

### **3.0 ALTERNATIVES CONSIDERED**

A number of project alternatives were considered during the conceptual design phase of the project in terms of their ability to achieve each of the project objectives and their impacts. Five alignments were initially developed by the NJDOT for improvements to the Penns Neck area roadways. These potential improvements are designated as Alternatives A, C, D-1, E-1 and F. Several of these were modified during the alternatives evaluation to address particular design and environmental issues.

All alternatives developed by the NJDOT include the widening of Route U.S. 1 to six travel lanes with shoulders/auxiliary lanes and the elimination of traffic signals along Route U.S. 1 at County Route 571/Washington Road, Fisher Place and Harrison Street. The Millstone River bridge would be replaced under each of the NJDOT alternatives. Furthermore, all alternatives include the realignment of County Route 571 through the lands of the David Sarnoff Research Center with a grade-separated interchange at Route U.S. 1 north of the existing Penns Neck Circle. To the west of Route U.S. 1, realigned County Route 571 would meet Harrison Street, Washington Road or both depending on the alternative. To the east of Route U.S. 1, Relocated Route 571 would meet existing County Route 571 at the bridge over the Northeast Corridor rail lines (Amtrak). Just west of the tracks, a grade-separated roadway would link existing Washington Road to Relocated Route 571.

For all the NJDOT alternatives, Relocated Route 571 would be generally a two 12-foot lane roadway with 8-foot shoulders. Near the interchange, auxiliary lanes would be provided for weaving movements.

Where signals are present, left turn slots would be provided where shown. The posted speed for Relocated Route 571 would be 35 m.p.h.

A number of alternative improvement schemes suggested by others have also been examined as part of the alternatives analysis, and are described below. In addition, the No-Build alternative has been examined. As with the NJDOT alternatives, these alternatives were scrutinized in terms of their ability to fully meet the project need and objectives.

In addition to the discussion of each alternative, Table 3-1 provides a summary matrix of the alternatives evaluated, including whether each meets the project need and objectives, impacts to the natural and manmade environment, and engineering considerations.

#### **3.1 Preferred Alternative**

The alternative selected as the preferred, is described in Section 1.2.2. The reasons for selection of this alternative are summarized below and in Table 3-1. This alternative meets the project need and each of its objectives, and would avoid or minimize environmental impacts.

The preferred alternative would meet the project need and project Objective No. 1 as it would eliminate the existing Route U.S. 1 traffic signals as well as the constriction at the Millstone River bridge. Elimination of these existing impediments is expected to stabilize peak period LOS at D to E in 2022 and provide uniform traffic flow. This benefit is expected to be enhanced by the provision for auxiliary traffic lanes that would move turning traffic more quickly and safely into and out of the through traffic stream.

The preferred alternative meets project Objective No. 2 as it maintains existing east-west traffic distribution patterns. The relocation of Route 571 as proposed in the preferred alternative would provide connections to Washington Road as well as Harrison Street. As now, motorists would have the opportunity to select the route that best suits their travel needs. The reconfiguration of east-west through traffic patterns via a grade-separated interchange would substantially improve the east-west flow of traffic through the Penns Neck area. All movements to access Route U.S. 1, Route 571, Washington Road, and Harrison Street would be provided.

The volume of through and turning traffic from Washington Road would be accommodated on Relocated Route 571 and the proposed interchange. The elimination of east-west through traffic from Washington Road and the portion of Harrison Street between Route U.S. 1 and the canal via Relocated Route 571 would dramatically reduce heavy volumes on these local collector roads and would alleviate impacts to the communities of Penns Neck and Harrison Street between Route U.S. 1 and the canal.

The Route U.S. 1/Penns Neck Area Improvements would include provisions to reduce the potential for accidents within the project area. As a whole, these improvements would provide for a consistent roadway section throughout the Route U.S. 1 corridor, thereby eliminating potential driver confusion associated with inconsistent roadway geometry. New auxiliary lanes would divert turning traffic out of the through traffic stream. Auxiliary lanes would meet design standards for geometry and sight distance which would improve the safety of traffic weaves.

Tight curvature and poor sight distance on Harrison Street near the canal would be eliminated by construction of the connector road to Relocated Route 571. This improvement would benefit not only vehicular traffic but D&R Canal Park users who must cross Harrison Street.

The preferred alternative meets project Objective No. 3. The proposed action is consistent with the *Mercer County Growth Management Plan* which recommends reduced land access to arterial highways and the improvement of linkages among state and county highways (Mercer County, 1989). At the municipal level, the preferred alternative is a modified version of Alternative D-1.1 that was adopted by West Windsor and included in the *West Windsor Traffic Circulation Master Plan* (West Windsor, 1993).

As well, Princeton University, the major stakeholder on the west side of Route U.S. 1, has indicated that the preferred alternative is consistent with the Route 571 alignment included on their Master Plan for the land between the D&R Canal Park and Route U.S. 1. Moreover, in discussion with the University and Sarnoff, both stakeholders preferred to consider relinquishing land holdings as far north as possible. The University suggested that the interchange be moved north to the Logan Drive area. The David Sarnoff Research Center mirrored this suggestion that the alignment be moved as far north of their developed complex as possible to provide the maximum useable area for their future development plans. This alignment would create useable parcels for the existing stakeholders, and would minimize the potential that subdivided properties be ultimately developed by others in what would amount to ongoing development sprawl. This shift would place the interchange as far north as possible, maximizing the distance between the Relocated Route 571 interchange and Alexander Road interchange. Maximizing the distance between the interchanges is also beneficial as the weaving distance between the interchanges and the northbound acceleration and deceleration lanes between the interchanges can be optimized.

