Early Implementation of Regional Rail Service between Carrollton and Addison White Paper

This discussion highlights key issues and costs associated with the early implementation of passenger service on the Cotton Belt Corridor, in particular the five mile segment between downtown Carrollton Station and the Addison Transit Center reflected in Figure 1. In addition, a bus rapid transit (BRT) alternative operating on the Belt Line Road corridor has been assessed and detailed in this report.

1.0 Background

The Cotton Belt Preliminary Engineering/Environmental Assessment (PE/EA) focused on the full double tracking of the Cotton Belt Corridor from DFW Airport to the vicinity of Shiloh Road in east Plano. The Cotton Belt PE/EA also incorporates the assumption that a new regional rail service using a vehicle similar to the Denton County Transportation Authority (DCTA) A-Train, would be implemented in the corridor. DART is contemplating the introduction of service on the segment of the Cotton Belt Corridor between Downtown Carrollton and Addison. This report includes an assessment of lower cost options that would provide a reliable level of service between Downtown Carrollton and Addison to establish a minimal operating segment of the Cotton Belt Corridor. A minimal operating segment, or MOS, is a term defined by the Federal Transit Administration (FTA) as smaller section of a larger rail alternative that has its own independent utility.

The rail segment between downtown Carrollton and Addison is currently a single track line designated Class 1 and used by Dallas Garland Northeastern Railroad (DGN0) for limited freight service. A primary focus of this report is to identify improvements and costs associated with upgrading the track to Class 3 to accommodate passenger service. The early implementation passenger service would operate on a single track alignment with passing tracks to allow for greater efficiency and flexibility.

Figure 1: Cotton Belt Corridor – DFW Airport to Plano/Richardson
2.0 Overview of Scenarios
For the purpose of this report, three alternatives have been identified, two regional rail options and a BRT line along Belt Line Road. The following sections describe the features of each alternative, as well as provide cost estimates to implement each of the alternatives.

2.1 Regional Rail
The two rail options (C1 and C2) will operate along the five mile segment between downtown Carrollton and Addison. Each option will use the same operating plan and vehicle type. Rail Diesel Cars (RDC or Budd Cars) from the Trinity Railway Express (TRE) rail service will be used until 2017. After this time, Stadler vehicles will be implemented. The alignment will be single-track with passing tracks, and double tracked station areas. The passing tracks will be located at three locations: 1) between Surveyor Boulevard and Midway Road, 2) between County Club Drive and John Connally Drive, and 3) just west of Kelly Boulevard. The primary difference between the two options is the location of the station at downtown Carrollton and the capital investment to realign tracks around Mercer Yard and the regional rail station.

Both options will require rehabilitation to the existing track section up to Class 3 standards. The existing track assessment report for the Cotton Belt Corridor, as described in Section 3.0, states that the existing track condition does not meet Class 3/Commuter rail operation requirement. This includes current use of 85 pound rail instead of the require minimum of 132 pounds, as well as smaller tie spacing. Table 2.1 reflects the maximum operating speed for each track class.

<table>
<thead>
<tr>
<th>Track Class</th>
<th>Max Operating Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freight</td>
</tr>
<tr>
<td>Excepted Track</td>
<td>10</td>
</tr>
<tr>
<td>Class 1 Track</td>
<td>10</td>
</tr>
<tr>
<td>Class 2 Track</td>
<td>25</td>
</tr>
<tr>
<td>Class 3 Track</td>
<td>40</td>
</tr>
<tr>
<td>Class 4 Track</td>
<td>60</td>
</tr>
<tr>
<td>Class 5 Track</td>
<td>80</td>
</tr>
<tr>
<td>Class 6 Track</td>
<td>110</td>
</tr>
</tbody>
</table>

Option C1
Option C1 includes a temporary at-grade station in downtown Carrollton that would allow for the continuation of the existing freight traffic on the Burlington Northern Santa Fe Railroad (BNSF) alignment. The main advantage to this option is the cost savings of not having to realign track around Mercer Yard and the Downtown Carrollton Station. The primary disadvantage is the temporary station would have to shut down if the Cotton Belt Corridor is fully implemented in the future as the existing BNSF tracks would need to be realigned to accommodate the through traffic and the increased regional rail service. This option would also require additional costs ($4.63 million) due to construction of the station that would be used in Option C2.

