C2.08 - I-35 Commuter Rail

TEXAS STATE
INGRAM SCHOOL OF ENGINEERING

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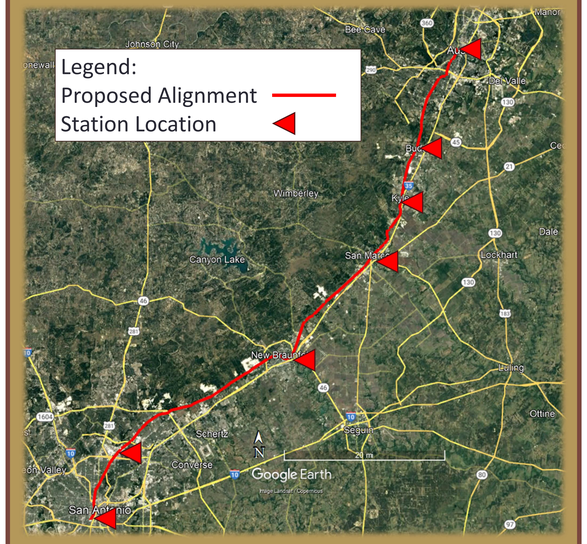
Overall Track Layout



Cost Estimate

Table 2: Commuter Rail Line-Item Estimation

Items Required	Estimate	Units	Unit Cost	Total Cost
PREPARING ROW	3273.6	STA	$5,932.44	$19,420,435.58
Traffic Control System	62	miles	$357,500.00	$22,165,000.00
Railway Turnout	0	each	$605,000.00	$-
Passenger Siding	0	each	$1,650,000.00	$-
Signals	172	each	$2,950.00	$507,400.00
Crossing barrier / gate	344	each	$11,000.00	$3,784,000.00
Railroad ties	392832	each	$133.44	$209,678,008.32
Tie Plates	785664	each	$10.75	$33,783,552.00
Track Bolts	0	each	$3.55	$-
Rail Spikes	1571328	each	$1.05	$6,568,151.04
Rail Stop	8	each	$950.00	$7,600.00
Rail	1309440	feet	$33.15	$43,407,936.00
Construction Labor	124	miles	$2,000,000.00	$248,000,000.00
Ground Level Station	7	each	$24,000,000.00	$168,000,000.00
Lime Treatment	19641600	ft²	$0.33	$6,481,728.00
Ballast Gravel	716010.5216	yard³	$50.00	$35,800,526.08
Subballast Gravel	358005.2608	yard³	$50.00	$17,900,263.04
Operation and Management	62	miles	N/A	$353,000,000.00
Detailed Design	5.25%	%		$68,865,541.50
Construction Management and Inspection	3.50%	%		$45,910,361.00
Owner Engineering / Oversight	1.25%	%		$16,396,557.50
Total				$1,638,355,060.07

Years	Const. Cost (Thsd. $)	Maint. Cost (Thsd. $)	Rehap. Cost (Thsd $)
0	$1,638,355		
5		$41,070	
10		$41,070	
15			$66,830
20		$41,070	
25		$41,070	
30			$66,830
35		$41,070	
40		$41,070	
45			$66,830
50		$41,070	
55		$41,070	
60			$66,830
65		$41,070	
70		$41,070	
75		$40,070	
Salvage	$10,000		
Total Cost	$2,356,445,060	Actual Dollars	

The overall cost is estimated at 2.5 Billion USD.

Sustainability Analysis

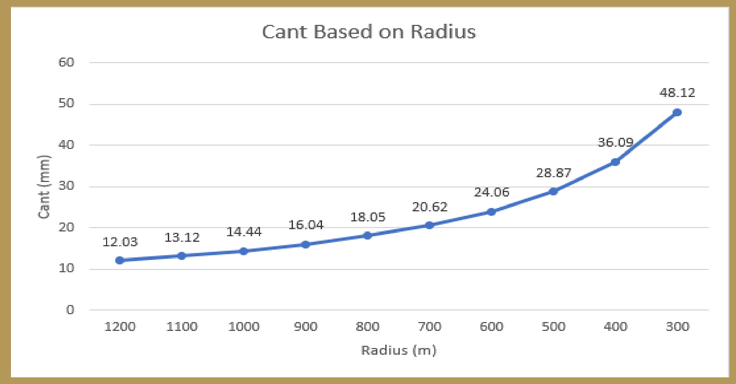
Class	Rail Score	Max Score
Quality of Life	157	200
Leadership	146	182
Resource Allocation	125	196
Natural World	108	232
Climate and Resilience	157	190
	693	1000

ENVISION

*Analysis done using ISI Envision
A score of 69.3% is Platinum Ranked

Track Alignment

M8 Electric Passenger Train
- 110 passengers per car
- 80 miles per hour traveling speed
- Electric > Diesel
- ~145,000 lbs train weight