In compliance with project Objective No. 4, the preferred alternative would utilize existing bridges to cross the D&R Canal Park. Thus, no impairment of Park usage would occur (Section 5.2). Realignment of Harrison Street to the east of the Park would improve existing geometry and increase sight distance in the vicinity of the Park. Relocation of the existing Park parking areas at Washington Road and Harrison Street would improve accessibility and safety for Park users. Additional discussion of the preferred alternative meeting project Objective No. 4 as well as Objective No. 5 is provided in Section 4.0 of this EA/4(f).

### **3.2 Alternative A**

Alternative A (Figure 3-1) would consist of two grade-separated crossings over Route U.S. 1, one located at existing Washington Road and the other, for Relocated Route 571, at existing Harrison Street.

Relocated Route 571 would begin at Harrison Street, cross over Route U.S. 1 and would extend easterly, through the lands of the David Sarnoff Research Center, to the bridge over Amtrak. Sarnoff's Route U.S. 1 entrance would be relocated approximately 900 feet east of Route U.S. 1 and would connect to Relocated Route 571. The jughandle at southbound Route U.S. 1/Fisher Place would be eliminated and the intersection modified to a "T"- intersection. Logan Drive, located just south of Harrison Street, would have a cul-de-sac just west of Route U.S. 1.

The proposed interchange at Harrison Street would allow all traffic movements between Relocated Route 571 and Route U.S. 1. These movements would be accomplished by utilizing a two-way loop ramp in the northwest quadrant, a loop ramp and finger ramp in the southeast quadrant, and a finger ramp in the northeast quadrant.

The interchange at the proposed Washington Road overpass would only allow right-turn movements to and from Route U.S. 1 and through movements along Washington Road. However, existing land uses, particularly on the east side of Route U.S. 1, would limit construction of right-turn movement ramps between Route U.S. 1 and Washington Road. Right-of-way acquisition involving residential and business properties, as well as a portion of the Penns Neck Baptist Church cemetery, would be unavoidable to construct these ramps, even with the use of retaining walls. The retaining walls east of Route U.S. 1, along Washington Road, would each be approximately 370 feet in length; and the walls west of Route U.S. 1 would each be approximately 440 feet in length. Left turn movements at this intersection would be prohibited due to lack of space and geometrical limitations.

Due to the slow design speed required to safely negotiate turning movements at Washington Road, acceleration and deceleration lanes on Route U.S. 1 would have to be lengthy. These lanes may meet or overlap with the Alexander Road acceleration/deceleration lanes in the vicinity of the Dinky bridge. This design condition in combination with the substandard turning lane configuration at Washington Road would be imprudent for safety reasons.

Property acquisitions to construct the interchange at Harrison Street would include portions of properties held by Princeton University and Sarnoff Research Center.

Traffic signals under this alternative would be required at the following three intersections along Relocated Route 571:

- 1) Two-way loop ramp west of Route U.S. 1;
- 2) Finger ramp east of Route U.S. 1; and
- 3) Relocated David Sarnoff Research Center entrance at Relocated Route 571 east of Route U.S. 1.

These signals would operate in the AM peak hour with acceptable levels of service B and C, and in the PM with acceptable levels of service C to D. The Route U.S. 1 ramp terminals would operate acceptably except for the southbound exit terminal in the PM peak hour.

Due to the interchange location at existing Harrison Street, substantial impacts to the Millstone River would be unavoidable. The northwest quadrant of the interchange would be in the wetlands of the Millstone River as well as the 100-year flood plain. Near its easterly terminus point, Relocated Route 571 would cross Little Bear Brook at a sharp skew involving substantial impacts to both the wetlands and the 100-year flood plain of the Brook.

Alternative A would preserve useable parcels of land for the existing stakeholders=future plans, and would minimize the potential that subdivided properties be ultimately developed by others in what would amount to ongoing development sprawl.

Alternative A would not meet project Objective Nos. 3, 4, and 5. This alternative would not achieve the project objective of removing through traffic movements from Washington Road in the Penns Neck community. Impacts to the Millstone River and Little Bear Brook (wetlands, floodplain, and floodway) would be the largest of all the alternatives considered. In addition, impacts consequent to construction of the retaining walls, particularly in terms of restricting access to adjacent businesses and residences as well as visual impacts to the same, were considered unacceptable. An adverse effect on the Penns Neck Baptist Church would likely result both due to setting impacts as well as right-of-way acquisition at the cemetery. Moreover, the construction of two grade-separated interchanges is unnecessarily redundant, particularly considering the proximity of the Alexander Road interchange one third of a mile to the south. In light of there being other alternatives meeting project need and objectives with less impact, Alternative A was rejected from further consideration.

### **3.3 Alternative C**

Alternative C (Figure 3-2) was developed to provide minimal curvature on Relocated Route 571 such that the new roadway would follow a nearly straight alignment through the project area. Relocated Route 571 would begin at Harrison Street on the eastern side of the bridge over the D&R Canal Park and would follow an alignment eastward through Princeton University property. The interchange would be located between the existing Route U.S. 1 intersections with Harrison Street and Fisher Place, approximately 300 feet north of Fisher Place and would consist of loop ramps in the northwestern, northeastern, and southwestern quadrants and a finger ramp in the northeastern quadrant. This interchange would allow for all turning movements, replacing the existing traffic signals at the Washington Road, Fisher Place, and Harrison Street intersections. Property acquisitions to construct the interchange would include portions of properties held by Princeton University and Sarnoff Research Center.

From the interchange, Relocated Route 571 would extend through the southern portion of the David Sarnoff Research Center parallel to and approximately 300 feet north of Fisher Place.

