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"Life Cycle Cost Examination of Bituminous Asphalts and Substantial Asphalts in Metropolitan Regions"

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ABSTRACT: Road building requires substantial investments that go towards repair and construction of infrastructure. For developing countries, like India, it can be difficult to save money for new infrastructural projects. The emphasis is turning toward the construction of long-term performing pavement that are built to withstand increased loads, traffic intensity, or high tire pressure. This study examines the benefits of using a different material, concrete pavements, to replace bituminous ones. Concrete pavements provide economic and environmental benefits, as well as improving traffic safety, due to its higher visibility.

Keywords:Bituminous pavement, Concrete pavement, Life Cycle Analysis.

I. INTRODUCTION

India has been struggling with expenses for new road projects. They also lack the necessary funds for maintenance and repairs of roads, which often become unusable. Today, we are more focused on the construction of long lasting pavements. Most of our roads are made from bituminous paving material. Bituminous pavement shows early signs of stiffness due to increasing loads, intensity of traffic, high tyre pressure, etc. Common forms of distresses in bituminous paving materials is rutting, cracking, aging etc. These distresses get more severe in hot climates like India as it is highly sensitive to temperature. A concrete road is better than an asphalt one because it is heavier, more resistant to cracks and lasts a long time. White topping consists of applying a cement mixture over an asphalt one to lengthen the lifespan of the asphalt (and increase readability as well). Pavement's life-cycle cost depends on your initial investment and the amount of maintenance or rehabilitation you need. Different types of pavements will require slightly different amounts, depending on their various benefits. For example, if your pavement is economically beneficial, you may want to choose bituminous or concrete at a variety of prices with low-long term investments.[1]

II. OBJECTIVES OF STUDY

1. The main objective is to calculate the total cost of pavement by using Life-Cycle Lost analysis. This will assist in selecting an appropriate pavement system.
2. Flexible and Rigid Pavements: Which is the Cheaper Option.
3. Alternative for the Maintaining and Rehabilitation Needed in Bituminous Pavements.

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III. METHODOLOGY LIFE CYCLE COST ANALYSIS PROCEDURE[2]

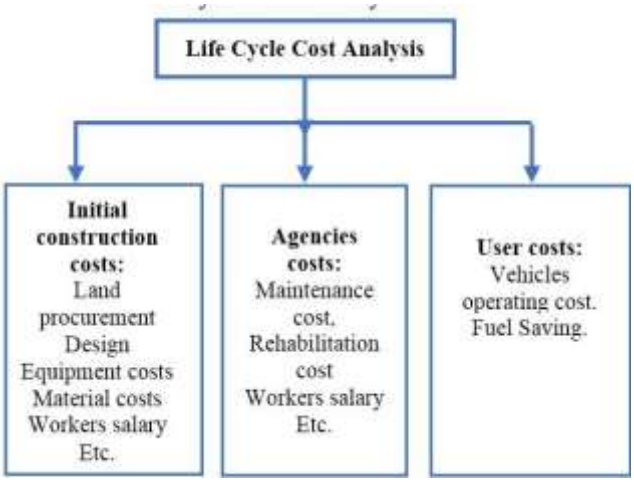

Figure1.

The steps involved in the LCCA methodology are as follows:

1. Estimatetheinitialconstruction cost.
2. Estimatemaintenancecost.
3. Estimateroadusercosts
4. Determinelife-cyclecost.

An investigation on the cost of pavements found that when life cycle cost analysis was done through net present value formula, IRC SP-30 was used.

Agency costs are calculated from the district scheduleofrates ofPublicWorks Department (PWD) Puneregion.

The procedures of construction and estimates werestudiedfromcasestudies doneonthreedifferentroads.

1) Construction of pavements UTWT and TWT, MadhubanareaatoldSanghviwardno59, PCMC.
2) ConstructionofPQCpavementroadfromChaphekarchowktobridgeonPavanaRivertowardsThergaon.PCMC
3) Developmentof45.00WwideroadfromPuneAlandiroadtoDabhadewastiinPCMCarea.