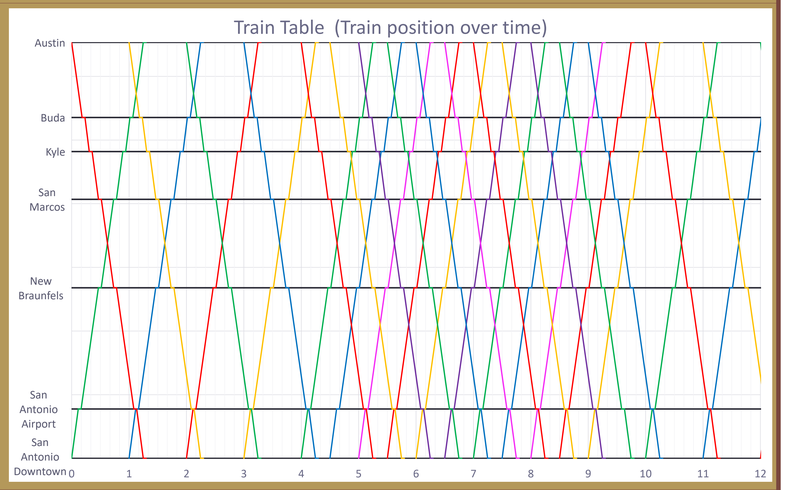
Two major radii taken into consideration.
As the radius increases, cant size increases.

$$E_{eq} = \frac{S}{3.6^2 * g} * \frac{V^2}{R}$$

Ridership and Train Schedule

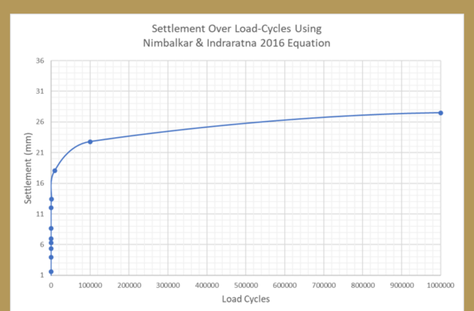
From \ To	Austin	Buda	Kyle	San Marcos	New Braunfels	San Antonio
Austin	11,625	133	310	170	95	871
Buda	53	15	24	10	3	11
Kyle	35	7	42	17	5	13
San Marcos	78	9	55	225	66	93
New Braunfels	34	3	12	45	424	169
San Antonio	597	10	37	57	354	17,507

Commuter data was taken from US Census and multiplied by a factor equal to the average number of trips made by public transit in the United States



Drainage and Foundation

	MATERIAL	DESCRIPTION	THICKNESS (FT)
Rail	Standard Steel	Steel rail to guide/support the train as it travels.	-5 ''
Sleeper	Wood	Support the track, maintain position, and transfer load downwards.	5 – 6 ''
Ballast	Crushed Gravel	Transmit and distribute an induced cyclic load downwards.	1
Geogrid	Plastic Polymers	Reinforce soils/layers and prevent fines from fouling the Ballast.	--
Sub-ballast	Well-graded crushed rock	Filter/Separation layer to transmit loads downward.	0.5
Subgrade	Existing Soil	Stiff layer capable to sustain induced stresses.	10



Drainage Considerations:
- 5% transverse gradient for run-off
- 1% longitudinal gradient for side ditches to direct water away

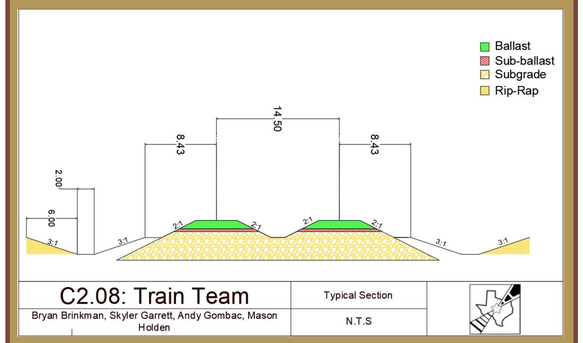
$$S_N = S_1(1 - e^{-\alpha N}) + \beta lnN$$

*A single load cycle occurs when a train passes over a location.

Meet the Team Members

From left to right:
Mason Holden, Andy Gombac, Skyler Garrett, Bryan Brinkman

Typical Profile



Pictured above shows the two proposed railroads with corresponding spacing, layer thickness', drainage ditches, and slope gradients.

Acknowledgements

We would like to thank the College of Science and Engineering for giving us the opportunity to create this project, Dr. Feng Hong and Dr. Gutierrez for guiding us through our design process, and our friends and family for encouraging and inspiring us to continue in our pursuit of higher education.

Without them, we would have been unable to accomplish all that we have in our time at Texas State University

Thank you.