Relocated Route 571 would meet the existing Route 571 alignment at the bridge over Amtrak. A two-way, north-south connector road would be located west of Route U.S. 1 to link Relocated Route 571 with Washington Road. A jughandle would be provided for westbound Relocated Route 571 traffic turning left onto the connector road.

Both Washington Road and Harrison Street would be modified to T-intersections at Route U.S. 1, allowing only right turns to and from southbound Route U.S. 1. The existing jughandle at southbound Route U.S. 1/Fisher Place would be eliminated and the northbound Route U.S. 1/Fisher Place intersection would be modified to a T-intersection. Access to the Penns Neck community would be provided from Washington Road or from Relocated Route 571 via Fairview Avenue.

Traffic signals under this alternative would be required at the following two intersections:

- 1) Relocated Route 571/Route U.S. 1 Northbound Ramps
- 2) Relocated Route 571/Washington Road Connector

Alternative C would not meet project Objectives 3 and 4. Relocated Route 571 would be located very close to the Penns Neck community on the east side of Route U.S. 1, resulting in adverse impacts

related to traffic noise, socioeconomics, and aesthetics. This alternative would have an adverse impact on the David Sarnoff Research Center whose formal campus entrance is Fairview Avenue. Alternative C would traverse the manicured front lawns of the Center causing a substantial negative impact on the existing campus-like setting afforded by the extensive lawns and landscaping.

Alternative C would avoid impacts on the Millstone River, and its floodplains and wetlands, that would occur in the interchange configuration proposed in Alternatives A and E. However, Alternative C would have a greater impact on the Little Bear Brook corridor than the AD-1.1@ series alternatives as Relocated Route 571 would cross the brook at one of the widest points of its floodplain and wetlands.

Alternative C was also rejected as Relocated Route 571 and the interchange would require acquisition of extensive property frontage along Route U.S. 1 owned by Princeton University and the David Sarnoff Research Center. These two land holders objected to such takes. In particular, Princeton University's Master Plan calls for the development of their lands west of Route U.S. 1 within the near future. Alternative C would have a substantial adverse impact on these plans as Relocated Route 571 would divide their holdings into multiple parcels and would virtually eliminate their frontage on Route U.S. 1. The David Sarnoff Research Center also expressed disfavor with the potential loss of substantial property frontage on Route U.S. 1 under this alternative. Discussions with both Princeton University and David Sarnoff Research Center indicated that Alternative C is highly unfavorable to their long-term improvement plans, and would reduce the visibility that each enjoys. Moreover, the subdivision of these parcels would increase the potential that the subdivided properties be ultimately developed by others in what would amount to ongoing development sprawl.

From a traffic engineering standpoint, the interchange could not provide all turning movements due to land use constraints, which preclude development of the required loop and finger ramps. Movements that Alternative C would not provide include: 1) from Route U.S. 1 southbound to Relocated Route 571 westbound, and 2) from Relocated Route 571 eastbound to Route U.S. 1 southbound. These two movements would be made at either the Harrison Street/Route U.S. 1 intersection or the Washington Road/Route U.S. 1 intersection. However, these requirements would not alleviate heavy westbound through traffic flows on Harrison Street between Route U.S. 1 and the canal, and the portion of Washington Road west of Route U.S. 1 would have to remain in order to provide access to Route U.S. 1 southbound. Further, strong opposition was voiced by local residents and municipal officials to the diversion of traffic to Harrison Street under Alternative C. In light of there being other alternatives meeting project need and objectives with less impact, Alternative C was rejected from further consideration.

### **3.4 Alternative D-1**

Alternative D-1 (Figure 3-3) would consist of a single grade-separated interchange with Relocated County Route 571 over Route U.S. 1. The interchange would be located between the existing Route U.S. 1 intersections with Fisher Place and Harrison Street just south of the PSE&G substation.

Relocated Route 571 would begin west of Route U.S. 1 on Washington Road at a point that is approximately 400 feet east of the D&R Canal Park and would continue easterly through the lands of Princeton University. A grade-separated interchange would carry Relocated Route 571 over Route U.S. 1. From the interchange, Relocated Route 571 would extend through the lands of David Sarnoff Research Center to existing Route 571 at a point west of the bridge over Amtrak.

The interchange would allow all turning movements except for the movement from southbound Route U.S. 1 to westbound Relocated Route 571, which is provided at Harrison Street. The interchange would consist of loop ramps and finger ramps in both the southwest and the southeast quadrants and a finger ramp in the northeast quadrant. Property acquisitions to construct the interchange would include portions of properties held by Princeton University and Sarnoff Research Center.

Acceleration and deceleration lanes for the interchange ramps could be constructed in a manner acceptable to the NJDOT Bureau of Major Access, while allowing the existing PSE&G substation driveway and Logan Drive (Eden Institute access) on southbound Route U.S. 1, as well as Fisher Place and Washington Road intersections on the northbound side of Route U.S. 1 to remain open. All but the Fisher Place access point would occur before the start of the tapers for the acceleration or deceleration lanes. The Fisher Place intersection falls within the beginning of the taper, which is acceptable to the Bureau.

Existing Washington Road west of Route U.S. 1 would be closed from Route U.S. 1 to the beginning of Relocated Route 571 further west. East of Route U.S. 1, Washington Road would remain but its intersection with Route U.S. 1 would be modified to a "T" intersection, allowing right turns only. The jughandles at southbound Route U.S. 1/Fisher Place and northbound Route U.S. 1/Harrison Street-Sarnoff Research Center entrance would be eliminated. Each of these intersections would be modified to a "T". Additionally, the existing David Sarnoff Research Center entrance on Route U.S. 1 would be moved to provide access to/from Relocated Route 571.