IV. LIFECYCLECOSTANALYSIS

This story is written in 2020, so we're going to talk about the future. 20 years from now, things will be more inflationary and more expensive, so they'll need to take that into account when they do this research.

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1. LifeCycleCostofBituminousPavements

1) Construction costofbituminouspavements.

Table1.ConstructionCost ofBituminousPavements

PavementCrust	Cost/km	Length(m)	Thickness (mm)	Width (m)	Rate(Rs)
Bituminous Concrete	3,272,800	1000	40	10	8182.00 /Cum
DenseBituminous Macadam	7,115,000	1000	100	10	7115.0 /Cum
WetMix Macadam	2,875,000	1000	250	10	1150.00 /Cum
GranularSub-Base	3,175,000	1000	250	10	1270.00 /Cum
PrimeCoat	210,000	1000	1 Coats	10	21.00 /Sqm.
TackCoat	350,000	1000	2 Coats	10	17.50 /Sqm.
InitialCost	16,997,800				

2. Maintenancecostofbituminouspavement

Overlay shall be provided at every 10th year afterconstruction for strengthening of existing pavement having a75mm DBM layer and 40mm BC layer. Overlay cost is showninTableII.

According to MoRTH guidelines a layerof 25mmBC is to be providedonce in5 years. Cost of overlaysisshowninTableIII.

Table2.PeriodicResurfacingineveryFiveYears(BC25mm)

Pavement Layer	Cost/km	Length (m)	Thick(mm)	Width (m)	Rate (Rs)
Bituminous Concrete	2,045,500	1000	25	10	8182.0/ Cum

Year	Costper Km.	InflatedCost@5.50%p.a.
5thYear	2,045,500	2,820,422.96
14thYear	2,045,500	4,566,530.66
18thYear	2,045,500	5,657,130.76
Total	6,136,500	13,044,084

Table3.CostofOverlaytobeprovided atevery10th year

OverlayLayer	Cost/km	Length (m)	Thick(mm)	Width (m)	Rate (Rs)
Bituminous Concrete	3,272,800	1000	40	10	8182.0 /Cum
Dense BituminousMacad	5,336,25	1000	75	10	7115.0 /Cum

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am	0				
TackCoat		1000	2	10	17.50

OverlayYear	InitialCost(Rs)	InflatedCost@5.50%p.a.
10thYear	8,959,050	16,145,035.95
Total	8,959,050	16,145,036

2) Life Cycle Cost of Concrete PavementConstructioncostofconcretepavements.

Table4.ConstructionCostofConcretePavements

Pavement Layer	Cost/km	Length (m)	Thick(mm)	Width (m)	Rate (Rs)
PQC	1,72,23,000	1000	300	10	5741.0/ Cum
DLC Layer	25,96,000	1000	100	10	2596.0/ Cum
GSB Layer	31,75,000	1000	250	10	1270.0/ Sqm.
Initial Cost	2,29,94,000				

MaintenancecostofConcretePavements

JointSealing:50%ofthejointsealantsaretobereplacedinevery5year:

Joint Length: ContractionJoint lengthperkm. for10m widecarriageway10000m

LongitudinalJointlengthfor1kmandtwojointsin10m width10000m

Length to be replaced every 5 years is 30% of total lengthContractionjoint=3333.333m

Longitudinaljoint=3333.333m

CostofjointsealsinshowninTableV

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Table5. CostofJointSeals(Preformed Seals)perKm

MaintenanceCostofJointsSealing		
Maintenance Year	MaintenanceCost(Rs.)	Inflated Cost@5.50%p.a.
5thYear	833,333	1,149,035.67
10thYear	833,333	1,501,743.67
15thYear	833,333	1,962,718.92
20thYear	833,333	2,565,195.13
Total	3,333,333	7,178,693