Option C1 could be implemented as a first phase to the project. This would allow for regional rail service to operate on the corridor without the large investment to realign the BNSF tracks. If additional funding becomes available for station improvements allowing for the transition to Option C2 or if passenger service on the Cotton Belt Corridor is extended in the future, the total throw-away cost of constructing a platform as part of Option C1 would be $3.8 million (see Table 9.1).

Option C2
Option C2 involves a permanent station in downtown Carrollton which will tie into the existing DART Green Line station. The main advantage to this option is the station will not be impacted if the Cotton Belt Corridor Regional Rail Service is fully implemented in the future. The key disadvantage is the high
capital costs associated with the realignment of the tracks around Mercer Yard and the Downtown Carrollton Station.

An overview of the options is displayed in Table 8.1. A more detailed description of the capital and operating costs is provided in the following sections.

2.2 Bus Rapid Transit (BRT)

BRT systems have various levels of treatments and capital investment to improve overall travel times. BRT often includes greater investment in applications such as dedicated busways (right of way), off-board fare collection, and level boarding than is typically found in bus operations. These are treatments to a bus alignment that allow it to operate more like a rail facility. Lower level BRT options often focus on bus branding, consolidated stations, and transit signal priority that improve travel time for passengers. Transit Signal Priority (TSP) is a system that modifies normal signal operations to accommodate transit vehicles. The signal will stay “green” slightly longer and “red” for shorter amount of time. Signal preemption is different than TSP because it interrupts the normal signal cycle to accommodate a special event, such as an approaching train or emergency vehicle.

A lower level BRT option or Rapid Bus system has been incorporated in the assessment of the MOS. The BRT line would be designed to operate in mixed-traffic along the 5.6 miles Belt Line Road segment. Other features of the service include signal priority, consolidated bus stops, branding on buses and at stations, and customized premium vehicles. Rapid Bus implementation at other transit properties has shown an improvement in travel time of a local fixed route bus by 20 to 25%. For the downtown Carrollton to Addison corridor that would reduce the current trip on the Route 400 from 20 minutes to 15 minutes. The perceived travel time reduction for riders is even greater as the buses will only make one intermediate stop between the ends of lines and the buses will have the option of traveling in the left lane to avoid driveways and right turning traffic. Therefore, the actual travel time could possibly be as low as 10 minutes each way resulting in a total round trip time of 30 minutes. As shown in Figure 2, the BRT alignment would operate along Belt Line Road with one intermediate stop at Josey Lane.

**Figure 2: Addison to Carrollton Alignment**
3.0 Track Assessment of Addison to Carrollton Operating Segment
A track assessment of the downtown Carrollton to Addison rail segment of the Cotton Belt Corridor was completed in February 2013. The purpose of the assessment was to determine the existing condition of the track and to make recommendations to improve the track to Class 3. Track samples were typically taken at approximately one mile intervals. Sampling consisted of inspection of 100 tie length of track at each location.

This section of track mainly consists of 85 and 90 pound rail with manufacturing dates ranging from 1907 to 1928. Figures 3 and 4 illustrate the age and condition of the rail. The rail within this segment of the corridor is considered scrap and unsuitable for regional rail service. It is recommended that Class 3 railroads use 132 pound or 136 pound rail.

Figure 3: Track with 85 pound rail in poor condition at DGNO MP599.1

Figure 4: Turnouts with 85 pound rail in very poor condition at DGNO MP 600.28
Of the track ties sampled 34 percent were considered to be deficient, approximately 20 percent considered to be relay and balance questionable. Due to the poor surface and lifted spikes, it was difficult to determine the extent of ties that had spike kill. Additionally, the tie spacing is unlikely to meet passenger train standards.