A two-way connector road would connect Relocated Route 571 west of Route U.S. 1 to Harrison Street. Harrison Street would be realigned just east of the D&R Canal bridge to provide a 90 degree intersection with the proposed connector road.

Traffic signals under this Alternative are proposed at the following three intersections:

- 1) Relocated Route 571/Relocated Sarnoff Research Center entrance;
- 2) Relocated Route 571/Connector Road;
- 3) Relocated Harrison Street/Connector Road.

The loop ramps in the southeast and southwest quadrants would provide connections for the highest turning movement volumes in the interchange. This arrangement would provide high levels of service along Relocated Route 571 except for the eastbound weave between the two loop ramps.

A large portion of the Harrison Street connector road would be within the 100-year flood plain of the Millstone River and the Canal Park. Relocated Route 571 would encroach on the wetlands and 100-year flood plain of the Millstone River at the curve in the alignment just north of the David Sarnoff Research Center. Near its easterly terminus point, Relocated Route 571 would cross Little Bear Brook at a sharp skew involving substantial impacts to both the wetlands and the 100-year flood plain of the brook.

Alternative D-1 would not meet project Objectives 4 and 5. Extensive property takes on either side of Route U.S. 1 to build the interchange would substantially impact the University and Sarnoff properties. As discussed under Alternative C, these front yards are extremely important to both stakeholders in terms of visibility, and in the case of the University, future campus development plans. Alternative D-1 would generally create useable parcels for the existing stakeholders, although the alignment does not optimize these land areas. Alternative D-1 would minimize the potential that subdivided properties be ultimately developed by others in what would amount to ongoing development sprawl. Relative to other alternatives considered, wetland and floodplain impacts as a result of Alternative D-1 would be large. In light of there being other alternatives meeting project need and objectives with less impact, Alternative D-1 was rejected from further consideration.

### **3.5 Alternative D-1.1**

Relocated Route 571 under Alternative D-1.1 (Figure 34) would begin at Washington Road approximately 400 feet east of the D&R Canal Park and follow an alignment northward and then

eastward through Princeton University property to a grade-separated interchange at Route U.S. 1. This alignment places the westernmost edge of Relocated Route 571 in line with an existing unpaved access road that parallels the D&R Canal Park on the University property.

The interchange would be located between the existing Route U.S. 1 intersections with Fisher Place and Harrison Street just south of the PSE&G substation. From the interchange, Relocated Route 571 would follow an alignment through the northern portion of the David Sarnoff Research Center property near the Millstone River, cross over Little Bear Brook, and join existing Route 571 at the bridge over Amtrak. As in the preferred alternative, a loop ramp and a finger ramp would be provided to direct vehicles to and from Relocated Route 571 westbound into the Princeton Junction train station. A new structure would be required to pass these ramps underneath Relocated Route 571. Property acquisitions to construct the interchange would include portions of properties held by Princeton University and Sarnoff Research Center.

Acceleration and deceleration lanes for the interchange ramps could be constructed in a manner acceptable to the NJDOT Bureau of Major Access, while allowing the existing PSE&G substation driveway and Logan Drive (Eden Institute access) on southbound Route U.S. 1, as well as Fisher Place and Washington Road intersections on the northbound side of Route U.S. 1 to remain open. All but the Fisher Place access point would occur before the start of the tapers for the acceleration or deceleration lanes. The Fisher Place intersection falls within the beginning of the taper, which is acceptable to the Bureau.

The portion of Washington Road on the west side of Route U.S. 1 would be terminated at Route U.S. 1 with a cul-de-sac. East of Route U.S. 1, the Route U.S. 1/Washington Road intersection would be modified to a T-intersection, providing right turns only. The jughandles at southbound Route U.S. 1/Fisher Place and northbound Route U.S. 1/Harrison Street-Sarnoff Research Center entrance would be eliminated. Each of these intersections would be modified to a T-intersection. Additionally, the existing David Sarnoff Research Center entrance on Route U.S. 1 would be moved to provide access from Relocated Route 571.

A two-way connector road is proposed from Relocated Route 571, west of Route U.S. 1, to the Harrison Street bridge.

Traffic signals under this alternative would be required at the following three intersections:

- 1) Relocated Route 571/Route U.S. 1 Northbound Ramps
- 2) Relocated Route 571/Route U.S. 1 Southbound Ramps
- 3) Relocated Route 571/Harrison Street Connector Road

Alternative D-1.1 would not meet project Objective No. 4. This alternative was developed to put greater distance between Relocated Route 571 and the Penns Neck community to the south than was provided by Alternative C, while avoiding impacts to the PSE&G substation and properties along Logan Drive to the north. However, as with Alternatives C and D-1, the land acquisition requirements for the interchange would be substantial and would eliminate the Route U.S. 1 frontage currently held by Princeton University and the David Sarnoff Research Center. Alternative D-1.1 would generally create useable parcels for the existing stakeholders, although the alignment does not optimize these land areas. Alternative D-1.1 would minimize the potential that subdivided properties be ultimately developed by others in what would amount to ongoing development sprawl. Finally, the proximity of the intersection of Relocated Route 571 and Washington Road to the canal crossing and park parking area would be less than optimal for pedestrian and motorist safety.

Alternative D-1.1 would have minimal waterway impacts. Relocated Route 571 would cross Little Bear Brook at one of the narrowest points of its floodplain and wetlands. The alignment would not encroach on the Millstone River floodplain or wetlands except where the connector road meets Harrison Street.