Concretespalling: -

	350,000		Coats		/Sqm.
InitialCost	8,959,050				

0.5%ofJointlength forawidthof500mmin every10 years10thyearspallingconcrete=50Sqm
Repairs ofconcretespalling=50*6889.2=Rs 344460

Table6.TotalCostandInflatedCostofConcreteSpalling

CONCRETE SPALLING		
Maintenance Year	Maintenance Cost (Rs.)	Inflated Cost @5.50% p.a.
10 th Year	344,460	620,748.75
Total	344,460	620,749

3) LifeCycleCost ofOverlays
Lifecyclecostof bituminousoverlays
BituminousOverlays

Table7.LCCofBituminousOverlays

Bituminous Overlays		
Overlay	Initial Cost	Inflated cost
Strengthening overlay	8,959,050	16,145,036
Periodic overlays	6,136,500	13,044,084
Total	15,095,550	29,189,120

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3. LifecyclecostofConcreteoverlays

2) ConstructioncostofThinWhitetoppingoverlay

Table8.ThinWhitetoppingoverlay

Pavement Layer	Cost/km	Length (m)	Thick (mm)	Width (m)	Rate (Rs)
ThinWhite Topping(TWT)	8,6,11,500	1000	150	10	5741.0 /Cum
Milling	26,775	1000	50	10	53.6/Cum
InitialCost	8,638,300				

Item	Unit	Quantity	Rate (Rs.)	Cost /Km.
Contraction Joint	m	3333.333 m	150	500000
Longitudinal Joint	m	3333.333 m	100	333333.333
			Total	833333.333

3) ConstructioncostofUltra-ThinWhitetoppingoverlay

Table8.Ultra-ThinWhitetoppingOverlay

PavementLayer	Cost/km	Length (m)	Thick(mm)	Width(m)	Rate(Rs)
Ultra-ThinWhiteTopping (UTWT)	5,741,000	1000	100	10	5741.0/Cum
Milling	26,775	1000	50	10	53.6/Cum
InitialCost	5,767,800				

4) Maintenancecostforconcreteoverlayswillbesameasthatofnewconcreteroads.

Table9.MaintenancecostofConcretePavements

Stages	Initialcost	Inflatedcost
Jointsealing	3,333,333	7,178,693
Concretespalling	344,460	620,749
Total	3,677,793	7,799,442

RoadUserCost.

1. VehicleOperatingCost(VOC): -

User cost are those that borne by the vehicles thattravel on the road. These cost comprise of Vehicle OperatingCost(VOC),timecostsofpassengerandcommoditiesintransit and accident cost. In the Present analysis, only VOC isconsidered, assuming the other two costs are equal in bothtypes of pavements. VOC consists of wear and tear of vehicle,fuel,lubricants,depreciationandfixedcost.Ithasbeenobserved that a well-constructed bituminous concrete surfacehas a smooth riding quality with a roughness index around2000 mm/km but the riding quality deteriorate with traffic andmay reach value of roughness of 4000 mm/km in a few yearsand renewal wearing course is givenat the stage to improvethe

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ridingquality.Ontheotherhand,initialroughnessofcement concrete surface is maintained almost throughout itslife with very little deterioration, for comparison of life cyclecost, roughness of bituminous surface is taken as 3000 mm/kmandforconcretesurface2000mm/km.

isfoundfromIRCSP:30Manualofeconomicevaluation for transportation projects. Annual growth in traffic7.5%andinflationrateof7.5%isconsidered.

VOC is calculatedas VOCperyear=(No.of vehicleperday)
(365)(VOCRs /km)

CalculationofVOCisshowninTableXI
Traffic volume survey was conducted manually forthreedays,twelvehoursdaily
andnumberofcommercialvehicles
perdaywereconsidered.