Signaling and safety equipment will require replacement in order to accommodate the frequency of passenger service. A summary of the existing conditions and improvement recommendations is presented in Table 3.1.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Materials and general condition of the track are not suitable for regional rail service. Most of the section consists of 85-pound rail and turnouts and substandard Other Track Materials.</td>
<td>Remove existing track and salvage useable materials. Install new track throughout the section with 132- to 136-pound track.</td>
</tr>
<tr>
<td>2</td>
<td>A significant percentage of ties are not suitable (34% defective and 20% questionable).</td>
<td>Replace all defective and questionable ties.</td>
</tr>
<tr>
<td>3</td>
<td>19 turnouts are considered scrap and unsuitable for passenger service due to substandard rail weight and age.</td>
<td>Replace all 19 turnouts.</td>
</tr>
<tr>
<td>4</td>
<td>Many sections have inadequate crib and shoulder ballast.</td>
<td>Improve the surface to a level that is suitable for passenger service.</td>
</tr>
<tr>
<td>5</td>
<td>Existing FLBGs are several years old. The at-grade crossing at Country Club Driveway would need FLBG.</td>
<td>Upgrade FLBGs to allow for passenger service. Install FLBG at Country Club crossing.</td>
</tr>
<tr>
<td>6</td>
<td>Rubber panels have varying degrees of loose panels that would need to be reset.</td>
<td>Replace all rubber and asphalt panels and wood planks with concrete panels.</td>
</tr>
</tbody>
</table>

Source: URS, 2013

4.0 Capital Costs

4.1 Regional Rail
The following section provides an overview of the capital costs for both Options C1 and C2 based on the Track Assessment recommendations.

Track Work
The cost to upgrade the rail to Class 3 level as specified in the track assessment is $118.14 million which includes the installation of new 132 pound track, the replacement of at least 54% of the ties, replacement of 19 turnouts, and upgrading the cribs and shoulder ballast to level the track surface.

Option C2 would include a total realignment of the BNSF track to accommodate a new regional rail station with direct access to the Downtown Carrollton Green Line Station. The cost to realign BNSF track
is $9.4 million. The cost estimates are only for basic civil engineering and systems. It does not include any contingency, right-of-way, vehicle, professional services, environmental allowance, or finance costs.

Crossings
Each of the eight at-grade crossings at intersections along the alignment need to be upgraded with new flashing lights, bells, and gates (FLBGs) and civil engineering work. Individual intersection upgrades cost roughly $445,000. Therefore, the cost to upgrade all eight crossings is $3.56 million.

Stations
For Option 1, the cost to build the platforms and basic passenger amenities and wheelchair ramps at the existing Downtown Carrollton Station and Addison Transit Center $7.78 million (or $3.89 million for each station). It should also be noted that if the Cotton Belt Corridor was to be fully implemented, the temporary platform would be demolished and a new station would have to be built. This new station would increase the capital costs of this option by the same cost as the station in Option 2, $4.63 million. These costs are estimates from the Cotton Belt PE/EA report and escalated for 2016 dollars.

For Option 2, the cost to build both Downtown Carrollton Stations and Addison is $8.52 million. Addison Transit Center costs $3.89 million, and Downtown Carrollton Station has a higher cost of $4.63 million for additional parking and pedestrian access treatments. These costs are estimates from the Cotton Belt PE/EA report and inflated for 2016 dollars. A more detailed description of the stations is presented in Section 5.0.

Sidings
Three sidings are proposed along the five mile segment to allow for greater flexibility operating two-way service on a single track. A siding or passing track would be located every one to two miles of the alignment. Each siding will be at least 1,650 linear feet in length for a total of 0.94 mile of siding track. The total cost for sidings is $22.14 million.

4.2 BRT
The implementation of the BRT option would include capital investment in a TSP system at intersections along Belt Line Road and new premium vehicles.

Transit Signal Priority (TSP)
TSP detection systems range from $3,000 to $47,000 per intersection, and $60 to $3,000 per vehicle, depending on the detection system used and would be implemented along the Belt Line Corridor.¹ There are 23 intersections along the proposed BRT alignment. The total number of intersections equates to a TSP cost of $67,500 to $1.1 million. This excludes the cost to vehicles because it is assumed that the vehicles would already be equipped with the appropriate TSP technology.

Vehicle Fleet
The proposed BRT line between downtown Carrollton and Addison could operate at 20 minute peak headways with two buses in service. A third bus would be needed to maintain the appropriate spare ratio. The cost for a premium 60-foot articulated BRT-style branded bus ranges from $750,000 to $1.1 million per vehicle. Total costs for all three vehicles ranges from $2.25 million to $3.30 million.