In light of there being other alternatives meeting project need and objectives with less impact, Alternative D-1.1 was rejected from further consideration.

### **3.6 Alternative D-1.1A**

This modification to Alternative D-1.1 places Relocated Route 571 just between the PSE&G substation and the Princeton Operating Station (now temporarily occupied by Eden Institute). This alignment would optimize the configuration of major stakeholders=land parcels and would minimize the potential that subdivided properties be ultimately developed by others in what would amount to ongoing development sprawl. The interchange would be configured similarly to Alternative D-1.1 with the exception that the finger ramp in the northeast quadrant would be eliminated.

This configuration would require retaining walls to be placed alongside both the substation and the Princeton Operating Station building. On the PSE&G side of Relocated Route 571, approximately 300 linear feet of wall would be required. The wall, with a maximum height of 25 feet, would be placed just north of the existing control house preventing any relocation of PSE&G components. On the Institute side of Relocated Route 571, approximately 550 linear feet of wall would be required. This wall would be placed down the side slope to minimize its height but also provide a side yard for the Institute. The proximity of the roadway and retaining wall configuration would impact the settings of the historic Princeton Operating Station and Covenhoven-Silvers-Logan House.

The Relocated Route 571 alignment would be shifted at the interchange only, taking on Alternative D-1.1 characteristics for the remainder of its length. Property acquisitions to construct the interchange would include portions of properties held by Princeton University, Sarnoff Research Center, and PSE&G.

Alternative D-1.1A would meet project Objectives. However, the interchange would require acquisition of a portion of PSE&G lands currently occupied by substation equipment. Compensation to PSE&G for relocation of this equipment was determined to cost approximately \$15 million, an unreasonable fee considering the total project cost. Moreover, the project schedule would be constrained by the time required to relocate the equipment. In light of there being other alternatives meeting project need and objectives with less impact, Alternative D-1.1A was rejected from further consideration.

### **3.7 Alternative D-1.1B**

This modification to Alternative D-1.1 places Relocated Route 571 just north of the location of D-1.1A. The alignment would eliminate the need for the property acquisition from PSE&G and retaining wall construction; however, this configuration would directly impact the historic Princeton Operating Station building, and historic Covenhoven-Silvers-Logan House.

The interchange is similar to Alternative D-1.1 except that the finger ramp in the northeast quadrant would be eliminated. As well, the double left turn lanes at the end of the loop ramp in the southwest quadrant would be replaced by a finger ramp in the northwest quadrant. This ramp would provide for the southbound Route U.S. 1 to westbound Relocated Route 571 movement currently provided by Harrison Street and Washington Road. The ramp would begin in the vicinity of the existing Route U.S. 1/Harrison Street intersection, thereby restricting access from Harrison Street to/from Route U.S. 1. Under this alternative, Harrison Street would have a cul-de-sac at its Route U.S. 1 terminus and would have access to Relocated Route 571 via the connector road (as described in Alternative D-1.1).

Relocated Route 571 would be shifted at the interchange only, taking on Alternative D1.1 characteristics for the remainder of its length. Property acquisitions to construct the interchange include portions of properties held by Princeton University and Sarnoff Research Center.

Alternative D-1.1B would meet all project Objectives. However, the ramp configurations would provide less than optimal access and turning movement capability considering the magnitude of the project. This limitation is caused primarily by the desire to avoid impacts to the Sunoco Station. Finally, the proximity of the Relocated Route 571/Washington Road intersection would be less than optimal for protecting pedestrian and motorist safety at the canal crossing and the existing park parking area. In light of there being other alternatives meeting project need and objectives with improved interchange geometry, Alternative D-1.1B was rejected from further consideration.

### **3.8 Alternative D-1.1C**

This alternative (Figure 3-5) is a modification to Alternative D-1.1B. It would contain the exact characteristics as Alternate D-1.1B with one exception. The geometry of Relocated Route 571 at the interchange would be improved by eliminating the reverse curves. A tangent would connect the curve at the north edge of the David Sarnoff Research Center and the curve on the northwest edge of Princeton University's property. This geometry would improve sight distance at the ramp merges, especially the short weave area provided between the two loop ramps.

Similar to Alternative D-1.1B, there would be a finger ramp in the northwest quadrant. This ramp would provide for the southbound Route U.S. 1 to westbound relocated Route 571 movement currently provided by Harrison Street and Washington Road. This ramp would eliminate access to/from Route U.S. 1 to Harrison Street. Harrison Street would have a cul-de-sac at its Route U.S. 1 terminus and would receive access to Relocated Route 571 via the connector road (as described in Alternative D-1.1). Property acquisitions to construct the interchange include the Sunoco Service Station, and portions of properties held by Princeton University and Sarnoff Research Center. This configuration would directly impact the historic Princeton Operating Station building, and historic Covenhoven-Silvers-Logan House.

Alternative D-1.1C would meet all project objectives. However, a concern was raised by the D&R Canal Commission regarding the proximity of the westernmost leg of Relocated Route 571 to the D&R Canal Park. This alternative, as well as Alternatives D-1, D-1.1, D-1.1A, D-1.1B, and E-1, would place this leg of Relocated Route 571 parallel and near to the Park. The Commission's concerns center on the potential for project impacts on the Park in terms of traffic noise, visibility, and pedestrian safety for park users crossing Washington Road and using the existing park parking area. In light of there being other alternatives meeting project need and objectives with less impact to the Canal Park, Alternative D-1.1C was rejected from further consideration.