Table10.TrafficVolumeCount

SiteName	ChaphekarChowk			Dabhadewasti, Charholi		
	CVPD			CVPD		
Day	D1	D2	D3	D1	D2	D3
Time(9amto 9pm)						
9.00- 10.00	58	61	58	58	59	63
10.00-11.00	61	58	58	59	64	61
11.00-12.00	48	51	55	69	67	64
12.00-01.00	53	55	52	57	61	59
01.00-02.00	49	47	52	52	48	47
02.00-03.00	55	51	47	45	53	43
03.00-04.00	48	50	49	58	56	55
04.00-05.00	50	48	53	54	51	59
05.00-06.00	55	53	55	61	59	66
06.00-07.00	57	61	60	53	66	61
07.00-08.00	62	58	56	58	61	60
08.00-09.00	63	60	65	68	67	66
Total	659	653	660	692	712	704
Average	657.33			702.67		
	657			703		

2. FuelSaving

In USA, a study was made and it was observed thatthere is fuel saving of 20% on concrete road as compared tobituminousroadshavingsameroughnessindex.

In India, central road research institute (CRRI), NewDelhialsomadesimilarstudyonDelhi-Agra(NH-2)andfound that there is a fuel saving of 14% on concrete roads ascompared to bituminous roads forcommercial vehicles. Dueto increase intraffic onroads and rising inthe fuel prices inthe international market, the impact of fuel saving has beenfoundquite
importantascomparedtoextrainitialcostofconcreteroadoverbituminousroad.

A case study on Durable and cost effective concreteoverlay oncity bituminous roads: White topping by BinodKumar, Scientist, CRRI also states that there is 10% – 15%fuelsavingforheavyvehiclesonconcreteroads.
Annualfuelsaving(Rs)=No.ofCVPD*365*14/100*1/4
*58
14/100=14%fuelsaving,1/4=(4kmperlitre),Inflation rate
-5%indiesel cost

CalculationofFuelsavingisshownin tableXII

V. RESULTS AND DISCUSSION

LifecyclecostcomparisonofnewbituminousandconcretepavementsisshowninTableXIII
LifeCycleCostComparisonofNewBituminousPavementsXIV

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VI. CONCLUSION

1) Life cycle cost analysis shows that even if the initial costof concrete pavements is high the net present value ofconcrete pavements is Rs 193 lakhs/km (5%) less thanbituminous pavements.

2) Life cycle cost analysis of overlays shows that the netpresentvalueofultra-thinwhitetoppingisRs283lakhs/km (7%) less and of thin white topping is Rs 254lakhs/km(6%)lessthanthecostofbituminousoverlays.

3) When the net present value of bituminous overlays andconcretewhitetoppingswithoutconsideringvehicleoperating cost and fuel saving the total cost of bituminousoverlaysisRs172lakhsandthatofconcrete whitetoppings is Rs 107 lakhs for thin white topping and Rs 78lakhs for ultra-thin white topping, which is 38% and 55%lesserthanbituminous overlays.

4) LCCAconcludesthatconcretepavementsare morebeneficialthanbituminouspavementsandconcreteoverlayscanbeconsideredasbeneficialoptionforrehabilitationofexistingbituminouspavements.

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Table11.VehicleOperatingCost