¹ TCRP Synthesis Report 83. 2010. The costs have been inflated to reflect 2016 dollars.
Stations
Downtown Carrollton Station and Addison Transit Center currently serve DART bus route 400 and would need a few modifications in order to implement BRT service to these two stations. A new station would be created at Josey Lane. The costs to enhance this station would be from $500,000 to $1 million. These costs could be used for enhanced ticketing systems, constructing attractive shelters, implementing level boarding systems, and branding the area for BRT.

Maintenance Yard
The closest Bus Operations Facility is the Northwest Operations Facility at Denton Drive and Webb Chapel. The facility will likely need to be upgraded in order to accommodate the specialized BRT vehicles. Upgrade costs are estimated to be approximately $1 million.

5.0 Stations
5.1 Regional Rail
Rail service in the corridor would require new stations at the Downtown Carrollton Station and the Addison Transit Center. Prior to 2017, the stations would include wheelchair ramps to accommodate the high floors of the Budd vehicles. After 2017 the ramps would be removed once the low floor (level boarding) Stadler vehicles begin operations.

Addison
The concept for the Addison Station platform was developed during the Cotton Belt Corridor PE/EA effort and is reflected in Figure 5. The platform could be built to the same configuration for continued service with the full implemented Cotton Belt Corridor Regional Rail Project (Cotton Belt Project). The current parking area at the Addison Transit Center could provide the necessary station parking. The Town of Addison is also considering a parking structure as a part of the development associated with the Cotton Belt Project that could be incorporated into the early service plan. Additionally, it is anticipated that this station would have significant ridership arriving by walk and bus.

Figure 5: Cotton Belt Plan for Addison Station
**Downtown Carrollton**

*Figure 6* illustrates existing conditions in downtown Carrollton with a proposed platform location shown. Regional planning efforts envision downtown Carrollton as being a major hub with a shared platform/station area used by the Cotton Belt Regional Rail moving east and west, and a potential regional rail service from Frisco to Irving along the BNSF Corridor running north to south.

**C1 Option**

As part of the MOS, a temporary terminus at the Downtown Carrollton Station could potentially use the existing Cotton Belt Corridor mainline track with a new platform. This platform could accommodate up to a three car consist immediately north of the existing Green Line Park-and-Ride lot with minimum impact to the BNSF track. It is suggested that a double-track platform be built to allow for operational flexibility including layovers and maintaining access to the freight storage facility (Mercer Yard) to the west.

The placement of the temporary platform is a key aspect of the interim service because it must stop short of the BNSF crossing immediately west of Interstate Highway (IH) 35 (shown in the inset photograph of *Figure 6*). The temporary terminus platform at this location would likely have removed from service during construction of the Cotton Belt Project given the major track realignments and bridge work needed. It does not appear that any passenger service conflicts arise as a result of freight movements in and out of the Mercer Yard given the configuration of the MOS service.

**C2 Option**

The station for Option C2, as shown in *Figure 7*, requires some significant track relocations surrounding the Downtown Carrollton Station area and the elimination of this at-grade rail crossing. The Station would also incorporate parking. BNSF freight service in this area is relatively heavy and both freight and passenger service benefit from the reworking of the track in this area. The current Cotton Belt PE/EA plans for downtown Carrollton require significant realignment of the existing Cotton Belt and BNSF tracks to best accommodate future rail services and improvements to Belt Line Road and IH 35E Freeway. This option would be able to maintain full functionality when the full Cotton Belt Project is implemented.
Figure 6: Carrollton Station Option C1

Figure 7: Carrollton Station Option C2
5.2 BRT
Downtown Carrollton Station and Addison Transit Center currently serve DART bus Route 400 and would only need a few minor modifications in order to implement BRT service to these two stations. Addison Transit Center also serves ten local routes, two rail feeder and transit center routes, and one express route.

A new station would be created at Josey Lane. This station location was chosen primarily because of the connection to the north/south Rail Feeder and Transit Center Route 531. The costs to enhance this station ranges from $500,000 to $1 million.