### **3.9 Alternative D-1.1D**

Alternative D-1.1D (Figure 3-6) is a modification of Alternative D-1.1C, developed to address community concerns regarding traffic volumes on Washington Road west of Route U.S. 1. This alternative would eliminate connection of Relocated Route 571 to Washington Road by connecting the roadway directly to Harrison Street. The grade-separated interchange geometry at Route U.S. 1, as well as the alignment of Relocated Route 571 east of Route U.S. 1, would be identical to that proposed in Alternative D-1.1C. Property acquisitions to construct the interchange include the Sunoco Service Station, and portions of properties held by Princeton University and the Sarnoff Research Center.

Diversion of all Route 571 through traffic to Harrison Street would require substantial improvements to the intersection of Harrison Street and Faculty Road as well as the intersection of Washington Road and Faculty Road, both in Princeton. Specifically, the Harrison Street approaches to Faculty Road would have to be widened to provide two lanes, and Faculty Road northbound would have to be widened at the intersection approach to two lanes. At the intersection with Washington Road, Faculty Road southbound would have to be widened to provide separate left turn, through, and right turn lanes.

Three traffic signals would be required at the following locations:

- 1) Relocated Route 571/Relocated Sarnoff driveway;
- 2) Relocated Route 571/Route U.S. 1 Southbound Ramps; and,
- 3) Relocated Route 571/Route U.S. 1 Northbound Ramps.

Diversion of all Route 571 traffic to Harrison Street would change the existing distribution of traffic. Whereas currently, Washington Road handles 30-34% of all traffic entering and exiting Princeton via Alexander Road, Washington Road, and Harrison Street, under Alternative D-1.1D, this distribution would drop to 15-18%. In contrast, the existing distribution at Harrison Street, 17-24%, would increase to 32-35%, causing Harrison Street to serve as the through connector to Route U.S. 1.

Alternative D-1.1D and the *Traffic Analysis Technical Memorandum* (Harris, 1999) were reviewed by Princeton Borough and rejected as placing too great a burden on the Harrison Street/Faculty Road street system. In terms of meeting NJDOT's project need and objectives, the diversion of Route 571 traffic volume to Harrison Street is contrary to the project Objective No. 2, maintaining the existing traffic distributions between the three east-west corridors into Princeton. In light of there being other alternatives meeting project need and objectives without changing existing traffic distributions, Alternative D-1.1D was rejected from further consideration.

### **3.10 Alternative E-1**

Alternative E-1 (Figure 3-7) would consist of a single grade-separated interchange with Relocated County Route 571 over Route U.S. 1. The interchange would be located at the existing at-grade intersection of Harrison Street and Route U.S. 1.

Relocated Route 571 would begin at Washington Road, 200 feet east of the D&R Canal Park, follow a northerly course nearly parallel to the D&R Canal Park through the lands of Princeton University and then turn right and follow the existing alignment of Harrison Street. A grade-separated interchange would carry Relocated Route 571 over Route U.S. 1. East of Route U.S. 1, Relocated Route 571 would run nearly parallel to the Millstone River through the lands of the David Sarnoff Research Center to existing Route 571 at a point west of the bridge over Amtrak.

The proposed interchange would allow for all traffic movements. These movements would be accomplished by utilizing a two-way loop ramp in the southwest quadrant (scaled down to reduce property impacts), a loop ramp and finger ramp in the southeast quadrant; and finger ramps in the northeast and northwest quadrants. Property acquisitions to construct the interchange include the Sunoco Service Station, and portions of properties held by Princeton University and Sarnoff Research Center.

A two-way connector road would link Relocated Route 571 to existing Harrison Street just east of the bridge over the D&R Canal Park. Harrison Street would be realigned in this area to provide a 90 degree intersection with the proposed connector road.

The jughandles at southbound Route U. S. 1/Fisher Place and northbound Route U.S. 1/Harrison Street would be eliminated and modified to "T"-intersections. The Route U.S. 1/Washington Road intersection would also be converted to a "T" intersection at both the eastbound and westbound approaches. Additionally, the existing Sarnoff Research Center entrance on Route U.S. 1 would be moved.

Traffic signals under this alternative would be located at the following four intersections along Relocated Route 571:

- 1) The two-way loop ramp west of Route U.S. 1;
  - 2) The diamond slip ramp east of Route U.S. 1;
  - 3) The relocated Sarnoff Research Center entrance east of Route U.S. 1;
- and,
- 4) Relocated Route 571/Harrison Street Connector Road.

Alternative E-1 would not meet project Objective Nos. 4 and 5. A large portion of Harrison Street is within the 100-year flood plain of the Millstone River. Relocated Route 571 on the Harrison Street alignment, as well as portions of the interchange, would also be within the 100-year floodplain. Also, relocated Route 571 would encroach on the wetlands and 100-year flood plain of the Millstone River at the curve in the alignment just north of the David Sarnoff Research Center. Near its easterly terminus point, Relocated Route 571 would cross Little Bear Brook at a sharp skew involving substantial impacts to both the wetlands and the 100-year flood plain of the Brook.

The westernmost leg of Relocated Route 571 would be located very close and parallel to the D&R Canal Park. Proximity impacts to the Park, including loss of existing wooded buffer, traffic noise, visibility, and safety concerns with regard to pedestrian and motorist activity in the vicinity of the existing park parking area, would be unavoidable. In light of there being other alternatives meeting project need and objectives with less impact to the environment and the Park, Alternative E-1 was rejected from further consideration.

### **3.11 Alternative F**

Alternative F (Figure 3-8) would consist of a single grade-separated interchange with Relocated Route 571 over Route U.S. 1. The interchange would be located midway between the existing intersections of Route U.S. 1/Fisher Place and Route U.S. 1/Harrison Street.