VOC													
Vehicle Operating Cost for Concrete Pavements							Vehicle Operating Cost for Bituminous Pavements						
Sr No	Year	CVPD Traffic Growth @ 7.5%	VOC (IRC SP 30 for Roughness) 2000	Days	VOC	VOC (in Lakhs)	Sr No	Year	CVPD Traffic Growth @ 7.5%	VOC (IRC SP 30 for Roughness) 3000	Days	VOC	VOC (in Lakhs)
1	2016	0	57.95	365	0	**0**	1	2016	0	59.26	365	0	**0**
2	2017	700	62.30	365	15917384.39	**159.174**	2	2017	700	63.71	365	16277506.21	**162.775**
3	2018	753	66.97	365	18394527.34	**183.945**	3	2018	753	68.49	365	18810693.12	**188.107**
4	2019	809	71.99	365	21257175.66	**212.572**	4	2019	809	73.62	365	21738107.23	**217.381**
5	2020	870	77.39	365	24565323.62	**245.653**	5	2020	870	79.14	365	25121100.17	**251.211**
6	2021	935	83.20	365	28388302.1	**283.883**	6	2021	935	85.08	365	29030571.38	**290.306**
7	2022	1005	89.44	365	32806231.62	**328.062**	7	2022	1005	91.46	365	33548454.05	**335.485**
8	2023	1080	96.15	365	37911701.42	**379.117**	8	2023	1080	98.32	365	38769432.22	**387.694**
9	2024	1161	103.36	365	43811709.95	**438.117**	9	2024	1161	105.70	365	44802925.11	**448.029**
10	2025	1248	111.11	365	50629907.31	**506.299**	10	2025	1248	113.62	365	51775380.33	**517.754**
11	2026	1342	119.44	365	58509186.63	**585.092**	11	2026	1342	122.14	365	59832923.89	**598.329**
12	2027	1443	128.40	365	67614678.8	**676.147**	12	2027	1443	131.31	365	69144422.67	**691.444**
13	2028	1551	138.03	365	78137213.19	**781.372**	13	2028	1551	141.15	365	79905023.45	**799.050**
14	2029	1667	148.38	365	90297317	**902.973**	14	2029	1667	151.74	365	92340242.72	**923.402**
15	2030	1792	159.51	365	104349837	**1043.498**	15	2030	1792	163.12	365	106710693	**1067.107**
16	2031	1927	171.47	365	120589280.3	**1205.893**	16	2031	1927	175.35	365	123317544.6	**1233.175**
17	2032	2071	184.33	365	139355987.1	**1393.560**	17	2032	2071	188.51	365	142508837.5	**1425.088**
18	2033	2227	198.16	365	161043262.6	**1610.433**	18	2033	2227	202.64	365	164686775.3	**1646.868**
19	2034	2394	213.02	365	186105620.3	**1861.056**	19	2034	2394	217.84	365	190316154.7	**1903.162**
20	2035	2573	229.00	365	215068307.5	**2150.683**	20	2035	2573	234.18	365	219934106.3	**2199.341**
21	2036	2766	246.17	365	248538312.8	**2485.383**	21	2036	2766	251.74	365	254161351.6	**2541.614**

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Table12.FuelSaving

FUEL SAVING							
Year	CVPD	Days	Fuel Saving @ 14%	Mileage (1/4)	Diesel Cost Inflation @ 5%	Extra Fuel Cost	Extra Fuel Cost in Lakhs
2016	0	0	0	0	0	0	0
2017	703	365	0.14	0.25	58	520887.85	5.21
2018	756	365	0.14	0.25	61	587952.1607	5.88
2019	812	365	0.14	0.25	64	663651.0014	6.64
2020	873	365	0.14	0.25	67	749096.0678	7.49
2021	939	365	0.14	0.25	70	845542.1865	8.46
2022	1009	365	0.14	0.25	74	954405.743	9.54
2023	1085	365	0.14	0.25	78	1077285.482	10.77
2024	1166	365	0.14	0.25	82	1215985.988	12.16
2025	1254	365	0.14	0.25	86	1372544.184	13.73
2026	1348	365	0.14	0.25	90	1549259.248	15.49
2027	1449	365	0.14	0.25	94	1748726.376	17.49
2028	1558	365	0.14	0.25	99	1973874.897	19.74
2029	1674	365	0.14	0.25	104	2228011.29	22.28
2030	1800	365	0.14	0.25	109	2514867.744	25.15
2031	1935	365	0.14	0.25	115	2838656.966	28.39
2032	2080	365	0.14	0.25	121	3204134.05	32.04
2033	2236	365	0.14	0.25	127	3616666.309	36.17
2034	2404	365	0.14	0.25	133	4082312.096	40.82
2035	2584	365	0.14	0.25	140	4607909.779	46.08
2036	2778	365	0.14	0.25	147	5201178.163	52.01

