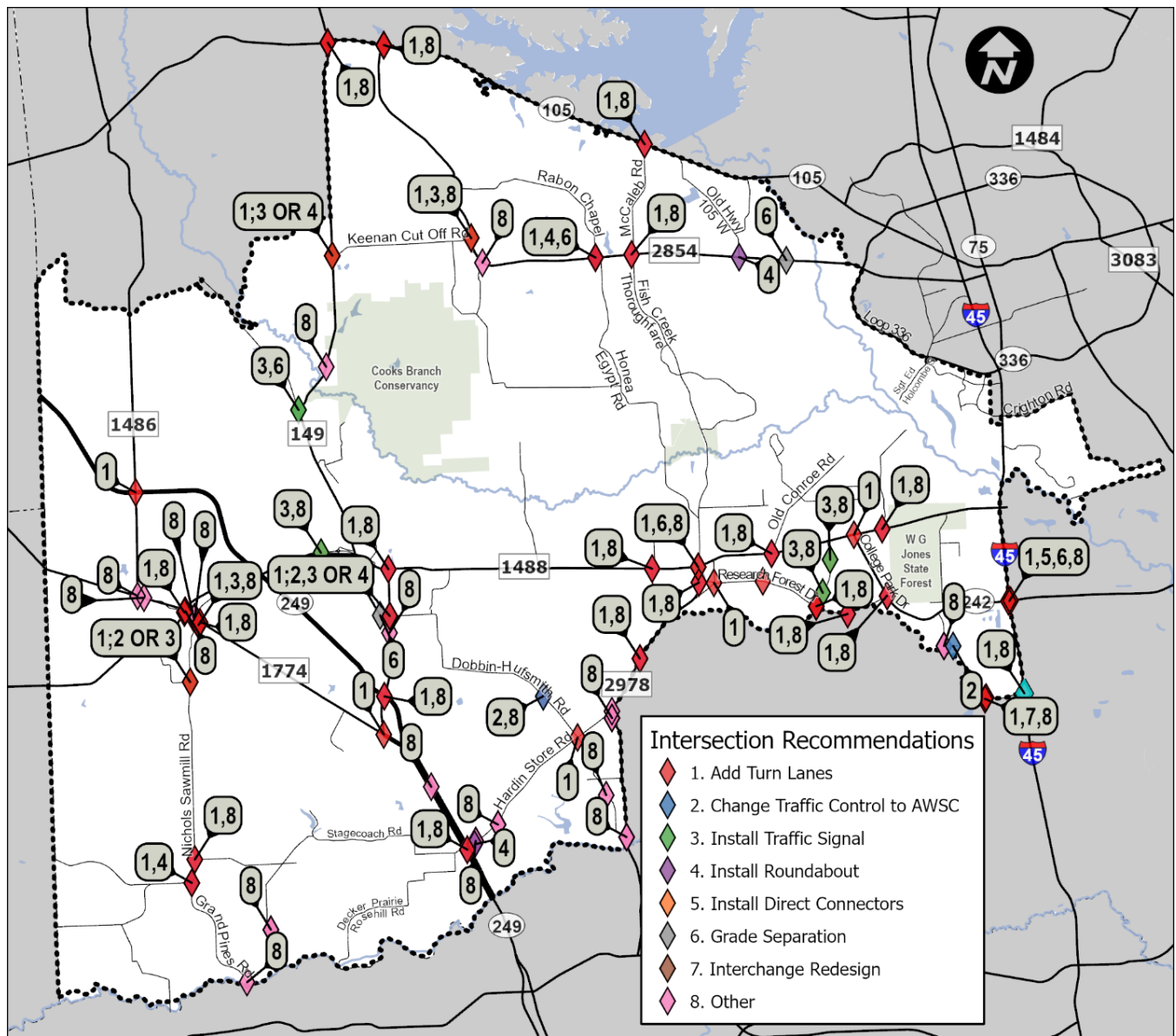


Figure V-7: Final Combined Intersection Recommendations

C. Active Transportation

Final active transportation recommendations include installing separated shared use paths, widening existing sidewalks for shared use with bicycles, providing safe interchange crossings for cyclists, and one shared use bridge. There are **173.5 miles of proposed shared use paths** in Precinct 2 and **1.6 miles of proposed sidewalk widening**. Figure V-8 shows an overview of the final recommendations for these locations.