Relocated Route 571 would begin west of Route U.S. 1 on Washington Road (at a point that is approximately 1,100 feet east of the D&R Canal Park) and continue easterly through the lands of Princeton University. A grade-separated interchange would carry relocated Route 571 over Route U.S. 1. From the interchange, Relocated Route 571 would parallel the Millstone River, passing through the lands of the David Sarnoff Research Center to existing Route 571 at a point west of the bridge over Amtrak.

The interchange would allow for all movements of traffic, except from southbound Route U.S. 1 to westbound relocated Route 571. This movement would be furnished at existing Harrison Street. Construction of the northwest quadrant of the interchange would require acquisition of PSE&G property and relocation of the substation, as well as acquisition of portions of Princeton University and Sarnoff properties.

A two-way connector road is proposed from Relocated Route 571 to the Harrison Street bridge over the D&R Canal Park. Harrison Street would be realigned in this area to meet the proposed connector road at a right angle.

Washington Road would be abandoned from Route U.S. 1 westward to where relocated Route 571 would meet existing Washington Road. East of Route U.S. 1, Washington Road would remain and its intersection with Route U.S. 1 would be modified to a "T" intersection, providing right turns only. The jughandles at southbound Route U.S. 1/Fisher Place and northbound Route U.S. 1/Harrison Street would be eliminated. Each intersection would be modified to a "T"-intersection. The existing David Sarnoff Research Center entrance on Route U.S. 1 would be moved to provide access to/from Relocated Route 571.

Traffic signals under this alternative would be provide at the following three intersections:

- 1) Relocated Route 571 and the relocated David Sarnoff Research Center entrance;
- 2) Relocated Route 571 and the Connector Road; and
- 3) The Connector Road and Harrison Street.

Alternative F would not meet project Objectives 3, 4, and 5. As with Alternative C, the interchange would require acquisition of extensive property frontage along Route U.S. 1 owned by Princeton University and the David Sarnoff Research Center. This would be highly unfavorable to the long-term improvement plans of both stakeholders. In addition, Alternative F would bisect the University property in a manner incompatible with their master plan goals. Moreover, the configuration would increase the potential that the subdivided properties could ultimately be developed by others in what would amount to ongoing development sprawl.

The interchange would require acquisition and relocation of the PSE&G substation. Compensation to PSE&G for relocation of this equipment was determined to be an exorbitant expense in light of the total project cost.

Relocated Route 571 would encroach on on wetlands and the 100-year flood plain of the Millstone River at the curve in the alignment just north of the David Sarnoff Research Center. Near its easterly terminus point, Relocated Route 571 crosses Little Bear Brook at a sharp skew involving substantial impacts to both the wetlands and the 100-year flood plain of the Brook. In light of there being other alternatives meeting project need and objectives with less impact to the environment, the University, and Sarnoff, Alternative F was rejected from further consideration.

### **3.12 Depress Route U.S. 1**

Community input suggested the possibility that depressing Route U.S. 1 and allowing the existing east-west corridors to travel over Route U.S. 1 might be considered to address project need. This idea would extend the depressed section of Route U.S. 1 northbound from the Dinky bridge through the Washington Road interchange. Route U.S. 1 would emerge at grade at the Harrison Street intersection just south of the Millstone River bridge.

This alternative would eliminate the traffic signals at Washington Road and Fisher Place. Because the depressed section would have to come up to grade in order to cross the Millstone River, the adjacent Route U.S. 1/Harrison Street intersection would remain at grade. Retaining this intersection would necessitate a traffic signal. Thus, this alternative would not fully address the project purpose and need, to remove all traffic signals in the Penns Neck corridor.

Depressing Route U.S. 1 would enable Washington Road/Route 571 to pass over Route U.S. 1 along its existing alignment. However, existing land uses, particularly on the east side of Route U.S. 1, would limit construction of right-turn movement ramps between depressed Route U.S. 1 and Washington Road. Right-of-way acquisition involving residential and business properties, as well as a portion of the Penns Neck Baptist Church cemetery, would be unavoidable to construct these ramps, even with the use of retaining walls. Left turn movements at this intersection would be prohibited due to lack of space and geometrical limitations. The proximity of the Dinky bridge would preclude construction of access ramps to NJDOT-s design standards.

Addressing both the need to remove all traffic signals in the Route U.S. 1 Penns Neck corridor and the need to accommodate turning movements to and from Route U.S. 1 would necessitate construction of a new interchange and bypass roadway in addition to the Washington Road overpass contemplated

under this alternative. Constructing both an interchange and an overpass is more than is warranted to satisfy the purpose and need.

Depressing Route U.S. 1 through Penns Neck would necessitate substantial retaining wall construction on both sides of the roadway forming a canyon-like section. Soil boring work in the project area has identified shallow bedrock as occurring at intervals. Thus, excavation work may require blasting to achieve the desired section. The proximity of existing structures to the roadway edge, in particular the historic Penns Neck Baptist Church, raise serious concerns regarding protecting the structural integrity of these buildings during construction. Simple excavation so close to these structures would render these structures vulnerable to future settlement and shifting consequent to the loosening of the soil and traffic vibration. Placing proximate residences and historic structures at this risk is an unacceptable environmental impact.

Both sides of depressed Route U.S. 1, as well as the Washington Road and Fisher Place crossings, would have to be fitted with safety fencing and/or barrier walls to separate residents and pedestrians from Route U.S. 1. Such elements would have to be approximately eight feet in height, thereby obstructing views across Route U.S. 1 from the community. This visual impact would likely have a greater feeling of physical separation than existing Route U.S. 1 because, excepting peak traffic periods, breaks in traffic flow currently allow views across Route U.S. 1.