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Table13.LifeCycleCostComparisonofBituminousandConcretePavements

LIFE CYCLE COST ANALYSIS									LIFE CYCLE COST ANALYSIS							
Bituminous Pavements									Concrete Pavements							
Cost/Rs/Lakhs									Cost/Rs/Lakhs							
Sr No	Year	Construction & Maintenance cost	VOC	Extra Fuel Cost	Total Cost	(1/1.12)^n	NPV Construction & Maintenance	NPV Total	Sr No	Year	Construction & Maintenance cost	VOC	Total Cost	(1/1.12)^n	NPV Construction & Maintenance	NPV Total
1	2016	169.97	0.00	0	169.98	1.00	169.98	169.98	1	2016	229.94	0.00	229.94	1.00	229.94	229.94
2	2017		162.78	5.21	167.98	0.89	0.00	149.99	2	2017	0.00	159.17	159.17	0.89	0.00	142.12
3	2018		188.11	5.88	193.99	0.80	0.00	154.64	3	2018	0.00	183.95	183.95	0.80	0.00	146.64
4	2019		217.38	6.64	224.02	0.71	0.00	159.45	4	2019	0.00	212.57	212.57	0.71	0.00	151.30
5	2020		251.21	7.49	258.70	0.64	0.00	164.41	5	2020	0.00	245.65	245.65	0.64	0.00	156.12
6	2021	28.20	290.31	8.46	326.97	0.57	16.00	185.53	6	2021	11.49	283.88	295.37	0.57	6.52	167.60
7	2022		335.48	9.54	345.03	0.51	0.00	174.80	7	2022	0.00	328.06	328.06	0.51	0.00	166.21
8	2023		387.69	10.77	398.47	0.45	0.00	180.25	8	2023	0.00	379.12	379.12	0.45	0.00	171.40
9	2024		448.03	12.16	460.19	0.40	0.00	185.86	9	2024	0.00	438.12	438.12	0.40	0.00	176.95
10	2025		517.75	13.73	531.48	0.36	0.00	191.66	10	2025	0.00	506.30	506.30	0.36	0.00	182.58
11	2026	161.45	598.33	15.49	775.27	0.32	51.98	249.62	11	2026	21.22	585.09	606.32	0.32	6.83	195.22
12	2027		691.44	17.49	708.93	0.29	0.00	203.80	12	2027	0.00	676.15	676.15	0.29	0.00	194.38
13	2028		799.05	19.74	818.79	0.26	0.00	210.16	13	2028	0.00	781.37	781.37	0.26	0.00	200.56
14	2029		923.40	22.28	945.68	0.23	0.00	216.73	14	2029	0.00	902.97	902.97	0.23	0.00	206.94
15	2030	45.67	1067.11	25.15	1137.92	0.20	9.34	232.84	15	2030	0.00	1043.50	1043.50	0.20	0.00	213.52
16	2031		1233.18	28.39	1261.56	0.18	0.00	230.48	16	2031	19.63	1205.89	1225.52	0.18	3.59	223.90
17	2032		1425.09	32.04	1457.13	0.16	0.00	237.69	17	2032	0.00	1393.56	1393.56	0.16	0.00	227.32
18	2033		1646.87	36.17	1683.03	0.15	0.00	245.12	18	2033	0.00	1610.43	1610.43	0.15	0.00	234.55
19	2034	56.57	1903.16	40.82	2000.56	0.13	7.36	260.15	19	2034	0.00	1861.06	1861.06	0.13	0.00	242.01
20	2035		2199.34	46.08	2245.42	0.12	0.00	260.71	20	2035	0.00	2150.68	2150.68	0.12	0.00	249.71
21	2036		2541.61	52.01	2593.63	0.10	0.00	268.87	21	2036	25.65	2485.38	2511.04	0.10	2.66	260.31
Total NPV							254.67	4332.74	Total NPV						249.54	4139.36

