Technical Memorandum

To:	Durham County
From:	Brian Hughes, STV
Date:	9/20/2022
CC:	
2022 Grant Application:	**RCE Durham REPAIR Grant**
Subject:	Benefits Analysis

Potential Benefits under Build Scenarios

The Benefits Analysis was conducted as part of the FRA RCE **Durham Rail-crossing Engagement, Planning, And Innovative Revitalization (Durham REPAIR)** grant application to list the potential benefits under future potential closures and/or grade separations of three at-grade crossings along the North Carolina Railroad (NCRR) corridor. The at-grade crossings in question include crossings 630472K (Plum Street), 630471D (Driver Street) and 735236Y (Ellis Road) in East Durham, North Carolina. Since the three crossings are adjacent to each other and are the connecting passages to both sides of the railroad, they cannot be studied independently. Upon data collection and analysis, this list of benefits may change.

For the analysis, there are three potential Build scenarios, which are being evaluated with varying benefits due to their modifications to the existing at-grade crossings, also known as the No Build scenario. These Build scenarios are contingent upon a traffic model which shows how traffic reroutes once each scenario is defined. The concept of an induced vehicle/bike-ped traffic is introduced in this technical memorandum to account for the potential of modeled traffic from a network of grade crossings utilizing these three grade crossings differently than they currently do in the no-build scenario.

- **No Build – at-grade crossings remain as-is:** The current at-grade crossings at Plum Street, Driver Street, and Ellis Road will remain in place, allowing vehicles to cross the rail tracks. Existing operations and maintenance (O&M) of the crossing signalization and gates will continue to be realized.
- **Build Option 1 – at-grade crossings are closed to traffic:** The current at-grade crossings are closed to vehicle and pedestrian traffic, remaining open for railroad use. The crossings will be fenced off to deter pedestrian trespassing, creating a safer pedestrian realm. With vehicles rerouting to get from one side of the tracks to the other, it is assumed that vehicle miles traveled (VMT) and vehicle hours traveled (VHT) will increase compared to the No Build scenario. While vehicle and rail incidents will be eliminated with the road closures, an increase in VMT will increase incident frequencies on the roadway with other vehicles.
- **Build Option 2 – grade crossings are separated:** The current at-grade crossings will become grade separated, with the railway remaining in place, and a bridge built over or a bypass built under the railway for vehicles and bike/peds. Access to the railroad will be fenced off to deter pedestrians and bikers from trespassing, creating a safer pedestrian and bike realm. With vehicles no longer interfacing with trains, the potential to have to wait for a train to clear the roadway for vehicles is eliminated which decreases delay, idling emissions and VHT. VMT of existing drivers will remain the same; however, the grade separation may induce vehicles to use these routes that were

previously avoided because of the unreliability of the grade crossing. Safety will increase for vehicle and rail as incidents will be eliminated with the grade separation.

- **Build Option 3 – optimized hybrid of at-grade closures and grade separations:** The three current at-grade crossings at Plum Street, Driver Street, and Ellis Road will be evaluated to identify a balance between eliminating the crossing and minimizing construction costs, or/and performing a grade separation and retaining vehicular/community access at that crossing. While the composition of eliminations and grade separations cannot be properly calculated without a network traffic model and cost estimate, the benefits of Option 2 will be realized but with a lesser impact; however, a portion of the cost savings of Option 1 will also be realized.

Table 1 summarizes the potential benefits under each Build scenario. Benefits highlighted in green have significant benefits; cells in yellow identified potential benefits, while red cells identified potential disbenefits.

Table 1: Potential Benefits under Each Build Scenario

<table>
<tr><th>Selection Criteria</th><th>Option 1 – At-Grade Crossings Are Closed to Traffic</th><th>Option 2 – At-Grade Crossing Are Separated</th><th>Option 3 – Optimized Hybrid of At-Grade Closures And Grade Separations</th></tr>
<tr><td rowspan="4">Safety</td><td>Crashes avoided: personal and commercial vehicles and trains – close at-grade crossings will eliminate safety incidents between vehicles and trains.</td><td>Crashes avoided: personal and commercial vehicles and trains – grade separation of the at-grade crossings will eliminate safety incidents between vehicles and trains.</td><td>Crashes avoided: personal and commercial vehicles and trains – closure and grade separation of the at-grade crossings will eliminate safety incidents between vehicles and trains.</td></tr>
<tr><td>Crashes increased due to more VMT – increase in VMT for vehicles rerouting around the closed at-grade crossings will increase safety incidents.</td><td colspan="2">Crashes increased due to more VMT– not applicable</td></tr>
<tr><td>Crashes avoided: pedestrians/bikers and trains – fencing off the grade crossing will deter pedestrians and bikers from walking across the active railroad or trespassing on the railroad, reducing the number of safety incidents.</td><td>Crashes avoided: pedestrians/bikers and trains – fencing off the grade crossing and adding a grade separated crossing will deter pedestrians and bikers from walking across the active railroad or trespassing on the railroad, reducing the number of safety incidents.</td><td>Crashes avoided: pedestrians/bikers and trains – fencing off the grade crossing will deter pedestrians and bikers from walking across the active railroad or trespassing on the railroad, reducing the number of safety incidents.</td></tr>
<tr><td colspan="3">Crashes avoided: school buses and trains – Around 70 school buses travel every day through the studied crossings.</td></tr>
</table>