Depressing Route U.S. 1 does not meet the project purpose and need, or project Objectives 1, 3, and 4. In light of there being other alternatives that meet the project purpose, need and objectives at a lesser scale while avoiding the detrimental community impacts that would result from depressing Route U.S. 1, this Alternative was rejected from further consideration.

### **3.13 Route U.S. 1 Frontage Road**

This alternative is a modification of Alternative D-1.1C in that west of Route U.S. 1, Relocated Route 571 would bend sharply to the south and follow a curving route roughly parallel to Route U.S. 1 at a variable distance of 50 to 300 feet west of Route U.S. 1 (Figure 3-9). This alternative was developed in response to community and D&R Canal Commission concerns that the alignment of Alternative D-1.1C was positioned too close to the Canal Park. The location and geometry of the grade-separated interchange at Route U.S. 1, as well as the alignment of Relocated Route 571 east of Route U.S. 1, would be identical to Alternative D-1.1C.

The frontage road alternative would not meet project Objectives 3 and 4. The alignment is inconsistent with Princeton University's Master Plan for redevelopment of their lands, as it would create a less than optimal subdivision of University land. The frontage road alignment would unnecessarily restrict their use of the property in the future. This alignment would encourage the potential for ultimate development of the frontage property by others in what could amount to ongoing development sprawl. In light of there being other alternatives that meet the project need and objectives while avoiding bisecting the University property, this Alternative was rejected from further consideration.

### **3.14 Alexander Road Connection**

NJDOT's alternatives development considered the possibility of a southerly alignment that would connect Route 571 to Alexander Road. This alternative was evaluated prior to Princeton voicing their concern that existing traffic distribution patterns into and out of the Borough be maintained on Alexander Road, Washington Road, and Harrison Street. At the time, determination of a probable route for such a connection was unsuccessful due to the presence of substantial existing development between Washington Road and Alexander Road. North of the Dinky, existing residential development, the broad floodplain of Little Bear Brook, and Princeton Junction Station block a feasible alignment for

Relocated Route 571. South of the Dinky Railroad, existing office-research development and the Little Bear Brook floodplain preclude identification of a feasible alignment. Crossing the Dinky railroad would be problematic considering the elevated nature of the rail line relative to the surrounding terrain.

Consideration was also given to upgrading existing roadways connecting Route 571 with Alexander Road east of the Amtrak right-of-way. However, construction of such roadway improvements in the context of the existing residential development along these roadways would shift impacts from one community to another. This concept was considered by the NJDOT to be unacceptable.

The new Alexander Road interchange was constructed to handle existing and projected traffic within the corridor based on known development patterns in the local and regional area. These patterns did not include diversion of Washington Road/Route 571 traffic to Alexander Road. As stated in Section 3.9 above, Washington Road/Route 571 currently handles approximately 30-34% of the total traffic distribution to Princeton among Alexander Road, Washington Road, and Harrison Street. Alexander Road currently handles approximately 42-53% of the current traffic into Princeton. Diversion of Route 571 traffic to Alexander Road would result in Alexander Road handling a majority of the current traffic. Such substantial traffic growth would cause an over capacity situation at the interchange, requiring modifications to accommodate the additional traffic.

This type of growth would also require substantial improvement of a large portion of Alexander Road itself and its intersections in Princeton, as these traffic volumes represent vehicles entering and exiting Princeton. As stated in Section 3.9 above, a change in the existing distribution patterns in and out of Princeton would be unsatisfactory to the Borough. Moreover, it would be contrary to the project need and objectives.

Finally, an Alexander Road connection would not provide traffic relief to the portion of Harrison Street between Route U.S. 1 and the canal. In sum, this Alternative does not meet project Objectives 1, 3, 4, and 5. In light of there being other alternatives that meet the project need and objectives, the Alexander Road connection was rejected from further consideration.

### **3.15 No-Build Alternative**

Improvements in the No-Build alternative would be limited to replacement of the Route U.S. 1 bridge over the Millstone River. The deficient structural condition of the bridge would require replacement independent of the other improvements contemplated. In a No-Build context, the bridge would be replaced in kind with no change in cross section dimensions or lane configuration. The design year No-Build roadway network would be the same configuration as the existing network, thus meeting project Objective 2.

The No-Build alternative would not meet project Objective 1. Goals of improving operating conditions along Route U.S. 1 by eliminating existing traffic signals and relieving congestion from the residential neighborhoods adjacent to Washington Road (County Route 571) would not be achieved. The traffic analysis for the project includes in both the No-Build and Build scenarios traffic generation expected from other roadway and land development projects in the area (Harris, 1993a and 1993b). Examination of the effect of this development on Route U.S. 1 and east-west corridors in the project area determined that increasing traffic demand would exacerbate already impaired roadway operating and safety conditions.

The No-Build alternative would not meet project Objective 3 as it would not be responsive to state, county, municipal, and major stakeholder master planning for an east-west link in the project area. The No-Build alternative would not address the state and county goals of improving linkage between Route U.S. 1 and Route 571, as well as reducing land access to arterial highways. The No-Build alternative would be contrary to the municipal and University master plans for relocation of Route 571 in the project area.

With respect to project Objectives 4 or 5, the No-Build alternative would have no long-term impact on human or environmental resources. Thus, the No-Build alternative would meet Objectives 4 and 5.

As the No-Build alternative would meet only project Objectives 2, 4, and 5, this alternative was determined to not meet the overall project purpose and need. In light of there being other alternatives that would meet all project needs and objectives, the No-Build alternative was rejected from further consideration.