6.0 Vehicle

6.1 Regional Rail
The initial service would use a diesel RDC (Budd Car) vehicle from the existing TRE fleet as depicted in Figure 8. Some of these cars are currently out of service and may need some light maintenance prior to implementation of the service. The Budd cars have a 92 seat capacity. In 2017, a new regional rail vehicle similar to the Stadler GTW diesel-electric car used by the DCTA A-Train would ultimately be implemented in the corridor. The cost is approximately $10 million per vehicle. The vehicle has a capacity of 104 seats and standing room for 96 people. Figure 9 shows an example of the Stadler car.

![Figure 8: Budd Car](image8)
![Figure 9: Stadler GTW Car](image9)

6.2 BRT
The BRT option would require the purchase of three new vehicles. Two vehicles would provide daily operations and one vehicle would be kept as a spare. It is recommended to purchase vehicles that have been stylized and fitted for BRT service. This will allow the vehicles to be ready for TSP and match the ramp height at station areas. The 60-foot bus reflected in Figure 10 is articulated and will accommodate approximately 63 people. The vehicle cost ranges from $750,000 to $1 million.
7.0 Vehicle Maintenance

7.1 Regional Rail
The Downtown Carrollton to Addison MOS presents a challenge related to where the regional rail vehicles will be maintained. Maintenance could be separated into both light and heavy maintenance with those services being provided at separate locations. Heavy maintenance could be provided at existing facilities in Irving on the TRE or in Lewisville at the DCTA maintenance facility. Both of these options will add deadhead mileage and hours into the system which will increase O&M costs. It is possible that the cars could be routinely stored at the Mercer Yard for light maintenance, daily cleaning and fueling, with heavier maintenance occurring at TRE or DCTA. Coordination with DGNO and the BNSF would be required under either circumstance.

Mercer Yard is utilized exclusively for the sorting of inbound and outbound revenue freight traffic. The facility does not accommodate short or long term railcar storage. Most switching activity occurs at the east end of the yard since all tracks funnel into a lead that enters the Cotton Belt Corridor at this location. Some switching does occur from the west end for the limited number of tracks that are not stub-ended at the west side of the yard.

While the industrial areas between downtown Carrollton and Addison contain numerous spur tracks that could be used for short or long-term railcar storage during business downturns, this type of business is generally not pursued. If requested, each possible storage opportunity could be reviewed on a case-by-case basis. DGNO indicated that the Dallas-Fort Worth region is not ideal for railcar storage and this type of business is typically avoided.

7.2 BRT
The closest Bus Operations Facility is the Northwest Operations Facility at Denton Drive and Webb Chapel. The facility will likely need to be upgraded in order to accommodate the specialized BRT vehicles. Upgrade costs are estimated to be approximately $1 million.

8.0 Preliminary Operations Plan

8.1 Regional Rail
A brief operational analysis was performed as part of the Cotton Belt PE/EA to determine how rail service between downtown Carrollton and Addison would operate. The analysis found that if the service was structured as a basic shuttle service, twenty minute frequency could be achieved with a single track.
Additionally, the corridor would need significant upgrades to the existing track and strategically placed passing tracks as reflected in Figure 11. Passing tracks will allow bi-directional regional rail service and the capacity to accommodate freight service (operated by the DGNO) along the five mile segment. Two passenger trains would be required for peak service because of the 10 minute layover at each terminus is needed to inspect the trains. The Federal Railroad Administration (FRA) requires that trains be inspected any time there is a directional change (reversing). Twenty minute frequencies are the highest level of service achievable without adding trains and double tracking. A single train could achieve 30-minute service, which may provide better connections to the Green Line service than the 20 minute frequency.

Based on the following frequencies and span of service, operating and maintenance (O&M) costs are estimated at $6.56 million. Service can be scaled according to demand and budget.

- **Weekdays** – 20-minutes peak/60-minutes midday/60 minutes evening (5:30 a.m. to 12:00 midnight span of service)
- **Saturday** – 60-minutes all-day (5:30 am. to 12:00 midnight span of service)
- **Sunday** – 60-minutes all-day (6:00 a.m. to 10:00 p.m. span of service)

### 8.2 BRT

As mentioned briefly in the Overview of Scenarios section, the BRT alignment would operate along Belt Line Road from Addison Transit Center to the Downtown Carrollton Station. While the vehicles would not operate in an exclusive lane, the rest of the operation would resemble traditional BRT with Traffic Signal Prioritization (TSP) and BRT-styled vehicles and stations. Between Addison Transit Center and Downtown Carrollton Station, there would be one stop at Josey Lane. The one-way-trip time is estimated to be 15 minutes. Including a 5 minute layover at each end, the estimated total round-trip time is 40 minutes. Operating at 20 minute headways during peak periods, this alternative would require two vehicles. One vehicle would maintain service during off-peak periods. In addition, a third vehicle would be needed to maintain the spare ratio.