There are also several locations identified in the Safety and Maintenance recommendations for the addition of "Share the Road" signing along existing bike route corridors.

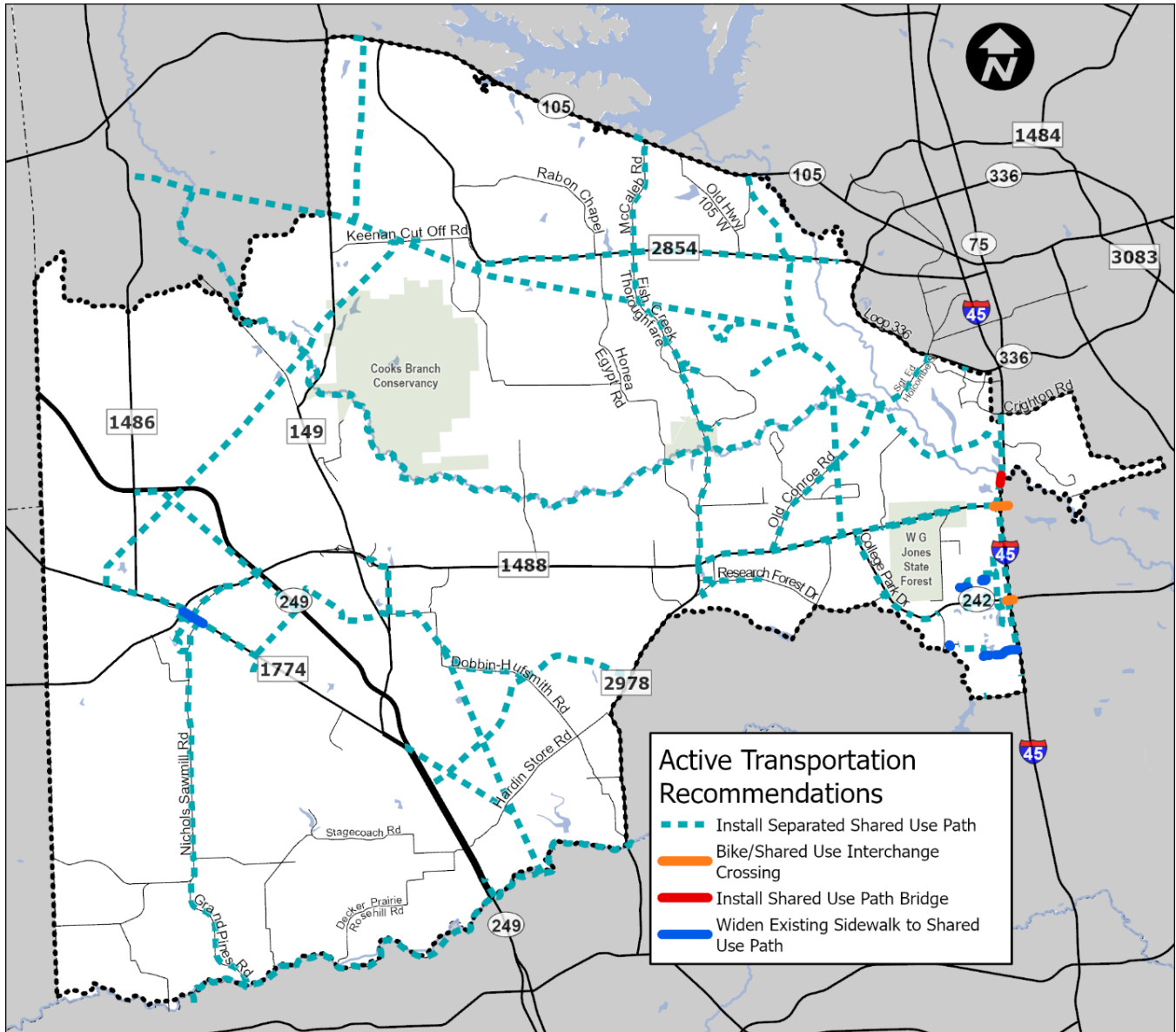


Figure V-8: Final Active Transportation Recommendations