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Table14.LifeCycleCost ComparisonofBituminousandConcreteOverlays

Net Present Value of OVERLAYS																		
NPV Bituminous Overlays							NPV Concrete Overlays (Ultra Thin White Topping Thickness - 100mm)						NPV Concrete Overlays (Thin White Topping Thickness - 150mm)					
Sr No	Year	Construction & Maintenance cost	VOC	Extra Fuel Cost	(1/1.12)^n	NPV	Sr No	Year	Construction & Maintenance cost	VOC	(1/1.12)^n	NPV	Sr No	Year	Construction & Maintenance cost	VOC	(1/1.12)^n	NPV
1	2016	89.5905	0.000	0	1.00	89.5905	1	2016	57.678	0.000	1.00	57.678	1	2016	86.383	0.000	1.00	86.383
2	2017		162.775	5.21	0.89	149.985661	2	2017		159.174	0.89	142.12	2	2017		159.174	0.89	142.119504
3	2018		188.107	5.88	0.80	154.644812	3	2018		183.945	0.80	146.64	3	2018		183.945	0.80	146.640046
4	2019		217.381	6.64	0.71	159.45129	4	2019		212.572	0.71	151.3	4	2019		212.572	0.71	151.304378
5	2020		251.211	7.49	0.64	164.409774	5	2020		245.653	0.64	156.12	5	2020		245.653	0.64	156.117073
6	2021	28.20	290.306	8.46	0.57	185.528929	6	2021	11.49	283.883	0.57	167.6	6	2021	11.49	283.883	0.57	167.602787
7	2022		335.485	9.54	0.51	174.802225	7	2022		328.062	0.51	166.21	7	2022		328.062	0.51	166.206579
8	2023		387.694	10.77	0.45	180.246315	8	2023		379.117	0.45	171.49	8	2023		379.117	0.45	171.493284
9	2024		448.029	12.16	0.40	185.862664	9	2024		438.117	0.40	176.95	9	2024		438.117	0.40	176.948148
10	2025		517.754	13.73	0.36	191.656744	10	2025		506.299	0.36	182.58	10	2025		506.299	0.36	182.576521
11	2026	161.45	598.329	15.49	0.32	249.616897	11	2026	21.22	585.092	0.32	195.22	11	2026	21.22	585.092	0.32	195.217779
12	2027		691.444	17.49	0.29	203.800863	12	2027		676.147	0.29	194.38	12	2027		676.147	0.29	194.376044
13	2028		799.050	19.74	0.26	210.162738	13	2028		781.372	0.26	200.56	13	2028		781.372	0.26	200.558765
14	2029		923.402	22.28	0.23	216.72603	14	2029		902.973	0.23	206.94	14	2029		902.973	0.23	206.938145
15	2030		1067.107	25.15	0.20	223.497138	15	2030		1043.498	0.20	213.52	15	2030		1043.498	0.20	213.520441
16	2031	45.67	1233.175	28.39	0.18	238.825544	16	2031	19.63	1205.893	0.18	223.9	16	2031	19.63	1205.893	0.18	223.897921
17	2032		1425.088	32.04	0.16	237.689421	17	2032		1393.560	0.16	227.32	17	2032		1393.560	0.16	227.319802
18	2033		1646.868	36.17	0.15	245.124438	18	2033		1610.433	0.15	234.55	18	2033		1610.433	0.15	234.550398
19	2034		1903.162	40.82	0.13	252.794969	19	2034		1861.056	0.13	242.01	19	2034		1861.056	0.13	242.010986
20	2035		2199.341	46.08	0.12	260.708498	20	2035		2150.683	0.12	249.71	20	2035		2150.683	0.12	249.70888
21	2036	56.57	2541.614	52.01	0.10	274.737309	21	2036	25.65	2485.383	0.10	260.31	21	2036	25.65	2485.383	0.10	260.310884
					Total	4249.86					Total	3967.1					Total	3995.8014