Based on the following frequencies and span of service operating and maintenance (O&M) costs are estimated at $1.56 million for BRT service between downtown Carrollton and Addison. Service can be scaled according to demand and budget.

- **Weekdays** – 20-minutes peak/60-minutes midday/60 minutes evening (5:30 a.m. to 12:00 midnight span of service)
- **Saturday** – 60-minutes all-day (5:30 am. to 12:00 midnight span of service)
Sunday – 60-minutes all-day (6:00 a.m. to 10:00 p.m. span of service)

9.0 Summary

This section provides a summary of costs described in this analysis, shown in Table 9.1, as well as highlighting the key issues for each option.

<table>
<thead>
<tr>
<th>Table 9.1 – Summary of Costs and Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bus Rapid Transit (BRT)</strong></td>
</tr>
<tr>
<td><strong>Capital Costs (2016$)</strong></td>
</tr>
<tr>
<td>Track work</td>
</tr>
<tr>
<td>Siding tracks (4,963 ft)</td>
</tr>
<tr>
<td>Crossings</td>
</tr>
<tr>
<td>BNSF Realignment</td>
</tr>
<tr>
<td>Addison Station</td>
</tr>
<tr>
<td>Carrollton Station</td>
</tr>
<tr>
<td>Josey Lane Station</td>
</tr>
<tr>
<td>Maintenance Yard Upgrades</td>
</tr>
<tr>
<td>Vehicles (3 total vehicles)</td>
</tr>
<tr>
<td>Transit Signal Prioritization (TSP)</td>
</tr>
<tr>
<td>Contingency (30%)</td>
</tr>
<tr>
<td><strong>Total Capital Cost</strong></td>
</tr>
</tbody>
</table>

| **Operating Characteristics and Costs (2016$)** | | |
| Route Distance | 5.65 miles | 5.0 miles | 5.0 miles |
| Headways | 20 min peak/60 min off peak | 20 min peak/60 min off peak | 20 min peak/60 min off peak |
| Schedule | M-F: 5:30am – 12:00am Sat: 5:30am – 12:00am Sun: 6:00am – 10:00pm | M-F: 5:30am – 12:00am Sat: 5:30am – 12:00am Sun: 6:00am – 10:00pm | M-F: 5:30am – 12:00am Sat: 5:30am – 12:00am Sun: 6:00am – 10:00pm |
| Round-trip Run Time | 40 minutes | 30 minutes | 30 minutes |
| **Total Operating Cost** | $1.56 Million/year | $6.56 Million/year | $6.56 Million/year |

Source: Bowman Engineering

Commuter Rail

- The Cotton Belt Preliminary Engineering/Environmental Assessment (PE/EA) currently under development by DART has focused on the full double tracking of the corridor from DFW Airport to the vicinity of Shiloh Road in east Plano.
- Initial service under the MOS would use a RDC (Budd Car) vehicle from the existing fleet.
- A new regional regional rail vehicle similar to the DCTA A-Train, would ultimately be implemented in the corridor.
- There will be infrastructure investments for Option C1, like the temporary platform in downtown Carrollton that will no longer be viable when the Cotton Belt Project is fully built out.
- A new station at downtown Carrollton will need to be constructed if Option C1 is chosen.
• O&M costs for the regional rail option are estimated at $6.56 million for service between downtown Carrollton and Addison.

**Bus-Rapid Transit**

• Service would operate along Belt Line Road, similar to the existing Route 400.
• Service would operate in mixed-traffic. There is no exclusive lane.
• New BRT stylized vehicles and TSP implementation would create a service that mimics modern BRT.
• One station will be added at Josey Lane at a cost of approximately $1 million.
• The highest capital cost would come from purchasing the three new vehicles.