Selection Criteria	Option 1 – At-Grade Crossings Are Closed to Traffic	Option 2 – At-Grade Crossing Are Separated	Option 3 – Optimized Hybrid of At-Grade Closures And Grade Separations
	Avoided potential hazardous material incidents – Chemical companies in the study area transport their products through the studied crossings increasing the likelihood of a hazardous material incidents.		
Equitable Economic Strength and Improving Core Assets	**Property premium –** with the removal of grade crossings, trains will no longer be required to blow a whistle to signal they are approaching the crossing. Properties in close proximity to these crossings will realize a one time property premium benefit for the value of their property due to this reduction in noise.		
	Trip not taken – Not applicable	**Trip not taken –** making the area safer will induce vehicles, bike/ped trips in the community	
	Job creation – improving area connectivity and safety will make the project area more attractive to business creating more jobs.		
Equity and Barriers to Opportunity	**Travel time increase –** the increase in VHT for vehicles which must detour to new routes across the railroad will decrease travel time savings, making this a disbenefit.	**Travel time savings –** the decrease in VHT for vehicles due to less signalization and waiting for trains that are blocking the roadway will generate travel time savings.	**Travel time savings –** the decrease in VHT for vehicles due to less signalization and waiting for trains that are blocking the roadway will generate travel time savings, to a lesser extent than Option 2 due to a partial rerouting of vehicles.
	Reliability due to elimination of at-grade crossing – with the elimination of the possibility of a train blocking vehicles, there is an increase in trip reliability.	**Reliability due to grade separation** – with the elimination of the possibility of a train blocking vehicles, there is an increase in trip reliability for these grade separated crossings.	**Reliability due to elimination of at-grade crossing and grade separation** – with the elimination of the possibility of a train blocking vehicles, there is an increase in trip reliability for these grade separated crossings.
	Reliability decline due to more VMT – the increase in VMT will also decrease trip reliability, making this a disbenefit.	**Reliability decline -** not applicable	
	Delay avoided at crossings – with the elimination of a train blocking vehicles, there is a decrease in vehicle delay.		
	More delay due to VMT – a higher VMT and reduction in routes which vehicles may cross the railroad will	**More delay due to VMT -** not applicable	

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	increase delay, making this a disbenefit.		
	Emergency vehicle response deterioration – the closure of the at-grade crossings will cause emergency response vehicles to reroute to cross the railroad, increasing the emergency vehicle response time, making this a disbenefit.	**Emergency vehicle response improvement –** removing the probability of a train blocking the roadway will decrease emergency vehicle response time to an incident.	**Emergency vehicle response improvement –** removing the probability of a train blocking the roadway will decrease emergency vehicle response time to an incident, to a lesser extent than Option 2.
	Unrealized health for bike/ped – the closure of the at-grade crossings with increased VMT for rerouting will make it less likely that a person will walk or use a bike in lieu of driving, making this a disbenefit.	**Health for bike/ped** – a safer grade separated crossing will induce more people to walk or ride a bike if they aren't crossing the railroad, improving the health of the community.	**Health for bike/ped** – a safer grade separated crossing will induce more people to walk or ride a bike if they aren't crossing the railroad, improving the health of the community, to a lesser extent than Option 2.
Climate Change and Sustainability	**Idling emissions avoided** – the removal of trains blocking vehicles from crossing the railroad will result in less idling emissions.		
	More emissions due to VMT – the elimination of the grade crossing will detour vehicles to other routes, increasing VMT and increasing emissions, making this a disbenefit.	**More emissions due to VMT** - not applicable	
Transformation of Our Nation's Transportation Infrastructure	**O&M costs avoided** – elimination of grade crossings will eliminate O&M of crossing gates, lights, etc.	**O&M costs avoided** – elimination of grade crossings will eliminate O&M of crossing gates, lights, etc. New bridges are assumed to have minimal maintenance.	**O&M costs avoided** – elimination of grade crossings will eliminate O&M of crossing gates, lights, etc. New bridge(s) are assumed to have minimal maintenance.
	Residual value – not applicable. No infrastructure will be installed under this build scenario.	**Residual value** – bridge/under pass infrastructure service life is equal to 100 years. Period of analysis is either 20 or 30 years. The remaining value of the capital investment for the years the bridges are still in use after the period of analysis is over is the residual value.	

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	Pavement cost avoided due to VMT – this is a disbenefit as VMT increases in this build scenario.	**Pavement cost avoided due to VMT** – not applicable	
	VOC avoided due to VMT – there will be an increase in vehicle operating costs because there is an increase in VMT, making this a disbenefit.	**VOC avoided due to VMT** – not applicable	

Initial Data Request

As previously stated, the benefits listed in this document are contingent until Build scenarios are defined and upon assumptions data can be applied to estimate (dis)benefits. The potential data required to progress this technical memorandum to a quantitative benefit-cost analysis are listed below.

1. Capital cost estimate
2. Annual O&M cost estimate for the period of analysis
3. Detailed construction schedule
4. Updated network traffic model
5. Safety Analysis
6. Ped/bike counts